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An economic assessment of the value of recreational angling at Queensland dams involved in the Stocked Impoundment Permit Scheme

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Publication Date:	2013
Produced by:	Environmental Economics Programme Centre for Environmental Management
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Executive Summary

Recreational fishing at Stocked Impoundment Permit (SIP) dams in Queensland generates economic impacts on regional economies and provides direct recreation benefits to users. As these benefits are not directly traded in markets, specialist non-market valuation techniques such as the Travel Cost Method are required to estimate values.

Data for this study has been collected in two ways in 2012 and early 2013. First, an onsite survey has been conducted at six dams in Queensland, with 804 anglers interviewed in total on their trip and fishing experiences. Second, an online survey has been offered to all anglers purchasing a SIP licence, with 219 responses being collected.

The data identifies that there are substantial visit rates across a number of dams in Queensland. For the 31 dams where data was available for this study, recreational anglers purchasing SIP licences have spent an estimated 272,305 days fishing at the dams, spending an average 2.43 days per trip on 2.15 trips per year to spend 4.36 days fishing per angler group. Within those dams there is substantial variation in total fishing effort, with Somerset, Tinaroo, Wivenhoe and North Pine Dam generating more than 20,000 visits per annum.

There are substantial impacts on regional economies from these recreational fishing visits. Queensland is already a net beneficiary of recreational fishing visits, with more interstate visitors coming to visit than the reverse. Many regional areas also benefit from the same patterns, with expenditure on items such as food, accommodation and fuel generating economic activity. The on-site survey and the on-line survey identified trip expenditures on non-travel items of $411 and $496 respectively, and a further $165 on travel, with nearly half of this spent in regional areas. This translates into between $46.1 and $55.6 Million in consumption expenditure on food, accommodation, alcohol and fishing related expenditures, and $18.6 Million on travel expenditure, with at least $28.5 Million spent directly into regional economies.

There are substantial values associated with regional fishing. Application of the travel cost method using very conservative estimates of trip costs identified average values for $184.23 per fishing day at a dam. Extrapolation to total annual fishing days and across dams generates total annual estimates of recreational fishing values at $56.44 Million. Dams with the largest values for recreational fishing include Somerset, Tinaroo, Glen Lyon, Cressbrook, Leslie and Borumba Dams.

The values that have been estimated with this report are very conservative, as only direct travel costs have been included as estimates of trip costs. Other consumption expenditure has not been included because of the difficulties in getting data consistent across respondents, with the effect that recreation values are understated. Comparisons with previous value estimates for Bjelke-Petersen, Boondooma and Fairbairn Dams indicates that approximately 60% of full trip values are being captured. On this basis, the total economic value of recreational fishing at the SIP dams is predicted to be approximately $95.3 Million per annum.

Contents

1. Introduction

This report is focused on estimating the economic values associated with recreational fishing at a number of freshwater dams in Queensland, Australia. Recreational fishing is important because it creates both commercial and recreational benefits. Most commercial benefits are generated by the expenditure of recreational users on travel, equipment, services and other items, while recreational benefits are enjoyed by people engaged in freshwater fishing. These benefits can be substantial, particularly for freshwater dams that have high visitation rates and usage.

A major data gap for policy makers is that few estimates exist about the value of recreational fishing, even though economic values for these activities may be important for a number of reasons. Many freshwater impoundments are constructed for agricultural and industry uses, and the value of consequential recreational benefits are rarely assessed, even though these may be an important component of total values. Value information may be required to justify investment in fish stocking programs, recreation facilities, access roads and other services relating to regional activity. Value information may also be important in assessing the tradeoffs involved in changing access and management systems that might impact on recreational uses.

Most recreation activities are not purchased in markets, and hence can not be directly valued from market information like market goods. Instead, specialist non-market valuation techniques such as the Travel Cost Method can be applied to assess these values. The relevant data is collected by interviewing or surveying recreational fishers directly to assess their expenditure patterns and other factors. An analysis then allows two key estimates to be made. The first is the amount of expenditure that is being generated for recreational fishing, which can be used to estimate the direct economic stimulus of activities, particularly at a regional level. The second is estimates of the value of the activity, which can be used to evaluate the appropriateness of public and other funding on services and infrastructure. A potential benefit of performing valuation studies is that results can be potentially transferred to other similar sites.

In this study, the value of recreational fishing has been assessed for several freshwater impoundments (dams) in Queensland that are important recreational fishing sites. The focus of the research presented in this report was on freshwater recreational angling and in particular, angling at dams operating under the Stocked Impoundment Permit (SIP) scheme. Anglers wishing to access the fishing at dams falling under the SIP scheme are required to purchase a permit prior to fishing. Permits are issued for annual or weekly periods at a cost of $38.60 and $7.70 respectively. Permits can be purchased online or at a network of retail outlets, which are generally in close proximity to the impoundments operating under the SIP scheme. Many impoundments also have privately run camping/caravan facilities located on their shores from which permits may be purchased.

Funds raised from SIP permit sales are largely used to purchase fingerlings to develop and sustain the stocked fisheries. Funds are disbursed annually to community-based fish stocking associations participating in the program after administration costs (capped at 25%) are met. .. State-wide across Queensland approximately 70 stocking groups hold stocking permits and release fingerlings into more than 180 water bodies including dams, weirs and river systems. However, only dams with established stocked fisheries are eligible to join the SIP scheme. The SIP scheme currently operates at 32 dams in Queensland (Table 1.1).

An important goal of the research is to identify whether the value of recreational fishing justifies the collection of fees from anglers and the investment in fish stocking programs.

Table 1.1: Dams/lakes operating under the SIP scheme in Queensland

Bill Gunn Dam	Eungella Dam	Lake Monduran
Bjelke-Petersen Dam	Fairbairn Dam	North Pine Dam
Boondooma Dam	Glenlyon Dam	Peter Faust Dam
Borumba Dam	Gordonbrook Dam	Somerset Dam
Burdekin Falls Dam	Lake Gregory	Storm King Dam
Callide Dam	Kinchant Dam	Teemburra Dam
Cania Dam	Lenthalls Dam	Theresa Creek Dam
Connolly Dam	Leslie Dam	Tinaroo Falls Dam
Cooby Dam	Maroon Dam	Wivenhoe Dam
Coolmunda Dam	Moogerah Dam	Wuruma Dam
Cressbrook Dam	Lake MacDonald	

This report is structured as follows. An overview of recreational fishing activities in Australia and previous studies estimating expenditure and values is presented in the next section. The data collection and methods of data analysis are presented in sections three and four, and results of the survey in section five. Model results of the on-site and on-line surveys are provided in sections six and seven, and discussion and conclusions follow.

2. Background

2.1 Recreational fishing in Australia and Queensland

Fishing for sport and recreation is one of the most widespread and undertaken leisure activities across the world. Australians are particularly keen on recreational fishing with an estimated 15-20% (3.4 million) of all residents having involvement in this activity (Henry and Lyle 2003). Some basic values are available to provide baseline support for the more comprehensive valuation exercises carried out in the research presented in this report:

- The recreational fishing sector is estimated to support about 90,000 Australian jobs (ABS 2003).
- Recreational fishers spent $223 million on durable and consumable goods associated with fishing in the 12 months to May 2000 (ABARE 2012; Campbell and Murphy 2005).
- An alternative estimate by Dominion Consulting (2005) placed the value of retail sales of tackle and bait in the year 2003-04 at $665 million (ABARE 2012).
- Fishing related boat expenditure was estimated at $300 million per year in 2003 (ABARE 2012).
- Freshwater fishing represents about 20% of the total fishing effort in Australia (FRDC 2013).

National surveys of recreational fishing are rare in Australia. The last survey, carried out in 2000-01, was referred to as the National Recreational and Indigenous Fishing Survey (Henry and Lyle 2003). This survey provided estimates of recreational fishing expenditure for each state and territory jurisdiction in Australia. These estimates are presented in Table 2.1.

Table 2.1: Summary statistics for recreational fishing across Australian State and Territory jurisdictions (2000/01)

							Interstate fishing (hours)			
	Total expenditure (millions $)	Expenditure per fisher	Expenditure per person	Participation (persons)	Participation (million person days)	Participation (% pop.)	Exports	Imports	Net Exports	Export rate (net.exp/exports)
New South Wales	554	555	38.3	998,501	6.9	17.10%	1,726,478	7,650,742	5,924,264	343%
Victoria	396	720	18.7	549,803	2.6	12.70%	6,444,154	385,656	-6,058,498	-94%
Queensland	320	408	18.8	785,045	4.6	24.70%	2,246,502	2,580,042	333,540	15%
Western Australia	338	705	24.0	479,425	3.4	28.50%	429,325	817,043	387,718	90%
South Australia	149	454	8.6	328,227	1.9	24.10%	744,744	460,212	-284,532	-38%
Tasmania	52	417	3.3	124,590	0.8	29.30%	97,083	122,947	25,864	27%
Australian Capital Territory	19	355	0.1	53,467	0.03	31.60%	999,157	11,537	-987,620	-99%
Northern Territory	27	615	1.8	43,932	0.3	19.20%	63,493	722,756	659,263	1038%
Australia	1,855	552		3,362,990	20.6	19.50%	-	-	-	-

Data sourced from Henry and Lyle (2003).

Of particular interest are the figures over fishing ‘exports’ and ‘imports’ by State and the ‘net exports’ (exports minus imports)[1]. A negative value for net exports suggests that the state/territory of interest experienced a net drain of fishing effort in 2000-01 and the associated expenditures associated with this fishing effort. The data revealed that Queensland had a positive estimate for net exports of fishing days, implying that it is a net source of revenue for Queensland communities and the Queensland Government through fishing licenses (freshwater stocked impoundment scheme dams only) and taxes on durable and consumable fishing items.

2.2 Freshwater fishing

Fishing in freshwater locations accounted for approximately 6% of all fishing effort in Queensland in 2000/01, marginally more than effort in offshore locations (Henry and Lyle 2003). Table 2.2 presents the fishing effort and proportional representation across four divisions of locations in Queensland for 2000/01. The most popular area for fishing was coastal locations with 44.2% of fishing effort.

Table 2.2: Fishing effort by location type in Queensland (2000/01)

	Offshore	Coastal	Estuarine	Lakes/Dams	Total
# events	344,845	2,547,953	2,232,759	346,642	5,765,661
% of total	6%	44.20%	28.20%	6%	100%

Data sourced from Henry and Lyle (2003).

Taking the data in Table 2.1 as representative of the breakup of fishing effort and expenditure provides a rough approximation of the amount of expenditures on freshwater fishing in Queensland in 2000/01 as $19.2 million. Freshwater fishing, then, is a not insubstantial generator of economic activity in Queensland. Around 15%, or $2.9 million, of this expenditure was likely to be as income earned for the state as a whole (the net exports percentage) from the net gain of interstate visitors. These estimates only account for direct expenditures on fishing-related products such as fishing gear, boats, and bait. The economic stimulus of fishing however also involves the expenditures undertaken by anglers in the pursuit of their hobby – from fuel used in travelling to fishing destinations from home to accommodation, entertainment and food expenditures undertaken during fishing trips. The cumulative effects of these additional expenditures, often spent in regional locations, can be substantial.

[1] Note these values are calculated with ‘exports’ implying visitation by interstate visitors to the state/territory of interest and vice versa for ‘imports’. That is, an export of fishing effort involves the travel of a non-resident to the state/territory of interest. This definition is consistent with the method of valuing tourism as an external source of revenue for communities.

2.3 Value of fishing activity in Queensland

There has been extensive use of non-market valuation techniques to estimate values for recreational fishing in north America. For example, Rosenberger and Loomis (2001) identify 39 valuation studies and Kaval and Loomis (2003) found 129 studies on non-market values for recreational fishing in the United States and Canada, while Johnston et al. (2006) identified over 450 studies across north America and Europe. There is a much smaller number of studies in Australia. A revealed preference technique was used by Swait *et al*. (2004) to estimate values for recreational fishing in Western Australia, while Wheeler and Damania (2001) used the contingent valuation method (CVM) to estimate the recreational values of fishing in New Zealand, with an average value estimated at $30.85NZ per fish.

Rolfe and Prayaga (2007) used the travel cost method to estimate values for recreational fishing at three Queensland impoundments, Bjelke-Petersen, Boondooma and Fairbairn dams. The consumer surplus (value) per fishing group per trip for the frequent visitors was estimated at $543.36, $958.30 and $1776.30 respectively at the three dams, or $220.88, $358.92 and $440.77 per person per trip respectively. The consumer surplus (value) per fishing group per trip for the occasional visitors, including retirees travelling on longer trips, were $191.49, $1006.34 and $3436.74 respectively, or $59.65, $348.22 and $904.40 pre person per trip respectively. Because of the remote location of each dam, average visit lengths were several days, so the daily recreation values would be lower.

Prayaga et al. (2010) used the Travel Cost Method to estimate values for recreational fishing trips off the Capricorn Coast in Central Queensland. Values per trip were estimated at $385.34 per group and $166.82 per individual angler. As the average trip was for 1.54 days, this translates to $108.32 per individual angler per day.

3. Data requirements for this study

The key aim of this study was to estimate the non-market values associated with recreational fishing at a selection of SIP impoundments in Queensland. The Travel Cost Method is the major non-market valuation technique used to estimate values for recreation, including for recreational fishing activities, and was chosen for this study. For this technique to be operated, information on the individual costs and trade-offs to go fishing, particularly the travel cost information, are required as inputs into the model.

No accurate data existed for the SIP dams of interest in Queensland, which meant that primary data needed to be collected for the study. It was not feasible to collect this data for all relevant dams in Queensland (Table 1.1), so different data collection methods were designed, with intensive data collection only performed at a small number of dams that were representative of the wider set.

Two main forms of data were collected for use in this research:

- Data from a specialised questionnaire designed to assess the economic value of visitation to and recreation at individual SIP dams in Queensland;
- Data from an online questionnaire of SIP scheme permit purchasers asking them their preferences for visitation to the various SIP dams and how they select dams to visit, and;

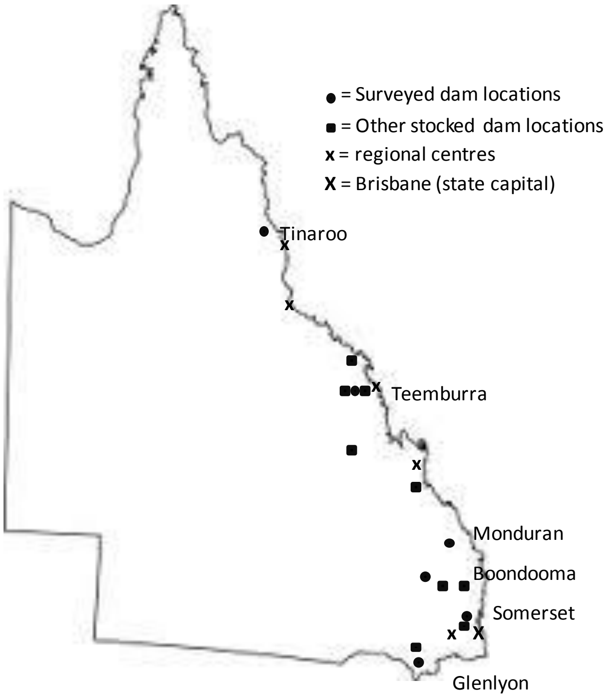
On-site surveys

Six dams from across Queensland were involved in the more intensive survey of angling in SIP scheme dams in Queensland:

- Boondooma (near Kingaroy)
- Glenlyon (near Texas)
- Monduran (near Bundaberg)
- Somerset (west of Brisbane)
- Teemburra (west of Mackay)
- Tinaroo (west of Cairns)

The location of the surveyed dams, relative to other major stocked impoundments and major population centres, is shown in the Figure 3.1 below.

Figure 3.1: Surveyed dam locations relative to other major stocked impoundments and population centres in Queensland



The on-site survey needed to be limited so that it was practical to collect in the field. The survey instrument had five main sections:

- Details about their current trip, including mode of travel, distance and stay length,
- Details about their fishing effort, equipment and number of times fished each year
- The expenses incurred on their current trip
- Ratings of characteristics of the site and fishing experience
- Respondent characteristics

An additional question on visit rates to all individual SIP dams proved too difficult to collect in practice, and was dropped from the final survey version. A copy of the final survey is shown in Appendix One.

On-site surveys were conducted by members of local fish stocking associations. The data were not collected using a formal stratified survey due to time and organisational constraints; however data collectors were asked to collect questionnaires on a regular fortnightly basis and instructed on using random selection techniques to reduce sampling bias. Data was collected during 2012 and early 2013 at the different dams. There were variations between the fish stocking groups in terms of their capacity and enthusiasm to collect surveys, and so the extent and timing of sampling varied across the dams of focus. The lack of a stratified structure nevertheless limits the potential for establishing a total and seasonal visitation profile using the questionnaire data alone.

Data were both employed in (a) econometric modelling as a pooled dataset considering the overall contributions to stay-length and value of travel costs at SIP dams and in (b) individual models for each of the dams. An exception was for the Teemburra and Somerset dams where satisfactory econometric models could not be achieved; this is likely to be because of low sample sizes at each and, for the Teemburra dam, due to the fact that almost half of visitors to Teemburra stated that their visit to the dam was not the sole objective of their trip[2].

On-line surveys

The on-line survey was offered at point of sale to anglers purchasing their SIP permits through the DAFF website,. As with the on-site survey, the number of questions had to be strictly limited so that it was not an onerous task for anglers to complete. The survey instrument had several main sections:

- Details about their annual fishing trips, including information about the type of fishing group, permit, site, vehicle and boats;
- Details about a typical trip to a SIP dam, including stay length and expenditure details,
- Ratings of characteristics of the site and fishing experience
- Respondent characteristics
- Annual days visiting each SIP dam in Queensland

The on-line survey was collected from mid-2012 to February 2013, with a total of 219 valid responses completed.

[2] For future research it is suggested that effort be made to collect information from several dams in the region of Teemburra dam. It is likely visitors to the area are interested in visiting the more well-known dams such as Kinchant and Peter Faust whilst Teemburra is likely a 'value-adding' exercise for visitors from outside of the region. However, a greater survey effort allowing for greater detail over the multi-visit nature of these visits may well suffice to understand the independent value of visitation to Teemburra dam particularly for local anglers and recreationists.

4. Methods

4.1 Descriptive statistics and significance testing

The on-site questionnaire utilised in this research included a range of questions on demographics and the qualitative preferences of respondents. This data was first summarised in tabular and graphical form and, for appropriate data, tested for statistically significant differences between contributing dams. Student t-tests were used for this purpose for data which was continuous and could be presumed to be normally distributed (e.g. age of respondents, expenditures, etc). For non-normal data (e.g. data for rating questions involving a Likert scale) the Mann-Whitney U test was used for testing of significant differences in scores between dams whilst the Spearman rank correlation coefficient was used for describing correlation between rated items within and between questions.

4.2 The Travel Cost Methodology (TCM)

The discussion above suggests that, if it was possible to observe the direct costs of engagement in a recreational activity, a description of its value would be able to be calculated. This is indeed the approach of the Travel Cost Methodology (TCM) which has been employed over the last four decades to value recreational activities (Garrod and Willis 1999; Ward and Beal 2000, Haab and McConnell 2002; Shrestha *et al.* 2002). The TCM is well-regarded as a robust tool to approximate the true underling value of recreational activities because it uses data derived from actual market transactions and is thus not generally subject to problems of hypothetical bias (bias induced from the asking of 'what if' questions) and framing bias (bias induced by the frame/focus of a question).

Two basic variants of the TCM depend on whether the visit rate to a recreation site, as the dependent variable, is defined in terms of a population group (the zonal model) or as an individual (the individual model). The zonal model is appropriate for sites that have very low individual visitation patterns, while the individual model is appropriate for sites that have high individual visitation rates (Haab and McConnell 2002). Whilst the zonal approach is simple to construct and can provide a lower bound on the current value of visitation (using only travel costs), it is unable to pick up variations originating from the differences between people visiting a particular site – it fails to account for differences in recreational values derived from personal information such as group type (couple, family, etc) and activity type (fishing, boating, camping, etc). The individual model is able to consider individual differences between visitors but requires a more in-depth survey approach including collecting information on visitor expenses for the trip. The additional effort can provide both a more accurate estimate of value for the recreational activity and detailed information on qualitative aspects contributing to visitor welfare. In this research we used the individual TCM approach.

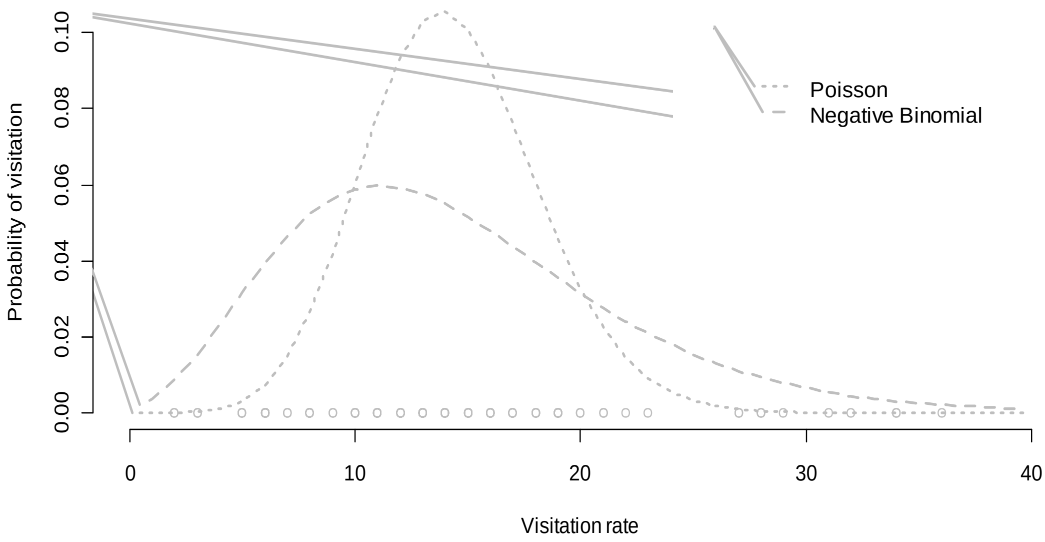
Early applications of the TCM employed standard regression techniques to identify the relationship between visit rates and independent variables such as travel costs. However, the non-negative, integer and sometimes truncated nature of the dependent variable (visit rate) means that standard regression techniques generally result in biased estimates of parameters driving visitation – they include, for example, the possibility that people will make both a negative number of trips and a number of trips which is not a whole number (e.g. 2.5 trips). As a result, more recent applications have employed approaches which account for both of these problems and, additionally, have a representation as a utility (individual welfare) function. The models are generally referred to as ‘count data models’ and are associated with probability distributions which are limited to integers (whole numbers) and to the non-negative domain (no negative visit numbers are possible).

4.3 Estimation of TCM models

The TCM approach involves inherently non-linear statistical functions due to the use of the representation of visitation as a probabilistic process defined by an assumed probability distribution. The standard approach to estimation of probabilistic processes using statistical routines is the method of Maximum Likelihood (Cameron and Trivedi 2005). This approach attempts to obtain the most likely representation of the data under the assumed probability distribution using mathematical optimisation methods. In addition to collected data, then, the method of Maximum Likelihood requires assumptions over the distribution of visitation, conditional on observations on the visitors themselves (e.g. travel costs, group size, motivation in the recreational activity, etc).

The TCM approach is a mature technology which has evolved to allow analysts to test their assumptions for applicability to a given scenario (Haab and McConnell 2002). For example, the original count data model employed the Poisson distribution which has the restriction that the expected visitation rate was equal to the variance of the distribution of visitation. This implicit restriction can be simply tested for validity by estimating a more recent model, employing the Negative Binomial distribution, which allows the variance to be inflated beyond the expected rate of visitation. This phenomenon is probably the most common generalisation required in the application of statistical models in the use of the TCM. It is referred to as ‘over-dispersion’ and can be generally described as a greater spread in the observations for a given level of, for example, travel costs, than would be expected under the Poisson model. Figure 4.1 presents the issue graphically. The points represent 100 different visitors with the same travel costs. The dotted line is the fit from a Poisson distribution and the dashed the fit from a Negative Binomial distribution. Clearly, the Poisson distribution is not able to properly account for the full range of observations as it has an almost zero probability for both two of the lower observations and seven of the upper observations.

Figure 4.1: Poisson versus Negative Binomial representations for over-dispersed data



In this research we tested for over-dispersion by estimating count data models using the Poisson and the NB distribution and testing for an improvement in 'fit' of the latter by using the likelihood ratio test (Cameron and Trivedi 2005). The count data models were also truncated at a visitation rate of '1' to account for only collecting data at sites where no '0' visit rates could be observed.

A further issue is that sampling recreational users directly, as in on-site surveys, leads to the likelihood that more frequent visitors are over-sampled. To address this problem of endogenous stratification, Englin and Shonkwiler (1995) recommend that one trip be subtracted from each trip observation, with the corrected trip count variable then used as the dependent variable in the standard Poisson model. This has the additional effect of creating a zero visit rate for the site of interest, helping to address truncation issues (Loomis 2003). The correction recommended by Englin and Shonkwiler (1995) is more complex for the negative binomial model, however the use of the zero truncated specification provides a useful alternative that corrects for oversampling (Shresha et al. 2002, Martinez-Espineira and Amoaka-Tuffour 2008, Rolfe and Dyack 2010).

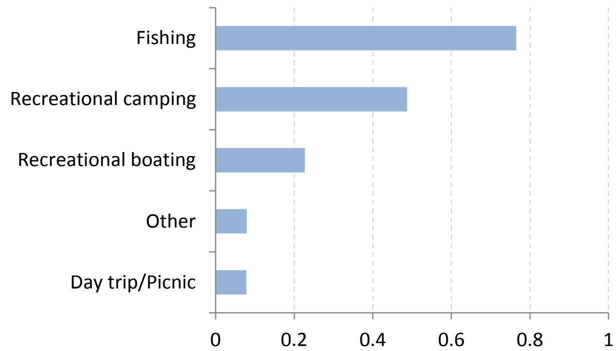
The functions above were maximised (to obtain the most likely parameters for the data) using the maxLik package (Toomet et al. 2010) in the R statistical program (R Development Core Team 2013).

5. Results – qualitative and descriptive

A total of 804 responses were obtained from the onsite survey. Of these responses, 303 were obtained from Boondooma, 103 from Glenlyon, 142 from Monduran, 64 from Teemburra, 174 from Tinaroo and 18 from Somerset. The low sample size obtained for Somerset Dam indicates that results for this dam should be interpreted with caution.

Analysis of the on-site questionnaire data shows that surveyed impoundments were visited primarily for the purposes of fishing and secondly for recreational camping or boating. Almost 80% of respondents to the SIP questionnaire indicated fishing as one of their primary reasons for visiting the dam. Almost 50% also indicated that the reason for their visit was in order to camp. Figure 5.1 presents the proportions of respondents indicating a range of reasons for making the trip to one of the surveyed SIP dams.

Figure 5.1: Proportion of respondents indicating the reason for their trip to surveyed dams



Note: The proportions do not add to 1 as respondents could indicate more than one reason for making their trip

Respondents provided information over total trip length (time away from 'home' on their reported trip) and the length of time spent at the respective dams. Such information can help to understand whether a particular dam is more of a 'destination' dam than others by considering the ratio of total trip time to time at the dam – a score closer to 1 provides some evidence that the given dam is more of a final 'destination' than others for which their ratio of total trip time to dam time is further from 1. Table 5.1 provides a summary of the ratios of time at dam to total trip time for five of the six dams considered in this research (Somerset Dam was not included due to a very low sample size).

Table 5.1: Total trip time and time at dam

	Average total trip time ('a')	Average time at dam ('b')	Proportion of respondents planning on visiting other dams	Ratio (a/b)
Boondooma	11.0	6.3	0.31	0.57
Glenlyon	7.0	6.8	0.22	0.98
Monduran	30.9	4.5	0.12	0.14
Somerset	2.7	2.7	0.00	0.98
Teemburra	3.5	1.2	0.46	0.34
Tinaroo	3.7	3.2	0.16	0.88

The low proportion of visitors planning to visit other dams (Table 5.1) and its proximity to a major population centre (Brisbane) suggests that Somerset Dam was strongly oriented toward being a ‘destination’ dam rather than an ‘opportunistic’ dam[3]..

At the other end of the scale is Teemburra Dam which has both: (1) a high proportion of respondents indicating they were visiting other dams on the trip in which they were surveyed for this research and; (2) a low ratio of time at dam to total trip time, despite being located close to Mackay, a regional population centre in northern Queensland. However the low ratio for Teemburra dam shown in Table 5.1 is influenced by six visitors who had relatively long total trip times and low periods of time spent at Teemburra, suggesting that it may in fact be a destination dam for local anglers.

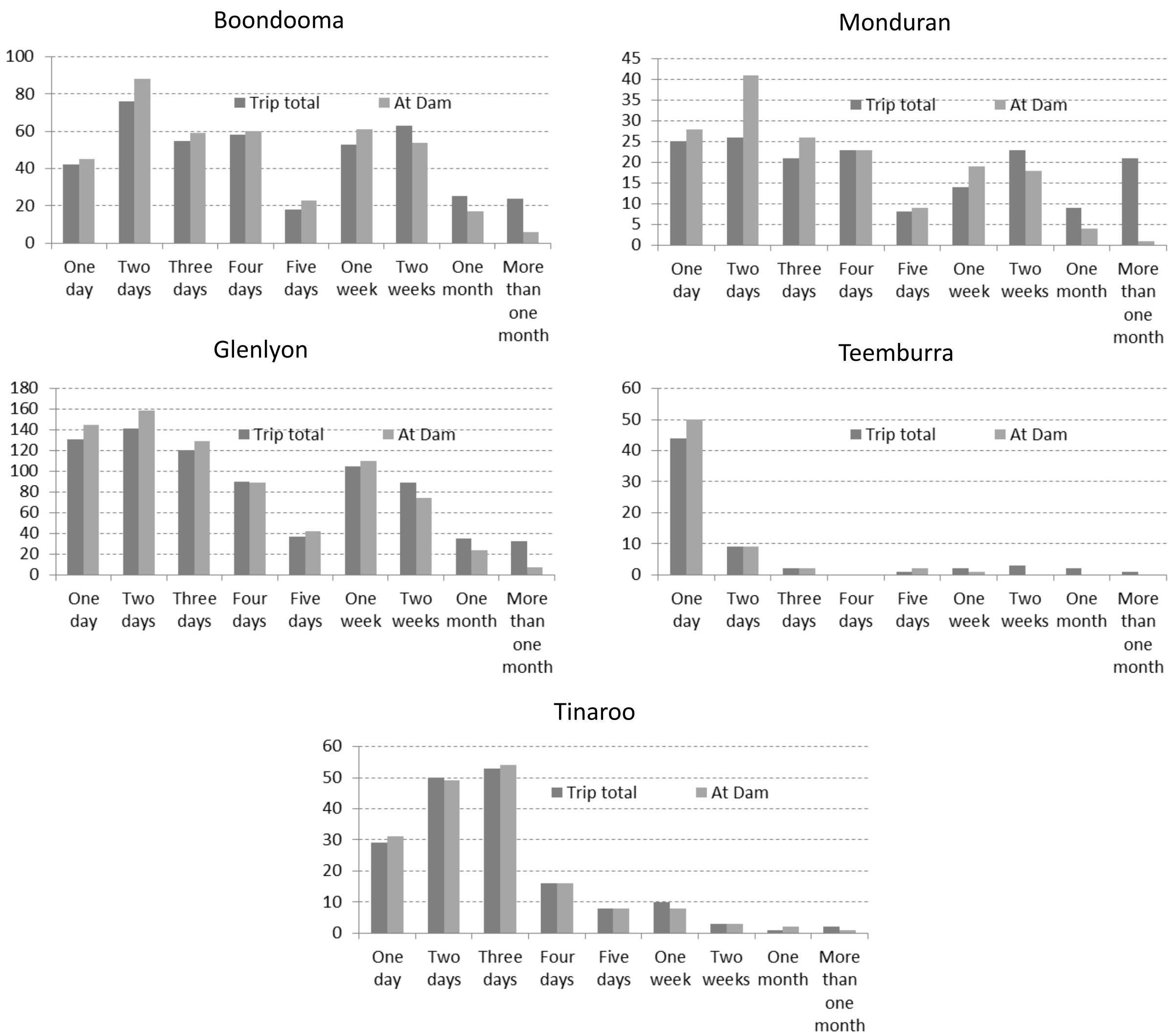
Of the remaining dams included in this research, Glen Lyon and Tinaroo dams appeared to be destination dams (both high ratio of dam time to total trip time and a low proportion of respondents planning on visiting other dams) whilst Boondooma and Monduran dams appeared to be, at least partly, dams which people visited opportunistically or as part of a longer trip.

These trends are supported by considering the ‘geographic monopoly’ held by the respective dams in addition to their proximity to population centres. The location of surveyed dams relative to other stocked dams and population centres in Queensland has been shown in Figure 3.1. The relatively non-central location of Tinaroo dam is apparent whilst Glenlyon dam is located toward the outer limits of major stocked dam but is also very close to the New South Wales – Queensland border, facilitating interstate visitation. The remainder of the dams are in close proximity to alternative fishing locations. Somerset dam can be set apart from the other surveyed dams due to its proximity to the state capital (Brisbane).

[3] This conclusion is based off a very small dataset (n=17) so care must be taken in extrapolating results

The results indicate that Monduran and Tinaroo had relatively low ratios of time at dam relative to total trip time whilst Tinaroo had a very high ratio. Low scores may be a result of either a propensity for visitors to travel to that dam only as a component of a larger trip or as a result of visitors to that dam originating from distant locations, and hence having high travel times. Figure 5.2 reviews the visitation rate data by total trip time and time at dam categories for each dam. It shows that correlation between 'time at dam' and 'total trip time' was low for Monduran and high for Tinaroo.

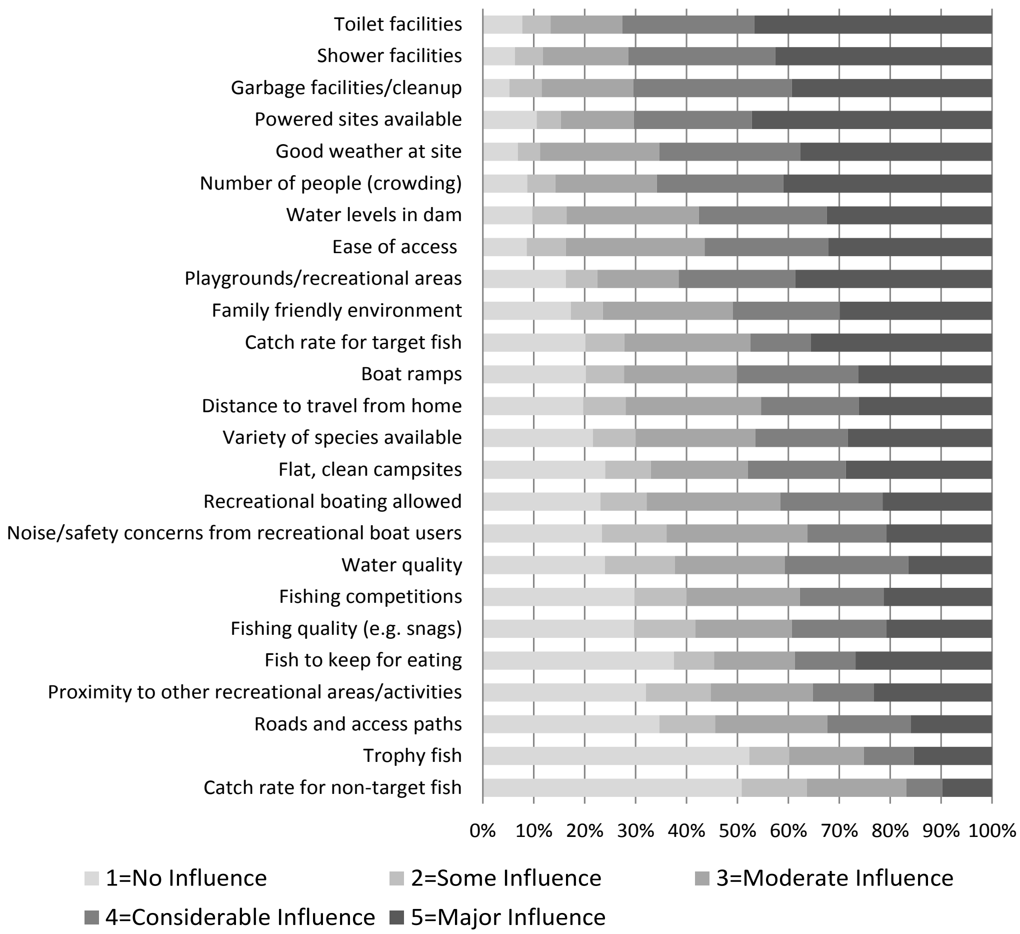
Figure 5.1: Visitation rates by categories (# of respondents in each category)



Respondents to the surveys were asked about the importance of a range of different factors relating to their visits. Overall, visitors to SIP dams appear to be more concerned with attributes of the impoundment sites associated with sanitary fixtures, cleanliness, weather and the general environment *surrounding* the dam sites. Fishing-specific attributes appear to be a far less important dam attribute for the majority of visitors with the first fishing-related factor being ranked as the 11th most important attribute using a simple weighted average of influence scores.

Figure 5.3 below provides a more detailed depiction of the proportion of influence ratings accrued by each of the main factors. The low ratings for the fishing factors cannot be explained by differences in the number of responses; fishing related factors received the lowest respondent attention out of the four types of factors (“fishing”, “campsite”, “recreational” and “site”) with an average number of responses of 609 versus 631, 630 and 638 for the other types of factors respectively. It is possible that the relatively low importance of fishing-related attributes is a result of the sampling scheme which utilised opportunistic recruitment methods of respondents at dam campsites and fishing locations. This type of sampling scheme results in a greater probability of obtaining responses from people who stay overnight at dams, who spend more time in the campsite or located at the shore and/or who spend less time fishing. Some higher weighting for the ranking of amenity-related factors can thus be expected.

Figure 5.3: Influence ratings for dam attributes



The information above suggests that, of the surveyed dams in this research, Tinaroo and Glenlyon dams are geographically differentiated and as a result may receive more visitation solely focused on these dams as ‘end destinations’. The remaining dams do not appear to be highly geographically differentiated, suggesting that they may need to focus more strongly on alternative sources of driving customer (visitor) retention and growth. These aspects are considered later in this report.

Whilst geographic differentiation appeared to provide a possible source of visitation length, of primary focus in this research was the contribution of surveyed dams to regional and local economic value. Table 5.2 below summarises some economic variables collected and calculated for this research by dam. 'Consumption Expenditures' reflects variable expenditures on consumption goods such as accommodation, food, boat fuel, etc – these would be expected to occur relatively more often in the local area than the amounts listed under 'Travel Expenditures' representing the travel costs in arriving at the dams.

Table 5.2: Summary of economic variables by dam

	Boondooma	Glenlyon	Monduran	Somerset	Teemburra	Tinaroo
Consumption Expenditures ($ Total)	$475.3	$668.4	$449.7	$261.3	$185.0	$426.2
Travel Expenditures	$220.5	$221.6	$233.4	$68.8	$90.5	$159.8
Consumption Expenditures ($/person/day)	$38.7	$41.3	$63.7	$46.4	$49.1	$49.2
Total Expenditures ($/person/day	$65.0	$58.8	$97.7	$62.4	$85.4	$71.1
Regional Expenditures ($/person/day	$18.4	$25.2	$45.6	$22.8	$37.8	$44.3
Time at Dam (days)	6.3	6.9	4.5	2.9	1.5	3.3
Number of people in group	3.5	3.1	2.5	2.1	2.6	3.6

Table 5.2 above shows that the per person, per day expenditures were lowest for Glenlyon and highest for Monduran. Consumption expenditures appeared to be slightly less variable between dams with Monduran Dam appearing to have a much larger per person, per day expenditure rate and Boondooma having a much lower rate. It would appear then, that whilst Glenlyon and Tinaroo are differentiated on a geographical basis, Monduran Dam may hold an attraction either inducing visitors to spend more whilst there, or attracting visitors who have a generally higher daily expenditure rate, or some combination of both of these.

A Principal Components Analysis (PCA) was undertaken on the ratings for dam attributes to develop an understanding of the foci of respondents visiting these dams across broad categories and to describe how these foci are ranked for each of the surveyed dams. The VSS (Very Simple Structure) methodology was employed to determine the optimal number of descriptive factors, chosen to be 4, to reduce the large number of dam attributes (n=25). The results of the PCA in terms of condensing the variables into four summary attributes are presented in Table 5.3 below.

The first factor appears to be mainly associated with camping facilities and potentially day-use amenities. Toilet facilities (potentially valuable to both day-use and overnight visitors) in particular load heavily on the first factor as do shower facilities and the availability of powered campsites (suggesting value for overnight visitors only). The second factor is clearly associated with fishing-related dam attributes with catch rates, access (boat ramps) and the potential for 'fishing for food' being of particular importance in identification of this factor. The third factor appears to be a mix of interactions possibilities with other users and alternative recreational possibilities whilst the final factor (Factor 4) appears to be concerned mostly with access issues. Using these interpretations we label the respective factors "Amenities", "Fishing quality", "Recreational quality" and "Access".

Table 5.3: Key factors identified with Principal Components Analysis

Attribute	Factor 1 "Amenities"	Factor 2 "Fishing quality"	Factor 3 "Recreational quality"	Factor 4 "Access"
Catch rate for target fish	0.08	0.84	0.07	0.04
Catch rate for non-target fish	0.09	0.59	0.18	-0.01
Variety of species available	0.29	0.65	0.3	0.02
Boat ramps	0.11	0.77	0.28	0.03
Fishing quality (e.g. snags)	0.16	0.43	0.08	0.11
Fish to keep for eating	0.1	0.72	0.04	0.18
Trophy fish	-0.03	0.61	0.06	0.29
Fishing competitions	0.02	0.42	0.49	-0.31
Number of people (crowding)	0.56	0.22	0.3	-0.09
Flat, clean campsites	0.61	0.2	-0.11	0.4
Powered sites available	0.81	-0.01	0.22	-0.13
Toilet facilities	0.85	0.12	0.05	0.18
Shower facilities	0.83	0.1	0.16	0.19
Garbage facilities/cleanup	0.74	0.17	0.22	0.24
Roads and access paths	0.19	0.05	0.06	0.72
Playgrounds/recreational areas	0.37	0.19	0.62	-0.24
Water quality	0.14	0.15	0.17	0.76
Proximity to other recreational areas/activities	0.08	0.04	0.65	0.14
Recreational boating allowed	0.1	0.06	0.69	0.02
Noise/safety concerns from recreational boat users	0.03	0.21	0.46	0.25
Family friendly environment	0.06	0.23	0.46	0.6
Distance to travel from home	0.06	0.22	0.61	0.48
Ease of access	0.39	0.24	0.52	0.31
Water levels in dam	0.26	0.28	0.62	0.25
Good weather at site	0.38	0.12	0.49	0.12

(dark shading) = attribute loaded on this factor
(light shading) = loading conflict, this loading is the minor loading

Factor scores: what they are and how to interpret them

Factor scores can be interpreted as a relative 'importance' weighting for that factor. The factor itself is a combination of the scores provided by the respondent for each of the included variables in that factor (the darkly shaded cells in Table 5.3) – so for example Factor 1 includes 'Number of People', 'Flat, clean campsites', 'Powers sites available', 'Toilet facilities', 'Shower facilities', and 'Garbage facilities/cleanup'. This factor is titled 'Amenities' to reflect the variables that are associated with it. Whilst we use a title to aid description of these factors the naming of the factor is subjective, based on the analysts consideration of what it that factor encompasses.

A high score for a variable associated with a given factor indicates that the respondent feels its elements are jointly important components of their reasons for travelling to a site. Factor analysis such as this is used to reduce the number of variables employed in subsequent modelling exercises – as carried out in the next section.

Table 5.4 presents the normalised relative importance of scores calculated using the sum of factor loadings for shaded attributes (in Table 5.3 above), multiplied by each respondent's reported 'importance' score for that attribute. These scores indicate the relative importance of each aggregate factor, derived from the PCA, for each dam.

For all dams, the 'Access' attribute was least important, possibly indicating either that, (1) access was a minor factor in visitation decisions for respondents, or (2) that access was not deemed to be a limiting factor (i.e. access was adequate at all dams). Respondents from Tinaroo and Teemburra dams did not provide a clear ranking of the remaining factors for their dam, suggesting that they viewed the presence of quality amenities, fishing and alternative recreation possibilities approximately equally. Somerset Dam respondents appeared to consider 'Recreational quality' to be the most important attribute at that dam whilst quality 'Amenities' appeared to be the most important factor for Boondooma, Glenlyon and Monduran visitors. The factor 'Fishing quality' was generally the second or third most important factor but was generally significantly lower than the highest ranked factor other than at Somerset, Teemburra and Tinaroo dams.

Table 5.4: Normalised factor scores by dam and factor type

	Boondooma	**Glenlyon**	**Monduran**	**Somerset**	**Teemburra**	**Tinaroo**
Factor 1 ('**Amenities**')	0.9	1.1	1.0	0.2	0.5	0.5
Factor 2 ('**Fishing quality**')	-0.1	0.2	0.1	0.5	0.4	0.5
Factor 3 ('**Recreational quality**')	0.6	0.1	0.3	0.8	0.6	0.6
Factor 4 ('**Access**')	-1.4	-1.4	-1.4	-1.5	-1.5	-1.5

Whilst factors derived from PCAs allow a summary of complex preference data, real interest lies in whether they are related to actual economic phenomena, such as the expenditures of recreational anglers. If the preferences of visitors to the dams about their trips and recreational experiences can be linked to actual behavioural data, it will provide more confidence in study results and allow visitor 'typologies' to be developed for the dams included in this study. Table 5.5 presents simple regression results (Ordinary Least Squares) across the pooled data set for several economic parameters using the PCA-derived factors as explanatory variables.

Table 5.5: OLS regressions of key economic variables on PCA-derived factors

Explanatory variables:	Consumption Expenditures ($ Total)	Travel Expenditures	Total Expenditures ($/person/day	Time at Dam (days)^
Intercept	4.16***	4.91***	3.86***	1.49***
Factor 1 ('Amenities')	0.07***	0.06***	0.01	0.06***
Factor 2 ('Fishing quality')	0.02	-0.01	0.03***	-0.01***
Factor 3 ('Recreational quality')	-0.03	-0.05***	-0.02**	-0.06***
Factor 4 ('Access')	0.04	-0.02	-0.02	0.03***
Sample size = 687				
R-squared	0.05106	0.07809	0.03635	-

^ = A Poisson model was used rather than OLS as this data was in count (integer) form.
Note: '***' = significant at 0.01 level; '**' = significant at 0.05 level; '*' = significant at 0.1 level

The model fits (R-squared statistic) in Table 5.5 indicate that the PCA-derived factors had low explanatory power in understanding the range of outcomes for the economic phenomena considered. This low explanatory power is however common in socio-economic studies due to significant heterogeneity in preferences of respondents and constraints in their decision making which are generally unobserved. All models were significant at the 5% level of significance. As expected, a higher ranking for the amenities component tended to be associated with a greater time spent at the dams but also was associated with a greater level of expenditure in general, although not at the per person, per day level. Interestingly, 'Fishing quality' was significantly positively associated with a higher mean expenditure (per person per day), indicating that dams which were able to improve their quality of fishing may also facilitate an increase in expenditures. The effects would be stronger for the more localised 'consumption expenditure' than with general 'travel expenditures' (i.e. car travel costs), which are largely incurred in areas more distant to the dam location. Greater ratings of importance for 'Recreational quality' appeared to be associated with visitors who spent less and who had lower visitation periods.

The above results may suggest that communities in proximity to stocked dams may benefit relatively more from improvements in fishing quality at those dams than alternative improvements.

6. Results – econometric modelling of Willingness to Pay

In this section we review the results from econometric modelling for a range of combinations of data derived from the survey of visitors to the six surveyed stocked freshwater impoundments. Expenditure data was calculated for trip cost data in the model by estimating the travel costs for the dam in question (distance from last overnight destination) plus consumption expenditures. A 'pooled' model, involving data for all dams pooled together was estimated in addition to models for each dam for which there was sufficient data (Boondooma, Glenlyon, Monduran and Tinaroo Dams).

6.1 Pooled dams data results

The travel cost model involved regressing a number of independent variables about the angler, trip and dam characteristics (independent variables) to explain a dependent variable, the length of stay at the given dam. The most important independent variable in the travel cost model is the estimate of travel costs for each trip.

Travel costs were comprised of three main components which were added together to obtain the final total travel costs per group. These were:

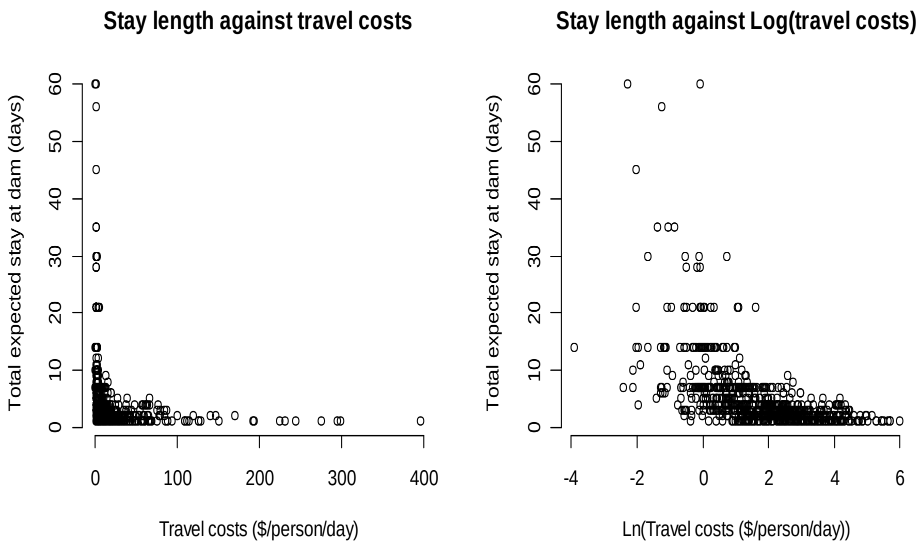
(1) The direct costs of travel to the dam site – estimated as vehicle costs. Vehicle costs were calculated using Australian Taxation Office claimable allowances for small cars (0.65cents/km), large cars (0.74cents/km) and 4WDs (0.75cents/km). These rates were multiplied by the return distance implied by the distance travelled from the last overnight destination of respondents.

(2) The consumption and materials costs for the trip including accommodation, boat fuel, bait, food and beverages and other entertainment expenses. These were obtained from the respondents by direct questioning.

(3) The opportunity cost of time. Time spent travelling to recreational locations involves implicit costs associated with the time which could have been spent in alternative productive or recreational pursuits. The literature suggests a value of 1/3 of gross income for the household as the rate of time-costs in travel for recreational pursuits. To calculate this value we multiplied the reported return trip time by the reported household income level divided by 48 weeks (4 weeks holiday) and divided by a 37.5 hour assumed working week.

The total travel costs were divided by total expected stay at dam and the number of people in the group to obtain the cost per day per person at the dam. Figure 6.1 plots these costs against the total expected stay at dam for all respondents, with results demonstrating a standard inverse relationship between travel costs and stay length.

Figure 6.1: Scatterplot of stay length against calculated travel costs ($/pp/day)



Pooled model results are shown below in Table 6.1. Dummy variables were included to allow for different visitation levels between the dams. The base-case (needed to ensure that dummy variables are relative to some 'base' scenario) was set as Teemburra dam as this dam had the average lowest visitation level. All dummy variables for the relative visitation at the other dams were significant and positive, suggesting that visitation to Teemburra involved inherently lower visitation periods than at the other dams. The Glenlyon dam had the highest average visitation length, although this result was statistically significant only for comparisons against Tinaroo and Teemburra dams.

The ZTNB model was clearly preferred over the ZTP model on the basis of the likelihood ratio test and the Akaike Information Criterion (AIC). The over-dispersion parameter (alpha) suggests weak over-dispersion in the data (multiple trip costs are observed for each visitation rate).

The value of fishing gear was positive with a coefficient of 0.000013, suggesting that stay-length was increased by 1.14 days for an increase in fishing gear value of $10,000. The average fishing gear value was approximately $1500, so although this is a statistically significant positive relationship indicating relative commitment to recreational angling, it is a relatively minor contributor to understanding the length of trip undertaken to SIP dams. Boat usage was common amongst visitors to all SIP dams with a minimum of 64% of respondents using boats at Monduran and more than 96% at Tinaroo dams. Boat usage was strongly correlated with increased stay-length. The ZTNB model indicated an average expected increase in stay-length of 2.08 days with boat use.

Table 6.1: Travel cost models for pooled data set

	ZTP			ZTNB		
	Estimate	Std Err	P-value	Estimate	Std Err	P-value
Intercept	0.0523	0.1544	0.3766	-0.2093	0.3765	0.3417
Boondooma	0.9878	0.1253	0.0000	1.0933	0.2689	0.0001
Glenlyon	1.1105	0.1281	0.0000	1.2519	0.2880	0.0000
Monduran	0.9267	0.1261	0.0000	1.0070	0.2738	0.0005
Teemburra	-0.9349	0.1676	0.0000	-0.8710	0.3130	0.0084
Tinaroo	0.5156	0.1273	0.0001	0.5564	0.2783	0.0542
Exp/pp/day	-0.0097	0.0003	0.0000	-0.0070	0.0006	0.0000
# in party	-0.0671	0.0087	0.0000	-0.0442	0.0277	0.1114
Average age	0.0163	0.0009	0.0000	0.0155	0.0029	0.0000
Proportion male	0.0943	0.0610	0.1207	0.0655	0.1833	0.3741
Family? (y=1)	0.1789	0.0325	0.0000	0.0439	0.1002	0.3622
Couple? (y=1)	0.1688	0.0373	0.0000	0.1708	0.1209	0.1469
Single? (y=1)	0.7592	0.0409	0.0000	0.6349	0.1423	0.0000
Main reason: Fishing (y=1)	0.2109	0.0289	0.0000	0.2742	0.0886	0.0034
Multiple dams? (y=1)	-0.0755	0.0201	0.0004	-0.1191	0.0772	0.1211
Hours fished/day	-0.0380	0.0050	0.0000	-0.0338	0.0162	0.0457
Fishing gear value	0.0024	0.0051	0.3551	-0.0020	0.0141	0.3950
Used boat? (y=1)	0.6650	0.0388	0.0000	0.5939	0.1053	0.0000
Boat value	0.0000	0.0000	0.0009	0.0000	0.0000	0.2524
# children in household	0.0014	0.0151	0.3971	0.0106	0.0446	0.3878
# adults in household	-0.0480	0.0165	0.0060	-0.0414	0.0568	0.3054
Income	0.0000	0.0000	0.3973	0.0000	0.0000	0.3781
Dispersion coefficient (alpha)		-		0.4340	0.0456	0.0000
Log Likelihood value		-2116.36			-1756.7060	
N		786			786	
Likelihood ratio statistic			719.30802			
AIC		4277			3557	
Preferred model?			ZTNB			

Significant at the 10% level
Significant at the 5% level
Significant at the 1% level

Family groups and singles tended to stay the longest on trips to the surveyed SIP dams with couples and friend groups tending to lower stay lengths. Visitation by people from larger household sizes tended to indicate a lower willingness to stay for longer lengths of times at surveyed dams although this was not a statistically significant predictor of stay length. Meanwhile household income levels appeared to be positively correlated with visitation length but, as with fishing gear, involved a relatively minor contribution (e.g. an expected increase in stay-length of 0.78 days at $80,000 household income level) and the effect was not statistically significant.

The willingness to pay, estimated from the travel cost variable ("Exp/pp/day") and calculated as $-\frac{1}{\beta_{TC}}$ was highly statistically significant with an expected level of approximately $142 per person per day for time spent at SIP dams. This estimate is in line with the literature on the value of recreational angling.

6.2 Individual dams data results

Data from four dams was sufficient to estimate individual models, namely: Boondooma, Glenlyon, Monduran and Tinaroo dams. Table 6.2 below presents the results from econometric models for these four dams using total travel costs (results for regional expenditures follows). Dispersion coefficients were significant for all models and indicated weak over-dispersion which was supported by likelihood ratio tests supporting the use of the ZTNB model over the ZTP model for these data series.

Table 6.2: Travel cost models for individual dams

	Boondooma	Glenlyon	Monduran	Tinaroo
Intercept	0.5846	1.1531	2.2737**	0.2452
Exp/pp/day	-0.0125***	-0.0111***	-0.0068***	-0.0051***
# in party	-0.0502	-0.2008**	-0.2752**	0.0355
Average age	0.0221***	0.0134*	0.0033	0.0142*
Proportion male	0.2902	-0.2660	0.3244	-0.2605
Family? (y=1)	0.1692	0.5806**	0.0758	-0.1574
Couple? (y=1)	0.1221	0.2684	-0.2457	1.0571***
Single? (y=1)	0.9841***	0.9407**	0.2656	-0.8854
Main reason: Fishing (y=1)	0.2619**	0.1703	-0.4459	0.2504
Multiple dams? (y=1)	-0.0944	-0.2025	0.1873	-0.2870
Hours fished/day	-0.0503*	-0.0357	0.0399	-0.0090
Fishing gear value	0.0017	-0.0113	-0.0048	-0.0105
Used boat? (y=1)	0.6901***	0.9065***	0.5605	0.2827
Boat value	0.0000	0.0000*	0.0000	0.0000
# children in household	0.0460	-0.0194	-0.1189	0.1213
# adults in household	-0.0746	0.0676	-0.1345	0.0551
Income	0.0000	0.0000	0.0000	0.0000
Dispersion coefficient (alpha)	0.3399***	0.1055**	0.5257**	0.2647***
Number of observations	296	101	138	170
Log Likelihood value	-727.10	-247.96	-299.93	-311.34
Model?	ZTNB	ZTNB	ZTNB	ZTNB

Note, statistical significance level indicated by: "***" = significant at 1%; "**" = significant at 5%; "*" significant at 10%.

Whilst the general results appear to be similar comparing the individual models to the pooled model, there are some differences between the dams themselves which allow for some interpretation. The fishing gear value coefficient is highest in the individual models results for Lake Monduran. Taken together with the earlier information that Lake Monduran had the lowest level of boat utilisation, it might be expected that fishing gear is a substitute for a fishing boat, at least at Lake Monduran. The non-significance of the coefficient for 'multiple dam visits' at Boondooma Dam and Tinaroo Dam, its significantly positive estimate for Lake Monduran, and the statistically negative estimate for Glenlyon

Dam suggests that the latter may not be a 'key destination' dam for people travelling on a multi-destination trip and that visitors at Glenlyon may view their visit as the prime reason for travelling. Meanwhile, Boondooma Dam, Tinaroo Dam and Lake Monduran are likely 'key destination' dams for freshwater anglers, whether they are visiting several dams or not. Expenditure (per person per day) was a significant explanatory variable for length of stay at all four dams allowing calculation of the WTP for these locations. Age of respondents appeared to generally indicate a greater propensity to stay for longer lengths of time at the surveyed dam.

The estimated travel cost coefficients were all of the expected sign and highly statistically significant. Table 6.3 below presents the calculated WTP values from these models and the pooled model. The pooled model indicated a much higher WTP value than any of the values originating from the individual models except for Monduran and Tinaroo dams.

The higher WTP values for the pooled model may suggest that freshwater anglers 'just want to fish at a dam' – meaning low levels of substitutability for 'freshwater angling' with other recreational pursuits but high substitutability between dams leading to lower WTP values for individual dams and higher WTP values for pooled models.

Table 6.5: Consumer Surplus values (per person per day) for the pooled and individual dam models

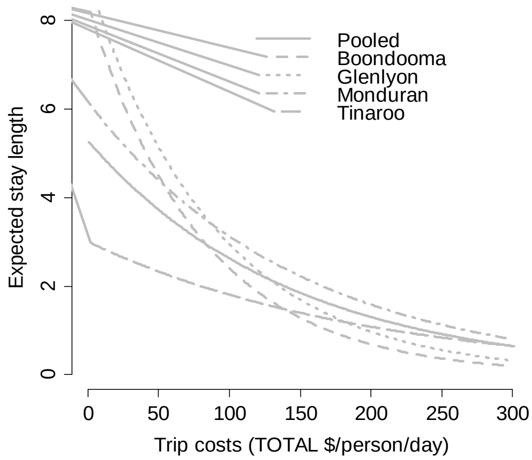
	Pooled	Boondooma	Glenlyon	Monduran	Tinaroo
WTP/person/day (all expenses)	$142	$80	$90	$147	$196
Lower bound for 95% confidence interval	$110	$105	$174	$282	$374
Upper bound for 95% confidence interval	$97	$65	$61	$99	$134

Whilst the calculated WTP values were generally higher for the pooled model, other factors (such as a lower intercept term) served to reduce expected visitation levels. Figure 6.2 presents the expected stay-length for the pooled and individual dams models. Expected stay length was calculated by taking the exponent of the sum of the product of the means of the data and the estimated parameter vector, or:

$$E(stay\ length) = e^{x\beta}$$

The expenditure variable was replaced with a range of values from $0 to $300 to allow consideration of the response of stay-length to expenditure levels between individual dams and also with the pooled model results. For the 4 individual dams, the stay-length approached zero days as the expenditure, per person per day, for travelling parties approached $500. The diagram allows visualisation of the sensitivity of visitors to each of the dams to travel costs – flatter lines from left to right indicate lower sensitivity to travel costs regardless of the starting point for ($0 travel costs) average expected stay length.

Figure 6.1: Expected stay length against trip expenditures (per person per day) for the pooled and individual dam models

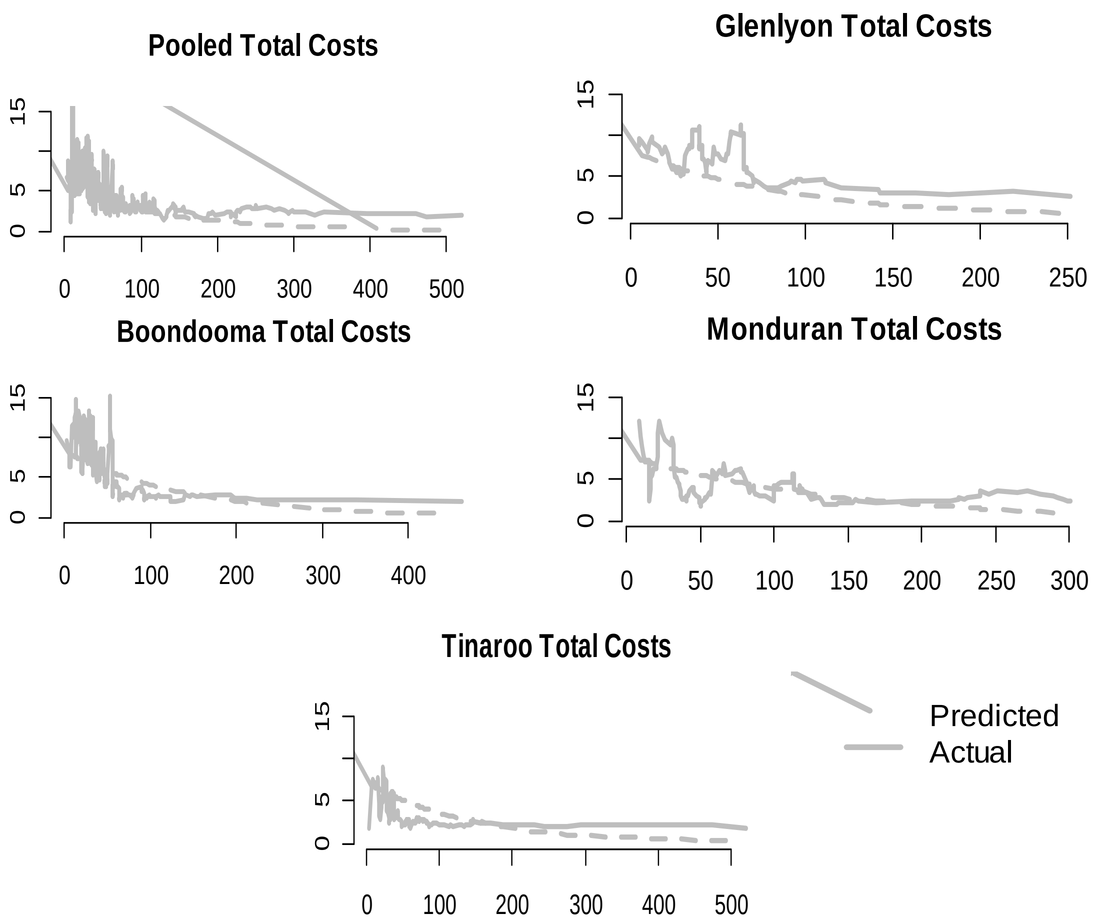


For total costs, Boondooma dam was most sensitive but also appeared to have one of the highest underlying length of stay durations across all dams. Tinaroo and particularly Monduran dams appeared to have a travel-cost sensitivity close to that of the average for all dams for the total costs specification. In contrast, travellers to Monduran dam were most sensitive to costs incurred in close proximity to the dam whilst Tinaroo visitors were least sensitive.

The total trip costs were generally strong predictors of stay-length at the dams assessed. Figure 6.3 below shows the good association between the predicted and observed trip length[4] for given levels of daily travel costs.

[4] Calculated using a 10 year moving average with trip length ordered by travel costs

Figure 6.3: Actual versus predicted length of stay using different travel costs levels



7. Results – Online Data Analysis

The online data was collected from recreational anglers purchasing a SIP permit, where the angler could nominate a particular SIP dam of interest. This allowed the responses to the on-line survey to be collated for the different dams across the State[5]. The inclusion of a similar ratings question (to the on-site survey) allowed consideration of how respondents' preferences over dam attributes was correlated with their attendance at the range of dams operating under the SIP scheme.

A total of 219 completed responses could be used in this analysis. No data was available for Lenthalls Dam (near Maryborough), as no purchases of permits for this impoundment occurred during the survey period. This meant that models could only be estimated for the other 31 dams in the SIP scheme. From the data a count data model (see methods section) was estimated for each dam using calculated PCA factors derived from the earlier PCA analysis and applied against ratings provided by online respondents (Table 7.1[6]). Travel costs, calculated using only the expected vehicle return trip costs, were also included as an explanatory variable. The dependent variable was the total number of days respondents expected to spend at each dam based on average trip profiles provided in the online questionnaire.

Overall the estimated parameters appeared to have the expected sign with dams with low amenities levels (e.g. Teemburra) having a negative response for this factor whilst others with good provision of amenities (e.g. Glenlyon and Monduran) having a significant positive response for this factor. It appeared that smaller dams were the only ones for which fishing attributes were important predictors of frequency of expected attendance at the dam – the exception was Somerset dam which had a significant, but not overwhelmingly positive, effect of fishing preferences on dam attendance. Some dams with high levels of amenities, such as Tinaroo Falls, also have a negative association with this factor – a significant explanation for this outcome is the fact that Tinaroo Falls dam has a very large number of access points which have no facilities and which are regularly accessed by local anglers. Estimated WTP parameters are also mostly significant with the correct sign indicating that higher travel costs negatively affect length of attendance at dams.

Whilst the rankings of PCA factors indicate the relevance of different factors at each dam, they fail to provide an indication of the relevance of PCA factors across the SIP scheme more generally. Assuming that social utility (value) can be indicated by relative attendance at the dams we multiplied the coefficient estimates for the effect of PCA factor rankings (Table 7.1) on dam attendance by the

[5] Data was only collected from SIP permit holders, whereas the data from the on-site surveys (reported in sections 5 and 6) also allowed inclusion of non-angling recreational users of SIP dams.

6 Note that the net impact of an increase in the ratings score for each factor by 1 unit is calculated as e^{β} where β is the estimated parameter.

frequency of total dam attendance also from Table 7.1. This resulted in a set of scores with the highest indicating, jointly, high levels of dam attendance and high levels of influence for the relevant dam and relevant PCA factor respectively. Results were ranked from highest to lowest with resultant ranks presented in Table 7.2[7]. This joint measure provides a rough indication of the value of each of the PCA factors to the SIP scheme generally. Ranks were considered on their absolute value (total impact including negative impacts) with an indicator ('+ve' and '-ve') provided to indicate the nature of their impact on visitation.

Table 7.1: Attendance and TCM models (Online survey)

	Intercept	Travel Costs	Factor 1 "Amenities"	Factor 2 "Fishing quality"	Factor 3 "Recreational quality"	Factor 4 "Access"	Model Type
Tinaroo Falls	2.0896*	-0.0039***	-0.0274	0.0489	0.0076	-0.0428	NB
Burdekin Falls	-3.8139**	-0.0006	0.3372***	-0.0892	-0.0411	-0.4513**	Poisson
North Pine Dam	0.7077	-0.0089***	-0.0286	0.0283	-0.1012	0.2971	NB
Peter Faust	-0.7815	-0.0051***	0.0792	0.0832	-0.0256	-0.0965	Poisson
Eungella	7.0773***	-0.0024***	-0.0545	0.0933	-0.4980**	-0.2367	NB
Teemburra	-0.0348	-0.0023	-0.1885	0.3787	0.1667	-1.2605*	NB
Kinchant	1.2007	-0.0042***	0.0170	0.4903**	0.0211	-1.3856**	NB
Theresa Creek	5.1589*	-0.0024	0.3546*	-0.2716	-0.4323*	-0.4272	NB
Fairbairn	0.6125	-0.0029*	0.3220*	-0.6043***	-0.0181	0.2316	NB
Callide	5.6519***	-0.0185***	0.2702**	-0.0369	0.0044	-1.4997***	Poisson
Cania	3.9132	-0.0063**	-0.0483	-0.0221	-0.0030	-0.4926	NB
Lake Monduran	0.9010	-0.0057***	0.0744	0.1251*	-0.0776	-0.2408	NB
Lake Gregory	0.8350	-0.0159***	-0.1208	0.2366***	0.0689	-0.6080***	Poisson
Wuruma	-2.6067**	-0.0049***	0.0793	0.2240***	0.0867	-0.6000***	Poisson
Boondooma	-1.8997	-0.0014	0.0394	0.1167	-0.0067	-0.0383	NB
Bjelke-Petersen	-1.3613	-0.0007	0.2683***	-0.0797	-0.0766	-0.3587	NB
Gordonbrook	-4.4709	0.0003	0.2131	0.6298**	-0.9227**	0.0781	NB
Cooby	-0.8760	-0.0153***	-0.0984	-0.0332	0.0676	0.1921	NB
Leslie	-0.0595	-0.0029*	-0.0329	-0.0539	0.1403	-0.1796	NB
Storm King Dam	3.6974***	-0.0124***	0.1412*	-0.0188	-0.2042**	-0.6495***	Poisson
Coolmunda	2.7359	-0.0103***	-0.2243*	0.0734	-0.3744**	0.8616**	NB
Connolly	4.9624*	-0.0151**	0.1369	0.0012	0.0622	-1.6486***	NB
Glenlyon	1.6692	-0.0032**	0.1685*	0.1145	-0.3385**	-0.1518	NB
Lake MacDonald	-1.4757	-0.0070*	-0.0296	0.1448	0.0284	-0.3052	NB
Borumba	0.9467	-0.0005	0.0349	0.1509**	-0.4400***	0.4253*	NB
Somerset	-0.9215	-0.0029***	0.1751***	0.0775	0.0422	-0.4641***	NB
Cressbrook	-1.7550	-0.0030**	0.0357	-0.0098	0.1011	-0.0086	NB
Wivenhoe	0.1438	-0.0095***	0.1330**	0.0511	-0.0519	-0.1721	NB
Lake Dyer	0.1805	-0.0199***	0.0096	0.1295***	0.0785**	-0.3330***	Poisson
Moogerah	1.5765	-0.0100***	0.0527	-0.0221	0.0944	-0.5204**	NB
Maroon	0.0253	-0.0063**	-0.0936	0.1512*	0.0678	-0.2590	NB

Note: Sample size was 219 for all models

[7] Results for insignificant estimates from Table 7.1 were not included.

Note, statistical significance level indicated by: "***" = significant at 1%; "**" = significant at 5%; "*" significant at 10%.
Sample size was 219 for all models (including respondents indicating a zero visitation rate to dams)

Table 7.2 shows that all factors are relevant to SIP permit purchasers but that 'Amenities' and 'Fishing quality' generally appeared to be most important across the dams for SIP permit purchasers. It also indicates that certain dams are more important to SIP permit purchasers than others.

Table 7.2: Ranked measure of relevance of PCA factor types to SIP scheme 'usage' (attendance at SIP dams for SIP permit purchasers)

	Proportion of total visitation	Factor 1 "Amenities"	Factor 2 "Fishing quality"	Factor 3 "Recreational quality"	Factor 4 "Access"
Tinaroo Falls	10.1%	-	-	-	-
Burdekin Falls	0.4%	19 (+ve)	-	-	22 (-ve)
North Pine Dam	9.5%	-	-	-	-
Peter Faust	1.1%	-	-	-	-
Eungella	1.4%	-	-	31 (-ve)	-
Teemburra	0.3%	-	-	-	25 (-ve)
Kinchant	1.7%	-	7 (+ve)	-	37 (-ve)
Theresa Creek	1.2%	13 (+ve)	-	28 (-ve)	-
Fairbairn	1.8%	10 (+ve)	32 (-ve)	-	-
Callide	1.3%	14 (+ve)	-	-	35 (-ve)
Cania	1.4%	-	-	-	-
Lake Monduran	4.8%	-	9 (+ve)	-	-
Lake Gregory	0.7%	-	17 (+ve)	-	27 (-ve)
Wuruma	0.9%	-	16 (+ve)	-	30 (-ve)
Boondooma	4.5%	-	-	-	-
Bjelke-Petersen	2.7%	8 (+ve)	-	-	-
Gordonbrook	0.2%	-	18 (+ve)	23 (-ve)	-
Cooby	0.7%	-	-	-	-
Leslie	3.6%	-	-	-	-
Storm King Dam (near Stanthorpe)	0.8%	20 (+ve)	-	21 (-ve)	29 (-ve)
Coolmunda	1.1%	24 (-ve)	-	26 (-ve)	6 (+ve)
Connolly	2.0%	-	-	-	39 (-ve)
Glenlyon	6.7%	3 (+ve)	-	36 (-ve)	-
Lake MacDonald	0.8%	-	-	-	-
Borumba	6.7%	-	4 (+ve)	38 (-ve)	1 (+ve)
Somerset	11.3%	2 (+ve)	-	-	40 (-ve)
Cressbrook	4.6%	-	-	-	-
Wivenhoe	7.6%	5 (+ve)	-	-	-
Lake Dyer	3.9%	-	11 (+ve)	15 (+ve)	33 (-ve)
Moogerah	3.2%	-	-	-	34 (-ve)
Maroon	2.9%	-	12 (+ve)	-	-

The most important factor affecting attendance decisions at SIP dams appeared to be the preference for dam ‘Amenities’ (e.g. clean campsites and ablutions) indicated by an average rank score of 11.8 versus 14 for the next most important attribute on average, ‘Fishing quality’.

The ‘recreational quality’ of the dams does not appear to be a positive factor influencing visitation, in a positive manner, by SIP permit purchasers – all significant factor-dam attendance interactions for the ‘recreational quality’ factor were negative indicating that preferences for good quality recreational opportunities may actually deter purchasers of SIP permits from dams.

The ‘Fishing quality’ factor ranks quite highly across most dams for our contrived measure of ‘importance’ with all but two dams recording significant positive associations between increasing fishing preferences and increasing dam attendance. The Amenities factor was also highly important seemingly strongly positively influencing attendance at many of the dams including well-provisioned dams such as Somerset, Wivenhoe and Glenlyon as expected.

The count data models reported in Table 7.1 can also be used to estimate trip values. The travel cost parameters shown in Table 7.1 were mostly significant at the 10% level of significance or better, with only 6 of the 31 dams having insignificant parameter estimates. Preferred specifications for the count response were mixed between the Poisson type response (mean and variance equal) and the Negative Binomial type response (variance allowed to be greater than the mean indicating some possible heterogeneity). The estimated parameters included only travel costs calculated from car type used (small car=0.65c/km; large car=0.75c/km, 4WD=$1/km) and the return trip distance from nominated home destinations to each of the SIP dams divided by the number of days expected on the trip. Calculated WTP from these estimates thus reflects the WTP for an additional day of attendance at the dam.

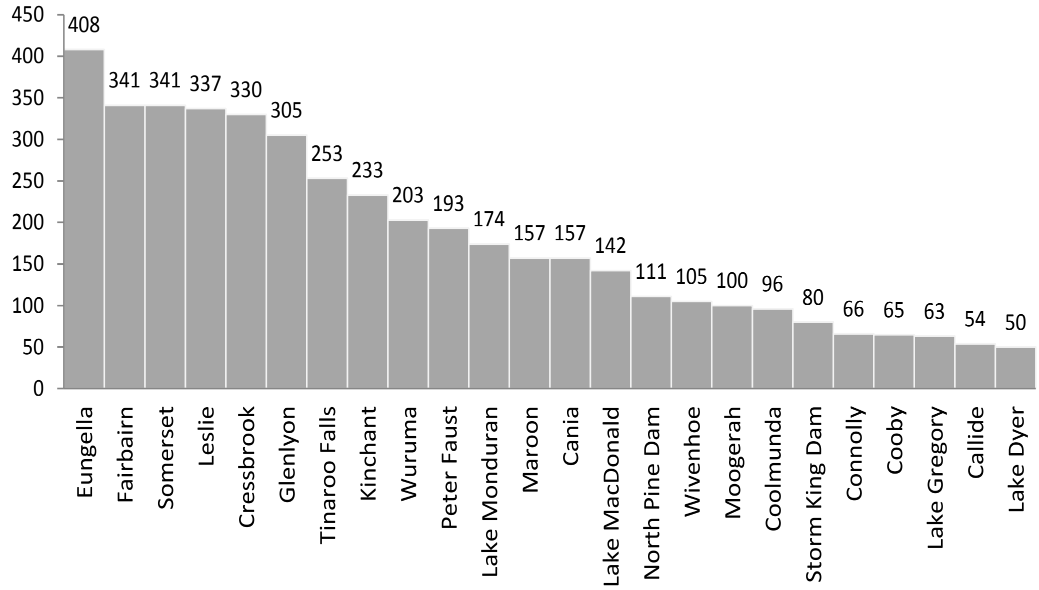
Most estimated WTP values were within reasonable limits – from between $50 to $350 per expected day of visitation[8]. Figure 7.1 shows the distribution of estimated WTP values calculated from dam models for which the travel cost parameter was statistically significant (Table 7.1).

Most dams in close proximity to Brisbane (e.g. Wivenhoe, Moogerah and North Pine) had low WTP ($/day) indicating a majority of day trippers visiting these dams. The exception was Somerset Dam which had a high estimate (in the order of $340 per day) indicating Somerset may attract visitors from more distant locations. Dams with a relative geographic monopoly – such as Glenlyon and Tinaroo Falls – also appeared to have a relatively high WTP value (above $250 per day) providing supporting evidence of their importance as destination dams.

[8] Note that these values do not take into account potential multi-activity trips and so the higher values may be over-estimates even though accommodation and other consumption (direct) costs have not been included.

Values are conservative compared with previous estimates reported by Rolfe and Prayaga (2007). For example, Fairbairn Dam was estimated in the previous study to have a group visit value of $1776.30, which matches with a day rate of $344.83 by 3.5 days average stay = $1,206.90 per trip estimated in this study. At average trip values of $184.23 per day in this study, values for Bjelke-Petersen and Boondooma Dams are estimated in this study at $276.35 and $589.84 per visit, which corresponds with previous values of $543.36 and $958.30 per visit respectively.

Figure 7.1: Dams ranked by estimated WTP per day per angler group



Total visit rates were estimated by estimating the number of days fishing for each permit. Total fishing days per annum were estimated at 3.95, 10.82 and 11.85 days for the weekly, yearly and yearly concessional permit holders. Further analysis identified that the weekly anglers made an estimated 2.7 trips per annum for an average 1.46 days per trip. These estimates of days per permit were then multiplied by the total number of SIP permits issued in 2011-12[9] to generate a total estimate of 272,305 days of fishing effort at the SIP dams (Table 7.3).

[9] Data available at: http://www.daff.qld.gov.au/28_22067.htm

Table 7.3: Total visit rates to SIP dams x SIP Permit

Permit type	Number of permits	Average Days / permit	Total days
Weekly	32,808	1.46	47,900
Yearly	16,378	10.82	177,210
Yearly concessional	3,992	11.85	47,305
Total	**53,178**		**272,415**

Data from the online survey was also used to estimate annual visit rates to each dam. Respondents were asked in the survey to indicate the number of trips that they made to freshwater sites each year, as well as their average trip length and the number of days fishing at each dam. The data was analysed and averaged to identify average visit rates, as well as the percentage of dam visits for the 219 online respondents (Table 7.4). The data showed a 62% correlation with the nominated allocation to dams by SIP permit holders (Table 7.4), possibly because anglers had preferences for 'trophy' dams[10].

Table 7.4: Annual visit rates per dam (indicates average value substituted)**

[10] The differences between the estimated visit rates and the SIP allocations per dam raise the possibility that visits have been over-estimated for Borumba, Glenlyon, Monduran, North Pine, Somerset, Tinaroo, and Wivenhoe Dams, and under-estimated for other dams.

	Days per angler	Days per visit	Visits per year	% of total visitation	SIP Funding allocation	Annual visits
Bjelke-Petersen	3.2	1.0	3.2	2.70%	4.32%	9,561
Boondooma	4.8	3.0	1.6	4.50%	5.72%	15,935
Borumba	5.3	2.0	2.6	6.70%	4.07%	23,725
Burdekin Falls	2.5	2.4**	1.0	0.40%	1.00%	1,416
Callide	6.4	1.0	6.4	1.30%	1.62%	4,603
Cania	4.0	4.0	1.0	1.40%	2.73%	4,957
Connolly	7.1	1.0	7.1	2.00%	1.23%	7,082
Cooby	1.3	2.4**	0.5	0.70%	3.07%	2,479
Coolmundra	2.5	3.0	0.8	1.10%	3.01%	3,895
Cressbrook	3.8	1.9	2.0	4.60%	5.05%	16,289
Eungulla	4.0	2.5	1.6	1.40%	2.81%	4,957
Fairbairn	4.6	3.5	1.3	1.80%	1.38%	6,374
Glenlyon	8.8	7.8	1.1	6.70%	3.89%	23,725
Gordonbrook	1.5	2.4**	0.6	0.20%	1.24%	708
Kinchant	4.8	2.0	2.4	1.70%	3.34%	6,020
Lake Dyer	6.5	1.0	6.5	3.90%	1.80%	13,810
Lake Gregory	3.0	1.0	3.0	0.70%	1.28%	2,479
Lake McDonald	2.1	2.5	0.8	0.80%	1.38%	2,833
Lake Monduran	4.1	4.3	1.0	4.80%	0.00%	16,997
Leslie	3.7	2.6	1.4	3.60%	5.69%	12,748
Maroon	3.7	1.6	2.3	2.90%	4.04%	10,269
Moogerah	3.3	2.4	1.4	3.20%	4.22%	11,331
North Pine Dam	8.8	2.5	3.5	9.50%	2.52%	33,640
Peter Faust	2.5	2.8	0.9	1.10%	2.55%	3,895
Somerset	4.8	3.0	1.6	11.10%	9.13%	39,306
Storm King Dam	4.0	2.4**	1.6	0.80%	1.26%	2,833
Teemburra	1.6	1.0	1.6	0.30%	3.06%	1,062
Theresa Creek	3.6	2.0	1.8	1.20%	1.51%	4,249
Tinaroo Falls	10.9	2.6	4.2	10.10%	4.19%	35,765
Wivenhoe	4.0	1.5	2.7	7.60%	5.01%	26,912
Wuruma	3.8	7.0	0.5	0.90%	1.17%	3,187
Average	**4.36**	**2.43**	**2.20**			

The estimates of daily trip values estimated from the on-line survey (Figure 7.1) and the annual visit rates per dam (Table 7.4) can be combined to generate total value estimates for recreational fishing at each of the SIP dams. These estimates are summarised in Table 7.5, and indicate an annual value of recreational fishing of $56.44 Million.

Table 7.5: Total recreational values per dam (indicates average value substituted)**

	Value per day	% of total visitation	Annual visits	Annual value ($M)
Bjelke-Petersen	$184.23**	2.70%	7,352	$1.35
Boondooma	$184.23**	4.50%	12,254	$2.26
Borumba	$184.23**	6.70%	18,244	$3.36
Burdekin Falls	$184.23**	0.40%	1,089	$0.20
Callide	$54.05	1.30%	3,540	$0.19
Cania	$158.73	1.40%	3,812	$0.61
Connolly	$66.23	2.00%	5,446	$0.36
Cooby	$65.36	0.70%	1,906	$0.12
Coolmundra	$97.09	1.10%	2,995	$0.29
Cressbrook	$333.33	4.60%	12,526	$4.18
Eungulla	$416.67	1.40%	3,812	$1.59
Fairbairn	$344.83	1.80%	4,901	$1.69
Glenlyon	$312.50	6.70%	18,244	$5.70
Gordonbrook	$184.23**	0.20%	545	$0.10
Kinchant	$238.10	1.70%	4,629	$1.10
Lake Dyer	$50.25	3.90%	10,620	$0.53
Lake Gregory	$62.89	0.70%	1,906	$0.12
Lake McDonald	$142.86	0.80%	2,178	$0.31
Lake Monduran	$175.44	4.80%	13,071	$2.29
Leslie	$344.83	3.60%	9,803	$3.38
Maroon	$158.73	2.90%	7,897	$1.25
Moogerah	$100.00	3.20%	8,714	$0.87
North Pine Dam	$112.36	9.50%	25,869	$2.91
Peter Faust	$196.08	1.10%	2,995	$0.59
Somerset	$344.83	11.10%	30,226	$10.42
Storm King Dam	$80.65	0.80%	2,178	$0.18
Teemburra	$184.23**	0.30%	817	$0.15
Theresa Creek	$184.23**	1.20%	3,268	$0.60
Tinaroo Falls	$256.41	10.10%	27,503	$7.05
Wivenhoe	$105.26	7.60%	20,695	$2.18
Wuruma	$204.08	0.90%	2,451	$0.50
Total				**$56.44**

8. Conclusions

The results of this study confirm that recreational fishing activities at SIP dams in Queensland generate economic values in several important ways.

First, there are substantial visit rates across a number of dams in Queensland. For the 31 dams where data was available for this study, recreational anglers purchasing SIP licences have spent an estimated 272,305 days fishing at the dams, spending an average 2.43 days per trip on 2.15 trips per year to spend 4.36 days fishing per angler group. Within those dams there is substantial variation in total fishing effort, with Somerset, Tinaroo, Wivenhoe and North Pine Dam generating more than 20,000 visits per annum.

Second, there are substantial impacts on regional economies from recreational fishing visits. Queensland is already a net beneficiary of recreational fishing visits, with more interstate visitors coming to visit than the reverse. Many regional areas also benefit from the same patterns, with expenditure on items such as food, accommodation and fuel generating economic activity. The on-site survey and the on-line survey identified trip expenditures on non-travel items of $411 and $496 respectively, and a further $165 on travel, with nearly half of this spent in regional areas. This translates into between $46.1 and $55.6 Million in consumption expenditure on food, accommodation, alcohol and fishing related expenditures, and $18.6 Million on travel expenditure, with at least $28.5 Million spent directly into regional economies.

Third, there are substantial values associated with regional fishing. Application of the travel cost method using very conservative estimates of trip costs identified average values for $184.23 per fishing day at a dam. Extrapolation to total annual fishing days and across dams generates total annual estimates of recreational fishing values at $56.44 Million. Dams with the largest values for recreational fishing include Somerset, Tinaroo, Glenlyon, Cressbrook, Leslie and Borumba Dams.

The values that have been estimated with this report are very conservative, as only direct travel costs have been included as estimates of trip costs. Other consumption expenditure has not been included because of the difficulties in getting data consistent across respondents, with the effect that recreation values are understated. Comparisons with previous value estimates for Bjelke-Petersen, Boondooma and Fairbairn Dams indicates that approximately 60% of full trip values are being captured. On this basis, the total economic value of recreational fishing at the SIP dams is predicted to be approximately $95.3 Million per annum.

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APPENDIX ONE: ON-SITE SURVEY

Impoundment name: ________________________ Date: ___________

SOME PRELIMINARY INFORMATION: PLEASE READ FIRST

This survey is for visitors to Queensland SIP dams. If you come across this survey at a dam it means you are visiting a SIP dam!

You may answer this survey no matter what your reason is for visiting this dam. Whether it is fishing, skiing, camping, or just for a picnic, we are interested in your trip.

This survey is designed to be answered by a "Travel Party". By a travel party we mean a group of people generally travelling in a single car and sharing expenses.

If your camping/travelling group are in multiple cars it is best to answer separate surveys – one for each car group.

If you have participated in this survey before you may answer it again – please just ensure you indicate where and when you previously answered it. You may also consider undertaking a similar, but more informative internet-based survey we have developed which can be found by going to the Queensland Fisheries (SIP scheme) website at: http://www.dpi.qld.gov.au/28_16113.htm.

If you have any questions on how to answer the survey, or over its content you may call Mr Daniel Gregg on (07) 5641 0437

REMEMBER, the information contained in this survey is completely anonymous and confidential. The information asked is the minimum needed to make informative descriptions of visitation to SIP dams and the value of SIP fishing in Queensland. This information will benefit the anglers, boaters, other visitors, and dam and fish stocking managers alike to create a better and more sustainable stocked impoundment scheme into the future.

Thank you for your time and help with the survey. We hope you have an enjoyable time on your visit to this dam and good luck for any fishing you may

SECTION 1: Survey information

Q 1. Have you answered one of these questionnaires already? (please tick)

YES ☐ NO ☐

IF YES,

Q 2. At which dam did you fill out the last one? ________________________________

Q 3. How many times before have completed this questionnaire at this dam? _______

Q 4. How many times before have you filled out one of these questionnaires at any dam?

____

SECTION 2: Your trip details

In this section we will ask you some details about your current trip.

This type of data is needed to ensure that we do not over or under estimate the true value of visitation to freshwater SIP dams in Queensland.

Q 5. Why have you travelled to this dam? (please tick relevant reasons)

Fishing ………………………………..…. ☐
Picnic/day trip…………………………. …. ☐
Camping…………………………….. …. ☐
Skiing/wakeboarding/recreational boating… ☐
Other……………………………………. ☐

Q 6. How long do you plan to be away from home, *in total*, on this trip/journey?

_______ hours OR _______ days OR _______ weeks OR ______ months

Q 7. How long do you plan to spend *at this dam* on this trip?

_______ hours OR _______ days OR _______ weeks OR ______ months

Q 8. Your vehicle details?

Small car (less than 2 litre engine) ☐
Large car (2 litre or more engine) ☐
4WD ☐
Other ☐
No car ☐

Q 9: Please identify for your trip to this site:

a. How far have you travelled from home on this trip? _____________ kms

b. How long did the trip take (one way)?______ days________ hours

c. How far have you travelled *FROM YOUR LAST OVERNIGHT DESTINATION*?
___________ kms

Q 10. How many people are in your vehicle travel party?

a. Females ______ ; Ages? ______________________________

b. Males ______ ; Ages? ______________________________

Q 11. Which of the following would best describe your group? (please tick one only)

a. Group of friends ☐
b. Family ☐
c. A couple ☐
d. Just you ☐

Q 12: Is staying/fishing at this dam the main reason for your trip?

Yes ☐ No ☐

Q 13: Is staying/fishing at a DIFFERENT dam the main reason for your trip?

Yes ☐ No ☐

Q 14. Approximately how long, on average, would you/your party spend fishing on each fishing day while at this dam?

___________ HOURS

Q 15. In the past year, how many times have you gone fishing?

a. At Saltwater and estuary sites ....______
b. At Freshwater sites …....................................______

Q 16. If you fish, what are your two favourite freshwater fish species to catch anywhere?

a. ____
b. ____

Q 17. What is the approximate value of your personal fishing gear used on this trip (NOT including boat/vessel)?

$_________________

Q 18. Did you use a water craft on this trip? *(tick box)*

Yes ☐ No ☐

If YES, what is the approximate value of the boat/vessel?
$ _________________
NB: If more than one please just indicate the value of the vessel used on this trip

EXPENSES

In this section we want to ask you about the costs of your stay at this dam. We use this data to describe the value of trips undertaken to freshwater dams in Queensland.

When answering this section please include the approximate *cost* of all items used in your travels to and your stay at this dam. For example if you used three loaves of bread which were brought from home you should include the approximate value of these in your estimations. Likewise, in the "Boat fuel" section we are asking for an estimate of the value of *fuel used*, not simply the amount bought during this trip.

If some travel costs are shared between more than one travel party (i.e. vehicle) please discuss this amongst the group and split the shared costs appropriately between the groups

The information below refers to your total stay costs at this dam if your stay is/was less than one week.

If you are staying/have stayed for more than one week please calculate the costs as your weekly costs.

Q 19. Please provide some details or estimates on your travel party's (by vehicle) total trip expenses for each item below:

Expense item:	Cost/Value ($)	Percentage spent within 50km travel of *this* dam (%)
Accommodation		
Boat fuel		
Food		
Alcohol		
Bait		
Other		

SECTION 3: Choosing a site for your fishing trip

Q 20. When you choose a dam site to go fishing, what factors matter most to you?

Please Circle the number indicating the level of influence for each attribute of a freshwater dam fishing site in Queensland: 1=No Influence on trip decision

3=Moderate Influence on trip decision

5 = Major influence on trip decision

	No Influence		Moderate Influence		Major Influence
FISHING ATTRIBUTES					
20a. Catch rate for target fish	1	2	3	4	5
20b. Catch rate for non-target (nuisance) fish	1	2	3	4	5
20c. Boat ramps	1	2	3	4	5
20d. Fishing quality (e.g. snags etc)	1	2	3	4	5
20e. Fish to keep for eating	1	2	3	4	5
20f. Trophy fish	1	2	3	4	5
20g. Fishing competitions	1	2	3	4	5
20h. Number of people (crowding)	1	2	3	4	5
CAMPSITE ATTRIBUTES					
20i. Flat, clean camping pitches	1	2	3	4	5
20j. Powered sites available	1	2	3	4	5
20k. Toilet facilities	1	2	3	4	5
20l. Shower facilities	1	2	3	4	5
20m. Garbage facilities/cleanup	1	2	3	4	5
20n. Roads and access paths	1	2	3	4	5
RECREATIONAL ATTRIBUTES					
20o. Playgrounds/recreational areas	1	2	3	4	5
20p. Water quality (clarity, smell, safety)	1	2	3	4	5
20q. Proximity to other recreational areas/activities	1	2	3	4	5
20r. Recreational boating (skiing, boarding) allowed	1	2	3	4	5
20s. Noise/safety concerns from rec. boat users	1	2	3	4	5
20t. Conflict between anglers and rec. boaters	1	2	3	4	5
SITE ATTRIBUTES					
20u. Distance to travel from home/usual residence	1	2	3	4	5
20v. Distance to travel from home/usual residence	1	2	3	4	5
20w. Ease of access (road quality)	1	2	3	4	5
20x. Water levels in dam or river	1	2	3	4	5
20y. Good weather at the site	1	2	3	4	5

SECTION 4: Your details

In this section we want to ask you some information about your household.

Some of the information asked in this section may seem unrelated to our aims in this survey.

We assure you that the information is important to understanding visitation to SIP dams in Queensland. We also assure you again that all information from this survey is completely anonymous and confidential

Specifically, this section will allow us to compare data from this survey to information obtained from the 5 yearly National Census undertaken by the Australian Bureau of Statistics. Using this information we can provide estimates of state and national trends in SIP dam visitation and value to local communities.

Q 21: *Where do you normally live?*

Postcode ___________ Town __________________

Q 22: *How many people live in your **household** including you?*

*(a) Young people (17 years or younger)*___________________

(b) Adults (18 years or older) _________________________

Q 23: *Which category best describes your **gross household** income (ie before taxes) in the previous year? Please tick one box.*

Total household income before tax

per week	per fortnight	per year	*Please tick*
Less than $200	Less than $400	Less than $10,400	☐
$200-$399	$400 to $799	$10,400 to $20,799	☐
$400-$599	$800 to $1,199	$20,800 to $31,199	☐
$600-$799	$1,200 to $1,599	$31,200 to $41,599	☐
$800-$999	$1,600 to $1,999	$41,600 to $51,999	☐
$1,000-$1,499	$2,000 to $2,999	$52,000 to $72, 799	☐
$1,500 - $1,999	$3,000 to $3,999	$72,800 to $103,999	☐
$2,000 - $2,499	$4,000 - $4,999	$104,000 to $129,000	☐
$2,500 or higher	$5,000 or higher	$130,000 or higher	☐

APPENDIX TWO: ON-LINE SURVEY