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Recreational boating in the Murray-Darling Basin

Case study supporting the Independent Assessment of Economic and Social Conditions in the Murray-Darling Basin

A Marsden Jacob Report

Prepared for Social and Economic Assessment Panel
Marsden Jacob Associates

This investigation has been commissioned by the Panel for the Independent Assessment of Social and Economic Conditions in the Murray-Darling Basin. The Panel has made this document available for public scrutiny as part of its commitment to transparency. The views in this report do not necessarily represent the views of the Panel. This is part of a series of literature reviews and research investigations that will help inform the Panel's eventual findings and recommendations.

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Contents

Acronyms and abbreviations

ABS	Australian Bureau of Statistics
CPI	consumer price index
CS	consumer surplus
GL	gigalitres
GVA	gross value-added
I-O	input-output model
LGA	local government area
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
NSW	New South Wales
OECD	Organisation for Economic Cooperation and Development
RDV	Regional Development Victoria
RIS	regulatory impact statement
RMS	Roads and Maritime Services
SA	South Australia
SEQ	South-east Queensland
TRA	Tourism Research Australia
Vic	Victoria

Glossary

Benefit transfer	Valuing a good or service by transferring economic values from another study or region.
Confidence interval	A type of interval estimate, computed from the statistics of the observed data, that might contain the true value of an unknown population parameter.
Consumptive pool	The amount of a water resource that can be made available for consumptive use in a particular water resource plan area under the rules of the water resource plan for that water resource plan area.
Crowding out	Occurs when increased government or other involvement in a sector of the market economy substantially affects the remainder of the market, either on the supply or demand side of the market.
Economic value	A measure of the benefit derived from a good or service. It is the maximum amount someone is willing to pay for the good or service, or the willingness to accept compensation to do without the good or service.
Elasticity	In economics, *elasticity* measures the proportional change of an economic variable in response to a change in another. For example, people may consume 5% less of a good or service if its price increases by 10%.
Environmental flows	The streamflow required to maintain appropriate environmental conditions in a waterway or water body.
Environmental water(ing)	Water that is available or preserved, to achieve environmental outcomes, including ecosystem function, biodiversity, water quality and water resource health.
floodplain inundation	Flooding of flat or nearly flat land adjacent to a stream or river.
Gross output	In economics, gross output measures total economic activity in the production of new goods and services in an accounting period.
Gross value-added	In economics, gross value added measures the value of goods and services produced in an area, industry or sector of an economy. GVA is gross output minus intermediate consumption.
input-output model	In economics, an input–output model is a quantitative economic model that represents the interdependencies between different sectors of a national economy or different regional economies.
Net economic value	The difference between economic benefits and economic costs, calculated as benefits – costs.
Over-allocation	Refers to situations where with full development of water access entitlements and licence holders, the total volume of water able to be extracted at a given time exceeds the environmentally sustainable level of extraction for that system.

p-value	In statistics, the p-value is the probability of obtaining the observed results of a test, assuming that the null hypothesis is correct.
Production relationship	A relationship between inputs and outputs produced.
Replacement values	A measure of value that estimates the cost of replacing a natural asset's functions and services.
Travel cost method	An economic valuation method that uses data on the costs incurred by individuals in travelling to the recreational site or amenity to estimate the recreational use value of a site or asset.
Water recovery	Water reallocation for environmental use.

1. Introduction

At the request of the Minister for Water, The Hon David Littleproud, MDBA has convened an Independent Panel ('the Panel') to assess economic and social conditions in the Murray-Darling Basin ('the Basin'). The Panel's independent assessment is a critical opportunity to shape understanding of current economic and social conditions in the Basin, longer-term approaches for monitoring these conditions, and future Basin policy.

Marsden Jacob is supporting the Panel by delivering seven case studies of Basin industries with high water consumption dependency. Our case studies complement the regional impact modelling and the trends and drivers analyses that Marsden Jacob is completing in parallel for the Panel, through more detailed examination and ground-truthing, and a tighter regional focus.

The Panel has asked that these case studies focus on answering the general theme questions posed by the Panel (Table 1).

The Panel asked that our reports are concise, and take into account how water reform, weather and climate, technology, prices, structural, demographic and preference change and other factors known to impact on industries in the Basin might impact in the future.

The Panel asked that our work identify the order of magnitude throughput levels that would result in structural change in the case study industry's value chain. The Panel also asked that we consider possible flow-on impacts to local communities, which depends on the adaptive capacity of local workers, among other factors. We were asked to prepare our case studies using consultations (and, where possible, data), other research (such as estimated changes in irrigated agricultural production), and available literature.

Table 1: Case study questions posed by the Panel

Question	Section(s) where we answer this question
1. What is the consumptive pool 'as is'. What is the volume of water that the industry's value chain needs to operate under current settings (current technology and industry structure and likely future technology and industry structure). This analysis will take into account current regional water availability and reliability, how regional water availability relates to the case study industry's economic activity, and value-chain (upstream supply and downstream sectors).	3
2. Is the Basin over-developed relative to the currently available consumptive pool 'as-is'. The case studies will focus on whether the region / sector is 'viable' over the longer run, as is. We will embed assumptions around future productivity, farm terms of trade, and regional production mix and water uses to understand this.	3
3. If the Basin is over-developed, where are the impacts of over-development going to be observed? Which regions and their communities and industries are going to go through transitional and structural adjustment? The Panel can focus on recommendations to assist communities or commodities to go through a transition to a different, less water-reliant future. The case studies will focus, if the Basin is over-developed, on the impacts on regions and sectors. Here we will focus not only on what could transition out of regions, but also what could (or is) transitioning in.	4
4. What happens for Questions 2-3 under a range of recovery scenarios? Taking 100GL, 200GL, 300GL required to deliver a 3,200GL Plan. This will help understand thresholds for commodity sectors and communities. The case studies will look at points 2-3 above, under a range of recovery scenarios.	4

1.1 This discussion paper

This Marsden Jacob discussion paper focuses on recreational boating in the Basin. In agreement with the Panel, we have concentrated on recreational boating in the River Murray. The evidence base we use in this discussion paper draws on reviews and earlier assessments of recreational boating activities in the Basin, including how recreational boating activity levels change, or do not change, subject to changing river flow levels and storage levels.

2. Boating activity in the Basin

Recreational boating activity is associated with 4,000,000 visitor nights and 450,000 day trips per year, with the vast majority of activity occurring during the peak season between September and April. Boating in the southern Basin accounts for approximately 80 per cent of MDB boating activity.

2.1 What is recreational boating

For the purpose of this case study, we define recreational boating to include water activities/sports (including sailing, windsurfing, kayaking), travel by charter boat/cruise/ferry, and a proportion of fishing activity that includes boating. This definition includes both commercial and non-commercial operators. The recreational boating industry in the Basin includes a range of groups such as vessel and equipment suppliers, fuel suppliers, riverboat operators, and boat hire and tourism operators.

Recreational boating activity in the Murray-Darling Basin makes important contributions to economic and social wellbeing in Australia. Boating activity in the Basin contributes to economic activity both within and outside Basin regions, by creating employment, bringing in tourism revenue, creating supply chains, and developing infrastructure. These activities translate into jobs and revenue for businesses and incomes for families. When recreational boaters travel to the Murray-Darling Basin for boating, they import revenue for local businesses.

2.2 Major Southern Basin recreational boating sites

Recreational boating occurs across the whole of the Basin. Different recreational boating activities dominate in different areas, and some sites are much more significant than others.

Most recreational boating in the southern Basin[1] happens more than 40 kilometres from peoples' homes. As a result, this activity is picked up in Tourism Research Australia (TRA) data (Figure 7 and Table 6). Table 2 lists key recreational boating sites and the main activities occurring at these sites during peak season (September to April). A map of the major sites in the southern Basin is provided in Figure 1.

Within South Australia (SA), recreational boating is popular along the length of the Murray River from the Lower Lakes and the Coorong (near the Murray mouth) up to Renmark-Paringa toward the NSW-Victoria border. Based on TRA data, the major recreational boating regions, in broad order of significance, appear to be: Mid Murray Victoria (includes Campaspe, Moira, Loddon), Murrumbidgee and Upper Murray (includes Murrumbidgee, Greater Hume), Lower Murray Victoria (includes Mildura, Swan Hill), and Lower Murray SA (includes Murray Bridge, Alexandrina).

Previous consultation by Marsden Jacob with BIA Victoria suggested the major recreational boating sites in Victoria and along the NSW-Victoria border (defined by the Murray River) are, in broad order of significance: Lake Hume, near Albury-Wodonga; Lake Eildon; Lake Mulwala at Yarrawonga-Mulwala; and along the Murray from Echuca to the SA border.

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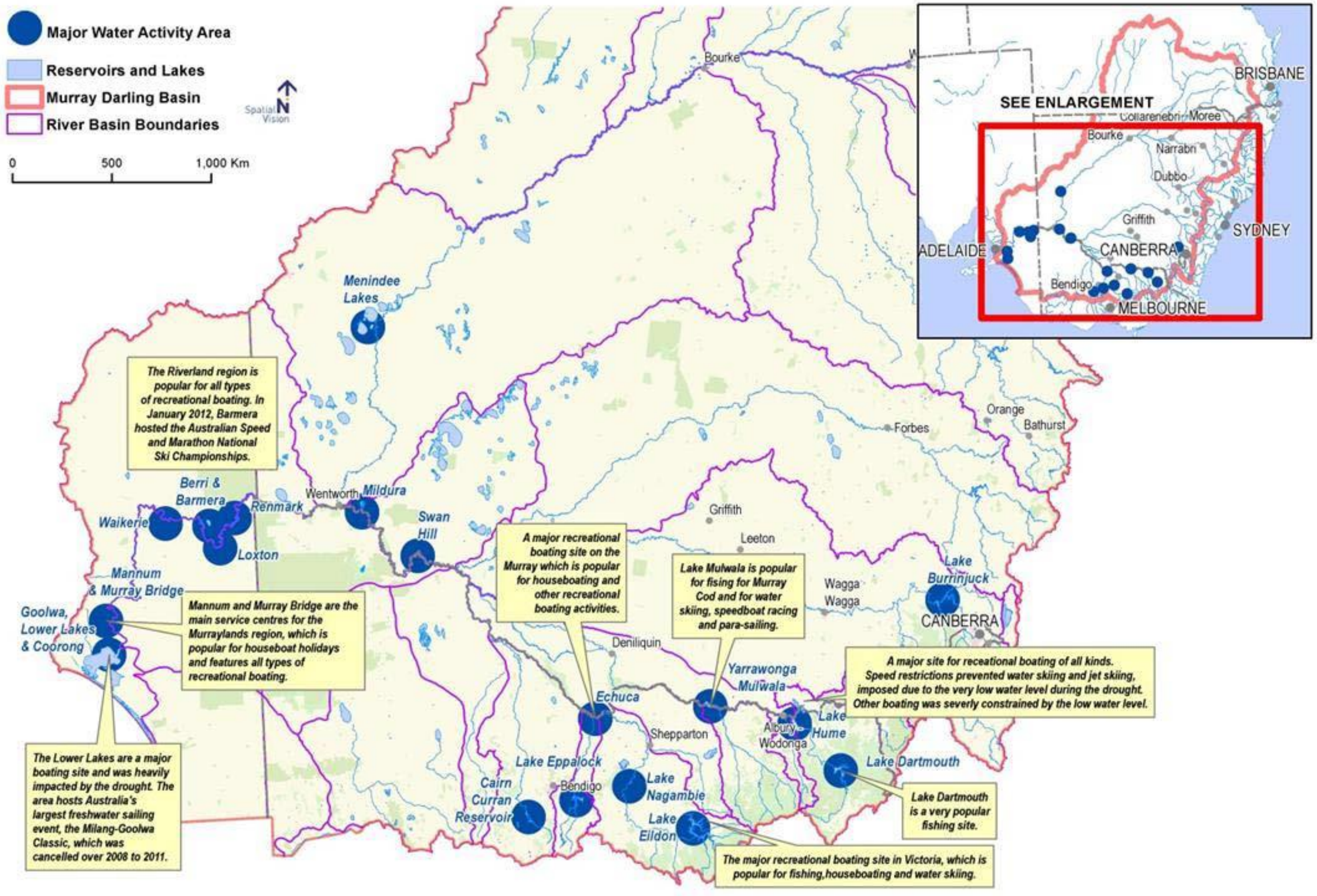
[1] Based on previous consultations with Marine Queensland, we have judged that any recreational boating activity that occurred in the Queensland part of the Basin was likely to be minor compared with activity in South Australia and Victoria.

Table 2: Major sites for recreational boating activity in the Murray-Darling Basin

			Cruising/ sailing	Fishing	House-boats	Water skiing	Personal watercraft
South Australia							
Goolwa, Lower Lakes & Coorong	SA	Sept-Apr	✓	✓	✓	✓	✓
Goolwa to Blanchetown (Lock 1)	SA	Sept-Apr	✓	✓	✓	✓	✓
Blanchetown to Berri (Lock 4)	SA	Sept-Apr	✓	✓	✓	✓	✓
Berri to SA Border (includes Renmark)	SA	Sept-Apr	✓	✓	✓	✓	✓
Victoria							
Lake Dartmouth	VIC	Sept-Apr	×	✓✓	×	✓	✓
Lake Nagambie	VIC	Sept-Apr	✓	✓✓	×	✓	✓
Cairn Curran Reservoir	VIC	Sept-Apr	✓	✓✓	×	✓✓	✓
Lake Eildon	VIC	Sept-Apr	✓	✓✓	✓✓	✓✓	✓
Echuca	VIC	Sept-Apr	✓	✓	✓	✓	✓
Mildura	VIC	Sept-Apr	✓	✓	✓	✓	✓
Swan Hill	VIC	Sept-Apr	✓	✓	✓	✓	✓
Lake Eppalock	VIC	Sept-Apr	✓	✓✓	×	✓✓	✓
NSW							
Lake Hume & Albury-Wodonga	NSW / VIC	Sept-Apr	✓	✓	✓	✓	✓
Yarrawonga-Mulwala	NSW / VIC	Sept-Apr	✓	✓	✓	✓	✓
Menindee Lakes	NSW	Sept-Apr	✓	✓	✓	✓	✓
Burrinjuck Dam/Lake Burrinjuck	NSW	Sept-Apr	✓	✓	×	✓	✓

Source: Marsden Jacob, based on consultations with Boating Industry Associations and clubs (2012)

Figure 1: Major recreational boating sites in the southern Basin



Source: NSW RMS

3. Relationship between recreational boating activity and water availability in the southern Basin

Most recreational boating activity occurs in the southern Basin, in Victoria and South Australia. Our case studies focus on recreational boating activities in the Lower Lakes of South Australia, and Mildura on the Victorian River Murray.

3.1 Relationship between water availability and recreational boating activity

Statistical analysis of TRA data and flow rates/volumes did not identify strong relationships between peak season water availability and recreational boating activity at any of the Basin's major recreational boating sites (see Figure 2 for a visual representation). This finding has important implications for preliminary forecasting of potential Basin Plan impacts. The results imply that, based on the best available data on recreational boating in the Basin at this time, that:

- there is no strong evidence that changing water availability will systematically change recreational boating activity levels.
- instead, recreational boating activity is strongly correlated with overall tourism activity (for example, see Figure 3 and Figure 4).

This result provides insight into the drivers of recreational boating activity. Rather than being the sole or main reason for tourism activity, recreational boating is typically a component of a multi-purpose trip. Consistently, (i) visiting friends or relatives and (ii) business are given as the second and third most popular reasons for visiting a region, respectively. Visiting parks is another popular reason for travel[2]. Therefore, it is unsurprising that there is not a strong relationship between recreational boating activity and flow rates/volumes, except possibly in times of extremely low or extremely high water availability.

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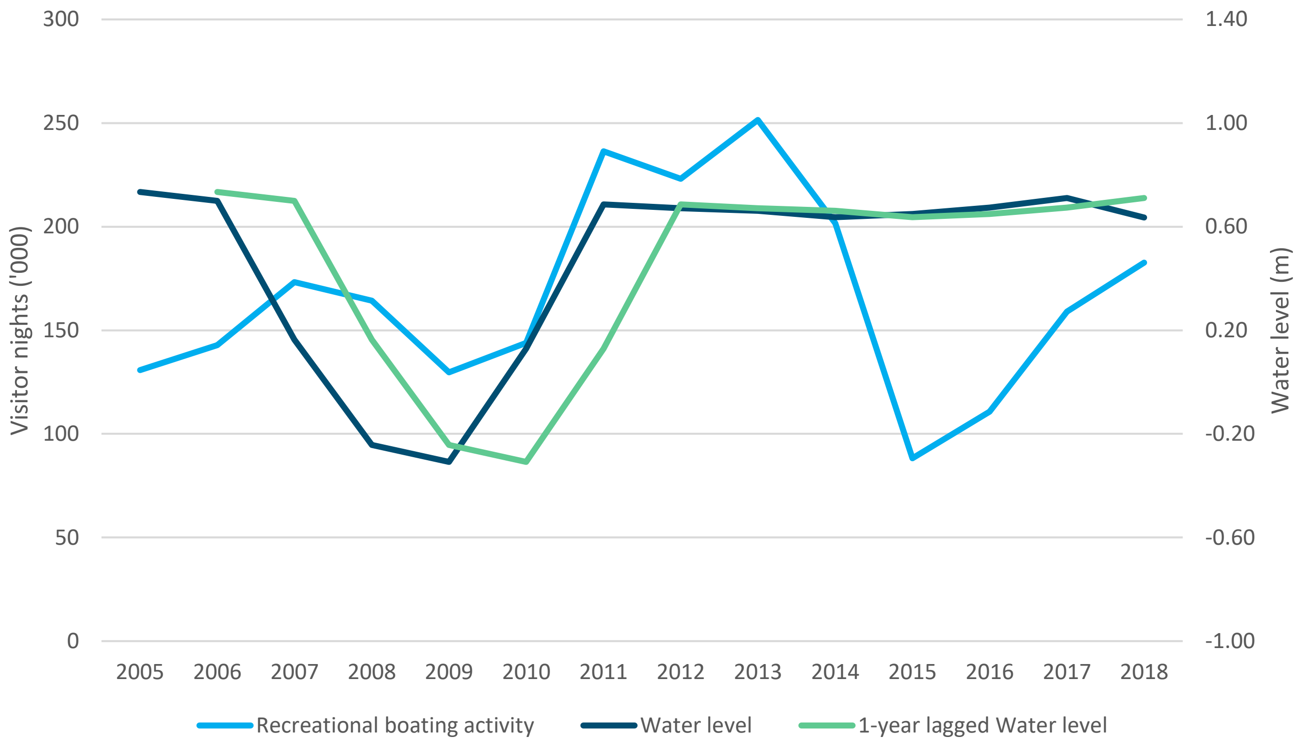
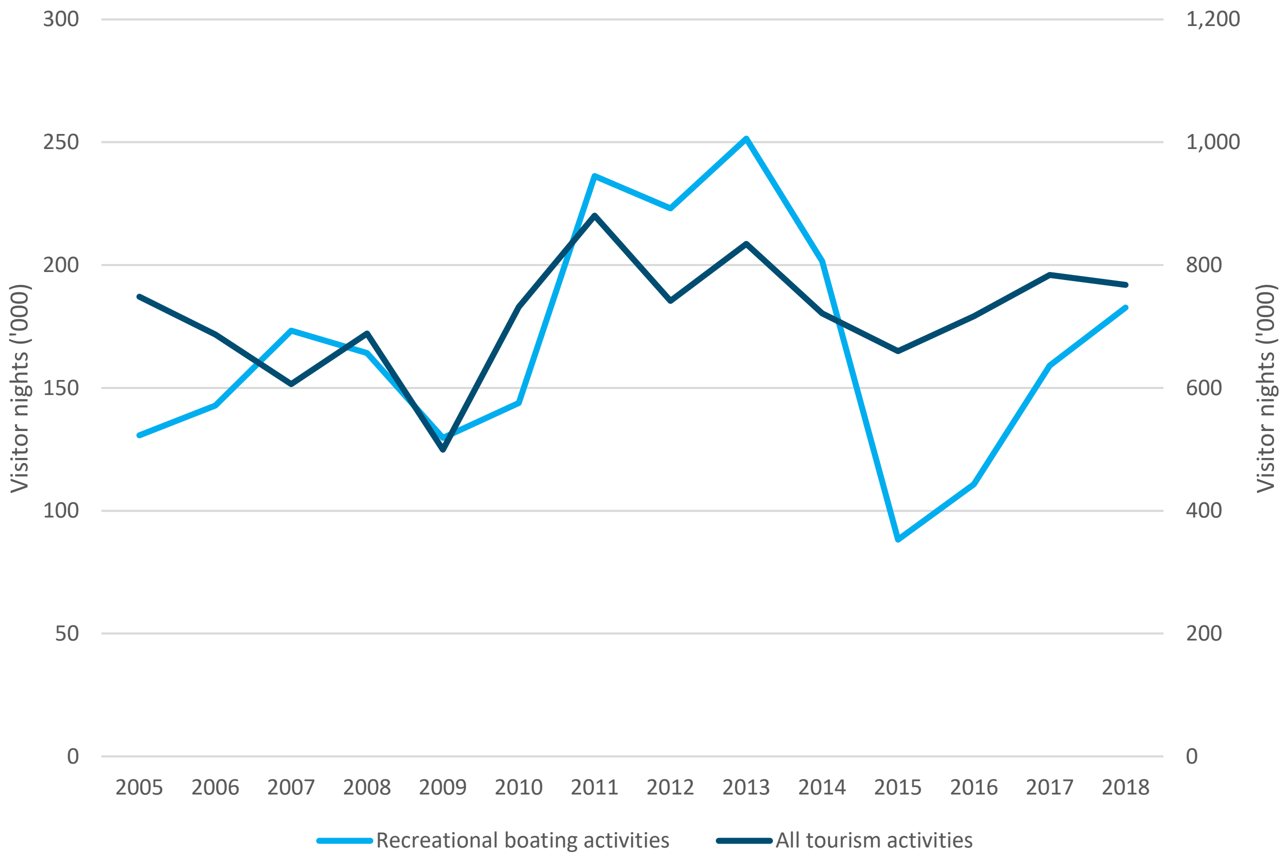
[2] https://www.tra.gov.au/domestic/domestic-tourism-results

Figure 2: Recreational boating activity and water levels at Alexandrina LGA



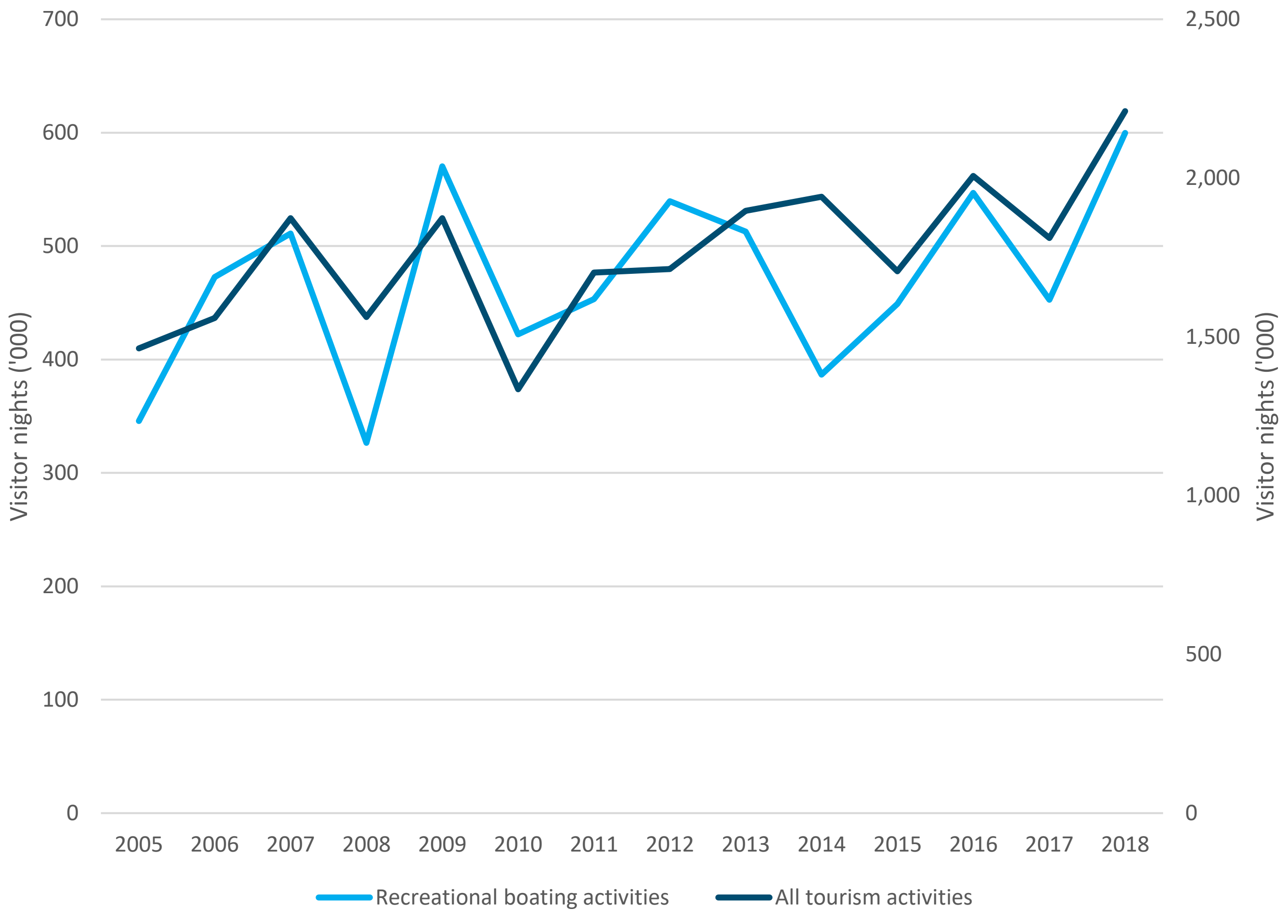
Source: Marsden Jacob analysis of TRA data (2019)

Figure 3: Tourism activity in the Alexandrina LGA (nearest recreational boating site: Lake Alexandrina)



Source: Marsden Jacob analysis of TRA data (2019)

Figure 4: Tourism activity in the Mildura LGA (nearest recreational boating site: Murray at Mildura)



Source: Marsden Jacob analysis of TRA data (2019)

3.2 Limitations

The lack of statistically significant relationships may be attributed to several factors other than the possible explanation that there is not a production relationship between water availability and recreational boating activity at MDB sites:

- The coarseness of the visitor and expenditure data used in the analysis. TRA data is available on an annual time step, which means that river flow rates/volumes have been averaged over the peak season for that year, to allow for statistical analysis. This averaging process removes the daily variability of flow rates and removes valuable information. However, previous analysis conducted by Marsden Jacob using daily data[3] also found no significant relationship between boating activity and flow rates.
- The short time series of 14 years (2005-2018) might be insufficient to identify relationships.
- There are other unmeasured factors that influence recreational boating activity and expenditure levels.
- Recreational activities might be impacted in different ways. For example, wake boarding and jet skiing might not be possible/allowed at times of low water availability, but fishing activity might be appealing and permitted. In other words, there might be a degree of offsetting of impacts that is not captured when using aggregated data.
- The analysis only captures activity from tourism. However, there is also local activity, which is important for local communities.
- It is possible that recreational boating is only adversely affected during times of extremely low or extremely high water availability (see Section 3.3).

The above discussion reinforces the need for better and more precise data over a long time series for recreational boating. These data are essential to estimating regression models that are necessary to estimate elasticities between tourism activity and water availability – i.e. elasticities that can be used to estimate potential benefits of improved water availability. This current study has made a preliminary attempt at estimating these elasticities for recreational boating.

3.3 Previous examples of restrictions on recreational boating

In many parts of the southern Basin, recreational boating activity has been possible even in times of drought. The main implication of this is that there is no strong evidence that changing water availability will systematically change recreational boating activity levels.

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[3] For example, analysis of boating activity at South Corowa and Bundalong, for NSW RMS (2019).

However, there are some examples from the Millennium Drought of restrictions being placed on boating in waterways and storages in the Basin. These restrictions range from speed restrictions to a lack of water effectively stopping recreational boating of any kind. However, in many parts of the southern Basin, recreational boating activity was possible even in times of drought.

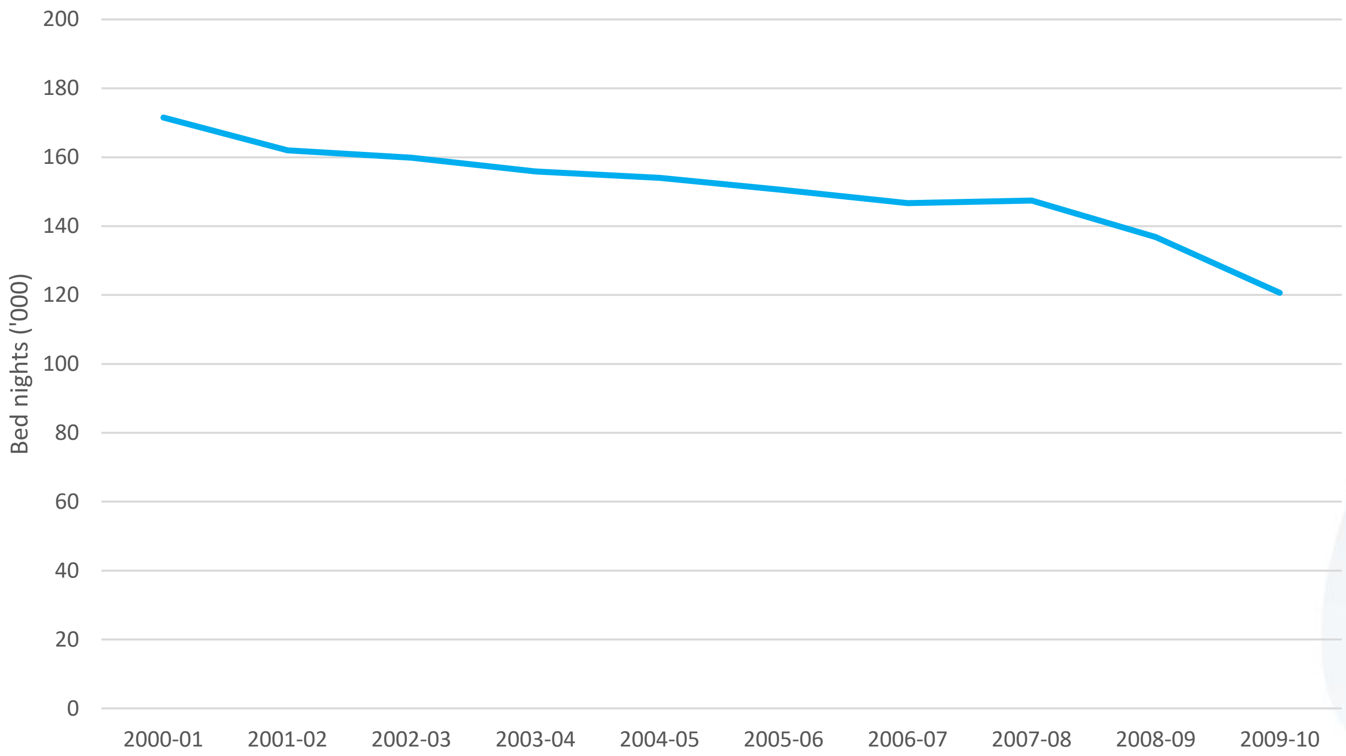
Two examples of restrictions on recreational boating are described in Table 3, while the impact of the Millennium Drought on houseboat hires in the South Australia Murray are shown in Figure 5.

Table 3: Restrictions on boating activity in the Basin during the Millennium Drought

Major boating site	Restriction
Murray below Lock 1	Very low water levels and salinity severely limited recreational boating. Milang-Goolwa Freshwater Classic was cancelled from 2008 and has only resumed in 2012. Other sailing events were cancelled as well. One major ferry operator relocated.
Lake Hume	Speed restrictions to 5 knots from March 2009.

Source: Previous Marsden Jacob stakeholder consultations and TRA (2010).

Figure 5: Houseboat hires in the SA Murray region



Source: SA Houseboat Hirers Association (2012)

4. Potential impact of changing water availability on recreational boating and its economic value and contribution to Basin communities

Recreational boating in the MDB has an estimated baseline economic contribution of $350 million gross output and $300 million gross value-added per year. However, all available evidence suggests that this contribution will not be materially impacted by changes to water availability, such as resulting from increased environmental flows.

4.1 Change in economic contribution and value of recreational boating

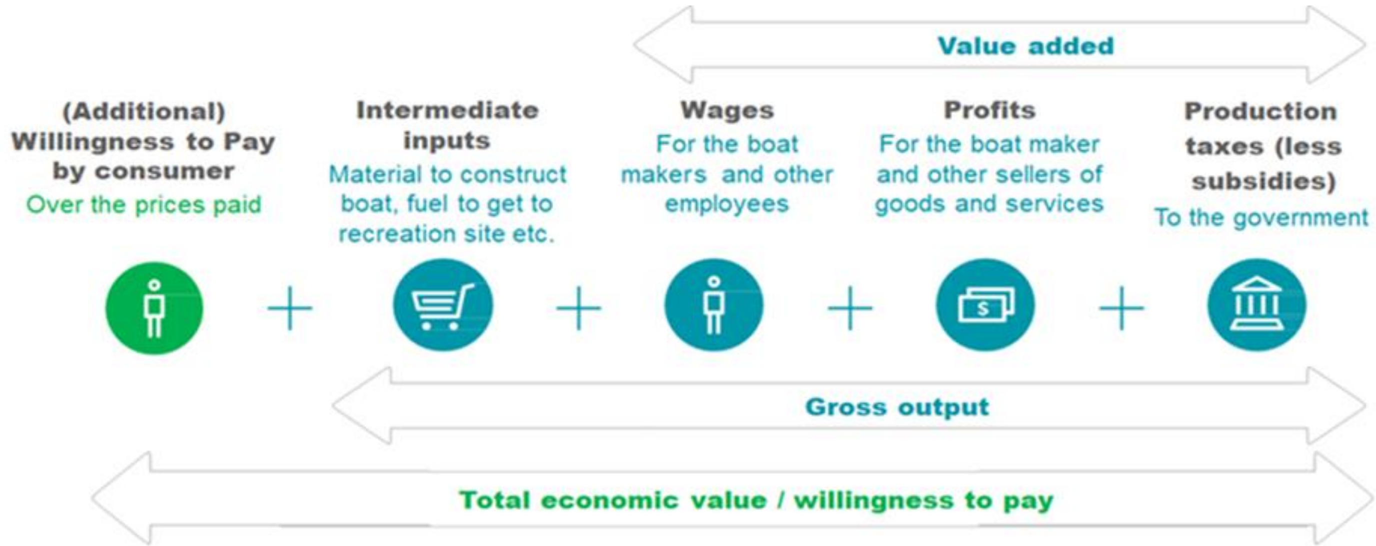
Economic contribution measures how economic activity contributes to the economy through market transactions and output. The significance of an activity is usually defined by its relative share of market transactions and output compared to other activities or sectors.

Figure 6 shows how the economic contribution of recreational boating is measured in the economy in simplified terms. Components of economic contribution accounting are shown in blue in

Figure 6. For recreational boating:

- **Gross output** is the amount that the recreational boater pays 'in the market' for their recreational boating activity. Gross output is the sum of the cost of intermediate inputs (the cost of the boat, costs to get the boat on to the water, etc.), wages, taxes net of subsidies, and profits to the businesses providing goods and services to the recreational boater.
- **Gross value-added (GVA)** is a subset of gross output. GVA includes local business profits and wages paid, and therefore represents economic returns on local capital and labour resources from recreational boating activity. It measures the true contribution of the economic activity to the economy because it backs out leakage out of the economy.

Figure 6: Economic activity and economic value framework – recreational boating



A detailed explanation of the methology used is provided in Appendices Appendix 2 and Appendix 3.

Table 4: Estimated economic contribution from recreational boating at selected sites, 2014-18

		Economic contribution ($m, 2019)				
Location	Metric	2014	2015	2016	2017	2018
Mildura LGA	Gross output	13.5	15.7	19.1	15.8	21.0
	Gross value-added	11.6	13.5	16.4	13.6	18.0
Alexandrina LGA	Gross output	7.1	3.1	3.9	5.6	6.4
	Gross value-added	6.0	2.6	3.3	4.8	5.5
Total MDB	Gross output	313	337	298	371	374
	Gross value-added	268	289	256	318	321

Source: Marsden Jacob analysis of TRA data (2019)

4.2 Potential impact of changing water availability on recreational boating

Based on the available data, there is no strong evidence that changing water availability will systematically change recreational boating activity levels (for example, Table 5). Therefore, water recovery and improved water availability due to higher environmental flows is unlikely to materially impact recreational boating activity. The exception to this finding is during times of very low flows, where anecdotal evidence and limited available data suggest that improved water availability, such as due to additional environmental flows, might be sufficient to avoid restrictions (see Table 3) or maintain the appeal of recreational boating activity.

Table 5: Potential impact of changing water availability on recreational boating activity, for selected locations

Location (LGA)	Variable	Elasticity	95% confidence interval	t-stat	p-value
Alexandrina	All tourism activities in LGA	1.72	0.12 to 3.31	2.38	0.04**
	Water level	-0.39	-1.09 to 0.31	-1.22	0.25

Location (LGA)	Variable	Elasticity	95% confidence interval	t-stat	p-value
Mildura	All tourism activities in LGA	0.86	0.21 to 1.51	2.91	0.01***
	Water level	2.67	-2.44 to 7.78	1.15	0.27

Source: Marsden Jacob analysis of TRA data (2019)

5. Conclusions and next steps

The conclusions and recommended next steps all revolve around improving data collection and quality.

- **The best available evidence did not identify strong relationships between peak season water availability and recreational boating activity at any of the Basin's major recreational boating sites.** Marsden Jacob's statistical analyses of TRA recreational boating expenditure and activity data and Basin water availability shows that there is no statistical relationship between peak season water availability and recreational boating activity at any of the main sites in the Basin.

  This finding is consistent with the conclusions of several earlier reports that reported no statistically significant relationship between Basin water availability and tourism levels, and those very significant changes in Basin water availability that occurred during the drought did not translate into an equivalent decline in tourism activity in the Basin.

- **Due to the coarseness of the TRA data, these overall findings about the production relationship between Basin water availability and recreational boating activity must be treated with due caution.** However, these results suggest that water availability is not the only (and potentially not even a main) driver of recreational boating activity at many of the Basin's major recreational boating sites, except under very extreme drought circumstances. Further research and investigation is warranted on this issue.

- **The lack of statistically significant relationships may imply that changing water availability by increasing environmental flows will not predictably or systematically translate into increases in recreational boating activity or measures of economic contribution.** Data are required on a shorter time step, such as daily, weekly, or monthly to better evidence this claim. At a time step longer than monthly, the data are likely to be too coarse to identify production relationships between recreational boating activity and water availability, even if such relationships are strong. Collection of more comprehensive boat count data might assist with this objective.

- **Regular recreational boater and related industries surveys would provide more valuable information.** End user surveys would derive boating expenditure attributable to recreational boating in the Basin, boat attributes, and drivers of preferences.

6. References

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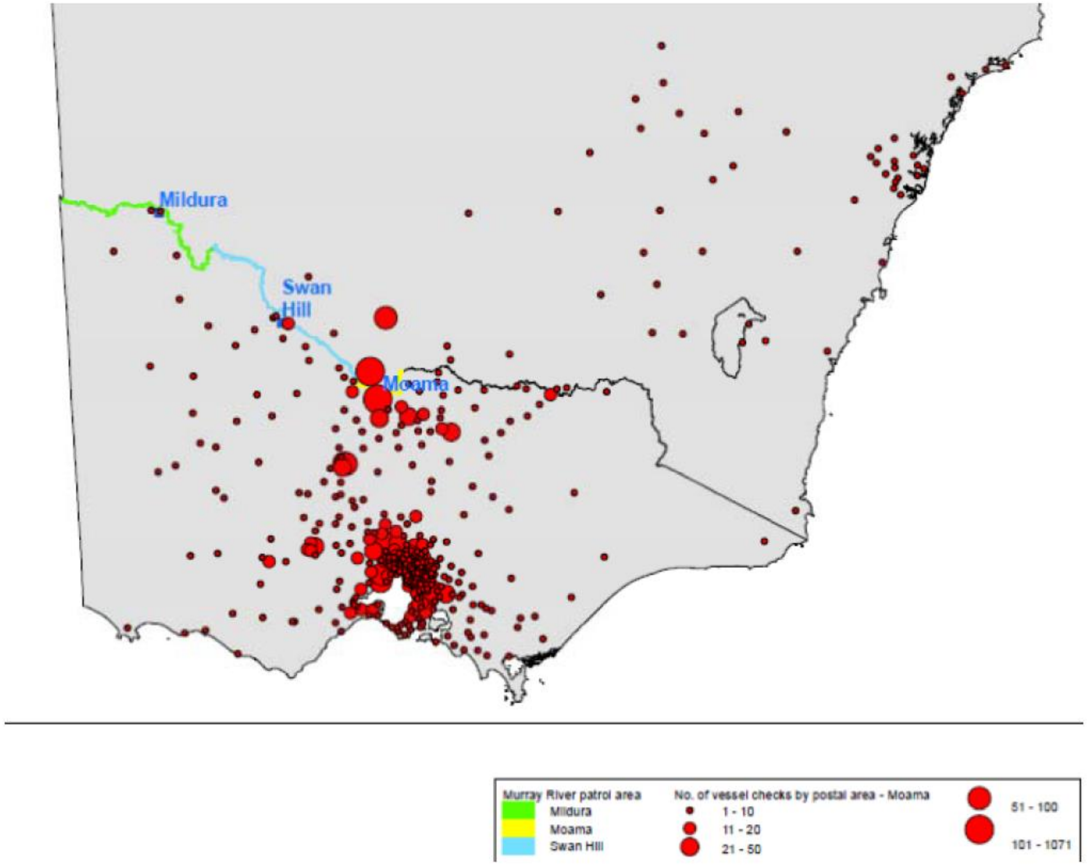
Appendix 1 Origins of recreational boaters

The bulk of Murray River users are from Victoria, with many from the Melbourne metropolitan area.

Figure 7: Vessels checked at Moama, Murray River – by origin (2012)



Source: NSW RMS

Table 6: NSW Maritime inspections of vessels at waterway sites, by location of origin (2009-10)

Waterway	Total no. checked	NSW %	Vic %	Other %
Lake Mulwala (incl. Ovens River to MV Highway Bridge)	328	12.8	87.2	0.0
Murray River – Tom Groggin to Lake Hume (to Bethanga Bridge)	15	93.3	6.7	0.0
Murray River – Lake Hume to Lake Mulwala	86	1.2	98.8	0.0
Murray River – Yarrawonga Weir to Tocumwal	125	4.0	96.0	0.0
Murray River – Tocumwal to Barmah	162	7.4	91.4	1.2
Murray River – Barmah to Moama	282	3.9	95.7	0.4
Murray River – Moama to Torrumbarry Weir	515	6.0	92.4	1.6
Murray River – Torrumbarry Weir to Swan Hill	23	30.4	69.6	0.0
Murray River – Swan Hill to Robinvale	46	8.7	91.3	0.0
Murray River – Robinvale to Mildura	340	9.4	87.1	3.5
Murray River – Mildura to SA Border	386	13.0	83.2	3.9
Total	2,308	9.1	89.3	1.6

Source: NSW RMS data (2012)

Appendix 2 Literature review of recreation values

This appendix summarises relevant contemporary studies that value recreational benefits and expenditures of inland power boating. We have used the estimates in this appendix to estimate the recreational values and expenditures for the Murray-Darling Basin, using a process called 'value transfer'.

'Value transfer' is the process of estimating economic values in a location of interest (the policy site) by transferring values from studies already completed in another location (the study site).

This removes the need for primary research. In an ideal world, the recreational value of boating, wake boarding, water skiing, etc. would be estimated through surveys and observations of recreational activity on the river. For best results, this work would need to be undertaken over several years and would be expensive to undertake. For this report, we rely on value transfer, instead.

There is a need to exercise care when transferring data from one study to another. Recent evidence suggests that transferring economic value estimates from one context to another can be inaccurate unless there is a high degree of similarity between the study and policy contexts [1].

Value transfer needs judgement and analysis of both the source study and the policy site. We have sought to minimise value transfer errors in the current recreational value study by applying the best-practice value transfer steps summarised in Table 7.

Table 7: Value transfer best-practices

Select 'good quality' studies	The key test here is whether the study does what it purports to do, which is to estimate the willingness to pay for a particular recreation good. Our criteria for selecting good quality recreation valuation studies include that they: • are in peer-reviewed journals or books. This implies the study is more likely to have been well conducted and that appropriate statistical techniques were used. • are done after 2000. This reflects that valuation methodologies (in particular stated preference valuation studies) have been improving over time. • use sample sizes of >500 respondents, who were selected from the general population (for survey-based valuation methods). Larger and more

	representative samples mean that we can generalise values with more confidence. • are location-appropriate studies. Generally, we look for studies that have similar site-specific characteristics, and similar proximity to populations. More broadly, for NSW/Victorian valuation work, we look in the order of: studies from NSW/Victoria, other regions in South East Australia, other Australia, then high-income OECD countries. • are limited to values that can be readily transferred. Generally, this means that recreation values are expressed in $ per trip or $ per household data.
Minimise transfer errors	Adapting estimates from one context to another requires technical skills as well as an understanding of the key drivers of values, how they differ between sites, and a good dollop of common sense. In any value transfer exercise, the person doing the transfer should compare the primary study to the project outcomes they are expecting (for example, water quality, or riparian rehabilitation). They should consider whether adjustments should be made for the following: • the type and extent of recreation change (for example, estimates of the value of improvements to a specific wetland should not be extrapolated to an entire river basin). • the type and extent of change from the status quo (for example, estimates of the value of creating a new wetland in a degraded site should not be transferred to a wetland improvement project where the site is much less degraded). • the population impacted (for example, estimates of the value of wetlands in Europe should not be transferred to Australia without adjusting for differences in standards of living). • the time (for example, by adjusting values for CPI). In addition, you should also consider, for example, whether a study from 25 years ago is still relevant to today, or whether community preferences, and therefore values for recreation values, are likely to have changed over that time). • confidence intervals. The confidence intervals from the original study should be applied, where available. This will give a valuation range that the real value is likely to fall within. This is better than reporting point estimates.
Report value ranges, not point estimates, and be clear on limitations	• present a range of estimates – your analysis should not rely on a point estimate of the value of the recreation asset in question. Value transfer is not an exact science, and differences between the value estimated by value transfer and the ‘true’ valuation have been found to be up to 100 per cent, even in the best examples of value transfer (eftec 2009b). As such, the RIS should contain a sensitivity analysis of the transferred value; ranges of values may be based on confidence levels in the source study, or based on the ranges found in similar studies (eftec 2009a). • this includes clearly pointing out that the values transferred were not estimated with reference to the specific recreation changes being examined in the study, and that as a result, there remains some uncertainty about the community’s willingness to pay. At best, value transfer can provide an indication of the order of magnitude of the community’s willingness to pay for recreation services.

Source: Marsden Jacob, adapted from [2]

A2.1 Recreational power boating values

Table 8 summarises recreational power boating valuation studies that are relevant to the South Corowa to Bundalong Reach recreation values study. Key points here are:

- studies that estimate the recreational value of power boating are limited. Based on the studies summarised in Table 8, a recreation value of around $70 per person per day appears appropriate, with testing of confidence intervals between $35-$105.
- We note that this per-trip valuation estimate is broadly comparable with the per-trip travel cost values found in other recent Australian studies for a range of different outdoor recreation types in Australia [3] and overseas [4]. This includes recreational fishing (land-based or boat-based).
- We again note that the $35-$105 per day estimate is (1) a gross estimate of recreation value. This means that if the recreation is transferred to another site, or substituted with another recreation activity, then the recreation value is not lost. The recreation value may not even change, it simply changes location, and (2) the value is for a full day of recreation activity. A per-hour activity can be derived by dividing by 8. This is important where recreation is dominated by part-day trips.

Table 8: Studies that report value per trip for recreational boating

Authors	Title	Location	Context and location	Value per person per day (year of $)	Value 2018 AU$
[5]	The economic value of recreation undertaken on Seqwater's land	SEQ, Queensland	Travel cost survey of 600 respondents, including recreational boating for skiing and wakeboarding at inland dams. Value of recreational visit to dam estimated to be in the range of $47-84 per trip, with a point mid estimate of around $60 per trip.	$60	$64.50
[6]	The economic value of boating and marine industries associated with the use of Gippsland Lakes	Gippsland Lakes, Victoria	This study did not estimate consumer surplus from recreational boating trips.	$NA	$NA
[7]	The Non-Market Value of Private Recreational Boating in the Channel Islands National Marine Sanctuary	US	Travel cost and random utility model of recreational power boat users in marine sanctuary. Empirical RUM model estimates how consumer surplus from travel varies as a function of attributes of the boating site. Estimated confidence interval of $42.44-$73.06 in $2013.	$53.70	$61.50

Authors	Title	Location	Context and location	Value per person per day (year of $)	Value 2018 AU$
[8]	Assessment of the benefits of the Basin Plan for the recreational boating industries	Murray-Darling Basin	Literature review of recreational boating used to estimate the economic value of inland boating in the Murray-Darling Basin. Review identified few Australian studies of recreational boating. The 2004 Hassells report assumes CS of $AUD30 per day $2004 for houseboating and recreational fishing in the MDB. However, the report does not state how this value was derived Other studies have estimated the use value (CS) derived from in-stream recreation, including activities such as boating, fishing, canoeing, and rafting. It is noted that CS will vary widely as a function of the attributes of the tripper, the destination site, destination activity and the valuation approach. Estimates from all studies broadly indicate CS from in-stream recreation of AUD$30-70 per day, measured in $2012.	$52.50	$58
[9]	Measuring the Net Economic Value of Recreational Boating as Water Levels Fluctuate	Lake Ontario, St Lawrence US/Can	Data was gathered via a survey of recreational boaters to determine days boated and willingness-to-pay (net economic value) for boating on Lake Ontario and on the St. Lawrence River. Depth measurements were taken at marinas and yacht clubs, boat launch ramps, and private docks. Stage-damage curves were used to pinpoint at what water levels and to what extent boaters would be impacted. Boaters recreated an estimated 1.3 million days in 2002 and spent an estimated US$178 million in New York counties bordering Lake Ontario and the St. Lawrence River. The mean net economic value per day per boat (above current expenditures) was $69.36 measured in $2007.	$69	$89

Authors	Title	Location	Context and location	Value per person per day (year of $)	Value 2018 AU$
[10]	Multivariate count data regression models with individual panel data from an on-site sample	USA	Recreational power boating survey of 550 respondents. Estimated consumer surplus of $52.40-$60 per day measured in $2006.	$56.20	$72
Oregon State University's Recreational Use Value Database	Recreational use value database	Global, mainly USA	Database contains around 220 studies on in-stream recreation use values from 2006-16. Average values for these 220 studies converge on around AUD$60 per day measured in $2017.	$60	$60

A2.2 Recreational power boating expenditures

Table 8 summarises recreational power boating valuation studies that are relevant to the South Corowa to Bundalong Reach recreation values study. The key points here are:

- There are not many studies that estimate expenditure by recreational power boaters in Australia. Based on the studies summarised in Table 9, a recreation expenditure of around $20 per person per day trip appears appropriate, with testing of confidence intervals between $5-$40. For overnight, we assume $70 per person. This is in-line with the most recent and comprehensive study listed in the table for recreational boating [11]. Our assessment of the AECOM estimates suggests that these expenditure estimates are likely overstated for a number of reasons relating to how the study was conducted.
- We note that these per-trip expenditure estimates are broadly comparable with per-trip expenditure found in other recent Australian studies, for a range of different outdoor recreation types in Australia [3]. This includes recreational fishing (land-based or boat-based).
- We again note that the expenditure estimates are (1) gross expenditure estimates. This means that if the recreation and associated expenditure is transferred to another site, or substituted with another recreation activity, then the recreation expenditure is not lost. The recreation expenditure may not even change, it simply changes location (2) the breakdown of overnight trips versus day trips is key to determining the total expenditure occurring along the Reach.

Table 9: Studies that report value per trip for recreational boating

Authors	Title	Location	Context and location	Expenditure per person per day (year of $)
[5]	The economic value of recreation undertaken on Seqwater's land	SEQ, Queensland	Travel cost survey of 600 respondents, including recreational boating for skiing and wakeboarding at inland dams. 90% of respondents said they stopped in nearby towns for petrol. 70% said they stopped for food or drink.	Overnight $70 Active day $16
[11]	Wimmera Southern Mallee Socio-Economic Value of Recreational Water	Wimmera Southern Mallee, Victoria	Recreational water use expenditure survey for 24 lakes, weir pools and rivers around the region. Active day visitors are recreational boat users (including water skiing, wakeboarding, fishing and other boating). Estimates based on person-to-person interviews with 1,357 recreational water facility users (overnight, active and passive day visitors) and online surveys completed by 171 recreational water facility users (overnight, active and passive day visitors), many of which were users of multiple facilities. Results summarised in Table 10. Recommended sensitivity range is $25-50 per person overnight and $10-30 per person per day.	Overnight $35.35 Active day visitor $18.68
[6]	The economic value of boating and marine industries associated with the use of Gippsland Lakes	Gippsland Lakes, Victoria	Daily expenditure estimates for local and visiting boat users was derived from the 2013-14 Gippsland recreational fishing survey conducted by the Department of Environment and Primary Industries (DEPI). This found that total expenditure per boating trip was: - $38 for local day-trippers - $170 for non-local day-trippers - $511 for non-local multi-day trippers.	Overnight $170 Active day visitor $38

Table 10: Estimated Expenditure by Participants at Recreational Water Facilities 2016-17

In-town*	Expenditure Overnight Visitors	Expenditure Active Day Users	Expenditure Passive Day Users	Expenditure Total Day Users	TOTAL	Visit Nights/ Person Nights	Active Day Users	Passive Day Users	$ per visit night	$ per active day users
Wimmera River - Horsham*	$445,839	$338,050	$144,398	$482,448	$928,288	10,429	13,510	61,446	$42.75	$25.02
Green Lake	$55,081	$197,662	$0	$197,662	$252,743	1,630	9,544	0	$33.79	$20.71
Taylors Lake	$184,359	$34,255	$0	$34,255	$218,614	6,289	1,612	0	$29.31	$21.25
Wimmera River - Dimboola*	$241,485	$65,129	$30,780	$95,909	$337,394	8,197	6,380	13,680	$29.46	$10.21
Nhill Lake*	$24,977	$94,372	$21,855	$116,227	$141,204	1,053	6,460	10,025	$23.72	$14.61
Wimmera River - Jeparit and Lake Hindmarsh*	$103,666	$40,457	$19,405	$59,862	$163,528	4,344	1,396	7,295	$23.86	$28.98
Lake Bellfield*	$157,181	$46,285	$37,105	$83,390	$240,571	4,453	2,173	14,842	$35.30	$21.30
Lake Fyans	$2,682,263	$59,876	$13,069	$72,944	$2,755,208	66,456	2,681	3,485	$40.36	$22.33
Lake Lonsdale	$44,650	$25,333	$17,200	$42,533	$87,183	1,995	1,500	5,000	$22.38	$16.89
Lake Wartook	$31,321	$11,000	$0	$11,000	$42,321	2,304	660	0	$13.59	$16.67
Walkers Lake	$74,437	$16,343	$0	$16,343	$90,780	3,101	1,430	0	$24.00	$11.43
Donald Park Lake*	$118,550	$48,847	$6,379	$55,225	$173,775	4,742	2,197	3,645	$25.00	$22.23
Tchum Lake	$112,565	$48,750	$3,720	$52,470	$165,035	3,830	2,600	1,459	$29.39	$18.75
Lake Watchem	$98,552	$19,125	$0	$19,125	$117,677	3,203	900	0	$30.77	$21.25
Lake Wooroonook	$129,964	$30,670	$0	$30,670	$160,634	3,630	1,094	0	$35.80	$28.03
Lake Wallace*	$790,565	$44,430	$25,097	$69,527	$860,092	19,834	2,038	9,842	$39.86	$21.80
Lake Charlegrark	$219,599	$57,201	$0	$57,201	$276,800	6,879	2,215	0	$31.92	$25.82

In-town*	Expenditure Overnight Visitors	Expenditure Active Day Users	Expenditure Passive Day Users	Expenditure Total Day Users	TOTAL	Visit Nights/ Person Nights	Active Day Users	Passive Day Users	$ per visit night	$ per active day users
Glenelg River - Harrow*	$114,906	$10,988	$3,953	$14,941	$129,847	4,692	464	1,813	$24.49	$23.68
Brim and Beulah Weirs*	$337,739	$92,705	$0	$92,705	$430,444	11,762	6,374	0	$28.71	$14.54
Lake Lascelles*	$427,209	$109,811	$0	$109,811	$537,020	6,320	8,052	5,005	$67.60	$13.64
Lake Marma*	$78,461	$20,589	$16,626	$37,214	$115,676	2,453	1,365	9,237	$31.99	$15.08
Yarriambiack Creek - Warracknabeal*	$458,222	$48,290	$34,472	$82,762	$540,984	18,492	3,512	16,415	$24.78	$13.75
Total	**$6,931,592**	**$1,460,168**	**$374,058**	**$1,834,225**	**$8,765,818**	**196,088**	**78,156**	**163,189**	**$35.35**	**$18.68**

Table 11: AECOM estimate trip expenditure by category, 2013

Category / Expenditure type	Local user (fisher)	Day trip visitor	Overnight / Multi day visitor
Fuel	$15	$19	$22
Accommodation	$2	$44	$174
Retail	$5	$45	$85
Restaurants	$5	$30	$56
Bait	$6	$10	$14
Other	$5	$23	$159
Total	**$38**	**$170**	**$511**

Table 12: Wimmera estimate trip expenditure by category, 2017

	Supermarket, and grocery stores	Fuel/vehicle servicing	Cafés and Coffee Shops	Bakeries Butchers	Hotels, motels	Other Retail	Total
Buloke	$31,589	$3,646	$145,165	$38,122	$75,211	$1,037	$300,090
Hindmarsh	$39,666	$1,275	$154,757	$2,797	$131,030	$7,725	$345,221
Horsham	$187,423	$11,558	$236,469	$17,327	$285,671	$2,353	$765,891
Northern Grampians	$179,552	$27,342	$465,506	$83,009	$1,291,280	$99,862	$2,171,174
West Wimmera	$66,906	$7,399	$205,784	$33,121	$221,115	$16,248	$634,821
Yarriambiack	$114,502	$4,989	$244,077	$8,154	$219,843	$21,958	$632,334
Total	$619,638	$56,209	$1,451,759	$182,531	$2,224,150	$149,184	$4,849,530
%	13%	1%	30%	7%	46%	3%	100%

Appendix 3 RDV Input-Output model

We used the regional economic impact model developed by Regional Development Victoria (RDV) to estimate the regional economic contribution of recreational boating activity.

The model provides measures of impacts from investments from consumer expenditure on recreational boating activities. This appendix describes the structure of the I-O model and the limitations of I-O models that readers should be aware of.

The estimates generated by the RDV regional economic impact model are underpinned by an input-output model developed by SGS Economics from national input-output figures from the ABS. This model shows the flow of goods and services between all the parts of the Australian economy. The figures developed for each local government area (LGA) disaggregate these total figures across regions using known regional subtotals and forcing the relationship across all regions to match the Australian total.

Using I-O to estimate order of magnitude economic impacts of recreational boating expenditure is considered reasonable, given the time and budget available to this project, and the magnitude and localised nature of the expenditures. However, I-O models have known limitations. These limitations mean that I-O models may overstate the economic contribution of economic activity and investment.

The issues with I-O models include:

- **The input-output approach assumes that relationships between industries are static.** That is, productivity improvements are not factored in and historical relationships are assumed to hold. Businesses are not able to adjust to changes in prices to change the way that they produce things.
- **The input-output approach uses total production estimates.** As a result, the relationships are average. However, if we think about where increases in spending might occur, we expect the spender to look for the best value option (or a

marginal option). Using an average approach does not allow for using any underutilised capacity at the industry level or for the better use of existing machinery as production expands from its existing base.

- **All of the expenditure is assumed to be new economic activities in each local government area.** That is, input-output models assume that labour and equipment are, in effect, unemployed and with no constraints on their availability. This means that crowding-out or industry substitution effects (including from saving) are assumed to be negligible. This means that there is sufficient slack in the local economy to service these stimuli without transferring significant resources from other uses. If that is not the case, then there is a tendency for input–output models to overstate economic value.

The input-output approach is also constrained by:

- the relevance of the most recent national input–output table, which was based on the structure of the economy in 2001-02.
- the high level of discretion that can be applied when disaggregating national tables to a state and regional industry level, where those local levels of data are not available.

These issues mean that input-output modelling generally overstates the gross and net economic impact of industry sectors. Changes in spending in an industry, for example, are unlikely to generate the same impact as suggested by the application of input-output multipliers. Ignoring these effects can cause input-output based estimates to overestimate the overall impact on the economy.