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Recreational fishing 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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Acronyms and abbreviations

ABS	Australian Bureau of Statistics
FRDC	the Fisheries Research and Development Corporation
GL	gigalitres
ha	hectare
I-O	input-output model
kg	kilogram
LGA	local government area
MDB	Murray-Darling Basin
MDBA	Murray-Darling Basin Authority
NCCP	National Carp Control Plan
RDV	Regional Development Victoria
TRA	Tourism Research Australia

Glossary

benefit transfer	
Choice modelling	A stated preference valuation approach that estimates implicit prices for the attributes of a non-market outcome. This is done by asking people to choose between options that are described by different levels of attributes and any costs they would have to pay.
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.
Contingent valuation method	A stated preference valuation approach that estimates the value of a non-market outcome. It usually involves asking people whether or not they would pay a set amount of money for the outcome.
Cost-benefit analysis	An evaluation technique used to compare the total costs of a programme/project with its benefits, using a common metric, typically dollars
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.

benefit transfer	
Headwater	The source, or headwaters, of a river or stream is the farthest place in that river or stream from its estuary or confluence with another river, as measured along the course of the river.
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.
Intrinsic value	A way of describing the perceived or true value of a good or service, as distinct from the price someone pays for the good or service.
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).	4 and 5
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.	N/A
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 and 5

1.1 This discussion paper

This Marsden Jacob discussion paper focuses on recreational fishing in the Basin. The evidence base we use in this discussion paper draws on reviews and earlier assessments of recreational fishing activities in the Basin [1-3], including how recreational fishing activity levels change, or do not change, subject to changing river flow levels.

2. Fishing activity in the Basin

Recreational fishing is a popular activity in the Murray-Darling Basin (MDB). As of 2018, there are estimated to be over 500,000 recreational anglers in the Murray–Darling Basin [4]. Recreational fishers have a direct interest in water management, acknowledging that improved river flows will deliver better outcomes for fish populations.

2.1 What is recreational fishing

For the purpose of this case study, we define recreational fishing as the fishing of aquatic animals (mainly fish), where this does not constitute the individual's primary resource to meet basic nutrition needs, and which and are not generally sold or traded. The recreational fishing industry in the Basin includes a range of groups such as fishers, tackle and equipment suppliers, bait suppliers, riverboat operators, boat hire and tourism operators.

Most recreational fishers want to catch native fish, as opposed to alien species (having originated outside Australia) such as carp. This contributes to a lack of native fish abundance, which in turn reduces the level of targeted recreational fishing effort and activity. The NSW/ACT Recreational Fishing Survey 2013/14 showed that overall, 62 per cent of the total catch of all species was attributed to targeted fishing effort. Most (71-90 per cent) key native species such as Murray Cod, Golden Perch and Australian Bass were derived from targeted fishing efforts. Conversely, species such as European Carp were quite rarely targeted (less than 20 per cent) indicating that catching carp was mostly accidental.

2.2 Factors that drive recreational fishing

The primary motivation for most recreational fishers is the enjoyment of the fishing experience in a relaxed natural environment. Some 96 per cent of recreational fishers in Australia are motivated by a connection to the environment. Recreational fishing can also promote social well-being, increase environmental awareness and provide health and economic benefits .

Environmental condition therefore plays a crucial role to the quantity and quality of recreational fishing experiences. The National Recreational Fishing Survey 2003 (NRFS) was the last major analysis of national recreational fishing activity. The result of the NRFS highlighted that the main factors that drive recreational fishing included ‘to relax and unwind’, ‘to spend time with family’, ‘fishing for sport’ and ‘to be outdoors’. All these factors show that recreational fishing is more about intrinsic value rather than economic attraction (i.e. not commercial fishing). More recent and localised analyses, such as VFA surveys, have made similar findings.

2.3 Recreational fishing across the Basin

Within the Basin, there are 23 major catchments and over 20 major water storages that can be used for recreational fishing. In inland NSW alone, it is estimated that there are over 200,000 locations where rivers, streams and lakes can be accessed by public land

More than 60 fish species are known from the Basin, which includes 10-12 species that are alien and seven marine or estuarine species capable of entering and surviving in fresh water. The MDBA Sustainable Rivers Audit was based on data collected at the end of the Millennium Drought (2008–2010) and highlighted that alien species were a major part of the Basin fish fauna. Common carp and gambusia— both aliens—were abundant (present in all 23 valleys), and goldfish in 22 valleys [5].

The flow regime in the northern Basin is one of the most variable in the world. It plays a vital role in the ecology of the aquatic and riparian environment of the system [6]. The northern catchments’ freshwater environments include an extensive range of aquatic habitats, including deep channels, swamps, floodplains and wetlands.

The northern Basin has a distinct fish assemblage supported by the extensive and diverse range of aquatic habitat across the region, with slightly different communities across the northern regions of the Condamine Balonne. A total of 22 native fish species and six introduced fish species occur in the northern Basin. Several fish species found in the northern Basin do not occur in the South, including Rendahl’s Tandan and Hyrtl’s Tandan [6].

3. Impacts of flows on fish populations

There is clear evidence that changes to river flow regimes directly impact Basin fish populations [7]. Improvements to water management improve the ability for native fish numbers to increase [8]. This in turn provides greater recreational fishing opportunities.

3.1 Basin Plan outcomes

River flows are a major factor that structure freshwater fish communities across the Basin. Flows influence the range of physical habitats that are available to fish, as well as ecological processes and functions to which their lifecycle is linked [8].

Prior to the Basin Plan, much of the Basin was over-allocated. Over-allocation was leading to the degradation of suitable fish habitats, especially for native species [3]. The 2008 Sustainable Rivers Audit rated three valleys as moderate, nine as poor, three as very poor and eight as extremely poor, with many being dominated by carp, based on analyses of the fish abundance and biomass [5]. Much of the northern Basin was rated poor, with the Warrego rated moderate and Paroo receiving the only 'good' health rating. This rating was based on the condition of the key biological components and processes of ecosystems, including vegetation, fish and macroinvertebrates.

Seven years since the Basin plan started, environmental watering is still evolving as a management practice. More ecological knowledge is required, particularly about how different fish species may be affected by flows, including natural events, environmental watering and other water management action.

Since the commencement of the Basin Plan, the delivery of over 300 environmental flows have supported native fish populations. Targeted monitoring programs have detected positive responses of native fish to the delivery of these flows [9]. These positive responses include triggering the movement and dispersal of golden perch and silver perch; enhancing recruitment success of Murray cod, freshwater catfish and silver perch; increasing abundances of Australian smelt and carp gudgeon; and maintaining critical habitat and hence facilitating the survival of populations of the endangered Murray hardyhead.

Critical populations of several key native fish species, including golden perch and Murray cod, are being maintained in the northern Basin. Evidence suggests that spawning and recruitment in the northern Basin, including Menindee Lakes, is currently supporting a large portion of the southern Basin population of golden perch. This highlights the importance of protecting environmental flows throughout the northern Basin for native fish and recreational fishing outcomes.

Environmental watering has been associated with better fishing outcomes in many cases. However, as with other potential benefits to the broader community from environmental watering events, the full benefits for recreational fishing from implementing the Basin Plan are not expected to be realised until water recovery is complete, and once there has been sufficient time for fish numbers and fishing conditions to respond to the additional water.

3.2 Carp

Where carp are above accepted threshold levels for detrimental ecological impact (i.e. 80-100 kg/ha), they limit the economic benefit of recreational fishing. Where environmental flows serve to increase carp populations above the detrimental ecological threshold level, environmental flows reduce recreational fishing benefits. This means that flows for native fish must be managed in conjunction with programs to eradicate carp, in order for recreational fishing benefits to be maintained or increased.

Common Carp populations pose a critical threat to the river environment across the Basin, including throughout most of the northern Basin, and wherever there are suitable habitats. The intermittent nature of the northern Basin river system means that it is more difficult for the carp (and native fish) to move upstream. The result is that carp remain largely absent from most headwater stream sites in the northern Basin, such as the Upper Condamine Balonne Cooby Dam [6]. However, there are some reports of carp now present is parts of the Condamine Balonne Water Management Area at Beardmore dam.

Common Carp populations will benefit from water delivered for the environment, particularly where floodplain inundation is achieved. Once established, carp eventually completely dominate freshwater fish communities. In many areas, carp make up the significant proportion of fish biomass, which sometimes exceeds 80 per cent [10].

The Fisheries Research and Development Corporation (FRDC) is leading a National Carp Control Plan (NCCP), which is assessing the feasibility of introducing the Carp virus. The NCCP will deliver a final report to the Australian Government at the end of 2019.

4. Relationship between recreational fishing activity and water availability in the southern Basin

On balance, there is evidence supporting the view that water recovery to date under the Basin Plan is contributing to the increase in native fish species, which has positive economic flow-on effects to industries like recreational fishing [1, 11].

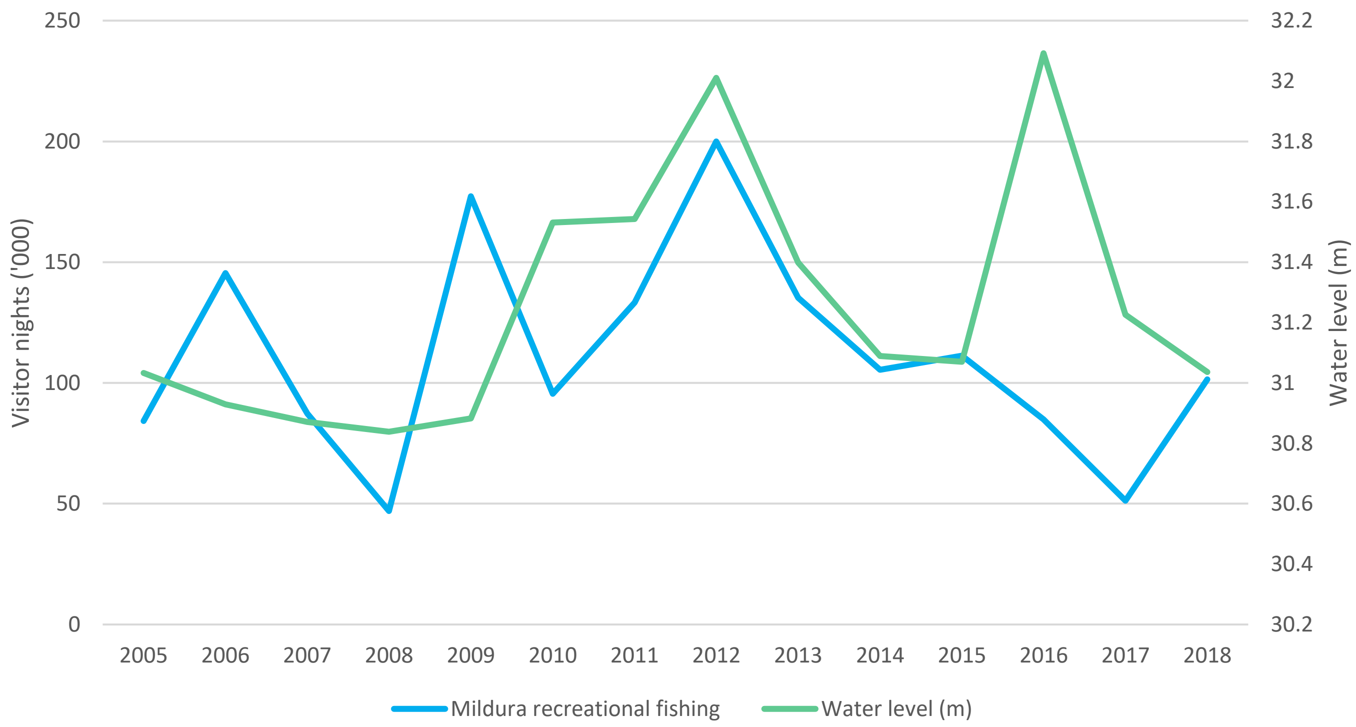
4.1 Relationship between water availability and recreational fishing activity

Statistical analysis of Tourism Research Australia data (TRA) and flow rates/volumes did not identify strong relationships between peak season water availability and recreational fishing activity for two sites in the southern Basin. 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 fishing in the Basin at this time, that:

- there is no strong evidence that changing water availability will systematically change recreational fishing activity levels (see figure 1 and 2).
- there is also no strong relationship between recreational fishing activity and overall tourism activity (for example, see figure 3 and 4). These activities include fishing, water and boat activities.

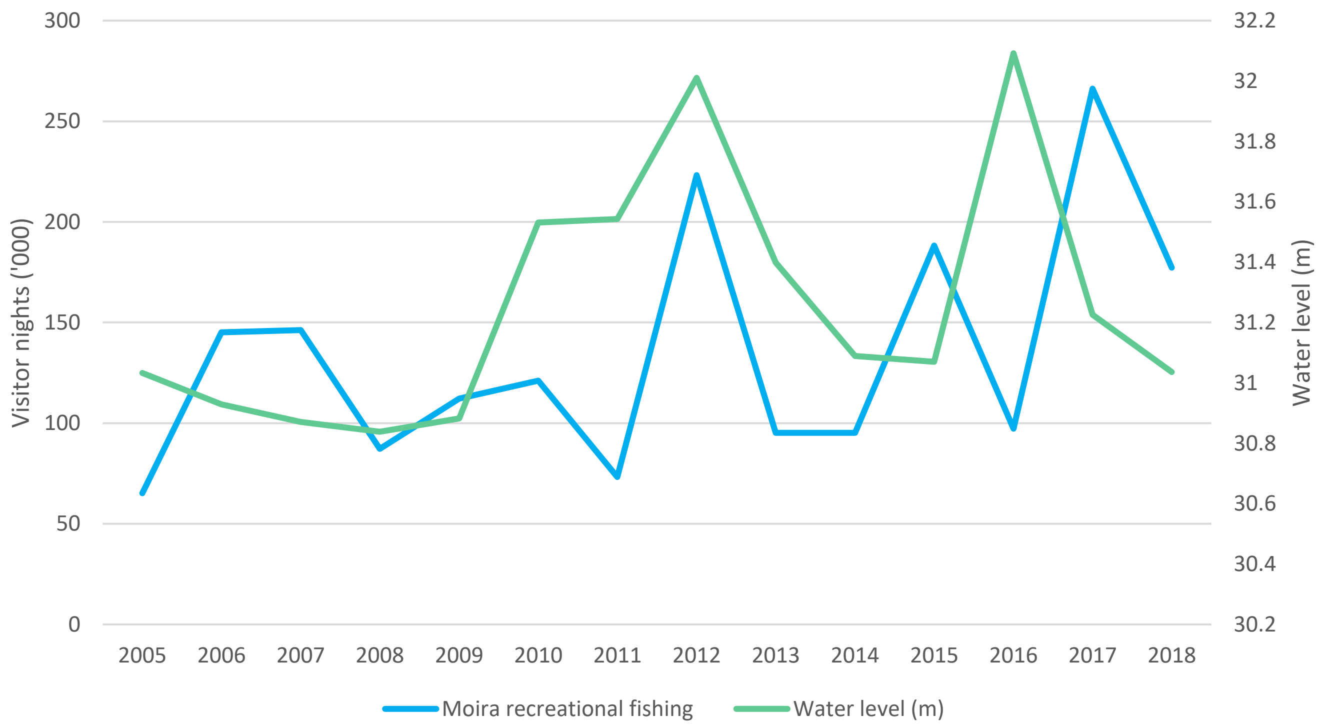
These results provide insight into the drivers of recreational fishing activity. Rather than being the sole or main reason for tourism activity, recreational fishing is typically a component of a multi-purpose trip. Consistently, (i) visiting friends or relatives and (ii) business are given as the second and third most popular reasons for visiting a region, respectively. Visiting parks is another popular reason for travel. Therefore, it is unsurprising that there is not a strong relationship between recreational fishing activity and flow rates/volumes. The potential exception is during times of extremely low or extremely high-water availability, such as in 2012.

Figure 1: Recreational fishing activity and water levels at Mildura LGA



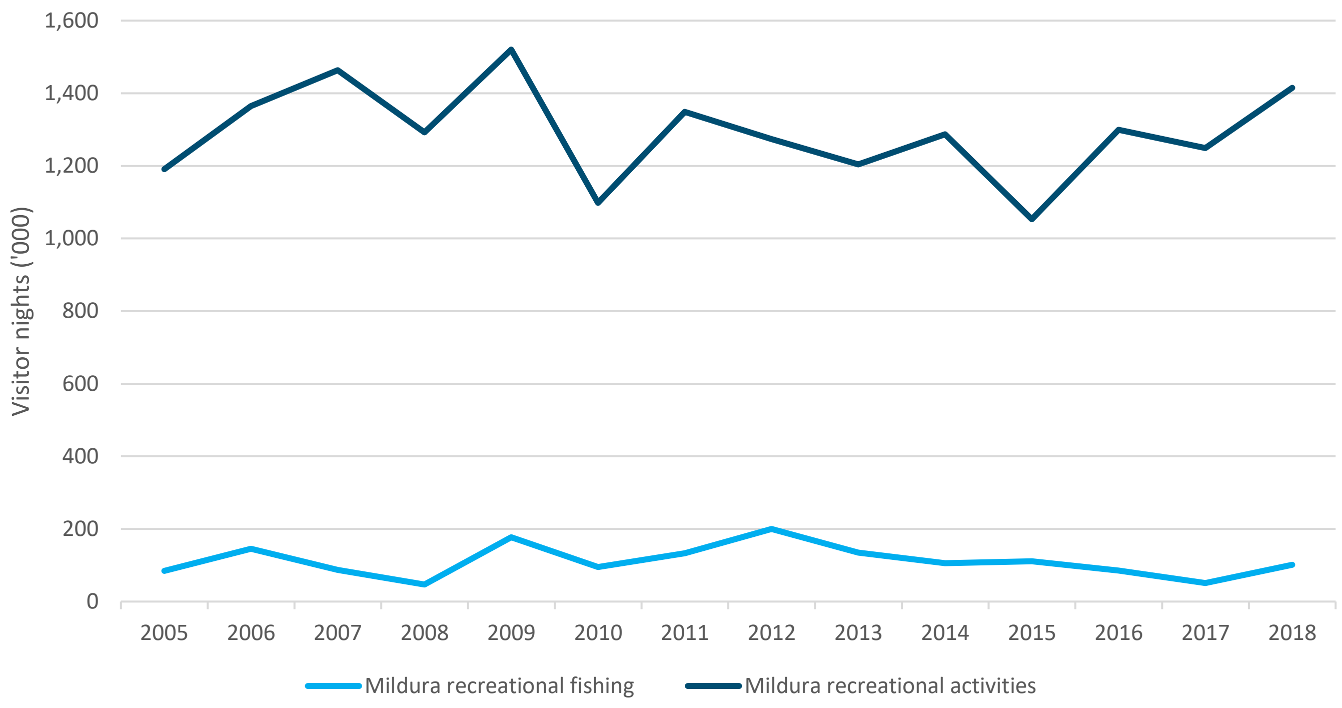
Source: Marsden Jacob analysis of TRA data (2019)

Figure 2: Recreational fishing activity and water levels at Moira LGA



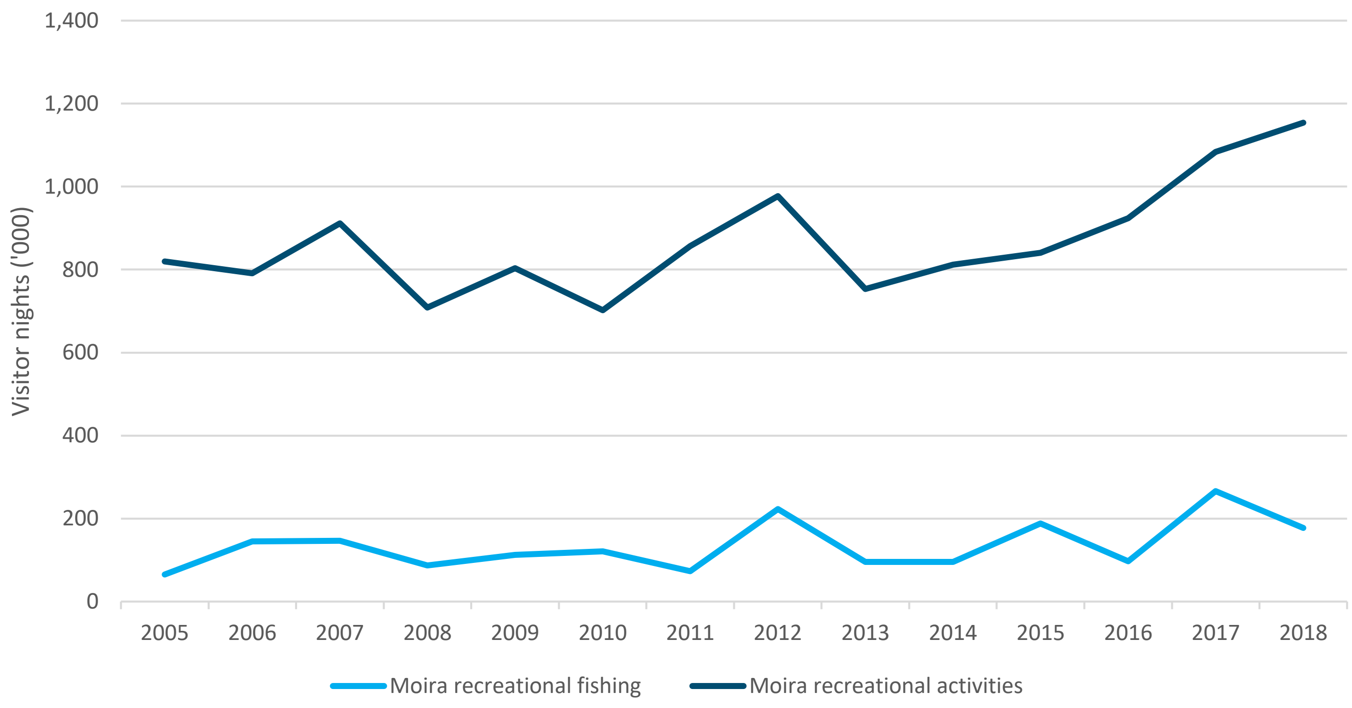
Source: Marsden Jacob analysis of TRA data (2019)

Figure 3: Tourism activity in the Mildura LGA



Source: Marsden Jacob analysis of TRA data (2019)

Figure 4: Tourism activity in the Moira LGA



Source: Marsden Jacob analysis of TRA data (2019)

4.2 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 fishing 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 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.
- The short time series of 14 years (2005-2018) might be insufficient to identify relationships.
- There are other unmeasured factors that influence recreational fishing activity and expenditure levels.
- Recreational activities might be impacted in different ways. For example, there are varying licence, catch limits and seasonal restrictions imposed throughout the year. In other words, there might be a degree of offsetting of impacts that is not captured when using aggregated data.
- The analysis captures only activity from tourism. However, there is also local activity, which is important for local communities.
- It is possible that recreational fishing is adversely affected only during times of extremely low or extremely high water availability such as during the mass fish kills in the Menindee Region NSW over the summer of 2018–2019.

The above discussion reinforces the need for better and more precise data over a long time series for recreational fishing. 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 fishing.

5. Potential impact of changing water recovery on recreational fishing and its economic value and contribution to Basin communities.

Recreational fishing in the MDB has an estimated baseline economic contribution of $100 million gross output and $90 million gross value-added per year. However, all available evidence suggests that water availability does not materially impact economic activity. This implies environmental flows may not materially impact on activity.

5.1 Estimating recreational fishing populations in the Basin

Over the last decade, there have been many attempts to estimate the recreational fishing population [2, 12, 13]. Estimates put recreational fisher levels at between 430,000 - 830,000 across the Basin [2, 12, 13].

A lack of comprehensive and consistent surveys of recreational fishing has meant that estimates of the number of recreational fishers are imprecise for the Basin. The methods rely of sample data collected either at the time of the study, or retrospectively adjusted for the current period to estimate population data, which leads to large variations.

5.2 Estimating economic contribution and value of recreational fishing in the Basin

Recreational fishing has the potential to significantly stimulate economic development, especially through increased tourism [14]. As fish caught are typically not part of a direct market transaction, the economic contribution requires alternative approaches to understand its value. For instance, the sector supports various economic activities related to fishing, such as travel, accommodation, boat rental, motor construction or repair, bait and tackle supply, infrastructure, restaurants, etc.

The literature supports a wide variety of studies that focus on developing economic metrics to determine the economic contribution of recreational fishing [2, 12, 13, 15-18]. These studies used concepts of economic valuation and various nonmarket valuation methods including replacement values, contingent valuation method, choice modelling, travel cost method, benefit transfer, survey method and cost benefit analysis among others.

5.3 Change in economic contribution and value of recreational fishing

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. For recreational fishing:

- **Gross output** is the amount the recreational fisher pays 'in the market' for their recreational activity. Gross output is the sum of the cost of intermediate inputs (the cost of the tackle, licence and costs to get to the water, etc.), wages, taxes net of subsidies, and profits to the businesses providing goods and services to the recreational fisher.
- **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 fishing activity. It measures the true contribution of the economic activity to the economy because it backs out leakage out of the economy.

A detailed explanation of the methodology used is provided in Appendix 8.3

5.4 Potential impact of changing water availability on recreational fishing

Based on the available data, there is no strong evidence that changing water availability will systematically change recreational fishing activity levels (for example, Table 3). Therefore, water recovery and improved water availability due to higher environmental flows is unlikely to materially impact recreational fishing 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 maintain the appeal of recreational fishing.

Table 2: Estimated economic contribution from recreational fishing at selected sites, 2014-18

		Economic contribution ($m, 2019)				
Location	Metric	2014	2015	2016	2017	2018
Mildura LGA	Gross output	3.7	3.9	3.0	1.8	3.6
	Gross value-added	3.2	3.3	2.5	1.5	3.0
Moira LGA	Gross output	3.3	6.6	3.4	9.3	6.2
	Gross value-added	2.9	5.6	2.9	8.0	5.3
Total MDB	Gross output	99	100	90	117	108
	Gross value-added	85	85	77	100	93

Source: Marsden Jacob analysis of TRA data (2019)

Table 3: Potential impact of changing water availability on recreational fishing activity, for selected locations

Location (LGA)	Variable	Elasticity	95% confidence interval	t-stat	p-value
Mildura	All tourism activities in LGA	1.09	-1.49 to 3.68	0.93	0.37
	Water level	10.26	-10.1 to 30.5	1.11	0.29
Moira	All tourism activities in LGA	1.79	0.25 to 3.32	2.56	0.03**
	Water level	-1.94	-19.2 to 15.3	-0.25	0.81

Source: Marsden Jacob analysis

5.5 Conclusions

On balance, there is some evidence supporting the view that water recovery to date under the Basin Plan is contributing to improved environmental outcomes [19]. These outcomes include the increase of native fish species, which has positive economic flow-on effects to industries like recreational fishing [13, 20]. However, based on our analysis of tourism data for two sites in the southern Basin, we were not able to show a significant link between flows and recreational fishing activity.

Specific environmental water activities have been associated with better fishing outcomes in many cases. However, as with other potential benefits to the broader community from environmental watering events, the full benefits for recreational fishing from implementing the Basin Plan are not expected to be realised until water recovery is complete, and once there has been sufficient time for fish numbers and fishing conditions to respond to the additional water.

Some of the main benefits associated with recreational fishing are more intrinsic values like relaxation, being outdoors, and spending time with friends and family [12]. These values are almost certainly positively related to the ecological condition of rivers and wetlands, and as important as fish populations for some anglers. However, improvements in fishing conditions are unlikely to be Basin-wide, and there are likely to be regions where fishing outcomes in terms of the number of fish caught have not improved.

Improvement is required in in the collection of primary data associated with recreational fishing such as expenditure and number of trips taken. The limited amount of data available on the economic contribution of recreational fishing has meant that economic studies are forced to use assumptions in-lieu of actual data. Given these limitations, it is difficult to determine if the benefits that recreational fishing is receiving from environmental flows are going any way to offset the impact of reduced agricultural production.

6. Next steps

Our recommended next steps all revolve around improving data collection and quality. This will support better evidencing of the relationship between environmental watering and recreational fishing activity, and regional contribution.

Key points here are:

- **The best available evidence did not identify strong relationships between peak season water availability and recreational fishing activity.** Marsden Jacob's statistical analyses of TRA recreational fishing expenditure and activity data and Basin water availability shows that there is no statistical relationship between peak season water availability and recreational fishing activity at any of two southern Basin sites for the period evaluated.
- **Due to the coarseness of the TRA data, these overall findings about the production relationship between Basin water availability and recreational fishing 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 fishing activity in the Basin, except potentially under very extreme drought circumstances. Further research and investigation is warranted on this issue.
- **At any given recreational fishing site, the lack of a statistically significant relationship strictly implies that changing water availability by increasing environmental flows may not predictably or systematically translate into increases** in recreational fishing activity or measures of economic contribution.
- **To better support this conclusion, better data is needed on a shorter time step, such as daily, weekly, or monthly.** At a time step longer than monthly, the data are likely to be too coarse to identify production relationships between recreational fishing activity and water availability, even if such relationships are strong. Collection of more comprehensive fisher population data might assist with this objective such as in Appendix 8.2. Regular national recreational fishing and related industries surveys would provide more valuable information.

7. References

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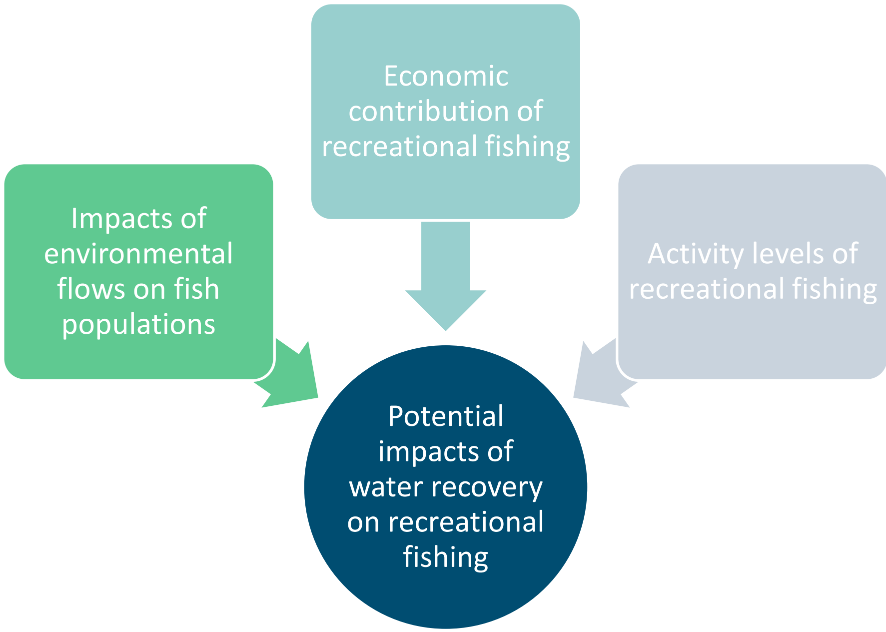
8. Appendices

8.1 Approach and methodology

The analytical framework captures the potential impacts of water recovery on recreational fishing by evaluating the impacts of environmental flows on fish populations and the levels of fishing and their associated economic contributions. In practical terms, this means that an increase in environmental water will increase fish populations, leading to greater fishing activity and subsequent economic contributions to communities.

Figure 5: Evaluation approach



8.2 Indicator framework for assessing ecosystem services benefits

The 2017 Basin Plan evaluation into social and economic benefits from environmental water uses the term ecosystem services benefits to describe the linkages between the condition of the natural environment and human well-being.

The below table lists possible indicators and potential data sources for conducting more detailed empirical research into the scale and scope of ecosystem services provided by riverine ecosystems in the Basin.

Beneficiaries	Changes in social and economic outcomes	Indicators and potential sources
Retail equipment suppliers, tourism operators	Increased economic activity and employment growth	Fishing related industry data Fishing activity Expenditure data (Ernest and Young and Deloitte studies) Number of recreational fishing competitions
Fishers	Increased fishing opportunity Improved experience of fishing Improved knowledge of ecosystem	Numbers participating in recreational fishing Enjoyment and satisfaction (ABS data) Recreational fishing surveys (e.g. National survey, State surveys, Regional Wellbeing survey)
Tourism and hospitality businesses and other parts of the services sector. Basin residents (expansion in jobs and available services)	Increased employment and diversification of tourism, hospitality and other service industries. Improvements to 'built' amenity linked to tourism	Visitor stays (Tourism Research Australia (TRA)) Expenditure data (TRA) Employment estimates (TRA) Visitor experience surveys (TRA) Private and public investment in promotion and management of nature
Basin residents and businesses	Increased enjoyment of the natural environment Maintenance of sense of place and identity Maintain or increase number of people choosing to reside in the Basin	Population growth Residential developments Perception of local liveability and quality of rivers, lakes and wetlands (Regional Wellbeing Survey) Local and regional events that incorporate and celebrate rivers lakes or wetlands

Beneficiaries	Changes in social and economic outcomes	Indicators and potential sources
		Area of wetlands/forests with outstanding cultural and or historical significance

8.3 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 fishing activity.

The model provides measures of impacts from investments from consumer expenditure on recreational fishing 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 fishing 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.