

If sustainability fails, who loses most?

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Abstract

A fishery may be 'sustainable' over a wide range of harvest/abundance regimes with an associated value at each level. We employed Contingent Valuation Methodology (Willingness-to-Pay approach) to obtain estimates of the value of the lower River Murray fishery recreational and non-consumptive sectors relative to the commercial sector at current stock levels. Respective estimates of \$A9.6m, \$A45.2m and \$A1.1m per annum indicate the importance of considering non-use values in fisheries management. Since the non-consumptive sector will lose absolutely in the event of stock collapse/sustainability failure, it has the most to lose. The recreational and commercial sectors are likely to be buffered from absolute loss (e.g. through increased emphasis on the experience component of recreational angling, through government assistance to the commercial sector).

Fisheries management in Australia is almost exclusively concerned with servicing two broad client groups; commercial fishers and recreational fishers. The key associated issue is the allocation of harvest between these groups. Our research indicates that there is a third user group, i.e. the non-consumptive sector, whose interests need to be considered and prioritised. To illustrate this we use the example of the native fish stocks of the River Murray in South Australia and

consider the outcomes eventuating from a loss of sustainability in this fishery.

To allocate a resource efficiently it is necessary to have some indication of the relative values of the resource to all the potential interest groups. To be able to estimate true indications of these values we need to consider the composition of the total economic value of the resource.

What is total economic value?

The composition of total economic value of a resource can be broken down into several broad types:

1. Use value
 - a) Actual
 - i) Direct (consumptive)
 - ii) Indirect (non-consumptive)
 - b) Option
2. Non-use value
 - a) Bequest
 - b) Vicarious
 - c) Existence

Use value, as is self explanatory, is derived from using good(s) or resource(s). In the case of fish this can be either directly, as in fishing, or indirectly by observation of some form (physically, books, film). While

an individual may not currently undertake any of these activities they may derive value from the knowledge that should they wish to, they have the option to do so (Randall 1987).

Bequest value is an altruistic concept whereby individuals derive utility and satisfaction from endowing future generations with a resource (Young 1991). Vicarious value is similar but in this case individuals derive value from the availability of a resource for use by others. Existence Value (Randall and Stoll 1983) reflects the utility and satisfaction derived by an individual purely from the continued existence of a resource. In the current example they may gain benefit from the knowledge that there are native fish stocks present in the River Murray, even though they may not ever envisage using them.

The terminology used and the degree of breakdown varies slightly in the literature. For the case in hand we have chosen to group the above categories into two types of value, based on their practical impact on the resource:

1. Direct use value.

Comprising of that value derived from activities that involve the consumption of native fish.

2. Non-consumptive value.

Comprising of that value derived from activities that do not involve the consumption of native fish together with the associated non-use value.

Who are the value holders?

The common perception is that those who can derive value from native fish stocks are commercial and recreational fishers. While

there can be no doubt that they are indeed major users, this view ignores the fact that native fish are also an environmental resource whose value can be derived without consumption. Australian native fish are in fact a common property resource (Krutilla and Fisher 1975), owned by the community, and administered by the State. To date governments have generally chosen to focus management on the consumptive aspects of the resource. A more accurate view is that all of society derives value from native fish stocks and that society can be divided into the following user groups:

1. Commercial fishers
2. Recreational fishers
3. Non-consumptive sector (i.e. everybody else).

How to quantify value?

When allocating resources it is desirable to be able to quantify the value(s) of the various groups involved, preferably in monetary terms, as this provides a readily understood means of comparison within western cultures. There are several economic assessment techniques available to accomplish this, such as market methods, hedonic measures (Streeting 1990), Travel-cost method (Pearce *et al.* 1989) and Contingent valuation (CVM) (Mitchell and Carson 1989). While the first two of these methods are currently more commonly employed, only Contingent Valuation is suitable when attempting to quantify the total economic value. This is because CVM is the only method able to provide an estimate of non-use values (Young 1991).

The Contingent Valuation Method is a direct approach to estimation, based on the premise that an indication of the value of a

good or resource to an individual can be obtained by 'asking' that individual. The aim is to disclose an individual's willingness-to-pay (WTP) for a benefit and/or their willingness-to-accept (WTA) compensation to tolerate a loss of benefit. This can be done either by a questionnaire approach or using experimental techniques where an individual's response to stimuli is observed under 'laboratory' conditions (Pearce *et al.* 1989). The aim under both approaches is to simulate a market for the good in question.

Methods adopted

In the case of non-consumptive users, it was necessary to estimate values which would be primarily non-use, therefore CVM was the only option available. It was also the most appropriate method for recreational fishers as there is a well established non-consumptive element to the overall experience (Glass and Muth 1987).

While both WTP and WTA approaches were used, there are a number of limitations with the use of WTA. As this case investigates a potential loss of benefit, WTA questioning would appear theoretically to be appropriate (Coker and Richards 1992). In practice, this and other studies have found that WTA produces consistently larger results than WTP (three to five times larger (Cummings *et al.* 1986)). There are several postulated causes for this variation which include the constraint of income under WTP (Dixon and Sherman 1990), a higher degree of strategic bias evident under WTA (Brookshire and Coursey 1987), rejection of the WTA property right (Mitchell and Carson 1989), and prospect theory (Kahneman and Tversky 1979; 1982).

While it was expected that more conservative results would be obtained from a WTP approach, WTA was also assessed to provide an indication of the magnitude of any difference and to see if the key value determinants were the same under each approach.

In the case of commercial fishers the net value was most effectively obtained by the use of market methods (Lal *et al.* 1992 pp 36-37). Gross market value of the commercial catch was used as a *defacto* indicator of net economic value. The demand for commercially caught fish in Australia is very price elastic (Pascoe *et al.* 1987) implying minimal consumer surplus¹. The associated annual production costs were not readily available, but anecdotal and observed evidence suggest that they are minimal (e.g. fishers are local or home based; boat, gear and running costs are low relative to most other fisheries).

This approach does not include any non-consumptive benefits to commercial fishers such as the enjoyment of the fishing life-style, the anticipation and capture of fish and the tradition of fishing (Holland *et al.* 1992). As there are only 40 commercial fishers, these additional values were assumed to be minimal relative to cumulative market value.

Survey

In order to obtain estimates of value, questions were included in a survey which

¹ A measure of benefit to a consumer, net of the sacrifice he or she has to make, from being able to buy a good at a particular price; the difference between the amount a consumer is prepared to pay for a good (rather than go without) and the amount actually paid (Department of Finance 1991).

formed a part of a broader project. The survey was conducted using a personal interview survey method to obtain CVM estimates, with all interviews conducted by the same person. This allowed an opportunity to form an opinion of the degree to which respondents understood the hypothetical situations and also to reduce variability due to extraneous influences such as personality and presentation.

The survey sample was drawn from the population of Adelaide and the Riverland region of South Australia. The sample was stratified, to detect any variation in value between the locations on or about the river and suburban Adelaide. These two areas represent 77.8% of the total population of South Australia (4.6% in the Riverland/Murray Mallee region and 73.1% in Adelaide)(South Australian Yearbook 1993 pp 48–49).

The survey questions were designed to:

1. Estimate the average net non-market dollar value that individuals place on native fish stocks in the lower River Murray;
2. Identify the key variables explaining the magnitude of this net value to individuals.

The questionnaire involved questions relating to the following variables:

- place of residence
- age
- sex
- was respondent a recreational fisher?
- if yes, did they fish in the River Murray?

These were then followed by CVM questioning using an iterative bidding approach

(Dixon and Sherman 1990 p 39). In each case the interviewee was read the following statement:

‘Scientific evidence indicates that the native fish species in the River Murray have declined significantly in the last few decades (e.g. Murray cod numbers have reduced 95% from 1950s levels). This decline is continuing unabated with several smaller species now extinct in South Australia.

In order to develop a strategy to resolve this situation, we are seeking information on people’s priorities for action. Therefore, please consider the following scenarios and answer the subsequent questions as if they were real situations and you would actually have to pay the amounts that you state.’

The following scenario was then presented:

‘Without any remedial action being undertaken, all native fish in the River Murray will be extinct within twelve months.’

Interviewees were then asked either:

‘What annual payment would you be willing to make to prevent this occurring?’ (WTP approach)

or

‘What annual payment would you be willing to accept to be indifferent to this situation?’ (WTA approach).

The starting point for bidding for WTP questions was \$2000 followed by bids of \$1000, \$500, \$100, \$50, \$10 and zero. Once a ‘yes’ response was obtained, further

questioning followed to narrow down the WTP of each interviewee. For the WTA surveys the order of bids was reversed.

Survey results

A total of 216 surveys were conducted in locations along the River Murray (n = 100) and in Adelaide and suburbs (n = 116) between March and June 1992.

Selected on a random basis 115 interviewees were presented with questions using the WTP approach, with the remainder presented the WTA version.

WTP version

Stepwise regression analysis disclosed that of the independent variables, only RMFISH (does the respondent fish recreationally in the River Murray?) was significant in explaining variation of the dependent variable DOLLAR (the annual amount the respondent is willing to pay to prevent extinction of all native fish) ($p < 0.001$, F Ratio = 32.27).

The resulting function is:

$$\text{DOLLAR}_{\text{WTP}} = 42.46 + 160.80 \text{ RMFISH}$$

RMFISH (yes = 1 and no = 0).

Data analysis revealed no outliers for DOLLAR responses.

WTA version

The WTA data contained one outlier (\$50 000 p.a.) and six negative bids, where the respondent indicated that they would be WTA an annual amount less than their current annual expenditure. Zero bids (3) were included as realistic bids as it was apparent to the interviewer that these

respondents would not require compensation.

As for the WTP group, the only significant independent variable contributing to an explanation of the dependent variable DOLLAR was RMFISH. ($p < 0.01$, F Ratio = 8.03). The resulting function was:

$$\text{DOLLAR}_{\text{WTA}} = 675.64 + 986.82 \text{ RMFISH}$$

RMFISH (yes = 1 and no = 0).

As expected the results under the WTA approach are of a much greater magnitude to those of WTP. However, in both cases the only statistically significant variable was RMFISH.

Summarising the WTP results on an individual basis:

	(\$ per annum)
Recreational Fishers	203.26
Non-Consumptive Users	42.46

Applying these figures to the population of South Australia over the age of 15 years we obtain an estimate of the total economic value of the native fish stocks of the lower River Murray to recreational fishers and non-consumptive users. This could then be compared with that of commercial fishing as derived from using market indicators.

An estimate of the annual dollar value of the commercial fishery was obtained by averaging the value of the catch over the last eight financial years (SA Department of Fisheries Annual Reports 1983/4–1991/92) using constant prices (1991/92). Value data prior to this period are not comparable. Whilst production is somewhat variable due to the influence of environmental conditions, beneficial and unusual flood conditions over four of the eight years are

likely to have exaggerated the longer term mean value.

Based on these data the average annual value of the commercial fishery is \$0.54 million (1991/92 prices).

Estimated dollar values are based on prices provided by South Australian processors which are generally less than those obtained for freshwater species on the Melbourne market. As a large proportion of the catch is forwarded to the higher priced Melbourne market, the gross returns may be as much as twice as high as those estimated (Rohan 1987), that is, the average annual value could be as high as \$1.1 million. We have used this latter figure in our comparison of user group values.

Results on user group basis:

	(\$m per annum)
Recreational Fishers	9.6
Non-Consumptive Users	42.7
Commercial fishers	1.1

Discussion

Initially these figures may seem large and disproportionately so in the case of the non-consumptive sector, but they need to be seen in context. The hypothetical situation under consideration is the total loss of native fish stocks and hence the loss of all related activities. The figures are the net value of the loss to each group, not the gross value. In the case of the two consumptive sectors there are potential offsets to the loss of native fish stocks.

Commercial fishers in this situation would be faced with a potential loss of income and employment. However, this could be partially overcome by shifting effort to target

non-native species. There is also the likelihood, in the case of a total industry collapse, of government assistance in some form, as is often the case in the Australian primary sector. Finally, assuming that the native species do not disappear overnight, due to the high price elasticity, the increased prices that fishers would receive for the reduced catch could offset losses. This of course would only apply while there were sufficient stocks to warrant an industry.

Recreational fishers would lose because there are less fish to catch, therefore it is harder to get a feed and the overall fishing experience may become less enjoyable. However, for many fishers this may not actually diminish the experience as the actual act of catching fish is only one aspect of the activity (P.A. Management Consultants 1984). A major part of the enjoyment is related to the atmosphere and the environment where the activity takes place. These aspects may also be degraded with the loss of the native fish and this loss is similar in nature to that experienced by non-consumptive users. The losses that are purely related to the act of catching fish can also be partially offset by changing the target species to non-native species or by fishing elsewhere. In fact, for some fishers, a decline in native stocks may actually enhance the experience as the challenge of catching these species is increased. This only applies while there are still fish to catch.

It was apparent to the interviewer that the majority of respondents view the River Murray as a vital environmental and economic resource and that the health of the fish stocks is a key indicator of the health of the river and its environs. Thus the extinction of all native fish stocks would result in a loss to non-consumptive

users due to the perception that, without native fish, the environment would be severely degraded. There is no potential for any offset to this loss.

It is clear from this that, faced with a total loss of native species, society as a whole loses and that the non-consumptive sector loses most. In this situation it makes economic sense for those resources at the disposal of fisheries management to be used to address the needs of the non-consumptive sector as their marginal utility² is by far, the greatest. That is they are the group who would derive the greatest satisfaction from each additional fish at these low levels. The problem is that management of fisheries is primarily designed to address the needs and interests of the consumptive sectors, in particular, harvest allocation. If the likelihood of native fish extinction became a possibility it is probable that management would address the problem from the perspective of the consumptive interests. This consumptive approach would only be likely to achieve the socially optimal result by good fortune, while failure to overcome the problem may result in the collapse of the fishery.

This scenario illustrates a deficiency in the management structures in operation in most fisheries. They are designed to operate in sustainable fisheries where the main issue is harvest allocation. They do not allow for a situation where the resource is under threat and the greatest marginal benefits would be gained by meeting non-consumptive needs. Management's first priority should therefore be to ensure long-term sustainability. It is

² The extra satisfaction gained by a consumer from a small increment in the use of a good.

essential that non-consumptive interests should have a significant influence in the management process. Once a structure that accurately represents society's values is in place current management measures should be reassessed to see if they meet society's needs efficiently.

In conclusion while the scenario used in this study was hypothetical, in many freshwater fisheries including the River Murray, extrapolation from current trends unfortunately indicates it is a highly likely scenario. It is to be hoped that fisheries management overcomes the deficiencies illustrated here and realises the opportunities for broadening funding bases, increasing community participation and support, and predicting socially optimal stock levels identified through this economic assessment approach.

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