

Estuaries

Estuaries and the impact of reduced flows on value

What happens to the socio-economic value of estuaries when they receive less freshwater than they should? A WRC project attempted to find out.

Estuary services under threat

The status of an increasing proportion of South African estuaries is being threatened by a number of factors. These include insensitive use and settlement of the banks of the estuaries, industrial, agricultural and domestic emissions into rivers that feed into the estuaries and the construction of recreation and transport infrastructure in the estuaries.

The factor that appears to have had the most severe impact is reduced freshwater inflows. The main cause of these reduced freshwater inflows is increased abstraction to satisfy upstream freshwater demand.

The National Water Act of 1998 (NWA) prioritises river flow allocations for a river ecosystem's functionality above those needed to satisfy agricultural and (non-basic right) urban demand, but does not require the ecosystem allocation to be based purely on a scientifically-determined flow requirement. The NWA implicitly subjects the allocation outcomes to the condition that they be collective choices of all stakeholders and that the economic benefit to society be considered.

Towards efficient water allocation: economic trade-offs

The reality imposed by the collective-choice requirement is that the economic trade-offs will have to be taken into account in a catchment's water allocation management. The problem with the current Reserve setting approach is that it is poorly equipped to manage the economic trade-offs with which it is tasked, more especially in cases where water is already over-allocated.

Research was thus necessary to contribute to understanding these trade-off issues. The two main objectives were to generate information that would be useful in guiding the efficient allocation of river water to South African estuaries and to investigate, and explain, willingness of current estuary users to pay for river inflows into South African estuaries.

Using marginal values to guide the efficient allocation of river water

It may be argued that management of freshwater allocations to estuaries should be guided by the notion of an optimal freshwater inflow rather than that of a freshwater Reserve. The allocation of freshwater inflows into South African estuaries would be optimal when the marginal social values of the inflow are brought into equivalence with the marginal social costs.

However, there are notable complications in attempting to employ this apparently simple decision rule. Firstly, estimates of these marginal values may be generated in controversial ways and for this reason would need to be qualified. Secondly, irrespective of the method of valuation employed, there are checks that should be made for relevant omissions and inconsistencies, before values can be used for the purpose of managing current river inflows into the estuaries of South Africa.

Contingent valuation – a method of determining marginal benefit values of river inflows into estuaries

One way of valuing environmental goods and services with such strong public good characteristics, is by analysis of values of the associated environmental benefits and costs

as indirectly reflected in the markets. A widely used method that employs this technique, the contingent valuation method (CVM), generates values in the form of willingness to pay (WTP) responses, elicited from people who are placed in hypothetical valuation positions. The CVM is very flexible and may be used to assess the values of a wide variety of non-market goods and services and also has the advantage of incorporating passive use and non-use values into the total value estimate.

The CVM was found to be highly suitable for meeting the needs of management with regard to obtaining the marginal social value of the freshwater inflows into South African estuaries. Notwithstanding this suitability, the method, if applied improperly, could easily yield misleading results.

Many of the six well-documented steps involved in applying the CVM are challenging, especially with regard to valuing the indirect recreational demand for freshwater inflows into estuaries. An important step is that of assessing the credibility of findings relating to household WTP, through employing a combination of theoretical validity tests and other tests that would allow conclusions to be drawn about the overall credibility of the predicted societal WTP pertaining to an estuary.

Generating the marginal benefit estimates for 40 selected estuaries

Over a nine-year period from 2000 to 2008 a total of 7 768 face-to-face questionnaires, covering 40 estuaries, were administered in the process of applying the CVM and obtaining WTP data. For each of the 40 estuaries an environmental change scenario was identified and valued. The scenario was a change in recreational services induced by a change in annual river water inflow into the estuary. The findings reveal that recreational users are willing to pay for river inflows into most of the estuaries considered. Mean WTP ranges between R58 and R582 per annum and median WTP between R0 and R350 per annum, depending on the estuary.

Collectively, over all estuaries, the mean predicted WTP was estimated as R162.45 and the median WTP as R84.18. The consumer surplus values found for changes in river inflow are particularly high for the estuaries located in the Eastern Cape and eastern coast of the Western Cape, especially those located within well-developed areas – such as the Swartkops, Keurbooms and Kromme estuaries. Because of the asymmetrical nature of the results, caution should be exercised in their use.

In order for the marginal values to be used to guide river allocations they must be compared to the per annum user opportunity costs of inflows into estuaries. One opportunity cost value was available for the Keurbooms and another was estimated for river water being abstracted for consumption from the Mngazi River. For the most part, lack of reliable market data and information prevent opportunity costs for inflows into estuaries from being calculated directly, thus necessitating the use of suitable indirect approaches.

Validity assessment

The wide dispersion of results obtained with the CVM helps to underscore the extreme importance of validity assessment as an integral part of CVM application. Since not all estimates generated by the CVM merit use in policy-making and management decisions, the relevant decision maker needs an indication of where potential problems reside. The validity of the valuations was assessed in terms of the plausibility of the predictive model and on the basis of comparisons with other similar valuations. Other valuations that were calculated for comparative purposes were annual user travel cost valuations at 23 estuaries (associated with visits to the estuaries), as well as the per annum user marginal valuation of inflow, generated specifically for the Bushmans Estuary through a so-called “choice experiment” which takes into consideration, in a comparative way, other significant issues besides river inflow that affect the recreational appeal of the estuary.

Validity tests revealed that there was cause for querying the validity or reliability of estimates for 14 out of the 40 estuaries considered. This substantial proportion indicates that many of the recognised complications associated with the application of the CVM probably had some effect on the results and would need to be addressed.

Explaining willingness to pay for river inflows into forty South African estuaries

A statistical analysis of selected variables showed that user characteristics such as gender and race are highly significant in determining the user's mean WTP for estuary services. In addition, the analysis revealed the estuary factors important for determining the user's mean WTP, these being the climatic zone in which the estuary falls and the time over which the estuary mouth remains open. User characteristics tended, however, to have the dominant influence.

The fact that white males' WTP for inflows into estuaries is higher than that of the other sections of the user population is not a reason for trivialising the interests of these other sections. Blacks and females are major users of South African estuaries and most, when interviewed, stated that they valued the conservation of the estuaries highly. WTP, when impacted by large differences in income, tends to become a weak proxy for users' interest in an estuary.

Conclusions

The following conclusions can be drawn:

- It is feasible to determine efficient allocations of South Africa's river water by considering the value of the water at different points along the rivers. Through application of the contingency valuation method (CVM), 40 useful estimates of the value of river inflows into South African estuaries were derived.
- The CVM is indeed a credible method for this purpose, albeit not without problems. It has been, and continues to be, challenged from many angles and quarters, but estimates serve as acceptable allocation guidelines when properly generated and subjected to validity assessment.
- The primary interest in estuaries is for the recreation services they yield. Two different estuary user populations are found – people engaging either in recreational activity or in subsistence activity. The former tend to be wealthy and the latter poor. The latter derive much of their value indirectly, by supplying services to those engaged in recreational activity.
- Two sets of characteristics are important in explaining WTP for river inflows into South African estuaries, one set relating to the users of estuary services and another to the estuaries' recreational characteristics. The WTP for river inflows into estuaries is best predicted by the number of white and male users, the climatic zone in which the estuary falls and the length of time the mouth is open. The impact of river inflows on the fish population was also found to influence demand positively, but not as convincingly as one might have expected.

- The results of applying the contingent valuation method need to be compared with the opportunity cost of the inflows into estuaries in order to provide more complete guidance for the allocation of river water toward economic efficiency. The direct estimation of opportunity costs is, however, severely constrained owing to imperfect market information. For this reason it is recommended that "stated choice" techniques also be employed to indirectly estimate these opportunity costs.
- The opportunity cost of water flowing into the estuary tends to become higher, the more highly developed the region in which the estuary is located.

Despite their usefulness, it would be ill-advised to draw sweeping generalisations from the results of the analyses. There were important omissions in the calculation of marginal values, such as scarcity value and the external cost linked to estuary uses other than recreational uses. In addition to these omissions there are inconsistencies between what is efficient and what is welfare-improving, especially given the significant differences in the incomes of the two groups of users and the nature of their respective uses of water (as a luxury or a necessity).

These omissions and inconsistencies are important in the South African context because the NWA has, as one of its primary aims, equitable access of water use. There may be welfare reasons for reallocating water even when the estimated prices of water between different users are brought into equivalence, or alternatively, not reallocating water even when differences in the estimated prices of water suggest that it would be efficient to do so.

Further reading:

To obtain the report, *The valuation of estuary services in South Africa specifically regarding changes to estuary services as a result of reductions to fresh water inflows* (WRC Report No. 1413/1/10), contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.

