WATER RESEARCH COMMISSION

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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

POLICY BRIEF

Estuaries

Ensuring sustainable ecosystem services from South Africa's estuaries.

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 on 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 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 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 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 of South Africa, 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. Two different user populations are found – people engaging either in recreation 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.

Policy considerations

- The recreational appeal of many estuaries has been undermined as a consequence of interference with the links to marine and freshwater inflows and resulting reduced functionality. There is an economically defensible public good case for government intervention to restrict uses of water that cause this problem.

- Economic efficiency should be one of the criteria that planners and CMAs use to guide such intervention. It entails comparing estimates of the marginal values of river water flowing into the estuary with those of river water abstracted or removed upstream of the estuary. Although efficiency is a relevant criterion for guiding this intervention, it has no claim to prioritisation above other criteria like welfare or sustainability.

- The contingent valuation method (CVM) is recommended as one of several credible techniques which, with the necessary validity checks, could be used to provide estimates of the marginal values of river flow for the guidance of water use planning.

- Policy responses should be considered where their desirability is highlighted as a result of applying the CVM. Examples are: i) Prevention of flow reductions should be prioritised for estuaries with high unit inflow values, where relatively small reductions of inflow cause large reductions in estuarine services; ii) From an economic efficiency perspective, inflows into estuaries should not be prioritised on the basis of their scientifically rated conservation importance only, given the weak correlation between contingent values and conservation importance.

- A policy framework for managing river water allocations based on prioritisation of certain users or uses reduces the merit of adopting the economic efficiency criterion. If a policy prioritises one allocation of water above another, efficiency cannot serve as a reference to guide the merit of these allocations. Economic efficiency can then only be recommended for guiding allocations between uses that enjoy the same priority rating.

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: Main report* (**Report No: 1413/1/10**), contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; E-mail: orders@wrc.org.za; or Visit: www.wrc.org.za