



Environmental flow requirements: A social dimension



Sharon Pollard and Anton Simanowitz, South Africa

SOUTH AFRICA IS a semi-arid country and, with a rainfall average of 500 mm, falls well below the global average of 800 mm (Alexander 1985, DWAF 1986). A combination of socio-economic and political factors, together with a growing population (2.7 per cent growth per annum, World Bank 1980) have compounded the effects of resource scarcity. These constraints have meant that water demand could not, and cannot be met and major water storage initiatives have had to be considered throughout the region. Many of the developments have carried with them high costs in terms of environmental consequences, largely because the functioning of the resource base has not received adequate consideration. For example, changes in the flow regime by impoundments on the Orange River have created ideal conditions for the proliferation of a livestock blackfly pest and carried with it severe economic implications for the agricultural sector in that region (De Moor 1986).

The challenge therefore, has been to determine *ecological or instream flow requirements (IFRs)*¹ for an impounded river, which involves identifying those components of the flow regime considered essential for the perpetuation of ecological functioning of the system in question. These IFRs, written into the operational rules of the dam, need to be quantified in terms of frequency, magnitude, duration and timing of different flows. A number methodologies for assessing IFRs, developed in other countries, have been tested here with limited success. Moreover, few of these methodologies comprehensively reflect water requirements for all components of the riverine system (for example, IFR's for channel maintenance, instream biota and riverine vegetation).

The urgent need for such determinations to accompany current and planned water developments, as well as to mitigate past perturbations, has precipitated the development and evolution of a local, rapid-assessment approach, known as the Building Block Methodology (BBM). Central to the BBM is a multi-disciplinary process which uses the best available data of the hydrology, geomorphology and ecology pertaining to the river system under question, to derive a modified flow regime in some pre-determined state (King and Louw 1985). Results of this process are then used to provide guidance on IFRs for a river.

One frequently overlooked component of this methodology has been the sociological assessment, due principally to the lack of a developed approach. The purpose of this paper is to describe the initial development of a method for the social assessment of IFRs, and to illustrate its applica-

tion by way of example from research with communities living along the Sabie River.

Objective

The objective of the social assessment is to determine the use of the riverine resources by rural communities living along a river, and from this to provide at least a qualitative assessment of their dependence on a healthy riverine ecosystem (King *et al.* in prep.) In essence, this involves detailing, with communities, the importance of and reliance on, run-of-river flow, use of riparian species for food, thatching, medicinal and other purposes, as well as the use of floodplains and pools. The central tenet of the research is to establish the *link between the resource use and discharge* so as to provide an indication of components of the flow regime that are considered important for resource maintenance from a community perspective.

Development of key questions

The methodology developed comprises a bottom-up approach, so that the process of gathering and detailing information facilitates a progressive understanding of, and support for, the conceptual basis of IFR's by communities involved. The background information constitutes establishing *what* river resources are used, *where* they are located and the *extent* of the resource is. Ascertaining *who* uses a particular resource highlights whether it used primarily by an individual or a group and further, underscores areas of potential conflict around resource use. Subsequently, prioritising the resource with the community indicates the *importance* of one resource relative to another, and whether the resource constitutes a primary, or supplementary livelihood source.

The seasonality-of-use or *when* the resource is used, then provides the initial *link with discharge* or flow regime (the most readily understandable currency for discharge is that of water levels). Subsequently, the method then develops on the relationship between the resource and flow by considering the following: How the resource availability changes with variations in water levels and hence, provides some evaluation of the quantity and seasonality of flow associated with a particular resource. This focuses on the extent of base flow (both in terms of "height" and timing), and the onset and continuation of flood events of different magnitudes. Additionally, an assessment of past resource-flow conditions by the community can, together with a hydrologist, provide some pointers with regard to flow-

induced changes on the resource base. Finally, this information is collated to provide a qualitative assessment of community dependence on these resources.

Case study: resource use by two communities along the Sabie River

The study site comprised two villages, Madras and Belfast, along the Sabie River, South Africa. A tributary of the Sabie is currently being impounded and the Department of Water Affairs is seeking guidance on IFRs for the system based on the BBM approach.

Approach taken

A combination of methodologies was used to collect the data according to the framework above, including standard Participatory Rural Appraisal (PRA) methodology, as well as key informant interviews. Key focus groups included general community members, womens groups, church members, farmers, *t'inangas*(healers) and fishermen.

General resource use of the Sabie River and riparian zone

Reliance on the Sabie River and riverine zone as a resource, is varied, and can be broadly summarised as:

- Direct use, comprising the use of plants for food, medicinal, cultural, building and craft purposes, all of

which constitute a source of revenue; the use of fish for local consumption; the use of riverine water for religious, cultural and recreational purposes, as well as

- indirect use (portage of water) mainly for agricultural purposes. A synopsis of results provided herewith focuses on one direct resource use, that of fish, in order to illustrate the process and to highlight salient findings.

Results: assessment of the use of fish resources

Approximately fourteen, of some thirty fish species, are caught for local consumption, principally by the men of the village.

Importance and preference

Fishermen rated fish according to importance and preference (Table 1), with the three most valued species comprising the kurpers. "Importance" referred to species that may be considered significant for consumption and reflects the ease of capture, whilst "preference" refers to favoured species, irrespective of the ease with which they could be caught.

Seasonal availability

Fishermen also indicated which months individual species were available and provided comment on why abundances changed over seasons (Table 2).

Table 1. Fish species use, importance and preferences as indicated by two communities along the Sabie River

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Table 2. Example of community assessment of the seasonal availability of the three fish species ranked as most important in the Sabie River. Hatched box indicates conflicting information. • indicates relative availabilities

Relationship between flow and fish availability

The importance of annual floods was regarded as essential for spawning and seasonal movements for a number of fish species (tigerfish, large-scale yellowfish and bulldog). Flows for the maintenance of certain habitats (rapids), considered essential for the survival of certain species (large-scale yellowish and squeaker), were also highlighted. Certain species were also regarded as sensitive to temperature (yellowish, kurpers and the butter catfish). Fishermen indicated seasonal minimum and maximum water levels needed to provide such conditions, against a fixed point, which were later quantified by a hydrologist.

Long term changes

A number of respondents indicated that an unidentified fish species had disappeared since the 1960's. Further, a key informant noted that there had been a decrease in fishing success over the years, and speculated that this may reflect either a decrease in flow or an increase in the number of people fishing.

Qualitative assessment of dependence

Fish provide an important source of free protein, and most of the men interviewed fished on a regular basis. The importance of this supplementary food source for the household was corroborated by women. In poorer families, fish are potentially the only source of protein and as such, constitute a primary food source. In all cases, fishing represents a considerable advantage in terms of cash savings.

Discussion and conclusions

Results indicate that the reliance by communities on the Sabie River and riverine zone as a resource, is multivariate.

Fishermen identified a number of important flow-related aspects of the fisheries resource, including the maintenance of summer floods, adequate low flows during the dry season, as well as flows sufficiently deep to ensure the existence of specific fish habitats. Fishing was considered an important component of riverine use and fish, a favoured food source. Both villages are characterised by high unemployment and a lack of access to arable land, and frequently fish represent the only source of protein for poorer families. The social importance of being able to provide for the family, particularly for unemployed men, was also stressed.

In addition, the results of this study indicated a number of important plants that confined to the riparian zone, are harvested for food, medicinal and cultural purposes and also constitute an important source of vitamins and trace minerals in peoples diets. Medicinal plants, most frequently collected by *t'inangas*, who charge for their consultations, provide an important source of revenue for these individuals, as well as having high social value amongst the community. The fact that most members of the community were able to name and identify useful plant species, indicates the continued reliance of communities on the natural resource base to meet a range of requirements. This corroborates evidence from a research initiative regarding sustainable livelihoods in the Sabie-Sand catchment (Shackleton *et al.* 1995). Water from the Sabie River

is also used for the irrigation of small gardens. In addition to the nutritional value provided by the crops, and the revenue generated by the sale of crops, these gardens are considered extremely important as sources of employment.

Results pertaining to specific plant and fish species were later linked to water use data provided by specialists at the IFR workshops. In almost all instances community analysis of water requirements of these species paralleled those of scientific findings and discharge values were hence refined. In this regard then, the social assessment both supported and integrated much of the stated IFRs of individual components.

The degree to which results from this work of two villages can be extrapolated to represent riverine resource reliance for all communities living along Sabie River would require verification. Further, it should be noted that the resources cited probably represent a proportion of the total use; work with communities requires time to establish trust and widen interview participation. Moreover, a comprehensive assessment of dependence would require an economic evaluation of the importance of the various resources. This was beyond the scope of this research and the necessity of conducting such research specifically in the context of IFR would need to be assessed. This is because in general, community needs are not pitted against other instream uses; rather all components serve to build up an consolidated evaluation of flow requirements which are then considered in the light of requirements by other sectoral users.

References

- ALEXANDER, W.J.R., 1985, Hydrology of low latitude Southern Hemisphere land masses. *Hydrobiologia* 125: 75-83.
- DE MOOR, F.C., 1986, Invertebrates of the lower Vaal River, with emphasis on the Simuliidae. Pp. 135-142. *In*: B.R., Davies and K.F., Walker. (Eds.). The ecology of river systems. Monogr. Biolog. 60. Dr. W., Junk. Dordrecht.
- DEPARTMENT OF WATER AFFAIRS, 1986, Management of the water resources of South Africa. Govt. Printer. Pretoria. 1031 pp.
- KING, J.M., and D., LOUW, 1995, Development and use of the Building Block Methodology for assessing instream flow requirements. Int. Rpt.
- SHACKLETON, S.E., J.J., STADLER, K.A., JEENES, S.R., POLLARD and J.S.S., GEAR, 1995, Adaptive strategies of the poor in arid and semi-arid lands: in search of sustainable livelihoods. A case study of the Bushbuckridge district, Eastern Transvaal, South Africa. WRF, Int. Publ. Pp. 178.
- WORLD BANK, 1980, World Development Report. Oxford University Press, New York, NY.
- ¹ This is a separate assessment to that of water allocations to different sectoral users such as domestic, agricultural or industrial use. As such, the river system itself may be regarded as one such competing sectoral user (or alternatively, as the resource) and IFRs are structured specifically to determine water needs for this user.

SHARON POLLARD, c/o F.R.U., Zoology, University of Cape Town.
