Managing rivers for fisheries and livelihoods: how can we do it better?

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Abstract The growing attention being given to improving water productivity at the catchment level has given rise to increased interest in the contribution of aquatic ecosystems and in particular fisheries to reducing rural poverty and improving food security. There is growing recognition that these natural resources have an important role to play in pro-poor water management in many of the world’s river basins, but that capacity to optimize these benefits is constrained by a lack of appropriate technologies and tools to do so. The present paper provides an overview of the current state of understanding of these issues and identifies a number of challenges to be addressed, namely the need to: (i) build wider understanding of the value of river fisheries; (ii) understand the water requirements for sustaining river fisheries; and (iii) develop governance arrangements that bring fisheries to the decision-making table. It concludes by distilling from recent reviews of river fisheries valuation, environmental flows, and governance, a set of specific directions that need to be taken in order to meet these challenges.

Keywords Environmental flows; fisheries; governance; livelihoods; rivers; valuation

Introduction
The past decade has seen growing attention drawn to the water crisis now facing many parts of the world. An increasing number of countries are suffering from severe water stress (UN, 2003; Falkenmark, 2001) and this has led to growing calls for more efficient use of water in all sectors. Agriculture is the main user of water worldwide and the growing call for water efficiency has led to calls for a Blue Revolution (UN, 2003).

Historically these efforts to improve water productivity have been almost exclusively focused on crops, and in particular ways to improve the efficiency of irrigated agriculture – or “more crop per drop” (see Kijne et al., 2003). This has begun to change however with several recent analyses making a forceful case for harnessing the potential for gain in water productivity through improvements in the efficiency of rain-fed agriculture (Rockstrom et al., 2003). Consideration of the contribution of other natural resources to improved water productivity, and in particular the value of livestock, fisheries and wildlife that are sustained by river flows, is however still largely restricted to a few countries such as South Africa and Australia where innovative water policies have driven the need for research into these issues (Postel and Richter, 2003).

The limited attention given to these wider environmental uses of water and the need to reconcile such requirements with those of agriculture, industry and urban use was highlighted by the World Water Vision presented at the 2nd World Water Forum in 2000 (Rijsberman and Molden, 2001). This has encouraged a number of innovative initiatives notably the Comprehensive Assessment of Water in Agriculture, the Dialogue on Water Food and Environment, and the Water and Food Challenge Program of the CGIAR, all of which seek to identify and build capacity to pursue a wider suite of natural resource use technologies as part of a more holistic approach to management of the world’s rivers and their water resources. The challenge now is to achieve this.
Amongst food production systems that need sustained water supply, fisheries are of special importance, not only because they are generally the most important wild resources harvested from river systems (Table 1), but also because they are especially accessible to the rural poor. Over 8 million tons of fish are harvested each year from inland fisheries in Asia, Africa and Latin America. Approximately 50% of this is estimated to come from rivers with some 2 million tons from the Mekong alone. Most of these figures are however widely regarded to be conservative with several authors suggesting that the real values in many river systems are at least twice as great (Welcomme, 2003).

At household level these fisheries play a central role in the livelihoods of many millions of people. Over 50 million people in the developing world derive income, food and livelihoods from river fisheries, including those involved in processing and marketing (Nieland et al., in press). Many of these are not full-time “fishers” but farmers and pastoralists who derive a small, but crucially important part of their income from fishing and related activities during part of the day or year.

In view of the importance of river fisheries for rural livelihoods it is increasingly widely appreciated that a pro-poor approach to river management therefore needs to embrace water management practices that sustain river fisheries and where possible enhance them. The present paper builds upon recent reviews of the management challenges faced by river fisheries to consider the main elements of such an improved approach to river management for fisheries.

### Three challenges in managing water for river fisheries

In view of the growing awareness of the importance of river fisheries and of the need to therefore include their requirements in water management at basin level, the question that is most often asked is – if we know that there is a problem – why can we not manage water better for fisheries? As part of the Comprehensive Assessment of Water in Agriculture and of the preparation of the Challenge Program on Water and Food, this question was reviewed in some detail (Dugan et al., 2002) and three major challenges identified that need to be addressed if rivers are to be managed better for fisheries.

**Challenge 1 – Build wider understanding of the value of river fisheries**

Despite the growing awareness of the value of river fisheries, only in very few cases does this translate into understanding of the value of specific river fisheries and of the importance of addressing their management requirements. For very few river systems is there good quality contemporary information available that can be used to build this understanding, and information from other rivers is largely ignored, or seen to be of limited relevance when decisions on water allocations are being made. Substantial new investment is now required to provide this information.

### Table 1 Value of river and floodplain resources to rural households in four stretches of the Zambezi river

(derived from Turpie et al., 1999)

<table>
<thead>
<tr>
<th>US$/y/h'hold</th>
<th>Barotse</th>
<th>Caprivi-Chobe</th>
<th>Lower Shire</th>
<th>Delta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>120</td>
<td>422</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>Crops</td>
<td>91</td>
<td>219</td>
<td>298</td>
<td>121</td>
</tr>
<tr>
<td>Fish</td>
<td>180 (43%)</td>
<td>324 (28%)</td>
<td>56 (13%)</td>
<td>100 (39%)</td>
</tr>
<tr>
<td>Wild animals</td>
<td>6</td>
<td>49</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Wild plants</td>
<td>24</td>
<td>121</td>
<td>48</td>
<td>29</td>
</tr>
<tr>
<td>Wild foods</td>
<td>0</td>
<td>11</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Clay</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>0.08</td>
</tr>
</tbody>
</table>
Challenge 2 – Understand the water requirements for sustaining river fisheries

If rivers are to be managed successfully to sustain fisheries – how much water does the fishery require? At present it is rarely possible to answer this question with any precision, and the relationship between river flow and fisheries’ productivity is known to vary from river to river and species to species. In a field where relatively robust generic models have been developed to assess the water requirements of different urban, industrial and agricultural sectors, the absence of such models for river fisheries is a major constraint. However, living systems are notoriously complex and correspondingly difficult to model, and the learning acquired through study of the impacts of dams and other water management structures on river fisheries has emphasized the need for tools that embrace this complexity (Postel and Richter, 2003). The development of these tools is still at an early stage and none have been developed for large tropical rivers with important river and floodplain fisheries (Arthington et al., in press).

Challenge 3 – Develop governance arrangements that bring fisheries to the decision-making table

It is widely acknowledged that the investments required to generate contemporary information on the value of river fisheries and on the water required to sustain these will only be made when those stakeholders for whom river fisheries are a high priority can have an effective voice in the policy and management processes governing river basin management and water allocation. At present, however, these individuals and institutions, whether poor fishers or Government Fisheries Departments, are largely absent from these processes. Governance arrangements need to be developed to achieve full and effective engagement of these stakeholders. Only in this way will the value and water requirements of river fisheries be considered when water management decisions are being made.

Doing it better – can we meet the challenges?

The three challenges described are deceptively simple. In summary we need to establish stronger governance systems that take account of the value and water requirements of river fisheries, and provide the information required to ensure that these systems are better informed. To achieve this more holistic approach to water management will however require a major and sustained political and technical commitment over many years. Some specific steps that will help achieve this are proposed below.

Valuation

If stakeholders are to understand the importance of the river fisheries resource, information on the value of river fisheries needs to be generated for many more rivers, and the capacity to do so in others when required needs to be developed. Recognising this need the Comprehensive Assessment of Water in Agriculture reviewed current understanding of the value of tropical river fisheries (Neiland et al., in press) and concluded:

(i) information on the value of river fisheries needs to be upgraded, and made available to national and international policy-makers in an accessible form.
(ii) information on the impact of changes in river management on the value of river fisheries also needs to be upgraded, and made similarly available to policy-makers.
(iii) a ‘valuation toolbox’ for tropical inland fisheries, combining theoretical and empirical approaches, should be developed and used to establish ‘best practice’ guidelines and a standardized approach to assessing the value of these fisheries and to providing this information into both national and international policy processes.

These three steps need to be pursued urgently.
Environmental flows
Understanding how much water is required to sustain specific levels of environmental benefits, including specific levels of fish diversity and production, needs to be addressed uniquely in each river system. This has proved highly problematic, in particular in the tropics where there is very limited, or no, capacity to address these questions. Even where capacity does exist there are at present no readily applicable tools to answer these questions for tropical river fisheries. To help address these issues the Comprehensive Assessment of Water in Agriculture has conducted a review of environmental flows and fisheries modeling tools to determine what combination of existing and new approaches will provide the strongest tools in the tropics. This study concludes that a suite of methods consisting of a modified version of the Downstream Response to In-stream Flow Transformation (DRIFT), together with some applications from Bayesian networks and age-based modeling of fish populations, should be developed and applied to tropical river systems (Arthington et al., in press). This integrated approach now needs to be tested.

Governance
Ultimately more and better information on the value of river fisheries and on their environmental flow requirements will only result in greater development benefits if the decision-making processes governing river management embrace and use this information to guide their policies and management practices. To achieve this there is an urgent need for governance arrangements that bring together all key stakeholders and in particular the poor who depend on rivers for their livelihoods. While this is widely accepted as a principle, however, a recent review carried out through the CPWF (Béné and Neiland, in press) has concluded that such changes will need to be underpinned by a sustained investment in research into exactly how changes in governance and management can lead to poverty reduction in fisheries. This review emphasized the need for:
(i) improved knowledge and understanding of the role of governance in the management of fisheries for poverty alleviation;
(ii) initiation of a policy development process by which pro-poor policy options and implementation approaches are identified and evaluated;
(iii) implementation of policies for new and appropriate governance arrangements relevant to poverty alleviation in fisheries.

Conclusion
On the basis of these analyses it is clear that river fisheries can be managed to sustain and enhance rural livelihoods if capacities are developed to value the resource, understand their water requirements and communicate this information more effectively through improved governance systems. There is an urgent need to pursue this integrated approach in most of the world’s rivers, and especially in the developing world where the dependence of people on river fisheries remains greatest.

References