Understanding Resilience in Small-Scale Fishery Communities

In many developing countries, small-scale inland fisheries are important to the livelihoods of the poor, contributing to both income (through capture and postharvest activities) and food security (Béné *et al.* 2006). This is particularly true for river fisheries, and especially so in Africa, which has important inland and de facto unregulated open access fisheries, on which millions of poor households depend.

These inland fisheries are characterized by complex multi-species, multi-gear exploitation systems, and large numbers of fishers operating completely within the informal sector. This makes small-scale inland fisheries extremely difficult to assess and manage, thus contributing to livelihood uncertainty and vulnerability.

The CGIAR Challenge Program on Water and Food (CPWF) Improving Resilience in Small-Scale Fisheries Project introduced a range of participatory assessment and adaptive management tools which are used to develop and evaluate management interventions to reduce vulnerability to external

processes and promote sound decision-making. This methodology was implemented in two pilot fishery systems in the Niger River Basin, aiming to operationalize concepts of resilience management.

In the area of water management, small-scale fisheries are significantly affected by processes outside their control. In particular, water allocation policy and investments (e.g., dams and irrigation schemes) are dominant factors driving many inland fishery dynamics. Additionally, the unpredictable institutional and policy environments, typical of many countries in Sub-Saharan Africa, is a source of great uncertainty and potential threat. Further, the uncertainty induced by climate change will in the future increase the unpredictability of fishery systems and competition for water, thereby impacting severely on the capacity of the local populations relying on those resources to sustain their livelihoods.

Faced with such constraints and multiple uncertainties, conventional management has, by and large, failed to provide a basis for sustainable development of aquatic resources. The project was designed to initiate and guide major changes in the way small-scale fisheries in sub-Saharan Africa are assessed and managed. The project, which had a strong 'action research' orientation, was aimed to strengthen the resilience of fishing communities through field-testing and application of an innovative framework for participatory diagnosis and adaptive management. Where effectively adopted, this new resilience management approach was expected to reduce the vulnerability of these fishing communities to external threats and changes, thus enhancing their capacity to contribute more actively to the process of economic development and poverty alleviation. Two pilot sites were chosen in the Niger River Basin to try this new approach, one in Mali in the Inner Delta of Niger and one in Nigeria on the shore of Lake Kainji.

A framework to manage resilience

In practical terms, the goal of resilience management is to ensure that the socio-ecological system under consideration will remain within a set of ecologically and socially desirable configurations (Carpenter *et al.* 2001). One needs therefore to identify indicators and thresholds that define these desired configurations. This is the role of the first component of the framework: the participatory diagnosis.

More formally, the objective of this participatory diagnosis is to identify key threats and resilience indicators specific to the system (in the present

The concept of resilience

In a broad sense, 'resilience' is about the capacity of systems to adapt to shocks, recognizing that disturbance and change are integral components of complex systems. More formally, resilience analysis proposes to focusing on mechanisms and processes that help systems absorb perturbations and shocks, and cope with uncertainty and risks. Defined in such a way, the concept of resilience thus appears particularly useful for the management of small-scale fisheries. While the resilience concept is appealing, particularly in the face of the failure of current management approaches, the danger is that it remains largely academic and theoretical, and not of great help in effectively improving the way natural resources are managed on the ground. The challenge, therefore, lies in a pragmatic approach to operationalizing the concept of resilience and making its implementation on the ground practical and meaningful. A framework aimed at this objective for specific context of small-scale fisheries in the Niger River Basin is proposed and discussed.

case, a fishery). This participatory diagnosis can be implemented using various techniques. In our case, we use a 360° integrated assessment map (see also Garcia *et al.,* in press). The idea of this integrated assessment tool is to 'scan', in a systematic and comprehensive manner the system in order to gain a better appreciation of the true nature of drivers and processes that affect its dynamics. Four domains are considered: (a) natural system, (b) livelihood and people, (c) institutions and governance and (d) external drivers (Figure1).

In each of these four domains, resilience indicators and the current conditions of the system assessed against those indicators are identified using a combination of quantitative variables and thresholds. One example is used here to illustrate the process. In the case of the indicator 'Asset and income poverty' in the domain 'People and livelihood', stakeholders (i.e., the fishing households) will be asked to assess their situation in terms of income by identifying two thresholds; one distinguishing what those households consider as a 'desirable' situation from an 'undesirable' one. Above, say, US$4 per household per day, the fisherfolk consider that their situation is satisfactory ('desirable'), while below that same US$4 threshold, the situation is considered as unsatisfactory ('undesirable'). Finally, under a lower threshold of US$2 per day, the households regard the situation as a 'crisis.' Over time (i.e., season, life), the households' income varies, passing above or below the thresholds. The objective of resilience management is to ensure that household's income remains in the 'desirable' zone.

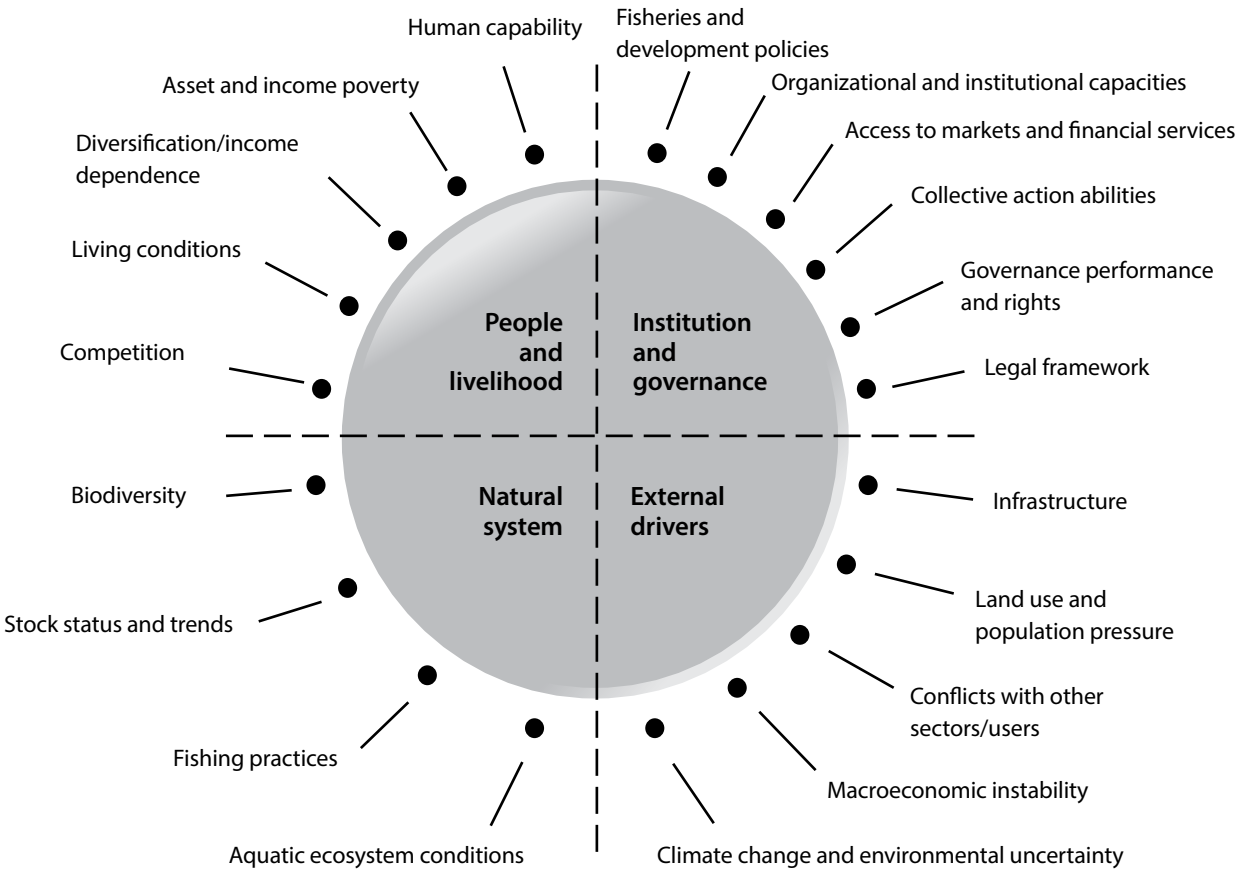

Figure 1. The 360° integrated assessment map

Applying this approach to each of the indicators is considered critical by the stakeholders. A dashboard can be constructed, which reflects, for each indicator, the perception of the stakeholders about the conditions of the system. Different stakeholders can contribute to the evaluation of different indicators (or even domains) of the system. One may, for instance, request a panel of experts to assess the situation of the system for the 'external drivers' domain, while the local community may be asked to express their views about the 'people and livelihood', or the 'natural systems' domains. An abridged example of a dashboard is given in Table, which was produced

Example of dashboard – with one indicator per domain extracted from a full dashboard completed for Lake Kainji fisheries (Nigeria).

Domain	Indicator	Justification	Variable	Thresholds	Status
Natural system	Fish biodiversity	Maintaining high and stable biodiversity is crucial to fisheries and fisheries dependent communities. The sustainability of the fishery is dependent on maintaining the ecological integrity of the natural resources.	Number of species available	◆ Desirable: > 30 species in the system ◆ Crisis: < 90 species	> 120 species (stable)
People and livelihoods	Health centers	Health facilities (e.g., hospitals, clinics, dispensaries, pharmacy) are vital to human capital and sustainabilityof livelihoods. Health has implications for household and community productivity, poverty reduction and food security.	Distance to health facilities	◆ Desirable: < 5 km to health centers ◆ Crisis: > 10 km to health centers	> 10 km to health care centers (crisis)
Institutions and governance	Accountability of traditional institutions	Accountability and responsiveness of traditional institutions are vital to providing a basis for measuring the confidence and cohesiveness of rural fishing communities.	Approval rating among community members	◆ Desirable: > 70% approval (accountable) ◆ Crisis: < 50% approval (low accountability)	> 80% (getting better)
External drivers	Infrastructure (roads)	Access roads are important for easy movement of fish and other agricultural products to market	Percentage of feeder roads in driveable condition during rainy season	◆ Desirable: > 70% in driveable condition ◆ Crisis: < 30%	< 10% (crisis)

by key stakeholders assessing the situation of the artisanal fisheries of Lake Kainji in Nigeria.

The completion of the dashboard allows the identification of site-specific indicators for which the system is considered in crisis—in the present case, the access to health services and the conditions of infrastructure—and for which immediate actions are requested. For those indicators, management actions will be identified and implemented by the stakeholders (with the support of the project), with the objective of bringing back the variables to levels considered 'acceptable'. The project was committed to help stakeholders to progressively enhance their ability to diagnose and respond to the various changes or shocks that affect the fishery. It is hoped that the improved managerial capacities resulting from this process, will lead to better informed and more appropriate decision-making processes in the fishery. In the long term this adaptive process is expected to lead in the long term to a more resilient management system and the reduction of the overall vulnerability of the households who depend on the viability of the fishery for their livelihoods.

Lessons learned

Because the dashboard allows the presentation of indicators of any nature, it provides a powerful way to integrate the combinations of economic, environmental and social dynamics that characterize the realm of fishery management. In this sense, it is an effective tool for multi-criteria assessment. The main merit of using the dashboard, however, is in its capacity to initiate and then strengthen the resilience management process. First, it helps all those involved in the process realize that there is no one unique management target. This aspect is critical in the sense that it clearly distinguishes this approach from the perceptions that the large majority of practitioners and researchers still have about fishery management.

Under the resilience approach, management is not about looking for the unique, or 'fair' solution; it is about negotiating a set of acceptable configurations and agreeing on interventions, incentives or constraints to stakeholder behaviors to ensure that the system stays within these negotiated and accepted configurations.

By so doing, the dashboard also helps stakeholders realize that the management process is bound to rely on trade-offs between ecological, social and economic indicators of management performance. A vivid example of these trade-offs could be a situation where catching 'too many' fish is a short-term objective that might be 'acceptable.' Indeed when small-scale fisheries are set within the reality of societies with great poverty, insecure food supplies and/or variable fishery resources, such levels of harvest may be necessary and unavoidable for a while as long as the overall system is not irreversibly affected.

If run through a participatory process that involves a large range of stakeholders, the dashboard assessment exercise can easily create the preliminary conditions that facilitate the adoption, comprehension and acceptance of the concept of resilience management among stakeholder groups that are not necessarily familiar with this rather abstract concept. The simplicity of the criteria ('undesirable' versus 'desirable' configurations) captures in a straightforward and clear manner the configurations of the system and management objectives.

The dashboard can facilitate communication and knowledge exchanges between the different groups of stakeholders, thus making the negotiation process easier. It also sets the stage for

rules and patterns of social interactions between stakeholders during the following adaptive learning process. In particular it can facilitate the identification of mechanisms and options that allow the fishery to move away from undesirable states. The identified resilience indicators will then be used during the implementation of the adaptive management phase to monitor the 'health' and evolution of the system under a resilience management approach.

resulted in a comprehensive socially accepted and context-relevant outcome. Overall, however, the outcomes reflect a much more nuanced understanding of small-scale fisheries as complex systems and show promise as mechanisms of achieving food security, improved livelihoods and environmental sustainability in the long term.

Conclusion

The action research project described in this article tested a participatory and resilience-based approach to diagnosis and adaptive management in an acute poverty context in West Africa. Conceptualizing small-scale fishery management as being about managing a multi-dimensional system in the context of uncertainty and prioritizing stakeholder-defined variables and thresholds

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