7 April 2006

Policy Perspectives

Perspectives on resource management and environmental policy from the Centre for Resource Management and Environmental Studies (CERMES), Faculty of Pure and Applied Sciences, University of the West Indies, Cave Hill Campus, Barbados.

The Centre for Resource Management and Environmental Studies (CERMES) has initiated this outreach publication, ***Policy Perspectives***, to share lessons learnt from research. The information in these policy briefs may be used by policy-makers and their advisers to strengthen the linkages between research outputs and policy-making in the Caribbean. This connection is often weak in natural resource management.

Governing fisheries as complex adaptive systems

The global crisis in fisheries has been widely acknowledged. A high proportion of the world's largest commercial stocks have been severely overfished by industrial fleets. Smaller scale fisheries have also overfished coastal and inland stocks. Overfishing has resulted in extreme reductions in biomass of target and bycatch species, extensive changes to communities of which the exploited species are a part, and in degradation of supporting habitats. These trends threaten livelihoods associated with fishing, undermine food security; and disrupt the integrity of ecosystems and biodiversity in ways that may be irreversible. A state of crisis already exists.

Conventional fisheries management has seldom been successful in addressing this crisis and appears to be particularly unsuited to small-scale fisheries. It treats fishery systems as controllable, provided enough information is available and enough control measures can be put in place. Most effort at improving fisheries management has focused on attempting to acquire more information, construct more complex models and refine or revise control systems. This approach has not been able to deal adequately with the complex, dynamic nature of fisheries systems and it has become apparent that something rather more radical is needed instead of, or in addition to, the conventional approach.

The complexity and unpredictability of fisheries systems is at the forefront of new thinking about fisheries management. These ideas are not new to fishery managers who have long been concerned with uncertainty and risk. However the approach to uncertainty and risk has been more focused on attempting to understand their sources and quantify them than by adapting to them. Recent emphasis on an Ecosystem Approach to Fisheries (EAF) is progress towards recognizing and the holistic nature of fisheries systems and the complex linkages that characterize them.

An emerging alternative to dealing with complexity in human-in-nature systems is to recognize that they are not controllable and to focus on resilience and adaptation. We argue that fisheries appear to exhibit the characteristics of complex adaptive systems and that the approach that will most likely result in improved management of fisheries systems, especially small-scale fisheries, is one of enabling adaptation in both governance and opportunity-taking. This thinking takes us towards a broad view of governance, where "governance is the whole of public as well as private interactions taken to solve societal problems and create societal opportunities. It includes the formulation and application of principles guiding those interactions and care for institutions that enable them" (*Interactive fisheries governance: a guide to better practice*).

Such thinking is emerging in other arenas such as medicine, business and city planning, and we believe that there is the need for fisheries managers to look outside of their usual disciplinary sources for models that may be useful. This perspective looks at governance (hence policy) implications of viewing fisheries as complex adaptive systems.

Perspectives on complex adaptive systems

Complex systems exhibit characteristics that stem from the interactions and patterns within the system. They often also exhibit the capacity to self-organize or adapt without outside influence. We refer to these as complex adaptive systems (CAS). Approaching fisheries as CAS will first require an understanding of complex systems behavior and conditions that facilitate self-organization, learning and adaptation.

Concepts of self-organisation and emergence have been explored in other sciences, business organisation and change management. The application of this thinking to human-in-nature systems is of particular interest for fisheries managers. One area that has received attention is the resilience of such systems and the characteristics that confer resilience. Two key determinants of resilience are the degree to which the system is capable of self-organisation and the extent to which the system has capacity for learning and adaptation.

Specifically in relation to fisheries, there is the Interactive Fisheries Governance perspective, which is based upon an analysis of the 'fish chain' which extends from the resource base and its supporting ecosystem through harvesting and distribution to the consumer. The 'fish chain' is diverse, dynamic and complex and its governance has a variety of dimensions that reflect complexity. 'Governability' as a holistic property of the 'system to be governed', the 'governing system' and their interactions emerged from this work. The Interactive Fisheries Governance perspective proposes three main areas of activity that can be pursued to

make systems more interactive and responsive: promotion of shared principles and values, ensuring stakeholder inclusiveness and transparency, building learning capacity.

A critical question is how much of the experience and learning that is taking place in other disciplines is relevant to human-in-nature systems, and fisheries in particular. While there is much to be worked out, these signals are clear and persuasive enough to indicate that it is necessary to begin to change and learn along the way.

Fisheries as complex adaptive human-in-nature systems

The conventional approach treats fisheries as predictable and controllable; when in fact as complex systems they are neither and have to be approached differently. Fisheries systems (natural and social) self-organize in response to a wide variety of stimuli: internal feedback, external effects, and the governing system itself. The capacity to self-organize and adapt does not necessarily result in sustainable or fair resource use systems. The extent to which this can happen will depend on the balance of power among stakeholders and their appreciation for these issues. Indeed, it can be argued that this capacity to self-organize is one thing that has thwarted attempts to manage. Examples abound in which attempts to exert control in one part of the system have resulted in adaptive responses in other parts that undermine the attempts. Creative circumvention of gear restrictions by fishers defeat conservation restrictions to reduce fishing effort.,The literature on co-management, an increasingly important approach to natural resource governance, observed that stakeholder self-organisation is often in the context of crisis, conflict and competition.

The recognition that fisheries exhibit the characteristics of CAS should lead to a very different approach to managing fisheries systems that places much emphasis on enabling self-organization, learning and adaptation. This unconventional approach appears to have the potential to address human-in-nature resource management problems that conventional approaches have so far failed at.

Enabling inputs as a foundation

We expect that for any fishery system, management inputs from responsible agencies will be a mixture of enabling and regulation, but propose that the former must be there as a foundation in all cases. Regulatory inputs seek to control aspects of fishery behavior. They include all forms of legislation and regulation, their enforcement and technical programmes designed to support them. Enabling inputs seek to make it possible for the system to self-organize and adapt to change through internal interactions and activities. They include development of shared principles and values that would guide self-organization. These two types of inputs are complementary, with the critical issue being the relative weighting given to each in a particular situation. The best mix of inputs will be determined by the nature of the system.

Fisheries systems can be viewed as a CAS continuum (Figure 1). At one end, in situations with a predictable resource base and/or a few highly localized stakeholders (a simple fish chain) the ratio of regulation to enabling input may be high.

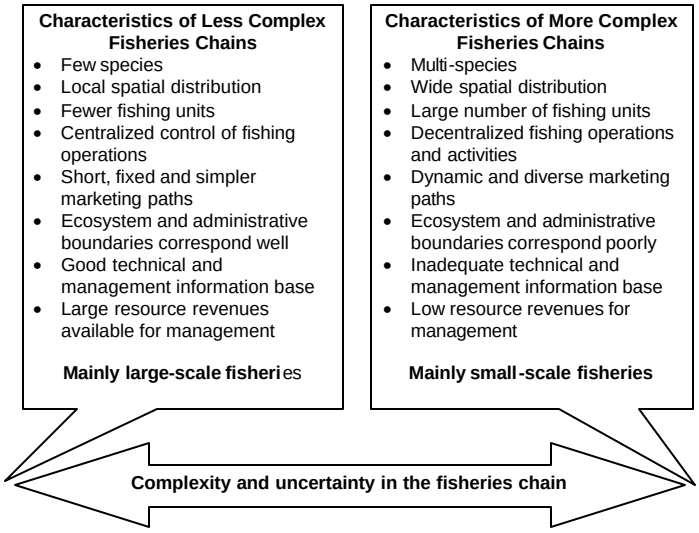

Figure 1. The complexity continuum in the fisheries chain and some of the key characteristics that define this continuum.

At the other end, with an unpredictable, multi-species resource base and/or many stakeholders widely distributed in space and time (complex fish chain) enabling may be the bulk of input and regulation may emerge in response to demands generated by self-organisation (Figure 2).

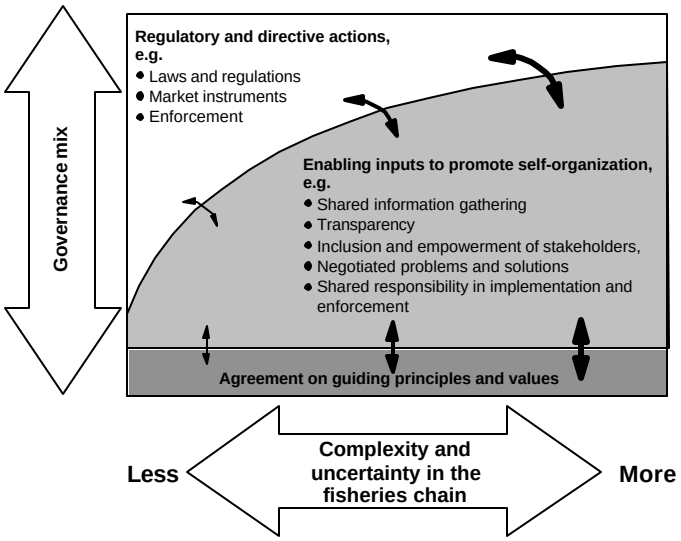

Figure 2. The relative proportion of management components needed for governance that addresses fisheries as complex adaptive systems (CASs).

Our perspective on fisheries is that they are predominantly towards the end where enabling is the predominantly needed input. Small-scale fisheries in particular appear to be towards that end.

Characteristics of the governing system, its capacity to deliver regulatory and enabling inputs, also affect its ability to cope with the complexity of the fishery system (Figure 2). Foremost is the extent to which the governing system has the resources to support or deliver the various input types. Small fisheries departments, especially in developing countries, cannot have the range of technical capacity required for the conventional approach, but enabling skills can be applied to a wide variety of situations and fishery types. Another factor is that the total size and thus value of the fishery resource may be too small to justify a conventional approach that has high information and enforcement demands, thus weighting the appropriate approach towards the enabling input.

We must not overlook that the notion of enabling and self-organizing is related to power and its distribution within and among institutions. While enabling is not necessarily synonymous with empowering it is likely that fisheries authorities will be relinquishing or re-distributing power in the fisheries system through providing or facilitating or receiving enabling inputs. There may be resistance to change among groups that stand to lose power. Fisheries authorities may therefore become obstacles to change rather than change agents.

We need working models or frameworks

Thus far, discussion of human-in-nature CAS and how to cope with them appears to be academic. Generalizations about what needs to be in place, such as those presented above, do not give specific guidance on what a manager should do to put them in place. Some literature looks at conditions that facilitate self- or co-management and whether learning can be scaled up from local to larger scales. These are more practical inputs than the resilience discussion, but focus somewhat narrowly on communities, rather than the whole governance system as conceived in our earlier definition of governance.

Frameworks or functional models within which a manager can implement an enabling programme are needed if enabling activities that are appropriate to resilience and adaptation of whole systems are to be taken up by managers and other stakeholders. Simple clear models and frameworks are also useful ways to communicate the message to implementers. One attempt to develop a framework within which to respond to complexity through enabling inputs is the Containers, Differences, Exchanges (CDE) model based on three generic properties of systems that facilitate self-organisation:

- *Containers* refer to the limits that define the self-organizing system and its sub-systems. These may be physical as in a geographical area, organizational as in an NGO, or conceptual as in an identity, a shared vision or an operating procedure.
- *Differences* among containers is system heterogeneity or diversity in terms of variables such as power, expertise, gender, ethnicity, educational background.
- *Exchanges* are active connections and flows between system entities (individuals or containers), e.g. information, money, motivation.

When containers are clear, diversity is high and exchanges are active, the system has the highest potential for self-organisation. This provides a simple understandable framework that can be used to organize balanced enabling inputs to promote self-organization. The Interactive Fisheries Governance approach provides another framework within which one can approach fisheries governance, but is complex and does not lend itself as readily to operationalization by practitioners. Interpretation however, has led to actions similar to those that would be expected from the CDE model.

It is not our aim to promote one model over another. Indeed, it may often be desirable to use more than one in concert to provide a fuller understanding from different perspectives. Our aim is primarily to illustrate the need for attention to the development of action models and frameworks. The value of this will become clearer in the next section when we examine the relationship of enabling to current trends in capacity building and community-based work in fisheries.

Enabling as it relates to current trends

A wide variety of enabling approaches and activities are currently being promoted and implemented in fisheries and other natural resource management arenas, particularly in developing countries: stakeholder analysis and mobilization, co-management, sustainable livelihoods approaches, use of traditional/local ecological knowledge and indicator based methodologies for assessment. These various inputs are not mutually exclusive; all involve aspects of capacity building. Fisheries managers seeking to promote the transition to an environment where enabling for self-organisation is prominent will find many familiar ideas and tools.

All of the above approaches now gaining favor in sustainable development take fisheries governance in the direction of equitable stakeholder participation, but building an enabled foundation for addressing self-organisation and adaptation in fisheries systems is seldom explicit in them. Lacking is a conceptual model relating to enabling organisational change in CAS that allows managers and other stakeholders to move forward with implementation and to monitor progress.

Using the CDE model, we illustrate how a framework for change in complex systems might be useful in integrating many of these current activities (Figure 3). It also provides the opportunity to ensure that key inputs are not missing and that they are balanced. Figure 3 is not complete or detailed. The boxes on the right are a mixture of the specific and the very broad, e.g. TEK/LEK and capacity building. The latter has so many components, including TEK/LEK and co-

management that it would need to be unpacked in order to be useful for implementation.

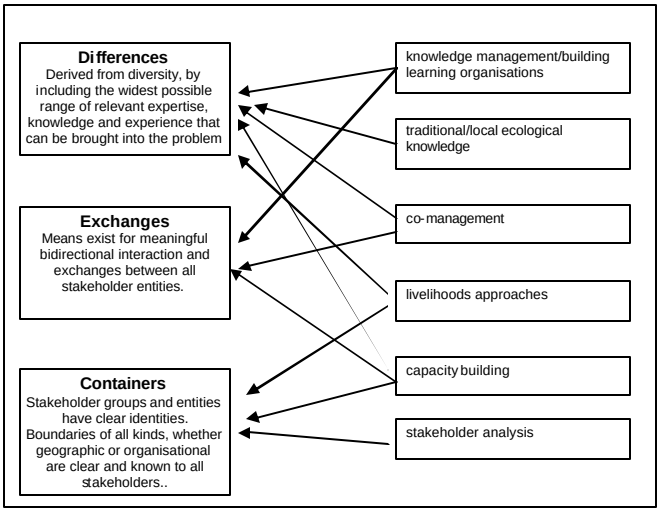

Figure 3. An illustration of how a conceptual framework model such as the CDE model for enabling self-organisation and adaptation in human-in-nature systems can help to organising the variety of current capacity building initiatives.

It is a framework that the managers can relate to. It can build an awareness and appreciation for a balanced enabling approach that includes all three types of activities/functions on the left. One way to enhance this framework would be to include a third column that shows the skill sets (facilitation, mediation, leadership, NGO management, etc.) needed by managers and stakeholders to address these three facets of self organisation. The framework also helps to show where current initiatives may be weak or lacking with regards to enabling for self-organization and adaptation..

Research and knowledge generation are an important component of conventional fisheries management, so it is important to be clear on the difference between that type of research and learning and what is being referred to in the CAS context. Conventional fisheries research has aimed at explaining and predicting how the system works, rather than in capturing information on emergent patterns and processes of the entire system or its subsystems. An emphasis on the latter is more consistent with CAS. Learning, however, must go beyond information about the fishery system itself to include information on the governance system and how it responds to different situations, especially surprises.

Shifting from conventional to enabling

Managers faced with the decision to shift resources from conventional top-down management to enabling will be concerned about whether it is possible to ensure that fisheries systems will self-organize to meet performance criteria such as sustainability and equity While there can be no guarantee that a system will self-organize positively, self-organisation based upon equitable input (inclusiveness, representativeness, legitimacy) according to good principles (transparency, truthfulness, respect), have the best chance of achieving outcomes that optimize the interests of all stakeholders. In the ideal situation where there are good principles and values stakeholders have adequate information and their power is matched with interest a good outcome is almost certain.

Ultimately, the decision to make the transition to a governance system that places emphasis on self-organisation, learning and adaptation involves taking a risk. Although this risk can be minimized by promoting a 'balanced' system and monitoring change with the aim of steering change in 'the right direction', problems with the transition are likely to be greatest at first, when the above inputs are out of balance. Therefore, 'trusting' the system to self-organize is a big step for managers and other stakeholders. In the early stages of transition from a largely regulatory to a largely enabled environment, a prominent challenge will be to simplify the concepts and communicate them to stakeholders to earn their trust and get them to commit to and participate in the process.

Another challenge is to be able to monitor change in order to steer as we go. Key questions are, will we monitor the right things and will we have the capacity to adapt? There is the need for both process indicators and product indicators. New indicators or metrics may have to be developed for system characteristics related to learning and adaptability.

Conclusions

An approach that emphasizes enabling self-organisation and adaptive capacity through empowerment, learning and response systems and promoting positive, equitable, transparent interaction among stakeholders is proposed as a foundation for governing fishery systems. It is likely to be valid for all fisheries systems, but most immediately useful for application in small-scale fisheries where complexity is highest and options for control are least feasible. Pursuit of this approach requires an emphasis on new skills in those whose role it is to promote good governance; essentially a shift in emphasis from technical to 'people' skills. However, it goes beyond this to include new processes that include a large component of 'letting go' of past control systems to allow space for self-organisation, while attempting to ensure that it follows a positive path.

The way is not clear and will become so only as the path is traveled. There is the need and scope for action-research based contributions to this approach that seek to develop and test enabling frameworks and indicators that make sense to stakeholders. This process should engage all interested parties especially those whose livelihoods depend on it.

This publication is based on a paper 'Governing fisheries as complex adaptive systems' by Robin Mahon, Patrick McConney and Rathindra N. Roy, presented at the Annual Conference of the American Association for the Advancement of Science, St. Louis, Missouri, February 2006.