

Diversity and management: from extractive to farming systems

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Worldwide extractive fishing and aquaculture are in transition driven by mainly economic imperatives. In particular in fast developing areas in the least developed countries, the effects on both the biophysical and socio-cultural environment are becoming better evidenced by research. At the biophysical side, extractive fisheries lead to stock depletion, and shrimp aquaculture to salinisation. At the social side the high investment needs lead to a high pressure of loans, and less income that is available to pay for education and health. Moreover during recent years insight in how to manage these complex problems changed. From a purely scientific-technological vision on management, we move to approaches that bring people and local knowledge explicitly on board of the managerial approach.

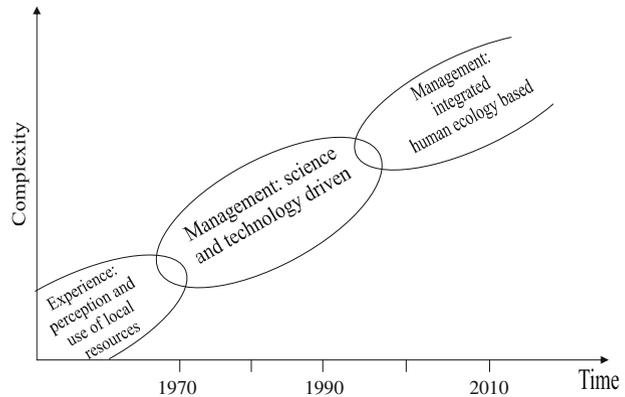
Such an approach, linking local people and management, has consequences at different levels. First, we move from a purely biological to a human-ecological approach; second, we amplify the set of used variables to deal better with the complexity we are faced with; third, we also include different scales, from the fish population to the extractive system and its regional impacts and linkages; fourth, we rely also on the local knowledge, build up and based on empirical observation and practices. As defined by Berkes et al. (2003) local knowledge refers to knowledge generated through observations on the local environment in any society. Finally, the possibility of using local knowledge towards management allows developing a genuine or legitimate co-management, involving local people, users, or stakeholders as interested partners in conservation issues. Co-management, and its variant forms, such as adaptive management and community-based management, is an area that had enormous development in the last years (Ostrom et al. 2002), and fisheries are a good example of that development (Wilson et al. 2003). In this volume a review of theory and practice of co-management in fisheries is given by Ruddle and Hickey. Figure 1

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Fig. 1 Evolution over time of management approaches in extractive and aquaculture resources



summarises this evolution from experience-based management towards integrated management that integrates not only science and technology but also local knowledge and local rules. The figure shows how a human ecological approach becomes gradually more important over the years.

Such a move, including locals in a managerial approach has consequences for policies on the management of these resources. It is suitable to recall the World Summit on Sustainable Development (WSSD), held in Johannesburg in 2002 (*Environment, Development, and Sustainability*, 5:1–2, 2003): science, and knowledge-building have become vital forces towards sustainability and there are key elements linking science communication and public policy processes (Stringl 2003). Such elements are the advent of new institutions and networks, and a shift from one-way technology transfer to participatory learning, among others. Such focus on sustainability after the WSSD 2002, or in other words, this new post-WSSD contract, has led to key issues addressing poverty and local populations (Nath and Hens 2003). A significant group of extractors are people that inhabit poor areas in poor or developing countries. Besides the *Indigenous People's networks*, an outcome from the WSSD (Begossi and Ávila-Pires 2003), we are still in need of practices that can really dialogue and link the two systems of knowledge, the local and scientific, towards new rules of extraction and management, maintaining diversity.

This special issue provides mainly a case driven overview of these problems and management approaches. It includes papers presented at a workshop on “Diversity and Management: from Extractive and to Farming Systems”. This workshop took place in Rio de Janeiro (Brazil) as part of the XVth International Conference of the Society of Human Ecology, in October 4–7, 2007.

Diversity embodies ecological and cultural definitions. Diversity, taking a human ecological approach, is about the interactions of human populations and nature through extraction of water resources and aqua farming. This type of extraction can be described using diversity indices that originate from ecology, one of them being the richness of what is extracted, such as fish, molluscs, or plants, among others. Ethnobotanical studies have been very illustrative in the study of the diversity of plants used by local people around the globe (Begossi 1996). Fish diversity is also important to understand local perceptions, such as the ethnoichthyological studies that combine ethno taxonomy and ethno ecology show (Silvano et al. 2006). Diversity is also about the different cultural procedures that relate to the knowledge on one species, such as the multiple uses of this species, and its processing techniques. Briefly, ecological and cultural diversity are intrinsically related in a way that

can only be understood using an interdisciplinary approach. They represent interactions of human populations and nature.

We approach extractive and aqua farming systems and their implications in a way that involves both short-term production and long-term sustainability. This issue, like the workshop, adopts an interdisciplinary framework that includes cultural, ecological, social and economic processes. We include studies on the perception and complexity of culture, on coastal systems, on shrimp production, on plant and agro biodiversity, on aquaculture, on local knowledge and on management and mismanagement. The outcome provides an interesting example of the added value of interdisciplinary research on environmental problems.

This issue follows the special volume of *Environment, Development and Sustainability* published in 2000 on *Local Knowledge in the Tropics: Relevance to Conservation and Management*, by Begossi and Hens (2000). At that time, we emphasized the importance of local knowledge for conservation, and the interdisciplinary studies associated to this theme. This time, in the XV SHE held in Rio, we go a step further: we are dealing with the diversity of extraction and farming of aquatic systems associated with management and sustainability. Our step forward is: having dealt with local knowledge, how can we manage extractive and farming systems under the diverse current ecological, cultural and socio-economic contexts?

Diverse are also the studies in this volume: starting from studies of local diversity and local knowledge, we build a bridge to sustainability and long-term development. Such bridge takes into consideration local and scientific knowledge, through analysis of management (and mismanagement) from the special cases included in this volume. Critical approaches are shown, which are contributions that can pass the threshold of considering local people as living in the “Garden of Eden”, and that take into account the lack of information on the management of local fisheries, small-scale farmers, and local extractors.

Contributions in this issue range from the sea to the land, but all of them refer to communities that live either in the banks of rivers or in coastal areas. We start with studies on extraction and management in freshwater and marine systems. Silvano and Valbo-Jorgensen deal with local and scientific knowledge in both systems; they show in particular the challenges in which tropical fisheries are embodied considering the trade-offs of living in poverty and attending management regulations coming from the governments. The importance of fishers within management programmes, such as a ‘data-less’ management approach is suggested. Their analysis flow by testing the likelihood of a set of hypotheses related to the local knowledge of fishermen.

MacGrath contributes on co-management systems in the Amazon, in Brazil. He discusses examples of lake fisheries, such as on the pirarucu, *Arapaima gigas*, among other species, and on a regional scale, on the *acordos de pesca*. He also analyses a current system of raising cattle and water buffalo on floodplains and points to the importance to integrate the three systems. We then follow up with studies on marine systems.

A review of management approaches in marine systems is presented by Ruddle and Hickey. The authors comment on the inadequacy of present models of fishery management. For example, colonialism and lack of knowledge on tropical fisheries are aspects highlighted, along with influences in fishery management, such as rural development policy, top-down approaches, latitude bias, and lack of integration of the systems of knowledge. They combine analyses on The Ecosystem Approach, Adaptive Management, Local Knowledge and Protected Areas, which they discuss from the perspectives of Western models and pre-existing Pacific Island systems as alternative models. Detailed thoughts on the shortcomings of these models and the analysis of non-Western alternatives

are presented uprising alternatives, rethinking the foci on important aspects of current fishery management.

Begossi associates local and scientific knowledge with proposals for education and local management. Understanding four kind of data are important: they include the local use of fishery resources, fisher decision-making processes, the use of the marine space, and the knowledge fishers have on target species. A combination of local knowledge and training courses is suggested, as an alternative to top-down, centralized management programmes.

Nauen updates the concept of sustainable development and reports the results on sustainability and education from the international collaborations and research led by the European Community in coastal areas, through INCO projects. These projects support international scientific cooperation and fisheries, aquaculture and coastal zone issues. Her conclusion is about lessons on the integration of sustainability dimensions, and in particular of environmental and economic issues. Difficulties to integrate socio-economic dimensions as food security into research, were obvious as these issues, were addressed by a small number of proposals. On the other hand, encouraging results were obtained by involving public knowledge on the sustainable use of aquatic and coastal resource systems.

Shrimp management is represented by a study: one in Brazil by MacCord. MacCord addresses the Brazilian shrimp market. He shows its relevance for South America, but also seen as still a wild sector as fishing and in marine fishing points to the aspects of wilderness as obscene of planning in aquaculture. Negative interactions between artisan and subsistence fishing are shown to be related with the lack of enforcement of local laws, and to be associated with the historical evolution of shrimp farming in Brazil. An accelerated growth of shrimp farming is noticed along with predicted economic and ecological impacts.

On land, the diversity of extracted and cultivated species from the Atlantic Forest Coast in Brazil, is studied, by Peroni, Hanazaki and Begossi. In this ethnobotanical study, the agro biodiversity of local caíçaras is illustrated using the diversity of the plants used. Functional relationships within a system of multiple uses and different management degrees are described: the increase in the degree of management is related to an increase in the ecological manipulation of plants, and related to different organization levels, from populations to communities. Swiddens areas (agro biodiversity) are areas frequently used that include both native and introduced species.

Over all this issue provides a collection of papers that are illustrative case studies. Dealing mostly within aquatic systems, but one study on land agro biodiversity, all cases deal with the management of cultural and ecological diverse systems. The scope, the strategy and the research approaches make these studies most significant as an inspiration for researchers and useful for trainers in human ecology. But, most importantly we hope that this information on evolving insights in these problems will be integrated in new policies, will result in less stress on the environment and will improve the living conditions of the fishers and other natural resource users.

References

- Begossi, A. (1996). Use of ecological methods in ethnobotany. *Economic Botany*, 50(3), 280–289.
- Begossi, A., & Hens, L. (2000). (Eds.). Local knowledge in the tropics: Relevance to conservation and management. Special issue of *Environment, Development and Sustainability*, 2(3–4). Introduction.
- Berkes, F. (1989). *Common-property resources: Ecology and community-based sustainable development*. London: Belhaven Press.
- Berkes, F., Colding, J., & Folke, C. (2003). *Navigating social-ecological systems*. New York: Cambridge University Press.

- Begossi, A., & Ávila-Pires, F. (2003). WSSD, Latin América and Brazil: Biodiversity and indigenous peoples. *Environment, Development, and Sustainability*, 5, 179–195.
- Nath, B., & Hens, L. (Eds.). (2003). The Johannesburg world summit on sustainable development—Science and Policy. Special I issue of *Environment, Development and Sustainability*, 5(1–2). Foreword.
- Ostrom, E., Dietz, T., Dolsak, N., Stern, P. C., Stonich, S., & Weber, E. U. (Eds.). (2002). *The drama of the commons*. Washington DC: National Academy Press.
- Silvano, R. A. M., MacCord, P., Lima, R. V., & Begossi, A. (2006). When does this fish spawn? Fishermen's local knowledge of migration and reproduction of Brazilian coastal fishes. *Environmental Biology of Fishes*, 76, 371–386.
- Stringl, A. W. (2003). Science, research, knowledge and capacity building. *Environment, Development and Sustainability* 5, 255–273.
- Wilson, D. C., Nielsen, J. R., & Degnbol, P. (Eds.). (2003). *The Fisheries co-management experience*. Kluwer Academic Pub., Fish and Fisheries Series 26, Dordrecht, pp. 135–152. ISBN: 1-4020-1427-9.