

Barriers to local-level, participatory ecosystem assessment and management in Brazil

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Introduction

One of the Millennium Ecosystem Assessment (MA) challenges is to “develop procedures that can integrate local knowledge with data collected at the regional or global level and produce information that is salient, credible, and politically legitimate to the decision makers that are a major audience for the results of the MA” (Millennium Assessment 2002). This paper aims to contribute to such effort by capturing lessons from participatory local-level ecosystem assessment and resource management. Participatory resource management has the potential to document local ecological knowledge about resource and ecosystem conditions and to enable knowledge flow across scales.

Natural resources and ecosystem management is often a product of institutional interactions across different political levels, and is directly affected by ecological interaction across space scales. For instance, any ecosystem is embedded in a larger one, being affected by and influencing dynamics at larger as well as smaller scale – the panarchy concept (Gunderson and Holling 2002). Within the social² context, resource user livelihoods are affected by a myriad of local and higher-level institutions not necessarily related to resource management. That is, resource management systems can be seen as complex systems (Levin 1999) involving several stakeholders, with distinct levels of influences, source of power and interests (Brown 2003). Hence, any promising management arrangement to address the complexity of management interests and problems should focus on cross-scale institutional linkages (Berkes 2002), particularly on those enabling resource user participation in decision-making.

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² The term social is used here to encompass all social, economic, political and cultural aspects.

The need to bring together local ecological knowledge and scientific knowledge for resource and ecosystem management (i.e., to promote participatory management) has been well stressed in the past two decades, especially after Rio 92 conference. As a result, the discourse of participatory management has been incorporated in several government policy agendas. In particular, many high-biodiverse developing countries with a history of centralized (top-down) natural resource management started to adapt their environmental policy towards a more decentralized and participatory resource management approach focusing on both conservation and development issues (Sick 2002). In Brazil, for example, environmental conservation policies were, for many decades, based on a command-and-control approach leading more often than not to ecosystem degradation - the pathological resources management (Gunderson et al. 1995). Brazilian conservation policies at that time focused mainly on the establishment of protected areas (excluding local population from use and management) and on repressive enforcement of environmental legislation, which were created in the nation capital, hundreds of kilometers away from where it was enforced, and based strictly on a limited technical/scientific knowledge available about resources and ecosystem dynamics.

Since 1990, when the first extractive reserve was created in the Amazon³, the Brazilian legislation contains a legal (formal) mechanism to promote participatory management. The cross-scale institutional arrangement in case is co-management – a share responsibility between government, users and other stakeholders in resource management. Interesting enough, few informal co-management arrangements – in which government approves area-specific regulations based on local demand and local ecological knowledge – already existed before 1990, at least since 1981 (Seixas and Berkes 2003). All these formal and informal arrangements created a space for users and decision-makers to share their needs, concerns and knowledge about the resource conditions in order to better understand management problems and improve management regulations.

³ Rubber-tappers with the support of environmental groups lobbied the federal government to create a new form of conservation unit in Brazil (Allegretti 1990).

Over the years, these formal and informal co-management arrangements started to ‘replicate’ throughout the country⁴. Nevertheless, most of these co-management arrangements were, in fact, state initiated (sometimes with support from NGO or research units) and state run, with local users having limited real input (Sick 2002). Moreover, government organizations often propose ways of combining local and scientific knowledge based on theoretical models extracted from scientific literature or based on experiences of successful case studies elsewhere, without taking into account socio-cultural differences among localities.

Hence, in a nation with a history of centralized decision-making, such as Brazil, several problems have arisen in trying to implement local-level, participatory research and management. For example, to what extent are policy-makers prepared to accept local knowledge as a credible knowledge system that may complement scientific knowledge? To what extent are local resource users (used to paternalistic, top-down decision-making) prepared to engage participatory research and management? To what extent are fieldworkers (government and NGO staff, including science-trained researchers) trained to mediate the flow of knowledge between bureaucrats and resource users or to accept different understanding of ecosystem dynamics? There is a huge gap between theory and praxis in conducting participatory research and management in the field and in combining local and scientific knowledge across political levels for ecosystem assessment.

The objective of this paper is to identify some of the driving forces that enable or impede local-level ecosystem assessment and participatory management in Brazil. For this purpose, I analyze four case studies of participatory fisheries management, based on government-, non-governmental-, or research-driven initiatives in different regions of Brazil. In particular, I intend to answer the following questions: What are some of the barriers faced by users in engaging a local-level ecosystem assessment (participatory research) and participatory management as proposed by MA? What are some of the major problems faced in trying to implement participatory research and management where there is no tradition on such approach? What role has nested institutions played in

⁴ Today in Brazil there exist 16 extractive reserves (12 inland and 4 marine) and 16 new ones are being implemented; 2 Sustainable Development Reserves - another category of formal co-management arrangement created in 2000 – and several less formal participatory initiatives of resource management (e.g., the “fishing accords” in the lower Amazon river (Castro 2000, Castro and McGrath 2003)).

combining local and scientific knowledge to improve policy at higher scale? How does higher-level institutional rigidity or flexibility impede or enable knowledge flow (both local and scientific) across scale?

Methods

This paper analyzes four cases studies of participatory fisheries management from different regions of Brazil: the Ceará Reservoir Fisheries Project (northeast region), the Maritime Extractive Reserve in Arraial do Cabo (southeast region), the Forum Lagoa⁵ dos Patos (south region) and the Lagoa de Ibiraquera Project (south region). The first three cases were extracted from the literature. The fourth – a Brazilian initiative of conducting local-level ecosystem assessment but not a MA case⁶ – is based on project reports and joint team project experiences. The project is being implemented in the same area where I carried out my doctorate field research; additionally, I was involved in this project during its conceptualization phase (1999-2000) and have followed up its progress from abroad. All these cases are briefly presented in Appendix I (cases I, II, III and IV, respectively).

These cases were chosen because they are examples of current or past fisheries co-management in Brazil, which has been well documented by the scientific literature. Future research could expand this sample to include other also quite interesting fisheries co-management cases such as the ‘fishing accords’ at the Lower Amazon River (Castro 2000, Castro and McGrath 2003) and the fisheries management at the Mamirauá Sustainable Development Reserve (Queiroz and Crampton 1999).

The case descriptions and analysis are based on the following publications: Christensen et al. (1995), Barbosa and Hartmann (1997) and Hartmann and Campelo (1998) for the Ceará Reservoir Fisheries Project; Lobão (2000) and Silva (*in press*) for the Maritime Extractive Reserve in Arraial do Cabo; Reis and D’Incao (2000), D’Incao and Reis (2002), Kalikoski et al. (2002), and Kalikoski and Vasconcellos (*in press*) for

⁵ Lagoon

⁶ This project follows the MA methodological approach and started as a potential pilot project for the Millennium Local-level Ecosystem Assessment after the Workshop on “Linking Local and Regional Assessments to International Ecosystems Assessments”. World Resource Institute. Winnipeg, Canada. September 20-21, 1999.

the Forum Lagoa dos Patos; and NMD-UFSC (2003) and Freitas (*in prep*) for the Lagoa de Ibiraquera Project. It is important to mention that all the analyses presented below are based on my own interpretation of these publications, and it may not totally reflect the authors’ opinions.

Case studies background

Historically, three of the study cases occurring in natural ecosystems (Extractive Reserve, Lagoa dos Patos, and Lagoa de Ibiraquera) experienced successful (sustainable) community-based resources management until the early 1960s (Seixas and Berkes 2003, Silva *in press*, Kalikoski and Vasconcellos *in press*). Since 1967, when the Federal Fisheries Agency (SUDEPE⁷) was created (later replaced by IBAMA⁸ in 1989), government centralized management has been the norm in these localities; an exception was the advisory co-management agreements between fishers and SUDEPE/IBAMA at the Lagoa de Ibiraquera during the 1980s and early 1990s (Seixas and Berkes 2003). The fourth case study, the Reservoir fisheries system, experienced government centralized top-down management since reservoir was built (Barbosa and Hartmann 1997).

All the initiatives described here aim to promote sustainable fisheries through participatory management, although the scope of the Ibiraquera project – local ecosystem assessment at a micro-watershed and creation of a Local Agenda 21 – is larger than only fisheries management (Appendix I). The Reservoir Project, initiated by a co-operation of Brazilian Government and the German International Development Agency (GTZ) in 1990, led to an informal co-management arrangement between fishers and the Brazilian Environmental Agency (IBAMA). The Extractive Reserve, initiated by an IBAMA official, led in 1997 to a formal co-management arrangement between IBAMA and fishers, represented by a newly formed association, AREMAC⁹. The other two cases were initiated by researchers and resulted in the establishment of multistakeholder management bodies (*fora*) aiming to influence/advise decision-makers at higher political levels. The Forum Lagoa dos Patos was initiated in 1996 by the IBAMA Regional

⁷ Superintendência para o Desenvolvimento da Pesca

⁸ Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis

⁹ Associação da Reserva Extrativista Marinha de Arraial do Cabo (Community-based organization)

Research Centre and the Fishing Catholic Body¹⁰ and became a type of informal co-management as well. The Ibiraquera project was initiated in 2001 by a university research unit (NMD-UFSC¹¹) and is the only one, which is still in the early stages of participatory management (i.e., ecosystem assessment, capacity building, and community organization through establishment of a Local Agenda 21 Forum). The first three initiatives have advanced into fisheries management and were able to influence government to pass new fisheries regulations for their localities.

Barriers to participatory research and management

Barriers to user participation

The degree of fisher involvement in the several stages of participatory management – environmental assessment (data gathering, data analysis), planning (decision-making), implementation, monitoring (including enforcement), and evaluation – varies a lot from case to case. In the three cases where participatory research was reported (Reservoir Project, Forum Lagoa dos Patos, and Ibiraquera Project), fishers were usually a source of information or helpers in collecting data and samples, but, according to my understanding, were never involved in data analyses, which were carried out by outside researchers. Nevertheless, results from data analysis were discussed with fishers in fishing meetings at community level and supported fishers to formulate management recommendations in at least two cases (Hartmann 2004, pers. comm.; Vieira 2004, pers. comm.)

Barriers to user involvement in participatory management (Table 1) were, in general, related to a history of socio-economic and cultural marginalization of artisanal fishers (Pauly 1997) and the culture of patron-client relations established in Brazil. Fisher participation is often constrained by patron-client relations or other interdependent social relationships; and within this context, by the lack of secret voting procedures, reported in

¹⁰ *Pastoral da Pesca*: a unit within the established Catholic Church (and linked to its progressive wings) which aims at political and social development of artisanal fishing communities.

¹¹ Research Unit on Environment and Development (NMD) of the Federal University of Santa Catarina (UFSC)

at least one of these cases, which exposes fishers’ opinion to the entire society (Silva *in press*). There are still much prejudice against fisher knowledge and their “low” cultural and literacy level; and fisher participation, although advocated by many, is in fact, “undermined and sabotaged at many levels and by many organizations” (Barbosa and Hartman 1997, 442).

“Illiteracy and socio-economic marginalization create low expectations of the management value of fishers’ knowledge among scientists and decision makers” (Kalikoski and Vasconcellos *in press*, 452)

The problem of misrepresentation by fisher organizations (Jentoft et al. 2001) was noted in three of the cases. Quite often, long-established fisher organizations are controlled by a local elite that does not represent the interests of most artisanal fishers. This misrepresentation may reflect a lack of organizational skills of fishing communities, which has suffered many social and economic influences during the past four decades, leading to a breakdown of their traditional management system¹². Not only are fishers misrepresented but also some fisher-groups are excluded from the participatory management process or have limited access to it. For example, at the Forum Lagoa dos Patos out of 21 organizations with right to vote, only few were fisher organizations and fisher union (coordinators only) (Reis and D’Incao 2000).

Previous existing conflicts among stakeholder groups, which have not been properly addressed by the initiative, also hamper user participation in resource management. Lastly, some community members involved in ecosystem assessment, planning and rule enforcement have been physically, emotionally or economically threatened by rule transgressors.

¹² The breakdown of traditional fisheries management system due to outside socio-economic influences seems a trend in many coastal fishing communities in Brazil (Diegues 1983, Cordell e McKean 1992, Begossi 1998, Hanazaki e Begossi 2000, Seixas and Berkes 2003, Kalikoski and Vasconcellos *in press*).

Table 1. Barriers faced by users in engaging a participatory research and management

Barriers to user participation	Case studies¹
Socio-economic and cultural marginalization of artisanal fishers	I, II, III, IV
Culture of patron-client relations and corruption	I, II, III, IV
Prejudice against user knowledge and literacy level by researchers and decision-makers	I, II, III
Misrepresentation of fishers within their associations and in the decision-making process	II, III, IV
Physical and economic threats to those involved in assessment and enforcement	I, II, IV
Existing conflicts and hierarchies	I, II, IV
Restriction to some user-groups participation in process	II, III
Lack of secret voting procedures	II

¹Reservoir project (I); Extractive Reserve (II), Forum Lagoa dos Patos (III), Ibiraquera project (IV)

Government-related barriers to participatory management

Theoretically, government at different levels should play an important role in facilitating and enabling cross-scale participatory management, in particular co-management (Pomeroy and Berkes 1997). For instance, government may help bring different user groups into the decision-making process, and may provide technical and financial support as well as enabling legislation for participatory management and rule enforcement. Higher-level governments may also address problems and issues beyond the scope of local arrangements, supervise local arrangements and abuses of local authority, and coordinate multi-parties forum to minimize management conflicts (Pomeroy and Berkes 1997). Nevertheless, in practice, what one finds is quite the opposite.

In all the four initiatives, some government agencies (different levels and sectors) with a stake in the management process but not the major ones involved in it, demonstrate little or no support to or recognition of local (co-) management institutions (Table 2). This fact is intertwined with three others. Firstly, there is a high degree of multiplicity and fragmentation of government management at all levels. For instance, within the same government agency, two offices may have distinct management agendas (e.g., IBAMA’s enforcers and regulation decision-makers). Another example, power dispute and conflictive agenda between government agencies from different sectors and

political levels is quite common. Secondly, support by government staff to participatory management depend more on his/her own beliefs about community-based resource management and not so much on the organization agenda (ambivalent support) (Barbosa and Hartmann 1997). Hence, conservative representatives of government agencies (used to top-down management) tend to hinder the participatory management process. Thirdly, the limited social-environmental awareness of government staff, in particular at the lower political levels, obstructs the potential of participatory management. There is a lack of political will to promote conservation and development (NMD-UFSC 2004).

Another problem that sometimes hampers the participatory process is the involvement of government agencies related to environmental control and enforcement within the new cross-scale management institution. This may transmit a wrong image of the new management institution as another enforcement organization and may repel user involvement in the process due to their lack of trust on those enforcement agencies, which they see as corruptive and inefficient. In fact, in all cases, ineffective enforcement by government agencies (e.g., lack of resources and personnel, and unprepared or corruptive agents) at local and regional levels was one of major problems hampering resource management (Table 2)

Table 2. Government-related barriers to participatory management

Government-related barriers to participatory management	Case studies¹
Lack of gov't support to or recognition of co-management institutions	I, II, III, IV
Ambivalent support from gov't representatives	I, II, III, IV
User lack of trust on gov't agencies with a stake in the participatory management	I, II, III, IV
Ineffective enforcement structure by government agencies	I, II, III, IV
Conflicting gov't policies and agendas (all levels)	II, III, IV
Gov't staff with low social-environmental awareness and not willing to participate	II, IV
Lack of political will to promote sustainable development (at local and regional level)	II, IV

¹Reservoir project (I); Extractive Reserve (II), Forum Lagoa dos Patos (III), Ibiraquera project (IV)

Governance-related problems in participatory management

Many governance-related problems were observed in these four cases of participatory management (Table 3). Of particular interests are those related to (1) decision-making power, (2) level of decision-making and use of local knowledge, (3) share of responsibility, and (4) institutional capacity in conducting participatory management.

Despite the fact that all cases offers a democratic space through which fishers can express their values and knowledge, the final step of decision-making process does not remain on fishers’ hand. In all different forms of co-management, formal and informal arrangements, locally devised rules needs to be sanctioned by IBAMA at the federal level in order to be implemented. In other words, these are low-level co-management in which decision-making power is not totally shared. The situation was poorer in the case of Forum Lagoa dos Patos where relatively few fishers were consulted or participated in the decision-making process at the local level. The fishing community was merely informed of decisions; hence rule compliance became quite low. As Kalikoski and Vasconcellos (*in press*) puts, in spite of the efforts of the Forum Lagoa dos Patos towards a bottom-up management, the overall process of governance in the area “is still locked into a top-down management system based on conventional scientific approach”.

Two problems were identified concerning the level of decision-making and the use of local knowledge in the cases studies. First, formalization of locally devised rules at a higher political level (national in all cases) increased rules legal status but at the same time decreased flexibility for rule changes (i.e., hinders rapid feedback mechanisms for rule adaptation according to local resource dynamics and climatic conditions). On the other hand, frequent (yearly) rule change (adaptive management) at the Reservoir Project had weakened management impact because it has generated confusions and insufficient time to evaluate the effects of management rules on fishery (Hartmann and Campelo 1998). Second, government staff and researchers tend to have a preference for a few generally applicable and easily controllable rules in contrast to fishers desire for many locally specific rules – i.e., “one size fits all” syndrome. This is a clear a case of institutional misfit (Folke et al. 1997, Brown 2003) in resource management, especially

in very large heterogeneous ecosystem as in the case of Patos Lagoon (D’Incao and Reis 2002).

The question of responsibility over resource management is a key one. Co-management is, theoretically, a way for government to share responsibility with users. Nevertheless, after decades of command-and-control, top-down fisheries management, many fishers show that they are not used to (or willing to) take responsibilities for resource management. Moreover, communities are demanding better, more effective, actions and support from government for resource management, and not less. On the other hand, in at least one case, the Extractive Reserve, government seems to have declined such support arguing that community has to take more responsibility (Lobão 2000). “Many feel that the reserve is an added responsibility placed on fishers without sufficient support from the government” (Silva *in press*). Another issue is the transfer of responsibility for rule enforcement from government to resource users. As Hartmann and Campelo (1998) put it, “enforcement is passed on to user groups, mainly to make up the lack of funds and manpower of the responsible authority”. Nevertheless, many problems arose in the two cases where user participation in rule enforcement occurred (Reservoir project and Extractive Reserve), including corruption of voluntary agents (and a lack of a legal mechanism to punish them) and physical and emotional threats to voluntary enforcement agents by rule transgressors (Hartmann and Campelo 1998, Lobão 2000).

Participatory management is quite complex, and although there are several manuals about participatory research and group dynamics techniques, there is no black-and-white recipe for the participatory process itself. In addition, participatory research and management requires an interdisciplinary approach and in Brazil the higher-level education is still very disciplinary. Hence, because this approach to resource management is relatively new in Brazil, there are not many well-trained people (government and NGO staff and researchers) able to conduct the process effectively (i.e., able to deal with a diversity of interests and activities in any management area). Another problem is that there is not much government funds to carry out participatory management, despite the entire recent advocacy towards such approach.

Table 3. Governance-related problems in participatory management

Governance issues	Case studies¹
Low-level co-management: decision-making is not totally shared; gov't holds last word	I, II, III, IV
Lack of a clear property rights system in the area	I, II, III, IV
Lack of effective gov't presence	I, II, III, IV
Lack of commitment and support from all stakeholders, particular gov't agencies	I, II, III, IV
Lack of capacity (funds, training, and experience) from different partners	II, III, IV
Regulations: “one size fits all” syndrome	I, III
Fishers are not used to take responsibilities for resource management	II, III
Stakeholders with different social and environmental agendas	III, IV
New conflicts after co-management arrangements	II, IV
Problems in participatory rule enforcement	I, II
Low rate of fisher participation in decision-making	III
Controversy among fishers about resource conditions and management measures	IV
Conflict over user representations and management rights	II
Lack of management at larger ecosystem scale with consequences for local management	III

¹Reservoir project (I); Extractive Reserve (II), Forum Lagoa dos Patos (III), Ibiraquera project (IV)

Knowledge flow across scale

Institutions for combining local and scientific knowledge

Each initiative effort towards sharing and combining technical/scientific and local knowledge systems varied largely (Table 4). The Ibiraquera Project first proposal was to carry out a participatory local-level ecosystem assessment, which documents local knowledge for further integration with scientific knowledge. Later, the Ibiraquera Project focused on initiating a local Agenda 21 Forum for future resources co-management and ecodevelopment. The other three initiatives focused mainly on improving resource management; for some of the participants (users, government staff, researchers), sharing and combining knowledge systems was a mean towards this end.

Mechanisms used to share technical/scientific information with local people were found in all cases. These included: environmental education about local ecological processes; research information feedback to fishing communities; and researchers

advising users for decision-making when local knowledge was not sufficient (Table 4). More difficult to find was clear mechanisms that enable use and integration of local knowledge in resource management.

Despite the existence of formal or informal co-management arrangements, it is difficult to measure how much local knowledge has been used in decision-making in each case. At the Reservoir project, until 1997, all community-proposed management measures were ratified by IBAMA, becoming fisheries legislation (Barbosa and Hartmann 1997). However, based on the information given by the Barbosa and Hartmann (1997) that “there [were] no local traditions of [fisheries] resource use and management” in the area due to the reservoir recent origin and that environmental awareness training about local ecosystem process was provided to fishers, it seems that local decisions were quite influenced by technical knowledge.

Concerning the Extractive Reserve, according to Silva (*in press*), the reserve management plan was in part based on a long-standing informal arrangement of resource access (codified in 1921 by the old fisher organization). However, local decision has been also influenced by the Scientific Technical Council formed by university researchers, which is part of the AREMAC (association responsible for co-managing the reserve with government) (Lobão 2000).

At the Forum Lagoa dos Patos, decision-making has been largely influenced by scientific/technical knowledge (Reis and D’Incao 2000, Kalikoski et al. 2002), while user knowledge has been overlooked (Kalikoski and Vasconcellos *in press*). Nevertheless, some initial effort towards participatory research has happened (D’Incao and Reis 2002), and the Forum has triggered more management-oriented research by university teams to deal with questions raised by the Forum (Kalikoski et al. 2002).

Even when the project’s primary objective is to integrate knowledge systems, as it is the case of the Ibiraquera project, the distance between objectives and results is large. After three years of implementation, the project has not yet been able to create a database integrating data from all the research teams involved in the local-level participatory assessment (fisheries, aquatic invertebrates, birds, game and domestic animals, landscape, agriculture, water quality, health, socio-economic-political-cultural issues); moreover, each research team has collected, analyzed and documented its data separately. Some

results have been presented at meeting of working groups of the recently established Forum of the Lagoa de Ibiraquera (e.g., fisheries working group) but no overall summary of data has been yet presented to communities in a systematic way for discussion, validation and their own use – despite being anticipated in their methodology.

In fact, the Forum of the Lagoa de Ibiraquera has been quite active in bridging local and scientific knowledge to lobby decision-makers and in attempting to improve regulation enforcement and environmental policy (Freitas *in prep*). The Forum members have tried to influence decision-making by inviting government agents (municipal, state, federal) as guests to their meetings. As well, some Forum members and community representatives have participated in a regional fisheries conference trying to influence policy at state level. The involvement of local resource users in sub-regional management institutions (e.g., watershed management committee) was also noted at the Reservoir Project (Hartmann and Barbosa 1997).

Table 4. Use of local and scientific knowledge in participatory management

Use of local and scientific knowledge	Case studies¹
<i>Influences of scientific knowledge</i>	
Environmental education about local ecological processes	I, IV
Research information feedback to fishing communities	I, III, IV
Researchers advising users when local knowledge is not sufficient	II, IV
Local decisions largely influenced by scientific/technical knowledge	II (maybe), III
<i>Influences of local knowledge</i>	
Participatory research	I, III, IV
User participation in policy-making at higher levels (conference, watershed committee)	I, IV
Local decisions partially based on previous informal management system	II

¹Reservoir project (I); Extractive Reserve (II), Forum Lagoa dos Patos (III), Ibiraquera project (IV)

Impediments to knowledge flow across scale

Impediments to knowledge flow across scale found in these four cases are presented in Table 5. In most of areas in Brazil, there is no legal mechanism that compels government organizations to consult resource users for management decision-making. From the four cases analyzed here, only the Extractive Reserve provides such mechanism – a formal co-management arrangement. In two other cases of informal co-management arrangement, the Reservoir project and the Forum Lagoa dos Patos, government consultation with civil society and the use of local knowledge in resource management depend largely on the government staff’s own beliefs about the value of local knowledge and the potentials of community-based management and not so much on his/her organization agenda (Hartmann and Campelo 1998).

In the fourth case, the Ibiraquera Project, the situation is poorer compared to the other three cases. Firstly, because many government agencies from municipal and state level do not support the civil society initiative of establishing a Forum to manage local resources (NMD-UFSC 2004, Freitas *in prep*). Secondly, because the municipal government did not accepted a representative indicated by the Forum on the Municipal Environmental Board (i.e., it created a barrier to knowledge flow) (NMD-UFSC 2004). Lastly, because government agencies claimed that more scientific studies (which usually takes long time to be concluded) have to be carried out in order to prove local knowledge about ecosystem degradation – before they take actions to reverse the degradation process (NMD-UFSC 2004).

In fact, many government agencies and even some researchers do not accept and value local knowledge, and some government staffs do not accept user rights for co-managing. For instance, the Navy does not recognize fisher rights to co-manage the Extractive Reserve (Lobão 2000). Another example, despite some initial effort towards participatory research (D’Incao and Reis 2002), Kalikoski and Vasconcellos (*in press*) argue that exchange of knowledge between fishers and scientists has not been very intense, and that fisher knowledge has not yet received the required attention by this Forum in spite of its role in helping maintaining a productive and resilient fisheries system before the 1970s.

Another limitation to knowledge flow is in regarding a lack of institutions to create an integrated coastal zone management plan for the south Brazilian coast (Kalikoski et al 2001). Much of the factors affecting the Patos Lagoon fisheries are related to the industrial fisheries on the coast of outside the estuarine zone (Kalikoski et al. 2001).

Concerning the link of information systems related to the conditions of resources and ecosystems at different scales, the only initiative of the four studied here that had such an objective was the Ibiraguera Project. However, after three years of project implementation, the team has spent too much time in searching for funding (the project was only funded after June 2004) and trying to capacitate and coordinate team members, that almost no effort has been made so far towards the elaboration of a complete database of the local assessment– not mentioning about integrating it to other government scientific information systems encompassing larger ecosystems.

One final point to consider is that in spite of all the effort in combining local and scientific knowledge for resource management, common understanding of the problems and agreement on measures may not be reached. Conflicts between users and scientists and decision-makers about resource conditions may still occur.

Table 5. Impediments to knowledge flow across scale

Impediments to knowledge flow across scale	Case studies¹
Lack of legal mechanisms that compel government agencies to consult fishers	I, III, IV
Local knowledge use depending on gov't staff own beliefs about potentials of CBRM	I, III
Some gov't staff not accepting and valuing local knowledge (prejudice)	I, II, IV
Some gov't agencies not accepting user rights for co-managing	I, II, IV
Overall management process is still top-down based on conventional scientific approach	III, IV
Lack of an integrated coastal zone management plan	III, IV
Conflict between users and scientists about resource conditions	III, IV
Limited participatory research and exchange of knowledge	III
Lack of funding for participatory, local-level ecosystem assessment	IV

¹Reservoir project (I); Extractive Reserve (II), Forum Lagoa dos Patos (III), Ibiraguera project (IV)

Challenges in conducting local-level ecosystem assessment and participatory research

Several challenges emerged in these initiatives conducting participatory research. A major challenge is congregating and coordinating an inter- and transdisciplinary research team for the long periods required in participatory assessment and management – in many cases researchers are students (which results in a rapid turn-over of team members) (NMD-UFSC 2004, Lobão 2000). For the particular case of the Ibiraquera Project – the only one focusing on local-level ecosystem assessment – a reflective analysis from team members shows that other major challenges include: lack of research funding for participatory assessment; lack of an internal team assessment of the process of participatory appraisal; and communication problems during meetings (locals have difficult in understanding researchers’ objectives and limitations) (Freitas *in prep*). Other issues related to participatory research noted in some of these cases are: fatigue of community members involved in community organization and research projects for long periods of time; the need of researchers/development agents to adapt to users’ schedule and time availability and to spend very long periods of time in the field; and the pressures researchers received from fishers for rapid research feedback (results) in order to change regulations faster.

Creating new arenas for cross-scale institutional management and sharing experiences

All these initiatives have created new arenas for cross-scale institutional management. In particular, they have created a space for political inclusion of a working class traditionally socially excluded – the fishers. What one sees in all these four cases is a lot of learning-by-doing and exchange of knowledge and experience. Most of the initiatives, if not all, built on existing experience somewhere else. The Forum Lagoa dos Patos, for example, were established based on two successful experience of community-based management in nearby lagoons – also initiated by the same organization two years before (Reis and D’Incao 2000). The Ibiraquera Project initially used the “Participatory Local

Level Assessment of Life Support Systems – A Methodological Manual (Gadgil et al. 2000)” as research method, which was developed in India (NMD-UFSC 2004). The Extractive Reserve initiative drew on the available government institutional framework, in which ‘extractive reserve’ is one of the Brazilian categories of protected areas (Lobão 2000).

Within the learning/sharing experience context, these initiatives have (or intend to) also served as a model for other projects in same region or in other country region. This is the case of the Reservoir Project. The project was initiated as pilot project in two reservoirs. Later, project activities extended to five reservoirs within the same watershed (Barbosa and Hartmann 1997). The same project has been considered a model for similar endeavors by various organizations on state and regional levels. For instance, the successful experience of the Reservoir project towards community empowerment and strengthening of citizenship, and in particular in promoting social learning, participatory democracy, discursive design of management, and co-management, led the project staff to assist the state government in organizing community members for participation in a commission of reservoir users for integrated water resource management (Barbosa and Hartmann 1997, Hartmann and Campelo 1998).

At the Extractive Reserve, local fishers have shared experiences with fishers from other places intending to create new Maritime Extractive Reserves (Lobão 2000). One of the goals of the NMD/UFSC research team coordinating the Ibiraquera Project is to replicate the methodology at a large scale (larger watershed) (NMD-UFSC 2004).

Positive learning feedbacks of resource management have contributed to enlarge the actual arena of cross-scale institutional linkages. For example, the positive outcome of a legal dispute led by the Local Agenda 21 Forum of Lagoa de Ibiraquera to close a shrimp farm at the lagoon has strengthened the Forum credibility among community members, government and business people, as a space to discuss the Lagoon problems and search for solutions (Freitas *in prep*). At the Forum Lagoa dos Patos, something similar has occurred:

“Facing problems of representation, legitimacy and recognition is creating a positive feedback through an institutional learning where participants of the Forum of Patos Lagoon are developing the means to achieve a better internal organization to cope with the external

influences, and therefore to strengthen the co-management arrangement”
(Kalikoski et al. 2002)

“Because many of the 21 institutions that participate of the Forum represent interests beyond fisheries (e.g., Public Ministry, Environmental Agency), opportunities are being created for the Forum to challenge decisions which impact artisanal fisheries, thus empowering local institutions and fishers’ communities to call for better governance of the natural resources in the region” (Kalikoski and Vasconcellos *in press*),

Conclusions

This paper examines four cases of participatory fisheries management and points out many of the challenges of implementing local-level, participatory assessment and management in Brazil – a nation with a history of centralized decision-making. In the following paragraphs, I present a summary of them.

Policy-makers preparation to accept local knowledge as a credible knowledge system that may complement scientific knowledge varies largely. Acceptance of local knowledge seems to depend more on each policy-maker beliefs on the potential of community-based resource management (CBRM) than on the agenda of his/her organization. Of course other cases may exist where policy-makers willing to promote CBRM are constrained by the agenda of his/her organization – but in none of the cases analyzed here such situation was reported.

Concerning the extent to which local resource users (used to paternalistic, top-down decision-making) are prepared to engage in participatory research and management, this paper shows that some users seem not yet prepared for such challenge. Much capacity building concerning community organization and empowerment is needed, in particular, to overcome decades of socio-economic marginalization and to find a way out of the patron-client culture in resource management. Capacity building to engage in participatory research and management is needed not only by resource users but also by fieldworkers (government and NGO staff, including science-trained researchers). Most of the initiatives have demonstrated a lack of qualified personnel, who

are able to accept different understanding of resource condition, ecosystem dynamics, and management problems, and are able to mediate conflicts and facilitate the flow of knowledge between bureaucrats and resource users.

The conflicting agenda and power dispute of many government agencies, and within some agencies, is another major constraint in implementing participatory cross-scale management where there is no tradition on such approach. In fact, all the cases have faced several degrees of management constraints due to lack of support from some government agencies at different political levels and economic sectors.

The role of each initiative in combining local and scientific knowledge to improve policy also varied, but overall, my impression after reading all the publications is that scientific/technical knowledge still play a major role in decision-making, despite the fact that the first round of decisions are made locally by resource users and civil society (i.e., before regulation proposals are submitted to federal government approval).

In spite of the entire advocacy from government agencies and individual efforts to promote participatory management, at the end, decision-making is still centralized at the federal level. Moreover, in some other Brazilian experiences the participatory management ‘slogan’ has been used to engage resource users in management in order to legitimate assessments based on scientific knowledge or a decision-making process, which is in fact manipulated to achieve the goals of government or more powerful stakeholders (Freitas 2004, pers. comm.)

According to Sick (2002: 2), “Key to the success and flexibility of the next generation of [resource management institutions] will be the timely collection and dissemination of information among all levels of management in a manner mutually understandable to all stakeholders.” In theory, both formal and informal co-management arrangements may enable knowledge flow (both local and scientific) across levels. In practices, there is a lack of mechanisms for integrating the knowledge base and management efforts at local level with knowledge base and management efforts at larger scales. The challenge is to create more multi-level institutions to help understand ecosystem dynamics at different scales and how ecosystem management at one level affects management at lower and higher levels (the panarchy concept).

Last, although all these experiences have created new arenas for cross-scale institutional linkages, much is to be done in order to fit management institutions with one another and with the scale of management problems they are addressing.

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Appendix I. Cases of participatory fisheries management in Brazil

Case I	Ceará Reservoir Fisheries Project (PAPEC)
Management type	Informal co-management between resource users and federal government in co-operation with an international development agency
Establishment date	1989-1990
Stakeholders	Fishers (several gear-groups), DNOCS ¹ , IBAMA ² , GOPA-GTZ ³ ; several government and non-governmental organizations on federal, state and municipal levels
Initiative	Brazilian-German technical co-operation project (IBAMA-GTZ facilitated implementation)
Objectives	Integrated, participatory and sustainable resources management of public reservoir ⁴ [2, 3]
Preparation strategies	<ul style="list-style-type: none"> - Environmental awareness [1, 2] - Training in aspects of community organization, empowerment, and leadership [1, 2]
Actions/methods	<ul style="list-style-type: none"> - Promoting institutional arrangements for resource management (encourages regular meetings and fisheries agreements) and adaptive management [2, 3] - Conversion of fisher proposals into decrees: Agreements are submitted to IBAMA for ratification (advisory co-management) [2, 3] - Training courses for voluntary environmental agents (1997) [3] - Other actions: Entrepreneurial capacity formation; formation of revolving funds for small enterprises in communities; development of complementary sources of income [2]
Users involvement	<ul style="list-style-type: none"> - Bi-monthly meetings; annual fishing congress [1, 2, 3] - Fishers are involved in data gathering, decision making (local level), rule enforcement (volunteers), habitat protection and restoration, resource use co-ordinations [2, 3] - Although users are involved in data gathering, data analysis is carried out by state agencies [2]
Gov't involvement	<ul style="list-style-type: none"> - Federal: IBAMA (state office promoted a number of activities), DNOCS - State: State office of IBAMA; Secretaria do Meio Ambiente⁶; Secretaria dos Recursos Hidricos⁷; COGERH⁸ - Municipal: municipal environmental and agricultural departments⁹; also PAPEC was supported by and contributed to a network of municipal governments (Comite da Bacia do Curu)

¹ National Department of Works Against Droughts

² Brazilian Environmental Agency (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)

³ German Agency for Technical Co-operation

⁴ Project objectives changed from “mainly technical to institutional development, and from predominantly fisheries-oriented to integrated reservoir resource management”

⁵ Community-based resource management

⁶ Secretariat for the Environment

⁷ Secretariat for Water Resources

⁸ Company for the Water Resources Management (Compania do Gerenciamento dos Recursos Hidricos)

⁹ Secretarias Municipais de Agricultura e do Meio Ambiente

[1] Christensen et al. (1995); [2] Barbosa and Hartmann (1997); [3] Hartmann and Campelo (1998)

Appendix I. (cont'd)

Case II	Maritime Extractive Reserve (MER) of Arraial do Cabo
Management type	Extractive Reserve: Formal co-management between users and federal gov't (CNPT-IBAMA ¹)
Establishment date	1997
Stakeholders	Fishers (several gear-groups); CNPT-IBAMA; AREMAC ² , UFF ³ , tourism sector
Initiative	Gov't (IBAMA agent from a local office)
Objectives	<ul style="list-style-type: none"> - Promote sustainable fisheries and traditional livelihoods - Create and implement a management plan for the MER
Preparation strategies	<ul style="list-style-type: none"> - Identification of the user groups - Elaboration of a MER project (IBAMA and UFF) - Project approval by CNPT-IBAMA - Federal Decree creates MER - Creation of a new fisher association (AREMAC) to co-manage the MER with IBAMA
Actions/methods	<ul style="list-style-type: none"> - AREMAC assemblies to elaborate a management plan - Scientific assistance from UFF - Management plan analyzed and approved by IBAMA <ul style="list-style-type: none"> o Management innovation: Voluntary Environmental Agent o Based partially on previous local fishing agreements (<i>acordos</i>): direct negotiation with no facilitator or superior authority
Users involvement	<ul style="list-style-type: none"> - Participation in AREMAC meetings - Participation in rule enforcement
Gov't involvement	<ul style="list-style-type: none"> - Federal: IBAMA – local office agent is very active - State: Environmental Military Police (rule enforcement) - Municipal: first supported the project and then became a barrier to its implementation

¹National Centre for Sustainable Development of Traditional Peoples (Centro Nacional de Desenvolvimento Sustentável de Populações Tradicionais) / Brazilian Environmental Agency (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)

²Associação da Reserva Extrativista Marinha de Arraial do Cabo (Community-based organization)

³Fluminense Federal University

[1] Lobão (2000); [2] Silva (in press)

Appendix I. (cont'd)

Case III	Forum Lagoa dos Patos
Management type	Multistakeholder body (Forum)
Establishment date	1996
Stakeholders	21 organizations; including fishermen organizations, fishermen unions, religious movement, fishing industries union, official environmental agencies, law enforcement units (IBAMA ¹ division), universities, State Government, public defender, NGOs, technical assistant organizations and municipalities (small-scale fishers: > 3,500)
Initiative	IBAMA's regional research unit ¹ (Rio Grande) and Fishing Catholic Body
Objectives	<ul style="list-style-type: none"> - Overall: Discuss and develop alternative actions to mitigate and/or resolve the problems of the fishers and the crisis in the artisanal fisheries sector; share decisions to address problems more effectively [4] - Forum minutes: [2] <ul style="list-style-type: none"> o To organize the artisanal fisheries sector in relation to fisheries administration policies o To prompt partnerships within the sector in order to implement action plans to rebuild the productive capacity of the fisheries resources in the Lagoa dos Patos o To establish criteria that allow the fishing effort control as one mechanism for rebuilding fisheries resources o To encourage the collective organization for the support of local sustainable artisanal fishing communities
Preparation strategies	(not clear)
Actions/methods	<ul style="list-style-type: none"> - Workshops, led by IBAMA, involving several stakeholders, including fishers, to identify main fisheries problems and discuss about more appropriate management methods [1]; evaluation of the present practices of fisheries management and enforcement [1] - Encouragement of co-operative initiatives [1] - Planning and implementation of new management regulations (3 years); defining and revising rules to regulate the fisheries (rules devised locally were legitimized by federal decrees) [1, 4] - Participatory research: Fishers involved in design and data collection [3]
Users involvement	<ul style="list-style-type: none"> - All the 21 organization representatives have the right to speak and vote. Public can attend the meetings with no right to vote [1] - Quite low number of fisher representatives (only coordinators of fisher organization and fisher union) [1] - Monthly meetings, plus other meetings of the Directive Board [1]. Some organizations were either absent or rarely present at the general meetings [2]
Gov't involvement	<ul style="list-style-type: none"> - Federal: IBAMA (through its regional/state research unit) - State: not clear which sectors are involved - Municipal: Not clear which sectors and municipalities are involved

¹Brazilian Environmental Agency

²IBAMA Research Unit is completely apart from IBAMA's enforcement division

[1] Reis and D'Incao (2000); [2] Kalikoski et al. (2001); [3] D'Incao and Reis (2002); [4] Kalikoski and Vasconcellos (*in press*).

Appendix I. (cont'd)

Case IV	Lagoa de Ibiraquera Project
Management type	Multistakeholder body (Forum)
Establishment date	Ibiraquera Local Ecosystem Assessment Project (2001) Local Agenda 21 Forum (2002)
Stakeholders	Resource users, local community councils ¹ , local NGOs, local business associations, academic researchers, municipal gov't, state gov't, federal gov't <i>Forum members</i> : local NGOs and CBOs, and academic researchers (gov't agencies are sometime guests in their meetings)
Initiative	University research team (NMD/UFSC ²)
Objectives	<ul style="list-style-type: none"> - Generate and integrate knowledge about local social-environmental problems through participatory assessment [1] - Improve local people's environmental awareness [1] - Empowerment and capacity-building for co-management and ecodevelopment [1] - Contribute to gov't scientific information systems on coastal ecosystems (GERCO3, ORLA4, REVIZEE5, PRONABIO6) [1] - Provide scientific consultancy to identify alternative strategies for resource appropriation and create an adaptive co-management system [1] - Elaborate a participatory fisheries management plan⁷ [3]
Preparation strategies	<ul style="list-style-type: none"> - Project presentation to stakeholders [1, 3] - Capacity-building (ecodevelopment courses) – contact with local schools has increased team acceptance by locals [1, 2]
Actions/methods	<ul style="list-style-type: none"> - Method: Participatory Local Level Assessment of Life Support Systems – A Methodological Manual (Gadgil et al. 2000) [1] - Phase 1: literature review; archival research; cartographic research; participatory assessment of social and ecological systems (led by the university team) (almost completed) [1] - Phase 2: presentation of data analysis to stakeholders, discussion and envisioning resource management alternatives (to be completed in 2005) [1] - Other actions: capacity building (training in education for ecodevelopment, artisanry, health; seminars on conservation units and on fisheries management) [1, 2, 3]
Users involvement	<ul style="list-style-type: none"> - Participation in local ecosystem assessment and on Forum meetings [3]
Gov't involvement	<ul style="list-style-type: none"> - Federal: IBAMA (mainly listener, ineffective involvement) - State: EPAGRI; FATMA (mainly listeners, ineffective involvement) - Municipal: disclaimed responsibilities for environmental problems

¹Community-based organization

²Research Unit on Environment and Development (NMD) of the Federal University of Santa Catarina (UFSC)

³National Program for Coastal Management (Programa Nacional de Gerenciamento Costeiro)

⁴Integrated Coastal Management Project (Projeto de Gestão Integrada da Orla)

⁵Assessment Program on Sustainable Potentials of Living Resources on the Exclusive Economic Zone – Ministry of Environment (Programa de Avaliação do Potencial Sustentável de Recursos Vivos na Zona Econômica Exclusiva – MMA)

⁶National Program on Biological Diversity (Programa Nacional sobre a Diversidade Biológica)

⁷Major objective of a project approved in 2003 and funded by the National Fund for the Environment (FNMA) of the Brazilian Ministry of Environment.

[1] NMD-UFSC (2003); [2] Freitas (in prep); [3] my own knowledge about the project