CHAPTER 14

Barriers to Local-level Ecosystem Assessment and Participatory Management in Brazil

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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 Ecosystem Assessment 2004). This chapter aims to contribute to such effort by capturing lessons from participatory local-level ecosystem assessment and resource management in Brazil.

Participatory approaches in natural resource management have the potential to bridge knowledge systems (e.g., local ecological knowledge and scientific knowledge), enable knowledge flow across scales, empower local people, speed up technological adaptation, enhance human capital, and increase adherence to resource management goals (Chambers 1991; McAllister 1999). Since the Rio 92 Conference, the discourse of participatory management has been incorporated into several government policy agendas, particularly in high-biodiverse developing countries with a history of centralized (top-down) natural resource management.

In Brazil during the military regime (from the mid-1960s to the mid-1980s), environmental conservation policies were based on a command-and-control approach, with no attention paid to local knowledge and needs, leading more often than not to ecosystem degradation (Fearnside 1979, 1987; Moran 1983; Hecht and Cockburn 1989; Becker 2001)—the pathological resources management (Gunderson, Holling, and Light 1995). Since 1990, when the first

extractive reserve was created by the federal government in the Amazon, the Brazilian legislation has contained a legal (formal) mechanism to promote participatory management and, hence, to bridge local and scientific knowledge.[1] The cross-scale institutional arrangement in this case is a formal comanagement—a shared responsibility between government, users, and other stakeholders in resource management.[2]

Interestingly enough, informal comanagement arrangements—in which government approves area-specific regulations based on local demand and local ecological knowledge—already existed before 1990; for instance, Seixas and Berkes (2003) documented informal comanagement occurring at the Lagoa de Ibiraquera since 1981. All these formal and informal arrangements created a space for users and decision makers from different levels to share their needs, concerns, and knowledge about the resource conditions in order to better understand management problems and improve management regulations.

Over the years, these formal and informal comanagement arrangements started to "replicate" throughout the country, without taking into account sociocultural differences among localities.[3] Moreover, most of the arrangements were, in fact, state initiated (sometimes with support from nongovernmental organizations [NGOs] or research units) and state run, with local users having limited real input (Sick 2002). In light of this situation, several questions are raised here: 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 (who are used to paternalistic, top-down decision making) prepared to engage in ecosystem assessment 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 understandings of ecosystem dynamics? We see 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.

Thus the objective of this chapter is to identify some of the driving forces that impede local-level ecosystem assessment and participatory management in Brazil. To our knowledge, local-level ecosystem assessment has only recently (since the late 1990s) started in Brazil, and few reports are available about it (e.g., NMD 2004). Hence, we focus our attention on cases of participatory management, which often include participatory research, in order to bring out some important

issues that may be broadened to assessment activities, particularly concerning bridging different knowledge systems and information across scale. For this purpose, we analyze four case studies of participatory fisheries management, based on government-, NGO-, or research-driven initiatives in different regions of Brazil.

Methods

This chapter analyzes four cases studies of participatory fisheries management from different regions of Brazil (table 14.1; see also the online appendix at http://www.islandpress.org/bridging_scales), none of which is an MA case. The first three cases were extracted from the literature. The fourth—also a Brazilian initiative of conducting local-level ecosystem assessment[4]—is based on project reports and joint team project experiences in which we were partially involved. All analyses presented in this chapter are based on our own interpretation of the publications and may not totally reflect the authors' opinions.

We chose these cases because they are examples of current or past fisheries comanagement in Brazil, which has been well documented by the scientific literature. Future research could expand this sample to include other also quite interesting fisheries comanagement 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).

Case Studies Background

Historically, three of the study cases occurring in natural ecosystems (Extractive Reserve, Lagoa dos Patos, and Lagoa de Ibiraquera) experienced successful community-based resources management (CBRM; i.e., resource abundance, high catches, and few user group conflicts) until the early 1960s (Seixas and Berkes 2003; Silva 2004; Kalikoski and Vasconcellos 2005). In 1967, the Federal Fisheries Agency (SUDEPE) was created (later replaced by the Brazilian Environmental Agency, or IBAMA, in 1989) as part of the national policy.[5] Between 1967 and the establishment of comanagement arrangements (respectively in 1997, 1996, and 2002), government centralized management was the norm in these localities and locally devised rules were no longer respected. An exception was the advisory comanagement agreements between fishers and

Table 14.1

Case studies in participatory fisheries management in Brazil

Case Study (region)	Management Arrangement (establishment date)	Source of Information
Ceará Reservoir Fisheries Project (northeast region)	Informal comanagement between users and federal government (supported by international development agency) (1989/1990)	Christensen et al. (1995) Barbosa and Hartmann (1997) Hartmann and Campelo (1998)
Maritime Extractive Reserve in Arraial do Cabo (southeast region)	Formal comanagement between users and federal government (1997)	Lobão (2000) Silva (2004)
Forum Lagoa [lagoon] dos Patos (south region)	Multistakeholder body (forum) (1996)	Reis and D'Incao (2000) D'Incao and Reis (2002) Kalikoski, Vasconcellos, and Lavkulich (2002) Kalikoski and Vasconcellos (2005)
Lagoa de Ibiraquera Project (south region)	Multistakeholder body (forum) (2002) Ibiraquera Local Ecosystem Assessment Project (2001)	NMD (2004) Freitas (forthcoming)

SUDEPE/IBAMA at the Lagoa de Ibiraquera during the 1980s and early 1990s (Seixas and Berkes 2003).[6] The fourth case study, the Ceará Reservoir fisheries system, experienced government centralized top-down management from the time the reservoir was built until the Reservoir Fisheries Project was implemented (Barbosa and Hartmann 1997).

All of the initiatives described here aim to promote sustainable fisheries through participatory management. The Ibiraquera project is the only one 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 other three initiatives have advanced into fisheries management and were able to influence government to pass new fisheries regulations for their localities.

Results and Discussion

Barriers to Participatory Research and Management

Several factors impede the full success of participatory research and management in Brazil. Below we present and discuss those found in at least three of the four cases analyzed here (table 14.2).

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 significantly from case to case. In the three cases where participatory research was reported (Ceará 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 our 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 the community level and supported fishers to formulate management recommendations in at least two cases (W. D. Hartmann, personal communication, 2004; P. F. Vieira, personal communication, 2004).

Barriers to user involvement in participatory research and management were, in general, related to a history of socioeconomic and cultural marginalization of artisanal fishers and the culture of patron-client relations established in Brazil. Much prejudice still exists against fishers' knowledge and their perceived "low" cultural and literacy level; fisher participation, although advocated by many, is in fact "undermined and sabotaged at many levels and by many organizations" (Barbosa and Hartmann 1997, 442).

Misrepresentation of fishers within their organizations and in the decision-making process hinders the potential of local knowledge use in decision making. Quite often, long-established fisher organizations are controlled by a local elite that neither represents the interests of most artisanal fishers nor holds their knowledge.[7] This misrepresentation may reflect a lack of organizational skills of fishing communities, which have experienced many social and economic influences during the past four decades (e.g., exposure to new values brought by outsiders, modernization of fishing gear and transportation systems, opening to a market-oriented society, and change from subsistence to

Table 14.2

Barriers to participatory research and management. The barriers to participatory research and management shown here were present in all four cases analyzed (with the exceptions noted).

Barriers to User Participation
• Socioeconomic and cultural marginalization of artisanal fishers
• Culture of patron-client relations and corruption
• Prejudice against user knowledge and literacy level by researchers and decision makers (except Ibiraquera project)
• Misrepresentation of fishers within their associations and in decision making
• Physical and economic threats to those involved in assessment and enforcement (except Forum Lagoa dos Patos)
• Existing conflicts and hierarchies (except Forum Lagoa dos Patos)
Government-related Barriers
• Lack of government support to or recognition of comanagement institutions
• Ambivalent support from government representatives
• User lack of trust of government agencies with a stake in the participatory management
• Ineffective enforcement by government
• Conflicting government policies and agendas (all levels) (except Ceará Reservoir project)
Governance Challenges
• Low-level comanagement: decision making not totally shared; government holding the last word
• Lack of a clear property rights system in the area
• Lack of effective government presence
• Lack of commitment and support from all stakeholders, particularly government agencies
• Lack of capacity (funds, training, and experience) from different partners (except Ceará Reservoir project)

commercial fisheries). These influences have in turn produced a breakdown of their traditional management system.[8]

Previous existing conflicts among stakeholder groups that have not been properly addressed by the initiative also hamper user participation in resource management and, consequently, the full potential of bringing together different understandings of ecosystem and resource conditions. Some community members involved in ecosystem assessment, planning, and rule enforcement have been physically, emotionally, or economically threatened by rule transgressors.

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 comanagement (Pomeroy and Berkes 1997). Nevertheless, in all 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 comanagement institutions. This situation involves two factors in particular. First, a high degree of multiplicity and fragmentation of government exists 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). Also, power disputes and conflictive agendas between government agencies from different sectors and political levels are quite common. The second factor is that support by government staff to participatory management depends more on staff members' own beliefs about CBRM and not so much on the organization's agenda (ambivalent support) (Barbosa and Hartmann 1997). Hence, conservative representatives of government agencies (who are used to top-down management) tend to hinder the participatory management process.

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 an inaccurate image of the new management institution as another enforcement organization, thereby repelling user involvement in the process because of users' lack of trust in such 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 a major problem hampering resource management.

Governance Challenges

Many governance-related problems were observed in these four cases of participatory management. Of particular interest 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 four cases offer a democratic space through which

fishers can express their values and knowledge, the final step of the decision-making process does not remain in the fishers' hands. In all different forms of comanagement (formal and informal arrangements), locally devised rules need to be sanctioned by IBAMA at the federal level to be enforced by government agencies. In other words, these are low-level comanagement arrangements 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 either 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 because the resource users did not perceive the rules as legitimate—a fact well discussed in the common property literature (Ostrom 1990; Ostrom et al. 2002).

Two problems were identified concerning the level of decision making and the use of local knowledge in the cases studies. First, formalizing locally devised rules at a higher political level (national in all cases) increased the rules' legal status but at the same time decreased flexibility for rule changes (i.e., hindering rapid feedback mechanisms for rule adaptation according to local resource dynamics and climatic conditions). On the other hand, frequent (yearly) rule changes (adaptive management) at the Ceará Reservoir project weakened management impact because it generated confusion and insufficient time to evaluate the effects of management rules on fishery (Hartmann and Campelo 1998).

Second, government staff and researchers tend to prefer a few generally applicable and easily controllable rules to reduce transactional costs (i.e., the "one-size-fits-all" syndrome [Berkes 2003]); fishers, in contrast, desire specific rules for each locality within a large ecosystem, resulting in many different rules for this large ecosystem. This is clearly a case of institutional misfit (Folke et al. 1997; Brown 2003) in resource management, especially in a very large heterogeneous ecosystem, as in the case of Lagoa dos Patos (D'Incao and Reis 2002).

The question of responsibility over resource management is key. Comanagement is, theoretically, a way for government to share responsibility with users. Nevertheless, after decades of command-and-control top-down fisheries management, many fishers have shown that they are not used to taking (or willing to take) responsibilities for resource management. Moreover, communities are demanding better, more effective actions and support from government for resource management, not less. For instance, communities want government agencies to enforce locally devised rules sanctioned by IBAMA. They also want recognition of local ecological knowledge and support to comanagement from

Table 14.3
Use of local and scientific knowledge in participatory management

Use of Local and Scientific Knowledge	Ceará Reservoir Project	Extractive Reserve	Forum Lagoa dos Patos	Ibiraquera Project
Influences of scientific knowledge				
Environmental education about local ecological processes	X			X
Research information feedback to fishing communities	X		X	X
Researchers advising users when local knowledge is not sufficient		X		X
Local decisions largely influenced by scientific/technical knowledge		X (likely)	X	
Influences of local knowledge				
Participatory research	X		X	X
User participation in policy making at higher levels (conference, watershed committee)	X			X
Local decisions partially based on previous informal management system		X		

government agencies directly or indirectly involved in the process. This is by no means a return to command-and-control management.

Participatory research and management requires an interdisciplinary approach (i.e., bridging different disciplines), and in Brazil the higher-level education is still very disciplinary. Thus, because participatory approach is relatively new in Brazil, well-trained people (government and NGO staff and researchers) able to conduct the process are in short supply. Another problem is that government funds to carry out participatory management are insufficient, despite the extensive recent advocacy toward such an approach.

Knowledge Flow across Scale

Institutions for Combining Local and Scientific Knowledge

Each initiative's effort toward sharing and combining technical/scientific and local knowledge systems varied largely (table 14.3). The Ibiraquera project's first proposal was to carry out a participatory local-level ecosystem assessment

that documents local knowledge for further integration with scientific knowledge. Later, the Ibiraquera project focused on initiating a local Agenda 21 forum for future resources comanagement and ecodevelopment. The other three initiatives focused mainly on improving resource management; sharing and combining knowledge systems were a means toward this end for some participants.

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 insufficient (see table 14.3). Environmental education was conducted through courses and seminars given to fishers, local schoolteachers, and the community in general. Pure scientific or participatory research findings were presented to fishers during meetings to discuss resource management, and sometimes to propose management regulations. University researchers speaking at some of these meetings advised local users when local knowledge was not sufficient to make a decision (e.g., at the Extractive Reserve and the Ibiraquera projects). Clear mechanisms that enable use and integration of local knowledge in resource management were more difficult to find.

Despite the existence of formal or informal comanagement arrangements, it is difficult to measure how much local knowledge has been used in decision making in each case, particularly because this analysis uses secondary data. In the Ceará Reservoir project, until 1997, all community-proposed management measures were ratified by IBAMA, becoming fisheries regulations (Barbosa and Hartmann 1997). However, based on the information given by Barbosa and Hartmann (1997) that (1) "there [were] no local traditions of [fisheries] resource use and management" in the area because of the reservoir's recent origin and (2) 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 (2004), 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 also been influenced by the Scientific Technical Council formed by university researchers, which is linked to the Associação da Reserva Extrativista Marinha de Arraial do Cabo (an association responsible for comanaging the reserve with the government) (Lobão 2000).

At the Forum Lagoa dos Patos, decision making has been largely influenced

by scientific and technical knowledge (Reis and D'Incao 2000; Kalikoski, Vasconcellos, and Lavkulich 2002), while user knowledge has been overlooked (Kalikoski and Vasconcellos 2005). Nevertheless, some initial effort toward 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, Vasconcellos, and Lavkulich 2002).

Even when a project's primary objective is to integrate knowledge systems, as for the Ibiraquera project, the distance between objectives and results is large. Until January 2004, three years after the project started, the Ibiraquera project had not been able to create a database integrating data from all research teams involved in the local-level participatory assessment (fisheries, aquatic invertebrates, birds, game and domestic animals, landscape, agriculture, water quality, health, socioeconomic-political-cultural issues); moreover, each research team has collected, analyzed, and documented its data separately. At the time of this writing, some results had been presented at meetings of working groups of the recently established Forum of the Lagoa de Ibiraquera (e.g., fisheries working group), but no overall summary of data had been presented to communities in a systematic method allowing for discussion, validation, and use by the communities—despite being anticipated in the project methodology.

In fact, the Forum 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, forthcoming). The forum members have tried to influence decision making by inviting government agents (municipal, state, and federal) as guests to their meetings. Some forum members and community representatives have also participated in a regional fisheries conference intended to influence policy at state level. The involvement of local resource users in subregional management institutions (e.g., a watershed management committee) was also noted at the Ceará Reservoir Project (Barbosa and Hartmann 1997).

Impediments to Knowledge Flow across Scale

Table 14.4 presents impediments to knowledge flow across scale found in the four cases. In most fishing areas in Brazil except conservation areas, there exists no legal mechanism that compels government organizations to consult resource users for management decision making. Of the four cases analyzed here, only the Extractive Reserve provides such a mechanism—a formal

comanagement arrangement in which a management plan has to be developed by a local organization of resources users to be later analyzed and approved by the government (IBAMA). In two other cases of informal comanagement arrangement, the Ceará 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 the organization's agenda (Hartmann and Campelo 1998).

In the fourth case, the Ibiraquera project, the situation is poorer compared to the other three cases. This is for three primary reasons: (1) because many government agencies at the municipal and state levels do not support the civil society initiative of establishing a forum to manage local resources (NMD 2004; Freitas, forthcoming); (2) because the municipal government did not accept a representative indicated by the forum on the Municipal Environmental Board (i.e., it created a barrier to knowledge flow) (NMD 2004); and (3) because government agencies claimed that before they take actions to reverse degradation processes, more scientific studies (which usually take a long time to complete) have to be carried out to prove local knowledge and perceptions about ecosystem degradations (NMD 2004).

In fact, many government agencies and even some researchers do not accept and value local knowledge, and some government staff members do not accept user rights for comanaging. For instance, a segment of the Brazilian Navy does not recognize fisher rights to comanage the Extractive Reserve; moreover, the Navy's research institute continues to carry out research within the reserve area without interacting with local fishers (Lobão 2000). Another example, despite some initial effort toward participatory research (D'Incao and Reis 2002), Kalikoski and Vasconcellos (2003) 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 despite its role in helping maintaining a productive and resilient fisheries system before the 1970s. Indeed, these authors point out that "illiteracy and socio-economic marginalization create low expectations of the management value of fishers' knowledge among scientists and decision makers" (p. 452)

Another limitation to knowledge flow relates to the lack of institutions to create an integrated coastal zone management plan for the Brazilian coast (Kalikoski, Vasconcellos, and Lavkulich 2002). Integrated coastal zone

Table 14.4

Impediments to knowledge flow across scale

Impediments to Knowledge Flow across Scale	Ceará Reservoir Project	Extractive Reserve	Forum Lagoa dos Patos	Ibiraquera Project
Some government staff not accepting and valuing local knowledge (prejudice)	X	X	X	X
Lack of legal mechanisms that compel government agencies to consult fishers	X		X	X
Some government agencies not accepting user rights for comanaging	X	X		X
Local knowledge use depending on government staff's own beliefs about potentials of community-based resource management	X		X	
Overall management process is still top-down based on conventional scientific approach			X	X
Lack of an integrated coastal zone management plan			X	X
Conflict between users and scientists about resource conditions			X	X
Limited participatory research and exchange of knowledge			X	
Misfit between institutions and ecosystems that hinders use of fisher knowledge in management			X	
Lack of funding for participatory, local-level ecosystem assessment				X

management has the potential to bring together resource users and government agents from different economic sectors, geographical scales, and political levels to exchange knowledge and experiences in order to develop and implement a management plan. Indeed, many problems affecting local resource management are external to the scale or sector being managed. For instance, many of the factors affecting the Lagoa dos Patos fisheries are related to the industrial fisheries on the coast outside the estuarine zone (Kalikoski, Vasconcellos, and Lavkulich 2002). At the Lagoa de Ibiraquera and the Extractive Reserve, local fisheries are also affected by human actions at a larger ecosystem scale (i.e., the coastal zone).

Related also to the issue of scale, there is often a misfit between

management institutions governing a large ecosystem and the local characteristics of (and local knowledge about) its parts. For instance, fishing rules that may be appropriate for one area of a large ecosystem may not be so for another area, and the local knowledge held by a group of fishers for the first area may differ from the local knowledge held by another group of fishers for the second area. This fact may hinder fishers' stewardship of resources and the use of their knowledge in managing large ecosystems (Kalikoski and Vasconcellos 2005).

The Ibiraquera project was the only one of the four initiatives that clearly aimed to link (and integrate) information systems related to the conditions of resources and ecosystems at different scales. However, three years after the project started, the team had spent so much time searching for funding (the project was funded only after June 2003) and trying to coordinate team members that almost no effort had been made by then toward elaborating a complete database of the local assessment—not to mention integrating it to other government scientific information systems encompassing larger ecosystems.

Finally, despite the effort of certain people engaged in some comanagement arrangements in combining local and scientific knowledge for resource management, common understanding of the problems and agreement on measures still may not be reached. Conflicts among users, scientists, and decision makers over resource conditions may still occur; hence, stakeholders must craft mechanisms that facilitate conflict resolution and consensus building.

Challenges in Conducting Local-level Ecosystem Assessment and Participatory Research

Several challenges emerged in these initiatives when conducting participatory research. A major challenge is how to congregate and coordinate an interdisciplinary, transdisciplinary research team (i.e., researchers from different disciplines with different understanding and approaches to user participation in research and management) (NMD 2004; Lobão 2000). The task becomes even more difficult when considering the long periods of time required in participatory assessment and management—in many cases, researchers are students, which results in a rapid turnover of team members (NMD 2004).

For the Ibiraquera project—the only one focusing on local-level ecosystem assessment—a reflective analysis by 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 difficulty understanding researchers' objectives and limitations) (Freitas, forthcoming). 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 for researchers and development agents to adapt to users' schedules and time availability and to spend very long periods of time in the field; and the pressures researchers receive from fishers for rapid research feedback (results) in order to change regulations more quickly.

Creating New Arenas for Bridging Knowledge through Cross-scale Institutional Management

All these initiatives have created new arenas for cross-scale institutional management, with the potential to bridge knowledge systems and perhaps compile information from ecosystem assessment at different scales. In particular, they have created a space for political inclusion of a working-class, traditionally socially excluded group—the fishers. They have given an opportunity for fishers to express their needs, knowledge, and concerns. What can be seen in all four cases is much learning-by-doing and exchange of knowledge and experience. Most, if not all, of the initiatives have built on existing experience from elsewhere. The Forum Lagoa dos Patos, for example, was established based on two successful experiences of community-based management in nearby lagoons, which were initiated by the same organization two years earlier (Reis and D'Incao 2000). The Ibiraquera project initially used a research method developed in India (NMD 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 and sharing experiences context, these initiatives also have served (or intend to serve) as a model for other projects in the same region or in another region of the country. For example, the Ceará Reservoir project was initiated as a 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 as a model for similar endeavors by various organizations on state and regional levels. For instance, the experience of the Ceará Reservoir project in community empowerment and strengthening of citizenship—and particularly in promoting social learning, participatory democracy, discursive design of management, and comanagement—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 goal of the NMD/UFSC research team coordinating the Ibiraquera project is to replicate the methodology at a large scale (that of a larger watershed) (NMD 2004).

Positive learning feedbacks from resource management have helped expand the actual arena of cross-scale institutional linkages. For example, the positive outcome of a legal dispute led by the Forum of Lagoa de Ibiraquera to close a shrimp farm at the lagoon has strengthened the forum's credibility among community members, government employees, and businesspeople as a space to discuss the lagoon's problems and search for solutions (Freitas, forthcoming). At the Forum Lagoa dos Patos, something similar has occurred in which participants "are developing the means to achieve a better internal organization to cope with the external influences" (Kalikoski, Vasconcellos, and Lavkulich 2002).

Conclusions

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's beliefs about the potential of CBRM than on the agenda of the person's organization. Of course, other cases may exist in which policy makers willing to promote CBRM are constrained by the agenda of their organizations—but no such situation was reported in any of the cases analyzed here.

Concerning the extent to which local resource users (who are used to paternalistic, top-down decision making) are prepared to engage in participatory research and management, this chapter 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 socioeconomic 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 a different knowledge system (i.e., a different understanding of resource condition, ecosystem dynamics, and management problems) and who are able to mediate conflicts and facilitate the flow of knowledge between bureaucrats and resource users.

The conflicting agendas and power disputes among many government agencies, and within some agencies, is another major constraint in implementing participatory cross-scale management (and thus in bridging different knowledge systems); they have no tradition for such an approach. In fact, all four cases have faced several degrees of management constraints because of 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 varied, but our overall impression after reading all the publications is that scientific and technical knowledge still plays a major role in decision making, despite the fact that the first round of decisions is made locally by resource users and civil society (i.e., before regulation proposals are submitted to federal government approval).

In the end, despite the advocacy from government agencies and individual efforts to promote participatory management, 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 of more powerful stakeholders (R. R. Freitas, personal communication, 2004).

In theory, both formal and informal comanagement arrangements may enable knowledge flow (both local and scientific) across levels. In practice, a lack of mechanisms exists for integrating the knowledge base and management efforts at the local level with those at larger scales. The challenge is to create more multilevel institutions to help understand ecosystem dynamics at different scales and how ecosystem management at one level affects management at lower and higher levels.

Finally, although all of these experiences have created new arenas for bridging knowledge through cross-scale institutional linkages, much remains to be done to fit management institutions with one another and with the scale of the management problems they are addressing.

Despite of all the challenges highlighted above, however, all four cases have positive aspects that contributed to improving participatory fisheries management in Brazil and to bridging epistemologies and scales in resource management and ecosystem assessment. For instance, all four cases promoted the involvement of resource users in decision making to an extent not seen before in those areas. At least two cases (the Ibiraquera project and the Ceará Reservoir project) have contributed to fishers' empowerment and enhanced local human capital. In addition, at least one initiative (the Ibiraquera project), and probably the other three, has tried to influence decision making by inviting government agents (municipal, state, federal) as guests to its meetings. Moreover, three initiatives (Forum Lagoa dos Patos, Extractive Reserve, and Ceará Reservoir project) were able to influence federal government to pass fisheries regulations specifically for their localities. These regulations very likely resulted from efforts to bridge epistemologies (local and scientific knowledge) and information assessed at different scales.

References

Allegretti, M. H. 1990. Extractive reserves: An alternative for reconciling development and environmental conservation in Amazonia. In *Alternatives to deforestation: Steps towards sustainable use of the Amazon rainforest,* ed. A. B. Anderson, 253–64. New York: Columbia University Press.

Barbosa, F. I., and W. D. Hartmann. 1997. Participatory management of reservoir fisheries in North-Eastern Brazil. In *Inland fishery enhancements,* ed. T. Petr, 427–445. FAO Fisheries Technical Paper 374. Rome.

Becker, B. K. 2001. Amazonian frontiers at the beginning of the 21st century. In *Human dimensions of global environmental change—Brazilian perspectives,* ed. D. J. Hogan and M. T. Tolmasquim, 301–23. Rio de Janeiro: Academia Brasileira de Ciências.

Begossi, A. 1998. Resilience and neo-traditional populations: The caiçaras (Atlantic Forest) and cablocos (Amazon, Brazil). In *Linking social and ecological systems: Management practices and social mechanisms for building resilience,* ed. F. Berkes and C. Folke, 129–57. Cambridge: Cambridge University Press.

Berkes, F. 2003. Alternatives to conventional management: Lessons from small-scale fisheries. *Environments* 31 (1): 5–19.

Brown, K. 2003. Integrating conservation and development: A case of institutional misfit. *Frontiers in Ecology and the Environment* 1 (9): 479–87.

Brown, K., and S. Rosendo. 2000. The institutional architecture of extractive reserves in Rondônia, Brazil. *Geographical Journal* 166 (1): 35–48.

Castro, F. 2000. Fishing accords: The political ecology of fishing intensification in the Amazon. PhD diss., Indiana University, Bloomington.

Castro, F., and D. G. McGrath. 2003. Moving toward sustainability in the local

management of floodplain lake fisheries in the Brazilian Amazon. *Human Organization* 62 (2): 123–33.

Chambers, R. 1991. Shortcut and participatory methods for gaining social information for projects. In *Putting people first: Social variables in rural development,* ed. M. M. Cernea, 515–37. 2nd ed. Oxford: Oxford University Press.

Christensen, M., W.J.M. Soares, F.C.B. Silva, and G.M.L. Barros. 1995. Participatory management of a reservoir fishery in Northeastern Brazil. *Naga* 18 (2): 7–9.

Cordell, J., and M. A. McKean. 1992. Sea tenure in Bahia, Brazil. In *Making the commons work: Theory, practice, and policy,* ed. D. W. Bromley, 183–205. San Francisco: ICS (Institute for Contemporary Studies) Press.

Diegues, A. C. 1983. *Pescadores, Camponeses e Trabalhadores do Mar* [Fishers, peasants, and sea workers]. Rio de Janeiro: Editora Ática.

D'Incao, F., and E. G. Reis. 2002. Community-based management and technical advice in Patos Lagoon estuary (Brazil). *Ocean and Coastal Management* 45:531–39.

Fearnside, P. M. 1979. The development of the Amazon rain forest: Priority problem for the formulation of guidelines. *Interciencia* 4:338–43.

———. 1987. Deforestation and international economic development projects in Brazilian Amazonia. *Conservation Biology* 1 (3): 214–21.

———. 1989. Extractive reserves in Brazilian Amazonia: An opportunity to maintain tropical rain forest under sustainable use. *BioScience* 39 (6): 387–93.

Folke, C., L. Pritchard Jr., F. Berkes, C. Colding, and U. Svedin. 1997. *The problem of fit between ecosystems and institutions.* Beijer Discussion Paper Series No. 108. Stockholm: Beijer International Institute of Ecological Economics, The Royal Swedish Academy of Science.

Freitas, R. R. Forthcoming. Manejo costero integrado y participativo: Breve descripción del proyecto de ecodesarrollo en la laguna de Ibiraquera, Santa Catarina (Brasil) [Integrated and participatory coastal management: A brief description of the ecodevelopment project at the Lagoa de Ibiraqurea, Santa Catarina (Brazil)].

Gadgil, M., K. Achar, A. Shetty, et al. 2000. *Participatory local level assessment of life support systems—A methodological manual.* Bangalore: Center for Ecological Science, Indian Institute of Science.

Gunderson, L. H., C. S. Holling, and S. S. Light, eds. 1995. *Barriers and bridges to the renewal of ecosystems and institutions.* New York: Columbia University Press.

Hartmann, W. D., and C.M.F. Campelo. 1998. Ambivalent enforcers: Rules and conflicts in the co-management of Brazilian reservoir fisheries. Paper presented at the Seventh Conference of the International Association for the Study of Common Property—Crossing Boundaries, June 10–14, Vancouver, British Columbia.

Hecht, S. B., and A. Cockburn. 1989. *The fate of the forest: Developers, destroyers and defenders of the Amazon.* New York: Verso.

Kalikoski, D. C., and M. Vasconcellos. 2003. Fishers' knowledge role in the co-management of artisanal fisheries in the estuary of Patos Lagoon, southern Brazil. *Putting fishers' knowledge to work,* ed. N. Haggan, C. Brignall, and L. Wood. Conference proceedings, University of British Columbia, August 27–30, 2001. Fisheries Centre Research Report 11 (1): 445–55.

———. 2005. The role of fishers' knowledge in the co-management of small-scale

fisheries in the estuary of Patos Lagoon, southern Brazil. Chap. 14 in *Fishers' knowledge in fisheries science and management,* ed. N. Haggan, B. Neis, and I. G. Baird. Oxford: Blackwell Science / UNESCO (United Nations Educational, Scientific and Cultural Organization).

Kalikoski, D. C., M. Vasconcellos, and L. Lavkulich. 2002. Fitting institutions to ecosystems: The case of artisanal fisheries management in the estuary of Patos Lagoon. *Marine Policy* 26:179–96.

Lobão, R.J.S. 2000. Reservas Extrativistas Marinhas: Uma Reforma Agrária do Mar? [Marine Extractive Reserves: A land reform of the sea?]. Master's thesis, Fluminense Federal University, Niterói, Brazil.

McAllister, K. 1999. *Understanding participation: Monitoring and evaluating process, outputs and outcomes.* IDRC Series. Ottawa, Ontario: International Development Research Centre (IDRC).

Millennium Ecosystem Assessment. 2004. Millennium Ecosystem Assessment Web site. http://www.millenniumassessment.org/ (accessed March 2004).

Moran, E. F., ed. 1983. *The dilemma of Amazonian development.* Boulder, CO: Westview.

NMD (Núcleo de Meio Ambiente e Desenvolvimento—Center for Environment and Development) at the Santa Catarina Federal University (USFC). 2004. Avaliação Local Participativa de Ecossistemas Litorâneos no Sul do Brasil: Projeto Piloto de Criação de uma Agenda 21 Local na Área da Lagoa de Ibiraquera, Municípios de Imbituba e Garopaba, Estado de Santa Catarina [Local participatory assessment of coastal ecosystems in South Brazil: A pilot project to create a local Agenda 21 at the Lagoa de Ibiraquera area]. Partial Project Report to CNPq. Florianópolis, Brazil: USFC.

Ostrom, E. 1990. *Governing the commons: The evolution of institutions for collective action.* Cambridge: Cambridge University Press.

Ostrom, E., T. Dietz, N. Dolšak, P. C. Stern, S. Stonich, and E. U. Weber, eds. 2002. *The drama of the commons.* Washington, DC: National Academy Press.

Pomeroy, R. S., and F. Berkes. 1997. Two to tango: The role of government in fisheries co-management. *Marine Policy* 21 (5): 465–80.

Queiroz, H. L., and W.G.R. Crampton, eds. 1999. *Estratégias para Manejo de Recursos Pesqueiros em Mamirauá.* Série Estudos de Mamirauá, V 5, Coleção Bases Científicas do Plano de Manejo de Mamirauá [Strategies for fisheries management in Mamirauá]. Brasilia: Sociedade Civil Mamirauá, MCT-CNPq, DF.

Reis, E. G., and F. D'Incao. 2000. The present status of artisanal fisheries of extreme Southern Brazil: An effort towards community-based management. *Ocean and Coastal Management* 43:585–95.

Seixas, C. S., and F. Berkes. 2003. Dynamics of social-ecological changes in a Lagoon fishery in Southern Brazil. In *Navigating social-ecological systems: Building resilience for complexity and change,* ed. F. Berkes, J. Colding, and C. Folke, 271–98. Cambridge: Cambridge University Press.

Sick, D. 2002. *Managing environmental process across boundaries: A review of the literature on institutions and resource management.* Minga Program Initiative. Ottawa, Ontario: International Development Research Centre.

Silva, P. P. 2004. From common property to co-management: Lessons from Brazil's first maritime extractive reserve. *Marine Police* 28: 419–28.

APPENDIX TO CHAPTER 14

Cases of Participatory Fisheries Management in Brazil

CASE 1	Ceará Reservoir Fisheries Project (PAPEC)
Management type	Informal comanagement between resource users and federal government in cooperation with an international development agency
Establishment date	1989–90
Initiative	Brazil-German technical cooperation (IBAMA-GTZ facilitated implementation)
Stakeholders at different levels	• *Local:* fishers (several gear groups) (involved in data gathering, decision making [local level], rule enforcement [volunteers], habitat protection and restoration, resource use coordinations [1, 2, 3]) • *Municipal:* environmental and agricultural departments[1]; also, PAPEC was supported by and contributed to a network of municipal governments (Comitê da Bacia do Curu) • *State:* state office of IBAMA[2]; Secretariat for the Environment[3]; Secretariat for Water Resources[4]; COGERH[5] • *Federal:* DNOCS[6]; IBAMA (state office promoted a number of activities) • *International:* GOPA-GTZ[7] • *Unclear:* NGOs (nongovernmental organizations) not specified from which level
Objectives	Integrated, participatory, and sustainable resources management of public reservoir[8] [2, 3]

Preparation strategies	• Environmental awareness [1, 2] • Training in aspects of community organization, empowerment, and leadership [1, 2]
Actions/methods	• 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 comanagement) [2, 3] • Training courses for voluntary environmental agents (1997) [3] • Bimonthly meetings; annual fishing congress [1, 2, 3] • Other actions: entrepreneurial capacity formation; formation of revolving funds for small enterprises in communities; development of complementary sources of income [2]
Opportunities for bridging ecological knowledge	• Participatory research (although users are involved in data gathering, data analysis is carried out by state agencies [2]) • Environmental awareness training about local ecological processes • Frequent research information feedback to fishers and their communities • Fisher participation in watershed management committee

[1] Secretarias Municipais de Agricultura e do Meio Ambiente

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

[3] Secretaria do Meio Ambiente

[4] Secretaria dos Recursos Hidricos

[5] Company for the Water Resources Management (Compania do Gerenciamento dos Recursos Hidricos)

[6] National Department of Works Against Droughts

[7] German Agency for Technical Co-operation

[8] Project objectives changed from "mainly technical" to "institutional development," and from "predominantly fisheries-oriented" to "integrated reservoir resource management"

[1] Christensen, M., W.J.M. Soares, F.C.B. Silva, and G.M.L. Barros. 1995. Participatory management of a reservoir fishery in Northeastern Brazil. *Naga* 18 (2): 7–9; [2] Barbosa, F. I., and W. D. Hartmann. 1997. Participatory management of reservoir fisheries in North-Eastern Brazil. In *Inland fishery enhancements,* ed. T. Petr, 427–445. FAO Fisheries Technical Paper 374. Rome; [3] Hartmann, W. D., and C.M.F. Campelo. 1998. Ambivalent enforcers: Rules and conflicts in the co-management of Brazilian reservoir fisheries. Paper presented at the Seventh Conference of the International Association for the Study of Common Property—Crossing Boundaries, June 10–14, Vancouver, British Columbia

CASE 2	**Maritime Extractive Reserve (MER) of Arraial do Cabo**
Management type	Extractive reserve: formal comanagement between users and federal government (CNPT-IBAMA[1])
Establishment date	1997
Initiative	Government (IBAMA agent from a local office)
Stakeholders at different levels	• *Local:* AREMAC[2]; fishers (several gear groups) (participation in AREMAC meetings and in rule enforcement) • *Municipal:* government (first supported the project and then became a barrier to its implementation); tourism sector • *State:* Environmental Military Police (rule enforcement) • *Federal:* CNPT-IBAMA (IBAMA's local office agent was very active) • *Unclear:* Academic researcher (UFF[3])
Objectives	• Promote sustainable fisheries and traditional livelihoods • Create and implement a management plan for the MER
Preparation strategies	• Identification of the user groups • Elaboration of a MER project (IBAMA and UFF) • Project approval by CNPT-IBAMA • Federal decree creates the MER • Creation of a new fisher association (AREMAC) to comanage the MER with IBAMA
Actions/methods	• AREMAC assembles to elaborate a management plan • Scientific assistance from UFF • Management plan analyzed and approved by IBAMA • Management innovation: Voluntary Environmental Agent • Based partially on previous local fishing agreements (*acordos*): direct negotiation, with no facilitator or superior authority
Opportunities for bridging ecological knowledge	• Management regulations partially based on previous informal management systems • Technical-scientific council (UFF) advising AREMAC when local knowledge is not sufficient

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

[2] Associação da Reserva Extrativista Marinha de Arraial do Cabo (community-based organization)

[3] Fluminense Federal University

[1] Lobão, R.J.S. 2000. Reservas Extrativistas Marinhas: Uma Reforma Agrária do Mar? [Marine Extractive Reserves: A land reform of the sea?]. Master's thesis, Fluminense Federal University, Niterói, Brazil;
[2] Silva, P. P. 2004. From common property to co-management: Lessons from Brazil's first maritime extractive reserve. *Marine Police* 28: 419–28

CASE 3	Forum Lagoa dos Patos
Management type	Multistakeholder body (forum)
Establishment date	1996
Initiative	IBAMA's regional research unit[1] (Rio Grande) and Fishing Catholic Body
Stakeholders at different levels	• *Local:* fisher organizations (small-scale fishers: fewer than 3,500) (few fisher representatives—only coordinators of fisher organization and fisher union) [1] • *Municipal:* several municipalities (not clear how many and which sectors are involved); religious movement • *State:* government (not clear which sectors are involved); fisher unions; fishing industries union • *Federal:* public defender; IBAMA[1] (through its regional/state research unit[2]); law enforcement units (IBAMA division) • *Unclear:* official environmental agencies; universities; NGOs; technical assistant organizations • *Total:* twenty-one organizations (some were either absent or rarely present at the general meetings) [2]

Objectives	• 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]
	  • To organize the artisanal fisheries sector in relation to fisheries administration policies
	  • 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
	  • To establish criteria that allow the fishing effort control as one mechanism for rebuilding fisheries resources
	  • To encourage the collective organization for the support of local sustainable artisanal fishing communities

Preparation strategies	Not clear
Actions/methods	• Workshops, led by IBAMA, involving several stakeholders, including fishers, to identify main fisheries problems and discuss more appropriate management methods [1]; evaluation of the present practices of fisheries management and enforcement [1] • Encouragement of cooperative initiatives [1] • Planning and implementation of new management regulations (three years); defining and revising rules to regulate the fisheries (rules devised locally were legitimized by federal decrees) [1, 4] • Monthly meetings, plus other meetings of the Directive Board [1] • All twenty-one organization representatives have the

	right to speak and vote; public can attend the meetings with no right to vote [1]
Opportunities for bridging ecological knowledge	• Participatory research: fishers involved in design and data collection [3] • Fishing communities are informed of the research results and decisions are made through meetings with the researchers and technicians [2]

[1] Brazilian Environmental Agency
[2] IBAMA Research Unit is completely separate from IBAMA's enforcement division

[1] Reis, E. G., and F. D'Incao. 2000. The present status of artisanal fisheries of extreme Southern Brazil: An effort towards community-based management. *Ocean and Coastal Management* 43:585–95; [2] Kalikoski, D. C., M. Vasconcellos, and L. Lavkulich. 2002. Fitting institutions to ecosystems: The case of artisanal fisheries management in the estuary of Patos Lagoon. *Marine Policy* 26:179–96; [3] D'Incao, F., and E. G. Reis. 2002. Community-based management and technical advice in Patos Lagoon estuary (Brazil). *Ocean and Coastal Management* 45:531–39; [4] Kalikoski, D. C., and M. Vasconcellos. 2005. The role of fishers' knowledge in the co-management of small-scale fisheries in the estuary of Patos Lagoon, southern Brazil. Chap. 14 in *Fishers' knowledge in fisheries science and management,* ed. N. Haggan, B. Neis, and I. G. Baird. Oxford: Blackwell Science / UNESCO (United Nations Educational, Scientific and Cultural Organization).

CASE 4	**Lagoa de Ibiraquera Project**
Management type	Multistakeholder body (forum)
Establishment date	2001: Ibiraquera Local Ecosystem Assessment Project 2002: Local Agenda 21 Forum
Initiative	University research team (NMD/UFSC[1])
Stakeholders at different levels	• *Local:* resource users; local community councils (CBOs[2]); local NGOs; local business associations (participation in local ecosystem assessment and in forum meetings [3]) • *Municipal:* city mayor and secretariat (disclaimed responsibilities for environmental problems) • *State:* EPAGRI[3]; FATMA[3] (mainly listeners; ineffective involvement) • *Federal:* IBAMA (mainly listener; ineffective involvement) • *Unclear:* academic researchers • *Forum members:* local NGOs and CBOs, and academic researchers (government agencies are sometimes guests in their meetings)
Objectives	• 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 comanagement and ecodevelopment [1] • Contribute to government scientific information systems on coastal ecosystems (GERCO[4], ORLA[5], REVIZEE[6], PRONABIO[7]) [1] • Provide scientific consultancy to identify alternative strategies for resource appropriation and create an adaptive comanagement system [1]

	• Elaborate a participatory fisheries management plan[8] [3]
Preparation strategies	• Project presentation to stakeholders [1, 3] • Capacity building (ecodevelopment courses): contact with local schools has increased team acceptance by locals [1, 2]
Actions/methods	• 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]
Opportunities for bridging ecological knowledge	• Participatory research • Capacity-building/training courses; environmental education • Feedback to communities on research findings • Researchers' participation in forum's discussion • Forum has been very active in bridging local and scientific knowledge and in attempting to improve environmental regulation enforcement and policy • Forum members and CBO members' participation at the Regional Conference of Aquaculture and Fisheries

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

[2] Community-based organization

[3] State Environmental Agencies

[4] National Program for Coastal Management (Programa Nacional de Gerenciamento Costeiro)

[5] Integrated Coastal Management Project (Projeto de Gestão Integrada da Orla)

[6] Assessment 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)

[7] National Program on Biological Diversity (Programa Nacional sobre a Diversidade Biológica)

[8] Major 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 (Núcleo de Meio Ambiente e Desenvolvimento—Center for Environment and Development) at the Santa Catarina Federal University (USFC). 2004. Avaliação Local Participativa de Ecossistemas Litorâneos no Sul do Brasil: Projeto Piloto de Criação de uma Agenda 21 Local na Área da Lagoa de Ibiraquera, Municípios de Imbituba e Garopaba, Estado de Santa Catarina [Local participatory assessment of coastal ecosystems in South Brazil: A pilot project to create a local Agenda 21 at the Lagoa de Ibiraquera area]. Partial Project Report to CNPq. Florianópolis, Brazil: USFC; [2] Freitas, R. R. Forthcoming. Manejo costero integrado y participativo: Breve descripción del proyecto de ecodesarrollo en la laguna de Ibiraquera, Santa Catarina (Brasil) [Integrated and participatory coastal management: A brief description of the ecodevelopment project at the Lagoa de Ibiraqurea, Santa Catarina (Brazil)]; [3] the authors' own knowledge about the project