

**PAVING THE WAY TOWARDS CO-MANAGEMENT  
THROUGH PARTICIPATORY RESEARCH:  
A CASE STUDY WITH ARTISANAL FISHERIES IN URUGUAY**

Micaela Trimble<sup>1</sup>, Marila Lázaro<sup>2</sup>, Fikret Berkes<sup>3</sup>

**ABSTRACT**

In Uruguay, both artisanal fishers and the State agency in charge of fisheries management (DINARA) have shown interest in seeking co-management arrangements, leaving behind the top-down regime, still prevalent today. Our research is based on a case study in Piriápolis (coastal Río de la Plata), in which a participatory research process among fishery stakeholders (fishers, DINARA, University scientists, NGOs) was facilitated to investigate its contributions to the emergence of co-management. Our findings show that participatory research had an impact on the various faces of co-management: (1) *power sharing*: power was actually shared during the research process, (2) *institution building*: a multi-stakeholder group (POPA), with a common vision and goals, was created, (3) *trust building*: trust among participants increased, (4) *process*: the process of group formation was considered important by participants, (5) *learning*: stakeholders learned skills for participation, among others, (6) *problem solving*: two problem-solving exercises were conducted (POPA started with the problem of sea lion impact on the fishery but ended up addressing the competition from imported *pangasius*), (7) *governance*: a diversity of stakeholders of the initial problem identified by fishers participated in the process. These impacts on co-management are indeed useful criteria for evaluating the *outcomes* of participatory research as a knowledge co-production approach in which resource users participate of the entire research, and whose final aim is community empowerment. When evaluating the *process* of participatory research, our case study contributed to identifying several criteria that can facilitate co-management, such as: participation of all stakeholder groups of the selected problem/topic; participants' representativeness; involvement of all stakeholder groups in every research stage; independent facilitation; collective decision-making through deliberative and consensus-building processes; and appropriate information management. This research provides empirical evidence to support the claim that participatory research is a strategy to facilitate and improve co-management.

**Key-words:** participatory research / co-management / learning / small-scale fisheries / Uruguay

The authors agree to allow the Digital Library of the Commons to add this paper to its archives for IASC conferences.

---

<sup>1</sup> Natural Resources Institute, University of Manitoba, Canada / Unidad de Ciencia y Desarrollo, Facultad de Ciencias, Universidad de la República (UDELAR), Uruguay. E-mail: [mica.trimble@gmail.com](mailto:mica.trimble@gmail.com)

<sup>2</sup> Unidad de Ciencia y Desarrollo, Facultad de Ciencias, UDELAR, Uruguay

<sup>3</sup> Natural Resources Institute, University of Manitoba, Canada

## INTRODUCTION

Since the 1980s, co-management has been extensively proposed as a necessary but insufficient solution to the commons problem (Jentoft 1989). Often associated with commons theory, co-management can be understood as a type of property rights regime, in the continuum between common property and state property, in which there is a power-sharing arrangement between the state and a community of resource users (Pomeroy and Berkes 1997). The understanding of co-management has been evolving over time: the concept has become more complex, involving multiple stakeholders and networks, and as a problem-solving process in which power sharing is the result of the process, rather than the starting point (Carlsson and Berkes 2005).

The processes of transition from top-down management to co-management have been receiving increasing attention. Recent reviews of the co-management experience have improved our understanding of factors leading to successful management (Evans et al. 2011). A key factor for co-management and its evolution is an enabling policy environment (Armitage et al. 2007). Governments must be willing to share management power, a condition that does not occur frequently. In Uruguay, where fisheries management has been predominantly top-down, there may be a window-of-opportunity, with the government indicating intentions for artisanal fisheries co-management through a proposed fisheries law before the Parliament. In fact, fisheries zonal councils (with the participation of representatives of artisanal fishers, fisheries agency, Coast Guard and local governments) started to be implemented in pilot areas of the country in 2012.

Participatory research has been said to contribute to co-management but the relationships between the two concepts have received little attention. Participatory research is a knowledge co-production approach with an action-oriented component based on local interests and concerns, in which local people participate of the entire research process, and whose final aim is community empowerment (Cornwall and Jewkes 1995). The origin of participatory research (some authors prefer participatory action research) goes back to the 1970s, when a research methodology that combines theory, action and participation committed to further the interests of exploited groups and classes was developed and used in many Latin American and other countries (Fals Borda 1987). The assumption is that those who are most affected by decisions should have a say in those decisions; they should be empowered to participate in the direction of research and application of results (Wiber et al. 2009).

Participatory research has become increasingly common in the context of natural resources management (Shirk et al. 2012; Wilmsen et al. 2008), including fisheries (Hartley and Robertson 2006; Wiber et al. 2009). Numerous positive impacts have been attributed to participatory research, such as increased trust in the research process, mutual learning and understanding among participants, trust/confidence building, conflict resolution, capacity building, and empowerment of the community (Arnold and Fernandez-Gimenez 2007; Cornwall and Jewkes 1995; Johnson 2010). Nevertheless, it is likely that these positive impacts will depend on the participatory research mode (i.e. the degree of participation). The different modes of participatory research have been represented by varied typologies, such as “contractual, consultative, collaborative, and collegiate” (Biggs 1989), and “co-option, compliance, consultation, cooperation, and co-learning” (Kindon 2008). In one extreme of the continuum, the researcher designs and carries out research; community representatives are chosen but largely uninvolved; and there is no real power sharing. In the other extreme, the researcher and the community share knowledge, create new understanding, and work together

to form action plans, with clear power sharing. Collegiate or empowering participatory research has been difficult to achieve (Arnold and Fernandez-Gimenez 2007; Cornwall and Jewkes 1995).

In 2011, a participatory research process that would address artisanal fishers' local concerns was initiated in Piriápolis (coastal Uruguay), with the underlying purpose of studying the contributions to the emergence of conditions for fisheries co-management. Using Bigg's (1989) modes of participation, this case could be best defined as collegiate because scientists and fishers worked together as colleagues with different skills to offer, in a process of mutual learning, generating knowledge on a constraint of mutual importance. The Piriápolis case intended to answer the call to improve the nature of participatory research initiatives in natural resources management (Arnold and Fernandez-Gimenez 2007), and in fisheries in particular (Wiber et al. 2009).

The present paper is about facilitating progress toward co-management through participatory research. The objective is to analyze the contributions of participatory research to the emergence of co-management in Piriápolis. We hypothesize that participatory research involving artisanal fishers, government and other stakeholders can be a key stimulus towards the emergence of a co-management process. This study is timely because new legislation for fisher participation in management is under discussion in Uruguay. Furthermore, drawing from the evaluation of the Piriápolis case, we propose criteria that can guide the development of collegiate participatory research, promoting a wider use of this approach.

## **METHODS**

### **Case study description: Participatory research in Piriápolis artisanal fishery (Uruguay)**

This research is based on a case study in the artisanal fishery in Piriápolis, a tourist city on the Río de la Plata coast. The fishery represents an important economic activity of the city. There are approximately 50 small-scale fishing boats in the Piriápolis area (some only used seasonally), and no large-scale ones. A description of Piriápolis artisanal fishery can be found in Trimble and Johnson (2013).

After an initial stage in which fishers from Piriápolis decided that this participatory research should address the problem of sea lions (which feed from their nets and long-lines, damaging them), the other stakeholders were invited to participate: DINARA (the National Directorate of Aquatic Resources, within the Ministry of Livestock, Agriculture and Fisheries - MGAP), which is the agency in charge of fisheries management; National University (UDELAR) biologists doing research about sea lions and the interaction with the fishery; and two local NGOs, SOS, dedicated to marine animal rescue and rehabilitation, and Ecópolis, a multisectoral and interdisciplinary arena in which Piriápolis citizens and local organizations promote sustainable development. One social scientist in communication and culture studies joined the participatory research in a later stage.

Since May 2011, stakeholders have been meeting regularly in Piriápolis, generally in a monthly basis, to develop participatory research addressing local concerns of the fishery. These workshops and the whole participatory research process have been facilitated by a research group of the Science and Development Unit (UDELAR). During the first workshop in Piriápolis, stakeholders exchanged ideas and knowledge regarding the interaction between

fishers and sea lions, such as sea lions' population status and feeding habits. The next step consisted of defining a research question of interest to all participants. Due to the high impact of sea lions on long-lines (which is a costly gear) and the lack of scientific data about that in Piriápolis since 2002, participants decided to investigate the current interaction between sea lions and long-lines. The second workshop was dedicated to the discussion of study methods, which ended in a protocol for joint data collection during fishing trips. This protocol was generated with input from all participants, based on a previous protocol developed by scientists. This was the first time in Uruguay that fishers participated in defining the methodology to study sea lions' impact. The data collection phase could not start, however, because the long-line fishing season was ending at that time and fishers started to migrate along the coast.

Concomitantly with the progress of the planning stage of the study on sea lions' impact, the group started to discuss a second local concern that was initially brought up by one fisher during the first workshop and caught the attention of the other stakeholders. This was the market competition of imported *Pangasianodon hypophthalmus* (locally known as *pangasius*, farmed catfish from Vietnam), which is sold at a cheaper price than local fish. In fact, restaurants that used to buy local fish in Piriápolis were now serving *pangasius*, often cheating consumers about the identity and origin of the fish species (i.e. the menu says Brazilian codling – *brótola* or flatfish - *lenguado*, which are local fish of high value). Once participants discussed this problem and possible actions, the group agreed to work on communication strategies to promote local fish. As part of that effort, the First Artisanal Fisheries Festival (*Primera Feria de la Pesca Artesanal en Piriápolis*) was organized.

The objectives of the Festival were to achieve informed consumption, leading people to have more local fish and less *pangasius*; to make people value local fish and the artisanal fishery; to bring consumers closer to fishers; and, in the long term, to improve the life quality of consumers and fishers. The group needed a name, and through a brainstorming exercise, the name “POPA – *Por la Pesca Artesanal en Piriápolis*” (For Artisanal Fisheries in Piriápolis) was chosen. The organization of the Festival required intensive group work, and sub-groups were formed to divide up the tasks (funding, logistics, brochures, posters, media, photo exhibition, logo of the group, primary school activities). The Festival took place during a weekend in February 2012 and was considered as the first significant accomplishment of POPA.

Fifteen participants from four stakeholder groups were committed to the participatory research process in Piriápolis: fishers (n=7; 4-10 participated in different stages), artisanal fisheries manager (DINARA, n=1), university scientists (n=5), and local NGO representatives (n=2). For all of them, this was the first involvement in a participatory research process. Stakeholders volunteered their time to participate. Workshop costs from May to December 2011, including travel and food, were funded by M.T.'s research budget from the Centre for Community-Based Resource Management (Natural Resources Institute, University of Manitoba). In 2012 the group got its own funding from Global Greengrants Fund.

## **Data collection and analysis**

An evaluation of the participatory research in Piriápolis was conducted throughout the process with the purpose of learning and improving, and the ultimate goal of informing future research work (Blackstock et al. 2007). Data collection took place by means of individual face-to-face semi-structured interviews (Dunn 2008) with participants, participant observation (Bernard 2006) during workshops, group/subgroup meetings, the Festival, and informal conversations with participants. The final interviews with all participants (n=15) were conducted between February and April 2012, following the Festival. M.T. conducted the interviews with the collaboration of one undergraduate student.

Interviews' transcriptions and fieldnotes were coded and analyzed qualitatively (using Atlas.ti software) from the angle of seven characteristics of co-management, or seven "faces" by which co-management can be analyzed: (1) as power sharing, (2) as institution building, (3) as trust building, (4) as process, (5) as learning and knowledge co-production, (6) as problem solving, and (7) as governance (Berkes 2007). Data were also analyzed according to 17 evaluation criteria: 9 related to the participatory research process and 8 to its outcomes. These criteria were defined based on some of the literature on public participation evaluation (Rowe and Frewer 2000; Stephens and Berner 2011), a key article about participatory research evaluation which comprised an extensive literature review (Blackstock et al. 2007), and the experience in Piriápolis (leading to new criteria or modification of the existing ones).

## **RESULTS**

### **Participatory research for transitioning towards co-management**

This section argues that participatory research (of the collegiate or empowering mode) is a valuable approach for transitioning towards co-management. Table 1 shows the contributions that participatory research can have on the seven faces of co-management, after which data from the Piriápolis case supporting this claim are presented (a more complete analysis can be found in Trimble and Berkes *Under review*).

**Table 1.** Contributions from participatory research to the seven faces of co-management

Faces of co-management (Berkes 2007)	Contributions from participatory research
1. <u>As power sharing</u> : co-management requires some degree of power and responsibility sharing between government agencies and resource users.	1. Participatory research could be part of the participatory roots needed for co-management, given that it involves power sharing for making decisions among expert and non-expert participants.
2. <u>As institution building</u> : co-management occurs among individuals who represent institutions, and thus it often involves capacity and institution building at both local and government levels.	2. Participatory research can enhance the capacity of all stakeholders (e.g. participation/interaction skills) and collective decision-making towards a common goal.
3. <u>As trust building</u> : trust is an essential part of the social capital that needs to develop among a group of people trying to solve a problem through co-management.	3. Participatory research can be the required prelude for building trust among stakeholders, through facilitating respectful communication in moving towards a common goal.
4. <u>As process</u> : co-management should be regarded as a process (rather than an endpoint), in which parties constantly deliberate and negotiate their positions and change their activities.	4. Participatory research should also be understood as a deliberative process in making decisions among stakeholders, which enables the development of skills, capacities and knowledge.
5. <u>As learning and knowledge co-production</u> : learning is a key aspect for adapting management processes in uncertain and dynamic environments (leading to adaptive co-management).	5. Participatory research is a learning platform in which stakeholders learn from each other, and learn to integrate different sources of knowledge, co-producing in many cases new knowledge.
6. <u>As problem solving</u> : co-management evolves over time and is very much a result of deliberate problem-solving, in which management alternatives are generated.	6. Participatory research is an iterative process of finding solutions for local problems in a collective manner, by planning, acting, learning and reflecting.
7. <u>As governance</u> : co-management is a kind of governance in which there is a diversity of parties, including public and private actors, linked to one another through a variety of relationships.	7. In participatory research a diversity of actors from different levels (i.e. all stakeholders in the problem to be addressed) must participate (contrasting with the original conception of participatory research).

### *Participatory research and co-management as power sharing*

To evaluate power sharing in our case study, participants were asked whether the opinion of every member of the group had been considered during participatory research, and all of them replied affirmatively, giving a variety of examples. Moreover, all participants replied affirmatively when asked if it was important to consider everyone's opinions and interests equally within the group. The case study also shows that one of the reasons why participants of the four stakeholder groups considered that participatory research contributed to the emergence of co-management is that the study about sea lions' impacts on the fishery will serve for future decision making. Thus, in terms of power sharing, participatory research could be thought of as a preparatory stage in the process towards co-management, but there is a perceived risk of the government making decisions in a top-down manner regardless the participatory nature of the research process that preceded it.

### *Participatory research and co-management as institution building*

When Piriápolis stakeholders were asked about the contributions of participatory research to co-management, one fisher and one scientist argued that it did contribute by enhancing fishers' organization. Two scientists stated that it did this by building fishers' capacity for co-management. Given that the lack of unity among fishers is a common topic in Piriápolis, participants were asked whether they considered that participatory research had helped increase unity. All participants replied affirmatively, except for two fishers who thought participating fishers were already united. Moreover, eight participants added that unity not only increased among participating fishers but also among fishers in general, from Piriápolis and other localities, referring to the support received during the Festival, and the interest of other fishers to join the group. Institution building was accomplished specifically by the creation of a multi-stakeholder group (POPA) in which fishers, scientists, a government manager and NGO representatives share a common vision and goals for the group after months of working collaboratively. Except for four participants who thought that one of the NGO representatives was there just for his own benefit, the rest perceived that everyone's objectives became integrated into the group interests.

### *Participatory research and co-management as trust building*

Our participatory research case showed three findings related to relationships, trust and respect. First, most relationships between and within stakeholder groups improved (including relationships formed during the participatory research) and none became worse. Second, trust among participants increased in most relationships, especially among participants who established a new relationship and/or shared more time or group work. Third, according to four participants, respect towards other group members increased; the rest responded that they always respected everyone equally anyway. Moreover, three fishers, one scientist and one NGO representative explained that participatory research contributed to the emergence of co-management by bringing together fishers and DINARA, facilitating their dialogue, and enabling a more direct relationship. Furthermore, all participants stated that they wished to maintain the relationships they established in the group.

### *Participatory research and co-management as process*

When participants were asked to evaluate the success of the participatory research in Piriápolis, the degree to which the objectives of the group had been achieved, and the

strengths/weaknesses, all except three of them highlighted the process of group formation, increased cohesion and trust among members, even though the sea lion study was not taken to completion. Moreover, for participants of the four stakeholder groups, the group itself was one of the motivators to continue participating. Deliberation throughout participatory research, enhanced by the facilitators, was valued by participants. All participants except for one could not remember any situation in which someone's opinion had not been considered. The DINARA manager stated that participatory research was part of the process leading to a participatory management or co-management.

#### *Participatory research and co-management as learning and knowledge co-production*

The group which was created during the participatory research in Piriápolis, POPA, could be thought of as a bridging organization linking fishers, universities, government agencies and NGOs. Bridging organizations, linking actors across multiple sectors can stimulate co-management through providing an arena for knowledge co-production, trust building, sense making, learning, vertical and horizontal collaboration, and conflict resolution (Folke et al. 2005). The diversity of stakeholders in the group motivated fishers who realized that they were not alone in their concerns. Participatory research contributed to co-management, as one fisher pointed out, because there was mutual learning between them and DINARA. In fact, all participants learned information and skills throughout the participatory research process. Participants improved their communication skills; their ability to reflect on their own opinions after listening to other views; and their skills in relating to people who are in different professions and/or institutions. Six participants learned about the need to integrate different sources of knowledge; others emphasized that participatory research actually put it into practice. Participants gave several examples of situations in which local and scientific knowledge were integrated, such as when the group produced collectively a poster about sea lions for the Festival. Furthermore, all participants recognized that co-production of knowledge took place. They gave examples of new approaches or strategies generated by the group, such as the process of collective elaboration of data collection protocols in the sea lion study; and participatory research as an approach to address a problem, working in a team with a common goal, respecting others' opinions, and learning from each other.

#### *Participatory research and co-management as problem solving*

In Piriápolis, the first problem-solving exercise consisted of addressing the conflict of sea lions and the long-line fishery, and only the first phase of the participatory research cycle (i.e. planning) was conducted. On the one hand, the complexity of this problem meant that solutions would not be easy to find (several participants considered that there was no solution at all). On the other hand, starting off by addressing this controversial topic meant that participants would need time together to exchange knowledge and thoughts. While this first cycle was taking place, a second problem-solving exercise began to address the market competition from imported *pangasius*. This soon led the group to the action phase of participatory research by organizing the First Artisanal Fisheries Festival in Piriápolis. The Festival was considered so successful by participants (e.g. nearly 3,000 people attended, most of them tourists, but also DINARA's director and MGAP's undersecretary) that it motivated them to continue working together as a group and to resume the study about sea lions. In summary, the group started addressing one problem and then turned to another one, which exemplifies the importance of adaptability for problem-solving approaches. However, the two problems were linked. Participants who thought that the two problems were linked, perceived the Festival as an action that was also oriented to the sea lion problem, arguing that it would



help fishers sell more fish and thus get a better income, counteracting economic losses due to sea lions.

### *Participatory research and co-management as governance*

Non-fisher participants of the case study were invited to the participatory research process because they were stakeholders in the research topic that fishers had initially chosen (sea lions). Stakeholder diversity was the most frequently mentioned element when participants were asked to define “participatory research”. One scientist pointed out that her opinion about the need to integrate different sources of knowledge changed throughout the participatory research process by noticing the contributions from all parties in this more inclusive concept of governance. Furthermore, one fisher and one scientist expressed that the participatory research contributed to co-management by promoting, through the Festival, increased attention to fishers by society at large, broadening the concept of governance. The main attractions of the Festival were a photo exhibition entitled “A day in the life of artisanal fishers”; an exhibition of fishing gear, of which fishers were in charge; art inspired by artisanal fisheries; talks of health education focused on the nutritional properties of local fish; local fish tasting; and live music. The group received support from over 30 institutions and people from different sectors (public, private, academics, civil society) at different levels. The Festival was featured on TV and radio programs, local and national newspapers, websites, and other media.

### **Lessons from evaluating the participatory research case**

Several contributions from participatory research to co-management (discussed in the previous section) can indeed be used as criteria to evaluate participatory research outcomes, such as co-production of knowledge, learning, strengthened social networks, and conflict resolution (see Trimble and Lázaro *Under review*). However, the most interesting findings arise when evaluating the participatory research process. What guidelines could be followed to carry out an empowering participatory research intended to contribute to co-management?

Considering several aspects that guided the organization and facilitation of the participatory research experience in Piriápolis (which were mostly based on the existing literature), we propose nine criteria that can be used both to evaluate a participatory research process and to guide the development of future initiatives. These criteria and the degree of achievement in Piriápolis are shown in Table 2.

It is worth noting that not all criteria could be achieved to the maximum degree: some invited stakeholders decided not to participate (e.g. DINARA’s Marine Mammals Department); fishers’ and DINARA’s representativeness was questioned; and academics’ and fishers’ jargon, as well as different means of communication, hampered information exchange among participants.

**Table 2. Process criteria used to evaluate participatory research**

<b>Evaluation criteria</b>	<b>Degree of achievement in the Piriápolis case</b>
1.1. Problem or topic to be addressed of key interest to local and additional stakeholders	<i>Fully achieved</i> The two topics (sea lions and <i>pangasius</i> ) were of interest to artisanal fishers, scientists, DINARA and NGOs.
1.2. Participation of all stakeholder groups of the selected problem/topic (Stakeholder diversity)	<i>Partially achieved</i> Fishers, DINARA's Artisanal Fisheries Unit, University scientists and NGOs, participated. Additional stakeholders (e.g. DINARA's Marine Mammals Department, Coast Guard, Port Authority, Local Government) should have participated.
1.3. Participants' representativeness	<i>Partially achieved</i> Low fisher participation was recurrently mentioned by all stakeholder groups, but some participating fishers behaved as representatives of the rest. Even though DINARA was formally invited to this participatory research, the manager was not clear about his role as representative.
1.4. Involvement of all stakeholder groups in every research stage	<i>Fully achieved</i> The actions taken to address the two topics were all done collectively (e.g. elaboration of the protocol to study sea lions' impact; organization, development, evaluation, and diffusion of the Artisanal Fisheries Festival), which was valued positively by participants.
1.5. Independent facilitation	<i>Fully achieved</i> The facilitator team was not involved in the topics addressed, and participants appreciated the role of the facilitators.
1.6. Collective decision-making through deliberation and consensus-building	<i>Fully achieved</i> The facilitator team ensured that participants exchanged opinions and made decisions through consensus.
1.7. Appropriate information management	<i>Partially achieved</i> Participants valued positively sharing information among them. The different means of communication participants would use was a weakness (e.g. not all participants could use internet).
1.8. Adaptability through iterative cycles of planning, acting, observing and reflecting	<i>Fully achieved</i> Stakeholders who had been initially reunited to address the sea lion problem, soon started to address the market competition from imported <i>pangasius</i> . Participants valued this transition.
1.9. Cost-effectiveness of the process	<i>Not evaluated in detail</i> (The process seemed cost-effective for participating stakeholders but not so for non-participating fishers).

## DISCUSSION AND CONCLUSIONS

Empowering or collegiate participatory research is rare, and so are the studies which investigate what actually transpires in a participatory research process. Our case is significant in that we were able to analyze the actual details of interactions. Our findings have shown that participatory research can have an impact on the various faces of co-management. Of course, many of these faces are inter-related and have cross-cutting elements. For example, learning is a cross-cutting component of the different faces of co-management: (1) learning is needed if the exercise of sharing power during participatory research is to be important for future power sharing in management; (2) participation/interaction skills, which are part of capacity building, are learned during participatory research; (3) one of the factors that facilitated relationship improvement and trust building among participants was communication and knowledge exchange; (4) learning in the form of development of skills, capacities and knowledge is one of the elements of success when participatory research is conceived as a process; (5) learning is part of the problem-solving iterative cycle which characterizes participatory research (i.e. planning, acting, learning and reflecting); and lastly, (6) to achieve co-management as governance, the importance of stakeholder inclusion should be learned.

Given that learning-by-doing, integration of different kinds of knowledge, and appreciating multiple perspectives are key features of adaptive co-management (Armitage et al. 2007), our case study shows that participatory research can pave the way towards adaptive co-management by injecting a dynamic learning characteristic in its early stages. We therefore anticipate that the learning outcomes of the participatory research in Piriápolis will be useful for the future emergence of co-management in coastal Uruguay. For example, the skills that the DINARA manager learned through the problem-solving exercises during this participatory research can be applied to other situations (Berkes 2009). However, the fact that there was only one DINARA manager and few fishers in the participatory research process is a problem. One cannot count on individual capacity building necessarily translating into institutional capacity building (Wiber et al. 2009).

The Piriápolis case has also contributed to the scarce literature on how to develop, implement and evaluate participatory research (Blackstock et al. 2007; Shirk et al. 2012). The process evaluation criteria used in this study could be considered conditions to promote a collegial mode or truly participatory research. Moreover, considering that some of the expected outcomes of participatory research are needed for co-management (e.g. learning, co-production of knowledge, strengthened social networks), by evaluating the participatory research process, the Piriápolis case contributed to identifying several criteria that can facilitate co-management: participation of all stakeholder groups of the selected problem/topic; participant representativeness; involvement of all stakeholder groups in every research stage; independent facilitation; collective decision-making through deliberative and consensus-building processes; and appropriate information management. Process and outcomes are closely interrelated, and thus, ineffective processes (e.g. fishers as collaborators of scientists rather than as co-researchers, or unbalanced power sharing during decision-making) might lead to undesirable outcomes, such as increased distrust or conflict by participants (Blackstock et al. 2007). Efforts should be made in order to overcome the challenges identified during evaluation (e.g. stakeholders' representativeness).

The continuation and replication of the participatory research approach could be promoted if each participant did the job of sharing with his/her organization or fellows the experience in

Piriápolis. The benefits or advantages that participants and stakeholder groups in general, perceive from participatory research will also affect a wider use of this approach. First, scientists probably need to find scientific rigor within participatory research so as not to underestimate this approach, a frequent challenge. They should neither see participatory research as less reliable or valid than more conventional approaches. Integrating the participatory research approach into the university curricula will provide students with real-world experience and will likely contribute to increasing scientists' openness to other modes of doing science (e.g. respecting local knowledge instead of underestimating it because of its non-scientific nature). Secondly, motivating fishers to become co-researchers, looking for solutions to local problems in order to improve their reality, has proved not to be easy. Participatory research not only needs to persuade scientists about the validity of considering multiple forms of knowledge and understanding when doing research, but also fishers, who might be hesitant or not confident about their contributions for every research stage (Cornwall and Jewkes 1995). Thirdly, even though participatory research originally tended to involve primary stakeholders and researchers, we now know that engagement with stakeholders at all levels is essential, especially if policy-makers are to be influenced by participatory research. Government agencies might need first to learn that environmental conflicts are better managed through participatory processes.

Further research is needed to investigate how to facilitate government agencies and universities to support and initiate multi-stakeholder participatory research. Emerging co-management in Uruguay or elsewhere would need facilitation, suitable policy environment, better organization of fishers, as well as rebalanced government priorities.

## **ACKNOWLEDGEMENTS**

This paper is part of Trimble's PhD research supported by the University of Manitoba Graduate Fellowship and Manitoba Graduate Scholarship, IDRC and the CRC in Community-Based Resource Management. We particularly thank the members of POPA (*Por la Pesca Artesanal en Piriápolis*) for their unconditional support and interest in this participatory research. Special thanks to Patricia Iribarne for her assistance in the field, including workshop facilitation.

## **LITERATURE CITED**

- Armitage, D., Berkes, F., Doubleday, N., 2007. Adaptive Co-Management: Collaboration, Learning and Multi-Level Governance. University of British Columbia Press, Vancouver.
- Arnold, J.S., Fernandez-Gimenez, M., 2007. Building social capital through participatory research: An analysis of collaboration on Tohono O'odham Tribal Rangelands in Arizona. *Society and Natural Resources* 20, 481-495.
- Berkes, F., 2007. Adaptive co-management and complexity: Exploring the many faces of co-management, in: Armitage, D., Berkes, F., Doubleday, N. (Eds.), *Adaptive Co-Management. Collaboration, Learning, and Multi-Level Governance*. UBC Press, Vancouver, pp. 19-37.
- Berkes, F., 2009. Evolution of co-management: Role of knowledge generation, bridging organization and social learning. *Journal of Environmental Management* 90, 1692-1702.
- Bernard, H.R., 2006. *Research Methods in Anthropology. Qualitative and Quantitative Approaches*, fourth ed. Altamira Press, Lanham.

- Biggs, S., 1989. Resource-poor farmer participation in research: a synthesis of experiences from nine national agricultural research systems. OFCOR Comparative Study Paper 3. International Service for National Agricultural Research. The Hague.
- Blackstock, K.L., Kelly, G.J., Horsey, B. L., 2007. Developing and applying a framework to evaluate participatory research for sustainability. *Ecological Economics* 60(4), 726-42.
- Carlsson, L., Berkes, F., 2005. Co-management: concepts and methodological implications. *Journal of Environmental Management* 75, 65-76.
- Cornwall, A., Jewkes, R., 1995. What is participatory research? *Social Science and Medicine* 41(12), 1667-76.
- Dunn, K., 2008. Interviewing, in: Hay, I. (Ed.), *Qualitative research methods in human geography*. Oxford University Press, Melbourne, pp. 79-105.
- Evans, L., Cherrett, N., Pems, D., 2011. Assessing the impact of fisheries co-management interventions in developing countries: A meta-analysis. *Journal of Environmental Management* 92, 1938-1949.
- Fals Borda, O., 1987. The application of participatory action-research in Latin America. *International Sociology* 2(4), 329-47.
- Folke, C., Hahn, T., Olsson, P., Norberg, J., 2005. Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* 30, 441-73.
- Hartley, T.W., Robertson, R.A., 2006. Stakeholder engagement, cooperative fisheries research and democratic science: the case of the Northeast Consortium. *Human Ecology Review* 13(2), 161-71.
- Jentoft, S., 1989. Fisheries co-management. Delegating government responsibility to fishermen's organizations. *Marine Policy* 13, 137-54.
- Johnson, T.R., 2010. Cooperative research and knowledge flow in the marine commons: Lessons from the Northeast United States. *International Journal of the Commons* 4(1), 251-72.
- Kindon, S., 2008. Participatory Action Research, in: Hay, I. (Ed.), *Qualitative Research Methods in Human Geography*, Oxford University Press, Melbourne, pp. 207-220.
- Pomeroy, R.S., Berkes, F., 1997. Two to tango: The role of government in fisheries co-management. *Marine Policy* 21(5), 465-80.
- Rowe, G., Frewer, L.J., 2000. Public participation methods: A framework for evaluation. *Science Technology and Human Values* 25(1), 3-29.
- Shirk, J.L., Ballard, H.L., Wilderman, C.C., Phillips, T., Wiggins, A., Jordan, R., McCallie, E., Minarchek, M., Lewenstein, B.V., Krasny, M. E., Bonney, R., 2012. Public participation in scientific research: a framework for deliberate design. *Ecology and Society* 17(2), 29.
- Stephens, J.B., Berner, M., 2011. Learning from your neighbor: The value of public participation evaluation for public policy dispute resolution. *Journal of Public Deliberation* 7(1).
- Trimble, M., Berkes, F. *Under review*. Participatory research for transitioning to co-management: lessons from artisanal fisheries in coastal Uruguay. *Journal of Environmental Management*.
- Trimble, M., Johnson, D., 2013. Artisanal fishing as an undesirable way of life? The implications for governance of fishers' wellbeing aspirations in coastal Uruguay and southeastern Brazil. *Marine Policy* 37, 37-44.
- Trimble, M., Lázaro, M. *Under review*. Evaluation criteria for Participatory Research: Insights from a case study in Piriápolis' artisanal fishery (coastal Uruguay). *Environmental Management*.
- Wiber, M., Charles, A., Kearney, J., Berkes, F., 2009. Enhancing community empowerment through participatory fisheries research. *Marine Policy* 33(1), 172-9.

Wilmsen, C., Elmendorf, W., Fisher, L., Ross, J., Sarathy, B., Wells, G., 2008. Partnerships for empowerment: participatory research for community-based natural resource management. Earthscan, London.