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Context matters to explain field experiments: Results from Colombian and Thai fishing villages

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ABSTRACT

During the last decade, field experiments regarding the study of common pool resource governance have been performed that replicated earlier findings of laboratory experiments. One of the questions is how the decisions made by participants in rural communities are influenced by their experience. This paper presents the results of field experiments in Colombia and Thailand on fishery resources. Context information is derived from the communities via in-depth interviews, surveys and role playing exercises. The use of different methodological tools allowed to link decisions in field experiments with contextual variables for two fishery villages. Explanation of core variables in social dilemmas is given, the degree of cooperation levels, preferred rules, rule compliance and enforcement. Main findings include: i) fishermen made decisions in the field experiments that reflected their own experience and context, ii) agreements for rule crafting are possible only under specific conditions that guarantees livelihoods and sustainability, iii) the broader context determines cooperation levels at a local level, iv) inequalities in the sanctioning of rule breakers decrease the possibilities of reaching cooperation agreements, and v) high levels of trust among local fishermen is not a sufficient condition for resource sustainability, when trust in external rule makers and enforcers is low.

1. Introduction

Overexploitation in fisheries all over the world has been an increasing problem at least since the middle of the 20th century (Berkes et al., 2006; Jackson et al., 2001; Myers and Worm, 2003). Causes have pointed out to poor governance practices and deficient incentives for conservation (Berkes et al., 2006). Although the critical situation seems to be general, not all fisheries have suffered the consequences of overexploitation (Acheson, 2003). Among small scale fisheries, which include artisanal and subsistence systems (Berkes et al., 2001), it is possible to find success stories regarding resource maintenance. For example, Basurto (2008) reports a case at a small fishery in the Gulf of California (northwest Mexico), where biological and ecological characteristics have shaped the self-governance institutional arrangements, that have maintained the resource. Depletion problems in small fisheries are critical due to the livelihoods of locals' high dependence on the resources. In order to understand the causes of these depletion trends, the focus has been placed on stock assessment in the Northern Hemisphere with disciplinary emphasis on biology and economics, and with less intensity on social science (Berkes et al., 2001). It is also necessary to understand the relevant factors that have kept some small fisheries on 'the safe side', thus avoiding stock depletion.

Formal and informal rules for fisheries management are a public good that affect collective action and interact with the ecological dynamics. One of the key components of a small fisheries system, known as a Social Ecological System (SES) (Berkes and Folke, 1998), is the set of management rules or institutional arrangements, but they should not be studied separately from the rest of the SESs as well as their context. The aim of this paper is to provide meaningful insights for improving the understanding about the relations between broader context variables (Ostrom, 2007, 2009; Poteete et al., 2010), and individual and collective behavior as consequence or cause of rules in artisanal fishery systems.

The general question that guided our research was about the effect of the context on rule crafting trust and cooperation in common pool resources (CPR) dilemmas. We wanted to explore the hypothesis that the ability to craft rules in small scale fisheries is context dependent. To answer this question we designed a set of tools to observe individual decision making patterns, to go one step further in connecting

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individual behavior in field experiments with the participants' SES; to observe processes of rule crafting for fishery management, and to generate an open space for discussion, possible negotiation regarding problems, and rules for resource management. Our intention is to explain the "how and why" of human behavior and not only its patterns, in line with Vernon Smith's (2010) call. A step further in CPR experiments is to include the ecosystem dynamics in the experimental design as a way to diminish the gap with the SES, but at the same time, keeping experimental control. These experiments are rooted within the line of CPR experiments, whose benchmark is Ostrom et al. (1994). The main innovation of the experimental design we used in this research is the inclusion of ecological dynamics and complexity, which are described in detail in Cardenas et al. (in press). An innovation in the ComMod approach (Barreteau et al., 2003) was to start a collective construction of an RPG having as a point of departure the experimental setting aiming to establish connections between experimental and SES' action arenas. We wanted to link the controlled experimentation with an increasing participatory approach, reflecting the path from experimental simplification to the complex gradual inclusion of the SES.

A comparative study was carried out in two artisanal fisheries in Colombia and Thailand. In these countries we have an important research trajectory in CPR studies. Poteete et al. (2010) propose three levels of analysis that should be addressed in order to move the conventional theory of collective action and the commons a step towards an integral understanding of the SESs. These levels are: i) individual human behavior, ii) micro-situational variables, and iii) broader social ecological context variables. It is recommended that at the core of the analysis will be a theory of human behavior that acknowledges the large amount of evidence in the field and experiments that deviate from the traditional *homo economicus*; a richer theory without meaningful explanatory links with context is insufficient. Along this line we designed a methodology aiming to link these three analytical dimensions. To study the individual dimension and the core variables of human behavior proposed by Ostrom (1998), economic experiments were designed for three specific resource problems, namely: forestry, irrigation and fisheries. In this paper we refer only to the fishery case. After running the experiments, a collective construction of a role playing game (RPG), (see Barreteau et al., 2003; and Bousquet and Trebuil, 2005) was performed on the same field site, having as a starting point the experimental setting in order to observe how participants add complexity and include micro-situational and broader context variables in the RPG. In the methodological section a detailed description of the approach is discussed. The paper is organized in six sections. Section 2 explains the methodological approach, giving a detailed description of each one of the tools used. Section 3 illustrates the location and the problems with each of the two case studies. Section 4 describes the results, starting with the decision tendencies in the experiments; exploring statistical relations with survey data, rule preferences and performance. In Section 5 the findings from the collective discussion of experimental results are reported. Additionally, the process of the co-construction of the RPG and the results of the implementation of the RPG are reported. Moreover, in the fifth section we discuss the results explaining the findings in terms of cooperation, trust and rules, and the relationship with the SES' context. Finally, a section of Conclusions is offered highlighting the main findings and challenges that arose.

2. Methodological Framework

To explore the research question mentioned above we chose case studies that share similar characteristics of the common pool resource (CPR) as well as dependence upon it. In addition, we looked at the social and cultural context variations, because we wanted to study its influence on the relationship between decisions and rules. The methodological framework is based on three phases: 1) economic experiments, 2) collective building of a role playing game (RPG), and 3) implementation/playing the RPG. These phases were complemented by qualitative and quantitative tools such as surveys, semi structured and in-depth interviews, direct observation and secondary information collection.

The research reported in this paper is part of a wider project named "Dynamic of Rules in Commons Dilemmas" in which the same methodology was used to study irrigation and forests as CPR. Therefore, the Colombian and Thai fishery communities that we are reporting here were one out of three cases in each country. The other two cases were focused on water and forest resources. An overview of the project is available in this web site: http://gamesgdynamicscommons.uniandes.edu.co.

In each village 60 people participated in three different experiments (Cardenas et al., in press), and 20 of them participated in the fishery experiment in each fishery village per country. The experiments were replicated in 2008 with students in Bogotá and Bangkok using the same protocol and incentives as for the villagers. The experiments were carried out with undergraduate students recruited from the Universidad de Los Andes in Bogotá, and in Thailand, students of Economics, Science and Engineering were recruited from Chulalongkorn University in Bangkok. Data from students' decisions in economic experiments is useful because it is a reference point for the analysis and results. Behavioral patterns in response to incentives are similar between students and non-students and the distribution of students' decisions tends to be closer to the *homo economicus* model from the neoclassical economy (Cardenas, 2005).

The economic experiment was designed to be implemented in the field with participants who manage natural resources in their daily lives. The pencil and paper based fishery experiments were held in six villages in Thailand and Colombia, three in each country. One of the villages in each country had fisheries as a dominant activity; forestry was most important in the next and finally irrigation in the remaining one. In Thailand experiments were performed in the Petchaburi watershed, which is located in the West of Thailand, in three separate locations. One of the locations is in the coastal area, and the other two are inland. The Colombian experiments were conducted in three different rural sites. The fishery community is represented by a village on Barú Island, (rural area of Cartagena city, in the Caribbean coast).

2.1. Field Experiments

A fishery experiment was designed aiming to capture the essence of the most common situations found in the research literature regarding artisanal fisheries. The design of the experiment entailed an innovation in the experimental economics field, reported in Cardenas et al. (in press): notably, because the experiments include the dynamics of the resources in the study of social dilemmas and natural resources problems. The experimental design includes: a) the resource dynamics over time, b) decisions that comprehends not only effort allocation but spatial allocation too, and c) provision and appropriation problems in commons dilemmas (Ostrom et al., 1994). Expected outcomes of the experiments were information about individual actions, earnings, rule preferences, rule compliance, resource remaining and cooperation levels that could yield insights about the dilemma between individual and collective interests. Fig. 1 illustrates graphically the experimental structure, which is described below.

In the fishery experiment participants decide in each round where to fish between two locations A and B, and how much effort (low or high) to exert in the chosen location. There is a slightly higher return from a high effort compared to a low effort (see Table 1 below), but the return from effort depends on the fish available in each location. The payoff table is the same for both locations, and the initial state of the resource is of high fish availability. However, when the total effort in a location is five or more units in a round, the state of the fish stock will move to the low availability for the next round. This situation can only be reversed when in two consecutive rounds not more than one unit of effort is invested in that location by those who had decided to

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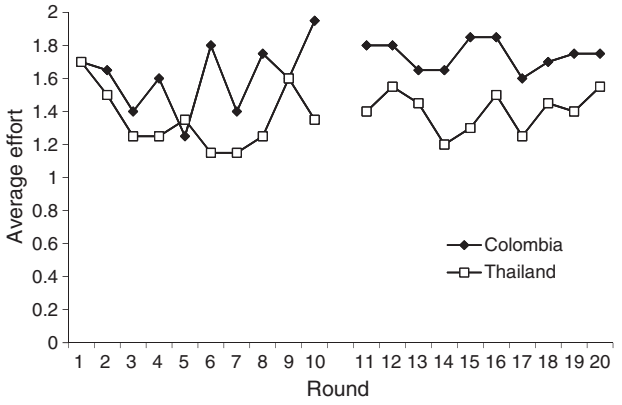

Fig. 1. Average individual fishing effort in the fishing villages of sample.

fish there. When participants behave opportunistically they move to the low state of both resources in two rounds, and get stuck in that situation for the remainder of the rounds since there is no individual incentive to refrain from fishing due to the opportunity cost of fish not caught. For a sequence of 10 rounds, this opportunistic behavior will result in 200 tokens extracted by the group. However, if they were to coordinate their efforts, the cooperative solution leads to 382 tokens by spreading the effort equally and alternating over the two fishing sites so that at least two people do not exert the maximum effort. Experimental literature in the study of CPR has demonstrated that communication between individuals lead to a higher probability to solve the commons dilemma without third party intervention or externally imposed rules (Ostrom et al., 1994). In contrast, there is no clear understanding how experience with resource management would affect those choices of rules and its effect on cooperation in a common dilemma; therefore we decided to include this type of treatment instead of communication in line with objectives regarding the research. In small scale fisheries social dynamics can lead to conflicts among fishers breaking communication and affecting organizational capacity; and consequently, generating suboptimal outcomes. The main reason for banning communication in the experiment had to do with the focus of the project, and given the experimental results reported in the literature mentioned above, we wanted to isolate preferences and behavior regarding rules. Communication among participants with the rest of the villagers was not tracked once they had left the room. Monetary incentives and conversion of tokens into money, were calculated in such a way that each participant could earn, in average, the equivalent to one days labor, this is around 8 USD.

The experiment consists of two stages, 10 rounds in each one; the first stage has no management rules. The second stage starts with a presentation of three management rules which will be voted for. The three rules are designed to solve the commons dilemma and they simulate: 1) random access, 2) rotation and 3) quota rule. If two rules were tied, an additional round of votes between those two candidates was used to solve the tie. The first round after the election had the same starting situation as round 1 of the experiment. As we mentioned before, after ten rounds the participants could vote for one of the following three rules:

Rule 1 (Random Access). In each round the location where each of the participants is allowed to fish is randomly determined by rolling a dice. If a participant harvested in a location not permitted, a roll of a six of the dice led to paying back the harvested points.

Rule 2 (Rotation of Access). In each round one of the locations is banned from fishing. A in rounds 1 and 2 and B in rounds 3 and 4, etc. If a participant is caught fishing illegally, also with a one-sixth (1/6) probability of inspection, the harvested amount had to be returned.

Rule 3 (Quota of Effort). Each participant can exert an effort of 0 or 1 per round regardless of the site they have chosen. In the case of a participant putting in two units of effort, again with a probability of one-sixth (1/6) of being inspected, the participant had to return back the harvested amount.

The protocol and forms of the experiment can be found in the online appendix. The costs of breaking the rules were calculated according to the most common penalty for small scale fisheries, which is the confiscation of the yield. If four of the players exert an effort of 1, in fishery spots in high condition, and one of them breaks, for example the quota rule, choosing an effort of 2, the group earns 36 tokens; and if the offender is inspected a fine is applied and the collective losses in one round represent 22.3% of the total payoffs of the group. In general, the fines range regarding collective losses and are between 20 and 27.3%. Besides, the monitoring probability of one-sixth is much higher than the actual possibilities of environmental authority, at least in the case studies. Therefore, the cost of breaking any of the rules is a strong incentive to cooperate.

After the experiments participants were asked to fill out a short survey on their opinions of the three rules, and a second survey about household socio-economic information and social capital. The experiments were held during the first 6 months of 2007. In Colombia the experiments were carried out between February 12th and 18th. Thai experiments were carried out from January 25th to February 1st. At the end of the field work we selected five people to give in-depth interviews about fishery management and institutional topics. Those individuals were selected among the participants trying to choose experienced people.

In this paper we analyze the fishery case study and use the experimental decision data from the fishery games held in the six villages in Colombia and Thailand as well as the group of students that participated in the fishery experiment. In each village, the fishery games (sessions) were conducted between 4 groups of 5 people each. As a result, 20 people participated in each of the six villages and two universities, leading to a total of 160 individuals.

For the three field sites, permission was given when needed by the head of the village to perform the experiments. The participants in the experiments were recruited by word of mouth and posters hung throughout the village; participants had to be 18 years or older to participate. Special emphasis was placed to recruit adults from households engaged in the resource extraction and only one member of a family was allowed during the same session.

2.2. Collective Construction of a RPG

We came back to the villages in 2008; to Colombia from June 16th to the 20th, and to Thailand from August 19th to the 21st, to give feedback on the experiments to the villagers and to collectively build a Role-Playing Game (RPG). We invited all the participants to the feedback workshop regarding the experiments, but only 25 people showed up. The meeting started with a reminder of the experiments and continued with a presentation of the main results from those experiments. Finally, an open discussion was carried out on the different strategies people

Table 1
Returns (tokens) from effort and fish availability in one location.

Payoff table			
Fish available in location	Fishing effort		
	0	1	2
High	0	7	8
Low	0	2	3

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followed, rule preferences and the relationship regarding local fishery problems.

Role Playing Games have been used numerous times in the field of fisheries management since the developing of the emblematic Fish Banks Ltd. (Meadows et al., 1989), to help students and stakeholders to understand problems and the tragic consequences of overfishing. The approach followed in this research uses RPG to understand rule crafting dynamics and adopts the principles of Companion Modelling (Barreteau et al., 2003). A complete review of RPGs and modeling in natural resource management is done by Bousquet et al. (2002). The co-construction of a RPG refers to a group of participants that in the experiments, along with researchers, design and test a game with the objective, set collectively, to discuss and negotiate rules of use regarding the common resource. The process allowed for observation of how the participants bring the most relevant elements into the new game from their micro-situational and broader context variables; as well as their attitudes towards rules and the collective rule crafting process.

RPGs and modeling constitute the core of the Companion Modeling (ComMod) approach (Barreteau et al., 2003). According to Bousquet and Trebuil (2005), the methodology is epistemologically based on the idea that people build their own realities through the process of social learning. Barreteau et al. (2003) states that the results that the methodology could yield can be classified in three types: 1) change of stakeholders' perceptions, 2) modeling, the transformation of existent knowledge in a formal tool to be used as a simulator, and 3) concrete actions. This approach can be used in two different contexts, the first has to do with knowledge production about complex systems, to be used here, and the second is oriented towards the companion of the decision making processes (Barreteau et al., 2003).

In this phase the purpose was to build an RPG collectively, starting from the fishery field experiment design, with a group of participants from the economic experiments (10 people). The objective of the game was set with people according to their needs and their resource management experience. One of the aims of this process was to allow "collective learning" about resource management, allowing at least for an exchange of points of view but eventually leading up to concrete decisions. The program for the first day workshop focused on reviewing the fishery experimental setting and dynamics and to provide feedback on the experimental results. Table 2 illustrates the agenda that was presented to the participants for the workshop as feedback and for discussion of the experimental results. To achieve the objectives it was necessary to understand what the important variables for local users were. The elicitation of such variables was carried out using information obtained from interviews, discussions in the workshops, and the collective design of the RPG. This qualitative information was analyzed using content analysis. The exercise assumes that participants bring to the game construction salient issues from their local fishery.

The purpose of this first step (items 1 through 4 in the agenda) was to carry out a discussion about experimental results with participants, and to link them with the RPG construction. Another objective of this phase was to identify the variables relevant for participants in the experiments, the most relevant relations among variables, and discuss their rule preferences and reasons for them. The facilitator reviewed the experiments, followed by a presentation of the results in an interactive format. This allowed to understand their decision-making reasoning and the links participants perceived with their real production systems. At the end, the proposal for co-construction was announced inviting about 10 people to build a representation of a more concrete and realistic artisanal fishery situation. The criterion for inviting these people was their interest in the activity, their representativeness regarding leadership and age.

The collective construction of the RPG started with a participative setting of the objective of the game and the construction of the RPG building agenda (Table 3). The role of facilitators was not to guide fishers in the activity, but to observe their discussions and what they wanted to change regarding the experiments towards a RPG. We already had an initial model, namely the experiment; therefore, if they do not make changes, we kept it as it was in the experiment and concluded that they endorsed it, asking each time if there was consensus about keeping such variables as they were in the experiment. We provided all the necessary material to craft any kind of board, tokens or formats they could design. This step could last one or two days of collective work. The main purpose was to observe what kinds of modifications players were going to perform on the experiment. Finally, a test of the RPG was performed with the same designers.

2.3. Implementation of the RPG

This activity consisted of the implementation of the RPG, which was performed once with relevant stakeholders and designers as observers along with researchers. The players that participated in the game were invited by the designers, who acted as facilitators. At the end of the RPG, a summary regarding principal insights and agreements was carried out.

3. Field Sites

The Barú fishermen community is situated southwest of Cartagena. The village belongs to the archipelago of Rosario Islands and Barú with a total area of 1573 km^2, 22.5% of emerged lands and 75.1% of coral reefs (IGAC, 2002). Barú is located in the border of the National Natural Park Corales del Rosario y San Bernardo. The park is, in essence, a marine protected area of about 1200 km^2, with coral reefs as one of the most important ecosystems and where fishermen of Barú fish, and where the more valuable fishing spots are located. In Barú there are about 200 fishermen of Afro Colombian origin with low incomes and high poverty indexes. They allocate their workforce, mainly, to artisanal fishing. The unemployment levels generate social problems and a high pressure on natural resources, according to an official document (Pineda et al., 2006). Artisanal fishery and tourism are the main economic activities in the islands which depend completely from the local ecosystems. According this document these activities contribute to the constant pressure on the hydro-biological resources of the zone creating overexploitation. Two problems affect these fishermen: 1) difficulties in obtaining bait due to the lack of appropriate equipment and 2) the

Table 2
Agenda for the first day workshop.

Agenda for the workshop on a discussion of experimental results		
1	Presentation and objective.	
2	Introduction of the participants.	
3	Fishery game.	
	3.1	How does the game work?
	3.2	How did people play?
	3.3	What if everybody were selfish?
	3.4	What is the game solution?
	3.5	Lessons from the fishery game.
4	Can we improve the game?	

Table 3
Protocol for the co-construction of the RPG.

1	Setting the objective of the RPG	
2	Board game/Spatial setting:	
	2.1	Fishery spots
	2.2	Fishers groups
	2.3	Actors
3	Representation of the fishery activity:	
	3.1	Effort
	3.2	Condition of the fishery spots
4	Organization of the round	
5	Meaning of 1 round	

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industrial fishery accused of being responsible for the collapse of a number of species due to their highly harmful fishing techniques such as trawl fishery in reproduction areas. Other studies such as Hernandez et al. (1993 in Pineda et al., 2006) also confirm overexploitation of the resource and low natural regeneration rates, due to inappropriate fishing methods, intensive exploitation and an increase in fish demand during last 30 years. The net result is a combination of a decrease in catch and a decrease in the stocks of commercial species (PNNC 2006).

Bangtaboon fishery village is located in the area of the Bangtaboon river mouth which belongs to Phetchaburi watershed in Phetchaburi province, Central Thailand. The village is located in the upper part of the Gulf of Thailand. Located in this region are the four major river mouths of Thailand, these contribute greatly to a high level of nutrients all year long. Surrounding the village are mangroves and some inland aquaculture areas. The administration of Bangtaboon is based on a municipality system. The municipality covers an area of 7.92 km^2 and has a population of 6260 people (PAO 2007). The fishers settled in this village more than 100 years ago. Aquaculture, especially cockles and mussels, is the major activity in this area. However, aquaculture in the coastal waters needs a license from the Department of Fishery. There exists no specific regulation for the local fishery such as bans or fishing quota. Local fishers can harvest freely all year long with regular fishing gear. There are many marine species in the coastal water such as fish and various shellfish that locals can fish for at different periods of the year. Resource depletion and the industrial trawler vessels fishing near the shoreline are the main problems in this area. However, these are general problems for every coastal fishery in Thailand.

4. Results

In this section we provide the more relevant results from field experiments in Thai and Colombian fishery villages. The second part of the section illustrates the results from the second field visits, in which researchers and fishermen collectively designed a RPG and finally implemented it.

4.1. Experiments

Since the focus of this paper is on fishery villages, we only report in detail the results of the field experiments in these villages. However, we will also show some comparisons with the non fishery villages.

Fig. 1 shows the average individual effort in each country for the fishery villages. Two main results are observed. The ineffectiveness of the rules in the second stage as no major change is observed across stages (a Mann–Whitney test comparing rounds 8–10 to rounds 11–13, p-value = 0.8609 or to rounds 11–20 shows no significant differences, p-value = 0.7256). Also, Colombian groups apply a higher effort to the fishery if compared to the Thailand cases (p = 0.0001).

As a result, group earnings (Fig. 2) could not be sustained at high levels after the third round, both before and after the rules were applied. For the second stage, higher earnings were sustained for an extra round or two, but such improvement did not last. The reason is that the group efforts on both sites A and B were sufficiently high, thus bringing both sites to the low level of stocks as required by Table 1. Recovering back from low to high stocks for fisheries was very difficult as it required two sequential rounds with total effort equal or below 1 unit of effort at that particular fishing site, and with no possibility that players will verbally coordinate their actions.

The econometric analysis shown in Table 4 confirms that Thai participants showed significantly lower effort in fishing compared to Colombian participants. Being older also led to lower effort. Under high stocks the effort tended to be higher during rounds 1–10 but such effect disappeared for the second stage.

Four groups elected random access, 2 groups elected rotation of access, and 2 groups elected quota. The results are presented in Table 5. There is a modest improvement of the earnings due to the rule

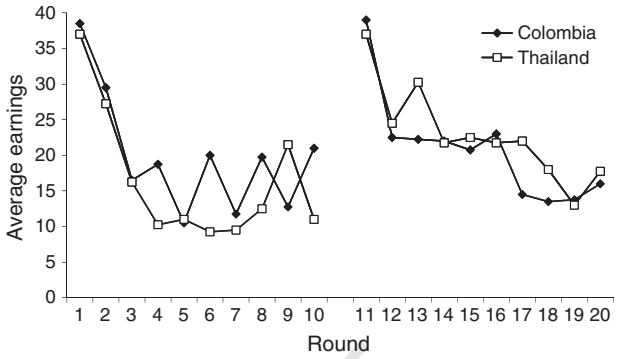

Fig. 2. Average group earnings in the fishing villages of the sample.

change: 36.45 vs 43.58 (p-value = 0.001). This difference is mainly due to the quota rule efficiency. When we look at the individual behaviors we see that with the rules, stocks remain high for longer periods in both locations. This is mainly caused by groups who had elected the quota rule and largely complied with it. Note that the statistical difference between countries disappeared; the quota rule was elected in Thailand twice, but never in Colombia (see Table 5).

If we compare the results from experiments in fishery villages with other villages, as well as students in urban areas, we see some interesting differences (See Table 6). In both countries the fishery villages have the lowest earnings in the first 10 rounds. This is significant for Thailand (Mann–Whitney test, p = 0.025). Furthermore, in both countries the student groups do significantly better (p = 0.0024 and p<0.001 for Colombia and Thailand respectively). This indicates that previous experience with the resource dynamics does not lead to better performance in the experiment. In the next section, we will explore explanations for lack of collaboration among fishermen in these two villages.

On the other hand, the fishery villages are the only ones with an increase in the performance after the rule choice (p = 0.064 and p = 0.004 for Colombia and Thailand respectively). This result leads to the question: Are fishers able to choose more relevant rules and comply to those rules more effectively? It does not depend on the rule choice since the non-fishers have the same distribution of rules chosen as the fishers. In the next section we will discuss how fishery villages perceive the actual regulations they are exposed to, and how this may shed light on the findings in the field experiments.

Table 4
Regression results for two analyses for *group-level* data of group effort in fishing, in rounds 1–20.

	Effort (rounds 1–10)	Effort (rounds 11–20)
Constant	1.386*** (0.177)	1.990*** (0.256)
Country (Thailand = 1)	−0.237*** (0.079)	−0.109* (0.094)
State of fishery (HH = 2)	0.262*** (0.061)	0.079 (0.056)
Age	−0.005** (0.002)	−0.006*** (0.002)
Trust	0.143 (0.214)	−0.267 (0.169)
Round	0.037*** (0.014)	0.013 (0.013)
Quota (elected=1)		−0.378*** (0.119)
Allowed		−0.129 (0.087)
N	400	400
−Loglikelihood	−399.948	−293.937
χ^2	0.45 (p-value = 0.7982)	2.63 (p-value = 0.2682)

We used a multi-level analysis distinguishing levels for country and session. The significance metric for multi-level analysis is reported (χ^2).
*** p<0.01.
** p<0.05.
* p<0.1.

Table 5
Rules elected by fishery village in each country and resulting earnings.

	# Times elected		% Rule broken		Average earnings per person (rounds 1–10)		Average earnings (rounds 11–20)	
	Colombia	Thailand	Colombia	Thailand	Colombia	Thailand	Colombia	Thailand
Random access	3	1	14.7	6	41.7	39.0	40.7	36.2
Rotation	1	1	12	16	33	34.0	43.8	32.8
Quota	0	2	0	24	–	36.0	–	56.9

4.2. Role-Playing Games

The goals of the these workshops carried out in 2008 were twofold; on one hand to debrief the community with the general results of the field experiments, have a discussion about possible explanations for the results and how the experiments relate to their local fishery context. On the other hand, to build collectively between participants and researchers, a RPG that has the experiments as a departing point. There were three specific objectives to these exercises: (i) to go one step further in connecting individual behavior in field experiments with the participants' SES, (ii) to observe processes of rule crafting for fishery management, and (iii) to generate an open space for discussion, possible negotiation regarding problems, and rules for resource management. The main observational dimensions were: rules and norms, interactions, representation, problem perception, sequence of modifications and actual modifications compared with researchers' hypothesis.

4.2.1. Collective Discussion of Experimental Results

Though participants acknowledged that to allow the recovery of the resource stocks it would be necessary to diminish the harvest effort and/or stop fishing in some places and organize a rotation scheme, they explicitly expressed that they could not stop fishing because they have to bring food for their family or because they were already heavily indebted. They are aware that the resource should be protected but cannot take any action. Fishers concluded that it would be difficult to keep agreements among all the local fishers, basically due to the free riding behavior of some of them (at both places) and the local organizational difficulties (in the Colombian case).

There are also some differences between the countries. In Colombia, participants assimilated the low condition of the resource in the experiment to the current condition of their fishery grounds. This was a permanent and generalized comment during the discussion. They also explained that not only fishers from their community use the resource but also people from neighboring villages came to fish in this zone. Their explanation to this situation was that in their own fishery places, the illegal fishery gear utilization had exhausted the resource. They proposed two solutions for the experiment: (i) all going to one spot and leaving the other resting, and (ii) to distribute the 5 players in the two spots.

4.2.2. Co-Construction of the RPG

For the collective construction workshop we made an open invitation during the discussion of experimental results and 10 people stayed to participate in the activity. In the Colombian case, these people were six experienced fishers, members of the local fisher association, and four young fishers. In the Thai case participants were selected from the participants in the feedback workshop and invited to participate on a voluntary basis, and finally 7 people decided to participate in the activity. The collective construction of the RPG started with a participative setting of the objectives of the game and the construction of the RPG building agenda. The role of the facilitators was not to guide fishers in the activity, but to observe their discussions and what they wanted to change of the experiments towards an RPG. Previously we agreed with them that if they did not make changes, we considered that the experimental design reflected their situation, meaning that they endorsed the unchanged characteristic. We provided all necessary material to craft any kind of board, tokens or formats they could design. This step could last up to one or two days of collective work. The main purpose was to observe what kinds of modifications players were going to perform in the experiment. A second objective of this phase was to understand what kinds of variables were relevant for participants in the experiments, what were the most relevant relations among variables and to discuss their rule preferences.

The fishery economic experiment described in Section 2.1 was designed to address problems studied in artisanal fisheries and experimental tradition in CPR literature. The hypotheses about modifications of the experimental setting for RPG that local fishers could carry out (Table 9) arouse from our knowledge of the context of each case study; this was acquired throughout research, secondary information and interviews done at the end of the field experiments. The expectation was that people were going to modify the experiment in terms of resource representation and the possibilities of individual decision making and collective decision making. In regards to the resource, the expected changes were: 1) to differentiate the kind of target species, 2) fishery seasons, and 3) more realistic fishery places. Regarding individual decision making, the expectation was they would include: 1) possibilities to switch from one target species to another, 2) the market price of fish, and 3) the possibility of going to different areas to fish that can be grouped into coastal and far zones. The expectations regarding collective decisions were that participants would: 1) negotiate about the rules, 2) like to have more frequent enforcement and 3) inclusion of new actors and roles.

4.2.3. Objective of the RPG

4.2.3.1. Colombia. The objective of the RPG was discussed among participants, always trying to address the principal problem affecting local fisheries management. Finally they reached a consensus, and the objective was set: the RPG must serve to facilitate the negotiation between local fishers and other actors such as Natural Park authorities and other governmental agencies, as well as fishers from neighboring villages. They planned to use the RPG in a meeting with Natural Park authorities and other governmental agency representatives. It is a relevant fact that, though Barú fishers recognize endogenous organizational and collective action problems, they saw the game as a tool for negotiation on natural resource management with external stakeholders.

Table 6
Average earnings of all groups (in tokens) categorized by countries and expertise.

Average earnings per person	Rounds 1–10	Rounds 11–20
Colombia fishing village	39.8	41.5
Colombia non-fishing	40.1	37.6
Colombia students	46.3	44.5
Thailand fishing village	33.1	45.7
Thailand non-fishing	38.8	39.1
Thailand students	46.4	46.0

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4.2.3.2. Thailand. The first objective they mentioned was for collective discussion about management. The second important objective was to play with the department of fisheries in order for them to understand how their life is and what the problems are. The underlying idea is that the fishery department may help them by restocking with fish and shrimp.

4.2.4. Board Game

4.2.4.1. Colombia. The construction of the board game started by the location of the fishery spots used by the local fishermen in a map of Barú and its marine zones. During this activity, the discussion focused on the two types of fishery grounds: the ones located close to land and the farther spots. The emphasis was on the technical difficulties when fishing in the far zones, such as lack of appropriate boat engines or even total lack of engines. Participants insisted in the representation of the fishery zone used by the industrial fishery ships. From fishers' perspectives, industrial fisheries, though they do not fish in the same zones, affects the resource in the fishing grounds where locals practice artisanal fisheries. Researchers proposed a spatial simplification for the board game that captured the two main problems, close and far fishery places and industrial. The RPG was designed for 9 players, 8 fishers and a Natural Park representative. One of the players was to represent fishers from other villages and the other, the industrial fisheries. Fig. 3 illustrates the proposed board game accepted by participants in the exercise.

4.2.4.2. Thailand. Participants decided to have 4 fishery spots instead of 2 with local names. Fig. 4 depicts the schema of the RPG.

4.2.5. Representation of the Fishery

4.2.5.1. Colombia. A discussion was had about the meaning of "effort" for them and how we could represent that in the game. The conclusion was that the effort consisted of the time they spend fishing measured in hours per day. The second aspect of the fishing effort was how to represent the fishing gear. The decision was to include explicitly all the fishing equipment, legal and illegal, and allocate an amount of fish in kilograms harvested with each one according to the effort (Table 7). The issue of the state or condition of fishery spots, was left as in the experiments, the places could be in high or low condition. They classified the fishery spots in two groups: close and far from the shore. The implication of this classification is that most of the fishers do not have boats and equipment to go to the far spots; they can only fish in the spots close to the shore; as a consequence, the initial conditions of the game was that the closest fishing places were in bad condition regarding fish abundance.

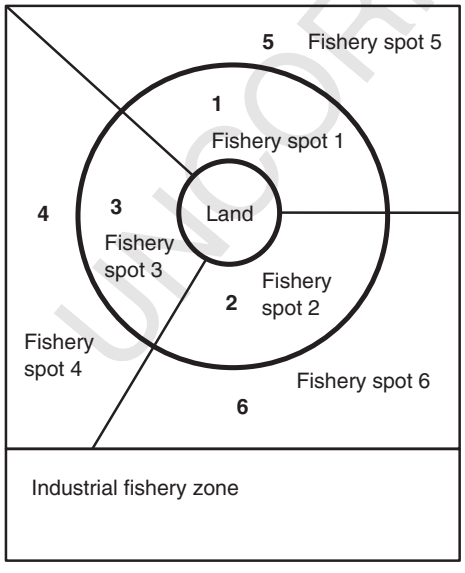

Fig. 3. Game board for the fishery RPG (Colombia). The smaller circle represents the land. The bigger circle represents the border for closer fishery spots (1, 2, 3). Spaces labeled 4, 5 and 7 represent the farther fishery spots. The rectangle at the bottom represents the zone where industrial fisheries carry out their activities.

4.2.5.2. Thailand. They introduced a third state for the resource (medium). At each place the catch is different (Table 8). It also depends on the state and the number of visitors (total/number of visitor truncated). They decided to have only one level of effort instead of two because having two was too complex. If two fishers go to the same spot, its state will decrease to the lower category. More than two fishers on the same spot leads to a low level. As for the renewal of resource: if the spot is not harvested, its state increases to the upper category.

4.2.6. Organization and Meaning of One Round

In Thailand and Colombia the steps of each round were set in the following way. 1) Each fisher made his decisions (fishery gear, effort, and fishery spot). 2) Calculations for each fishery spot and the amount of fish harvested by each player measured in kilograms.

In Colombia, after 5 rounds the monitor informed the Natural Park representative about the state of the game board variables (aggregated amount of fish harvested from each spot in kg), the number of times each place was visited and the state of each place (High or Low stock condition). The park officer could intervene at any moment and he was free to talk, discuss, impose regulations, monitor and fine fishers if he considered necessary. The representative could say and do whatever he wanted (discussion, rules, sanctions, call for agreements, etc.). In the public game board only the state of the places (High and Low) was reported. Another set of 5 rounds followed. The meaning of each round was discussed and set as one day of fishing. Therefore, the National Park received the report from the monitor each week. RPG designers decided the way the park representative could intervene.

Table 9 presents a summary comparison between researchers' expected and actual changes that occurred during the building of the game. It shows what the important contextual dimensions needed to be taken into account to model the social dilemma:

- In Thailand and Colombia: resource diversity, ecological seasonality, and market differences are not core dimensions while the spatial complexity of the resource system is important. Effort representation does not have to be represented in a more complex manner.
- In the Colombian case only, the technologies were increased, new roles were introduced and rule settings are part of the structure of the RPG.
- In Thailand only, the resource abundance was modified for a more complex setting.

5. Discussion

In this section a discussion of the explicative power of context on individual behavior will be carried out. Poteete et al. (2010) proposed different core relationships in social dilemmas, which are presented in Fig. 5. In behavioral theory, cooperation in social dilemmas depends on individual differences and context. Our methodology proposes three different tools to study the individual and collective decision making in social dilemmas, namely surveys and interviews, field experiments and role playing games. We discuss here how results obtained through these role playing games, surveys and interviews may explain the field experiment observations on (1) the levels of trust and cooperation among players and the influence of context (2) how rules are set among players. Finally we make two comments

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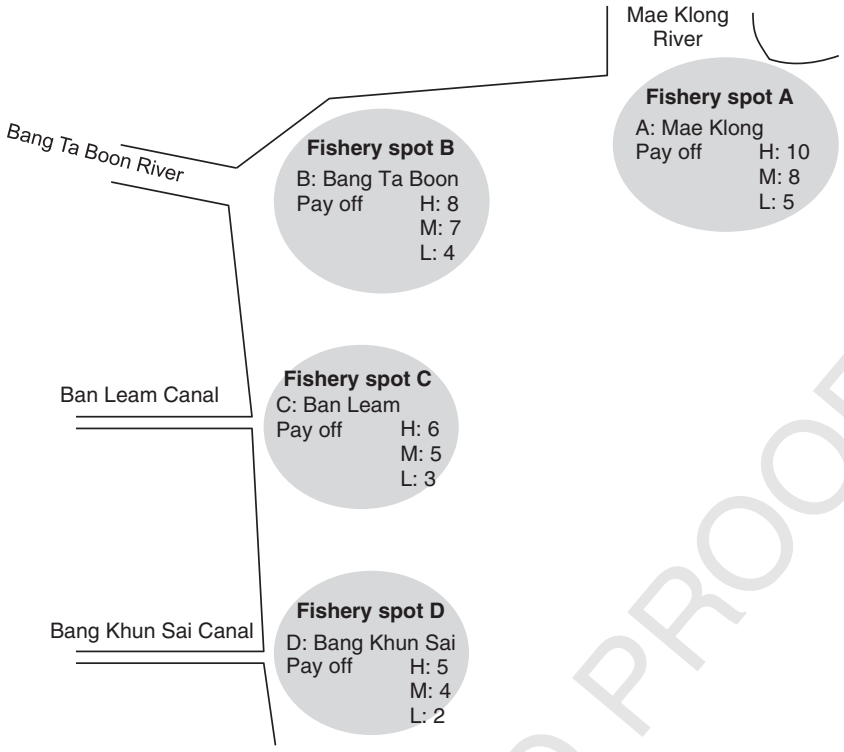

Fig. 4. The game board for the fishery RPG in Thailand. There are 4 fishery spots. Te RPG was designed for 6–10 layers with 10 rounds. H: High resource level. M: Mid resource level. L: Low resource level.

Table 7
Returns in kilograms from effort and fish availability in fishery spots (Colombian RPG).

RPG payoff table							
Fishery gear		Good resource conditions			Bad resource conditions		
	Code fishery gear	Effort 0	Effort 1 (4 h fishing)	Effort 2 (8 h fishing)	Effort 0	Effort 1 (4 h fishing)	Effort 2 (8 h fishing)
Diving	1	0	4	8	0	2	4
Trolling line	2	0	4	8	0	2	4
"Boliche"	3	0	6	12	0	2	4
Net	4	0	5	10	0	2	5
Dynamite	5	0	10	20	0	5	10
"Palangre"	6	0	7	15	0	3	7
Industrial fishery	7	0	15	30	0	7	15

on the complementarities of experiments and RPGs, debriefing, facilitation and research.

5.1. Cooperation and Trust

The average behavior at the group level of the field experiments indicates lower levels of cooperation than optimal in the two stages: with and without external rules, most groups over extracted the resource leading both sites A and B towards low stock levels. If we consider the effort as an indicator of the cooperation there are no significant differences between the first and second stages of the experiment. As another indicator of cooperation, we can also measure how frequently a fishery place is in a low or high state, and we observe that the groups had difficulties in getting the fishing sites back to the high state. Group earnings could not be sustained at high levels after the third round both before and after the rules were applied. For the second stage, higher earnings were sustained for an extra round or two but such improvement did not last. The reason is that the group efforts on both sites A and B were sufficiently high, thus bringing both sites to the low level of stocks as with the consequent lower payoffs shown in Table 2, recovering back from low to high stocks of fisheries was very difficult. It is only when the fishermen followed the quota rule that the results were better. This exception shows that the difficulty to manage this system can be overcome. Prediger et al. (this issue) repeated exactly the same experiments, including the maximum effort level, at other places where people succeeded at maintaining a high state for the two sites: this confirms that the experimental settings are not so difficult that sustainable management is impossible.

Surveys carried out after the field experiments show an interesting perception about community from the participants. The results are very different in Thailand and in Colombia. In Colombia 61% of respondents answered that people were likely to cooperate if there was a problem related with the natural resources, and 30% responded that people

Table 8
Returns for the different locations (Thailand RPG).

Total resource/place	Mae Klong	Bang Ta Boon	Ban Laem	Bang Khun Sai
High	10	8	6	5
Medium	8	7	5	4
Low	5	4	3	2

Table 9
Expected and actual changes during RPG co-construction.

Topic	Expected changes	Changes in Colombian fishing village	Changes in Thai fishing village
Changes in resource settings			
Resource diversity	Different kind of target species.	No. Participants did not differentiate between species.	No. There are different resources but they harvest them at different seasons.
Season to fish	Different seasons or climate restrictions according season.	No. Participants did not include any climate variable or seasonal particularity.	No. When the season changes they change target species.
Differences due to the context in Thailand and Colombia	Differences — aquaculture (much more in Thailand) and conservation area (Colombia).	Yes.	No. They did not take into account aquaculture in Thailand and did not mention it. Because the aquaculture is privatized resource, it's not collective.
Fishery spots	More realistic fishery places (number and names).	Yes. Participants began by a realistic map of the region and fishery spots, and then a middle point between experiments representation and the map was used.	Yes.
Condition of fishery spots	No hypothesis.	No. High and low conditions were kept from the experiments.	Yes. Medium condition was added.
Individual decision making			
Species choice	Possibility to switch from one target specie to another one.	No. No differentiation in species to fish.	No. No differentiation in species
Price	Taking into account the price at market.	No. Not considered.	No. They have thought about that but think that this will make the game too complex, and it is also related to the decision to have one generic specie. In reality 4 prices for a given specie.
Fishery spots choice	Different areas to fish which can be grouped into coastal zone, far zone.	Yes, fishery places were classified in coastal and far zone. Seven fishery laces were defined: 3 coastal, and 4 far zones.	No.
Fishery gear	No hypothesis.	Yes. Participants differentiated fishing gear. They included 7 types of gear legal and illegal, with explicit names and including Industrial fishery.	No.
Incentives structure	No hypothesis.	Yes. The payoffs were assimilated to kilograms of fish and were defined according to the gear, effort and spot condition.	No.
Effort	No hypothesis.	No. The values of the experiments (0, 1, 2) were kept, but it was necessary to specify their meaning in term s of hours: 1 = 4 h, and 2 = 8 h.	Yes. They simplified it. Only one effort is possible.
Collective decisions			
Rules	Rules would be negotiated.	Yes. They tried to make rotation agreements. Negotiation was about alternative production activities in order to lower the pressure on fishery spots.	No. They have set the game like in the reality, and in reality there is no rule (except Buddha day rule[a]). There is no arena for discussion.
Sanctions	Sanctions would be more probable.	No. No sanctions were implemented in the agreements, but Park authority threatened with the implementing of sanctions.	No. Not relevant because no rules.
Roles	Integration of new roles.	Yes. New roles were defined: Environmental authority (Park official), Incoder official, and fisher from other village.	No. For them, regarding the situation in this village it is meaningless to include the department of fisheries. "They serve only the rich guys."

[a] On Budha day, the fisherman should not go fishing (the periodicity is one day/8).

would cooperate only somewhat. In Thailand, the numbers are respectively 8% and 50%. The trust variable (Table 4), calculated from the individual survey to participants in experiments, did not show a significant correlation with effort in any of the stages of the experiment.

When it comes to RPG, we found different results in Thailand and Colombia; in Colombia the players introduced the role of the National Park. There are no direct interactions among the fishermen to manage the resource. The cooperation goes through the authority of the National Park. In the RPG session cooperation exhibits an increasing trend when environmental authorities hear their concerns and discuss collaboration among fishermen and the Natural Park. A second factor for a cooperation increase is the existence of alternative income generating options. In Thailand, the players refused to set any regulation body. In reality the Fishery department is the state agency in charge of managing the fishery. The fishermen have very loose relationships with the agency which they see as a top–down control body acting only through retaliation. They did not want any institution on collective resource regulation to be included in the game. The reality of this tragedy is perfectly illustrated by the situation in this village. Their rationale is the fact that people would not respect the rule, the one who does not go fishing is the looser because the other ones will take the resource.

In Colombia, three points are important to highlight from interviews made to local fishermen. 1) Local leaders and authorities are an obstacle instead of support for cooperation. 2) Interviewees, outside the arena of experiments and RPG, express that there is short and long term cooperation. Short term cooperation is focused on household's daily needs, and it destroys long term cooperation, which is identified as collective actions for the conservation of the resources. 3) Long term cooperation would be affected by coordination difficulties and free riding behavior. In Thailand, the interviews show that there is no cooperation among fishermen. Cooperation is achieved in reactive ways when stakeholders want to protest again the administration and obtain something for it. People do not group to collectively solve common problems. The head of the village has little power and the village is made up-of small groups who compete for power.

The information obtained through the surveys, interviews and during the RPG shed some light on the cooperation during the experiments. The context pushes the players towards individualistic behavior. The contextual dimensions are different in Thailand and Colombia. In Colombia, the state of the resource is much poorer than in Thailand and there are not many alternative livelihoods other than fishing. In Thailand the ecological context is much better, however, in

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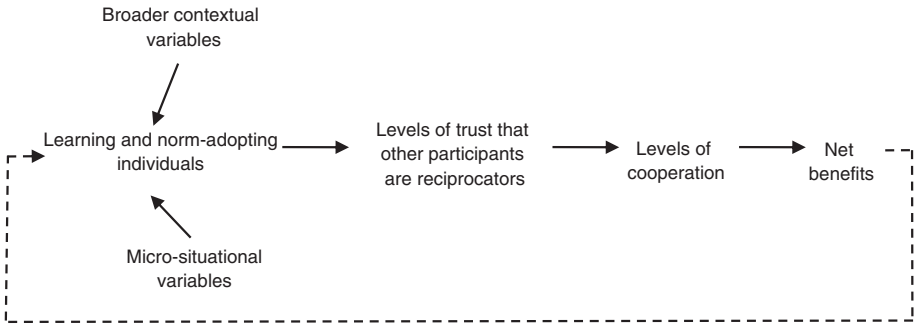

Fig. 5. Core relationships in social dilemma.
Adapted from Poteete et al. (2010).

that case fishing is considered as a very competitive activity: in the Thai village, surveys, interviews and RPG all indicate that the level of trust is very low. In both cases, stakeholders consider that the governance of the fishery is in the hands of local leaders or a governmental body, which are considered as obstacles. If we link this context to the settings of the field experiments we can understand the uncooperative behavior. Participants are in an individual short term situation where incentives for cooperation are not straightforward, and need high levels of coordination without communication. The short term monetary incentives are perceived as a means to fulfill daily needs, and in the absence of communication coordination is difficult.

5.2. Rules

During the field experiments the players could only vote and choose among a proposed set of rules. As a result we observe that these rules did not make a big difference for most groups, except the fishery villages. Would having the opportunity to craft their own rule lead to more efficient use of the resources? What kind of rules would they propose? We use the results of the RPG and then the results of the interviews to explore these questions.

The two RPG in Thailand and Colombia showed very different approaches. In Thailand the fishermen did not include any rule; they did not discuss the opportunity of including rules in the game nor including a discussion protocol for resource management. When the researchers raised the question of the rules, they mentioned one rule, which is the Buddha day. But during the game this rule was not respected. In Colombia, the fishery RPG contributes to explain the interest and ability in crafting rules as well as the conditions under which they could be implemented. The interest of players in talking about rules was explicit from the very beginning of the game design and in the setting of the objective which was: to facilitate the negotiation between local fishermen and other actors such as Natural Park authorities and other governmental agencies, as well as fishermen from neighboring villages. The central topic for negotiation was to reach agreements among fishermen and environmental authorities to find solutions that satisfy the conservationist interests and community livelihood sustainability. In the first part of the RPG players tried to craft a rotation scheme encouraged by the environmental authority. But there were difficulties for coordination and fulfillment of the rule. The underlying reason for this failure was evident towards the last simulated week of the game, when an alternative production activity different to fishing was introduced into the game with positive effects on the compliance of the rotation agreement. The environmental authority representative called fishermen to fulfill the agreements and at the same time he reminded them of his ability to impose bans and sanctions. On the other hand he acknowledged the physical limitations of the Natural Park for effective monitoring and that the collaboration with fishermen was necessary. In turn, fishermen expressed their need to explain to authorities the reason for the high level of rule breaking.

The contextual situation explains behavior in the experiments. In the previous section we explained that in Thailand fishermen from fishing villages are very reluctant to rules. In the interviews, when this question was raised, the fishermen said that on the one hand, rules are imposed from the top of the administration without any discussion, and on the other hand, locally, due to the individualistic and competitive behavior no agreement on rules could be reached. The election of a quota rule, however, led to improved performance in the experiments. Although there was a significant amount of rule violation, 76% compliance to the rule was sufficient to increase earnings.

The lack of effect from rules in the Colombian case is consistent with two factors: 1) permanent conflict with environmental authorities, as well as incapacity of authorities for monitoring rule compliance. 2) Livelihood fulfillment needs. As in the RPG, players are bringing to the experiment their necessity of income and the lack of understanding, (from the authorities' side) of their situation; therefore, for fishermen rules have no legitimacy.

Formal regulation in the Colombian case consists in rules for fishery gear, banning of endangered species, ornamental fish, and individual size constraints. Since the area has the status of a national natural park, all the formal regulation falls under the umbrella of the kind of fishery that is permitted, which is called “subsistence fishery”. This means that it is permitted to fish within a non-profit character in order to supply food for the fisherman and his family (Congreso de La Republica de Colombia, 1990).

Lessons from the RPG led us to believe that external rules such as rotation and quota, without participation in their design, have less legitimacy than random rule. Therefore, random rule could be perceived as being very similar to the kind of situation they face daily, given the difficulties and type of monitoring carried out by the authorities. In addition, given the difficulties of coordination in the first 10 rounds, players could have thought that the random rule could give better results only by chance.

From the analysis of the RPG, surveys and interviews, it seems that in this context we cannot expect the fishermen of the Colombian and Thai villages to be very sensitive to the regulation. In the field experiment the rules are imposed as if in reality. They have a modest effect because a small proportion of cheaters will lead to a low resource state. In reality, the few rules which are imposed are not respected either. When we examine the context, we conclude that the problem is not in the freedom to craft rules instead of adopting rules. In both villages, for different reasons, people are very reluctant to any rule, even when crafted by them.

5.3. Complementarities of the Two Action Arenas

Experiments and RPG constitute two versions of the local fishery action situation. The first is a simplification designed by researchers, the second, is designed by locals and researchers; it goes deeper into the context. In a continuum from the simplest to the most complex

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representation of the system, the experiment is close to the simplest end of the spectrum. The experimental setting can be viewed as a simplistic model that allows the elicitation of patterns of behavior, and the co-construction of the RPG. Starting from the experimental setting constitutes "*A gradual increase in model complexity* (that) *will give insights into the essential mechanisms responsible for the studied behavior*." (Vieira and Castillo, 2010:1331) The two settings are nested action situations, in which the description and explanation for each of its components (participants, positions, actions, information, control, and costs and benefits) are complementary. Materials for both settings were designed in a way that participants could easily enter into the dynamics of the simulations. The assumption, in the RPG design process, was that the level of complexity in the system could be accounted by the number of variables and relations included in the RPG, in line with Kopainsky et al. (2010) and Sterman (2000) among others in the realm of systemic simulation gaming.

While the experimental setting is a device that conveys specific information to researchers, the RPG is a polysemic object (Vieira and Castillo, 2010), which "*speak in different voices for different audiences*" (Suchman et al., 2002, 174), therefore it works as a talking object speaking to fishers, other local actors (environmental authorities) and researchers (Vieira and Castillo, 2010). Another advantage of the RPG is that it compresses a numbers of variables, conflicts, positions, rules, time and space in one representational object called a "*dense methodological tool*", used to represent complexity. Since it condenses time and space, it makes problems explicit, providing a space for finding solutions and exploring possible scenarios (Vieira and Castillo, 2010).

Finally, the outcomes of each action situation are of a different nature. The experiments generate patterns of behavior, state of the resource through time and essentially quantitative information. While the RPG produces qualitative information that explain decisions and interactions. The RPG can be seen as a bridge between experimental patterns and the SES context. Interactions and outcomes in the RPG action situation contribute to explain decision patterns in experiments.

5.4. The Challenges of Facilitation in RPG Construction

In recent years facilitation and debriefing have been gaining attention as a scientific subject (Herbert, 2010; Kato, 2010; Kriz, 2010). The relevance of facilitation and debriefing in our research can be illustrated by the idea discussed by Kato (2010), in which, facilitation is viewed as the utilization of a group of tools and as a social construction of technology. These activities constitute a type of social action and a research method in which "*facilitator and participants engage in a mutual, joint process of learning*" (Kato, 2010: 698).

Debriefing of experimental results and facilitation of the collective construction of the RPG entail a challenge, because at the same time, one is playing both facilitator and researcher. Elements such as trust building with participants, expectations and careful observation of the social and game dynamics, are at the intersection between both roles. Herbert (2010) proposes four metaphors for representing the kind of pressures and challenges when facilitation and research are carried out at the same time in gaming and simulation debriefing. Categories, such as "politician", "magician", "trader/traitor", and "ventriloquist" are roles that may be adopted at different moments in the activity. The politician role is needed when the group of participants entails a variety of interests and power relations are an issue. "*Facilitating and researching in the same context can feel like doing a magic trick. A successful magician controls the space around themselves as performer and the audience and thereby creates a bubble wherein all the elements of a successful performance are coordinated in a flawless flow.*" (Herbert, 2010: 687). Therefore, the challenge, for the facilitator/researcher, is to keep the bubble safe, and effectively control the high number of elements present in the dynamics. The line between the trader and the traitor role is thin and sometimes blurred. It is clear that the debriefing activity implies an exchange of knowledge, time, and energy. Reciprocity is not always easy to accomplish; it is easy to become a traitor if tacit agreements on confidentiality are broken, or relations with other stakeholders makes it difficult to maintain a level of neutrality. Effective debriefing must ensure that all voices can be represented and the researcher, when reporting results, must have the skill to show the multiple voices heading in different directions: this is the role of the ventriloquist of the facilitator/researcher.

The collective construction of the RPG in communities where there is a high dependence on the resource of interest is a situation in which the researcher/facilitator plays all these roles. Beyond the issue of the efficiency of the process, the most important consideration must be of an ethical nature. Participants must be aware that the researchers are, at the same time, researchers and facilitators (Herbert, 2010). A transparent statement and explanation of researchers' interests for participants is necessary to decrease the risks of playing the traitor role. The researcher has to cope with the pressure from different stakeholders, groups of fishers and park authorities, in the sense of adopting their perspectives as the legitimate ones. This situation demands a careful play of the "politician" role in understanding local power relations, and of the "ventriloquist" role in balancing the variety of perspectives. The use of different tools such as voice and video recording devices becomes an issue, especially when playing the RPG. In this phase, the ideal scenario is to have one assistant with an observation guide per player, and one or two people in charge of the video recording. Budget constraints imply a considerable reduction regarding the research team. The result is, typically, two or three people per team trying to maintain the bubble and the fluency of the RPG.

6. Conclusions

Renewable resource management problems are often considered as a social dilemma. In a situation where no central authority is regulating and actually controlling the management of resources, the sustainability of the social–ecological system at stake depends on the ability of the resource users to cooperate. After several years of research scholars such as Elinor Ostrom and colleagues have proposed a model which explains the cooperative behavior, i.e. the ability to craft rules and fulfill rules: it depends on the level of trust, on the capacity to learn and adopt rules. The difficulty is that these abilities are context-dependent. Field experiments are a methodology that aims at capturing the behaviors of resource users when they are put into action. In an experimental setting they are collectively facing a social dilemma. One can observe their behavior, however the role of context is difficult to assess. Our research proposes a methodological framework which associates field experiments with a role-playing game, surveys and interviews.

This paper presents an insight into two fishery villages in Colombia and Thailand. Field experiments were conducted in these two villages and we explored the cooperation level and the efficiency of rules for a better management of the resource. The results show a low level of cooperation and very small efficiency of the rules. We use RPG, surveys and interviews to explain how ecological and social contexts may explain the field experiment results. Co-construction of role-playing games, which take into account the local context, revealed that the fishermen behave in a very individualistic way. This was because, in the case of Colombia, their subsistence depends on the fishery, which is not ecologically productive. In the case of Thailand, the social structure of the village leads to very competitive behavior. In both cases the fishermen do not trust local leaders and governmental organizations.

Experimental behavior, in line with Levitt and List (2007), is strongly influenced by scrutiny of others, the decision making context and selection of participants. Results of experiments may be used as an indicator of behavior patterns outside the experimental arena as qualitative insights instead of significant statistical results. In this paper we focus especially on the context. Though results from RPG

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and interviews do not constitute a proven statistic, they contribute significantly to explain experimental decisions. The collective construction and implementation of the RPG entails a process of gradual inclusion of participants' daily context in the initial experimental action arena, and consequently, generating insights about experimental behavior.

When fishermen participate in the field experiment they are embedded in an action arena where structure entails economic incentives for cooperation that can only be optimized through coordination between themselves. In this context, coordination is hard to achieve without communication. For example, a clear finding in the two case studies is the poor outcomes in experiments when already crafted rules were chosen and implemented. The issue of external rules was discussed in depth in RPG and interviews, where they clearly explained the problems with local environmental authorities in the Colombian case, and national ones in the Thai case. In addition, they clearly explained their aversion to imposed rules.

This paper illustrates how a combination of different tools may contribute to explain the underlying causes of decisions in field experiments. Experiments shed light on the "what", meaning "What are the decisions?", but, as Smith (2010) remarks, what is relevant now to understand is the "how and why" of human behavior. In line with Levitt and List (2007), we claim that a combination of experimental and natural settings data offers deeper insights about the "how and why" of decisions.

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Appendix A. Supplementary data

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