

EXTERNAL REGULATIONS AND LOCAL APROPRIATIONS IN THE MANAGEMENT OF A RESOURCE IN OLD PROVIDENCE AND SANTA CATALINA ISLANDS

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This research was carried out in Old Providence and Santa Catalina islands (Archipelago of San Andres and Providence declared Biosphere Reserve –UNESCO 2002-) which are Colombian Caribbean insular oceanic territories. Archipelago's endemic species Black Crab (*Gecarcinus ruricola*) harvest is an important symbol of cultural identity and economic traditional practice on the islands. The purpose of the project was to understand the relations between behavioral norms of crab catchers and the biological conditions of the resource which in turn influence the decision making related with the management of the Black Crab as a common pool resource.

Through integration of different methodological approaches such ethnographic tools; dynamic modeling, and experimental economics, the analysis is framed in four levels of the system. The first one is the description of the local appropriations related with the resource; the second is about biological conditions of the Black Crab population on the island; the third are the decisions that crab catchers make for its management; and the fourth level of the system is the legitimization of the local environmental agency's role as a formal regulating institution.

As result there were found three scenarios that show the relations between the crab catchers and harvest activities. a) Relations under resource scarcity conditions, b) abundance resource conditions scenario and c) integration of local environmental agency's role and rules for the resource management. From this perspective was possible to understand a system in which despite of the high economic dependence of the catchers for the crabs since 30 years ago, the situation is far to be an unsustainability dilemma.

Theoretically there are two options to interpret the system: a) the tragedy of the commons in which the resource will go to the extinction caused by poor management; and b) the system will be sustainable for two reasons. On one hand, self management processes, on the other hand because of the function of external rules for management. However, this situation describe a particular case in which crabs extraction for sale and consumption seems not to threaten the system, because exist other aspects that determine the operation of the Black Crab system.

The catchers' motivations for resource management are determined by contextual aspects and many local attributes that has been maintain a sustainable dynamics of the system for more than 30 years. Although the existence of many reasons for over exploiting the crabs population, the inefficient self management process, and the difficulty for legitimate the external rules; the existence of local attributes like a time horizon, spatial dimension and the paternalistic vision of the state enforce the sustainability of the system.

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The challenge of the research is to do projections of the resource management, and serves as an incentive for the design of political and methodological proposals that contribute to understand the particular conditions of common pool resource management in local contexts.

INTRODUCTION

Demographic and social processes in Old Providence and Santa Catalina islands, unemployment and lack of opportunities, have made that traditional activities like fishing and Black Crab (*Gecarcinus ruricola*) harvest constitute important strategies and economic alternatives, thereby important cultural practices for many island families.

The ecological and social conditions on the islands; and the local community and tourist's high demand for Black Crab consumption and living¹, generates concern about resource management and crab's population conditions. This matter upsets the conservation and sustainable viability of the resource, which differs from the local appropriations and significant catcher practices.

The central axis of the problem is, on the one hand, the difficulties to generate local appropriation for the exploitation control rules for the resource management; and, on the other hand, the research intends to understand the illegitimacy rules' causes (if there are it) in the dismantled among the crab's biological conditions, with the local users' senses and logics.

The problem of the research can be described on the one hand as the effect of the rules on the crab catchers' behavior related with the biological conditions of the resource, and on the other hand, as the effect on the legitimatization of the external regulations because of the relationship among that biological conditions whit the catchers' behavior norms.

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¹ As result of the important in terms of the tourist, and the enlarge of that on the zone.

The content is organized as follows: the next section reviews an important part of the conceptual framework, and some background of the research obtained by Cárdena's work (2003b), followed by a methodological tool section where the research process is explained, and then, the results in terms of the analysis levels of the research (integration among). This paper ends with three scenarios that show the relations between the crab catchers and harvest activities: (a) Relations under resource scarcity conditions, b) under abundant resource conditions and c) under the integration of local environmental agency's roles and rules for the resource management, all of these as results of the work, and finally some conclusions.

1. PREVIOUS LITERATURE AND BASIC THEORETICALLY FRAMEWORK

The biology of the Black Crab (*Gecarcinus ruricola*) has been studied for Sjogreen (1999), and Coralina (2004). As pointed out by them, it is an archipelago's endemic species, and has a high importance in the social and economic level for more than 30 families on the island. Sjogreen (1999), obtained the description of the main population aspects of the Black Crab.

As part of Coralina's Project (The Black Land Crab *Gecarcinus ruricola* management), the Alayón and Llach's work (2004), was important to obtain the main approach of many socio – cultural and economic aspects, in terms of the management of the resource on the island. The typical crab food requirements, and some microeconomic dynamics related with the crab harvest, were described and taken into account for the research.

The theory of common pool resources (CPRs) has been well known. According to Ostrom (2000) there are resources in which there are no space-temporary restrictions for resource users. These resources are characterized by the difficulty of excluding actors from using them, and the fact that the use by one individual or group means that less is available for others; therefore, the possibilities that these remain are highly influenced by resource management that people carry out to extract them (Ostrom, 2000 in Ramos et al, 2004).

Under these assumptions, the Black Crab is defined as natural and economic resource in Old Providence and Santa Catalina islands. This definition involves a series of implications for the research; therefore presupposes assumptions given the recent economics and social theories that determine a particular analytical category.

To define the relation between crab users, and harvest activities, the study Cárdenas (2003a, & 2003b) gave the analysis baseline. His study consists of a series of economic experiments developed in several Colombian communities, including Providence Island, where studies were carried out with black crab catchers and fishermen, users of CPRs who faced the cooperation dilemma in their daily life.

The objective of this project (Cárdenas 2003) was to simulate a specific situation using a game, and then analyzing the way people made decisions. Cardenas and collaborators

used a combination of methodological tools made a combination among Rapid Rural Appraisal (RRA) instruments and tools, and socio-economic survey to analyze the heterogeneity between the actors and their perceptions about rules and norms.

Some results obtained in Cárdenas' work on Providence Island, such as the economic experiments results, and the socio economics surveys, are taken into consideration in order to analyze and triangulate the information with the other analysis levels.

In terms of the institutions, as was pointed out by Bowles (2002), these are the informal rules and the conventions which built the social interactions among the individuals. Ostrom (1997), defines the norms as interaction patterns based on the share appropriations related with the bad and good behaviors in particular social situations; and the rules are defined as the social interaction patterns of the common understanding about actions that can be sanctioned by the authority for that.

2. METHODOLOGICAL TOOLS

The research is framed in the interpretation of the social processes from the relations among some social components or levels: individual level (the catcher), the group level (the catchers), and the institutional level (formal and informal –rules and norms-). Through integration of different methodological approaches such ethnographic tools; dynamic modeling –representation of different scenarios of decision-making and experimental economics –since the study of Cárdenas and coworkers' (2003a)-.

The research seeks to answer the question, about the influence of behavioral norms of crab catchers on the function of external rules for management (legitimization). First, was necessary to understand local processes. Next the interpretation was done.

The first approach of that question, is given as the understanding of the processes, and then with the interpretation, where the value of the local singularity is empower previous to the establishment of policies and administrative plans of management, because the policies turn out to be culturally violent if they are extrapolated of different realities or if, the responsibility of the local understanding is not assumed by the investigator or manager.

3. BLACK CRAB: LOCAL APPROPRIATIONS AND A REPRESENTATION OF IT'S LIFE

The island society on Providence and Santa Catalina at environmental level, has been strongly influenced by global speeches of multiculturalism, conservation, biodiversity (Gorricho et al, 2003), and social transformation dynamics as a consequence of the capitals and foreign culture inserted (Márquez, cited in Gorricho et al, 2003). It turns out in gradual processes of conscience-making in order to protect the environment, and cultural strengthening. *“The continental people migrations, the contact with tourists and being immersed in the occurrence of the present world, defines constantly the socio – cultural conditions of the islands”* (Gorricho et al, 2003).

The socio-cultural practices such as sports, arts, and gastronomy, reflect a consolidation process of traditional and inserted values, where the *creolization* (“*linguistic island dynamic, that characterizes this cultural group, and its product of multiples colonizations, and different tongues which were intermingled slowly in a process that today turns out to be interesting and characteristic*” (Forbes, 1989 cited in Gorricho et al. S.f.)) plays an important role of local differentiation and identity

The island’s gastronomy is a materialization of the mixture of values, environment, and tradition, in which the Black Crab is an important resource because of its economic importance for many island families. It is the main ingredient at the moment of preparation of exquisite and traditional food as the *rundown* (the crab soup) crab stew, patties, rice, among others. The most important and traditional food is prepared at special time, or in traditional restaurants to serve tourists.

THE CRAB HARVEST

The Black Crab harvest represents the sharing of logics and social state for the catchers. Historically, the catchers never have been dependent of an institution or a leader, neither to have had to comply with obligations, then, they are not used to rules in their routine spaces, and their language is separated of the institutional one (regarding environmental agencies).

Most of crab catchers are native islanders, therefore the resource has been a traditional and economic alternative like fishing. Many of the catchers (127 totally, according to Alayón et al, 2004), or family catchers (60 on 1999 according to Coralina, 2003) maintain themselves mainly with the incomes that crab harvest and/or crab processing and sale generate. Some of them capture to sell crab bags; other for process and to sell meat and molars; and others sell the molars, it means that they free the alive crabs but without molars.

According to Cárdenas (2003a) study inhabitants of the island value the Black Crab as aN economic resource for more than a half of the islanders. It means a greater potential resource dependence, because of income generation.

Nevertheless, the importance of income from crab commercialization, depends on the existence or not of another economic alternative. The group was divided in two types of catchers (Alayón et al, 2004). On one hand, the full-time catchers, the ones who catch crab during the whole year (independently of the intensity in each month). It means that it is possible to infer that their main economic activity is the crab harvest. On the other hand part-time catchers who are the ones who only harvest during the reproductive migration season (March-April to June), months in which the major profits in the capture are given, and the harvest is higher. Therefore, catching trips per week enlarges significantly. This is due to the coincidence between the migration and tourism season, then the accessibility is better, and it increases the demand to regional and local sphere.

During the end of June and the whole month of July, neither full-time catchers nor part-time ones catch, because they argue that just after the second crab migration “*the quality of taste in a meat is bitter and the females are too thin*” (catcher testimony in Alayón et al, 2004).

Most of the full-time crab catchers live in the neighborhoods of *Bottom House*, and *South West Bay* (Alayón et al, 2004), neighborhoods in which writes down most of the black community -raizal- of the island, what surely generates a particular shared of values, and economics and socio - cultural horizons.

In other way, Black Crab population faces a number of human induced threats, including loss of habitat though current agricultural practices, associated labeling of crabs as pests, road kill during the annual migration event, and obviously crab catching.

The next section shows the biological conditions of the crab population, in order to integrate it with different catching scenarios

A DYNAMIC MODEL AS REPRESENTATION OF THE CRAB’S LIFE

A system dynamics model was built using crab species life cycle available data (Coralina, 2004). Although such information is of high quality, there are several uncertainties which are included in the structural assumptions of the model. STELLA software (Structural Thinking Experimental Learning Laboratory with Animations) was utilized to build the model.

This model represents the main phases of growth and development of the species (see Figure 1).

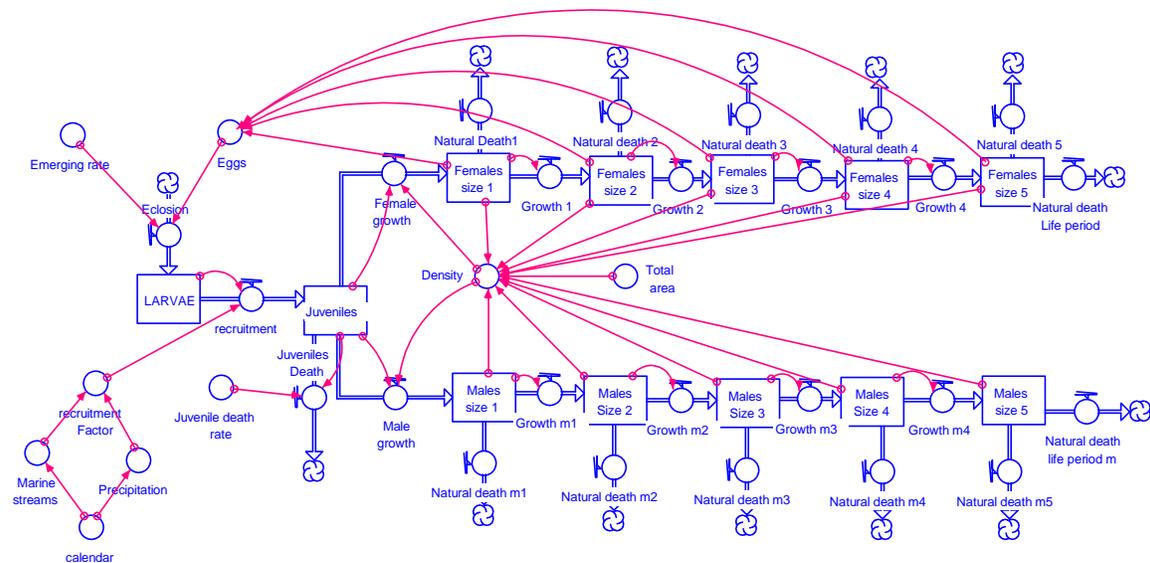


Figure 1. A representation of the life cycle of the Black Crab.

The crab's life cycle in the model, begins with the arrival of eggs to the sea, placed by each female every year during April to July.

The eggs emerge in larvae when enter in contact with the salt water, their viability depends on some external variables (predation, temperature and salt conditions of the water, etc) in the model is assumed a very low (20%) emerging rate.

The individuals stay in the larvae Stock during few days. When they pass to the juveniles state they cross the beach to reach the mountains. During the journey they require a series of optimal conditions that haven't been studied. This is one of the sources of uncertainties of the system. In the model, these conditions are assumed as two variables obtained from *what the people says* (Marine streams and precipitation); these conditions affect randomly the recruitment factor, and determine the percentage of individuals that will be recruit successfully to the juvenile state.

The recruitment factor is a percentage defined as the relation between precipitation and marine streams. It happens only in the season when the larvae are in the sea; its value range is from 0.05 to 0.5, it means that the percentage of larvae that become to juvenility stage is among the values of 5% to 50% of the total larvae.

The individuals in juvenile stages face several threats. Natural threats as predators (chickens, birds and reptilians), anthropic threats, like vehicles and motorcycles on the road, and extraction. Therefore the mortality rate in this stock is assumed as the 60% of the total of the individuals in juvenile stage.

The growth phase from juvenile to adult takes 7 years approximately (Velasco, 2004). A 1:1 sex proportions is assumed (Coralina, 2004 and Sjogreen, 1999). The carrying capacity is given by density values; it is assumed the estimated density by Sjogreen (1999), of 1.45 individuals / m², (in an estimation population of $8.787.016 \pm 4.393.508$ individuals), which is used in the model for all the adult Crab population, therefore, distribution frequencies from a size of 1 in the model, corresponds to a carapace width of 55 to 70 mm.

An initial situation is assumed were no catch is present neither stochastic variables, so the population shows a sigmoid growth to the equilibrium (Figure 2).

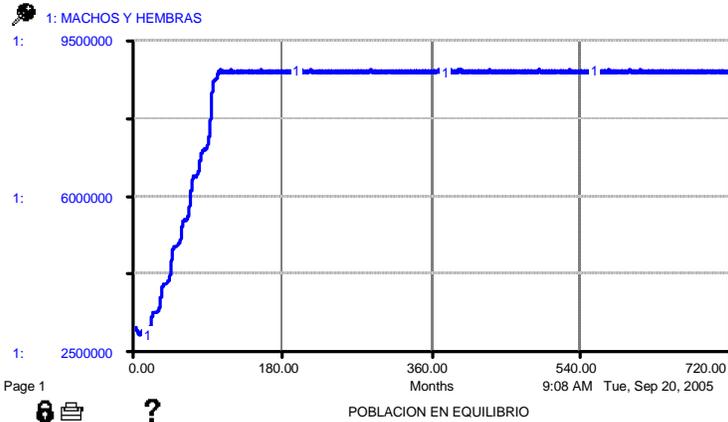


Figure 2. Black crab population in equilibrium.

EXTRACTION FOR SALE AND CONSUME: DIFFERENT SETTINGS

To talk about the extraction settings, two secondary sources are considered from studies done before in the Islands, which coincide with the annual catch in the model. Sjogreen (1999) studied the Providence Island species biology, and estimated a total annual capture of 1'000.000 crabs. Alayón and Llach (2004), determined 1'069.200 to 1'282.660 individuals of annual catch calculated from the number of catching trips done each month by part-time and full-time catchers (Figure 3).

The first extraction setting shows a reference behavior that simulates a sustainable capture on the adult individuals (calibrated in 100.000 ind. /month = 1.200.000 ind. /year. Figure 3), as a starting point generating different catching scenarios resulting from the decision making of catchers which were taken in economic experiments under each treatment (Cardenas 2003b).

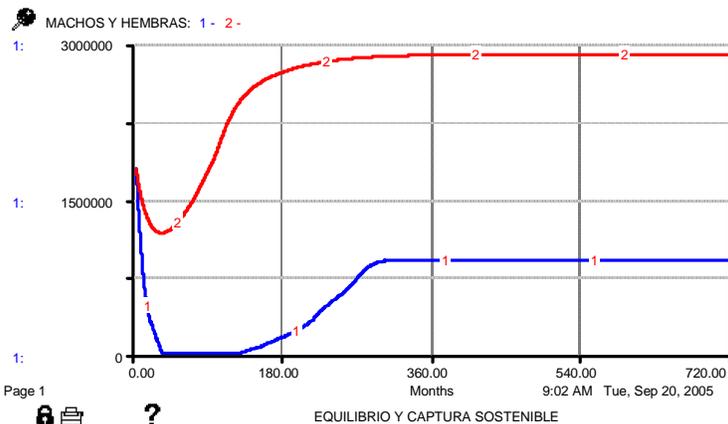


Figure 3. Comparison between individuals (sizes 3, 4 and 5) in equilibrium WITHOUT HARVEST (CURVE 2) and under sustainable catch conditions (CURVE 1).

Taking this model as a base, other five scenarios are designed as a result of the economic experiments extrapolation that were done in Providence with Black Crab catchers

(Cardenas 2003^a) under five different treatments. The effect of each one is compared in terms of the individual decisions effect on the Black Crab population, and the effect of different institutions on the users behavior.

Table 1. Extraction scenarios in economic experiments and its equivalent values (monthly) in the model.

KIND OF TREATMENT	MEAN	LEVEL OF TRUST 95%	RANGE	CATCH IN THE MODEL (# individuals)
ASYMMETRIES OF PAYMENTS	3.12	0.312	2.81 - 3.43	343.000 - 281.000
FACE TO FACE COMMUNICATION	1.52	0.312	1.21 - 1.83	183.000 - 121.000
LOW MONITORING	1.54	0.167	1.37 - 1.70	170.000 - 137.000
FOCALIZED MONITORING	1.4	0.15	1.25 - 1.55	155.000 - 125.000
SUBSIDE	2.67	0.39	2.28 - 3.06	306.000 - 228.000

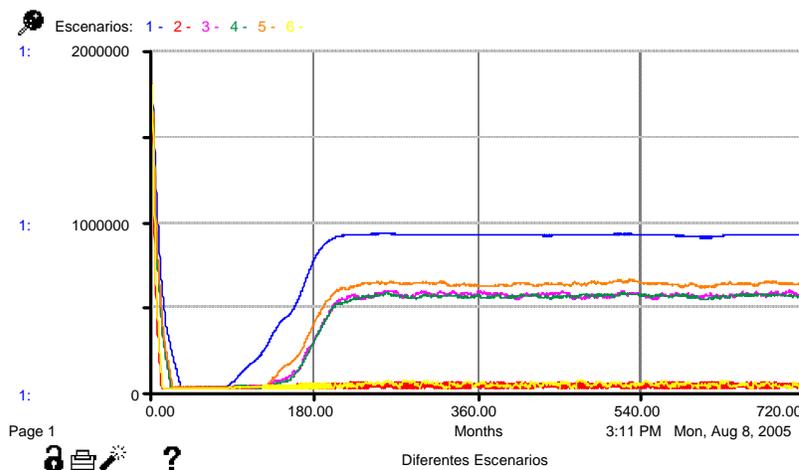


Figure 4. Comparative simulation of the different extraction scenarios based on the economic experiments of Cardenas (2003a). Each curve represents the total sum of the individuals of the sizes caught under each scenario.

Each of the curves observed in Figure 5, are explained bellow:

- 1 = Sustainable caught (100.000 individuos/mes)
- 2 = Asymmetries of payment (281.000 – 343.000 ind/mes)
- 3 = Communication (121.000 – 183.000 ind/mes)
- 4 = Low monitoring (137.000 – 170.000 ind/mes)
- 5 = Focalized monitoring (125.000 – 155.000 ind/mes)
- 6 = Subside (228.000 – 306.000 ind/mes)

The simulations are presented in 720 months that correspond to a time frame of 60 years, that is to say, twice the amount of time has elapsed since the beginning of crab catch for sale.

The stronger impacts over the crab population represented in the simulation (Figure 4), are given under scenarios two and six (asymmetries of payment and subsidy) that are the low scenarios under which the highest ranges are found for the extraction levels. Scenarios three, four and five (communication, low and focalized monitoring) are very similar to sustainable conditions.

Given the local extraction possibilities, the catching for each scenario is viable under real conditions, but it is necessary to take into account that local levels of catching are not constant.

DATA ANALYSIS FROM ECONOMIC EXPERIMENTS

Results analysis of Cárdenas (2003a) experiments, were developed from each treatment interpretation in light of the cooperation tendencies in the crabs extraction, and the result of the socioeconomic surveys, and interviews in field (Alayón, 2005).

The communication with a change factor value² of 43.25, and the subsidy with a change factor value of 36, for two of the groups submitted to these treatments; were the institutions in the economic experiments that had the highest positive effect on the cooperation. That is to say, that despite the descriptions that island people do of themselves, as the affirmations of distrust among them, the communication functions promotes expectations to be generated in others, so that their own agreements come fulfilled.

The subsidy treatment in the economic experiments showed to be efficient increasing cooperation levels in the community. Observations in the field suggested people would also want to have a subsidy, which can not be possible given the dynamic conditions of the extraction system, users number and agencies economic resources constraints.

The tables of asymmetry payment treatment with a change factor value of 10.78 showed the most negative effect over the cooperation, this possibly for the individual appropriations and local imaginary against the heterogeneity and inequality conditions. In the Black Crab system, asymmetries can be understood since the economic perspective as differences in opportunities and incomes. The importance of the feeling of equality is defined locally as the Crab Antics, from which just as proposes by Wilson (1995), are configured as reputation and respectability feelings in the islanders, which at last define social relation patterns in which inequality generate distrust.

Regarding norms and rules seems just as only the rules with real possibilities of being monitored are fulfilled. Rules fulfillment is given as a consequence of the paternalist feeling very close to the island people imaginariium with the National State, which is

² The change factor value is a proportion of the change between the first part of the experiments toward the second one, in which the treatment was applied. This value was homogenized among different treatments to obtain a comparable value. It shows the effect of the experiment treatment on the media of the decisions-making in each group, which is the effect on the cooperation level. The values are related directly with the cooperation levels, a highest value of the factor change, a highest level of cooperation.

product of some historic and political processes experienced in the archipelago. The rules seem to function in the experiment, and seem to function in real conditions despite the critics and contextual conditions that discredit external imposed aspects. As a result, a paradox between the local speech and the rules fulfillment is proposed. To argue this position is necessary to look over the defined local attribute as a paternalist feeling towards the State.

As pointed out by Gorricho & Rivera (2003), the local appreciations about the environmental agency's role (Coralina) in the management of the resource, is influenced by the permanent entrance of the island people in different socioeconomic contexts.

In this sense, there are two articulated perspectives that have been presented as a dilemma of collective action: the individual from their adaptation and identity processes, and the environmental agency as representant of distant National State with important but illegitimated imposed effects locally, and despite all of these they function.

INSTITUTIONALITY AND CRAB MANAGEMENT

I have mentioned two aspects: in terms of the formal (imposed by Coralina) and informal rules or local appropriations, these last ones are not assumed as rules in the speech of the resource users like the social control to the caught sizes. The no catching season of females who have just ovoposited neither with eggs, as proposed by Monsalve (2003), and the social control to impede the resource wasting, and not to remove crab's molars and let them free without surviving possibilities.

Just as Gorricho (2005) mentioned, Coralina is a governmental agency with great political and economical autonomy, but in the regional level, its legitimacy has been diminished because of the actions that has entrusted, as improve the community relation with the environment and natural resources, which have found many difficulties with islanders. Adding the particularities of the Black Crab users, we are witnesses of a complex situation, with interesting characteristics regarding dilemmas of collective action discussion, management of the commons, and the rules and norms legitimated and appropriated by the community.

Many of crab catchers community characteristics are modified at the same time by the type of macro legal regime, in which the users are immersed, such as the international norms of natural resources protection that has been acquired for the territory from the Reserve of the Biosphere management (by Unesco since 2000). These macro regimens could facilitate the local self-organization if they give precise information on the resource systems, and mechanisms to reinforce the local efforts of supervision and penalization (Blomquist 1992, in Ostrom 1997).

The probability that the participants establish more effective rules for the resource management, is greater in macro regimens that facilitate its efforts through the years than in others where the problem related to the natural resources are totally ignored, or in the other extreme where is assumed that all the management and administration decisions

must be taken by central authorities (Ostrom, 1997). In this way, one can talk about Coralina as the bridge of union between the community and a political- administrative macro-regimen; result from the mixture between the national state concerns and the international conservation of biodiversity rules. In both cases, despite of the difficulties of its function, it gets closer to the facilitation of collective efforts for a long time.

“I believe people that work in Coralina are not only Coralina, I believe they are people that are linked to the community and other activities and that are members of the community and their families are catchers too. They are part of all, so the way as they can see the control is different”³

Understanding Coralina as the main character in the resource management, being part of the community and carrying different roles, is important in order to address the institutionality in the Black Crab management since two different but complementary points of view: A) informal in terms of the local appropriations, and B) formal because of the implementation of a series of regulatory and legislations for the sustainable resource management.

The importance of the external regulations in some contexts, and the joining among these with local aspects of appropriation of internal norms, already has been exposed for Ostrom (1997), when she explains that in most modern economies, is rare to find any management system governed totally by the participants, without elaborated rules by local, regional, national and international authorities. This opens an interesting point, in terms of local contradictions with regard to Coralina, by the collision of two logics: a local (pre-modern or living economy) and an institutional one (modern logic under conservationists speeches focus).

ANALYSIS BETWEEN CORALINA - CATCHERS INSTITUTIONS

The crossing over between local and Coralina horizons, becomes evident at this point despite intrinsic differences among them, reason explained by the fulfillment of many of the *Design Principles of Long Duration Institutions* proposed by Ostrom (2000) to describe the main aspects or characterizes of successful institutions for the CPRs management.

In the institutional schemes analyses of CPRs, Ostrom (1998) proposes that the "tragedy of the commons"⁴ will occur in resources where the involved and/or external authorities do not establish an effective regime of management which regulates aspects found in the following principles⁵:

³ Documentalist of the Coralina Black Crab Project. Dic 24, 2004. Personal interview in *Light House*.

⁴ The tragedy of the commons since Garret Hardin (1968) is used to refer to a class of situation that involve a conflict for resources between individual interests and the common good, this expression has became to symbolize the environment degradation it can happen when many people use a scarcity resource at the same time (Ostrom, 2000).

⁵ Personal translation.

1. Well defined limits (in terms of the number of CPR users, and limits of the resource itself).
2. Coherence between appropriation and supplyment rules for the CPR management with local conditions.
3. Collective election arrangements (The people who are affected by the operative management rules can modify them)
4. Supervision (Refers to the presence of supervisors who watch over the resource conditions, and the users behavior).
5. Graduated sanctions (Means that the type of sanction depends on the kind of fault).
6. Conflict solving mechanisms
7. Minimum recognition of organization rights from the regulatory entity to the users.

As a general view the fulfillment of the attributes are represented by the following:

The Black Crab users, have had the option to contribute in the operative rules designe (**principle 3**), which are enforced by catchers (**principle 4**) and by Coralina officials too, through graduate sanctions (**principle 5**) that move among users - users, and Coralina – users levels. These last, can be social control mechanisms or sanctions imposed by Coralina, it depends on the kind of fault with the resource management.

In this point, its important to note, that sanctions imposed by Coralina are similar to the social control way, because the people who work for Coralina are related with the catchers, and in some cases, are part–time catchers too, thereby the sanctions consist in rebuke the catcher for his bad or breach actions.

These sanctions do not define the extraction rights of the resource because it seems this operating or management way is not viable, and neither it seems to be necessary (**Principle 1**). However, the sanctions restrict, or try to restrict with efficacy the appropriation activities according to the local conditions of extraction (**principle 2**) wich without underestimating the differences between Coralina and users, and the many critics to Coralina from the resource users.

Finally, conflicts presented among Coralina and users, never have had acquired a very important dimension (**principle 6**). Therefore, do not exist complicated conflicts solving mechanisms, and the resource users have the autonomy to generate its self organization processes (**principle 7**), even when these organization processes have not had functioned, probably because the need has not arisen yet.

The analysis of the principles proposed by Ostrom (1998), shows us that despite of the difficult fulfillment rules, and the differences between Coralina and catchers, in general

the institutions design are successful, mainly because it goes with the local conditions of the resource and the community.

4. WHAT IS HAPPENING WITH THE BLACK CRAB? SOME CONJECTURES

First we take up again the sense of this research: with the present study, I tried to understand the relations between the behavior norms of the Black Crab catchers and the biological conditions of the resource, which determine the kind of resource management. At first a central hypothesis was posed, which is 'that the abundance conditions of the Black Crab population, along with the cultural aspects associate of the island, generate a negative effect on the rules efficiency for the resource management'.

The following are questions that have arisen: How can we summarize what has been exposed until now, in an acceptable explanation of the different relation tan take part and determine the Black Crab system functioning? and How to define if the resource abundance conditions along with context aspects inhibit the effectiveness of the imposed rules for the control and resource management?

In order to answer these questions, has been necessary to itemize each one of the points that have been exposed along the work, to take up again some aspects, and finally propose a logical plan of relations that can conclude the reaches that had this investigation.

We already know that in the Black Crab case, an specific example of particular making sense is found from a physical element where two perspectives to define the uses and values for the resource management are articulated: a local, and an external one based on the speeches of conservation and of sustainable development (Monsalve 2003).

It has also been managed to identify some key points in the relation between Coralina and the community, and more specifically the Black Crab catchers, from which Coralina becomes an important character integrated to the local conditions despite the difficulty for the approvement of its function by the community.

Now we look at a scheme that integrates three different scenarios and pretends to become a possible explanation of the relationships that take part and determine the operation of the Black Crab system. First will be exposed each one of the settings, in order to integrate them at the end. These settings take in account variables that summarize many of the exposed aspects along the text.

The arrows of each diagram represent a causal relation; in the case of relations that show polarity (+ or -), the sign has an important role in such relation. In the positive case (+), the relation between the two variables is directly proportional. In case of a negative sign (-), the relation between the two variables is inverse.

- **SCENARIO 1: Relations Under Resource Scarcity Conditions**

This setting intends to represent the structural relations that are given in the Black Crab extraction, when the density of the resource falls. This condition is given in the season of intense summer, when the land is so dry, and crabs are buried in their burrows and they do not leave, or when very strong rainstorms fall; under these conditions, the catching trips are not successful.

“...at times they catch less because of the weather conditions. That has favored us a lot because the people have left to catch, the people stop catching when there is a so dry weather, neither when rains a lot. If the land is very wet, the water enters into the holes and the crabs have not to leave, and if is so dry they put the food and the water in the holes for don't have to leave”⁶

Based on these circumstances the relations among the variables are established; nevertheless is probable that this setting coincide with the relations that could be given under conditions in which the density of the Black Crab population decline dramatically near to the extinction.

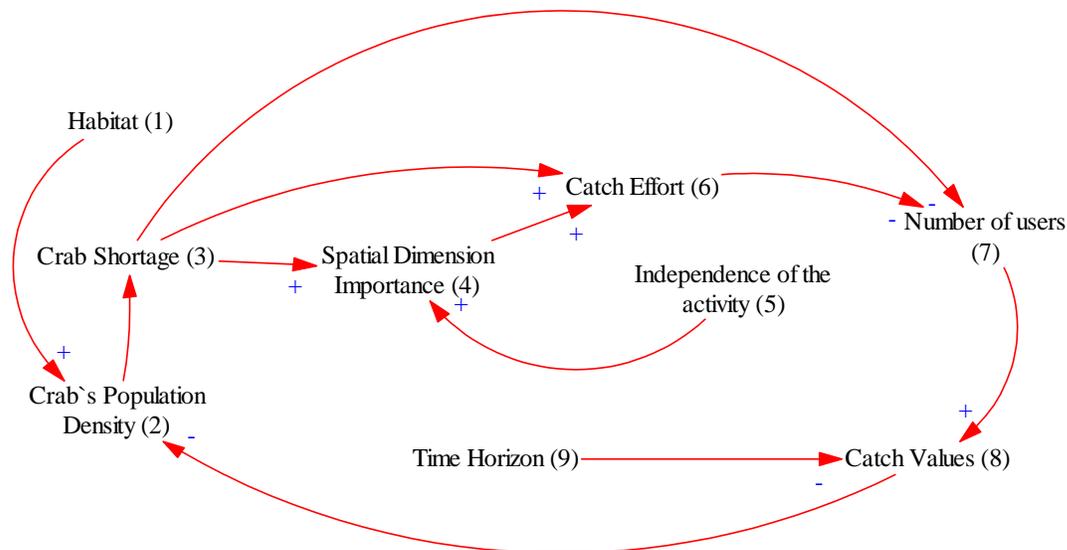


Figure 5. Structural variables in the catching relations under Black Crab scarcity conditions.

The **population density (2)** can diminish in the catching places because of the environmental conditions, the catch intensity, or by the **habitat loss (1)**, then the situation of **crab shortage (3)** is generated.

The **Crab shortage (3)**, and the **independence** inherent to the activity **(5)**, are variables that have a direct effect on the importance that takes the **spatial dimension (4)**, due to the

⁶ Federico Archbold, ex full time catcher. Personal interview, in *Bottom House*.

spatial restriction of the places to which the catcher can access. Therefore the independence determines that the users are used to catch each one in their own.

The importance of the **spatial dimension (4)** determines the relation between the restrictions of the spatial access with the consequent increase of the **catch effort (6)**.

When the **catch effort (6)** enlarges, many crab catchers simply decide not to catch, thereby the **number of users (7)** diminishes, this variable in this case are also influenced by the scarcity conditions of the crab population.

“If the crab season low, I don’t catch, if it enlarges I catch if I see more crabs, if I see little bit and catch is difficult, I don’t catch it.”⁷

The diminished in the **number of users (7)**, has a direct effect on the **values of catch (8)**, these at the same time are influenced by the **time horizon variable (9)**.

And at the same time, the **values of catch (8)**, feedback the system and generate a direct effect on the **population density (2)**.

- **SCENARIO 2: Catching relations under abundance resource conditions**

In this setting the main relations identified in the resource management are integrated under abundance conditions of the Black Crab population, that is to say when the individuals density is high and the **catch effort** is low (Figure 6).

⁷ Reynaldo Robinson. Fisherman and ex Black Crab catcher. Personal interview in Santa Catalina island.

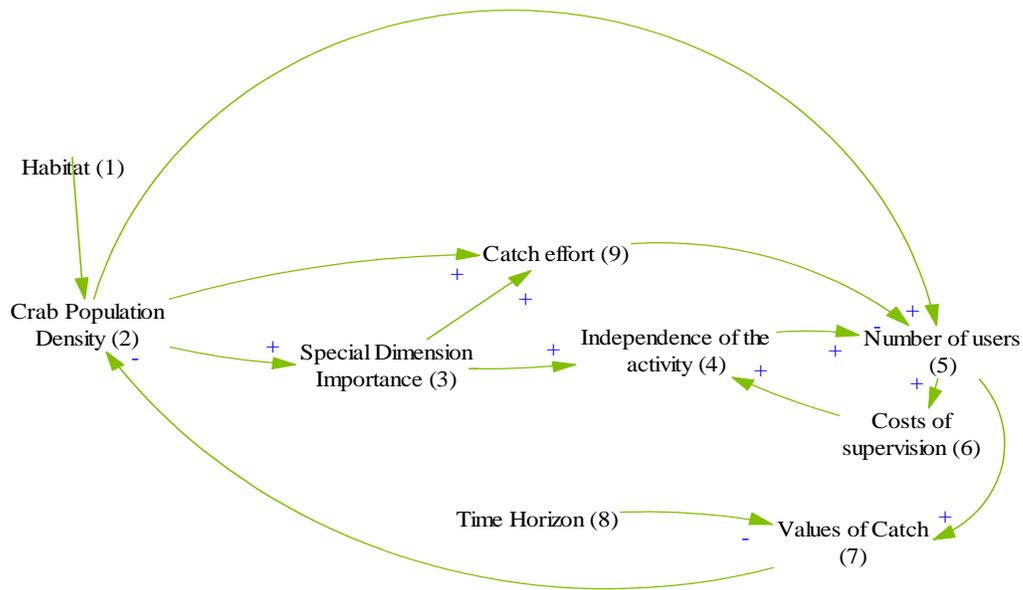


Figure 6. Structural variables in the catching relations under abundance resource conditions.

A high density of the resource is assumed for the breeding migration season when the journey back to the sea starts from the mountains, and all adult crabs have to cross the main road, and the density in specific areas enlarges.

This setting begins with a variable called **population density (2)**, related with the presence of appropriate **habitats (1)** which determine the optimal conditions for the species, and then, the abundance of the population is maintained (during breeding migration season and when the environmental conditions are optimal). In general terms the crabs are abundant in the island, thereby the catching trips are successful during some seasons that are recognized by the catchers, and in places in which the crabs inhabit and which are recognized for the users too.

These abundance conditions of the resource increase the importance of the **spatial dimension (3)**, because of the high probability to access to the resource leads each user to an appropriation of his own hunting place. The definition of the variable (3) arises from the identification of the hunting place value for each catcher.

This influences, just as has been explained, in that the activity to be very independent. The highest of the **independence of the activity (4)**, is the highest of the **number of users (5)**, therefore this is a common use resource with free access, and this independence does that there aren't limits defined on who can extract. The increase in the **number of users (5)** at the same time, enlarges the **costs of supervision (6)** and this is a positive feedback because the increase in the **costs of supervision (6)**, at the same time increases the **independence of the activity (4)**.

The **number of users (5)** is related with some intrinsic aspects like the identity and information levels of each catcher, which determine the force with the relation among this variable with the others. This variable not only depend on how independent is the activity, but also on the transience of the crabs' life cycle which is an incentive to catch, it means when the **population density (2)** due of the migration season and optimal environmental conditions, the number of users enlarges.

The **values of catch (7)** affect the **population density (2)**, but they are affected by two different variables, the first one logically has to do with the **number of users (5)**, and the second has to do with the **time horizon (8)** of the users.

Just as it has been interpreted in field, the time horizon is short, that is to say that exists a greater immediacy of the present corresponding with a significantly less efficacy than the future.

*"... when there are so many crabs, I catch 11 dozens as much, I catch only that I can carry in one trip..."*⁸

- **SCENARIO 3: Rules efficacy in the Users – Coralina relation.**

This setting has been adapted of the Second Generation Model proposed by Ostrom (1998), in which the relations among trust, reputation, and reciprocity are defined as behavior attributes among CPR users. "At the core of behavioral explanation are the links between the trust that individuals have in others, the investment others make in trustworthy reputations, and the probability that participants will use reciprocity norms", this mutually reinforcing core is affected by structural variables, and determine the development of effective cooperation (Ostrom, 1998).

Here, the institutional aspects in the relation are integrated between the users and Coralina from the establishment of the resource management rules. This scenario shows the establishment and control of the rules that generates relationships between users and Coralina, which at the same time influence the efficiency of the rules looking for the sustainability of the resource (Figure 8).

⁸ Soraida Livingston. Catcher and processor. personal interview in *Bottom House*.

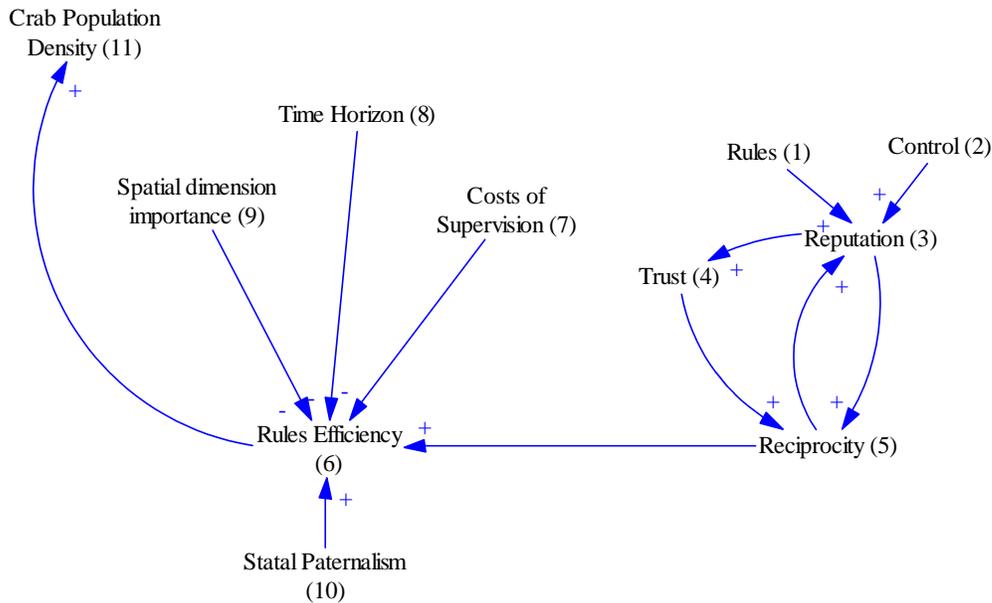


Figure 7. Structural variables in the users – Coralina institutional relation.

The **Rules (1)** and **Control (2)**⁹ imposed by Coralina, refer to the existence or not of rules but no the quantity, and the existence of control, but no talk about the kind of that. This two variables establish a synergic relation in the fulfillment of rules, and in the identification and in local recognition of the local environmental agency’s role (Coralina). It is to say that **rules (1)** and **control (2)** have a positive effect in the built of Coralina’s **reputation (3)** for keeping it’s role, and performing actions to reach it’s goals as regulatory agency.

In this way, Coralina’s **reputation (3)** makes it a trustworthy institution, thereby the people’s **trust (4)** enlarges, and then, it can engage in mutually productive social exchanges. Here we have a positive feedback, as was pointed out by Ostrom (1998), a reputation for being trustworthy, becomes a valuable asset.

Thus, the people or user’s **trust (4)** Coralina, it is the same of the probability or certain that Coralina will use retribution against those who do not fulfill the rules, thus, the **reciprocity (5)** enlarges, which means that the rules fulfillment enlarges too because the people respond to the regulation incentives, which are an incentive to acquire reputation, and in the same way Coralina acquire reputation too because of it’s role.

“...Some, some if they realizes... is good when one can’t catch the crabs when they are going low, if you are not there to pay attention and to watch over them, other people go and catches them, so it is important to watch out them all the time, because there are people that has no conscience about...”¹⁰

⁹ The rules like the design principle two, have coherence with the local conditions, and the control, like in the design principle 5, represents the graduated sanctions and are similar to the social control way.

¹⁰ Elbina Webster. Ex catcher. Personal interview in Santa Catalina

The relationship between **reciprocity (5)** and **reputation (3)** has two ways, because the user's reciprocal actions, in terms of fulfillment of the rules, works in a positive way on top of the Coralinas's reputation; and Coralinas's acquired reputation produces the responsibility to respond in terms in which the users trust, that means, the fulfillment of their functions.

These reciprocal actions, from Coralina's and user's side, work with the variable of **Statal paternalism (10)**, on behalf of the **rules efficiency (6)**, in theory; it looks for the sustainable management of the species. In the scheme means the maintenance or increase of the **population's density (11)**.

Although the **rules efficiency (6)** it is threatened by two reasons, one is the importance that users give to the **spatial dimension importance (9)**, because in breeding migration season, when the main rules operate, the incentives for the non-fulfillment are very high as the population towering density in the space that is restricted with the forbidden and control zones.

The other reason, is for the users' **time horizon (8)**, this generates incentives **non-fulfillment** of the rules because of the importance that is given to the immediate necessities that could be replaced if certain norms are fault.

“...in time of prohibited, one earns a little more than what one has to make when you purchase in sacks, it is profitable. Everybody goes to catch, even though those ones that don't catch”¹¹

- **INTEGRATION OF THE 3 SCENARIES**

Until here, it has been explained 3 different scenarios. However, the identified relationships, and the same scenarios coexist in the context of the management resource dynamics.

¹¹ Soledad Martínez. Black Crab Cooperative. Personal Interview. in Bottom House.

We see then, the three scenarios coexist, therefore, each dominance under real conditions, depends on the force of the relationships among the different variables of each scenario in a given moment.

In this way, the hypothesis has partially an answer, because it is clear the efficiency or legitimacy of the rules is determined by the resources' conditions; but on the other hand, it also depends on the force of the relationships among the rules and the monitoring proposed by the users and Coralina.

Until here, I have carried out a journey that has allowed me understand, until this research can reach, the relationships between the crab catchers' behavior norms with the biological conditions of the resource. That relation influences the decisions making on the crabs management as a common pool resource. And it allows conclude, the abundance conditions of the resource, and the contextual aspects of the island, have an important effect on the effectiveness and legitimating of rules.

5. CONCLUSIONS

“In the text ‘Comprender’, that closes the Misery of the World, Bourdieu insists in the idea it is necessary to have a huge knowledge acquired, sometimes during an entire investigation life to reach the height of its topic” (Bertaux, 1997)

Starting from the integration of the analysis levels among users, institutions and resource, it was possible to identify the main relationships that define aspects like the legitimating of the rules and the decisions making for the resource management.

It is evident that the biological conditions of the resource have an effect on the way it is perceived, as the management given. According to the analysis of the resources attributes (Ostrom, 1997), it is possible to settle from reliable local indicators, that crabs are abundant in the island, therefore has an important effect on the *effectiveness* of the institutions, because points to the idea of the perception of a dilemma on the users' side. It isn't easy to believe that there is a problem when all the users get a benefit and it doesn't seem to have a decrease of the resource. And on the other hand, all these conditions maintain strong relationships of independence in the management of it.

The relationship between the users with the resource isn't only identified since the extraction processes, but also of symbolic appropriations as the identification of themselves with the crabs, and the importance of the crab's life cycle in the configuration of the space, and the knowledge and feelings toward the species. And on the other hand, the behavior norms define users as the same way they are defined, just as it was proposed by Wilson (1998) as a dialectic result of the historical processes and of the conditions of insularity.

Some identified attributes from the islanders, as the **time horizon** which is very short; the **paternalist state** as a result of the distant relationships with the State; and the **spatial dimension** that has importance in the strong local appropriations of their own spaces;

they work in a synergy role in the appropriations toward the resource, and of course, in the management ways.

Coralina appears as entity that governs, from the speech and idea of the importance of the conservation and sustainable management of the species. That confirms the idea of Monsalve (2003) in front of the resource works between two logics to define the uses and values toward the species: a local one, and an external one. The coexistence of the two logics in the territory, given place to the crossing of both in the appropriations and local speeches. This is evidenced in what Coralina defines as the processes of taking conscience in the community. Even this way, there are important contradictions among the local appropriations of the Black Crab and scientific postulates that determine some of the main differences between both, such as the media life time of the crab, the possibility of extinction, and the necessity of management policies.

In spite of the processes of taking conscience, it is recognized that this is a problem that in a local way has not been assumed. Besides the abundance conditions of the resource, the extraction system turns in the current local market conditions, where the bid supplies a demand of the resource static or in increase, they are subject to particular and independent processes many times. The demand depends on the tourism, most of the times, which oscillates between good, ordinary and bad seasons, or with external but complex situations. On the other hand the bid depends on two principal factors: the environmental conditions (the days in which the crabs go out, and the days in that the buried and don't go out); and social conditions, as looking for a new job, or been quit form the job, because most of the catchers would prefer to work in other business, because this work belongs to inferior social hierarchies.

The challenge of this research was to do a feedback of the resource management among the rules of Coralina and the norms of the catchers toward the Black Crab extraction. Even though, there are some contradictions in this relation, the catchers' management and appropriation way of the resource seems to be sustainable; and the rules imposed by Coralina seem to be fulfill. This process is evident because the extraction has been work during more than 30 years, and the relationship with Coralina has been work during 10 years. However, in order to improve the resource management it is necessary to maintain and empower this relation. At last, it is important to understand the importance of some contextual variables such as the existence of optimal habitat conditions for the species, which must be conserved looking for the integral sustainability.

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