

Adaptive Management Response of a Rural Fishery Community Due to Changes in the Hydrological Regime of a Tropical Coastal Lagoon

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ABSTRACT In the coastal community of Chabihau, Yucatan, Mexico, hurricanes Gilbert (1988) and Isidore (2002) opened breaches in the coastal dune. The government modified these breaches with a floodgate, channels, and bridges, allowing tidal influx that has transformed the swamp ecosystem into a coastal lagoon. Our long-term research (1990-2006) has been based on participatory methods including identification of needs, introduction of technical changes, monitoring of modifications, and facilitating evaluations by local users. Researchers have documented their work with both women's and men's groups, as well as with community authorities and open assemblies of residents. Government agencies generally practice sectorial management, which focuses on a single sector or subject, even though it considers impacts and interdependencies with others (for example, fishing, road serviceability, protected areas, territorial zoning, and municipal strengthening). In contrast, this community (with its researchers/advisors) has struggled toward integrated coastal management, which focuses on guiding the necessary changes to maintain quality of life for human communities dependent on local ecosystem services, including those of coastal basins and extensive marine areas. Our findings question the accepted practice of designing conservation projects in centralized hierarchical structures that leave little space for local maneuvering and negotiation.

INTRODUCTION

Historically, the coastal area of Yucatan has been affected by the booms and crises of agricultural activities conducted inside the State (Fraga 1996) from the Pre-Classic Mayan period until the mid 20th century. Its entailment was extensive and complex: salt extraction, copra activities, fishery in cenotes (karstic sinkholes), swamps and lagoons for local consumption, as well as coastal navigation ports for the departure and access of a great variety of natural resources, which is best known the sisal fiber or henequen (Quezada 2001). The current structural conformation of the Yucatan coastal zone has passed through six major periods in almost 60 years (Baños 2000):

In the period from 1950 to 1970, when the last agricultural crisis took place (sisal activity), a process of structural change of socio – environmental relations began, resulting in a migration process of the rural community toward the coast, finding a series of obstacles in its incorporation to a newly rising mercantile fishery activity, in the search for minimal levels of survival (Fraga 1996). Among the main obstacles

are due to differentiated work processes of to the technical-productive changes that existed before and after the 60s. Through time, start a strong tendency to increase the tourist use – summer-time, particularly in the municipality of Progreso, linked with the growing of certain social classes in the metropolitan area of the city of Merida. Starting in the 70s, the capitalist expansion to boost industrial fishery activities began, mediated by intervention of the State and the public sector, outlining an environmental territory based on the promotion of organized groups of the social sector (cooperatives, rural societies, etc), accelerating the social division of the production and the specialization of the activity into three important species: grouper, octopus and lobster (Quezada 1996).

In the decade of 1980, the productive specialization led to the nearly total abandonment of agricultural and salt plots, increasing competition among other specialized fishery workers and starting a dependency with wider national and international markets for the acquisition of consumer goods. In the decade of 1990, the activity promoted a cultural homogenization and an increase in economic inequali-

ties. Fishing activities become stagnant, linked with the commercial overexploitation of resources and the degradation of the coastal and marine ecosystems in Yucatan. However, the inducement of capital into fishery (mainly technology) does not entail a disappearing of artisanal fishing off the shore, and fishing in coastal lagoons (shrimp, crab or fish) more oriented toward self-supply, but rather encourages industrial fishing with regards to capturing for the market (Quezada 1996).

In the current decade of 2000, fishing activities are in complete decline due to reduced production and competition in the international market. Currently, national and international institutional initiatives (like the Mesoamerican Biological Corridor-World Bank) are setting out for ecotourism activities in answer to global discourses of conservation and tourism, as a way out of the commercial fishing crisis (Fraga 2001).

This has been a review of the structural change in the environmental, economic, and social relations that have been forming in the coastal zone at interdim time. Nevertheless, another disturbance that change the socio-environmental relations are hurricanes, like Gilbert in 1988, and Isodore in 2002 (a short time), which changed the coastal configuration by breaching the sand barrier, connecting the sea with the swamp and salt ponds areas, as occurred in the Chabihau locality (fishers and saltmakers coastal study site), causing important hydrological changes and introducing a diversity of fish species that resulted strategic for an impoverished population, more than 80% of the total (Vallejo et al. 2004).

Traditionally, the inhabitants of the coastal areas have followed a strategy of multiple uses of coastal resources (Fraga 1999; Quezada 2001 and Toledo et al. 2003) that have been the basis of their subsistence, according to the changing seasons of the year (dry, rainy and north-winds). In this paper we will tackle the spatial aspect as the construction of delimited territory that is occupied, appropriated, its resources exploited and also protected and restored, through a relation between the members of the locality, as well as between the local community and the State, mediated by the environmental dimension (Angulo 2006). In particular, we review the manner in which the community of Chabihau has rebuilt its environmental territory after the effects produced by hurricanes on the coast, where emerging activities generate standards, values and rules.

METHODOLOGY

Our long time research (1990-2006) has been based on participatory methods in the locality, including identification of needs, introduction of technical changes, monitoring of modifications, and facilitating evaluations by local users. These have led to new introductions in a process that has spiraled to improve community resiliency.

Local Context of Chabihau

Chabihau is located on the north coast of the state of Yucatan, Mexico (21°18'N; 89° 09'W) (Figure 1). It extends for 17 km, from the San Crisanto locality to Santa Clara, and covers a surface area of approximately 4,500 ha, of which 3,400 ha are occupied by 2 lagoons with permanent water (1,149 ha), swamp mangrove vegetation (2,251 ha), and 1,100 ha of flooded lowland forests and savannahs. These wetlands are protected by a sand barrier with coastal dunes that barely exceed 300 ha.

RESULTS

Before the impact of hurricane Gilbert in 1988, the Chabihau swamp had no connection to the sea, therefore, it was not influenced by ocean tides, it flooded temporally with rainfall and fresh and brackish water from springs (Perry et al. 1989). However, it maintained hypersaline conditions all year round and so it was not possible to conduct fishery activities in it.

In the decade of the 1970s, the main activities in the Chabihau locality were artisanal offshore fishing and salt extraction in the swamp (Breton and Alcalá 1974). Currently, Chabihau has a population of 360 inhabitants distributed into a little over 80 families. 50% percent of the inhabitants of Chabihau are native to that locality, whereas immigration has two sources, the first, with 45% of the population, comes from the municipal capital (Yobain) and other ex-henequen municipalities, and the second source, with 5%, comes from other states such as Veracruz, Oaxaca and Campeche (Rendis 2003). There is a pendulum-type pattern of emigration toward the closest municipal capitals (Fraga 1996), offering their labor in these localities, as building workers and laborers for agricultural works inside the state. As one can observe, the locality's economic activities are temporary, governed by the calendar of the natural environment.

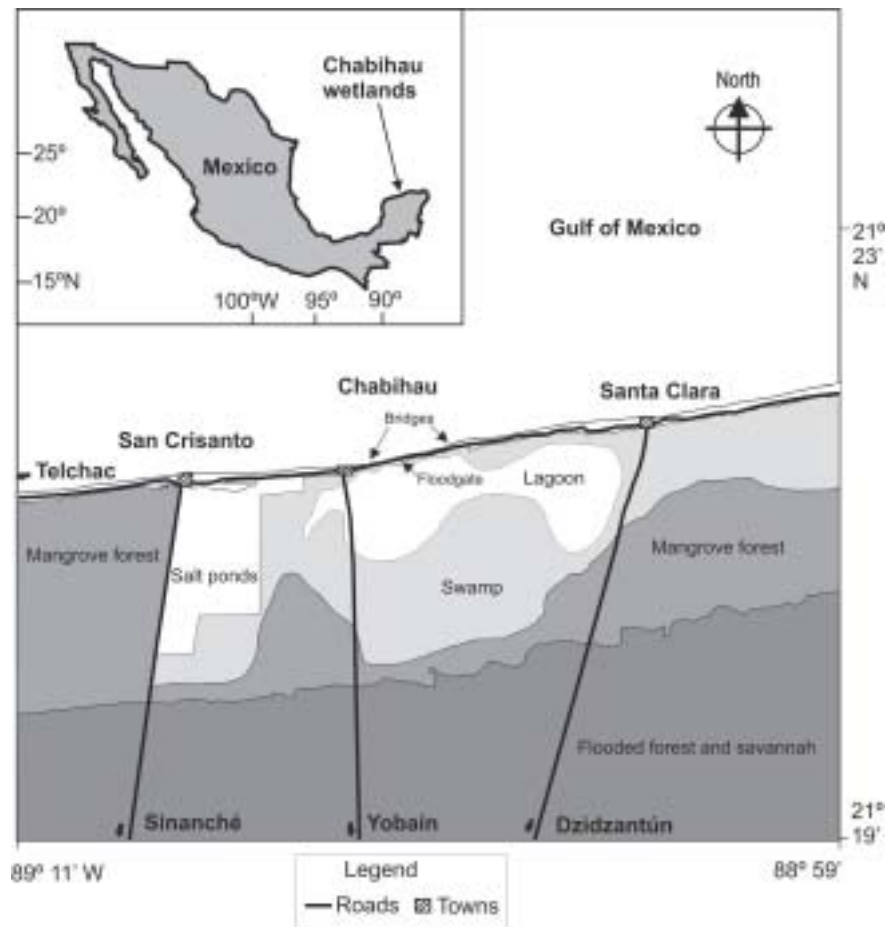


Fig. 1. Location of the coastal wetlands of Chabihau, Yucatan

When in 1992 the building of the coastal highway began (affected by hurricane Gilbert), the inhabitants of the locality of Chabihau, together with other close-by localities, such as San Crisanto and Santa Clara, requested that the hydrological conditions that resulted of hurricane Gilbert remain the same, and so, the government built a small floodgate in that inlet, approximately 3 km from Chabihau. Then, as a direct outgrowth of this event, management of the shrimp resource developed as a communal property. Later, in 1997, a larger culvert (4 m) located closer to the town was built. In late 2002, hurricane Isidore opened two inlets in the sand bar and the state government built 24 m-long bridges over each. Consolidating the change from a hypersaline - palustrine system (swamp) to an estuarine - marine one (coastal

lagoon). The consequent marine water influx, the drastic residence time reduction of water and the changes in salinity pattern, have led to habitat changes, such as the recent appearance of seagrass and algae beds into the lagoon (field observation).

Environmental Changes

The organisms that have been affected by this spatial and temporal dynamic of the lagoon are fishes (ichthyofauna). Compilation of studies conducted before and after hurricane Isidore resulted in a total of 62 different species (Batllori 2003a; Cabrera 2003; Heredia 2003 and Vega 2003). In general, a total of 45 euryhaline species, 11 stenohaline species (Lagler et al. 1977), and 6

estuarine-lagoon species were found. Other species were found under freshwater conditions (such as *Poecilia velifera*, in coastal sinkholes “cenotes” and freshwater springs) and others under conditions of hypersalinity (*Floridichthys carpio*). However, the analyzed studies found a great variation, meaning that the increase or decrease in the number of species did not necessarily mean the same species, but rather each study exhibited a certain amount of exclusive species, and only 7 species (of a total of 62) were continually recorded in the system, which means that a functional substitution was recorded as a response to the ecosystem’s environmental variability or auto-organization, as mentioned by Naveh and Lieberman (1994).

Not much is known about the large populations of shrimp in the State of Yucatan; however, some authors such as May (1999) and Almaral (2000) mention that the seagrass beds of the offshore-marine zone are the preferred habitat for penaeid shrimp settlements for feed and as refuge from predation, and *Farfantepenaeus brasiliensis* (a non estuarine – dependent shrimp) is the dominant species in this zone.

Variation in physical environmental factors in the Chabihau lagoon apparently affects shrimp distribution and abundance in this ecosystem. The resulting hypersaline conditions during the 2001-2002 flood season (before hurricane), shallow depth, insufficient water exchange, low dissolved oxygen (Batllori and Febles 2007) and lack of submarine vegetation, were all unfavorable to the settlement of postlarval shrimp within the lagoon (particularly estuarine – dependent shrimp species, like *F. duorarum*).

Cabrera (2003) reports that *F. brasiliensis* was scarce in the lagoon area, but that recruits (1.8%), juveniles (44% *F. notialis*, 21% *F. brasiliensis*, and 35% *F. duorarum*) and subadults were

collected after hurricane Isidore in 2002. Shrimp density also varied from 0.04 org/m² to 1.56 org/m² (average = 0.32 org/m²). Storms and other extreme weather events (like north winds in winter), also seem to affect shrimp distribution and abundance in the lagoon, suggesting that shrimp are transferred into the lagoon by currents from storm winds, and are then temporarily available. This does not mean, however, that greater water exchange (bridges of 12 m or more) guarantees that shrimp will remain in the lagoon, as shown by the 2004-2005 flood period when no important catches were made (Table 1). For the 2003-2004 flood period, the effective fishing time changed a little (average = 1:18 ± 0.38 hours/cast), versus the previous flood season 2002-2003, where shrimp caught per unit of effort ranged as high as 31 kg/cast (average = 2.39 ± 4.5 kg/cast) (Palomo 2005).

Another new species that is of interest to the Chabihau community is the crown conch *Melongena corona bispinosa*. Unlike the species mentioned earlier, the conk was introduced into Chabihau lagoon in december 1999, after the construction of the floodgate in 1997 (George and Batllori 2006). Starting as an aquacultural activity that consisted of two rustic enclosures, and given its wide tolerance to changes in salinity, the colonization of this species in the lagoon took place, with the release of 600 individuals from natural populations and measuring more than 40 mm (Zetina 1999). In August of 2005, it was observed that the population was increasing and distributing accordingly, supposing then, a reproduction succes and spreading of the organisms, probably also associated with hurricane Isidore in 2002. In august 2005, the 72% of conk population were recruits and juveniles (less than 40 mm shell length) and 28% reproductive adults were observed. The density found was of 0.191 ±

Table 1: Economic parameters of Chabihau Lagoon shrimp fishery, 1999 to 2006.

Parameter / Flood Season	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06
Total Catch Volume in 3 months (kg fresh weight)	14,700	22,355	0	0	8,000	8,080	0	0
Total Catch Volume in 3 months (kg cooked and peeling weight)	5,880	8,942	0	0	3,200	3,232	0	0
Production value (US\$/kg)	7	8	0	0	9.5	9	0	0
Total Production Value (US\$)	41,160	71,536	0	0	30,400	29,088	0	0
Number of people participating in shrimp fishery	150	130	0	0	60	168	0	0
Net income per person in 3 months of fishing (US\$)	274	550	0	0	423	173	0	0
Average daily income per person (US\$)	4.8	9.4	0	0	7.4	3.3	0	0

0.16 organism/m² (George and Batllori 2006), estimating a biological potential of more than 24 tons.

Socioeconomic Changes in the Community

For the year 2001, before hurricane Isidore, productive activities in Chabihau presented the following characteristics (Vallejo et al. 2004):

1) Artisanal offshore fishing ceases to be the main axis, as an activity that creates positive effects for the local economy, in terms of employments that generate earnings distributed among the Chabihau community; 2) Homes in conditions of extreme poverty and poverty are the most vulnerable to irregular changes in the price of octopus and main supplies for artisanal offshore fishing (such as fuel), because oscillations of the price of the first and a continuing rise in the price of the second influence the income level of these socioeconomic groups and, consequently, transmit depressive effects on the economy of Chabihau and encourage regional migration between the young population and the use of new natural resources of the lagoon for subsistence purposes.

In Chabihau, since 1970, the artisanal offshore fishery were carried out by three organized groups: fishermen associated with a private holder, Social Fishery Production Society Yumil Ha and Social Fishery Cooperative Viento de Oriente, all of them in decline, underemployment and immobilization.

After 1988 (hurricane Gilbert), shrimp fishing in the lagoon has allowed the activation of the economic system in Chabihau, particularly by providing better income for homes in conditions of extreme poverty. Shrimp fishing in the lagoon represents an important source of income that contributes to the decrease of the negative impact of up-and-down in coastal fisheries and a recession in salt-related activities.

In 1992, an incipient social organization was developed, related to the capture of shrimp, linked to Shrimp Work Group, as a response to the need to locally regulate this activity in the floodgate built in highway in 1992, and in the culverts in the Yobain road, with the objective of giving the opportunity to take advantage of the resource in an equitable manner. The Shrimp Work Group was represented by the Fishery Society of Social Solidarity "Yumil Ha" and Fishery Social Cooperative "Viento de Oriente", ejido owners

("Ejido de Chabihau"), salt makers (Society of Social Solidarity "Salinera de Chabihau"), cattle ranchers, all the women of the locality (represented by the Women's Agro-Industrial Salt Unit "UAIM") and the municipal local authorities.

In 1996, the State government and the federal authorities, acknowledging the severe deterioration process of the coastal wetlands in Yucatan, initiated environmental restoration actions in the entire coast through a plural planning committee (Manuel-Navarrete et al. 2004), that included research centers and universities, users of the natural resources (natural capital) and authorities of different sectors. Here, the concept of ecosystem management allowed the development of hydraulic restoration actions (construction of bridges, culverts, desiltation of springs and drainage channels), mangrove reforestation and waste collection in flood areas, propitiating the improvement of natural capital (such as shrimp). The concept "natural capital" (Clewell and Aronson 2005) is understood as ecosystems or landscapes out of which humans obtain products (forage, fishery, edaphic, etc) and environmental services, which allow economic income at very low production costs (as is the case of common-property resources in communities in conditions of poverty).

An economic analysis shows that fishing of shrimp in the lagoon is profitable and provides significant income and benefits for the community and its inhabitants. Shrimp catch not used directly for subsistence is sold informally. Average shrimp price in the 2002-2003 period was US\$ 5/kg for fresh (unpeeled) shrimp and US\$ 9.5/kg for cooked, peeled shrimp. The annual catch (2002-2003) was about 3.2 tons of cooked shrimp with an estimated income of US\$ 30,400. Using these estimates, the lagoon shrimp fishery has very low operating and capital investment costs, maximizing net income, and leading to wide income distribution among fishery participants (Table 1). Dividing this income by the number of people participating in the shrimp fishery, the daily income per person (and associated household) in the 2002-2003 season was estimated at US\$ 7.4, representing a little over 40% of annual income for families in extreme poverty (Vallejo et al. 2004). In the case of the crown conk, it is not very profitable due to the costs of recollection, yield, cooking and distribution and its low market price (snail flesh is sold at between US\$ 4.5/kg and

US\$ 5/kg), and so, it is basically used for self-supply.

When the second floodgate was built in 1997, the Shrimp Work Group was developed informally as the Users Committee of Chabihau lagoon, where in addition to the six groups mentioned before, four new members were incorporated: Women Work Social Group for management of municipal solid waste, Women Work Group for crown conk management, and Women Work Group for mangrove management. This committee included more than 160 persons. The Users Committee meets approximately three months before the shrimp season begins to repair fishing tools, coordinate activities and form work groups. When the season begins (October to February), leaders of the men's and women's groups test the fishing area and the results are analyzed during society meetings to determine the season opening date and to hold a lottery to assign groups to fishing areas.

However, also starting 1997, government fishery authorities, faced with the collapse of the shrimp fishing industry in the Gulf of Mexico, decreed a permanent prohibition on fishing for shrimps for household use in lagoon-estuarine waters in the State of Yucatan (a kind of State property), and so, the Users Committee associated with the Center of Research and Advanced Studies (CINVESTAV) to carry out a study on shrimp fishery in the area of Chabihau. This situation turns every person or family that catches shrimp in the lagoon into environmental criminals.

Almost coincident with Isidore, the Users Committee was transformed formally into a Rural Production Society, named "El Camarón Vagabundo", with the same 160 members of whose 80 families include almost all of Chabihau's inhabitants. In that time, 50% of the members (especially women), did not belong to any fishery, salt production or ejido group (Rendis 2003), which strengthens the character of a communal property resource for families. This new organization represented one more step in the attempt to legally formalize the capture of shrimp in the lagoon and establish rules for accessing the resource with the backing of the corresponding government institutions, meaning, formalizing the environmental territory (Angulo 2006) that was built before 1992.

The main change caused with the formation of El Camarón Vagabundo Rural Production

Society, was that the productive organizations ceased to be representative (salt makers, fisheries, Ejido, and others), and the people, divided by gender (groups of women and groups of men) were the ones who agreed upon the use of the resource, the culverts in the Yobain road by women and families, and the floodgate and bridge by men. Unlike artisanal offshore fishing, where women's role is less apparent, shrimp fishery in Chabihau lagoon is a family activity.

From the year 2003 to this date, Rural Production Society promotes actions for the maintenance of shrimp habitat, cleaning of springs and mangrove reforestation continues with the support of the North American Wetlands Conservation Council (NAWCC), through San Crisanto Foundation (NGO), in collaboration with CINVESTAV and the State Government.

It is important to point out that the formation of the Chabihau Lagoon Users Committee allowed the creation of a tactical supra-structure of coordination among the different productive groups that use the natural resources in the newly built environmental territory, and so when this Users Committee became a Rural Production Society, the supra-structure of coordination formed among the groups was dissolved. At that time, in addition to Rural Production Society, there were attempts to create two new Working Groups, the first for the production of handicrafts and the second for ecotourism services.

Salt-related activities also have, like shrimp, the productive vocation to boost the economy of Chabihau, however, it is declining: Society of Social Solidarity "Salinera de Chabihau" ceased its operations after hurricane Gilbert in 1988, and only the "UAIM" group managed a small production (15 ton) with marketing problems. Nevertheless, by the end of 2005 a new male group of salt makers formed the Cooperative Society "Salineros de Chabihau" linked to a private intermediary, as a response to the uncertainty in shrimp fishing in the lagoon during different seasons, because salt extraction is a reliable activity, there is work every year (Rendis 2003). This would be a social resilience process.

Seasonal tourism has marginally affected the local economy, but has the capacity to impel income, through its multiplier effect. Homes in extreme poverty are the ones that benefit from seasonal tourism, by offering their labor in domestic jobs (Vallejo et al. 2004). On the other hand, tourism is a source of seasonal work in the

coastal area, especially during Holy Week (april) and the summer (july and august), which is when restaurant services, local hotels and different products such as coconut, conk, etc. are treaded. When there is no tourism, the people have to look for ways to subsist, by arranging seasonal homes, weeding, masonry and plumbing, among others, and for the family expenses they sow different grain crops such as corn and beans, or fruit trees and vegetables such as melon, cucumber, pumpkin and watermelon, mostly for self-supply.

By the year 2004, the supra-structural space left by the Users Committee was filled by a new network-type organization, driven by the actions of the Mesoamerican Biological Corridor Program in the north coast of Yucatan, supported by the National Comission for the Biodiversity Knowledge (CONABIO) and the World Bank, which gathering most of the productive groups and promoting the formation of new legally constituted organizations, as is the case of the three Cooperative Societies: "Flor de Mangle" (mangrove and sand dune vegetation), "Mot Sohol" (solid waste) and "Hurich" (conk), and the support of tourist services work group, the handicrafts wrok group and the maintenance of freshwater springs work group. All of them organized in a "Union de Cooperativas de Chabihau".

DISCUSSION

Changes in the lagoon ecosystem have been observed and assimilated by the community in their struggle to survive, and they have constantly learned to manage their resources with knowledge obtained through daily experiences with their environment, complemented by external intervention by governmental or non-governmental organizations. However, the people face several limitations to develop their fishing activities, related to access to the lagoon. We have described here how the resources used by the Chabihau community are not completely open, but are used under a communal property rights agreement. Very frequently, there are community rules regarding group use and access, as shown by some case studies (Marin 2000 and Aguilar et al. 2002).

The property rights in a determined area can be complex, because the resources tenure frequently involve a "set of rights", including the

right of use, to exclude others, to manage the ecosystem and to sell (Berkes and Folke 1998). Likewise, different uses within an area can be sustained under different property rights regimes; in general, the local social systems develop rights and responsibilities for a certain resource that is considered important for the community, as is the case of shrimp, conk and, mangrove.

Even when quick changes occur, like a hurricane, usually there are initial property rights, rules that increase and evolve according to local needs, like in Chabihau, organized first by productive groups and later on by gender division. Men and women, who are users and managers of the common resources, have different roles, responsibilities, opportunities and restrictions in the management of the natural capital, just as in several other communities around the world (Fraga 1999).

The territorial positioning of the Chabihau Lagoon Users' Committee in the 1992-2001 period, regarding shrimp, was accompanied by investiture instituted by the fishery authority and, at the same time, it was an organization legitimated by the community (Angulo 2006) for the protection and exploitation of their natural resources. However, when in 2002, the Lagoon Users' Committee became the "Camaron Vagabundo" Rural Production Society, looking to consolidate the acknowledgement of the new environmental territory on behalf of the fishery authorities, these withdraw their support in 2004 and apply the rules in force, under which local inhabitants become lawbreakers in regards to the environment (Batllori 2003b).

However, it remains an organization legitimated by the community for the protection and exploitation of this natural resource. Its spatial domain is given by the existence of the new communal goods and services that are produced by the transformation from swamp to lagoon, and if these were to be of open access, they would pass through the mesh of individual, collective and patrimonial property relations, and not only in the case of shrimp, but also with crown conk, mangrove, solid waste management and other products, functions and attributes of this newly built territory, socially appropriated through groups of women, mainly.

The supra-structural empty space (mentioned above) is then filled with actions of the Mesoamerican Biological Corridor and the formation of the Union of Cooperatives (it is worth

mentioning that the “El Camarón Vagabundo” group was not included in the Union), with the full support and a priori acknowledgement of the authorities, in this case, the environmental ones, being formed as a new territory, run mainly from government spheres. This program has a strong inclination toward biodiversity and ecotourism activities; however, in Chabihau, also consolidated working groups that are representative, like the Cooperative Society “Hurich”, “Flor de Mangle” (mangrove reforestation) and “Mot Sohol”, (solid waste management).

We coincide with Acheson (1991) on the fact that government privatization and control are not the only mechanisms that can affect the use of natural resources, as the “tragedy of the commons” theorists assert. We share the idea that there is an intermediate way: The rules established within the community to manage the environment. The environmental territory, then, is built and legitimized on a local level, with or without official acknowledgement. The internal agreements that are achieved are maintained in spite of official prohibition, as in the case of shrimp. Like Feeney et al. (1990) say, the people are not helpless, but are able to organize, to monitor resource by members, to allocate use rights among members, and to adjust aggregate utilization levels to maintain sustainable use of the resource.

Due to the importance that *in situ* conservationist discourses and those that spin around sustainable development have acquired, and in light of the way in which the ecological integrity discourses (Manuel-Navarrete et al. 2004) have been assumed in our country, it is important to discuss the manner of conceiving and operating conservation projects that come from centralized hierarchical structures, and are based on judicial, administrative, financial, and political determinations that leave little space for maneuvering and negotiation. This government proposal is due to sectorial management, which focuses on a single sector or subject, even though it considers impacts and interdependencies with others (for example, fishing, road serviceability, protected areas, territorial zoning, municipal strengthening). However, the local communities push toward an integrated coastal management, which focuses on guiding the necessary changes for human and environmental life quality, in ecosystems that included coastal basins and marine areas of variable extension.

As mentioned by Ostrom (2000), the managerial arrangements between the users of goods in a common property create rules that are modified by the same participants, and they are the ones who supervise the compliance of these rules, restricting individual behavior, which, otherwise, could reduce the users’ community joint yield. This constitutes a proper way of guaranteeing the sustainability of the use of natural capital, without compromising the common property or subjecting it to authoritarian arrangement created by a distant and alien power, and so, the community tends to contradict what the pertinent legal instruments stipulate. This contradiction can be faced in two different and somewhat opposite manners:

In the first, the authority prohibits appropriation activities and considers all those who insist on carrying them out as environmental criminals, creating dynamics that promote clandestine handling of a traditional productive activity, persecution of those who do not consider themselves as lawbreakers, authorities being perceived (including those responsible for the conservation of natural wealth) as an enemy to mock, loss of information regarding the conditions of the natural resource in question and, consequently, inefficient conservation efforts.

In the second, the users of the natural resource undertake an organizational process for the management and attainment of authorizations or concessions that, when successful, determine the establishment of a formal relationship, institutionalized between the users and the authorities. In light of the ordinances in force, these organization and authorization processes involve a modification of the criterion of common property, by virtue of cancellation of open access to the resource through exclusion mechanisms, in a way that users who, for any reason, cannot become members of the authorized organization cease to have access to the resource. Although in this case we cannot say that “everybody wins”, because there is an exclusion process, at least a part of the community obtains access to the resource, creating a setting in which it is possible to propose resource appropriation and management mechanisms that are compatible with the rules in force.

This, however, does not mean that the attainment of an authorization or concession grants automatic sustainability to the resource appropriation process. Assumptions like self – regulation,

adaptive management, transpersonal – collaborative ecological integrity discourses, with the participation of the community in the decision-making process, and the creation of verifiable and reliable information will guarantee for sustainability.

One of the main factors that determine the access to the ecosystems and their resources is the one dealing with the theory of common property, which shows why institutions and property rights are considered important for the management of natural resources. It is common to believe that the users of common property resources were always caught in an inexorable “tragedy of the commons” (Hardin 1968); however, several studies conducted since the mid 80’s have shown that Hardin’s generalizations are not entirely sustained (Feeny et al. 1990 and Berkes and Folke 1998). Several ethnographic works that have tackled this subject show that common property does not imply “open access” and is not necessarily destined to overexploitation (Aguilar et al. 2002). It has been shown that the access to resources is controlled and different types of rules and institutional agreements may exist on a local level, which limit exploitation activities (Marin 2000). On the other hand, Acheson (1991) denies the fact that privatization and government control are the only mechanisms that can affect the use of natural resources, as assured by the “tragedy of the commons” theorists, this author considers that there is an intermediate way: the rules established in the community sphere.

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