REGULATORY COMPLIANCE IN SMALL-SCALE FISHERIES IN OLD PROVIDENCE ISLAND (COLOMBIA)

A Thesis Presented

by

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To Wouter for our sailing boat in which all the adventures happen, and in which all the dreams become true.

To all the fishers for their magic stories and their right to survive

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ABSTRACT

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This research evaluates how contextual variables such as knowledge of the rules, the perception about punishment and formal enforcement levels, perception of social control, fishers' attitudes about legitimacy of rules, and social/economic factors, affect compliance with fisheries regulations. The analysis is carried out in Old Providence Island [OPI]. A survey of 100 fishermen was completed and data from that survey is used to econometrically estimate a model of compliance choices. Results suggest that reports on compliance change depending whether the interviewed is asked about compliance or about violation. I argue that this seemingly inconsistency, reveals an implication on methodological approach. Contrary to the main literature on compliance behavior, in this research deterrence variables were not statistically

significant in the econometric estimations. This result may be because sanctions and fines are not clearly established, reflecting the existence of structural problems in enforcement activities in the island. The results indicate that fishers adjust their violation with respect to other fishers' behavior, and the knowledge about regulations. The probability of being a violator is higher for divers, and this fact is recognized by the fishers themselves.

The survey is discussed in section 6.1, results discussed in section 7, methodological and policy implications are discussed in section 8.

Key words: Fishing, Regulatory compliance, Enforcement, Legitimacy, Social control

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CHAPTER 1

INTRODUCTION

The importance of small-scale capture fisheries has been recognized internationally, because of its relevant contribution to worldwide food security, and poverty alleviation (Berkes *et al*. 2001). The theoretical models described in this study are for industrial fisheries, but my theoretical question is What determines compliance in artisan fisheries?.

The United States Agency for International Development (USAID) defines the small-scale or artisan fisheries, as those that are a "more traditional, and labor intensive form of fishing performed by men, women and children from fishing households. Although sometimes mechanized, more often these small-scale methods involve fishing from small boats or from shore, or by gleaning and use of traditional fishing gear, such as hand lines, small nets, traps, spears, and hand collection methods. Fish are marketed from small-scale fisheries. However in most of the cases the catch is eaten by the family and this is referred to as subsistence fisheries" (Fisheries Opportunities Assessment, 2006: 12).

In this same report, USAID concludes that the fisheries management now has not only biological objectives but institutional, political and social objectives. And it has been pointed out that the necessity of taking in to consideration that "if fisheries are governed responsibly and equitably, the sector has great potential to contribute to poverty reduction, economic growth, biodiversity conservation, sustainable livelihoods and peace

and security" (ibid: 16).

In fisheries management a major challenge associated with rules and regulations worldwide is to find better ways of enforcement to protect resource sustainability, and promote economic efficiency. Compliance with rules is a main concern of management authorities (Hauk & Kroese, 2006). The attributes and boundaries of the resource plus surveillance and fines are important factors in the decision to violate regulations, but other social factors such as local participation, legitimacy of rules, sense of belonging to the community and other attributes of behavior (Sutinen Viteri & Chavez, 2004) seem to have important influence on decision making and political implications. In Old Providence the path of development followed could explain the compliance behavior on the island.

The main studies of regulatory compliance in fisheries deal with trawl and industrial fisheries (Sutinen & Andersen, 1985; Sutinen & Gauvin, 1989; Kuperan & Sutinen, 1998; Eggert & Ellegard, 2003; Viteri & Chavez, 2004; Hauck & Kroess, 2006), where the capital input is much greater than for the artisan fisheries described in this study. Eggert and Lokina (2005); Eggert and Ellergard (2003) and Viteri and Chavez (2004) are the first to analyze artisan fishers. The fishers in this study all have low levels of capital input, i.e., they operate simple open wooden-hulled and small fiber glass vessels; some of the boats lack motors and use hand lines and free diving to fish. The theoretical model followed here extends the neoclassical utilitarian model of individual violation behavior to include the effect of social norms and the social characteristics and rules legitimacy

that determine compliance (Sutinen and Kuperan, 1999; Hatcher and Gordon, 2005).

Old Providence Island [OPI] is a Colombian Caribbean insular oceanic territory. In the island the native population and regulations belong to a special political system and category of conservation as a Biosphere Reserve[1]. OPI's development process differs from its neighboring islands. In Old Providence the key factors are ecotourism and traditional economic activities. Historical facts like the declaration of the Archipelago as a Biosphere Reserve (UNESCO - 2000), was a determinant factors for the development path followed.

Small-scale fishing is an important symbol of cultural identity and it is one of the most important economic traditional activities on the island. In Old Providence there are 181 fishers (Medina, 2004). Connolly (2005) pointed out that despite the lower technology; in OPI fishermen have higher productivity[2] than its neighbor Island [SAI]. Fishery economics literature tells us that when there are not property rights, then the resource is over harvested; and when there are not strong enforcement mechanisms, then compliance is at the lowest level. The paradox is why on this Island the resource does not seem to be overharvested and there is some compliance.

[1] The Archipelago of San Andres, Old Providence and Santa Catalina was declared as Biosphere Reserve by UNESCO in 2000 given it's innovation and demonstration of approaches to conservation and development.
[2] Catch per average artisanal fishing trip (Conolly, 2005)

This research describes the relationships between behavioral norms of fishermen and contextual conditions on the island (including historical background, institutional and ecosystem characteristics, etc), and how these variables influence resource users decision-making process.

This research integrates two levels of analysis: a descriptive one in terms of the economic performance in the fishery system, in which productivity, users' norms, and compliance with rules are described. The compilation of the main rules that apply to the island is an output in this section as well.

Second, statistical analysis is used to identify the determinants of compliance with rules by fishermen on the island. Following the econometric model used by Viteri and Chavez (2004), and proposed by Sutinen and Kuperan (1999), I analyze the factors that motivate the decision to violate existing regulations, and estimate the effect of these factors on this decision.

Understanding the factors that motivate fishermen's decisions to infringe on regulations and how they interact with contextual conditions may improve future compliance and rules efficiency in the island.

This research is motivated by my previous work about institutions and Black crab management in Old Providence Island (Alayon, 2005), and my desire to continue exploring the conditions in the archipelago which affect the way in which local people

perceive and use their natural resources. This research poses two general questions: First, to what extent do fishers from Old Providence (OP) Island violate fishery rules and regulations. Second, what factors are associated with violations?

Objectives And Research Question

Research question

To what extent do fishers from Old Providence [OPI] Island violate fishery rules and regulations? What factors are associated with violations? I examined fisher's knowledge of rules and regulations, perception of social control and formal enforcement levels, perception about punishment, social control and fishers' attitudes about legitimacy of rules and regulations and social/economic factors.

General objective

1) Estimate, using econometric analysis, the effect and differences of selected socioeconomic factors in the decision to comply with fisheries regulations in OPI. The factors considered include: fisher's knowledge of rules and regulations, the perception about punishment and formal enforcement levels, perception of social control and fishers' attitudes about legitimacy of rules, and social/economic factors.

Specific objectives

i. To describe the regulatory and socioeconomic conditions of the fishermen on the island.

ii. To gather self-reported data on compliance

iii. To analyze how key factors determine compliance using the model proposed by Sutinen and Kuperan (1999).

Hypotheses

Given the low level of enforcement and non-existence of monetary sanctions, a simple deterrence model will predict zero regulatory compliance. However, the hypothesis is that there is a high compliance level in the island because factors such as perceived legitimacy, knowledge of the rules, and the perception of social control and formal enforcement levels, determine in a significant way the compliance with rules.

Study Area

"*The Natives are a carefree, quiet and easy- going people who learned long ago to live in harmony with their natural surroundings*" (Gallardo, 2003 cited in: Mow, 2006).

Insularity is responsible for the fragility of this small island. Because of its particular ecological conditions and low capacity of recovering from strong disturbances, it is very

vulnerable. On islands economic alternatives are naturally limited, so efficiency and self-sustainability are crucial.

The population of the main island SAI, with an area of 27 km^2, is estimated at over 80,000. This high population density consists of a small component of traditional islander communities and a dominantly larger proportion of immigrant Colombian settlers. Old Providence [OPI] with an area of 18 km^2, has a population of more than 5000 people (DANE[3]). In OPI the path of development has not undergone the same level of development as SAI, and the cultural and environmental problems are much less than in San Andres (Baine et al, in press).

The island is isolated socially as well. The cultural and linguistic characteristics of native islanders in the Archipelago are different from those of mainlanders and closer to the Caribbean islands colonized by the English, of African ancestry. They speak Creole, which has been described as an English- based language with much of Africa and the Caribbean in its vocabulary (Gallardo, 2003 cited in: Mow, 2006). Until the free port declaration (event occurred in 1993), Colombian government was absent from the islands; islanders governed themselves in many ways. This experience produced strong informal institutions with respect to natural resources management that differ from other islands.

Native islanders are called "*raizales*", as an ethnic group they have an identity based on

[3] National Statistics Department (DANE)

their history as Afro descendents and their cultural manifestations and language (*Creol*). They have strong historic roots close with the native populations in the Antilles like Haiti and Jamaica. The most important religions are Baptist, Catholic and Adventist. Dance and music are influenced from Old European and Afro Caribbean communities.

During the development process in SAI, *raizales* were left behind, anthropologic and sociologic studies (Meisel (2003), Mow (2006a, 2006b), Conolly (2005)) have pointed out that they are currently an ethnic minority on their own territory. This reality influenced the way in which people in OPI faced their own challenges and path of development which is much closer to their traditions and the appropriation of their symbolic spaces.

People in SAI are facing a much more complicated situation than people in OPI, many in SAI could not adapt to the new economic system completely and have been marginalized and set apart, their choices are often between hard work, low-pay jobs on cruise ships or extremely high-pay trips to traffic drugs between Colombia and North America (Mow, 2006a). People in Old Providence did not want to follow this path, they tried to become more committed with their dreams and goals, in some sense they still live on the island of subsistence and carry out some of the old activities of the most traditional economy (Mow, 2006b). The landscape in OPI includes farmlands, dry tropical forests and isolated traditional settlements.

Many native islander groups, aware of the struggle and the fear of the complete loss of their identity and extinction as an ethnic group, have risen up against the growth and

socio-economic system imposed by the Colombian government trying to make serious attempts to reaffirm and protect their people on issues related to native rights, equity, land and sea tenure (CORALINA, 2000a, cited in Mow, *2006*).

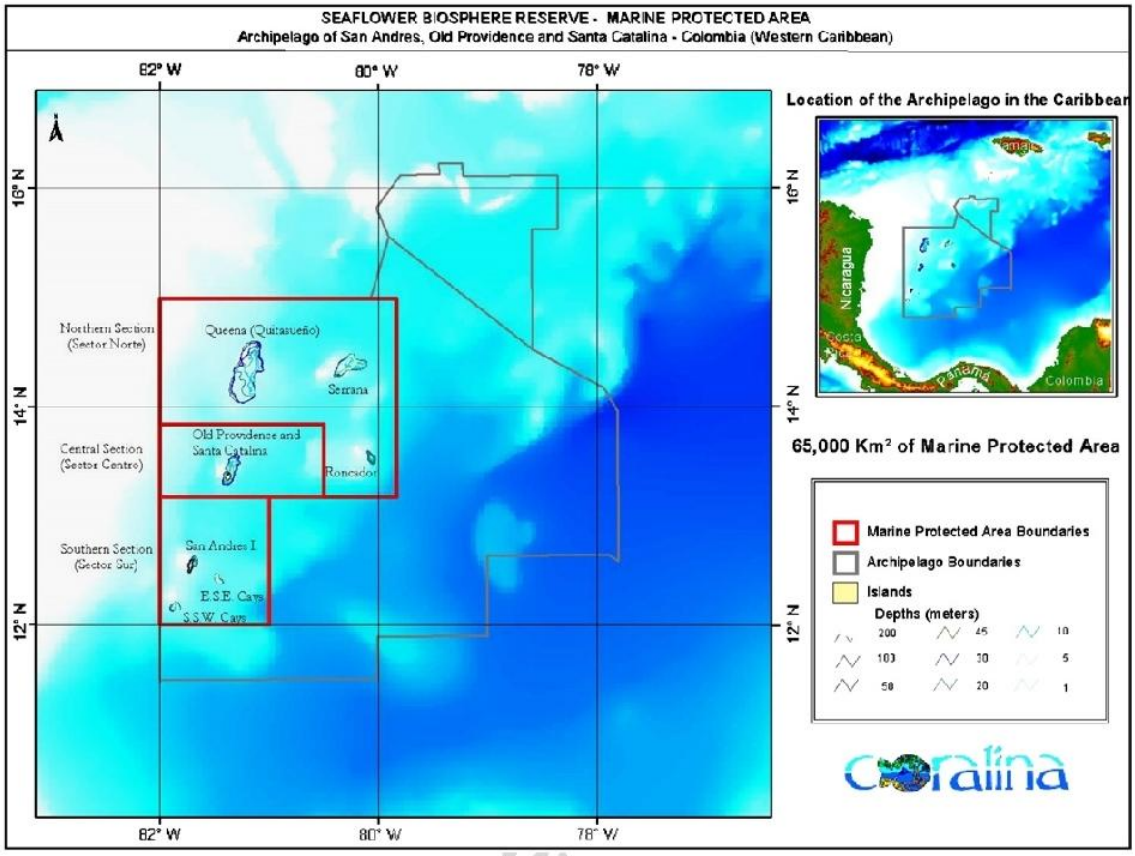
Despite of the strength to the OPI community in the construction of social capital, social problems remain and with the population growth, poverty and inequity are increasing, creating new problems relating to public health, education and security, and lack of social and environmental justice (Mow, 2006). The problems with natural resources increase with the increasing scarcity, of the resources they are economically dependent on.[4]

Fishing and crabs catching are the main traditional economic activities in OPI. The economic dependence on fishery can be explained by the differences between full-time fishermen and part-time ones. The first group represents 86% of the fishermen in the Archipelago (James, 2004), and their economic dependence on fishing is high. Nevertheless they can have alternative activities. 14% of the fishermen in both islands are part-time fishermen (James, 2004), and they have alternative activities such as agriculture, tourism, and others.

The number of species commercially important is approximated to be 19 (Castro, 2005). The fisheries in the island are mainly artisan or small-scale fisheries, but the national demand and international commercial boats have increased over the last years and some traditional species have started to be scarce (sea turtle, lobster, and conch "*pala*").

[4] Field notes, 2009

San Andres, Old providence and Santa Catalina Islands



Map 1. San Andres Archipelago and Seaflower MPA boundaries with location (2006). *Source*: A. Mitchell, 2006

Old Providence Island and the Coral reef barrier

Map 2. Old Providence Island and the Coral reef barrier. Source: Rocha (2006)

CHAPTER 2

LITERATURE REVIEW

Three sections are based on secondary data: first the generalities of regulatory compliance; second the enforcement issues and the description of the problematic identified in the literature; and third the description of the small scale fishery sector.

Regulatory compliance in fisheries

From a traditional microeconomics perspective the dynamics of fishers' behavior is determined by the economic costs and the rational calculation of the economic implications of rules violation. On the one hand, the costs and earnings are dependent on the price of fish, fuel, supplies, crew, vessel, fishing equipment, fishing rights, etc. On the other hand the rational calculation implies the perception of the effects of complying with the fisheries regulations or to violate with the risk of being detected and sanctioned.

The first formal model of compliance is inspired by Becker (1968) who developed a pure deterrence model based on the assumption that compliance or non-compliance behavior is an instrumental decision of calculation of gains when rules are complied and calculations of costs of non-compliance given the probability of being caught.

The pure deterrence model of regulatory compliance focuses primarily on the certainty and severity of sanctions as key determinants of compliance. However evidence shows that it does not provide a complete explanation of compliance behavior. When the rate of non-compliance is significant the first response is to increase deterrence, with an enforcement effort to violate increases. Sutinen *et al.* (1990) (Cited: Sutinen and Kuperan, 1999) noted that conventional models do not adequately explain observed patterns of compliance in many fisheries. Costs and revenues associated with illegal behavior are not enough to explain the decisions making by the users, and from this perspective, penalties high enough to offset the difference between legal and illegal gains, are not feasible in most of the cases.

Understanding violation behavior appears to be crucial for improving fishery enforcement or regulatory systems. Based on the theoretical work of Charles *et al.* (1999), illegal fishing will occur only if enforcement effort is not so high as to remove the incentive to do so, and if the effectiveness of violation is not too great, nor its cost too low. Violation effort will occur at a level jointly proportional to the extent of illegal activity and of enforcement; the violation effort increases with its effectiveness and decreases with its costs.

Charles *et al.* (1999) pointed out the relationship between violation and enforcement. When violation is neither too cheap nor too effective, the interaction between violation and enforcement is regular, the more enforcement the less violation. At low levels of enforcement, fishers respond to increases in enforcement by increasing violation, but at

higher enforcement levels, it becomes uneconomical to continue to do so, and violation decreases with enforcement.

So the fishery manager is able, in theory, to reduce illegal fishery toward zero by increasing enforcement. If, however, violation is very inexpensive and or very efficient, which hypothetically is the case for artisan fisheries, then the optimal level of violation will increase indefinitely with increasing enforcement; fishers react to enforcement not so much by reducing illegal behavior as by focusing on avoiding apprehension by the authority.

In his work with fishermen in OPI Rocha (2005), analyses fisher's violation of the rules from a different perspective. He pointed out the historical moral values people have developed on the island, where any manifestation of inequality is highly disapproved by the locals. Rocha argues that when the level of violation is high this is understood as a social protest against the external agents and regulators. His discussion is supported in several previous anthropological studies of the islands [OPI and SAI] (Gorricho & Rivera, 2004; Wilson, 1995; Monsalve, 2003). He proposes the communication among small groups as a social control mechanism to improve rule's efficiency and legitimacy. Alayón (2005) pointed out the importance of local participation for rules legitimacy as well as the importance of combining local appropriations with external regulations for common pool resources management in OPI.

Evidence supports that regulatory compliance in fisheries depends not only on economic

variables but also on some other contextual and psychological ones, as has been pointed out by Viteri and Chavez (2002), Sutinen and Kuperan (1999), and Mathiesen (2005).

Hatcher *et al.* (2000) analyzed the non- monetary factors that affect compliance with a catch quota among fishermen, and pointed out the importance of those factors in policy making beyond the traditional models which just take into account the enforcement process.

Viteri and Chavez (2004), followed the model proposed by Sutinen and Kuperan (1999), and they pointed out that regulatory compliance depends on the evaluation of the expected earnings of illegal activities faced by the fisherman, and it also depends on social variables. They discuss the importance of regulatory and enforcement instruments oriented towards promoting the legitimacy of rules, improving the representation of users in the local organizations and increasing the participation of individuals "with-in-grass-root organizations".

The intrinsic and extrinsic motivations for the individual are given by moral and social reputation. Sutinen and Kuperan (1999) defined moral reputation as the individual's moral development, personal values, and perception of legitimacy of the rules. Social reputation is defined as the social pressures in the community that affect the individual's decision; they developed a theoretical model consistent with basic principles of economics and with the sociology and psychology literature that identifies the following factors determining compliance: potential illegal gain, severity and certainty of sanctions,

individual moral development, standards of personal morality, individual's perceptions of how just and moral the rules being enforced are, and the social environmental influence.

From psychology, Cognitive Theory focuses primarily on the individual and stages of development; the key variables determining compliance are the individual's personal morality and level of moral development. The Social learning theory, on the other hand, focuses on the conditioning effects of the environment. The key variables include peers' opinions, and the extent of social influence an individual encounters.

From sociology literature there are two basic perspectives on compliance: the instrumental perspective as in Becker's model, assumes individuals are driven purely by self-interest and respond to changes in the tangible, immediate incentives and penalties associated with an act. The variables are the severity and certainty of sanctions.

The normative perspective on the other hand, emphasizes what individuals consider just and moral, instead of what is in their self-interest. Individuals tend to comply with the law to the extent that they perceive the law as appropriate and consistent with their internalized norms. The key variables are individuals' perceptions of the fairness and appropriateness of the law and its institutions (Sutinen & Kuperan, 1999).

Based on hypotheses from economic and sociological theories Raakjær (2003) developed an analytical framework of the legitimacy and compliance in fisheries management. First, he analyzes compliance as a result of the gains obtained by breaking the rules minus the

costs of being detected, as a risk model. Second, he analyzes compliance as determined by the legitimacy of the rules, and third, compliance as the result of institutional arrangements as a mean to reduce transaction costs.

From this perspective, increased enforcement activities can reduce the level of infractions.

Enforcement

The original deterrence model by Becker (1968), led to a large discussion about which other factors are missed in the model. A long number of empirical papers have tested and confirmed the significance of deterrence variables. Anthony *et al*. 1999 pointed out that the deterrence theory is developed on the individual level, while much of the empirical work is based on some level of aggregation.

Eggert and Lokina (2005) explain this problem as follows: "If crime rate is defined as crime per capita, and probability to be arrested is measured as the ratio of arrests to crimes, we have the number of crimes in the denominator of the independent variable and in the numerator of the dependent variable, which can imply spurious correlation. Similarly, if notorious criminals are arrested and kept in custody, it implies a lower crime level, but the negative correlation between crime and arrest rates is not due to the risk of being arrested, but to the actual captivity".

Manski (1978) suggested survey-collected individual self-reports as a means of avoiding these problems, since each individual will have a negligible impact on each of the three objections raised. Furlong (1991) applied these ideas to Canadian fishers and found the fishers to be most sensitive to changes in the likelihood of detection, while fines appeared to create the greatest deterrence among various penalties.

All of these studies describe concepts about the deterrence, social and personal influences that determine compliance. The empirical challenge consists on the measurement of those concepts.

Charles, et al. (1999) explains the fisher's response to the enforcement varies depending on the type of control. Furthermore, various studies indicate that the nature of this difference cannot be deduced from a simple maximization model or the specific linear-quadratic model.

From informal data[5] the enforcement in the Archipelago does not seem to be very effective, and could be very low for most of the cases, and the regulation activities are not formally established. The preliminary problems found is related to the division of roles among many different regulation institutions, and the lack of clarity regarding what the specific rules are for many of the actors; along the research this issue is explored in a meaningful way, because it is recognized as a critical factor.

[5] Personal interviews with inhabitants of the islands (August, 2008)

The problem of lack of effective enforcement has been discussed in the literature (Charles, *et al.*1999). Whatever the set of regulations, if moral feelings or social control aspects are absent there is absolutely no effect on fisher behavior if those regulations are not enforced . Here it is important to note that there is not just lack of enforcement but also lack of education about what the regulations are and lack of formal agreement on official laws.

Given that the risk of detection is low, and fines are modest and or not monetary, and the profits from violation are substantial, the prediction is to find a very high violation level. Nevertheless the hypothesis is that there is a high compliance level with the rules and the underlying factors have been analyzed. From empirical works a vast majority of fishers in various fisheries seem to comply with the regulations, which contradicts the predictions based on the simple deterrence model (e.g. Sutinen and Kuperan, 1999; Eggert and Ellegård, 2003). Extended analysis is therefore necessary to include both the instrumental and the normative perspective. The empirical evidence from such an approach is still mixed.

The literature would lead me to conclude that given the low level of enforcement in the island, and the lack of agreement on what the regulations and sanctions are, the probability of compliance must be very low, and the statistical significance of the deterrence variables would be low

Theoretical model

A general summary of some empirical and theoretical findings can be shown as follows. Kuperan and Sutinen (1998) and Hatcher *et al*. (2000) found that compliance in their specific fisheries studies depended on the tangible gains and losses, as well as the moral development, legitimacy, and behavior of others in the fishery. Hatcher and Gordon (2005) found less evidence in favor of normative influence on fisher compliance, while again confirming the deterrence effect.

The studies quoted above deal with trawl fisheries where the capital input is substantial. The study of Eggert and Lokina (2005), and the work of Viteri and Chavez (2004) are the first to analyze artisan fishers from this perspective. The present study tries to address in a smaller scale context, what factors determine compliance; it differs from other studies because of the specific location of the island on the main drugs traffic route in the Caribbean which influences the daily activities of fishermen; and because of the political frame, the biosphere declaration and development path followed by the Island.

Providence Island provides an interesting natural scenario where the main conditions analyzed in other fisheries compliance studies hold, and the contribution to the understanding of social and contextual factors that influence the long run behavior of fishers in the island has policy implications in the Archipelago for policy design and implementation.

The theoretical model followed here extends the neoclassical utilitarian model of individual violation behavior to include normative and social judgments (Eggert *et al*. 2005; Hatcher and Gordon, 2005; Viteri *et al.* 2005; Sutinen and Kuperan, 1999), of the form:

$$Vi = f\,(Fi, Di, Ki, Li, Si\ X) \qquad (1)$$

Where Vi is a self-reported violation rate, Fi is the variable related to the financial incentive to violate, Di is a vector of deterrence variables such as the probability of detection and the expected fine if detected, Ki is a vector of individual's knowledge about the regulations, Li is a vector of variables trying to capture perceived regulatory legitimacy, Si is a vector of social influence variables such as social control, and perception about other's compliance and X measures personal characteristics.

$$\delta Vi/\delta Yi > 0, \quad \delta Vi/\delta Di < 0, \quad \delta Vi/\delta Ki < 0, \quad \delta Vi/\delta Li < 0, \quad \delta Vi/\delta Si < 0 \qquad (2)$$

The main assumptions are that higher measurements of Si and Li, and Ki correspond, respectively to: perceptions of stronger social norms against violation, increasingly positive judgments concerning legitimacy of regulations and of the regulating authorities, and more accurate knowledge about specific regulations that affect different fishing activities. There are not prior predictions of the direction of the X variables.

Note that Viteri *et al* (2005) do not include moral obligation variables as Eggert et al (2005) do. The reason is that the questions to gather moral information are complicated to ask in this specific context. And from personal preferences they were excluded.

Institutions and fishing rules

This section is a description of the main actors' role and the main fishery regulations that operate in the island.

The main actors in the fishery regulation at the local level are: Coralina, the Fish and Farm Secretary, the Municipality of San Andrés Old Providence and Santa Catalina, Junta Departamental de Pesca, Junta for the protection of natural resources. Described below.

Coralina is the autonomous institution for the sustainable development in the archipelago; an institution with bottom-up approaches for the management of natural resources. Coralina is in charge of controlling the regulations for marine protected areas, the prohibition for catching turtles, and the prohibition of scuba diving equipment for extractive purposes.

The Farm and Fishing secretary[6], has the function of controlling and monitoring the activities related with the fishing and agriculture activities. They are in charge of

[6] *Secretaria de Pesca y Agricultura* is the name in Spanish

controlling sharks fishing and the catching season for lobster and conch.

The jurisdiction of Coralina and the Farm and Fishing Secretary, does not allow them to control or stop boats at the sea, reason why they need to work together with the Colombian police and Coast guards.

The Municipality of San Andrés, Old Providence and Santa Catalina, is in charge of executing the fishery policy of the national government; regulating and enforcing the fishing activity and establishing the maximum number of boats, their kind and size periodically, in order to not exceed the maximum allowed yield. They do not have jurisdiction in the water, and also depend on the central national government.

At the national level Incoder (Colombian Institute of rural development) and the National Institute of Fishery and Aquaculture (INPA) are the national organizations in charge of the fishery regulation. Their rules and policies are implemented by Coralina and by the local government in the archipelago.

The *Junta de Pesca Departamental's* is formed by nine members: the Governor of the archipelago; Secretary of fisheries and agriculture; a member from the general maritime direction of the National Army DIMAR; a represent from CORALINA[7]; a member from SENA[8]; represent from national Presidency; represent of artisanal fishers from OPI;

[7] Autonomous Corporation for the sustainable development of the Archipelago of San Andres Old Providence and Santa Catalina.
[8] SENA, *Servicio Nacional de Aprendizaje* (National Service for Learning)

represent of artisanal fishers from SAI; and a represent of industrial fishers. They have to make agreements on the regulatory system for fishing and land use, and the control of illegal activities at the sea such as drugs traffic.

The department for the Protection of natural resources and environment for the Archipelago: is a different department than the above mentioned, with the same The governor through this office promotes the actions for natural resources protection in the archipelago.

Notice that five organizations with roles on the fishing activity and regulations were described above, and some like the Junta, are linked with other organizations and represents of different sectors in the islands. From a participatory point of view this is a great example of people from different groups trying to solve issues together. However in this case, it also means great inefficiency and overlapping of roles from the different sectors. As the users, the authorities also blame on each other the responsibility of their own job. This affirmation is a direct result of my personal field work during the research, where I found the overlapping of roles as one of the main issues for the confusing rules and the consequent analysis of regulatory compliance.

Conflict regarding regulations in OPI fisheries was discussed by Gorricho y Rivera (2004). The presence of central government officials in the Island and its dependence on the central authorities in Bogota, creates difficulties in the relationship between the community and the authorities. Captain of Port has also the characteristic of dependence from the central government; in this sense the regulations related with the resources

access are homogenous in the national territory. For specific fishing regulations the departmental association of fisheries (*Junta de Pesca Departamental*) was created in order to approve the regulatory system for the archipelago.

The regulations showed in Table 1 can be summarized as two types: regulations about technology such as vessel sizes, engine power, mesh sizes, and regulations of techniques such as the length of nets, days at sea, number of trawls etc. However, until this point in the research, the rules do not appear very well organized in the literature, so part of the research is to go deeper to understanding of the way they proceed, and to see why some official documents they look very vague.

The lack of organization of the regulatory system as a whole presents an obstacle for this research, because in some cases the rules are not clear. Part of this confusion is because the legal organisms in charge of enforcement have different functions not compatible with fishing rules enforcement. This is the case of the Coast guards and Captain of Port, who are the only organism with jurisdiction at the sea to stop boats or check on the products. However their main responsibility and focus remains on drug traffic.

Table 1. Fishery regulations in The Archipelago of San Andrés Old Providence and Santa Catalina. Adapted from Rocha (2006). Continued on next page.

REFERENCE	REGULATOR	RULE
Article 017 **(1990)**	INDERENA	*Title 2. Article 4* (**prohibition**): Trade of lobster with a tale smaller than 14 cm is forbidden.
		Article 5 (**prohibition**): Trade of females with eggs is forbidden.
		Title 3. Article 6 (**prohibition**): Fishing with Scuba equipment and nylon nets is not allowed
		Article 10: if these materials are used they will be taken away from the user by the correspondent authority
Decreto 2256, **(1991)**	Agriculture Ministry, INPA	*Catching seasons:* from the knowledge about the potential value and importance of a species, INPA and the Executive Community for fisheries will define a reasonable quota and catching season times for the species. This applied in this research specifically for lobster and Conch. The two species are in danger of extinction and are widely extracted by industrial and artisanal divers. The catching season dates are established yearly, and for conch it comes mostly during June to October, and for lobsters it goes from April to the end of June.
Law 47 **(1993)**	INPA	*Article 38. Fishery systems forbidden:* Nets and dynamite in the Archipelago. And "long line" is forbidden in the territories designated for artisan fishery.
Resolution 158 **(1996)**	INPA	Maximum size of the artisan boats
Resolution 163 **(1998)**	Ministry of Defense	The characteristics of the commercial artisan boats are defined by regulation. Size, capacity, engine, fuel capacity, communication systems, technology, time fishing, and permits to fish are defined,
Resolution 574 **(2002)**	Alcaldía Municipal de Providencia y Santa Catalina	Allows an increase in the prices of sea products (without controlling prices)
Agreement 009 **(2003)**	INCODER	Every fisherman must have a carnet, which accredits him as a fisherman. Each one should declare his places of fishing and technology and arts used.
Resolution 206 **(2003)**	INPA	Given that the Archipelago did not comply with it's functions, with this regulation, INPA is in charge of giving the permits for extraction, processing and trading of sea products.
Resolution 121 **(2004)**	DIMAR	Boats of artisan fishermen, capacity of 3 tons and maximum power of 85HP have to be reported each time they go fishing and each time they come back
Resolution 407 **(2004)**	INCODER[9]	Limits catch season of lobster: from 1st April to 30th June

[9] Incoder (Colombian Institute for the Rural Development) is represented by Coralina

Resolution 613 **(2004)**	CORALINA	Use of harpoon is forbidden in some areas in the main the recreational diving locations
Law 915 **(2004)**	National Congress: Delimitation of the spatial frontiers for the economic and social development of the Archipelago of San Andres, Old Providence and Santa Catalina islands	***Article 31*** (**prohibition**): In the marine area of the reefs and coastal area of the Archipelago, fishing is allowed for artisan, scientific and sport purposes only. ***Article 32*** (**definition**): The artisan fishery activity, as done by fishermen individually or organized in cooperatives and other associations with individual and independent job. Within the Law, the artisanal fishing is defined as the one which uses arts and technology of a small production activity. ***Article 34***: To participate in an artisan fishery in the Archipelago, each boat must obtain the permit with the "Junta Departamental de Pesca y Acuicultura"
Agreement 022 **(2004)**	INCODER	Global quota for conch and lobster. Apply for industrials.
September **2004**	Interamerican Convention for the marine Turtles Conservation (CIT), controlled by CORALINA	*Turtles protection:* Colombia took part of the CIT, and it requires Colombia to forbid the catching and commercialization of marine turtles in the whole National territory, and promote the environmental education in the territories where the marine turtles live.
January 2005	CORALINA	*Marine Protected Areas MPAS:* To implement the Biosphere Reserve in the ocean, CORALINA set up the Seaflower MPA with support from GEF-World Bank and international, national and local government, NGOs and other stakeholders. The process took five years and in January 2005, the Ministry of Ebvironment, Housing and Territorial Development declared the MPA boundaries.
Resolution 3333 (**2008)**	Instituto Colombiano Agropecuario	The intentional catching of sharks is forbidden in the Archipelago.

Traditionally fishermen use fishhooks, free diving for lobster and snails, baskets made locally, and nets for sardines and sprats. The illegal methods used are mainly: harpoon, *Long line*, traps for lobsters, scuba equipment and nets for turtles.

The regulations I consider in this study are:

- **Turtle catching prohibition**: this rule is framed in a whole international agreement signed by Colombia in the International Convention for marine turtles protection (CITES, 2002)

- **Lobster and conch catching prohibition** applies for artisanal fishers during the breeding season, each year the authorities communicate the period. Conch catching season goes from 1st June to 31st October, lobster-catching season goes from 1st April to 30th June.

- **Shark fishing** is forbidden, however sharks can be captured and or killed in cases of personal defense.

- **Scuba diving tanks** are forbidden around the island for catching purposes and extractive diving is forbidden in certain areas, but this regulation will be taken as part of the next one which corresponds to the marine protected areas.

-**Marine Protected Areas** in the reserve cover 65,000 km2 divided in administrative sections. The main areas that apply for artisanal fishers are: *No-entry*, *No-take* , *Artisanal fishing* zones, *special use*, *for specific uses as determined,* and *General Use* zones.[10]

The reason to choose these regulations is because they are the rules that apply fo artisanal fishers and in brief they should be clear for the authorities and the users equally. Choosing less rules would have left valuable information out of the study.

[10] **No-entry**: UIT use restricted to research and monitoring, those are the zones with maximum protection. **No-take zones**: allow a variety of non-extractive uses, extraction of any resource is prohibited. **Artisanal fishing:** Are zones for use by traditional fishers. Controlled artisanal fishing, sport fishing guided by traditional fishers, small-scale aquaculture, research, and activities to restore and protect the ecosystems are allowed. Industrial fishing is forbidden. **Special use for specific uses as determined:** zones are defined and regulated according to use and can be temporary or permanent. **General use:** where minimal restrictions apply. Subsistence and artisanal fishing are allowed. Industrial fishing is prohibited in the Southern and central sections. It is permitted in the Northern Section in accord with regulations of the fishing authority and CORALINA.

CHAPTER 3

METHODOLOGY

The data for this study was collected using a questionnaire during January, February and July 2009. The research integrates two levels of analysis: first a descriptive one in terms of the economic performance in the fishery system, in which the differences and or similarities of users' norms, and compliance of rules are described.

Second an empirical analysis was used to examine the level of compliance with rules. Following the econometric model used by Viteri and Chavez (2004), and proposed by Sutinen and Kuperan (1999), I analyze the factors that motivate the decision to violate existing regulations, and estimate the effect of these factors on this decision. Instruments used include face-to-face interviews and structured questionnaires, and econometric estimation.

For the survey designing, the variables of the empirical model were taken as sections in the questionnaire. Questions to get information about financial characteristics, monitoring and control mechanisms, knowledge about sanctions and rules, personal beliefs and feelings towards existing regulations and authorities, social and personal characteristics, self report violation, and self evaluation on compliance were asked. A total of 76 questions were taken in the questionnaire.

Five pilot surveys were conducted with fishermen in the neighbor island of San Andres in order to improve the questionnaires in the field, from which some questions were discarded and others were re written in a clearer way..

In Old Providence face to face structured questionnaires were used to gather the self reported information. One hundred fishermen were randomly selected from the official census (Fish & Farm Coop, 2002) and organized by the sectors in the Island: Santa Catalina, Free Town, Old Town, Camp, San Felipe, South West Bay, Bottom House, La Montana, Rocky Point, Maracaibo, Baxon, and Town. Going around the island I visited more than 30 of the houses of the fishermen selected. Some others were interviewed in the main ports[11] when they came back from a fishing trip. Four refused to answer, one of them because of language problems, he was shy to accept the interview; one because he expected a five dollars payment to answer the questions; and two because they said were tired of answering surveys[12]

Each interview lasted from 30 minutes to one hour depending on the level of understanding of the interviewed. Most of the interviews were conducted without the presence of others. However in some cases friends passed by and wanted to stay. When that was the case, the interviewer stopped the interview in a friendly way to say hi to the

[11] South West Bay, Manzanillo Bay, Santa Catalina, Maracaibo and San Felipe
[12] From June 2009 to January 2008 and Anthropologist was conducting a study with fishermen from the Island, no information about the nature of the study was found.

visitor, but after a fast exchange of words asked the person to let the interview to be alone. In some cases that was not possible. I completed a total of 100 interviews.

Given that the local language is English, most of the native islanders were interviewed in English, and the non natives in Spanish. In person open ended interviews with people from the main regulatory agencies[13] were also applied, and locally sources of information were used from the formal regulatory agencies in order to triangulate information.

Survey Design

The challenge of measuring the theoretical variables results is because violation of rules is a sensitive issue. Furthermore there are many ways we could measure each concept. A group of questions per theoretical concept was carefully designed, following formats from previous studies (Vitery et al. 2005, and Sutinen and Kuperan, 1999). I adapted the questions to the specific context of the island that was well known by previous research experiences in the place.

The survey method must be the result of two key methodological developments. As proposed by Mitchell and Carson (1989); first, the probability sampling which enable the survey's findings to be accurately projected to larger populations, and second, the art of asking questions. The first is addressed by the random selection of 100 individuals from a population of 181 individuals. And the second part is addressed by finding the strategic

[13] Captain of Port, CORALINA, Farm and Fishing Secretary,

fitting of the questions with the local context, using the researcher's previous experience on conducting interviews and surveys in the island (Alayon, 2005).

The level of analysis is the individual, not the boat owner as in many of the previous studies given the relatively small number of boats. Structured questionnaires were administered to each of the respondents in a face-to-face interview. The interviewer informed the respondents of her mission and assured them that the respondent will not be identified and also their responses will be treated with strict confidentiality. To guarantee that the responses are not contaminated by opinions of others, each respondent is interviewed alone (See Appendix 1).

Self-reports may imply a risk of biased data, especially as respondents are asked about their own illegal activities. Consideration was taken in the design of the questionnaire to maximize the likelihood of honest responses, in particular regarding questions about the fishers' own violation behavior. Two types of questions were asked for compliance report, first a self evaluation regarding each respondent's behavior towards fishing regulations. The second type of questions is focused on violation of each one of the specific regulations: turtle catching, lobster and conch catching season, sharks fishing, scuba diving tanks for fishing, marine protected areas (Mpa's).

In order to deal with the challenge of improving accuracy for sensitive questions the randomized response technique has showed important effects (Sutinen and kuperan, 1999; Buschman and Tracy, 1982; Warner, 1965). In the method of randomized response

technique the interviewee responds with answers that furnish information only on a probability basis. The randomized response technique as a mean to get accurate answers to sensitive questions through a probability based questions was tested during the pilot surveys also. The questions were dropped from the questionnaire because of the difficulty that it created for the interviewed

The interviews include questions on respondent attitudes and perceptions about the legitimacy of regulations, social pressures to comply, attitudes towards violation and questions related with the perceived effectiveness and fairness of regulations, the legitimacy of management institutions, and the involvement of fishers in the management. Following the previous work by Eggert and Lokina (2005), Viteri and Chávez (2004), and Kuperan & Sutinen (1998), these questions are statements for which the respondents can rank their level of agreement on a five-digit scale, where a higher score means stronger agreement. The questionnaire requests information on respondents' (1) general information, household, type of fishing background, (2) financial characteristics (3) knowledge and opinion about regulations and sanctions (4) views of regulatory procedures and outcomes, deterrence variables and experience with enforcement authorities (5) personal compliance behavior, other's compliance behavior; (6) views of social influence and some personal characteristics and (7) perceptions about resource scarcity and conditions of the fishing activity in the island.

When an individual did not want to answer the survey, he was asked why. This provides extra information about perceptions of the actors related with the rules and the issue, of

non response or protest bias. There were not specific questions which people did not want to answer, but there were of course some in which respondents said they did not know the answer.

The overall impression for the field work during January, February and July 2009 was that the fishers were cooperative with their answers, including their own violations and personal opinions about authorities.

Empirical model

The empirical model takes the same variables from the theoretical model explained in Chapter 2 (Theoretical model). The main differences from the theoretical model consist on the definition of two dependent variables. There are different ways in practice to empirically measure the concept of violation. In this study, the concept of compliance is empirically measured from the two opposite sides: self evaluation on *Compliance*, and self report on *Violation.*

The dependent variables are consequently: *Complier* (Ci) and *Violator* (Vi) in order to compare the response bias from self report about violation to self evaluation about compliance.

The second difference from the theoretical model is the definition of the 5 specific regulations that apply for fishermen in the islands, and the fact that those regulations affect fishermen differently depending on whether they are divers or hand line fishermen.

The same independent variables defined in the theoretical model (section 4.3) are used in this empirical model. The specification of each one is explained in section 7 (Results).

The dependent variable, violation (Vi), is a latent variable that describes the degree to which fishers are in violation of the following rules:

- *Turtle catching*
- *Lobster and conch catching season*
- *Sharks fishing*
- *Scuba diving tanks for fishing*
- *Harvesting in marine protected areas (Mpa's)*

The questions of report on the survey were asked from the same two perspectives. In order to address the self-report violation two types of questions were asked in order to get more accurate answers to the sensitive concepts. Next to the questions regarding violation, a question which addresses compliance by selecting one out four options to evaluate behavior toward rules was asked. To the question *how do you evaluate your compliance to the discussed fishing regulations*? The four options are the following:

-I always comply with the rules
-Almost always I comply with the rules
-I try to respect the rules, but many times I face situations where I don't comply

- *I don't comply the rules*

A PROBIT/LOGIT type model was employed to estimate the effect of each of the chosen factors on violation. The dependent variable evaluates the probability of violating the current regulations by a fisherman. Is defined as the likelihood of violating the chosen regulations, if Vi>0

individuals infringe at least one regulation in the equation (2). The self evaluation gives as the variable Ci in the equation (3), it captures the same concept but through the opposite angle: compliance as self evaluation.

$$Vi = f\,(Yi, Di, Ki, Li, Si, X) \quad (2)$$

$$Ci = f\,(Yi, Di, Ki, Li, Si, X) \quad (3)$$

The set of social factors that were taken into account in the initial analysis include:

Ci is the dependent variable takes the self evaluation on each individual's behavior toward fishing regulations

Vi is the dependent variable takes the self report violation.

Yi is the variable related to the financial incentive to violate.

Di is a vector of deterrence variables such as the probability of detection and the expected fine if detected

Ki is a vector of individual's knowledge about the regulations

Li is a vector of variables trying to capture perceived regulatory legitimacy

*Si i*s a vector of social control influence variables

X is a measure of personal characteristic such as sense of ownership in the community, participation in local organizations and individual's perceptions towards resource scarcity.

Table 2. Variables and their expected values

VARIABLE	EXPECTED SIGN (Vi)	EXPECTED SIGN (Ci)
(L)	***(-)***	***(+)***
(D)	***(-)***	***(+)***
(K)	***(-)***	***(+)***
(Y)	(+)	***(-)***
(S)	***(-)***	***(+)***
(X)	***(?)***	***(?)***

See Appendix B for the specific questions per variable in the designed questionnaire.

Note that Viteri *et al* (2005) do not include moral obligation variables as Eggert et al (2005) do.

Factor analysis for the creation of indexes

Factor analysis procedure is used mostly for data reduction purposes. In order to get a small set o variables from a large set of variables some indexes were created to represent the independent variables of the model. The indexes measure conceptually similar things.

Indexes were created for the variables Legitimacy, L, Deterrence variables, Di, Dii; social influence from other fishers' violations, SV1, SV2.

The nature of the indexes created is *exploratory*, because there is not a theoretical or predefined idea of the structure or about how many dimensions are in a set of variables, from the survey questions to the definition of the variable for the econometric estimations. Remember that each variable in the model comes from a series of questions previously designed in the questionnaire.

To create the index for a variable such as legitimacy, L, the variables that conceptually can measure the legitimacy concept were analyzed by factor analysis. And one factor was chosen which involve three uncorrelated variables. The variables in a specific index were aggregated and divided by the number of variables.

Example:

$$L = (Benefit\_all + Accept + opinion\ matters) / 3$$

Note that all the variables in the index have the same weight, this is taken from Jack (1971) and Jae-on and Mueller (1978); there is another way to create the indexes in which the weights for the variables are specific for the weight the variable has in the factor.

CHAPTER 4

RESULTS

Compliance in small-scale fisheries is a difficult issue to explore and relatively few studies have been done in the specific context of OPI's fishery. The factors explored in this research correspond to the most significant factors analyzed in previous studies. Specific conditions in OPI play an important role for the final discussion as well as for the scientific contribution to the area under inquiry.

The following section describes the main characteristics of the interviewed fishermen. Next, the way in which one of the variables of the model was created starting from the outcome variables is explained; and the last section explains the econometric estimations.

Old Providence Fisherman's Identity and compliance factors

In this section, each one of the variables of the econometric model is explained from the theory and from the field, trying to capture the story behind the model.

$$Vi = f(Fi, Di, Ki, Li, Si, X)$$

$$Ci = f(Fi, Di, Ki, Li, Si, X)$$

Personal characteristics (X)

"There is no law at the sea. You go fishing behind the barrier all day in your boat, and the sea changes you. Being a fisherman is the most transparent job[14]*"*

In OPI the fishermen's physical and symbolic spaces were never regulated by external agents, this fact created a natural independence on all of their extractive activities, time and decisions. The space at the sea has no property limits, then prohibitions on fishers' daily spaces and control on their activities is challenging given the open access nature of their job.

"We did all of that without any law or rule, and now it happens that we cannot do it that way.[15]*"*

Their independence allows job movements through the year in different economic activities, but it is also the consequence of some long periods of low productivity at the sea that forces the fishermen to look for different activities. Number of users varies systematically depending on existence or lack of opportunities, the most common alternative sources of income for fishermen come from agriculture, carpentry, construction, and taxi services.

Personal characteristics such as sense of belonging to the Island and traditional activities may be a significant factor in compliance given that fishermen always blame resource

[14] Personal interview, February 2009, Old providence Island.
[15] Personal interview. February, 2009. Old Providence island.

depletion on actions done by outsiders; on the one hand this is a common way people respond, and on the other hand in this context it makes sense given the constant presence of big industrial ships fishing in the surrounding areas in a legal and illegal way. One way of looking at feelings towards the fishing activity, is asking about whether they want their children to make their live as fishermen, 36% of them would like their children to continue the tradition of being fishermen. They agree fishing is a hard activity but gives freedom and they explain the love involved in the relationship with the universe at the sea.

Regarding the question on whether they would like to stay in the Island 86% want to stay in Old Providence the rest of their lives. I asked these questions because a stronger sense of belonging to the island and to their traditional activity may be a reason for users to blame violators[16]

Sixteen variables tried to capture the effect of personal characteristics on regulatory compliance[17], and econometrical analysis was used to estimate the relative importance of each one in the model. The characteristics included in the model as X, are: if the fisherman is a Diver or a "liner", age, income, the number of dependents; type of job of his wife, is the fisherman was born in the island and his economic dependence on the activity.

[16] Personal Field Notes (2004). "*They argue that the islander takes care of the island because he loves it, a person who does not care about the place does not respect it"*

[17] The sixteen variables for the vector of personal characteristics: Place of birth, age, education, number of dependents, number of people in the household, source of income, income proportion from fishing, years fishing, fishing traditions, permanence on the island, fishing tools, product for consumptions, religion and church attendance, wife's job, income, and perception about resource scarcity.

Income, Divers and Liners

"There are divers and there are fishermen. Among them there are part-time fishermen who have other activities. Personally I am a professional fisherman, I don't do anything different than fishing, and when I go to bed I am fishing in my dreams as well"[18]

Even though fishery in Old Providence is a small-scale activity, income can be obtained above the subsistence level. Cano et al, (2006) estimated the fisherman's average income depending on the type of fisher. For divers the average income is more than twice the national minimum income[19], however for fishermen who use hand line the average income is less than 50% more than the minimum income in Colombia. Given the relative higher prices in the islands compare with the continental part of Colombia, Cano, et al (2006) qualified hand line fishery as a subsistence activity.

Table 3. Type of fisher and economic dependence on fishing activities.

Lineordive	N	Part time	Full time
Divers	23	7	16
Handline	47	25	22
Both	30	10	20
Total	100	42	58

If diving is certainly much more profitable than hand-line fishing, the normal question from an economic perspective would be why is not everybody a diver? Some of the fishermen interviewed don't know how to swim, some are afraid of using scuba tanks

[18] Jan, personal interview. February, 2009. Old Providence Island
[19]The study was done during May to October 2006. 550 USD per month for divers 300 USD for hand line fishermen.

because people have had problems diving; others said they think that diving is a very unfair practice because the use of tanks is unsustainable. In practical terms, age is very important, some hand-liners are the oldest and at some point they were divers, but now they feel it is much harder to be a diver. Age and diving had a correlation of 23.2% and was significant at 10% level. Diving and income did not show significant correlation in the study, because the income reported in the survey corresponds to the monthly income for each individual from all his economic activities. But being a diver and having a higher income proportion derived from fishing have a correlation of 23% and was significant at 5% level.

Table 4. Income percentage obtained from fishing

Income %	Freq
10-40	23
40-80	36
>80	41
Total	100

Type of fisherman (Full time – part time)

Depending on the direct economic dependency on fishing, fishers were classified as full time and part time. Out of 100 respondents randomly selected, 57% correspond to full time fishermen, and 43% are part time. 33 of them obtain 100% of their income from fishing activities. 39% have their own boat. This fact diminishes the earnings for those who don't own a boat because they always have to give a part to the boat owner. The total number of boats owned by the sample is 51. In terms of the type of boat they use,

86% go fishing in a fiberglass boat, and 14% of them use a wood boat.

Just 24% of the fishermen have a low economic dependence on fishing activities, given the more stable nature of their additional income; they have contracts with the government and activities

that represent higher income and/or more stability, such as taxi driver, pension from the government, own business, or dive master. All of these activities represent a better income in most of the cases and require either specialized knowledge or materials.

Fishing is an individual activity but the fishing teams show to have better caught and more fun at the sea. Fishers who don't own a boat go fishing with friends and family, mainly three people per boat. This type of informal contract is repeated in time but they have the freedom of changing peers when they want.

Each fishing trip takes on average 7 hours per day depending on the weather conditions and "the good luck of the fisherman". Just a few boats have enough capacity to carry more than 5 fishermen. The traditional ways of dividing the earnings per trip are:

After discounting the costs for gas, the remaining part of the catch is divided in equal parts for the fishermen and for the owner of the boat. This means that if the boat owner participates in the trip he will receive two parts. 70% of the respondents use this as a method of dividing the earnings.

The other way of dividing earnings is called “half”. This is applied mainly among divers. Each diver takes his own catch and divides it in two parts; one part is for the boat and the other for himself. With the boat part (all the divers’ halfs together) the captain, boat owner and gas is paid. 10% of the respondents used this as a method of dividing the earnings.

7% of the respondents used both methods of dividing the earnings, and 10% of them used sharing as a method, but with an additional 10% for the captain of the boat. This is for the cases where the boat goes further away and explores new places for fishing.

All native fishermen started fishing when they were kids, either with their parents, neighbors or friends from school. 84% of them have been fishing for more than 11 years ago.

Dependents

The mean of number of people living in the house with the respondent is 4 and fishermen have to maintain 3 or more people economically.

Born

In old Providence Island as expected, most of the fishermen are natives (76%). Given the demographic control, there are restrictions for foreigners to stay in the island. Fishermen

born in other place are mostly from San Andrés and moved to OPI more than 10 years ago, one of the oldest moved to the island 45 years ago, and just two of them moved 8 and 3 years ago respectively. The national department of Statistics in Colombia, estimates a native population in the archipelago as 57% (DANE, 2005), but clearly for traditional activities as fishing, natives representation is much higher.

Age

Age distribution of the sample ranges from 13 to 78 years old. 73% of the sample is in the 30-60 years old interval. Fishing remains as one of the most important traditional activities for the raizal community, however, incursion of young people in the activity has been slow. Fish & Farm (2009), reported that 72% of the fishermen population in the island is older than 35 years old, and from the sample of 100 fishermen, 78% were older than that. The table 5, shows that younger fishermen become divers easier given the difficulty of this activity and the potential higher income.

Table 5. Age distribution of fishermen on OPI

Age	Diver	hand line	Both activities
=<35	15	4	9
>35	8	43	21
Total	23	47	30

Education

Regarding education, the Archipelago of San Andres, Old Providence and Santa Catalina, has the lowest level of illiteracy in Colombia (DANE, 2005). Just 1% in the sample did not go to school and all the rest have some level of formal education; 81% of the sample went to high school. This fact is very different from other coastal areas in Colombia where the level of education is much lower. Many of the fishermen in the Archipelago have received technical training and are recognized as the best captains of boats in Colombia.

Wife Job

More and more the women in the Islands are taking the space of no traditional jobs. However on Providence Island still 60% of the fishermen's wives are on traditional activities such as at home, or crab catching. 40% of them have different jobs with more stable incomes.

The following table shows the descriptive statistics of the variables.

Table 6. Descriptive statistics Personal Characteristics vector. Continued on the next page.

NAME	Variables	Description	Values	Mean	Std Dev.
Personal characteristics (X)	Born	Were you born in the Island?	0=no 1=yes	0.76	0.429
	Move	If you were not born in OP/SAI When did you move to the islands	Number of years	21.7	14.83
	Age	Age	18 to 71	44.5	13.9
	Education	what is the higher formal year of education?	1=elementary 2=midle 3=high	8.35	2.8

			school 4=more than high school		
	Sourceincome	Is fishing your main source of income, and what other sources do you have?	0=F 1=FFC 2=Fcon 3=FI[20]	1.31	1.19
	Income proportion	What percentage of household income is derived from fishing?	20% to 100%	69	28.72
	Yearsfishing	How long have you been a fisherman? (years)	2 to 61	26.6	14.06
	Typeofish	Part time or full time fisherman?	0=part time 1=fulltime	0.58	0.49
	Kidsfish	Will your kids follow you as fishermen?	-1=No 0=Dont know 1=yes	0.58	0.68
	dependents	How many depend on you?	0 - 10	3.6	2.3
	Resourcedissap	What happens if the resource disappears?	0=not bad 1=very bad	0.61	0.494
	LINER	Are you a diver or do you fish with line?	LINE (just Line, or line + dive) = 1 DIVER (just diver)=0	0.47	0.501
	DIVER	Are you a diver or do you fish with line?	DIVE (just dive, or dive + line) = 1 Just LINE = 0	0.53	0.501
	Income	Average income per month	(USD)	417.7	243.7

Knowledge about regulations (K)

[20] F=Fishing; FFC=Fish, farm; Fcon= Fish and construction

Previous studies (Eggert and Ellegard, 2003; Viteri and Chavez, 2004) do not examine knowledge about current regulations as a factor influencing compliance; it means the effect of unclear rules on the compliance level is not widely studied.

In a well-organized system with a clear regulatory structure, common knowledge about which regulations apply is a fixed factor. In the specific case of small-scale fisheries in OPI the specific roles of authorities are not clear, because there is juxtaposition of roles within official institutions in the creation of rules, socialization and monitoring. It is common to find confusing answers to questions regarding who is in charge of monitoring and control; and confusing answers regarding what are the specific fishing regulations.

The study focuses on the 5 main regulations for artisanal fishermen in OPI. The variable *rulesknow* captures how many rules each fisherman knows. Given very low level of difficulty on this question, it remains as a very reliable way of analyzing knowledge about rules.

Table 7. Number of rules known by the fishermen (out of the five chosen rules for the research)

Rulesknow	***Freq (%)***
0	6
1	35
2	40
3	16
4	3
5	0
Total	100

In terms of knowledge on specific rules, the distribution is the following

Table 8. Knowledge about the specific chosen rules

Rulesknow	***Freq(%)***
No rules	5
Turtle	26
Catching season	58
Sharks	3
Scuba equipment	21
Marine Protected Areas	67

In terms of the knowledge about sanctions as outlined above, the institutions and overlapping roles make it difficult for the authority and for the community to establish the optimal level of sanctions and the way the current sanction system operates. From personal interviews with the main authorities in charge of fishing regulations this overlapping of authorities' roles was clear. Given that Coralina is the environmental authority in the islands, and the Fish and Farm Secretary is in charge of defining the specific fishing regulations, but none of them have jurisdiction at the sea to control the rules, it is the Captain of port who should control at the sea, but it is Coralina and Fish and Farm Secretary who are in charge of giving the respective sanctions, which are not clearly established. As they explained, sanctions go from a warning to a fine (not specific amount), or to take the product from the fisher or even to take away the license of the boat.

Talking with some officials at the Captain of Port in OPI, and with fishermen about regulations, it is clear that the main concern for Captain of Port is to control on drugs traffic. This scenario has specific impact on the individuals' perceptions about control,

and impact on the authorities' perceptions about compliance. Neither specific register of violation nor sailing schedules for monitoring were available.

It is clear that there are sanctions, what is not clear is the way they work. At this specific point, the question about each individual's knowledge regarding sanctions seems pertinent, but it cannot have a specific weight in the estimations given its uncertain nature.

Knowledge about sanction was classified in to five levels depending on the degree of severity of sanctions and fines, as follows.

Level 1: There are no sanctions or fines.

Level 2: There are fines but the respondent does not know how they apply.

Level 3: There are fines, but the respondent does not specify the amount of each fine. They all explain "taking away your equipment" as a sanction imposed by the authority. The equipment includes the harpoon, lines, and sometimes the product fished.

Level 4: There are fines up to three minimum monthly salaries.

Level 5: There are fines above four minimum monthly salaries; in some cases the authority can take boat, or bringing the offender to jail.

As shown in Table 9 only 13% of the respondents know about level 5, which clearly is an exaggeration given that nobody has been in jail because a violation on any of the specified rules. The most common answer refers to levels 2 and 3 (47%) which is the

actual level of punishment. Given the overlapping roles discussed in the previous section, authorities do not have a strict and straight sanction's protocol. Most of the times violators receive a call of attention note, small fine (amount not specified by any authority), or in few cases the equipment is taken away.

The other levels chosen such as level 1 lack of sanctions, and level 4 related with the amount of the fine, point out the structural uncertainty of the deterrence variables.

Table 9. Knowledge about sanctions applied for the violation on the five chosen rules

Sanctions know (Levels)	***Freq (%)***
1	31
2	26
3	21
4	9
5	13
Total	100

The asymmetric information problem and overlapping roles among official institutions give a complex context in which there is not total certainty about the way in which regulations, enforcement and monitoring work. Knowledge on current regulations and sanctions would therefore likely have an important effect on compliance. The high subjectivity about sanctions is the reason why the variable *Sanctionsknown* is dropped from the vector knowledge:

K is then the knowledge about specific regulations.

$$K= (rules\_known/max)$$

Table 10 summarizes the descriptive statistics for knowledge questions in the survey

Table 10. Descriptive statistics *Knowledge* vector (just Rulesknown is used)

NAME	Variables	Description	Mean	Std Dev.
Knowledge about regulations (K)	Rulesknow	Out of five rules, How many does the respondent recognize? (from 0 to 5)	1.75	1.08
	Sanctionknow	Perceived level of sanction's severity. From 1 to 5, being 1 not severe, and 5 very severe.	2.82	1.351

Legitimacy of the current regulations (L)

Traditionally, rules acceptation in the island has been difficult. Enciso (2004) points the threads in the islanders' history and the rejection towards rules:

"We are tired of the [authorities] always enforcing regulations and regulations, which we don't even know what are they good for, we continue being slaves: slavery continues in a different way, we have not been able to decide by ourselves what is good for us, and do it[21] *"*

Four characteristics are identified in the literature which deal with regulation legitimacy and its effect on compliance behavior; these characteristics show that perception of legitimacy is closely linked to people's views of the fairness of the procedures used by authorities (Tyler 1990 in Sutinen and Kuperan, 1995) the four characteristics are:

[21] Remark by a Bottom House neighbour. Field diary, Enciso (2004)

-Effectiveness of the outcome: the extent to which conservation is realized and an individual fisherman is made better off. Questions to address effectiveness of the rules are questions about the opinion on the effectiveness of catching seasons; the effect the rules have on the individual; the degree of rules acceptation by the community and the opinion about the main objective of the regulations

- Distributive justice of the outcome: involves the perceived fairness of how the benefits or sacrifices are shared among the affected parties. Questions to address the distributive justice of the outcomes involves whether the rules benefit everybody; whether the sanctions are fair and if rules are good for the future and involve future generations.

-Efficiency of the process: The speed and efficiency with which people perceive the authority responding to problems within the scope of the authority's jurisdiction. Questions to address efficiency of the process include: opinions about the government procedures with respect to the rules; whether fishermen's opinion is taken into account by the authorities; if they think there should be more rules and more officials at sea.

-Procedural justice: involves how fairly the authority treats people and the concerns of those affected by the process problems within the scope of the authority's jurisdiction. This characteristic as part of the legitimacy process is addressed in a qualitative way from the individual's responses, comments and opinions next to the previous questions.

From empirical evidence in Old Providence Island, rules legitimacy seems to be challenging giving the strong local rejection of external authorities. This rejection comes from historical relations with the National State, and of course is related to their symbolic and physical isolation from which they claim independence from formal institutions in their traditional activities. However, local speech is strongly oriented to environmental issues, and social influence plays an important role for institutional arrangements in the island.

The extent in which individuals accept the regulations highly determine the level of compliance. Sutinen and Kuperan, (1999) propose that efficiency and equity may be complements instead of substitutes, and equity is certainly one of the most important values in the island. Old Providence fishermen historically claim equity is at the basis of their traditional society. Power asymmetries are strongly rejected from the symbolic appropriations by islanders.

Differences of opportunities when compared with industrial fishers, and unfair structure of power when compared with other fishermen who belong to the authority on the Island, are seen as inequality and asymmetries, reason why those two facts are highly rejected among fishermen and diminish rules legitimacy.

From the open questions and conversations, inequality and concerns about resource depletion in the island and over extraction as a consequence of industrial activities are the

main fishers' concern. Next to that, when asked about personal opinion on specific rules, fishermen strongly agreed about the importance of regulating and protecting the resource.

Through factor analysis just three variables were included in the vector of *Legitimacy* for the econometric estimations[22].

On average, respondents say the community doesn't accept rules in general (mean=2.7 when <3=disagreement), and they don't feel that their opinions are taken into account by the authority (mean=2.6 when <3=disagreement). The importance of regulations for the future and future generations is highly accepted, and on average the general perception is that rules benefit the others and themselves. On average, fairness of sanctions lies on the indifferent level, because the lack of knowledge and common agreement of what the sanctions are. Some have information about very strong sanctions, while others strongly believe there are no sanctions at all. Either position diminishes reliability and accuracy on fairness perceptions.

A risk of resource collapse could be swiftly and severely dealt with by a legitimate authority, imposing on users significant short-term sacrifices. Fairness, equity and symmetric rules are at the base of legitimating. Three variables for the Legitimacy vector, all of them are positive on L and work under the agreement scale from 1 to 5 being 1 strongly disagree and 5 strongly agree.

[22] Acceptation of the rules; if users' opinion is taken in to account by the authorities; the rules benefit everybody.

To create the variable Legitimacy:

$$L = (ACCEPT + OPINIONMATTERS + BENEFITALL) / 3$$

The variables in the vector "L" have the same weight. There is not a theoretical framework to support the choice of giving all variables the same weight; however the previous studies on compliance (Eggert and Ellegard, 2003), define these variables as factors of legitimacy, and in the study were considered with the same importance as a result of the factor analysis procedures.

Descriptive statistics of the L variables are showed in table 11.

Table 11. Descriptive statistics *Legitimacy* vector. Continued on the next page.

NAME	Variables	Description	Mean	Std Dev.
Legitimacy of the current regulations (L)	Vedas good	Catching seasons improve the long term well being of all fishermen (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement*)	3.7	1.45
	Good for me	Rules are good for myself because catch will be better next year (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement)*	3.85	1.332
	Acceptation	Regulations generally accepted by most fishermen. (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement)*	2.76	1.51
	Benefit all	The rules benefit all the others (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement)*	3.62	1.5
	Good for children	Rules are good for my children (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement)*	4.49	1.07

	Sanction Fair	The penalties given to fishermen who are caught violating are fair (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement)*	3.17	1.321
	Gov Right	The government is doing the right thing imposing current regulations (*from "1" to "5" being 5 highest level of agreement, and 1 strongly disagreement)*	3.34	1.42
	Opinion matters	Fishermen's opinion is taken into account in the formulation of fisheries regulations (*from "1" to "5" being 5 highest level of agreement, and "1" strong disagreement)*	2.61	1.53
	More rules	There should be more regulations (yes=1, no=0)	0.3	0.46

Deterrence variables (Di and Dii)

The survey had seven questions about deterrence aspects regarding fishing regulations. In table 12, the descriptive statistics of the seven questions is showed, in order to tell the story behind the surveys. However the definition of the deterrence variables for the econometric model was defined through stepwise regressions and factor analysis. After factor analysis procedure two variables for deterrence were defined, and each one is a vector of two questions in the survey:

$$Di1 = (Enforcement\ frequency + Monitory\ frequency) / 2$$

$$Di2 = (Own\ sanction + Caught\ and\ sanctioned) / 2$$

Where Di1 as a factor captures the individual's perception about the frequency of monitoring and enforcement by the authorities; and Di2 captures the information on real sanctions applied for the individual himself and for the others based on his own knowledge about sanctions for violators.

Table 12 on the other hand includes aspects such as how often officials have been seen, a dummy for previous sanction, number of rules controlled, number of patrolling boats and the respondent' s subjective judgment of probability of detection and of being sanctioned.

Tyler (1990) points out the relation between how quickly and how often violators are detected, arrested and prosecuted as a process variable related to efficiency or effectiveness. The way each violator is treated and how consistently the law is enforced is a process variable related to procedural justice (Kuperan and Sutinen 1999)

On average in OPI respondents think that just one rule is enforced, most of them coincide on the active regulation of one specific marine protected area, which is the National Natural Park Mc Been Lagoon area.

The answers are consistent with the reality, because the enforcement in the sea is done by "Captain of port" and they just have 2 boats in the island. Those boats operate to monitor fishing rules with artisanal fishermen, Industrials, and drug traffic, but they focus their monitory activities mainly to control drug traffic.

"Enforcement with industrial fisheries is much stronger than with artisanal fishermen in the islands, the problem is that we cannot control the[industrial fishermen] very often, and if we controlled the artisanal more often there would be many problems with them"

"Coralina does not have a boat to control, they have one but [it] is broken so there is no control here and neither there is in the cays at the north"[23]

If we disregard the effects of authorities' overlapping roles, and take in to account the proportion of reported violators who have been sanctioned we find the following proportions:

In OPI 78 fishers reported violation on one or more rules, and 17 of them have been punished, this gives us a row proportion of 21,79.

The average perceived overall probability of being detected is 30% for OPI. This value is the mean of the answers to the question about the specific probability of being detected. And the probability of being punished is less than 10% which is still substantially larger than the "below 1 percent, and often at or near zero" found in Sutinen and Kuperan (1999), and the 7% found in Eggert and Lokina, (2005).

[23] Fishermen personal interview (January, 2009)

Inconsistency is found here because they report enforcement and monitoring by coast guards regarding sailing permits, drugs and product transportation, but not about fishing regulations specifically. This is another consequence of the overlapping institutions and roles by the authorities. When asked about specific enforcement and monitoring for fishing rules, they point out that basically Coast guards are there to control fishing rules as well, but they are mainly focus on drugs traffic control.

Deterrence variables don't show significant correlation with the dependent variables. This lack of correlation is assumed in the study as a structural problem. There isn't consensus on the islands on when and who is regulating which kind of rules at the sea. Authorities claim operational resources scarcity, while fishermen on average believe that different authorities regulate all the rules.

"People do not comply because there are not official budget to monitor and there are not opportunities for the fishermen in the island" [24]

Table 12. Descriptive statistics *Deterrence* vector. Continued on the next page.

NAME	Variables	Description	Mean	Std Dev.
Deterrence variables (D)	Rules controlled	How many rules the respondent believes are being enforced on the island *(out of five rules)*	0.89	0.99
	Frequencymonitoring	How often did you see enforcement officials at sea when you are fishing? (*1=always, almost always. 0=never and sometimes)*	3.48	1.50
	Frequencyenforcement	How often did the authority inspect on your boat, ask for information about your boat or inspect your catch? (*1=always, almost always. 0=never and sometimes)*	4.14	1.21
	Nboatscontrolling	How many patrol boats, if any, do you believe operate	3.2	10.27

[24] Fishermen personal interview (January, 2009)

		in the area you fish?		
	Ownsanctions	Any enforcement action was taken against you for violation on any on any fishing rule? (*No=0, yes=1)*	0.17	0.37
	Violataway	Many fishermen who are fishing illegally are getting away with it (i.e. not detected or penalized) (*level of agreement from 1 to 5, being 5 strongly agree)*	4.09	1.07
	Caughtsanctioned	How often artisanal fishermen are caught violating a rule is sanctioned? *(from 0 to 5, being 5 almost always and 0=never)*	2.29	1.88

Financial and economic characteristics (F)

Eggert & Lokina (2005), proposes a financial incentive to violate as some characteristics or incentives that can make the fisherman more likely to violate rules in order to get more revenue.

The financial variable is a vector of five variables[25] that capture financial incentives and necessity to cover debts, basic expenses and needs depending on the economic dependence to fishing activities (see Table 13).

Number of days per month dedicated for fishing activities (*TIMXMONTH),* source of income .and the income proportion that comes from fishing activities.

49% of the fishermen in the sample have their own boat, and 25% have financial debts related with fishing activities. The average of time at the sea is 15 days, however the time

[25] The number of boats owned; whether the respondent has economic debts related with fishing; days per month at the sea fishing; source of income; income proportion derived from fishing activities.

is distributed differently depending on the nature of each trip. Some fishermen go fishing by day, some go to the cays and each trip takes on average from 7 to 20 days.

Table 13. Descriptive statistics *Financial incentive* vector

NAME	Variables	Description	Mean	Std Dev.
Financial and economic characteristics (F)	Number of boats	How many boats do you own?	0.51	1.083
	Debt fish	Do you have any financial debt related to fishing activity?	0.25	0.411
	Time per month fishing	Days per month fishing (from 1 to 30)	15.83	7.82
	Source of income	Source of income (from 0 to 3, where 0 is when the income just comes from fishing activities; 1 when income comes from fishing and other traditional activity; 2 when income comes from fishing and another activity with stable monthly income, and 3 when income comes from fishing and a technical activity)	1.31	1.19
	Income proportion	Income proportion is the proportion that fishing represents for the total monthly income, from 0 to 1.	0.69	0.285

After analysis procedures to define a consistent variable that captures the financial conditions of the fisherman and his economic dependence to fishing activities, the variable Source of income was chosen to represent the financial characteristics of the fishermen and the level of economic dependence to the activity. Values of tha variable F are shown in table 14.

F= SOURCE OF INCOME

Table 14. Economic activities of fishermen on OPI

Source of income	Variable value	Freq(%)
Fishing	0	36
Fishing and farming	1	21
Fishing and other activities (construction, music, and small contracts)	2	19
Fishing and more stable economic activities	3	24
Total		100

Social influence variables (S)

"The speech of the islander is very conservative and ecologist, but at the individual level is more complicated"[26]

Soeftestand and Alayón (2007) analyzed institutions focused on how individuals and groups behave and act in relation to formal rules, how the institutions (norms and rules) are complied in practice. Values as reputation and respectability are an integral part of social relations in the island (Wilson, 1973, Alayon, 2005., & Rocha, 2006). Experimental evidence shows that individuals tend to strike a balance between self and group-interests (Cardenas, et al, 2000)

The behavior of others is expected to affect individual compliance in the same way as the extent of social influence exerted in the community. Sutinen and Kuperan (1999) point out that the moral principles on which individuals base their own behavior are the same

[26] Eric Castro, Director of Secretaria de Pesca y Agricultura, personal interview (March, 2009). Personal translation.

basis for the social influence they exercise, in the same fashion social influence depends on the larger community's moral development and perception of the institution's legitimacy. They infer then that the extent of noncompliance in the fishing community reflects the amount of social influence exerted within the community.

Social capital plays a significant role in social exchange. Like enforcement authorities, peer groups can reward and punish their members, either by withholding or conferring signs of group status and respect, or more directly by channeling material resources toward or away from a member of the group.

In a specific way social influence in OPI works in two opposite directions. On one hand there are sacred norms as "*never kill a dolphin no matter how much he is bothering you and taking your fish away, because he is like a human being*". And on the other, "*live and let live"* when people will never denounce a peer because they don't want to be called "*sapos*", synonym of traitor and because each one has his own needs. More than half of the interviewed fishermen disagree with the use of scuba diving equipment for fishing, but when somebody uses it, people argue in favor of him. Some people are against the authorities and their regulations; they confront the authority with arguments of freedom, because they value their freedom and independence so much.

For the social influence theoretical construct I measured 20 variables that include that include the perceived compliance of the others, and the social norms and social control

established and recognized. From an institutional perspective, the effect of these social influence variables must have an indirect relation with the levels of compliance.

To create the variable ***S***, the vector of variables includes 20 questions that represent social influence on different respects. Three social aspects are identified, related with participation; moral values; and perceptions about violators and the level of violation by others.

--Variable ***SM*** represents the social factors that influence decision from a *moral perspective*. One discrete variable measures the level of personal shame when caught or seen on violation of regulations by the community.

SM= ASHAMED

Table 15. Descriptive statistics *Social Influence* vector, moral values variables (SM)

NAME	**Variables**	**Description**	**Mean**	**Std Dev.**
Social Influence, Moral values variables (SM)	Ashamed	Answers to the question: Do you feel ashamed when somebody from the community sees you violating a rule? (*level of agreement from 1 to 5, being 5 strongly agree)*	3.33	1.70

-Variable ***SV*** represents the individual's perception about *other fisher's violations*. Six dummy variables with levels 0 for negative answers and 1 for positive ones, measure reports on other's violation on each one of the rules analyzed in the study (5) plus the

variable that captures whether the fisher believes almost all the others violate fishing rules or not .

Factor analysis two indexes were created which were measuring similar things conceptually.

$$\boldsymbol{SV1} = (\ MOSTVIOLATE + TURTLE\_others + \ VEDA\_others)/3$$

$$\boldsymbol{SV2} = (\ TANKS\_others + SHARKS\_others + MPAS\_others)\ /\ 3$$

Table 16. Descriptive statistics *Social Influence* vector, other's violation variables (SV)

NAME	Variables	Description	Mean	Std Dev.
Social Influence, Individual perceptions of other's violation (SV)	Most violate	Do most of the fishermen in the islands violate the fishing regulations? (0-1)	OPI 0.54	OPI 0.541
	Turtle others	Do fishers on the island capture turtle?	0.79	0.456
	Veda others	Do fishers on the island catch lobster or snail during the catching season prohibition? (0-1)	0.83	0.427
	Tanks others	Do fishers on the island use SCUBA tanks to dive with extractive purposes? (0-1)	0.82	0.386
	Shark others	Do fishers on the island catch sharks? (0-1)	0.32	0.468
	MPAs others	Do fishers on the island fish on forbidden areas? (0-1)	0.59	0.533

Traditionally in Old Providence Island there is a strong rejection against outsiders' interferences. In the specific case of fisheries the open access condition makes it possible for artisanal fishermen to identify industrial activities and to blame outsiders for violations, and at the same time this can be a factor that influences violation. But in the sample the opinions seem to be divided, 52% of the interviewed think foreigners violate

rules more than native islanders, and 65% don't recognize any type of self government among fishermen.

71% of the respondents recognized they know when somebody is violating a rule, and the variable has a significant and negative correlation with *divers* and the level of violation on MPAs, use of Scuba equipment, and catching season regulations.

53% of them do not talk about cheaters with anybody following the local saying of "live and let live". In the cases of positive answers in terms of talking about each other, every respondent showed a high respect for other fishermen's activities.

"I disagree about the use of scuba equipment but they are working hard, and they have families to maintain"[27]

Some others argument they strongly disagree with violations, and they say that openly, however nobody denounces to the authority because they will never cheat on a colleague. Despite of the disagreement they express about specific violations and the individualistic behavior they will always protect themselves against the authorities in most of the cases without violence or confrontation but with solidarity.

[27] Personal interview, March (2009)

Sutinen and Gauvin (1998) point out evidence showing that an individual is more non-compliant the more his community and peer groups are non-compliant. Social influence in Old Providence is often manifested in forms of verbal comments, insults or jokes.

The reports of other fishers' violation and the self report violation have a correlation of 23% at 5% level.

Table 17. Comparison between the self report violation with the report on other's violation for the five chosen rules

Rules	Report Freq (%)	Self Report Freq (%)
Turtle	42	34
Catching seasons	42	79
Scuba	46	9
Sharks	14	36
MPAS	30	23

-Variable ***SB*** represents the individual's sense of belonging to the community and island. Three variables consider the time the individual has been a fisherman; whether he wants to move to other place; and whether he wants his kids or grand kids to continue the tradition of being fishermen.

After stepwise analysis just the question on whether the fisher wants to stay in the island, was kept as the variable sense of belonging given the subjective judgment and bias behind the assumption of those variables representing the sense of belonging of a specific person.

$$\boldsymbol{SB} = OTH\_PLACE$$

Table 18. Descriptive statistics *Social Influence* vector, moral values variables (SM)

NAME	Variables	Description	Mean	Std Dev.
Social Influence, Sense of belonging variable (SB)	Oth_place	Answers to the question: Do you want to continue living in the island or do you want to move to other place? *(0 to 1 where 0 is wants to stay, and 1 is wants to move to other place)*	0.23	0.46

Rules compliance

From the survey, 70 questions capture the nature of the variables taken into account for the model, including the variables about compliance and report on violation. A stepwise analysis was carried out and some of these variables were left out of the model because of three reasons: confusing answers from the survey, very low explanatory power on all the stepwise analysis, and repeated concepts.

The variables considered were grouped in six categories of explanatory variables. Many of the variables show a statistically significant correlation with the outcome variable, and significant variables can be found in all of the six categories, i.e., *financial incentives*, *knowledge about regulations*, *deterrence*, *legitimacy*, *social* and *personal characteristics* variables.

Outcome variable: Violation – compliance rate (V)

Two outcome variables were chosen to explain compliance (Ci) and violation behavior (Vi). Theoretically both models should show the same results but with opposite signs. However it is important to note the reported compliance differs as a result of the type of question asked. When people were asked about their own behavior in a general way, their evaluation was much closer to compliance than when they were asked to report violation for specific rules, and then they reported high violation.

For self-evaluation questions (How do you evaluate your behavior towards regulations? Type of question): Non-compliance and occasional violation were reported as 47% while for self-report on specific rules violation questions (Do you violate (specific rule)?): violation was 73%. The differences among the outcome variables are not taken as inconsistencies rather as a methodology approach to deal with sensitive biases.

Making a parallel it will look as following, the table 19 shows:

- The percentage of people who evaluate themselves as **non-complier**. They answered to the self evaluation question with: " *I don't comply with the fishing regulations*", or "*I almost never comply*"
- The percentage of people who defined themselves as **compliers**. They answered with: "I always *comply*" or "*Almost always I comply*".
- The percentage of people who reported **zero violations**: report zero violations = "1", "0" otherwise.

- The percentage of people who reported a violation just on sharks and/or marine protected areas are called "**Unconscientiously violators**", because these two violations can be committed by accident.
- The percentage of people who reported violation on turtle, the use of scuba equipment for fishing and/or violation on catching season time, are called "**Conscientious violators**".
- At the end, the **overall violation rate** from self-report violation. Those are who reported violation on one rule or more. Note that the overall violation rate for the two islands is 73%, which is substantially higher than the rate reported in previous studies (see Sutinen and Kuperan, 1999; and Eggert & Lokina, 2005).

Table 19. Parallel of compliance and violation reports**.**

RATE	OPI. Freq (%)
Non-complier	**53%**
Complier	47%
Zero rules violated	27%
Violation on sharks and/or MPAS (Circumstantial violators)	22%
Violation on Turtle, Tanks, and/or catching seasons (Conscientious violators)	51%
Overall violation rate (report on one rule or more)	73%

Then six probit models are showed in order to understand the factors that influence compliance) violation choices. One model takes the Complier variable as a dependent

variable, and given the difference on each rule reports, other five models take each rule report (Tanks, MPAS, sharks, Catching seasons, and turtle) as dependent variables.

See section below.

Self-evaluation: complier as an outcome variable

Complier as Violation rate takes the self-evaluation on general behavior towards rules. Each fisherman evaluated his fishing activities choosing one of four options:

- I always comply
- Usually I comply
- Sometimes I can't comply
- I don't comply

Complier. "Always comply" and "usually comply" correspond to a complier (Complier=1). "Sometimes I can't comply" and "I don't comply" correspond to a non-complier (Complier=0)

Table 20. Frequency distribution of Complier

Complier	*Freq(%)*
0	*53*
1	*47*

Complier captures a different idea from self-report as an outcome variable, given the nature of the question asked. As explained above, Complier captures the evaluation each interviewed made about his own behavior towards fishing rules. And the next, self-report, is the direct report on violation.

Self-report as an outcome variable

The concept captured here, is the violation of the five specific regulations. First in table 22, the number of rules reported by the interviewed is showed, and in table 23, which specific rules were reported the most.

Questions about violation of 5 specific rules were asked. The report on these violations does not take into account a specific period of time like some other studies (Eggert and Ellegard, 2003;

Viteri and Chavez, 2004; Kuperan and Sutinen 1998), but takes common actions during each individual's fishing activities.

Table 21. Number of rules violation reports

Self-reported	Freq (%)
0	27
1	36
2	18
3	13
4	6
Total	100

Table 22. Number of violation reports by each specific rule

Rules	Frequency
Turtle	34
Veda	33
Tanks	9
Sharks	36
Protected Areas	23

Note that the report on "sharks" rule is the highest, and still, during the interviews many people did not see prohibition of sharks catching as a law; neither did they identify the specific places for marine protected areas.

Nobody reported violation on 5 rules. 63% reported zero or one rule violation. Here it is important to note that there are people (19%) who evaluated themselves as "*Always Comply*", but reported some rules violation, this inconsistency is found especially for self-reported violation on one rule. This violation of one rule when reported himself as a complier, in 12 out of 14 cases corresponds to *Sharks fishing* or *Marine Protected Areas.* Why do they evaluate themselves as "always comply", but still report violation on one rule? The discussion can be focused on whether this inconsistency reflects a measurement of different concepts or structural noise in the data. The fact that the inconsistency when appears, is always linked with sharks fishing or marine protected areas violation gives some light in terms of the structural reasons for this to happen. Some reasons can be the following:

- Catching sharks is a forbidden fishing practice in Colombia. However it is allowed in case the fisherman has to defend himself. Fishermen in Old Providence

do not commonly consider the sharks fishing prohibition as a rule, mainly because there is no enforcement over this rule: "*…it is impossible for a fisherman to decide who is going to bit*[28]"

- Shark is not part of their gastronomy and there is no market for sharks in the island.
- A market could emerge soon given the high prices of fins and oil. Hand line fishermen are those who catch more sharks, just 4 divers reported catching sharks against 26 hand-line who admitted the action, 12 of them said they have caught sharks as self-defense. 15 fishermen denounced during the interview, the presence of a Venezuelan's industrial boat that was fishing sharks with turtle meat as a bite. They complaint about their difficulty on having a specialized fishing under artisanal conditions, in that sense the rule had no sense for them.

On the other hand MPA's were established to implement the biosphere reserve in the ocean area. The Seaflower MPAs are divided into three management units (Northern, Central, and Southern Sections), and protects 65,000 km2 of marine area[29]. This is a project that has been executed but the official implementation has not started yet. There is no common knowledge about where all the specific zones are. The difficulty of establishing the limits can be the reason why some people evaluate themselves as "always comply" but report violation on this specific rule. The only area that is recognized by most of the fishermen as a protected area is the area of the Natural

[28] Personal interview with a fisherman in the center of Old Providence Island, June 2009

[29] MPA Project was declared by the Minister of Environment, Housing, and Territorial Development in January 2005 (Resolution 107).

National Park *Mc Been Lagoon,* this area is regulated by the National Park office in OPI.

If shark fishing as a rule and protected areas are not taking in to account, then hand liners have much less violations than divers. Here is important to reiterate that defining compliance has to be done in the context of whether people know and accept the rules, or how do they see the laws. As explained above, regulations on sharks catching and marine protected areas are not 100% accepted or recognized by fishermen.

Table 23. Violation report for specific rules distributed by type of fishermen.

Lineordive	#	Report turtle	Report (veda) conch-lobster	Report tanks	Report sharks	Report MPA
Divers	14	11	15	5	4	6
Handline	22	13	7	0	26	13
Both	21	10	11	4	6	4
Total	57	34	33	9	36	23

Econometric estimations

The following estimations use different variables as dependent variable, each model takes into account each one of the variables described as a dependent variable in section 6.2, the subsection *"Violation rate.*

Previous to the estimations, a correlation analysis was applied and the independent variables that show correlation at the 10% level or less with the chosen outcome variables were included in previous estimations in order to analyze each variable behavior. Several questions in the survey corresponded conceptually to the same variable, reason why the stepwise regressions and factor analysis method were so important in the definition of the final variables to use in the econometric models. The final sample size is 74 observations, 26 observations were dropped due to missing values.

In the following tables, the estimates and marginal effect for the significant variables are shown.

$$V = f\,(F, D, K, L, S, X)$$

$$S = f\,(SM, SV, SB)$$

$$X = f\,(\text{Individual characteristics})$$

Table 24. Econometric estimations: Dependent variables vs all the independent variables[30]. Continued on the next page.

	TURTLEME	**VEDAME**	**SHARKSME**	**MPASME**	**Complier**
F (*Financial characteristics)*	-0.340011 (-1.3)	**-0.67007** **(-2.21)****	-0.0702013 (-0.37)	-0.40393 (-1.64)	0.148812 (0.83)
Di (*Monitoring and enforcement frequency*)	-0.264557 (-1.1)	0.126583 (0.47)	-0.2528815 (-1.34)	**-0.48438** **(-2)****	0.086558 (0.49)

[30] Dependent variables *Turtle, Catching seasons, Sharks* and MPAs are four probit models which evaluate the violation report on each one of the rules. Where 1 = violation and 0 = non violation of the specific regulation (dependent variable). Note that *Tanks* as the regulation on the use of SCUBA equipment is not taken into account due structural problems.

Dii (*Perceived sanctions*)	0.0460071 (0.15)	-0.25785 (-0.92)	0.1605905 (0.72)	0.075287 (0.28)	0.319405 (1.49)
SM (Ashamed)	**-0.565051 (-3.44)*** **	**-0.28401 (-2.09)** **	0.0434866 (0.38)	-0.05837 (-0.5)	0.155258 (1.37)
SV1 (*other's violation – turtle, catching seasons, most violate*)	**2.048018 (2.35)** **	**2.152238 (2.29)** **	0.1803176 (0.28)	**1.440572 (1.93)***	**-1.07160 (-1.79)***
SV2 (*other's violation –tanks, sharks, MPA*)	**-2.837089 (-2.4)** **	0.235288 (0.24)	-0.3850468 (-0.55)	-0.30774 (-0.39)	**1.176956 (1.67)***
SB (*Sense of belonging*)	**-0.890233 (-1.69)***	-0.10425 (-0.21)	-0.5927128 (-1.26)	0.443743 (1.15)	0.103824 (0.28)
L (*Legitimacy*)	-0.034946 (-0.15)	-0.12063 (-0.51)	0.0597095 (0.31)	0.117688 (0.53)	-0.00094 (-0.01)
K (*Knowledge*)	**0.6318896 (2.32)** **	-0.04035 (-0.15)	**0.5229062 (2.35)** **	**0.460519 (1.81)***	-0.14067 (-0.65)
DIVER	**1.722239 (2.63)*** **	-0.52434 (-0.87)	**1.098247 (2.29)** **	0.763536 (1.4)	**-0.84495 (-1.68)***
AGE	-0.019274 (-1.18)	-0.02688 (-1.3)	0.004877 (0.33)	0.022225 (1.27)	0.017007 (1.25)
INCOME	0.0006695 (1.45)	0.000435 (1.06)	0.0002185 (0.62)	-8.16E-0 (0)	0.000541 (1.48)
TYPE_FISH	-0.412894 (-0.61)	0.127817 (0.19)	-0.5126671 (-1.08)	-0.34400 (-0.59)	-0.43139 (-0.88)
BOR	**-1.475123 (-2.5)** **	-0.70960 (-1.3)	0.0452929 (0.09)	-0.30715 (-0.63)	-0.27170 (-0.59)
Constant	2.8565 (1.63)	0.973696 (0.52)	-1.176304 (-0.86)	-1.42403 (-0.91)	-1.45285 (-1.12)
Num Obs	74	74	74	74	74
Pseudo R2	0.45	0.45	0.198	0.207	0.162
P > Chi 2	0.0001	0.0001	0.154	0.23	0.28

Z values in parenthesis *** p<0.01, ** p<0.05, * p<0.1

When violation report on one specific rule is taken as a dependent variable, all of them show explanatory power, however the use of SCUBA equipment for fishing presented collinearity problems and it was dropped from the analysis as a dependent variable.

As it has been explained previously in the text, the regulatory activities in the island face several structural problems, such as the overlapping of roles among the authorities, and lack of clarity about enforcement activities. However for the control on the National park, Mac been Lagoon area there is constant control during the day to prevent fishing activities and use of diving equipments in the area. D1 (monitoring and enforcement frequency) is significant at the 5% level as a factor that explains the probability to violate the MPA regulation.

It is important to note that all the literature reviewed in this study, finds *Deterrence (D1, D2)* and *Legitimacy (L)* as significant factors that determine compliance/violation. However, here these variables, structurally important on the compliance theory, are not significant in any of the models presented with the exception for violation on the marine protected areas rule.

The no significance of these two variables is a crucial fact to understand the context of the present study. Inconsistent control and overlapping of roles among the different authorities make the deterrence variables uncertain and perceptions differ significantly among users.

Legitimacy variable captures perceptions about the benefit of fishing regulations for the community, and overall acceptance of these regulations. Note that other factors (nine in total) were taken in to account from the survey in order to conceptually create the Legitimacy variable. And the no significance of the factors was persistent through all the stepwise analysis.

Financial characteristics are not significant for most of the regressions. Appears to be significant at the 5% for the probit model on *Catching seasons (Vedas)* with the expected negative sign. Higher level of financial characteristics, such as having more stable source of income, is a factor that significantly explains the probability of violate the catching season regulation. Fishers who have other sources of income different than fishing are less likely to violate the regulation.

Feeling *ashamed* on the other hand, represented as *SM*, shows significance at 10% level with the expected sign for turtles. Feeling ashamed about being caught on illegal behavior makes the fisher less likely to violate the regulation on turtles catching. The variable *SM* did not show significance for the other regressions. It is possible to infer that *Turtles* protection campaigns at the national and local level have worked.

Regarding the perception of other's violation, factor analysis procedure generated two factors consistent with the perceptions of rules. In brief, there is one factor (S*V1*) that captures individual's perceptions about other fishermen cheating on *turtles and catching season regulations.* Remember that these two regulations are the most recognized rules

by most of the fishermen. S*V1* shows significance in 4 out of the five models with the expected signs positive relation with violation on Marine Protected Areas, Turtles, and catching seasons' regulations: the more fishermen believe that other fishermen violate the *catching seasons and turtle regulations (SV1)* the less likely they are to violate *catching seasons, turtles and Marine protected areas regulations.* And, the more fishermen believe that other fishermen violate the *catching seasons and turtle regulations (SV1)* the less likely they are of being *Compliers* (significant at the 5% level). The result is consistent.

On the other hand, the second factor for the perception of other's violation is *SV2,* captures the individual's perceptions about other fishermen cheating on *tanks, sharks, and Marine protected areas' regulations,* SV2 showed significance for two models: the *Turtle* regulation (at the 5% level), however it showed the opposite sign than expected. The more individual believes other fishermen cheat on *tanks, sharks, and Marine protected areas' regulations,* the less likely he is to report violation on regulation of Turtles. The compliers tend to report more on others' violation captured in SV2. Complier and SV2 have a positive relation significant at the 1% level.

Knowledge (K) is significant for three of the regulations: *Sharks, Turtles and MPAS,* however it shows a positive relation, which means that the violators have more knowledge about what the regulations are.

The question about which regulations the fisherman knows, was asked before the questions on violation report by rule. After evaluating how many and what rules the fisher knew, he was provided with information about the rules taken in to account for the study.

Sense of Belonging (SB) for *Turtles* report, shows a consistent negative sign, significant at 1% level. Note that sense of belonging captures the plans of the individual to stay in the island or leave the place, and again I believe that the sensitivity towards turtles as emblematic species on the island plays an important role for this result.

Born as a variable that takes the differences between natives and foreigners, showed to be significant at 5% level with negative sign for *Turtles.* Fishers who were born in the island are less likely to catch turtles.

The model with MPAs as dependent variable does not show explanatory power, and the one with sharks violation as dependent variable has just two significant variables at 10 and 5% level. Somehow the poor explanatory power of the two models is consistent with the fishermen's declarations about the not recognition of legitimacy of those regulations.

Table 25. Marginal effects of the significant variables for each model.

VARIABLES	TURTLE	CATCHING SEASONS	SHARKS	MPAS	Complier[31]
F	-	0.187**	-	-	-
D1	-	-	-	-0.13**	-
D2	-	-	-	-	-
SM	-0.18***	-0.079**	-	-	-
SV1	0.672**	0.601**	-	0.388*	**-0424***
SV2	-0.931**	-	-	-	-
SB	-0.29*	-	-	-	-
L	-	-	-	-	-
K	0.207**	-	0.19**	-	-
DIVER	0.53***	-	0.385**	-	**-0.324***
AGE	-	-	-	-	-
INCOME	-	-	-	-	-
DEPN	-	-	-	-	-
WIFJOB	-	-	-	-	
TYPE_FISH	-	-	-	-	-
BORN	-0.528**	-	-	-	-

[31] *Complier* as a dependent variable takes the self evaluation report on compliance. Where 1= *"I comply with the fishing regulations",* and 0= "*I don't comply with the fishing regulations"*

In Table 25 the marginal effects for the statistically significant variables are presented, which measure the increased (decreased) probability that the fisher would have been in the violation or complier category, given one more unit of the explanatory variable with the other variables held at their mean. For the binary variables, the interpretation is the increase (decrease) in probability if the binary variable is equal to one. For example, the marginal value for SV1 (other's violation on turtle and catching season regulations) implies a reduced probability of catching a turtle. This marginal value indicates that the probability for a fisher to violate the rule that forbid the catching of turtles will increase by increasing perception about other fishers cheating on the formal regulations.

Higher values of moral values SM imply a reduced probability of catching turtles and violate the catching season rules. And higher values in the variable Sense of belonging SB imply a reduced probability of catching turtles. Remember that the variable SM captures the individual's feelings towards being ashamed of violating rules, and SB captures the individual's desire of staying in the island as his home. Being a native islander implies a reduced probability of catching turtles.

The financial characteristics F, shows the expected sign. Higher values of F, like having more stable source of income, imply a decreased probability of being a cheater on the catching seasons regulation.

The result for the effect of Knowledge on the probability to be a cheater on the specific regulations is not very consistent with the theory and the previous studies because te direction of change for turtles and sharks is positive.

In brief, the model for Turtles shows interesting results and policy implications from the analysis of the significant variables. The models for sharks and MPAs show inconsistencies and noises in the data, wrong sign for Knowledge (K) and Financial Characteristics (F), and few variables were significant.

CHAPTER 5

CONCLUSIONS

Talking about compliance in most of the contexts is a sensitive issue. For fisheries in Old Providence Island is specially complicated given the nature of the regulatory structure in the island and some other factors that affect the social norms towards legal behavior. It is evident that the proximity of the islanders and mainly the fishermen to drug traffic defines the structure of their social values towards compliance behavior, however, there is compliance to the main fishing regulations but still very low. In general fishers interviewed were very open with their answers and with the nature of the study. The main problems regarding the study arise from the lack of knowledge and consensus about what the rules and sanctions are, it is important then to define better mechanisms and incentives for fishermen to know the regulations and improve the relations between authorities and fishermen. In this sections the general conclusions are presented followed by the methodological conclusions and policy implications.

- Econometric analysis was attempted with the form Vi=f (*F, D, K, L, S, X)* and Ci=f (*F, D, K, L, S, X),* where *S= f (SM, SV, SP, SB),* and *X= f (Individual characteristics).* It shows different results depending on the nature of the dependent variable. Two approaches were followed with the same form of the model; one is analyzing compliance (Ci) and the other is analyzing violation rates.

- When people were asked about their own behavior, their self evaluation was closer to compliance than when they were asked to report their violation.
- The sample consists of 100 fishers of whom 12% evaluate themselves as non-complier, 30% as compliers; 17% as frequent compliers and 41% as occasional violators. The violation rate from self-reported violations is 27%on zero rules, 22% circumstantial violators (sharks and marine protected areas), and 39% for conscientious violators (includes turtles and the use of tanks). The overall violation rate would be then 73%, which is substantially higher than the rate reported in previous studies (see Sutinen and Kuperan, 1999).
- No significance for variables that were expected to show the effect on compliance from the literature, financial characteristics F, Deterence variables D, and legitimacy L. It is necessary to analyze the specific conditions of these fisheries in order to discuss the pertinence of the regulations that are not recognized , why does it happen, and have focus on improving the mechanisms to make them legitimate, and above all.
- Deterrence variable D does not show any significant relation in any of the models, with exception for MPAS. This contradicts the literature findings and is consequence of the type of regulatory control in the island.
- Individual's perceptions about others' violations on recognized rules (SV1) shows to be very influential on the decisions to violate. Social control and social norms are deeply related with whether the infraction is publicly known. However some other psychological and sociological phenomena have great impact on the responsibility recognition by violators and society. The first one deals with the

tendency of blame on industrial boats for resources depletion. And the second factor deals with the social acceptance of drug traffic within the archipelago and the occasional involvement of some people in to it.

- There are 98 boats operating in the island, no bigger than 10 mts long. The storage capacity of the boats is maximum 2 tons of product. The high dependency to the activity is mainly by fishermen older than 35 years old. Older fishermen, liners, and part time fishermen are more likely to be compliers, together with having more knowledge about regulations, and more average income per month.

Methodological conclusions

- In order to avoid to deal with the sensitive questions bias, the randomized response technique was used during the pilot surveys; however, the confusion generated to the respondent was the reason to don't use this tool. The fear of not getting violation reports was discard as well in the field. 73% overall violation report, is much higher than the reports in the literature, and I personally consider reliable the answers given during the interviews..
- Five models were chosen to explain compliance and rules violation. The reason why different models were chosen in the first place is in order to avoid bias in the classification of the explanatory variables, and because the aggregation of the five rules (MPAs, sharks, catching seasons, turtles, and tanks) as dependent variable had a lot of structural noise due the differences of each one of the rules, and

peoples' perceptions about them. Having different models for each rule and one model for the variable of compliance was consistent with the initial conclusions after the field work: some rules are recognized by the fishermen as formal regulations, and some are not. That's why MPAs and sharks model did not show many significant variables, and had inconsistencies with the signs of explanatory variables.

Policy implications

- Deterrence variable D is not significant. There is a structural problem that can explain this fact. Three different authorities are in charge of enforcement and monitoring. Captain of port, coast guards, and Coralina. Captain of port and coast guards are institutions from the Colombian security, all the officials are transferred regularly and fishing regulations is not one of their first duties but drugs traffic control. On the other hand, Coralina claims of not having enough financial resources to operate patrolling boats around the island constantly. At the bottom of this situation, authorities recognized they don't put a real control because artisanal fishermen do not have a great impact as industrial fisheries, and many of the fishermen in OPI are fishing for subsistence[32].
- This specific fishery is quite different from the previous studies, a big part of it can be classified as subsistence fishery, is a tight community with a strong ethic for some of their values. In this last point, is important to discuss about social

[32] From personal interview with the Director of one of the control institutions. March (2009)

capital and different manifestations of social capital in the island. One could be called the good social capital such as sense of belonging to the island and to the community. Another one as a bad social capital, will be described as the "live and let live" local saying that most of them use to describe fishermen actions when somebody is seen on an infraction, and the acceptation of drugs traffic within the community.

- In brief, the models for complier and Turtles show interesting results and policy implications from the analysis of the significant variables. The models for sharks and MPAs show inconsistencies and noises in the data, wrong sign for Knwoledge (K) and Financial Characteristics (F), and few variables were significant.
- The perception of other's violation on accepted rules (Turtles and Catching seasons) influences in a positive way the own behavior towards rules. When people perceived that other fishermen violate the regulations, they are more likely to be violators as well. Here this question needs to be answered from the story behind the surveys, and the experiences during the field work. It is clear that in a small place like OPI everybody knows who is doing what, and this fact is clear for fishing regulations and for the drugs traffic. In this sense the perception of other's behavior appears accepted by many people, and it creates a specific social capital.
- *Knowledge* has not significant effect on compliance, but has a positive effect on Sharks and turtle rules. People who know more about the regulations are more likely to cheat on certain rules such as sharks and turtles. This fact is important for policy makers to focus on campaigns to teach the regulations in a more

consistent way, to integrate the older fishermen in those campaigns to make better use of their knowledge and behavior.

- When the fisher has a more stable source of income *F*, he is less likely to cheat on certain rules (catching season). It is very important then, to find social mechanisms to make the fishing activity a more stable job, and work out the unfair competency at the sea with illegal industrial fishing boats, to guarantee a better income for the local fishermen.
- There are not real alternatives to fishing in the island, so drug traffic to Central America and United States becomes an important opportunity for many fishermen in the islands. Tourism is certainly not an alternative for fishermen as many believe and not a real option for society in general if the model of all inclusive tourist packages continues. Greater political will and government commitment is required to implement alternative strategies that will have a long-term impact on levels of compliance and quality of life improvement.

APPENDIX A

SURVEY

When an individual does not want to answer the survey, he will be asked about why he does not want to. This is in order to obtain some extra information about perceptions of the actors related with the rules, the research and the method.

This survey is part of a study, which analyzes the fishery regulations in the archipelago. The information you give will help us to have a better understanding about how the regulatory system works.

You have been randomly chosen as one of a few respondents in this study. Your fishing experience will greatly help us to understand the problems and issues involved in small-scale fisheries in this area.

All of your answers are confidential and your name will not be used in any document, it means that you will not be identified as an individual. The survey is designed only for artisanal fishermen in San Andres and Old Providence Islands.

1. General information Xi

1.1 Were you born in the Island?

1.2. If you were not born in OP/SAI When did you move to the islands: _____

1.3 Age: _____ years

1.4.1 How many people live in your household?:

1.4.2 How many depend on you?

1.5 what is the higher formal year of education?

1.6 Is fishing your main source of income?_____ if no from which activity do you get your income?

1.7 What percentage of household income is derived from fishing?

1.8 How long have you been a fisherman?

1.9 How did you get into fishing?

1.10 Do you want your kids to follow you?

1.11 Will you continue living in this island the rest of your life?

1.12 Would you like to leave? Why?

1.13 What type of fisherman are you? (diver-hanline-both-other..)

1.14 What percentage of the product is used as home consumption?

1.15 Do you belong to any religion?

1.16 How many times do you go to church per week?

1.17 What does your wife do?

2. Financial characteristics Yi (Financial incentives to violate)

2.1 Do you own the boat you use for fishing?

2.2 How many boats do you own?

2.3 Do you have any financial debt related to fishing activity?

2.3.1 Yes ☐

2.3.2 No ☐

2.4 How many times during the week do you usually go to fish?

2.5 How long is each trip?

2.6 type of fisher

2.7 where do you sell the product?

3. Fishery regulations, knowledge and legitimacy

3.1 Please fill out the following table. Which regulations apply to you and the fine you would get in case you violate them?

Regulation	Fine

List of regulations after answering question 3.1 we define together the right list of regulations

Establish your level of agreement with the next sentences: (Mark with X)

3.2 The regulations (specific regulations will be defined here)… generally are accepted by most fishermen.

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.3 Catching seasons improve the long term well being of all fishermen

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.4 The principal reasons for the is to protect fish and because this island is a biosphere reserve

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.5 The government is doing the right thing imposing the current regulations

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.6 The opinion of fishermen are taken into account in the formulation of fisheries regulations

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.7 The regulations are NOT enforced consistently

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.8 Many fishermen who are fishing illegally are getting away with it (i.e. not detected or penalized)

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.9 The penalties given to fishermen who are caught violating current regulations "fit the offense" (are fair)

Strongly agree	**Agree**	**Indifferent**	**Disagree**	**Strongly disagree**

3.10 What problems do the regulations create for you?

3.11 Do most of the fishermen violate rules?

3.12 What is your opinion about other fishermen's behavior?

3.13 What is the main reason for violating the rules?

4. Deterrence variables Di

4.1 From your point of view which of these regulations are being enforced?

4.2 How often did you see enforcement officials at sea when you were fishing during the last 12 months?

1. Almost always (50% to 90%) ☐
2. Often (30% to 50%) ☐
3. Sometimes (20% to 30%) ☐
4. Almost never (5% to 20%) ☐
5. Never (Less than 5%) ☐
6. Don't know ☐

4.3 How often did the authority inspect on your boat, information about your boat or inspect your catch?

Almost always (50% to 90%) ☐

Often (30% to 50%) ☐

Sometimes (20% to 30%) ☐

Almost never (5% to 20%) ☐

Never (Less than 5%) ☐

Don't know ☐

4.4 Do you think there should be more regulations? If so, what type of regulations would you like to see?

4.5 Do you think there should be more officials at sea?

4.7 How many patrol boats, if any, do you believe operate in the area you fish?

4.8 How often are violators caught by authorities?

Almost always (50% to 90%) ☐

Often (30% to 50%) ☐

Sometimes (20% to 30%) ☐

Almost never (5% to 20%) ☐

Never (Less than 5%) ☐

4.9 Who do you think violates more often?

4.10 Do you think foreigners violate the rules more than the natives?

4.11 What do fishermen say or do to the violators?

4.12 Do you know when somebody is cheating? How do you know if somebody is cheating?

4.13 Do you talk about it with other people?

4.14 How often an artisanal fisherman caught violating a fishery regulation is sanctioned? (fines…) Do you know somebody who was caught?

Always (50% to 90%) ☐

Almost always (30% to 50%) ☐

Sometimes (20% to 30%) ☐

Almost never (5% to 20%) ☐

Never (Less than 5%) ☐

4.15 Is there any form of self enforcement (any from of enforcement activity agreed upon and organized by the fishermen themselves)?

Yes ☐

No ☐

4.16 If yes what kind of self enforcement are you referring to?

_____

_____

_____

_____

4.17 I would like to know your views about fisheries enforcement in your area. What are your general views on the enforcement of the zoning regulation?

_____

_____

_____

_____

5. Self reported (compliance and violation)

Which one of the following sentences describes your fishing behavior better?

5.1.1 In each activity I am very careful and I respect what the authorities say ☐

5.1.2 Almost always I respect the rules… ☐

5.1.3 I try to respect the rules, but sometimes I face situations when I cannot follow the rules

5.1.4 I fulfill the rules rarely because there are many requisites and they are not very clear…

☐

5.2 Which one of the follow activities are done continuously by fishermen here?

(check ☑)

5.2.1 Turtle fishing ☐

5.2.2 Fishing during not catching season ☐

5.2.3 Fishing with guns and harpoon or tanks ☐

5.2.4 Fishing sharks ☐

5.2.5 Fishing in forbidden areas ☐

5.3 Do you do any of the following activities? (Check ☑)

5.3.1 Turtle fishing ☐

5.3.2 Fishing during not catching season ☐

5.3.3 Fishing with tanks ☐

5.3.4 Fishing sharks ☐

5.3.5 Fishing in forbidden areas ☐

5.4 Under what conditions would you risk fishing illegally?

_____

_____

_____

_____

5.5 Why would you comply with the rules?

5.5.1 It benefits all the others

Strongly agree	Agree	Indiferent	Disagree	Strongly disagree

5.5.2 Is good for my self because catch will be better next year

Strongly agree	Agree	Indiferent	Disagree	Strongly disagree

5.5.3 Is good for my children

Strongly agree	Agree	Indiferent	Disagree	Strongly disagree

5.5.4 I feel ashamed when I don't comply with the rules

Strongly agree	Agree	Indiferent	Disagree	Strongly disagree

6. Social influence Si

6.1 Do you belong to any fishermen cooperative?

7.1.1 yes ☐ _____

7.1.2 No ☐

6.2 Why do (not) you belong?

6.3 What are the benefits of belonging to the cooperative if there is any?

6.4 Does being in the cooperative give you fair deals with buyers?

6.5 Are you part of the directives of the cooperative?

6.5.1 yes ☐ _____

6.5.2 No ☐

6.6 How would you score your level of participation? (Check ☑)

6.6.1 I go to every meeting.. ☐

6.6.2 I usually go… ☐

6.6.3 Sometimes ☐

6.6.4 I just go when is important ☐

6.7 Do you think that the cooperative's opinion are taken in to account by the authority..? (Check ☑)

6.7.1 Almost always ☐

6.7.2 often ☐

6.7.3 Few times ☐

6.7.4 Almost never ☐

6.8 Do you belong to any group in the community? (Example: junta de accion communal, sports, religion etc)

6.9 If you have a problem, will the other fishermen help you?

6.10 Do you trust personal issues to ither fishermen?

6.11 Do you trust financially on other fishermen?

7. Perception of scarcity – rules – market – enforcement – group

7.1 What happens if the resource disappears?

7.2 What you would like to have changed in the fishermen as a group of people?

7.3 What do you think about the health of the population?

7.4 Which species are in danger?

Did other fishermen talk to you or discuss with you about this study before this interview?

Yes _____

No _____

Thank you.

APPENDIX B

QUESTIONS PER VARIABLE

VARIABLE		Question	Variables
Violation rate (V)	5.1	Which one of the follow describes your fishing behavior better? -Always comply -usually comply -Sometimes I cannot comply -I don't comply	Complier
	5.3	Do you do any of the following activities? Turtle fishing Fishing during not catching season Fishing with tanks Fishing sharks Fishing in forbidden areas	Cheater
Legitimacy of the current regulations (L)	3.2	The regulations are generally accepted by most fishermen.	acceptation
	3.3	Catching seasons improve the long term well being of all fishermen	vedasgood)
	3.4	The principal reasons for the is to protect fish and because this island is a biosphere reserve	BRprotect
	3.5	The government is doing the right thing imposing the current regulations	govright
	3.6	the opinion of fishermen are taken into account in the formulation of fisheries regulations	Acceptedopinion
	3.9	The penalties given to fishermen who are caught violating current regulations "fit the offense" (are fair)	Sanctionfair
	4.4	Do you think there should be more regulations? If so, what type of regulations would you like to see?	Morerules
	5.5.1	The rules benefit all the others	benefitall
	5.5.2	Rules are good for my self because catch will be better next year	Goodforme
	5.5.3	Rules are good for my children	Goodforchild
Deterrence variables (D)	4.1	From your point of view which of these regulations are being enforced?	Rulescontroled
	4.2	How often did you see enforcement officials at sea when you were fishing during the last 12 months?	monitfrequency
	4.3	How often did the authority inspect on your boat, information about your boat or inspect your catch	enforcementfreq
	4.5	Do you think there should be more officials at sea?	Moreofficials
	4.6	How could you avoid being inspected?	*Descriptive*
	4.7	How many patrol boats, if any, do you believe operate in the area you fish?	Nboatscontrolling
	4.8	How often are violators caught by authorities?	violatorscaught
	4.17	What enforcement actions were taken against you for violation any of the regulations?	Ownsanctions
	3.8	Many fishermen who are fishing illegally are getting away with it (i.e. not detected or penalized)	violataway
	4.14	How often an artisanal fisherman caught violating a fishery regulation is sanctioned? (Do you know somebody who was caught?)	thinkcaught_sanctioned
Knowledge about regulations (K)	3.1	Please fill out the following table. Which regulations apply to you?	rulesknow
	3.1	What is the fine or sanction you would get in case you violate them?	sanctionknow
	3.7	Regulations are not enforced consistently	notenforcem
Financial incentive to violate the rules (Y)	2.1	Do you own the boat you use for fishing?	ownboat
	2.2	How many boats do you own?	Nboats
	2.6	Do you have any financial debt related to fishing activity?	debtfish
	2.5	Price of the boat	
	1.15	What percentage of the product is used as home consumption?	*To include*

	1.18	What does your wife do?	*To include*
Social influence variables (S)	3.11	Do most of the fishermen violate rules?	mostviolate
	3.12	What is your opinion about other fishermen's behavior?	*descriptive*
	4.9	Who do you think violates more often?	violators
	4.10	Do you think foreigners violate the rules more than the natives?	foreigvsnativ
	4.11	What do fishermen say or do to the violators?	grouptalks
	4.12	Do you know when somebody is cheating? How do you know if somebody is cheating?	Iknowviolat
	4.13	Do you talk about it with other people?	Italk
	4.15	Is there any form of self enforcement (any from of enforcement activity agreed upon and organized by the fishermen themselves)?	self_enforcement
	5.2	Which one of the follow activities are done continuously by fishermen here? Turtle fishing Fishing during not catching season Fishing with tanks Fishing sharks Fishing in forbidden areas	reported rules
	5.5.3	I feel ashamed when I don't comply with the rules	ashamed
	6.1	Do you belong to any fishermen cooperative?	coop
	6.6	How would you score your level of participation?	participat
	4.12	Where do you sell the product?	*To include*
	1.16	Do you belong to any religion?	*To include*
	1.17	How many times do you go to church per week?	*To include*
Personal characteristics (X)	7.1	What happens if the resource disappears?	resourcedissap
	2.9	type of fisher	lineordive
	1.2	Were you born in the Island?	born
	1.3	If you were not born in OP/SAI When did you move to the islands	move
	1.4	Age	Age
	1.5.2	How many depend on you?	dependents
	1.6	what is the higher formal year of education?	education
	1.7	Is fishing your main source of income, and what other sources do you have?	sourceincome
	1.8	What percentage of household income is derived from fishing?	inmcome
	1.9	How long have you been a fisherman?	yearsfishing
	1.11	Will your kids follow you as fishermen?	kidsfish
	1.12	Will you continue living in this island the rest of your life?	stayisl
	1.13	Would you like to move to other place? Why?	moveother
	1.10	How did you get into fishing?	*descriptive*
	1.14	What were you doing before getting into fishing?	*descriptive*
	1.16	Do you belong to any religion?	*To include*
	1.17	How many times do you go to church per week?	*To include*

BIBLIOGRAPHY

Alayon, L,.(2005). External regulations and local appropriations of a resource management in Old Providence and Santa Catalina Islands. Dissertation. Facultad de Estudios Ambientales y Rurales. Ecología. Pontificia Universidad Javeriana, Bogotá – Colombia.

Anderson, L.G., and Lee, D.R. (1986). "Optimal Governing Instruments in Natural Resources Regulation: The Case of the Fishery". American Journal of Agricultural Economics, 68(4): 679-90.

Becker G.S. (1968). "Crime and Punishment: An Economic Approach". Journal of Political economy, Vol. 76, issue 2, pp 169-217.

Berkes, Fikret. Mahon, Robin. McConney, Patrick. Pollnac, Richard, & Pomeroy, Robert. (2001). Managing Small-scale Fisheries: Alternative Directions and methods. IDRC. Pp 250

Cardenas, J.C., Stranlund, J., and Willis, C. (2000). Local Environmental Control and Institutional Crowding-out. World Development, Vol. 28, No 10: 1719"1733

Castro, E. (2005).Caracterizacion del régimen de pesca artesanal en la isla de San Andres, Caribe Colombiano: Inferencias sobre la estructura de la comunidad Icitica. Tesis maestria Biologia marina. Universidad Nacional de Colombia. San Andres. 140 p

Charles, Anthony. Mazany, Leigh. Cross, Melvin. (1999). Marine Resource Economics. Volume 14, p 104.USA

Connolly, Ernesto. (2001). Información socioeconómica sobre la utilización de los recursos marinos – Providencia y Santa Catalina Islas. CORALINA. San Andrés Isla.

Connolly, Ernesto (2005). Diagnóstico socioeconómico y cultural de la actividad pesquera en el archipiélago de San Andrés, Providencia y Santa Catalina. Documento final del Proyecto: Programa de ordenación, manejo y conservación de los recursos pesqueros en la reserva de la Biosfera.

Eggert, H. and Ellergård, A. (2003). "Fishery control and regulation compliance: a case for Co-management in Swedish commercial fisheries" Marine Policy 27 525-533.

Eggert, H and Lokina, R. (2010). Regulatory compliance in Lake Victoria fisheries. Environment and Development Economics, **15** , pp 197-217

Enciso, Patricia. (2004). The threads that tie our history. Oral history and collective memory, tools to strengthen identity and inter-ethnic relationship in San Andres, old Providenca and Saint Catherine. GTZ, NAFASAD.

FAO. (2006). Consulta de Expertos Sobre los Procesos de Regulación del Acceso a la Pesca y la Sostenibilidad de las Pesquerías en Pequeña Escala en América Latina. Lima, Perú, 9-12 May 2006

Feldman, P. (1993) The Psychology of Crime. New York: Cambridge University Press.

Furlong, W.J. (1991) "The Deterrence Effect of Regulatory Enforcement in the Fishery". Land Economics. 67 (Feb): 116-29

Fisheries Opportunities Assessment. (2006). Coastal Resources Center, University of Rhode Island, and Florida International University. 104p.

Gorricho, J., & Rivera, C. (2004). Entre el discurso global de "reserve de Biosfera" y la realidad de los Pescadores: una aproximacion practica al caso de la Isla de Providencia y Santa Catalina. Informe técnico final presentado http://www.upeace.org/cyc/pdf/final Providencia.pdf

Hatcher, A., S. Jaffry., O. Thébaud, and E. Bennett (2000) "Normative and Social Influences affecting Compliance with Fishery Regulations". Land Economics. 76(3): 448-461.

Hatcher, A. and D.V. Gordon. (2005) 'Further Investigations into the Factors Affecting Compliance with U.K. Fishing Quotas' Land Economics 81(1):71-86.

Hauck, María. & Kroese, Marcel. (2006). Fisheries compliance in South Africa: A decade of challenges and reform 1994-2004. Marine policy 30 (2006) 74 - 83

Heckman, J.J. (1979)"Sample Selection Bias as a Specification Error". Econometrica, Vol.47(1) 153-162.

Jack, V. (1971). Factor Analysis in International Relations. Interpretation, Problem Areas and Application. University of Florida Press, Gainsville.

Jae-on. K., Mueller. C. (1978). Factor Analysis. Statistical Methods and Practical Issues, Sage publications.

Jae-on, K., Mueller. C. (1978). Introduction to Factor Analysis. What it is and How To Do It, Sage publications.

James, J. (2004) Estrategias de distribución de beneficios y evaluación de mecanismos de compensación. CORALINA, San Andrés.

Kuperan, K., and Sutinen, J, G .(1998), "Blue Water Crime: Legitimacy, Deterrence and Compliance in Fisheries". Law and Society Review, 32:309-38.

Mathiesen, C. (2005). Analytical framework for studying fishers' behavior and adaptation strategies. Institute of Fisheries Management and Coastal Community Development (IFM), Denmark.

Medina, J. (2004). La pesca artesanal en las islas de Providencia y Santa Catalina (Caribe Colombiano): Distribucion espacial y temporal de los recursos capturados con línea de mano. Tseis MAestria Biologia marina. Universidad Nacional de Colombia, San Andres, 104 p.

Meisel, A. (2003). The Continentalization of San Andres Island, Colombia: Panyas, Raizales and Tourism, 1953-2003. Documentos de Trabajo Sobre Economía Regional. N 37, August 2003. Banco de la República cartagena de Indias.

Milliman, S.R. (1986) 'Optimal Fishery Management in the Presence of Illegal Activity' Journal of Environmental Economics and Management, 13 (4):363-81.

Monsalve, L. (2003). Las Islas de los Cangrejos Negros. Representaciones de la Naturaleza en Old Providence y Santa Catalina a partir de las relaciones sociales entre los pobladores locales con su territorio y con los Cangrejos Negros. Dissertation. Departamento de Antropología. Universidad de los Andes. Bogotá – Colombia.

Mow, June Marie. (2006a). The native islanders of San Andres, Old Providence and Santa Catalina: Dreaming between two worlds. Proceedings of the Islands of the World IX Conference. Sustainable Islands – Sustainable Strategies. Kahului, Maui, Hawai'i.

Mow, June Marie (2006b). Incorporación del territorio marítimo y las zonas costeras al desarrollo del país. Fortalecimiento de los derechos de usos ancestrales del territorio por parte de las comunidades Afro-Colombianas del Pacífico, Wayuu del Caribe y nativos del Caribe Insular. -DNP- Departamento Nacional De Planeacion. Direccion de Desarrollo Territorial Sostenible. Informe. Colombia

Raakjær Nielsen J. (2003). An analytical framework for studying: compliance and legitimacy in fisheries management. Marine Policy 27 (2003) 425–432

Rocha, J. C. (2006). Resiliencia Ecológica de la Pesquería Artesanal de Langosta Espinosa (Panulirus Argus) En Providencia y Santa Catalina. Escenarios Virtuales y Reflexiones Acerca de su sostenibilidad. Dissertation. Facultad de Estudios Ambientales y Rurales. Ecologia. Pontificia Universidad Javeriana, Bogotá – Colombia.

Soeftestad, L, & Alayón, L. (2007) Institutions, organizations and poverty: Challenges to coastal zone management in Colombia and Ghana. Annual conference of the Norwegian Association for Development Research. Theme: Making institutions work for the poor? Bergen, Norway, 5-7 November, 2007. http://www.supras.biz/portfolio/research/nfu2007.html

Stigler, G.J. (1970) 'The Optimum Enforcement of Laws' Journal of Political Economy, 78(3), p526-36

Sutinen, J., and Andersen, P., (1985) "The Economics of Fisheries Law Enforcement". Land Economics 61(12):387-97.

Sutinen, J. G. and T.M. Hennessey, (1986) 'Enforcement: The Neglected Element in Fishery Management' Natural resources economics and policy applications: Essays in honor of James A. Crutchfield, Eds. E. Miles, R. Pealy, and R. Stokes. Seattle: University of Washington Press.

Sutinen, J and Kuperan, K. (1999) A Socioeconomic theory of regulatory compliance in fisheries. International Journal of Social Economics 26 (1/2/3): 174-193

Sutinen, J.G., and J.R. Gauvin. (1989). "An Econometrics Study of Regulatory Enforcement and Compliance in the Commercial Inshore Lobster Fishery of Massachusetts". In Rights Based Fishing, ed P. Neher, R. Arnason, and N. Mollet. NATO ASI Series E: Applied Sciences 169. Dordrecht: Kluwer.

Tyler, T.R., (1990) Why People Obey the Law. Yale University Press, New Haven and London.

Viteri, César and Chavez, Carlos. (2004). Legitimacy, local participation, and compliance in the Galapagos Marine Reserve. *Ocean and Coastal management. 50: 253 – 274*

Wilson, Peter. (1995). Las travesuras del Cangrejo, Un estudio de caso Caribe del conflicto entre reputación y respetabilidad. Universidad Nacional de Colombia, Sede San Andrés. Instituto de Estudios Caribeños.