

**Fishery Co-Management:
The Case of the Punta Allen Spiny Lobster Fishery**

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American Agricultural Economics Association Annual Meeting
August 2-5, 1998
Salt Lake City, Utah

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Fishery Co-Management: The Case of the Punta Allen Spiny Lobster Fishery¹

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Management of fisheries is an issue that has received widespread attention in the literature. Of particular concern is the relationship between fishery performance and management institutions and tools. There are a variety institutional designs for fisheries management which can involve user participation at various stages. The purpose of this paper is to describe a co-management arrangement where resource users participate in the implementation and monitoring and enforcement of government regulations. According to Hanna (1995), this type of “bottom up” management structure involving extensive user participation creates a stake in the outcome and can promote stewardship by creating an opportunity for resource users to control the outcomes.

The spiny lobster fishery located in Punta Allen, Mexico will be used as a case study to demonstrate how institutions and social norms can enhance cooperation between user groups and government. The primary focus will be on monitoring and enforcement in the fishery. Enforcement has been called the “Achilles heel of fisheries management and conservation” (Sutinen, 1988). Much of the problem with fishery management programs is that regulations are not self-enforcing and compliance is erratic. The high cost of enforcement programs is one reason for this. Most research on compliance in fisheries has focused on the role external enforcement plays in ensuring compliance with management programs (Kuperan, 1994; Sutinen et. al, 1990; Sutinen and Gauvin, 1989; Sutinen 1988; and Sutinen and Anderson, 1985). However, in Punta Allen external enforcement is practically non-existent. The cooperative is subject to federal regulations which dictate fishing practices, but the government relies on the cooperative to ensure enforcement

¹ Summary of the Dr. Frederick J. Prochaska Outstanding Master’s Thesis completed at University of Florida, Food and Resource Economics Department, 1997.

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There are several examples in the literature of co-managed fisheries (Berkes, 1995; Feeny, 1994; Pomeroy, 1994; McGoodwin, 1990; Jentoft and Kristoffersen, 1989; and Acheson, 1988). A key element in much of these writings has been the focus on the institutional arrangements. Likewise fishery managers seek to understand both the problems associated with trying to manage fisheries and why some institutions achieve effective and efficient results while others do not. The institutional arrangements in the Punta Allen spiny lobster fishery will be described and answers will be sought to the following questions. Is co-management which relies on bottom-up community governance, a more effective mechanisms for managing small-scale, inshore fisheries than centralized governance? And do social norms coupled with market mechanisms ensure higher levels of compliance with rules regulating use of the resource?

Background

Punta Allen is a small fishing village with about 500 residents located on the southern tip of a narrow peninsula in the state of Quintana Roo, Mexico. Enclosed by Ascensión Bay to the south, the Caribbean Sea to the east and a lagoon to the west, Punta Allen is extremely isolated. Ascensión Bay is an open shallow bay (less than 20 feet) approximately 740 km² in area. Several coral banks follow the shoreline along the mouth of the bay and form an interrupted reef. This reef reduces the wave surge resulting in relatively calm waters which are ideal for lobster fishing.

In 1968, a group of 49 fishers formed the Sociedad Cooperativa de Producción Pesquera Pescadores de Vigia Chico, S.C.L. Today 74 fishers are registered with the cooperative whose primary purpose is to facilitate the harvest of lobster. The cooperative reports 55 fiberglass boats which measure about 24 feet with 45 horsepower outboard motors. The Punta Allen fishery is unique in that a high degree of isolation has allowed for a self help approach to community development (Seijo, 1993).

Spiny lobster, *Panulirus argus*, is the target species and occurs in coastal waters up to depths of 60 meters (Briones and Lozano, 1994). Reproduction is constant throughout most of the year with a peak in Spring (March-May) and a second peak in Autumn (August-October) (Aguilar & Gonzalez-Cano, 1987). Females 76 to 138 mm carapace length are estimated to produce between 120,000 and 1,500,000 eggs per spawn

(Briones et al., 1988). Juvenile lobsters inhabit shallow bays and reef lagoons along the Quintana Roo coastline. Their growth is rapid, reaching 74 mm carapace length at 1.7 years after settling (Lozano-Alvarez et al., 1991). Once the lobsters reach sexual maturity, they migrate to deeper waters across the local coral reefs where reproduction occurs.

Fishing pressure on juveniles in the bay and shallow reef waters is heavy, but no lobster fishing is conducted on the coastal shelf outside the bay deeper than 15 meters. The reproductive segment of the population exists on the shelf outside the coral reef, at greater depths than are being fished (Lozano-Alvarez et al. 1993). However, the development of a trap fishery off the bay is considered impractical and costly, because of the narrow shelf, the complex morphology of the bottom, and the strong currents encountered in this area. (Lozano-Alvarez et al. 1993). As a result, the spiny lobster fishery in Punta Allen is focused on the capture of small-sized lobsters in shallow areas with conservation of the reproductive stock in the deeper waters.

Artificial reefs are used to facilitate and increase harvests. These man-made structures usually measure about 2 meters long x 1.5 meters wide and 6-8 centimeters high. They can be constructed from wood, cement, sheets of corrugated asbestos or metal drums. Artificial reefs are believed to enhance recruitment by mitigating predation mortality by other species besides humans (Seijo, 1993). The shallow depths of the bay provide a good environment for the placement of artificial reefs.

Regulations and the Structure of the Fishery

Spiny lobster was an open access resource prior to 1947 when the government granted fishermen organized in cooperatives exclusive rights to fish high valued species, including lobster. Today it is considered a common property resource. Fishing cooperatives have been granted fishing concessions which extend approximately 2,000 meters from the shore to the coral reefs. This division of fishing grounds into exclusive zones reflects a policy established in the 1930's when fishing cooperatives were organized like land-based agrarian collectives *ejidos*, and given title to fixed areas for exploitation (McGoodwin, 1980).

The cooperatives limit entry by controlling the number of members. Currently in Punta Allen, only sons of fishers may join the cooperative. However, this does not necessarily imply a limit in fishing effort. While fishers are constant in number, they employ various methods in order to enhance fishing performance such as faster boats and better constructed gear.

A distinguishing feature in the Punta Allen fishery is the informal allocation of property rights. In the early 1970s, the cooperative divided the common fishing grounds into parcels which were distributed among the fishers in order to protect the lobster resource from free rider behavior. From the beginning, fishers claimed ownership to an area of the ocean where they deployed artificial reefs. Unlike lobster traps with floating markers, artificial reefs are not easy to identify from the surface. The creation of individual fishing grounds allowed the cooperative to avoid boundary disputes as the area became more crowded with gear. Today there are 150 individual fishing grounds ranging in size from 0.5 to 3 km² and located in both the inner bay and back-coral reef areas (Seijo, 1993).

Ownership of a fishing ground is limited to cooperative members. A fisher cannot sell nor lease his fishing ground to a foreigner who is not a member of the cooperative. However, the temporary or permanent transfer of individual rights to fishing grounds is common and involves a simple artisanal transaction. Renting is done by an informal rental agreement where a fisher agrees to pay an amount in relation to ground size, the number of artificial habitats in the area, and its perceived relative productivity based on previous years. Permanent transfers of fishing grounds usually involve a monetary payment or a barter transaction where one area is traded for another. At the beginning of every new fishing season, bargaining for fishing grounds and existing artificial reefs takes place among the fishers.

The government's management plan for spiny lobster focuses on protecting the biological processes of the stock versus trying to limit total catch amounts. There is a closed season which runs from March 1 to June 30. Catch composition is regulated. The catch of egg bearing females is prohibited and there are two minimum size limits. The

minimum size length is 13.5 centimeters for the central bays (Ascensión Bay and Espíritu Santo Bay) and 14.5 centimeters for the rest of the fishery. The rationale for the smaller size limit is based on the fact that both bays are shallow (20 feet or less), and most catch consists of juveniles and young adults.

Prior to 1994, management decisions were carried out by the Ministry of Fisheries (Secretaria de Pesca). Since then the Ministry of the Environment, Natural Resources and Fisheries (Secretaria del Medio Ambiente, Recursos Naturales y Pesca) assumed responsibility for setting fishery regulations. Research and advisory support is provided by the National Institute of Fisheries (INP). A regional committee comprised of representatives from the cooperatives, research institutes, and the processing and export industry was established in 1986 to provide input on issues related to the lobster fishery and help define research priorities.

The co-management arrangements in the fishery are such that the cooperatives implement and enforce government policies and regulations which are generally accepted as beneficial to the fishers. Fishers do not participate in the decision-making process at the policy level. However, the Punta Allen spiny lobster fishing cooperative has internalized the government regulation and plays a key role in monitoring and enforcing these rules. The cooperative also has its own set of internal rules. These rules are designed for both individual and collective behavior. Internal rules fall into three categories: 1) participation in general assembly meetings; 2) access to lobster fishing; and 3) conflicts over fishing grounds. Graduated sanctions are imposed for breaking the rules. For example, a fisher entering another fisher's fishing grounds will be fined N\$150 for the first offense and N\$250 on the second offense. The third offense is grounds for liquidation of a fisher's assets and expulsion from the cooperative. Severe offenses like fishing during the closed season or stealing from the cooperative are grounds for immediate expulsion. This punishment is equivalent to loss of community respect and oftentimes results in the offender leaving Punta Allen.

Monitoring and graduated sanctions, according to Ostrom (1990), are key components of most successful common property resource institutions. In Punta Allen, an

enforcement agent appointed by the cooperative is responsible for supervising all activities of the members to ensure that they comply with government and cooperative rules. When a fisher is caught breaking a rule he is confronted by the agent. Because of the high degree of isolation and high transaction costs of state enforcement (Sutinen, 1987), external enforcement and monitoring mechanisms are for the most part absent.

Fishers also monitor one another's fishing activities. It is generally assumed that individuals are reluctant to monitor and enforce other members of the community due to the relatively high personal costs and the creation of a public good (Ostrom, 1990). Ostrom cites Elster (1989) who states that "punishment almost invariably is costly to the punisher, while the benefits of punishment are diffusely distributed over the members." However, observations reveal that Punta Allen fishers choose to reprimand violators in their community. Several fishers reported that they prefer to confront the offender rather than reporting him to the cooperative. This stems mainly from the fact that they are seeking to mitigate the personal cost associated with going through official channels. Furthermore, based on interviews with fishers, enforcement in Punta Allen is not perceived as a public good due to the informal system of property rights in the fishery.

Performance

Observations reveal that the market mechanism, namely the informal privatization of the fishing grounds, and collective choice arrangements have strengthened monitoring and compliance rates in the fishery. Theory suggests that there are several factors which influence compliance behavior in fisheries (Sutinen et al., 1990; Kuperan, 1994). These include enforcement actions, regulations, economic and biological conditions, social norms, and the behavior of others. Kuperan and Sutinen (1994) divide these influences into three groups: 1) deterrence factors; 2) intrinsic factors and 3) extrinsic factors. Deterrence implies that the certainty of being detected and severity of sanctions will either increase or decrease the monetary costs or benefits for an individual contemplating breaking the rules. Benefits derived from non-compliant behavior will depend on biological conditions and the value of fish landed from illegal fishing. The costs are revealed in the expected penalty for violating the rules and is estimated based on the probability of detection and conviction and the size of the fine. This in turn is affected by

the level of enforcement and the expediency with which the violators are convicted and punished. The self policing nature of the fishery makes the perceived risk of being detected is very high in the Punta Allen fishery. There are also several cases of fishers being expelled from the fishery. Expulsion is equivalent to loss of community respect and often results in the offender leaving the community. Thus the monetary and social costs are quite high.

Intrinsic factors represent internalized norms and moral obligation. These depend on the moral values of the individual and the extent to which individuals accord legitimacy to the enforcing agency. The latter depends on the outcome from enforcing the regulations. Extrinsic factors include the behavior of others and social norms within the community. The behavior of others can influence an individual's decision to comply with regulations. For example, fishers might feel justified in violating regulations like closed areas which provide benefits in the form of a collective good as long as other fishers refrain from fishing the area. This justification may stem from the fact that other fishers fish the closed area. This form of collusion among fishers is common. Like motorists who speed on the highway so it is impossible for the highway patrol to pull them all over, many fishers may decide to fish in closed areas because they know that enforcement agents will be challenged to catch and penalize all of them.

Decision trees were used to analyze the factors which affect a fisher's decision to comply with the rules. Decision trees are hybrid models which combine the iterative discovery process of ethnographic research with the linear research method. This methodology assumes that verbal descriptions of individual decision criteria, such as can be found in many strict ethnographies, are not enough. Decision models need to be developed and tested using a linear approach.

Data for the decision trees were obtained during interviews in the field from September to October 1996. A preliminary questionnaire was tested on ten fishers who were randomly selected. The information elicited from these ten interviews was used to revise the questionnaire in order to reflect local cultural beliefs. Thirty fishers were interviewed with the revised questionnaire to elicit demographic data, information about

the cooperative's co-management system, and fishers' perceptions regarding the rules and regulations.

Several sample decision trees were developed based on the criteria collected during interviews and observations. A preliminary composite decision tree was constructed and then revised after testing in March 1997. The revised model is presented in Diagram A. The choice alternatives are at the top of the tree, {Follow the Cooperative Rules Today; Break the Cooperative Rules Today}, the decision criteria of the tree are inside diamond shaped brackets (< >) and the outcomes are in boxes ([]). The decision maker starts at the top, and independent of other decision makers, is asked a set of questions based on the criteria and sent down a path to a particular outcome. The first set of criteria 1-4 on the tree are motivating reasons which lead a fisher to the branch [Follow the rules unless...]. Criterion 1 determines if the individual knows the cooperative rules. If he does not, he is quickly eliminated from the decision. This part of the decision is usually subconscious, because the decision maker takes these decisions for granted; the decisions are merely routine. This stage of the model is referred to as "elimination by aspects" (Tversky, 1972, Gladwin, 1980, Gladwin, 1989). All it takes is to answer *yes* to criteria 2-4 to take the decision maker to the outcome, *Follow the rules unless*. These "unless" conditions include constraints facing the fisher and signal the second stage of the model.

If the fisher says no to all the questions in the first stage of the model, he is sent down the right hand side of the tree. He will break the rules on this branch unless other constraints get in the way of his decision. These constraints deal with a risk sub-routine where the fisher first considers the risk and then decides if he has a way to reduce the risk. If the fisher passes these constraints successfully, he passes to an ordering aspect in criterion 15. Here the fisher weighs the risk of not being caught against the risk of not catching enough fish and therefore not being able to finance his debts.

A group of 28 fishers were interviewed and passed through the decision tree to determine its predictability. A simple success rate was determined for the model by dividing the total number of successes by the total number of cases. Therefore, the model

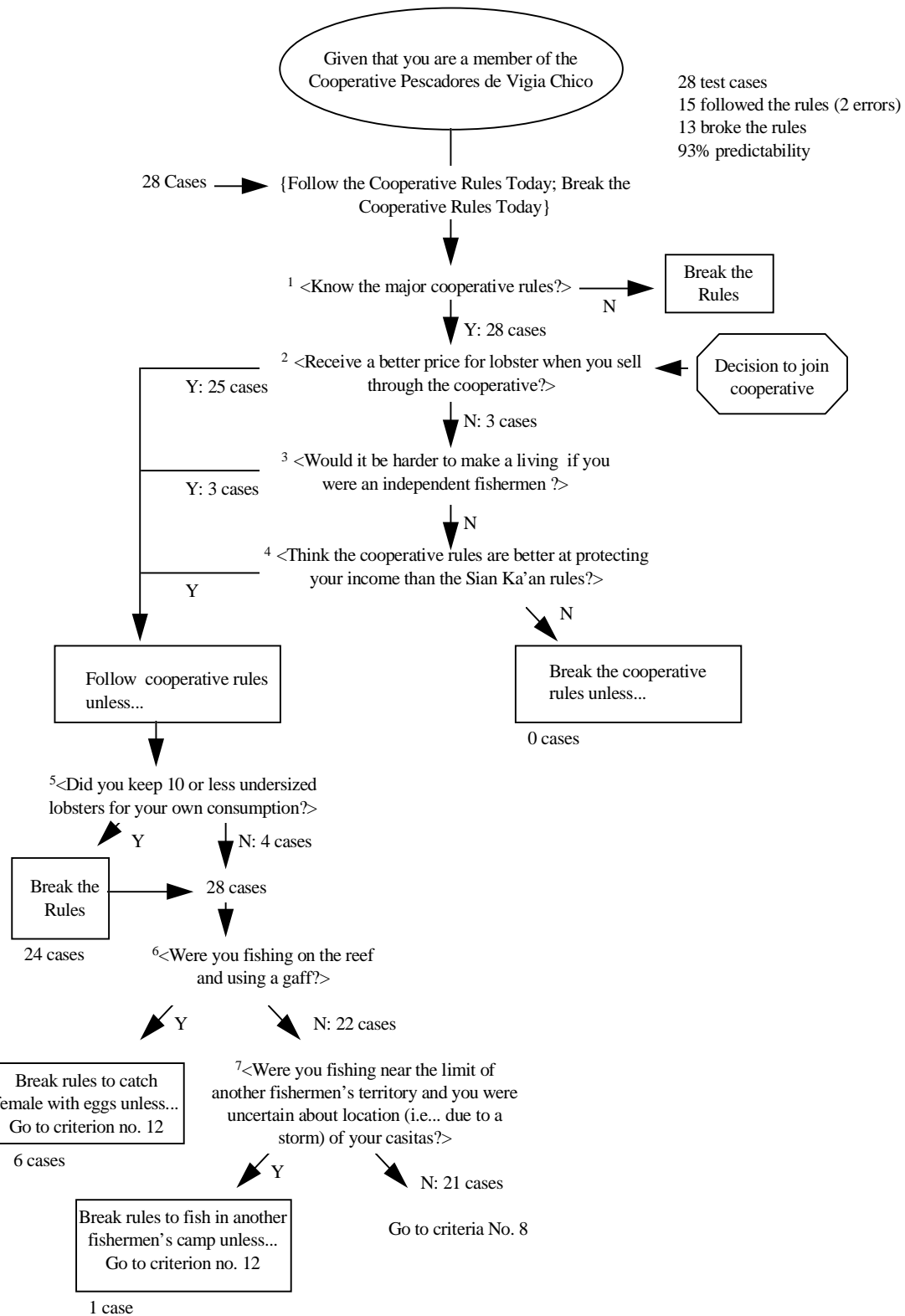
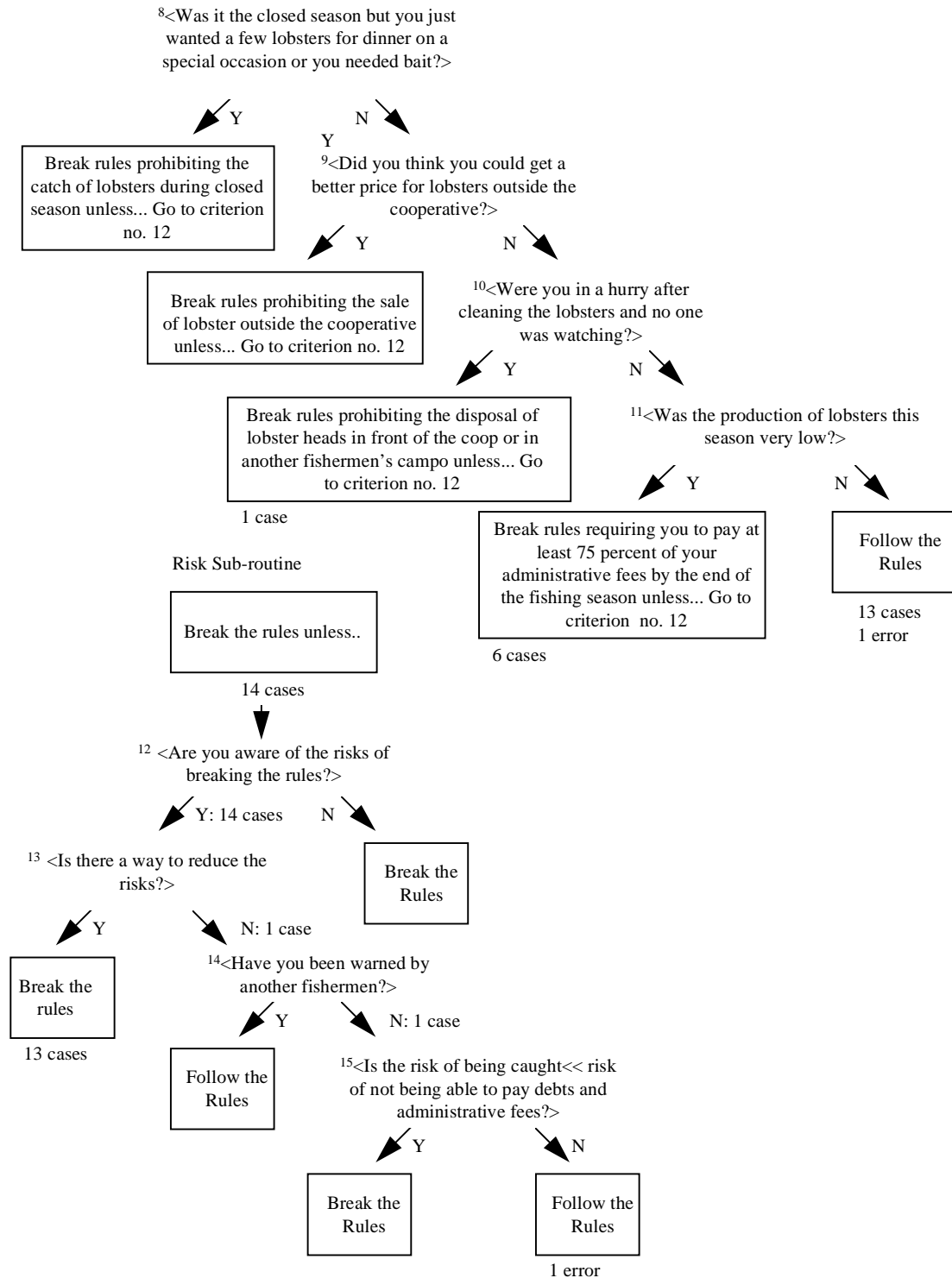


DIAGRAM A



predicted 26 of 28 cases correctly so the predictability rate is 93 percent. Thirteen of the fishers broke the rules, and 15 followed the rules with two errors. In this test sample, no one arrived at the “break the rules” outcome from criteria 8 and 9.

In the first stage of the model all 28 fishers responded yes to one of the first four questions, and so they moved on to the outcome [Follow the rules unless...]. At the second stage of the model 24 cases responded yes to criterion 5, “Did you keep 10 or less undersized lobsters for your own consumption?” This criterion is an extrinsic factor which reveals fishers collude to break rules. Although capturing undersized lobsters is a violation, fishers are rarely punished for this violation because there is an informal understanding that permits them to break the rule.

All 24 cases re-entered the decision model due to the informal agreement and proceeded to criterion 6, “Were you fishing on the reef and using a gaff?” Six fishers broke this rule. This is a common mistake and does not suggest an intent to break a cooperative rule. In 1996, the cooperative began producing live lobster for export to Japan. Prior to this most fishers used gaffs to remove lobsters from the artificial shelters and the natural reefs. Frequently, inexperienced fishers would accidentally gaff egg-bearing females. Although the use of gaffs has not been prohibited, the number of incidence has declined because fishers receive a higher price for live lobsters.

When a rule is broken on the tree, the fisher (or more accurately, his data) are sent to a risk sub-routine which starts with criterion 12, “*Are you aware of the risks of breaking the rules:*” If he says yes, his data is passed on to criterion 13, “*Is there a way to reduce the risk?*” There is a formal mechanism in place which allows the non-compliant fishers to reduce the risk. Every fisher, if accused of breaking a rule, must go before the General Assembly and explain why he broke the rule and the extenuating circumstances.

If they do not have a way to reduce the risk (criterion 13), they were asked criterion 14, “*Have you been warned by another fisher?*” One of the main reasons most fishers comply with the rules is the informal practice of self-policing in the fishery. The criteria in the risk sub-routine reveal a set of intrinsic factors which affect fishers’ decisions to comply. The fishers of Punta Allen possess a moral obligation to comply with the rules which arise from their own internalized values about right and wrong. The

moral obligation is largely a function of the socialization process (Kuperan and Sutinen, 1994). This moral obligation is strong as fishing rights are passed from father to sons. Furthermore, social norms dictate that if a fisher spots another fisher breaking a rule, he should confront that offender directly. Usually a fisher will be given two or three warnings by his colleagues. If he continues to break the rules, as a last resort the fisher will report him to the cooperative.

If the fisher has not been warned by another fisher, criterion 14, he passes to an ordering aspect in criterion 15. Criterion 15 seeks to get at the deterrence factor namely what are the costs and benefits of non-compliance. Only one fisher reached this stage in the model, and he was an error. This error occurred because the fisher responded no to the ordered aspect *“Is the risk of being caught less than the risk of not being able to pay debts and administrative fees?”* and so the model predicted the outcome [Follow the rules] when the fisher had broken the rules. This particular fisher had been caught fishing in another fisher’s grounds.

Other examples of non-compliance include fishing in another fisher’s grounds (criterion 7); tossing lobster heads in front of the dock (criterion 10); or failing to pay administrative fees to the cooperative (criterion 11). In every case where a rule was broken, the fisher passed through the risk sub-routine. Six cases responded yes to criterion 11 and failed to pay administrative fees. There are several possible explanations for this outcome. First landings for the year 1996-97 were below average and thus many fishers choose to work in tourism as fishing guides. As a result, they were unable to pay their fees which are deducted from their lobster earnings. However, another explanation was provided by a group of fishers who expressed their discontentment with the cooperative over the last several years.

An intrinsic factor which influences compliance behavior is the perceived legitimacy of the enforcement agency (Kuperan and Sutinen, 1994). For the last decade, the cooperative has relied heavily on external sources of financing. Ostrom (1994) indicates that the availability of “easy money” from external sources can threaten the sustainability of common property resource institutions. Opportunistic behavior is encouraged by the availability of outside funds sought to finance large-scale construction

projects. There was a major case of corruption when in 1990 cooperative leaders embezzled loan money intended to finance a processing plant which failed. This combined with the burden of repaying cooperative loans has generated resentment and lack trust among a group of fishers.

Conclusions

The purpose of this paper was to describe the co-management arrangement governing the exploitation of the resource. The collective choice arrangements and the informal allocation of property rights have resulted in a low level of free rider behavior which is very common in other fisheries in the area (i.e. trap fishery of Isla Mujeres) (Sejio, 1993). The rules concerning the allocation of fishing grounds and artificial reefs are well respected. These property rights have reduced non-contributing behavior by fishers in the cooperative and encouraged greater respect among many fishers regarding the need to participate in conserving the resource.

The legitimacy of the cooperative as an institution on the other hand is in question and this has affected perceptions of fairness. Some fishers feel that cooperative leaders are exploiting them. As a result, rules regarding attendance at cooperative meetings and payment of fees are frequently violated. However, fishers reported in interviews that as long as the informal allocation of property rights remains, they will continue to respect the rules regarding access to the resource.

Another important consideration for the fishery is that while the government regulation prohibiting fishing during the closed season is generally respected, the regulation regarding the minimum size restriction is not. This may pose a threat to the future sustainability of the resource. Sejio (1993) states "...in the long run they may become unwitting free riders by not knowing the overall shared stock effect of their fishing effort, and therefore, unwillingly contribute to the destruction of the resource." Fishers are aware of the long larval stages of spiny lobster (6-11 months) which makes them susceptible to ocean currents (Lyons, 1980). Therefore, recruitment into the fishery not only depends on the actions of fishers in Punta Allen, but on how juvenile and adult lobsters are being exploited in other areas of the Caribbean. Uncertainty about the actions of others may induce fishers to practice opportunistic behavior which poses a threat to

future rents in the fishery. This provides an opportunity for future bioeconomic analysis and research regarding regional cooperation.

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