People, Issues, and Networks in Small-scale Fisheries in the Eastern Caribbean

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ABSTRACT

Small-scale fisheries in the eastern Caribbean are plagued with numerous issues related to livelihoods, marketing, policy, management, and others. How these issues are played out can be analyzed structurally according to social networks that describe how relevant actors (people or organizations) are linked, and their relationships. We can apply network analysis to the governance of small-scale fisheries in the eastern Caribbean. I have begun characterizing some of these issues using case studies of the fisheries for large pelagic and reef fishes. In this paper, I identify and analyze some of these key issues of concern to stakeholders in these fisheries. I also provide and discuss conceptual network maps of the relationships among key actors and their perceived influence in these issues. This paper is part of doctoral research on the governance of small-scale fisheries in the eastern Caribbean. The findings here are based upon data and information collected through literature review, informal interviews and personal observation during scoping visits to Grenada.

KEY WORDS: Small-scale fisheries, issues, networks, Eastern Caribbean, key actors

Personas, Asuntos y Redes en la Pesca a Pequeña Escala en el Caribe Oriental

La pesca a pequeña escala en el Caribe Oriental se encuentra plagada con numerosos asuntos relacionados a la subsistencia, mercadeo, políticas, manejo entre otros. La manera en que estos asuntos se desenvuelven puede ser estructuralmente analizada de acuerdo a redes sociales que describen que tan relevante los actores (personas u organizaciones) se entrelazan y sus relaciones. Podemos aplicar el análisis de redes a la gobernabilidad de la pesca a pequeña escala dentro del Caribe oriental. Hemos iniciado caracterizando algunos de estos asuntos utilizando estudios de caso de la pesquería de grandes pelágicos y la pesquería en coralinas. En este escrito identificamos y analizamos los aspectos claves que conciernen a las personas de interés en este tipo de pesca. Igualmente proveemos y discutimos mapas conceptuales de redes de las relaciones de actores claves e influencias percibidas dentro de estos asuntos. Este escrito forma parte de una investigación de doctorado sobre la gobernabilidad de la pesca de pequeña escala en el Caribe oriental. Los resultados se basan en datos e información recolectada a través de revisión bibliográfica, entrevistas informales y observación personal durante visitas de sondeo efectuadas en Grenada.

PALABRAS CLAVES: Pesca de pequenia escala, asuntos, redes, Caribe Oriental, actores claves

Les Personnes, Les Questions et le Réseaux dans le Pêcheries de Petite Échelle dans le Caraïbes de L'est

Les pêcheries à petite échelle dans les Caraïbes orientales sont en proie à de nombreuses questions liées aux moyens de subsistance, au marketing, à la politique de gestion et autres. Comment ces questions se déroulent peut être analysé selon la structure des réseaux sociaux qui décrivent comment les acteurs concernés (personnes ou organisations) sont liés et leurs relations. Nous pouvons appliquer l'analyse de réseau à la gouvernance des pêcheris à petite échelle dans les Caraïbes orientales. Nous avons commencé à caractériser certaines de ces questions en utilisant des études de cas des pêcheries des grands pélagiques et les pêcheies dans les récifs peu profonds. Dans cet article, nous identifions et analysons certaines de ces questions essentielles qui préoccupent les parties prenantes dans ces pêcheries. Nous offrons également des cartes et discutons du réseau conceptuel des relations des principaux acteurs, leurs rôles dans les pêcheries et leur influence perçue sur ces questions. Ce document fait partie de la recherche doctorale sur la gouvernance des pêcheries à petite échelle dans les Caraïbes orientales. Les résultats ici sont basés sur des données et des informations recueillies par l'examen de la littérature, des entretiens informels et observations personnelles lors de visites d'étude d'envergure à la Grenade et Sainte Lucie.

MOTS CLÉS: Caraïbe orientale, questions, réseaux, pêcheries à petite échelles, acteurs clés

INTRODUCTION

Small-Scale fisheries (SSF) in the eastern Caribbean are plagued with numerous issues related to livelihoods, marketing, policy, management among others. Where there are efforts to address these issues through various management approaches and initiatives, they primarily continue to take a conventional command-and-control approach. Managers and other stakeholders continue to face difficulty in designing and implementing successful management solutions to these issues. Many management and governance initiatives are rendered ineffective because they pay inadequate attention not only to the interests and characteristics of stakeholders (see Grimble and Ward 1997, Prell *et al.* 2007), but also to the relationships amongst stakeholders. For some time now, stakeholder identification and analysis has been integral to participatory natural resource management initiatives (Mushove and Vogel 2005). The necessity of involving stakeholders in identifying causes and solutions for natural resource management issues has been fully recognized. However, a key deficiency in the process has been the inadequate focus on the relationships (networks) among stakeholders. Social network analysis seems to be a suitable tool for categorizing and understanding stakeholder relationships in natural

resource management (Prell *et. al*. 2007, Carlsson and Sandström 2006, Crona and Bodin 2006).

How issues, such as those inherent in SSF, are played out can be analyzed structurally through social networks that describe how relevant actors (people or organizations) are linked or relate to each other. I have begun analyzing governance issues in SSF in the eastern Caribbean from a network perspective, using case studies of the fisheries for large pelagic and reef fishes. In this paper, I briefly describe the fisheries and issues related to marketing and information and knowledge sharing in the large pelagic and reef fisheries of Grenville, Grenada. I go on to identify the relevant stakeholders in these issues and discuss conceptual network maps of these actors. I identify key players i.e. those actors that hold pivotal positions within these networks and may or may not be core to influencing any outcomes relevant to the specific issues. This paper is part of a larger study on the governance of marine resources in the eastern Caribbean, the MarGov project, being implemented by the Centre for Resource Management and Environmental Studies (CERMES) at the UWI Cave Hill Campus through grant funding from the International Development Research Centre (IDRC) of Canada.

METHODS

The information for this paper was collected through a scoping visit to Grenada in January 2009. Informal interviews, participant observation and literature review were the main data collection methods used to identify key issues of concern among stakeholders in the fisheries. For each issue identified, observation at the fish landing site and key informants assisted in identifying a broad list of stakeholders that have a stake in the fisheries based on whether they were resource users, managers, service providers, consumers etc. Over 300 stakeholders were identified and these were categorized into groups of fishers, boat owners, vendors, processors, service providers, government, fisherfolk organizations, and community based organizations. Following this broad stakeholder identification, social network analysis was conducted to determine who among them were critical to the issues of concern, map the structure of their networks, and identify key players and their perceived influence on the respective issues.

A typical social network analysis involves identifying all possible actors and asking each about their relations to others. This was, however, not possible due to the time limitations. Matsaert *et al.* (2004), Prell *et al*. (2007), and Schiffer and Waale (2008) outlined methods and tools to collect information on actors and their relations using actor oriented tools such as the actor linkage matrix. As a result, the actor linkage matrix approach was adopted in this study to collect information on actors and relations, by asking a few key informants to indicate "*who communicates with whom?*" regarding the issues. The resulting data were verified by observing the interactions of some of these actors during their daily routines at the landing site, and also by a review of existing official and unofficial reports, and news articles relevant to the issues. This information was entered into the social network analysis software, UCINET 6.0 and Netdraw (Borgatti *et al*. 2002) was used produce the respective network diagrams. To determine key players and perceived influence, the social network analysis metrics, degree centrality and betweeness centrality were measured to identify most connected actors, and those providing brokering roles, respectively.

The concept of centrality has received attention in the natural resource management literature (Bodin *et al*. 2006, Crona and Bodin 2006), including some distinction between the different kinds of centrality and their potential impacts on resource management (Prell 2007). Two types of centrality measures relevant to natural resource management are particularly prominent in the literature: degree centrality and betweenness centrality (Prell *et al*. 2007, Sandström 2009). Degree centrality indicates whether a particular stakeholder (actor) is directly connected to many others. Because central actors have many ties, they may have alternative ways to satisfy needs, and hence are less dependent on other individuals. These central actors are therefore key players in the network because they have many ties; they may have access to, and be able to call on more of the resources of the network as a whole. Because they have many ties, they are often third-parties and deal makers in exchanges among others, and are able to benefit from this brokerage. They can be seen as useful for mobilizing a network; bringing other stakeholders together and/or holding a network together. However, because these actors maintain a large number of ties, some of these ties are often weak. Thus, highly (degree) central stakeholders can be trusted to use their links to diffuse information and potentially mobilize collective action, but there is no guarantee that they are able to significantly influence those to whom they are tied (Prell *et al*. 2007). So, a very simple, but often very effective means of identifying a key player in social networks is to measure an actor's degree centrality.

Betweenness centrality on the other hand, refers to how many times an actor is positioned between two others who are themselves disconnected (Freeman 1979, Wasserman and Faust 1994). Stakeholders holding high betweeness centrality are important for performing a brokering role, bringing together otherwise disconnected groups, actors or segments of the network, thus resulting in increased diversity and providing opportunities for innovation in the network (Bodin *et al*. 2006, Brass 1992, Prell 2003). However, in situations of resource use conflicts these 'brokers' may feel 'torn between two lovers' within the network and will perhaps be forced to take sides (Krackhardt 1992). Network centrality reveals actors holding the majority of ties linking the network together; hence one should only need to reach these well-connected few to reach the entire network. On the other

hand, reliance on only a few is not the optimal structure for purposes of resilience and long-term problem-solving. However, by understanding these properties in any given network, it is possible for natural resource managers to make better informed decisions about how to engage with and involve stakeholders in meaningful deliberation and problem solving.

RESULTS

The Fisheries

Grenada is a 311km^2 island situated at the southern-most end of the Lesser Antillean chain in the Caribbean Sea and claims sovereignty over some twenty low-lying islands, including Carriacou and Petit Martinique known as the Grenada Grenadines (Figure 1). The total land area of the mainland and its dependencies totals 344 km^2. Grenada's coastline totals 121 km, and its exclusive economic zone (EEZ) and territorial waters comprise an area of 24,153 km^2 of sea with a continental shelf area of 1,595 km^2. A major fish landing site is in Grenville town, the second largest in Grenada, and is situated within the parish of St. Andrew's on the east coast of Grenada (Figure 1). The population of St. Andrew's parish is 27,116 persons with Grenville town itself accounting for approximately 1,217 (Government of Grenada). Grenville town is the economic and transportation hub for the eastern side of the island. Farming for nutmeg, banana and other cash crops, and fishing are the most prominent natural resource-related economic and subsistence livelihoods in the area.

The fishing industry can generally be described as a small-scale commercial tropical multi-species fishery involving oceanic and coastal pelagic fishes, reef fishes, lobster, conch, and turtles. The main fisheries, based upon average total annual landings, are for the oceanic, coastal pelagic and reef fishes. The main oceanic and coastal pelagic species targeted are yellow fin tuna (*Thunnus albacares*), sailfish or ocean gar (*Istiophorus albicans*), blackfin tuna or bonita (*Thunnus atlanticus*), wahoo (*Acanthocybium solandri*), bigeye tuna (*Thunnus obesus*), skipjack tuna (*Katsuwonus pelamis*), common dolphinfish (*Coryphaena hippurus*), rainbow runner (*Elagatis bipinnulatus*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), and great barracuda (*Sphyraena barracuda*). These are targeted mainly between the months of November to June. Some species such as the blackfin tuna is targeted beyond this period. There are no management measures in place for fisheries for large oceanic and coastal pelagics in Grenada; the fishery remains open access.

The reef fishes include grouper (*Serranidae*), snapper (*Lutjanidae*), squirrel fish (*Holocentridae*), parrot fish or caca bawie (*Scaridae*), grunt (*Pomadasyidae*), red hind (*Epinephelus guttatus*), queen trigger fish (*Balistes vetula*), surgeon/doctor fish (*Acanthuridae*), sandtile fish (*Malacanthus plumeri*) and coney or butterfish (*Cephalopholis fulvus*). These species are targeted throughout the year, but with increased intensity from June to November, when the ocean season has slowed. There is

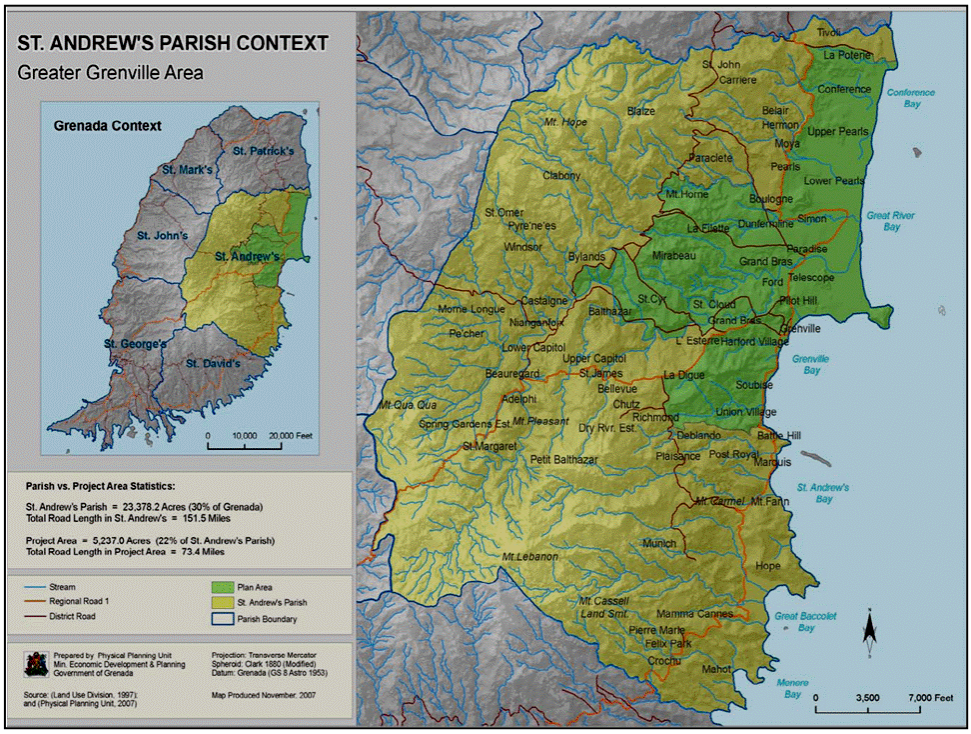

Figure 1. Map of Grenada showing the Greater Grenville Area Context.
(Source: Government of Grenada, Draft Greater Grenville Local Area Plan 2007)

an open and closed season for lobster and turtles between April and August each year. The majority of the vessels involved in these fisheries is open pirogues, mostly with wooden hulls and manned by two persons, a captain and a helper. Sizes range between 6 and 9 meters and outfitted with outboard engines of 40 - 75 horse power. The majority of these vessels do not carry onboard ice holds. The main fishing methods are trolling for large oceanic and coastal pelagics and bottom longlining for reef fishes. Fishers spend on average 4 - 5 hours at sea, leaving early in the morning and returning just after lunch. Some fishers may make two trips per day leaving shore at 4 am and returning 10 am, and out again after lunch returning late evening. Most of the catches are landed at the government built and managed Grenville Fish Market Complex (GFMC), catering mainly for a local market. Marketing of fish is solely a private undertaking, where fishers and self-employed fish vendors operate within or near the fish market facility provided by the government of Grenada through assistance from the Government of Japan. There is a fish processing establishment adjacent to the fish market engaged primarily in packaging and marketing fish to local high-volume buyers (restaurants and supermarkets) and some exports to neighboring islands. Fishers primarily sell their catch to vendors, and to the fish processing establishment.

The Issues

The issues associated with the fisheries in Grenville, Grenada, are numerous and multifaceted. These issues include, but are not limited to, poor data collection, lack of adequate knowledge and information sharing for management, poor and unhygienic handling of catch, inadequate cold storage capacity, unregulated pricing, and lack of markets. These issues are not separate and distinct but are cross-cutting and linked to each other. The information and knowledge sharing, and the marketing issues, are the focus of this paper as described below.

Inadequate information for management and knowledge sharing — Generally, the information, data, and knowledge for the much needed informed decision-making and management, and inputs into certain development planning have been inadequate if not lacking in Grenada. This is a symptom of inadequacies at the local levels such as in Grenville, where there is evidence of poor data collection practices, and inadequate knowledge and information exchange between resource users and Government officials. Not enough is known about the status of stocks. Despite the availability of catch statistics, the reliability and accuracy of the data is questionable. Observations at the GFMC revealed that a significant portion of the landed catch is not recorded as some fishers do not bring their fish to be weighed and recorded by the data clerks, but instead take it directly to be sold on the roadside away from the market complex. In addition, there is species misidentification and lack of proper classification of species at Grenville (staff of Fisheries Division Pers. comm.). Certain species of the oceanic, coastal pelagic and reef fishes landed are recorded as miscellaneous or lumped together and are not separated into individual species. This has obvious implications for the quality and reliability of data for determining stock status and for informing management decisions at national and international levels

In addition to inadequacies with fisheries data, fishers' local ecological knowledge is not always adequately harnessed if at all by Government. Despite the presence of a Fisheries Officer at Grenville, his duties and responsibilities are many, and limited resources preclude any meaningful and regular communication with fishers and other resource users, except when necessary or when there are conflicts to be addressed. Despite efforts mainly through informal and personal sharing of management advice and knowledge exchange between the Fisheries Officer and fishers, other resource users and the community in general, local ecological knowledge of fishers does not seem to get into decision-making fora at the national, regional or international levels. One forum that comes to mind is that of International Commission for the Conservation of Atlantic Tunas (ICCAT), which has responsibility for the management of tuna and tuna-like species. Ironically, fishers in Grenville are not even aware of ICCAT, but decisions taken by ICCAT to limit catches (for example calls for Grenada to reduce landings of Atlantic blue marlin (*Makaira nigricans*), Atlantic white marlin (*Tetrapturus albidus*), and Atlantic swordfish (*Xiphias gladius*) to their 1996 levels) will more than likely threaten livelihoods and investments of fishers and others in Grenville where there are already little alternative employment opportunities.

Apart from the above, there are various other constraints associated with the creation, production, dissemination and availability of information and knowledge, as well as its effective use and sharing, for informed decision-making and ensuring that the public is adequately informed. However, a discussion of these is beyond the scope of this paper.

Marketing of fish — Grenville has a modern Fish Market Complex comprising an administrative office, vending stalls, fish cleaning area, ice maker, cold storage, landing pier/jetty, docking and locker facilities. Nearby are a gas station and a gear and tackle shop. The Fish Market is the sole outlet for fish for the entire parish of St. Andrews and even for persons from St. Patrick's and as far as St. David's. Every year after the first few weeks of the ocean season, the cold storage space in the Grenville Fish Complex is full to capacity. Fishers target the seemingly abundant blackfin tuna (bonita) in addition to dolphin and kingfish. The result is a glut of these species on the market. In response, vendors respond by not purchasing fish or reducing price paid per pound of fish to fishers

claiming that they have no additional space for storage, and money is tied up in previous purchased inventory.

Despite this situation fishers do not opt to reduce effort, and continue to fish and then land and sell their catch directly to consumers on the roadside away from the Fish Complex, bypassing the vendors. The catch is sold to the public consumer at drastically reduced prices or at the wholesale price usually reserved for vendors. By doing so, they have the make a larger profit since they sell lower than the retail price, but higher that what the vendors would have normally paid them. As a result vendors suffer from a marked reduction in sales because they maintain their retail price, and with the existing preference by consumers for fresh fish rather than frozen fish, the inventory held by vendors in the cold rooms moves very slowly. Fishers have complained that they made efforts to reduce their wholesale prices offered to vendors, but vendors do not reduce their retail over the counter prices. As a result there is conflict between the fishers and vendors, as well as the market complex administrators since fishers break the rules of the marketing system put in place by the Fisheries Division. Fishers with the assistance of several unemployed youths assisting fishers to sell their catch (called fish touts locally) are said to be involved in an illegal activity by selling on the roadside and without the required health certificates. Health concerns have surfaced since the conditions that fish is offered for sale to the public is less than desirable. Fishes sold by the roadside are gutted by unkempt makeshift cleaners and washed with seemingly contaminated seawater, and are sold in the open sunlight, without any ice. Despite the practice of selling fresh fish on the road side, conducted under very unhygienic conditions, the buying public (consumers) still capitalizes on the opportunity to buy cheap and so-called 'fresh' fish. Having to find alternative retail market for themselves, fishers complain that government is not doing enough to help find additional markets.

Networks and Key Players

The network of stakeholders regarding information and knowledge sharing in the fisheries at Grenville is shown in Figure 2. The network comprises actors at the local level such as Fishers, Vendors, Market Manager, Supervisor, Data Collectors and the Fisheries Officer; the Fisheries Division and the Ministry of Health at the national level, to regional and international organizations in the likes of Caribbean Regional Fisheries Mechanism (CRFM), ICCAT, Western Central Atlantic Fisheries Commission of the United Nations Food and Agricultural Organization (FAO/WECAFC) and Convention on International Trade in Endangered Species (CITES). The majority of the actors and ties are concentrated at the local level.

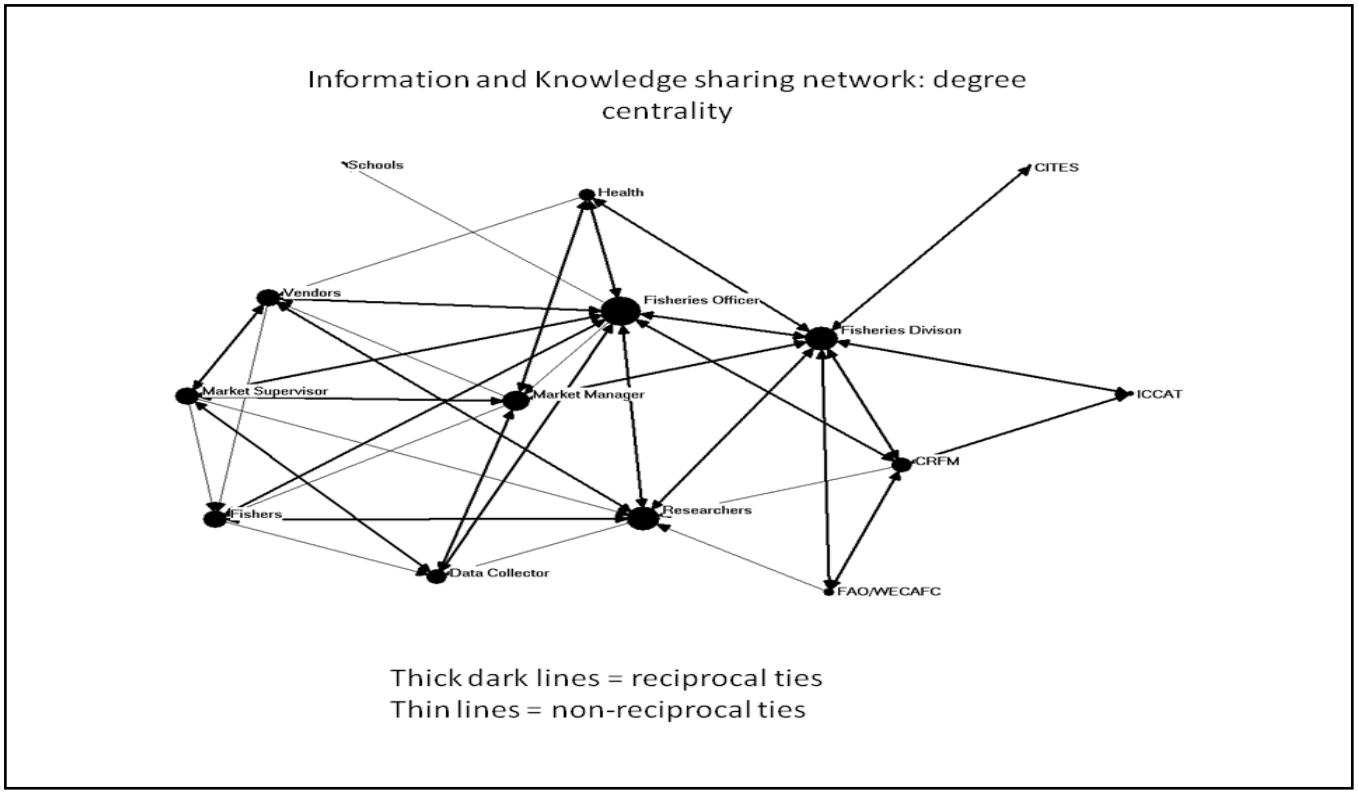

Figure 2. Network map showing degree centrality of the information and knowledge sharing network regarding fisheries in Grenville, Grenada

It was not my intention in this paper to analyze why there are issues with poor data collection and inadequate information sharing linkages e.g. between local fishers and decision-making bodies, but rather to determine who would be influential in perhaps improving the situation. Who then are the key players that one needs to target for addressing the issues regarding information and knowledge sharing in Grenville described above based upon their perceived levels of influence?

Figure 2 also indicates the degree centrality analysis, highlighting the actors with the greatest number of direct ties to many other actors in the network (larger sized nodes). A quick scan suggests that the network for information and knowledge sharing as a whole comprise several actors with varying degrees of centrality (unequal distribution of centrality), rather than a single central actor. However, it does suggest that certain actors are more central than others (namely the Fisheries Officer, the Fisheries Division, and researchers (students from UWI and other Universities). These three actors seem to have highly "favored" structural positions regarding flow of information and knowledge. Because of their greater number of direct ties to the other actors they can be seen as having more opportunities and alternatives than other actors for either receiving or spreading information or knowledge. For example, hypothetically if the Market Manager elects to not provide the Fisheries Officer with information for some reason or the other, the Fisheries Officer has a number of other actors who he can approach to get what he requires.

A deeper analysis of the ties that go into and out of a particular actor (a variation of the degree centrality measurement using Linton Freeman's approach (see Hanneman and Riddle 2005) reveals that the Fisheries Officer and the Fisheries Division (Government) have the greatest number of ties going out to others (out-degrees), and might be regarded as the most influential (though it might matter to whom they are sending information). The Fisheries Division, sending information to regional and international decision-making bodies and Fisheries Management Organizations, would be regarded as influential. The Fisheries Officer is sending information mostly to others at the local level in the network (Fishers, vendors etc.) and he is the brokering link between these and the Fisheries Division at the national level. One would argue that these government actors would obviously be influential, but at the community level these may not always be regarded as influential, since they may not be trusted or they may not be able to garner support from others. This does not seem to be the case here. These two actors are joined by Researchers when the number of incoming ties (in-degree) is examined. This suggests that a number of other actors share information with these three, and might be construed as recognition by others that these are influential, or that they can be trusted, or it might be a desire on the part of others to exert influence on these. It is perhaps then worthwhile to focus attention on these central actors as a first step in working towards improving information and knowledge sharing in Grenville.

Figure 3 is the same network of stakeholders regarding information and knowledge sharing in the fisheries at Grenville, but showing the betweenness centrality. An examination of Figure 3 and actors' betweenness centrality, indicated by the size of nodes, also confirms that the Fisheries Officer, the Fisheries Division and Researchers are still central in the network and remain in favored positions to the extent that they fall on the geodesic paths between other pairs of actors in the network. That is, more actors at the local level depend on these three actors to make connections with others at all levels, hence the more influence these actors have. If however, two actors are connected by more than one geodesic path, and one of the above three central actors is not on all of them, then that actor loses some influence. This seems to be the case with the Fisheries Officer and the Researchers as they do not always fall on the path linking local level actors to regional and international level actors. Closer examination of the network map (Figure 3) reveals these two actors as having a diminished level of betweenness centrality (depicted by size of node) when compared to their degree centrality. The Fisheries Division is the main broker of information between the local and national levels and the regional and international levels.

A modification of the degree centrality analysis approach that has been widely accepted as superior to the original measure is that of Phillip Bonacich (Hanneman and Riddle 2005). The original degree centrality (Freeman approach) argues that actors who have more connections are more likely to be very influential or perhaps "powerful" because they can directly affect more other actors. This makes sense, but having the same degree does not necessarily make actors equally important. Phillip Bonacich therefore argued that one's centrality is a function of how many connections one has, and how many connections the other actors in the network neighborhood had. The more connections the actors in a particular actor's neighborhood have, the more central that actor is. The fewer the connections the actors in an actor's neighborhood, the more powerful that actor is. In other words, being connected to connected others makes an actor central, but not powerful, but ironically, being connected to others that are not well connected makes one powerful, because these other actors are dependent on that actor, whereas well connected actors are not. This analysis is performed by examining the marketing related network below.

Figure 4 is the network of actors and its degree centrality analysis regarding who communicates with whom in the marketing of fish in Grenville. Fishers, Market Supervisor (MS), Market Manager (MM), Fisheries Officer (FO), and Spice Isle Fish House (SIFH) appear to be the central actors with the most connections. Vendors, Health, The Fisheries Division, and Consumers have some level of centrality as well.

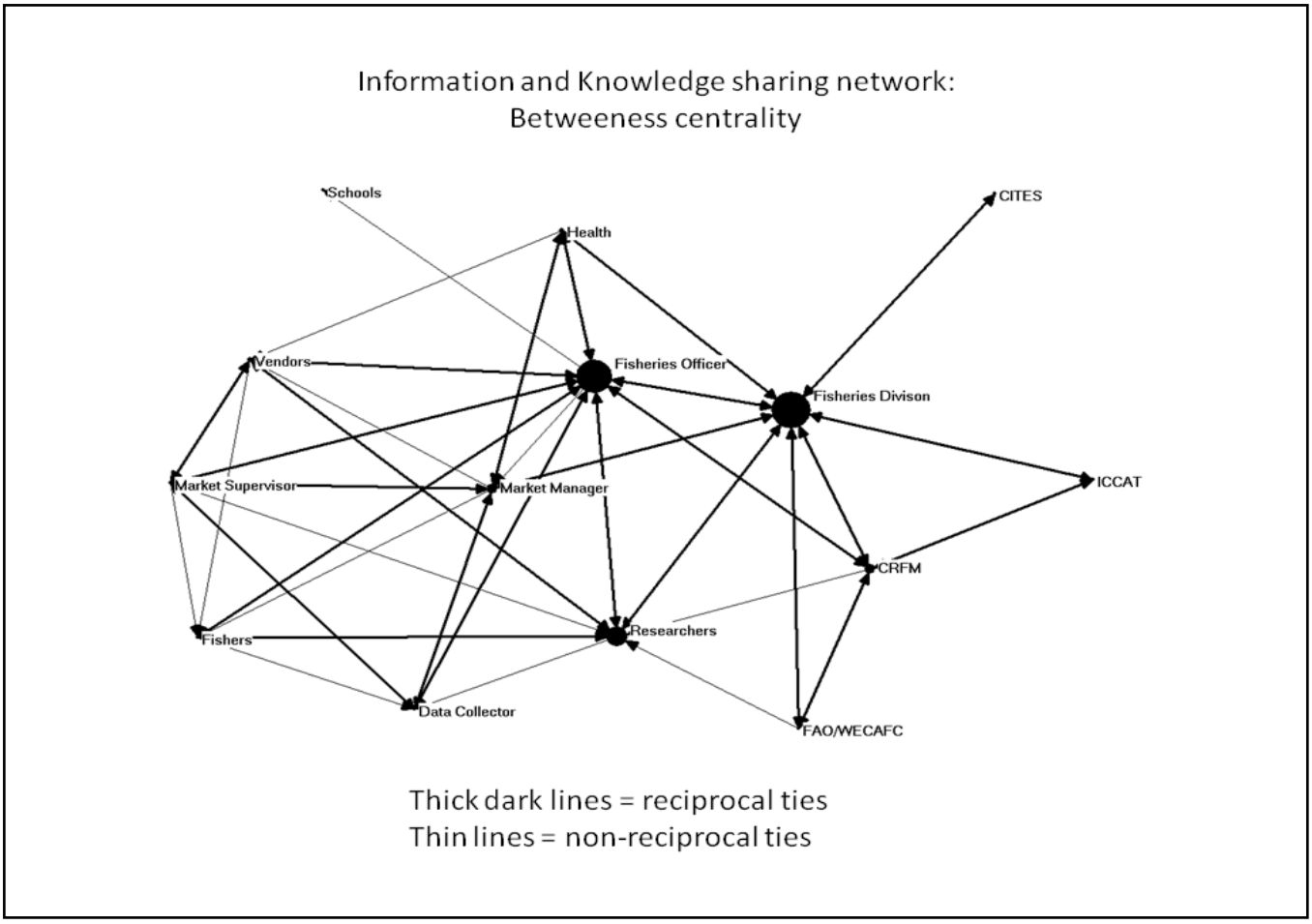

Figure 3. Network map showing betweeness centrality of the information and knowledge sharing network regarding fisheries in Grenville, Grenada

Analyzing degree centrality by using Bonacich's influence/power analysis in UCINET 6.0 reveals an interesting situation. Table 1 is the results of this analysis. The analysis distinguishes the Fishers, the Vendors, the Market Manager, and the Fisheries Division because their ties are mostly ties to other actors with high degree. They are therefore not perceived as having power or great influence in the issue. They are "weak" since they are connected to actors who are themselves well connected according to Bonacich's measure of degree centrality and power. The Fisheries Officer, the Market Supervisor, Cleaners, Health, Consumers, and the Police have more ties to actors who themselves have fewer ties to other actors, making them "strong" by having weak neighbors. This makes sense, because for example, observations revealed that the Fisheries Officer, the Market supervisor have good rapport or informal relations with fishers, vendors etc. and can be useful in influencing change in behavior or assisting in solving the issue regarding marketing of fish in Grenville. The Police and the Ministry of Health because of their legal mandate to enforce laws concerning health measures and illegal selling on the road they are surely powerful key players in the issue, but at the moment are not significantly involved in solving the issue. The consumers have more ties with weakly connected others. This again makes sense as they have been driving the issue to an extent in that they have been purchasing fish from fishers, touts etc. regardless of the illegality of the practice by fishers or without worry about health ramifications, but because it is cheap and so called fresh fish.

Reviewing the network diagrams (Figures 3 and 4) and Table 1 also shows some individuals/ actors that are not playing central roles. These include data collectors in the information and knowledge sharing network and hotels, supermarkets, other processors, the fish touts and country vendors in the communication network regarding marketing of fish, and can also be considered as important players and targeted for dealing with the respective issue/situation.

Table 1. Actor power in the communication network for the marketing of fish in Grenville Grenada, using Bonacich's degree centrality analysis of influence and power.

Actor Power			
Negative weights = actor connected to well connected others		Positive Weights = actor connected to weakly connected others	
Fishers	-2.286	FO	10.286
Vendors	-11.429	MS	12.000
Gill	-4.857	Cleaners	10.857
Touts	-4.857	Health(Hlth)	14.286
MM	-12.0	US Markets	1.286
Country Vendors	-4.857	Hotels	1.286
SIFH	-0.571	Supermarkets	1.286
FishDIV	-8.000	Restaurants	1.286
		Police	3.429
		Consumers	16.000

CONCLUSIONS

The analysis performed was very basic and limited to the extent that I mapped networks based only upon who communicated with whom in the respective issues. A stronger analysis could have examined frequency of communication, and the nature of the communication, etc. Barring this limitation of the study, the analysis performed in mapping the networks and examining actors' and the network degree and betweenness centrality as a whole have revealed several key players critical to the respective issues. Social network analysis methods therefore do provide some useful tools for addressing one of the most important aspects of dealing with any issue in natural resource management i.e. identifying key players and their social structure by a measure of their sources and distribution of influence or power. The network perspective suggests that the influence or power of individual actors is not an individual attribute, but arises from their relations with others. Whole social structures may also be seen as displaying high levels or low levels of influence or power as a result of variations in the patterns of ties among actors. I have applied and tested two basic approaches to identifying key players and their influence by measuring centrality of individuals' positions, and some elaborations on each of the two main centrality ideas of degree and betweenness. These approaches are by no means exhaustive. The question of how structural position confers influence and power remains a topic of active research and considerable debate (Hanneman and Riddle 2005). As revealed by this paper, different definitions and measures can capture different ideas about where influence and power comes from, and can result in some rather useful insights about key players and the social network structure of an issue in natural resource management.

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