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Network analysis of two stakeholder organisations involved in the governance of the fishing industry of Trinidad and Tobago

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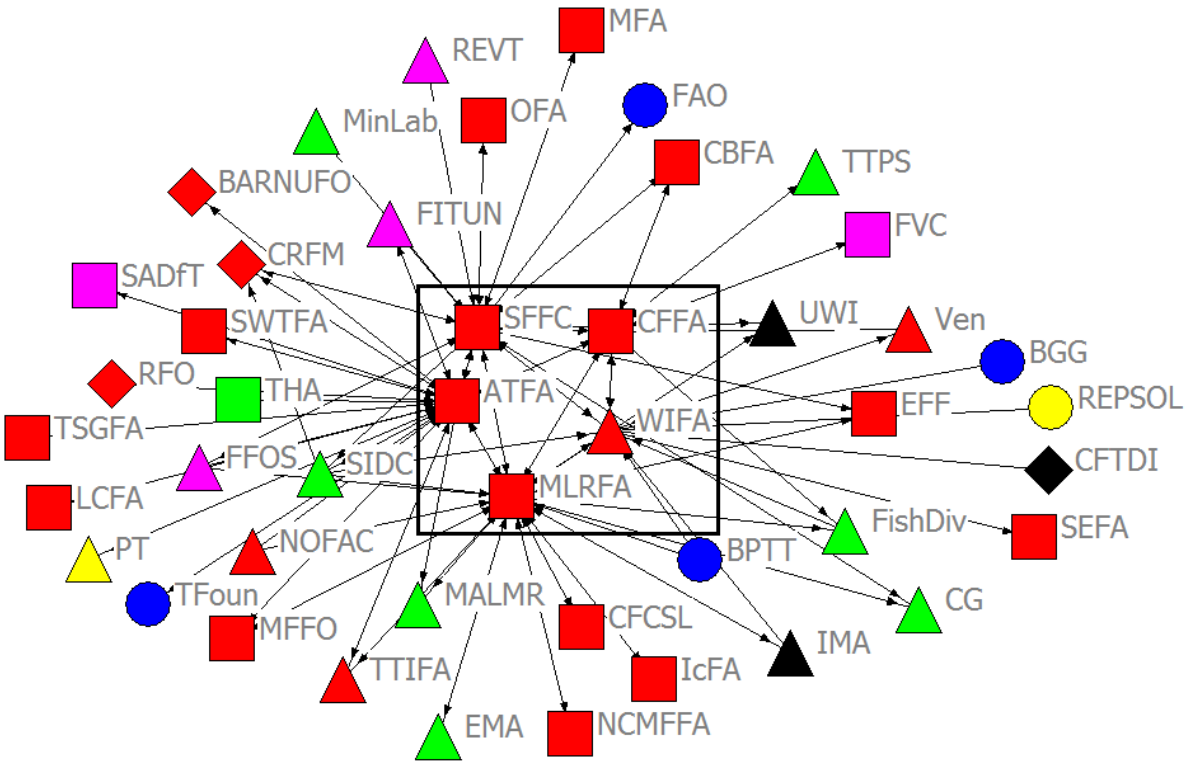

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ABSTRACT

In 2008, researchers collected data on the Monitoring and Advisory Committee on the Fisheries of Trinidad and Tobago (MAC) and the Trinidad and Tobago Unified Fisherfolk (TTUF) organisation to determine the characteristics of networks that are relevant to resilience and adaptability of fisheries governance. The research also examined the kinds of interventions and governance structures that have been effective in enhancing adaptive capacity and enabling self-organisation. The MAC is a Cabinet-appointed body that includes both direct and indirect stakeholders of the fishing industry, while the TTUF is the umbrella organisation that represents the primary fisherfolk organisations of Trinidad and Tobago. The study used social network analysis metrics such as density, network centralisation, degree centrality and homophily to investigate whether the networks of both organisations had features that facilitated resilience.

Keywords: adaptive management, fisheries, governance, resilience, social network analysis, Trinidad and Tobago

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ACRONYMS AND ABBREVIATIONS

ATFA	All Tobago Fisherfolk Organisation
BARNUFO	Barbados National Union of Fisherfolk Organisations
BGG	British Gas Group
BPTT	BP Trinidad and Tobago
CAU	Canadian and American Universities
CBFA	Claxton Bay Fishing Association
CDB	Caribbean Development Bank
CFCSL	Cedros Fishing Co-operative
CFFA	Cacandee/Felicity Fishing Association
CFTDI	Caribbean Fisheries Training and Development Institution
CG	Coast Guard of Trinidad and Tobago
CIDA	Canadian International Development Agency
COPE	Council of Presidents of the Environment
CRFM	Caribbean Regional Fisheries Mechanism
CTA	Technical Centre for Agricultural and Rural Cooperation ACP - EU
CUSTOMS	The Customs and Excise Division
EFF	Erin Fishing Association
EMA	Environmental Management Authority
EMB	Embassies
FAO	Food and Agriculture Organisation of the United Nations
FFC	National Monitoring Committee on Foreign Fishing and Related Matters
FFOS	Fishermen and Friends of the Sea
FFPI	Fish and Fish Processing Industry
FishDiv	Fisheries Division (T&T)
FITUN	Federation of Independent Trade Unions and Non–governmental Organisations
Forestry	Forestry
FVC	Felicity Village Council
GFATT	Game Fishing Association (T&T)
GFFO	Guayaguayare Fisherfolk Organisation
GNV	Guardia Nacional Venezuela
GVC	Guayaguayare Village Council
ICCAT	International Commission for the Conservation of Atlantic Tunas
IcFA	Icacos Fishing Association
IMA	Institute of Marine Affairs
IMM	Immigration Division of Trinidad and Tobago
LCFA	Las Cuevas Fishing Association
LPCC	La Pastora Community Council
MAC	Monitoring and Advisory Committee on the Fisheries of Trinidad and Tobago
MALMR	Ministry of Agriculture, Land and Marine Resources
MFA	Marabella Fishing Association Ltd.
MFFO	Mayaro Fisherfolk Organisation
MinFA	Ministry of Foreign Affairs

MinLab	Ministry of Labour
MIPED	Mayaro Initiative for Private Enterprise Development
MLRFA	Moruga/La Ruffin Fishing Association
MOE	Ministry of Energy
MOH	Ministry of Health
MOW	Ministry of Works
MSD	Maritime Services Division
NAMDEVCO	National Agricultural Marketing and Development Corporation
NCMFFA	North Coast Multipurpose Fishing Association
NEPA	National Environment and Planning Agency, Jamaica
NOFAC	National Organisation of Fishing and Allied Cooperative Society
OFA	Otaheite Fishing Association
OGITT	Oil and Gas Industries in TT
OSHA	The Trinidad and Tobago Occupational Safety and Health Authority and Agency
PC	Petro Canada
PT	Pan Trinbago
Quarries	Quarries
RBTT	Royal Bank of Trinidad and Tobago
RDF	Regional Directors of Fisheries
REPSOL	Repsol YPR
REVT	Revival Time (church)
RFO	Regional fisherfolk organisations
SADfT	Stakeholders Against Destrution for Toco
SEFA	South East Fishing Association
SEL	Seafood Express Limited
SFFC	San Fernando Cooperative Society Limited
SIDC	Seafood Industry Development Company
SWTFA	South West Tobago Fishermen's Association
TFoun	Travel Foundation
THA	Tobago House of Assembly
TSGFA	Toco/ Sangre Grande Fishing Association
TSL	Trinidad Seafood Limited
TTCOC	Trinidad and Tobago Chamber of Commerce
TTIFA	Trinidad and Tobago Industrial Fishing Association
TTPS	Trinidad and Tobago Police Service
TTUF	Trinidad and Tobago Unified Fisher Folk
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USEPA	US Environmental Protection Agency
UTT	University of Trinidad and Tobago
UWI	University of the West Indies
Ven	Vendors (fish and fishing industry suppliers)
WASA	Water and Sewerage Authority
WB	World Bank

WIFA	Women in Fishing Association
WRA	Water Resources Agency

1 BACKGROUND

In 2008 both the Monitoring and Advisory Committee on the Fisheries of Trinidad and Tobago (MAC) and the Trinidad and Tobago Unified Fisherfolk (TTUF) participated in the management of Trinidad and Tobago's fishing industry. This report contributes to understanding the kinds of interventions and governance structures that have been useful in enhancing adaptive capacity.

1.1 Context for fisheries governance in Trinidad and Tobago

Trinidad and Tobago (T&T) lies on the southernmost tip of the Caribbean archipelagic arc (see **Error! Reference source not found.**). It is the only oil and gas exporting country in the aribbean. Fisheries in T&T contribute little to the energy-dominated Gross Domestic Product (GDP); in 2005 it was estimated that fisheries contributed 0.09% to the total GDP and 10% to the agriculture, forestry and fishery GDP (FAO 2004; SIDC 2008). Despite this fact, the government has recognised the importance of fisheries to the general nutrition and food security of the country with the industry being among one of seven sectors earmarked for development in 2007 (SIDC 2008; Mallalieu 2011).

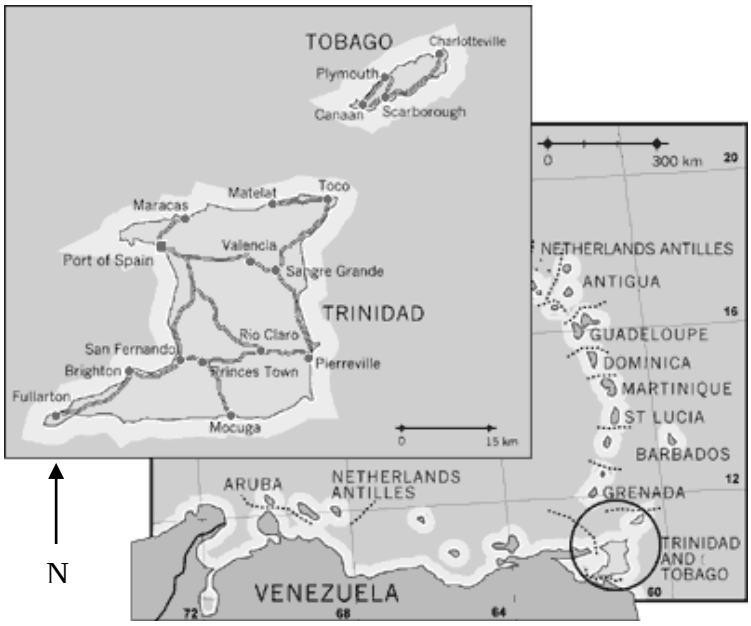

Figure 1 Map of Trinidad and Tobago

Approximately 75-80% of fishing in T&T is artisanal in nature (in small, open fishing vessels up to nine metres in length). Semi-industrial and industrial fishing fleets also fish within Trinidad and Tobago's Exclusive Economic Zone (EEZ). Most of the fish caught are large pelagics such as dolphinfish (*Coryphaena hippurus*) and kingfish (*Scomberomorus cavalla).* Shrimp (*Penaeus notialis*) are caught in Trinidad but not Tobago. Flyingfish (*Hurudichthys affinis*) represents the bulk of the fishery in Tobago (FAO, 2004).

The Fisheries Division (FishDiv) in Trinidad has overarching legislative responsibility for the management of fisheries in T&T. In 2008, it was housed within the Ministry of Agriculture, Land and Marine Resources (MALMR) that, following the 2010 general elections, became the Ministry of Food Production, Land and Marine Affairs. The Tobago House of Assembly (THA) Act of 1996 granted responsibility to the THA for the management of the fisheries in that island. The THA designated management of the fishing industry in Tobago to the Department of Marine

Resources and Fisheries within the then Division of Agriculture, Marine Affairs and the Environment which has subsequently changed name to the Division of Agriculture, Marine Affairs, Marketing and the Environment. The Ministry of Food Production, Land and Marine Affairs maintains responsibility for licensing all fishing vessels and fishers in both islands but day-to-day management of the fishing industry in Tobago is the responsibility of the THA.

The fishing industry is governed by several instruments including the Fisheries Act Chapter 67:51 and the Fishing (Assistance) Act 1955 Chapter 85:03 that provides subsidies to fishers to purchase fishing gear and offers rebates on fuel. The Fisheries Division is legislated to implement the regulations and policies regarding the fishing industry in T&T. There is no legislation at present that prescribes formal stakeholder involvement in fisheries governance. However, in 2008 stakeholder participation in fisheries management was formally facilitated through two organisations- the MAC and the TTUF.

1.2 Key organisations in governance

The MAC was a Cabinet-appointed multi-stakeholder organisation established in 1997 in response to the conflicts that arose between the trawlers and the artisanal fishers along the North Coast of Trinidad. The artisanal fishers protested that trawling activities were destroying the seabed and thus their source of livelihood. The MAC reported to and was funded by the MALMR. It was chaired by the FD which also provided secretariat support. The FishDivprovided each MAC member with a stipend to financially support attending meetings (Leid 2008).

The MAC played an advisory role in the fishing industry in 2008. It made recommendations based on advice from its various stakeholders. Recommendations were then submitted to the Minister with responsibility for the MALMR through the FishDiv (see Figure 2 for the relationship between the two organisations). The MAC advised the MALMR on changes to fishing regulations such as those regarding gear specification, zoning and operation of the trawlers. It reviewed the Draft National Marine Fisheries Policy and liaised with the energy companies to pay compensation to fishers who were affected by the energy companies' activities. The MAC worked with other governmental agencies such as the Urban Development Company of Trinidad and Tobago (UDeCOTT) to discuss impacts to the fishing industry in various development projects. The MAC provided space for sharing information relating to the fishing industry (Leid 2008).

The MAC met with mixed success with most of the success occurring at the inception of the organisation. Several recommendations were legally adopted but they were not always enforced. The MAC for example, recommended a ban on monofilament nets that became effective in 2000. Several fishing communities protested this ban and the ban was never effectively enforced (Leid 2008).

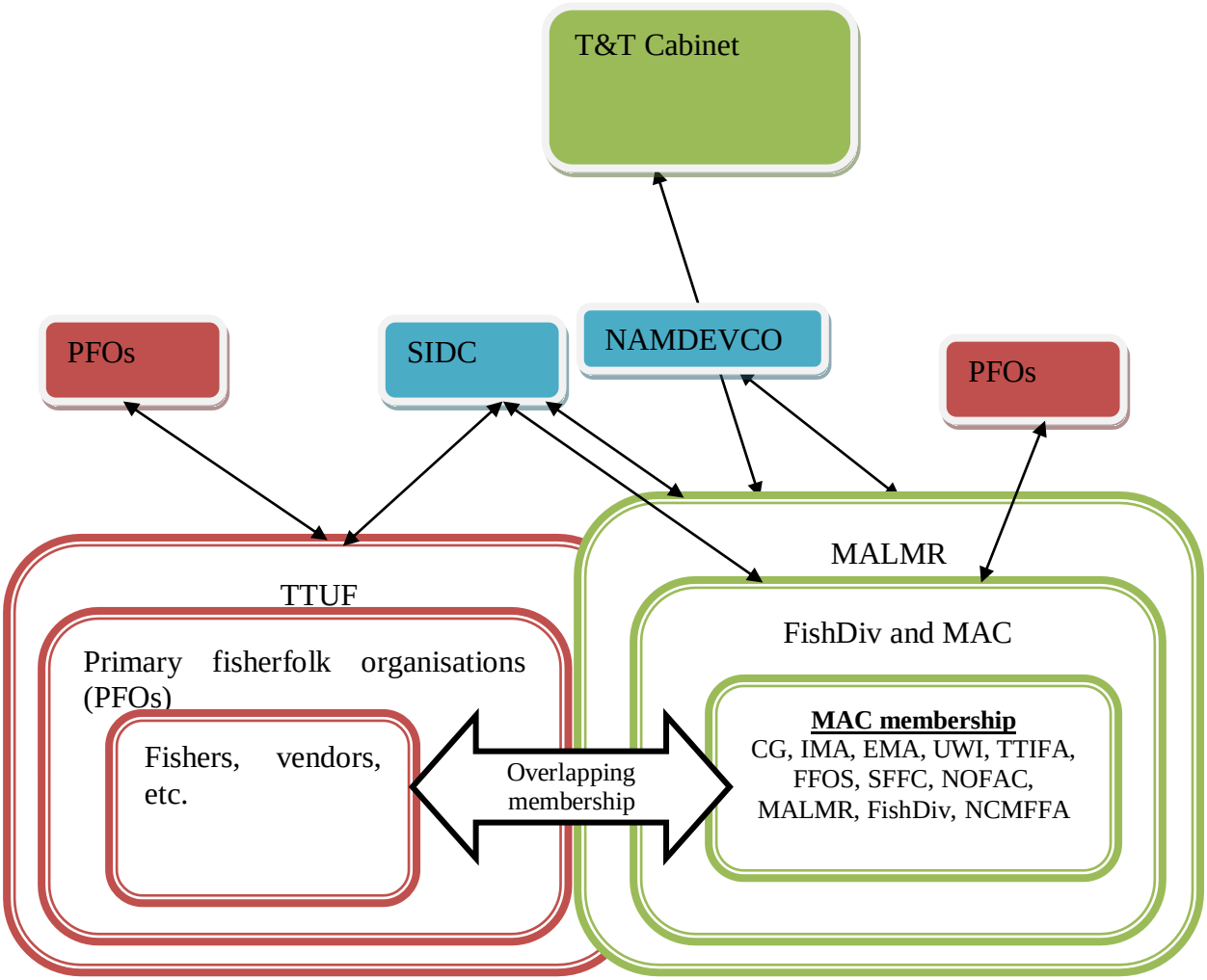

Figure 2 Relationship between TTUF and MAC in 2008

In 2008, there were 12 members of the MAC representing fishers, government agencies, non-governmental organisations (NGO) and research institutions. Table 1 shows that seven organisations represented government organisations and research institutions while the remaining five organisations represented the fishing industry. Four were industry NGOs and one was a more general fisherfolk and marine environmental NGO. Leid (2008) reported that after a dispute arose among the MAC members over the non-payment of meeting attendance stipends, the Cabinet-appointed body was not convened for a period of time while the matter was investigated. The Cabinet did not re-appoint some of the fisherfolk organisations after the MAC was reconvened. The fisherfolk organisations were disappointed and believed that it was critical to establish an umbrella organisation that represented primary fisherfolk organisations in T&T.

Leid (2008) reported that several fishers on the MAC were concerned that since the FishDiv chaired the MAC there was a tendency to use the MAC to implement FishDiv's policies. This was compounded by the need for ministerial approval for all the MAC's recommendations. Many of the fishers believed that the Chair should have rotated among members. They also argued that they were not privy to the recommendations that went to the Minister for approval.

Leid (2008) reported however, that the Director of Fisheries at that time believed that it was important that the Fisheries Division retained chairmanship of the MAC since the government had at heart the best interest of all the stakeholders and that the "fisherfolk representatives on the MAC [opposed] many of the management measures that the Committee wanted to institute".

In 2010, the MAC was formally disbanded after the general elections in T&T. The Cabinet did not appoint a new MAC. The Draft National Marine Fisheries Policy has recommended forming a Fisheries Advisory Committee to replace the MAC. The FAC should have wider representation of stakeholders in the fishing industry (Leid, 2008).

Table 1 MAC members in 2008

Name	Organisation	Role	Stakeholder category
Ann Marie Jobity	Fisheries Division, MALMR	Chairman	Government
Michelle Picou-Gill	Fisheries Division, MALMR	Secretary	Government
Salim Gool	San Fernando Fishing Cooperative Society Ltd (SFFC)	Member	Fisher
Joslyn Lee Quay	National Organization of Fishing and Allied Cooperative Ltd. (NOFAC)	Member	Fisher
Rosemarie Kishore	Institute of Marine Affairs (IMA)	Member	Government
Cecile Mc Clean	Fishermen and Friends of the Sea (FFOS)	Member	NGO
Gregory de Souza	Environmental Management Authority (EMA)	Member	Government
Terrence Beddoe	North Coast Multipurpose Fishing Association. (NCMFFA)	Member	Fisher
Indar Ramnarine	University of the West Indies (UWI)	Member	Research
Bruno Maharaj	Trinidad & Tobago Industrial Fishing Association (TTIFA)	Member	Fisher
Zin Mark- King	Trinidad & Tobago Coast Guard (CG)	Member	Government
Natasha Hosein	Legal Unit, MALMR	Legal Officer	Government

(Source: Leid 2008)

The TTUF is the national fisherfolk organisation (NFO) that represents primary fisherfolk organisations (PFOs) in T&T. PFOs are location-based cooperatives and associations that lobby for issues affecting their livelihoods. TTUF is a legally designated non-profit company under the Companies Act of 1995 and held its first Annual General Meeting in December 2007. At that time TTUF indicated that it hoped to support the PFOs to develop their business activities and liaise with the government and other organisations on matters relating to the fishing industry (SIDC 2008).

Several attempts to establish an umbrella fisherfolk organisation in T&T had failed in the past. Leid (2008) reported that the fishers believed that previous failures were caused by lack of organisation and disunity among the fishers.

Leid (2008) reported that some of the members of the TTUF Board who were interviewed as part of the initial data collection were members of the MAC who were excluded when it was

reconvened after the dispute over the non-payment of stipends. They believed that the MAC did not represent the interests of the fishers (only four out of twelve MAC members represented PFOs). They also believed that it was necessary to have an umbrella organisation that would represent the PFOs and their members in T&T on matters affecting the fishing industry (Leid 2008).

TTUF represents the PFOs at various national consultations and offers advice to the fishers. TTUF is also the point of contact for the regional fisherfolk organisation, the Caribbean Network of Fisherfolk Organisations (CNFO) that was initiated in part to lobby for the rights of fisherfolk in the region. TTUF has no formal role in fisheries governance in T&T but is recognised as the national fisherfolk organisation and is consulted with as such.

1.3 About this research

The purpose of the study was to determine:

a) the characteristics of networks that are relevant to resilience and adaptability of fisheries governance; and
b) the kinds of interventions and governance structures that have been effective in enhancing adaptive capacity and enabling self-organisation.

This study was funded by the small grant component of the Marine Resource Governance in the Eastern Caribbean (MarGov) project that seeks to understand marine resource governance related to the small-scale fisheries and coastal management using complex adaptive system (CAS) and social-ecological system (SES) perspectives. The MarGov project is implemented by the Centre for Resource Management and Environmental Studies in the University of the West Indies, Cave Hill Campus (Centre for Resource Management and Environmental Studies 2010).

Preliminary findings from the study were presented in a poster at the 62nd annual meeting of the Gulf and Caribbean Fisheries Institute in 2009 (see Appendix 1 for a reduced image).

2 METHODS

Information for this project was originally collected in 2008. The Caribbean Natural Resources Institute (CANARI) also carried out an exercise in 2011 to determine the currency of the information collected three years ago. On both occasions, but especially the first, the researchers conducted formal interviews and informal discussions with the Board members of the MAC and the TTUF. The data were analysed using UCINET 6 with NetDraw (Borgatti et al. 2002) software mainly in 2009 and 2010.

Several technical terms are used throughout the document. These are explained in Table 2.

Table 2 Key terms used in the research

Term	Explanation
Adaptive capacity	Ability of a social-ecological system to cope with new situations without losing options for the future (Resilience Alliance 2002)
Adaptive management	A management approach designed to address and reduce uncertainty to effectively achieve management goals and objectives (Murray and Marmorek 2004).
Complex adaptive systems	Systems that are made up of many different elements that can adapt and learn as they interact (Holland 2006)
Density	The number of actual ties as a proportion of the total possible number of ties in a network

Term	Explanation
	(Cheliotis 2006).
Homophily	Contact between similar people or organisations occurs at a higher rate than contact between dissimilar people or organisations (Cornell Info 2040 Networks 2007)
Key players	Key players are those that are most important for the network to function. They are the lynch pins that control the flow of information and resources through the network (Cheliotis 2006).
Network centralisation	Degree to which the network is centred around a few nodes (Cheliotis 2006)
Nodes	Organisations, groups, people etc. in the network. E.g. ATFA is a node in the network. Nodes are also called actors (Cheliotis 2006).
Resilience	Ability for an organisation/ecosystem to undergo change and still function and to build and increase the capacity for learning and adaptation (Resilience Alliance 2002)
Social network	People/groups/organisations (actors) and their relationships/interactions (ties) with each other. The actors and ties produce a social network.
Ties	Connections or interactions in a social network (Cheliotis 2006).

2.1 Formal interviews

The researchers used a structured survey instrument to interview eight of the 12 members of the MAC and all five members of the TTUF Board. The remaining four members of the MAC were unavailable during the data collection period in 2008.

Each interviewee was asked to indicate the name of a person and his/ her organisation he or she was in contact with. The questionnaires sought to elicit the type and nature of the exchanges or interactions and the frequency and formality of these interactions to determine the relationships among the nodes. Some interviewees were unable to answer questions about the frequency and formality of their exchanges as these interactions were neither documented nor clearly recalled. These are missing data. The questionnaire is shown in Appendi 2.

2.2 Data analysis

This research used social network analysis (SNA), which seeks to map the relationships that exist among groups, people or organisations to discern patterns of interactions (Cheliotis 2006). The main features of network maps are the links and nodes or actors. The research examined the two networks by measuring indicators of adaptive management of natural resources and by discussing the relationship of these to resilience of the organisations. The features of adaptive management, their meanings and link to social network structure are shown in Table 3.

The research looked at the types of organisations that were participating in the networks and the types of exchanges or interactions occurring among the organisations ("ties"), focusing on the flow of information and resources in and out of the networks. These can later help to determine the type of interventions that will be necessary to ensure more effective and resilient networks.

Table 3 Features important for adaptive management of natural resources and the ways in which they are linked to the social network structure metrics

Adaptive management feature	Significance of social network metric
Social memory - Collective memory or experiences to be used in times of change and uncertainty	Density – many links to others in the networks
Heterogeneity - A diversity of many types of actors or actors with collective knowledge base and increased capacity for innovation and maintenance of different knowledge systems and frameworks for interpretation	Homophily- High homophily reduces the potential for innovation and increases information redundancy among actors
	Density - High density may have a negative effect on heterogeneity by promoting homogeneity of experience and attitudes among actors and reduces the potential for innovation
Learning - Knowledge about ecosystems can be continuously increased and improved, and thereby governance and management function	Centrality- A high degree of centrality may give rise to centralised management and thereby fewer experiments and experiential learning
Trust - Co-management is facilitated by trust among actors	Density – many links foster feelings of belonging and group identity
Adaptive capacity - New knowledge and/ or changing conditions require adaptive capacity and innovation to meet new needs	Centrality- Coordination ability, which is important in times of change and rapid response, increases with centrality
	Density – Too many links may lock an actor into a particular position (because of peer pressure for example) thereby limiting the actor's ability to act or innovate.

Adapted from Bodin et al (2006)

The analysis was completed using the UCINET/NetDraw software package to graphically represent the scope of interactions in the two networks and looked at various measures. These are shown in Table 4.

Table 4 SNA parameter and method of calculation

Parameter	Description	Method of calculation
Network Structure		
Density	Density measures the number of ties or interactions in a network over the potential number of ties (Cheliotis 2006). The optimal density varies by network. Can be used to determine the strength of the networks.	Calculated by counting the number of ties in the network.
Determining key players		
Homophily	A measure of likeness or similarity among the organisations. It is based on the premise that like organisations choose to interact with each other more than dissimilar organisations (Prell et al, 2007).	Calculated by looking at the E-I index which is "the number of ties external to the groups minus the number of ties that are internal to the group divided by the total number of ties. The values range from 1 to -1, where -1 represents perfect homophily (Borgatti et al. 2002).

Parameter	Description	Method of calculation
		Homophily was calculated for the types and scale of operation of the organisations in both networks.
Degree centrality	The degree of centrality indicates how many links a node has (Freeman 1979). This measure can be applied to individual nodes or the whole network. A high degree of centrality for an individual node indicates that it has many links compared to other nodes. Centrality for the whole network indicates the tendency in the network for a few actors to have many links, e.g. a wheel-star structure.	Calculated by counting the number of connections in and out of the network.
Network centralisation	Determines "the degree to which the network is centred around a few central nodes" (Hagen et al. 1997)	
Characteristics of the ties		
Type of exchange	The study classified the type of exchange as being information, resource or both. Information is any intangible being exchanged such as being told that a meeting is taking place. Information on markets, laws, news, prices, issues, research, policy and new technologies were included in this category. Resource was classified as a tangible exchange such as giving the use of an office for a meeting. These included capital, technical and legal resources.	Calculated by counting ties coded as information, resource or both.
Nature of the exchange	Nature of the exchanges was a further classification of the information and/ or resources and were classified as technical, scientific, both technical and scientific, financial and other.	Calculated by counting the ties that were coded as technical, scientific, financial, both technical and scientific and other.

2.3 Validation of 2008 data in 2011

In March 2011, CANARI held a validation exercise with the interviewees. The original researcher from 2008, Simone Leid, also attended the meeting. CANARI presented the findings from the 2008 research and asked the interviewees to validate the results or suggest where updates were necessary. CANARI attempted to invite all 12 interviewees from 2008 but not all could be reached in time to attend the meeting. CANARI made several attempts to engage those interviewees who could be reached via telephone in conversations but they were busy.

A few persons were no longer with the organisation they represented in 2008 (e.g. Ann Marie Jobity of the Fisheries Division) or the organisation had disbanded (e.g. Joslyn Lee Quay of the National Organisation of Fishing and Allied Cooperative Society). CANARI however, believed that it was important to invite the original interviewees to the meeting. Attending the meeting were:

- All Tobago Fisherfolk Organisation (Emile Louis);
- Fisheries Division (Michelle Picou-Gill);
- National Organisation of Fishing and Allied Cooperative Society (Joslyn Lee Quay);
- San Fernando Fisherfolk Cooperative (Salim Gool); and
- Trinidad and Tobago Industrial Fishing Association (Bruno Maharaj).

2.4 Limitations of the study

The major limitation of the study was the incompleteness of the questionnaires. Because the interviewees were not all able to answer all the questions, the data did not yield as many answers as it did new research questions. For example, the study was not able to adequately address the question of frequency of communication that can be used to determine the speed of communication and the network's ability to respond to changes. Alters were not questioned about their communication with the egos in the networks. Such information can improve our understanding of the resilience and adaptability of both the MAC and TTUF.

3 RESULTS AND DISCUSSION

By 2011, the new T&T Cabinet had not appointed a new MAC. The FishDiv representative at the validation exercise reported that the T&T government was considering the formation of a Fisheries Advisory Committee (FAC) to replace the MAC. It is not clear if the composition of the new FAC would differ from the last MAC. FishDiv and its parent ministry continued to make decisions regarding the fishing industry without the advice of a formal multi-stakeholder organisation. FishDiv maintained informal relationships with several organisations in the former MAC that continued to offer advice. Since several organisations belonged to both networks, FishDiv also maintained informal access to information and resources in the TTUF network despite the absence of the formal multi-stakeholder body.

TTUF continued to play an advocacy role in the fishing industry in T&T. TTUF had re-elected the Chairman of the Board for another term as the head of the organisation. Several of the TTUF members at the meeting, and in brief conversations, indicated that they were dissatisfied with the direction of the organisation. They believed that the TTUF was not a vocal advocate of the fishers. The San Fernando Cooperative Society Limited (SFFC) representative for example, believed that the TTUF should have supported the fishers in San Fernando by standing beside them as they burned tyres in protest of the water taxi between Port-of-Spain and San Fernando that they believed affected their fishing activities. The members also believed that only a few persons made the decisions in the organisation. Several persons at the meeting indicated that they were still members of TTUF but that they no longer attended meetings.

The Chairman of TTUF expressed concern that the T&T government did not respect the TTUF. He indicated that the government was responsible for providing a home for the national fisherfolk organisation. The Chairman firmly believed that TTUF should follow the example of Pan Trinbago (the steelpan Union organisation in T&T) that was able to organise its members and obtain formal recognition and the respect of the T&T government without the use of violence. This was at odds with the other fishers who believed that TTUF should be more active in advocacy by protesting along with its primary fisherfolk organisations.

3.1 Network structure

The information from the questionnaires was used to produce network maps. These are shown in the Figures 3 and 4 below. The organisations were coded using different colours to represent the

type of organisation (yellow for fisherfolk, green for government agencies, etc.). Shapes represent the scale of operation (circles for international organisations; squares for local organisations, etc.). The organisations belonging to TTUF and MAC were placed in a box in their respective networks.

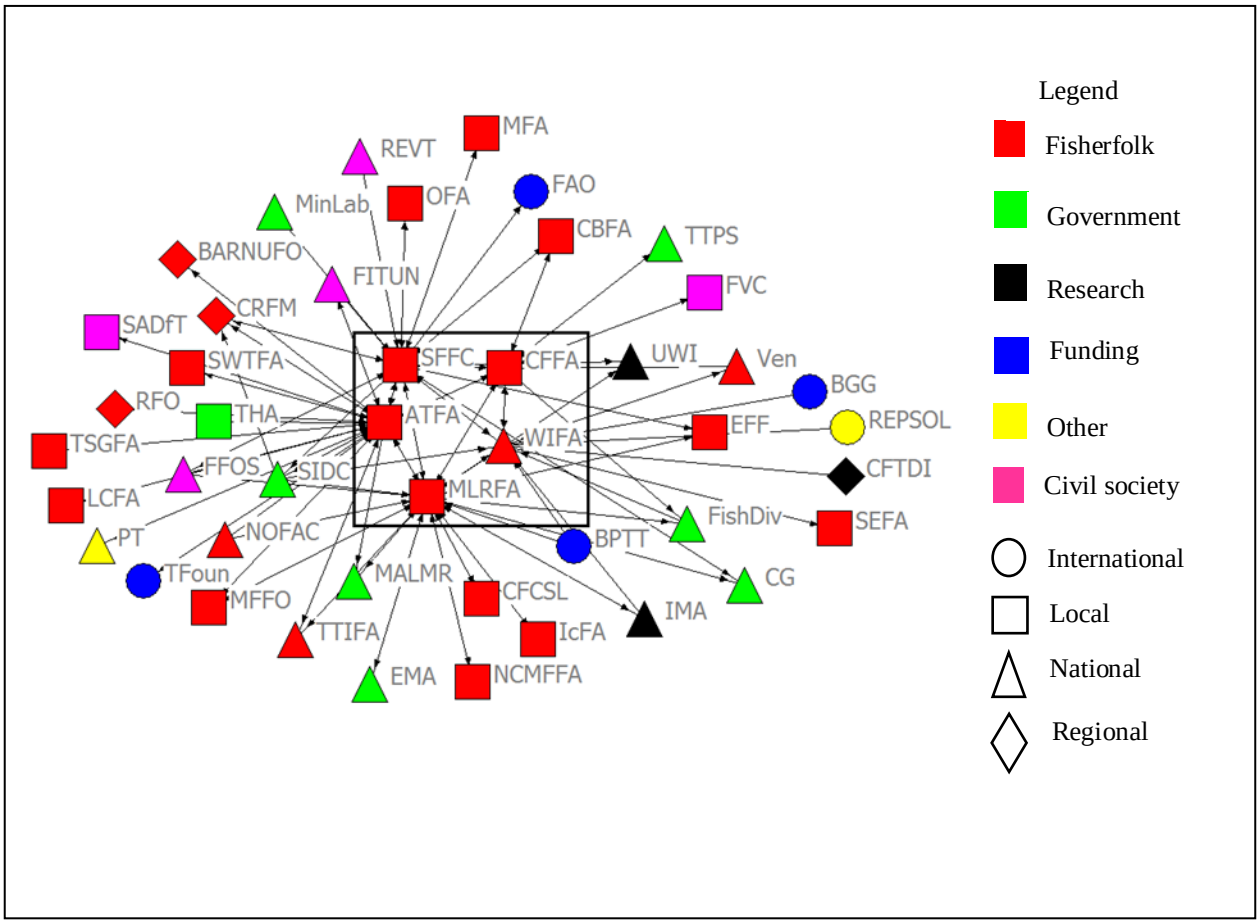

Figure 3 The TTUF network

There were 69 nodes and 224 ties in the MAC network. The MAC network shows that there were many different types of organisations interacting with the MAC. Most of the organisations operated on the national scale. Many of the interactions were reported as bi-directional.

Many of the organisations in the TTUF network were, as expected, fisherfolk organisations. Several of these organisations operated at the national and the regional scales. Many of the interviewees reported that there was two-way communication between pairs. There were 45 nodes and 118 ties in the TTUF network.

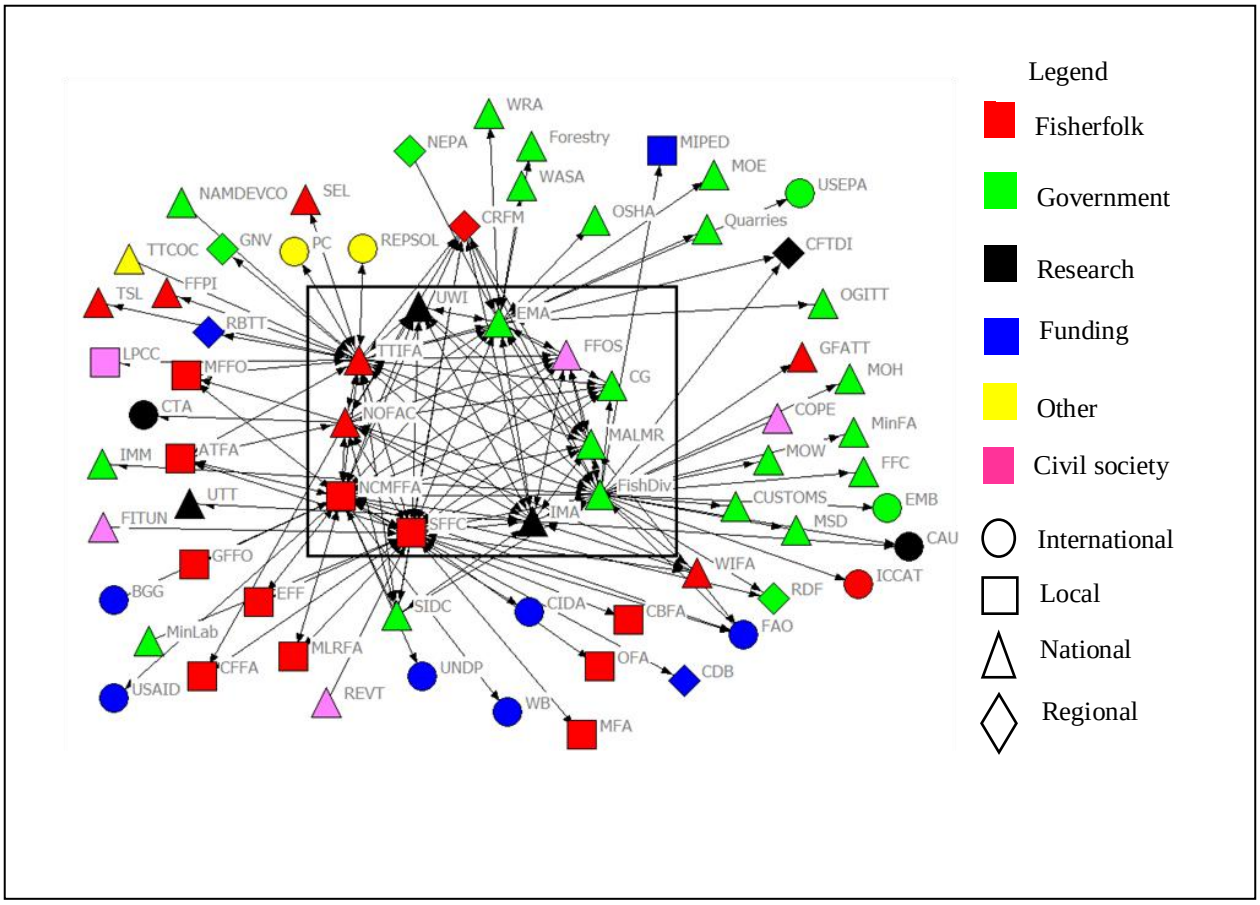

Figure 4 The MAC network

3.1.1 Density

The density recorded by both organisations was low, especially for small networks. TTUF's density at 0.0596 (nearly 6%) was slightly higher than that of MAC at 0.0482 (nearly 5%).

Low density can provide clues to the functioning of the network. Researchers have found that networks with low densities can have high costs of collaboration and low flow of information and resources through the networks since there are fewer avenues for communication. Researchers have found that there were higher incidences of mistrust among members in networks with low density (Bodin et al, 2006).

In the 2011 validation exercise several TTUF members indicated that they believed that TTUF was ineffective at representing the fishers in the way they believed they needed to be represented. They said that the current leadership of TTUF should be more vocal in advocating the rights of fishers. They argued that TTUF should look at other models to determine the most effective for TTUF. This indicated that there was some lack of trust among the TTUF members.

During the original data collection, Leid (2008) found that several former members of the MAC who were members of the TTUF believed that the MAC no longer represented the fishers. This indicated that some of the leading fishers did not trust the MAC. Trust is one of the factors that facilitates both adaptive management and resilience of organisations (Bodin et al. 2006).

It is uncertain if low network density affected the flow of information in the two organisations. Some of the fishers complained that they were not privy to recommendations that went to the Minister for approval despite belonging to the MAC. However, this may be attributed to the formal decision-making process and not necessarily the flow of information in the network.

3.2 Determining key players

Homophily, network centralisation and degree centrality were used to determine the key players in both networks.

3.2.1 Homophily

Box 1 Advantages and disadvantages of high homophily

Advantages

- Like organisations can potentially communicate with each other better. This can lead to strengthened ties and the building of new ties among like organisations (Thomas, 2008).
- There is the potential for less conflicts as there is similar understanding (Prell et al. 2007)

Disadvantages

- Limits to the influx of new information in the network

Lack of diversity can limit the network's adaptive capacity (Bodin et al. 2006)

A cursory look at the network maps in Figures 3 and 4 shows that, as expected, there are more fisherfolk organisations in the TTUF network than in the MAC network. This was verified when calculating homophily in UCINET. Homophily was calculated for the types and scale of operation of the organisations in both networks. The advantages and disadvantages of the high rates of homophily (Table 5) are shown in Box 1.

Table 5 Homophily for MAC and TTUF networks based on type of organisations and scale of operation

Measure	MAC	TTUF
Type of organisation	0.0973	-0.0678
Scale of operation	-0.1062	0.1525

TTUF was established as T&T's national fisherfolk organisation. Primary organisations in its network represented fisherfolk and were fairly similar in aims and membership despite being linked to different geographic locations. Researchers have generally found that the networks with higher rates of homophily have less conflict within the networks (Prell et al. 2007). In 2011 TTUF however reported that there were disagreements among its members regarding the role of the organisation in advocacy and its effectiveness at representing fishers.

In 2008, MAC had a diversity of organisational types in its network, and had experienced several internal conflicts that resulted in the temporary suspension of the multi-stakeholder organisation. This may support the proposition of Prell et al (2007) on homophily.

Researchers have also theorised that homogenous networks may have a limited flow of external information and this reduces the potential of the organisations involved to adapt and be resilient (Bodin et al. 2006). One charge that was repeatedly laid against TTUF in the 2011 validation exercise was that the leaders needed to use other sources of information to determine the best

model to make it effective. The participants argued that TTUF had become stagnant. This may be because the TTUF network was not well connected to sources of new information and ideas.

The E-I index of -0.1062 showed that the MAC network was more homogeneous than the TTUF network when looking at the scale of operation. MAC was created to operate on a national scale and therefore interacts with mainly national organisations. TTUF is not limited in its mandate and can draw on resources from organisations operating on any scale. Many of the organisations outside of Trinidad and Tobago that TTUF interacted with in 2008 were other fisherfolk organisations such as the Barbados National Union of Fisherfolk Organisations (BARNUFO) and regional intergovernmental organisations such as the Caribbean Regional Fisheries Mechanism (CRFM) that were assisting in the formation of TTUF as an umbrella organisation. Although the scale of operation was different, the organisational type was similar, and that may have contributed to the charges of stagnation in 2011.

3.2.2 Network centralisation

Despite the fact that only 12 persons were interviewed in the entire study, it was deemed instructive to look at entire network centralisation so that we can explore the flow of information and resources throughout the networks.

Table 6 Network centralisation in MAC and TTUF

Parameter	MAC	TTUF
Centralisation	19.67%	40.67%

Network centralisation in both networks was relatively low (less than 50%). Researchers have found that if central actors leave a network with low centralisation, the network should continue to function. The network should be able to adapt to the changing environment and be resilient (Bodin et al. 2006).

Leid (2008) reported that the MAC was able to reconvene despite several representatives being asked to leave the multi-stakeholder body. In 2011 several members of the TTUF reported being only peripherally involved in the organisation as they had disagreed with the direction of the organisation, yet TTUF continued to function with several new persons appointed to its Board. It is not certain however, if either organisation remained effective. TTUF members argued that it was not an effective representative of the fisherfolk. A new MAC (or replacement FAC) was not appointed at the time of the validation exercise in 2011.

3.2.3 Degree centrality

The results show that the Fisheries Division (FishDiv), the Trinidad and Tobago Industrial Fishing Association (TTIFA), the North Coast Multipurpose Fishing Association (NCMFFA), the San Fernando Cooperative Society (SFFC) and the Environmental Management Authority (EMA) have high degree centrality in the MAC network while the Moruga/La Ruffian Fishing Association (MLRFA) and All Tobago Fisherfolk Association (ATFA) are the key players in the TTUF network (See Table 7).

The FishDiv recorded the highest degree centrality at 29. It can be argued that because of its position as the government's agency responsible for national fisheries, the Fisheries Division should have the most contacts with the fishing industry's stakeholders.

Table 7 Degree centrality for MAC and TTUF networks

Degree Centrality	MAC	TTUF
<10	All other organisations in MAC	All other organisations in TTUF
10-14	MALMR	WIFA
15-19	NOFAC, IMA	SFFC
>20	FishDiv, TTIFA, NCMFFA, SFFC, EMA	MLRFA, ATFA

The ATFA and the MLRFA were pioneers in TTUF and continued to play a major role in the development of the fisherfolk organisation. This accounted for the high degree centrality of both organisations. Those organisations can quickly coordinate the networks' responses to issues - a feature necessary for adaptive management. One cannot, however, ignore the fact that only those organisations interviewed showed the highest degree centrality of 10 or more in both networks. Wider interviewing may change these results.

One of the main advantages of having high degree centrality is that those nodes act as focal points for the respective networks. These are the prominent organisations in the networks that are strategically placed to influence the flow of information and/ resources and they have the most influence in the network. Over time there is the potential for other actors in the network to resent the influence held by only a select few organisations because of perceived inequalities, potentially weakening the resilience of the networks. There was evidence of resentment towards the Fisheries Division among organisations in the MAC network in 2008 when some of the fisherfolk organisations were excluded from the Cabinet-appointed body partly because of disagreements with the decision-making processes for governance of fisheries in Trinidad and Tobago. Similarly, the high centrality of few organisations in TTUF has the potential to provoke resentment among the organisations in the network. This was observed at a validation exercise in March 2011, which showed that some of the members' organisations resented the Chairman's management of the organisation and that some of the founding organisations no longer actively participated in the management of the TTUF.

3.3 Characteristics of the ties – type and nature of exchanges

The ties were characterised in two ways by type and nature of exchanges.

described the characteristics of ties in terms of applicable metrics and their calculation.

3.3.1 Type of exchange

The results of the type of exchanges shown below in Table 8 demonstrate that most of the exchanges for the both networks were classified as being information.

Table 8 Type of exchanges in MAC and TTUF

Type of exchange	TTUF%	MAC%
Information	68	85
Resource	14	7
Information/Resource	18	9

One possible explanation for the unequal flow of information and resources in the MAC network could be because the MAC was charged with distilling information in such a way that it can be used to advise policy in the fishing industry. TTUF had the additional function of seeking to manage and expand the organisation and so exchange of resources was as information in its network.

3.3.2 Nature of exchange

The results presented in the Table 9show that most of the exchanges occurring in both networks were technical. Both stakeholder organisations represented fishing interests in T&T in ways that required them to have large amounts of technical exchanges. The MAC had greater scientific exchanges because it sometimes used scientific information to make policy recommendations. The MAC for example, based the ban on monofilament nets in 2000 on scientific research that showed that monofilament nets were detrimental to the coastal marine fishery (Leid, 2008).

Table 9 Results of the nature of exchange in both networks in percentages

Nature of exchange	TTUF%	MAC%
Technical (Exchange of information/ resource dealing with fishing)	78	67
Scientific (Research-based information or resource)	4	14
Financial (Exchange of resources dealing with money)	8	2
Technical/ Scientific (A mix of both research and technical information)	2	7
Other (Any other type of exchange that does not fit in the above categories)	8	10

4 CONCLUSIONS

The study has shown that both MAC and TTUF had some characteristics of adaptive capacity. Several, tentative and preliminary, conclusions can be drawn about the functioning of networks in fisheries governance in T&T given the limitations of the data set.

By 2008, several former MAC members had formed the TTUF partly because of dissatisfaction with the decision-making in the MAC. Actors who are dissatisfied with their networks tend to form new networks and organisations if they have the capacity.

All networks are subject to conflict that can cause the dissolution of networks or organisations if not properly managed. Conflicts can also make the network less effective. The MAC faced several internal conflicts that resulted in the organisation not functioning for a period of time before re-convening. It is unclear if the MAC had any effectiveness after re-convening. Several members of TTUF indicated there were conflicts within the TTUF and that they were no longer formally involved in the organisation. Training in conflict management, as part of building adaptive capacity, can help networks to be become both more resilient and effective in fisheries governance.

Both the MAC and the TTUF were formed as the result of conflicts. The MAC was formed out of the need to resolve the conflicts between the trawlers and the artisanal fishers in the North Coast of Trinidad. TTUF was formed partly because of conflict within the MAC and the need to form a national fisherfolk organisation. The MAC was not able to sustain the early successes that it achieved in managing the conflict that it was formed to resolve nor has TTUF been able to remain an active presence as some fishers demand in fisheries governance in T&T. Networks that are formed because of conflicts may not always sustain their activity once the conflict has been managed.

Information is important to the functioning of the networks. Effective communication channels can be used to manage conflicts and make the networks more effective in fisheries governance. Enabling legislation and policy that allows for stakeholder involvement in fisheries governance can assist in information flow through networks.

Much more needs to be researched to understand the governance networks in Trinidad and Tobago. This small research project served to demonstrate the analytical potential of social network analysis as a means of investigating fisheries governance.

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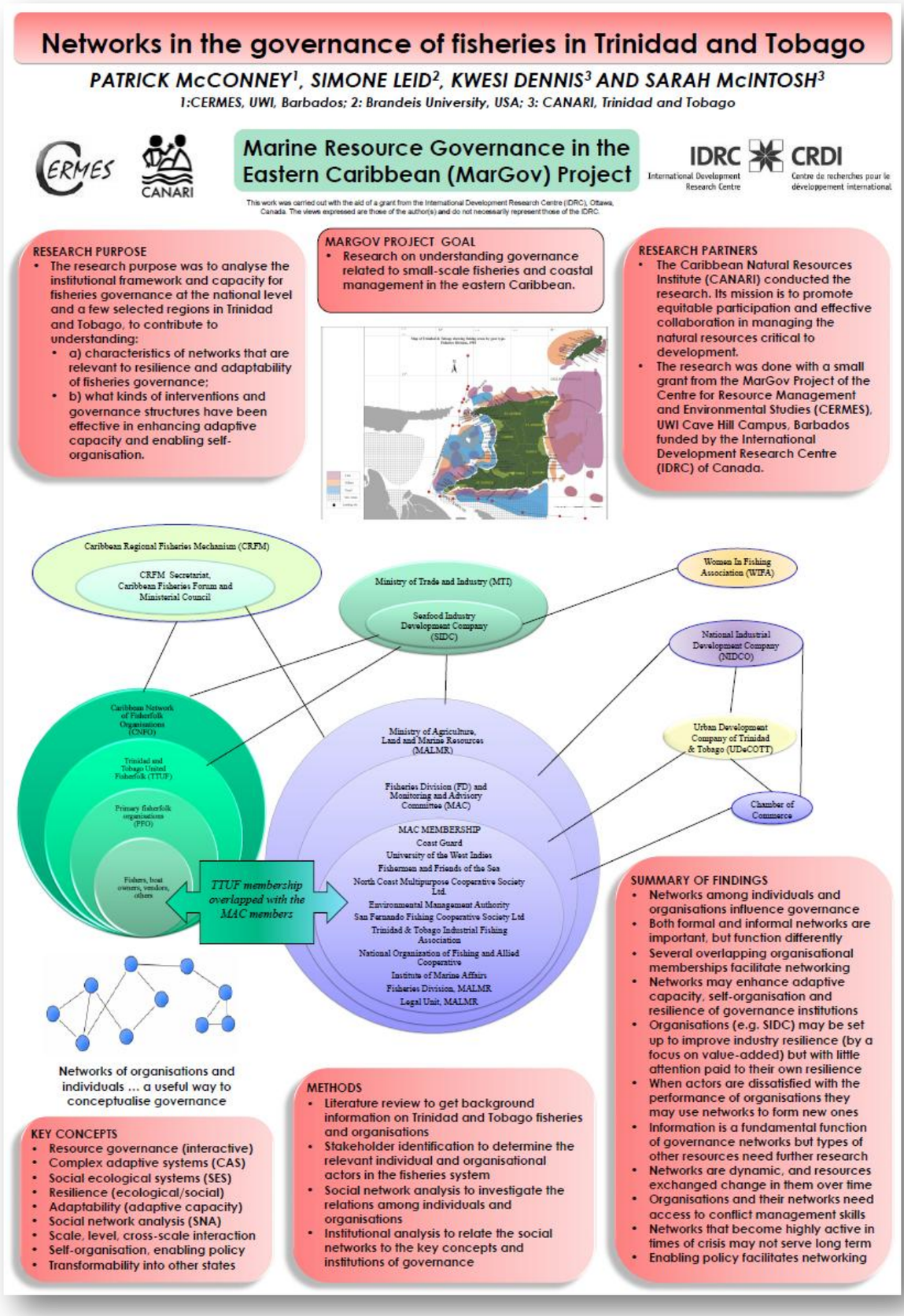
6 APPENDICES

6.1 Image of the 2009 GCFI poster



6.2 Questionnaire for the fisherfolk network

Name	Education level/ Profession -
Organisations/ position held	Affiliations/ Associations

Name (contact)	Organization (contact)	Attribute (business / NGO/PFO)	Relationship to contact (Friend, co-worker, board...)	Level Local National Regional International	Tie – (type of exchange) Information or Resource Identify nature of exchange (technical, scientific, financial)	Direction of exchange > to contact < from contact	Frequency 1 - weekly 2 - monthly 3- yearly	Importance 1-not very imp 2- import 3-very imp	Does this contact have relationship with any other on this grid? Y/N Who?