Report of the

NATIONAL CONSULTATION in TRINIDAD and TOBAGO CASE STUDY ON SHARED STOCKS OF THE SHRIMP AND GROUNDFISH FISHERY OF THE GUIANAS-BRAZIL SHELF

Chaguanas, 13 September 2012




Caribbean LME Project

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CASE STUDY ON SHARED STOCKS OF THE SHRIMP AND GROUNDFISH FISHERY OF THE GUIANAS-BRAZIL SHELF

Report of the National Consultation in Trinidad and Tobago

Chaguanas, 13 September 2012

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2013

CASE STUDY ON SHARED STOCKS OF THE SHRIMP AND GROUNDFISH FISHERY OF THE GUIANAS-BRAZIL SHELF

FAO implemented a "Case Study on Shared Stocks of the Shrimp and Groundfish Fishery of the Guianas-Brazil Shelf" (UNGF/INT/001/OPS) between July 2011 and February 2013, with six participating countries (Brazil, French Guiana (EU/France), Suriname, Guyana, Venezuela and Trinidad and Tobago). The case study was carried out within the framework of the GEF-funded Caribbean Large Marine Ecosystem (CLME) Project. The CLME Project aims at assisting Caribbean countries to improve the management of their shared living marine resources, most of which are considered to be fully or overexploited, through an ecosystem approach. A preliminary Transboundary Diagnostic Analysis identified three priority transboundary problems that affect the CLME: unsustainable exploitation of fish and other living resources, habitat degradation and community modification, and pollution.

The purpose of the case study of the Shared Stocks of the Shrimp and Groundfish Fishery of the Guianas-Brazil Shelf was to fill knowledge gaps, contribute to the final CLME Transboundary Diagnostic Analysis and to the Strategic Action Programme (SAP), with priority actions to be undertaken to ensure the sustainability of the shrimp and groundfish fisheries. Another objective was to mainstream the Ecosystem Approach to Fisheries (EAF) in the management of shrimp and groundfish fisheries. Both objectives were addressed through assessments/studies at the national and regional levels, with the participation of stakeholders and following some of the key steps of the planning process within an EAF framework.

PREPARATION OF THIS DOCUMENT

This is the report of the national consultation organized by the Fisheries Division of the Ministry of Food Production of Trinidad and Tobago, in collaboration with FAO and the Caribbean Regional Fisheries Mechanism (CRFM), held in Chaguanas, Trinidad on 12 September 2012. The report contains a summary of the discussions held during the national consultation, the results of a scoping exercise that was carried out by the participants, as well as the baseline report that was discussed and agreed upon by the stakeholders. The organizers are grateful to all workshop participants for their input into the report and to all resource persons for their presentations and summaries provided for this report.

CASE STUDY ON SHARED STOCKS OF THE SHRIMP AND GROUNDFISH FISHERY OF THE GUIANAS-BRAZIL SHELF
Report of the National Consultation in Trinidad and Tobago, Chaguanas, 12 September 2012
*CLME Case Study on Shrimp and Groundfish - Report.*No. 8 -, Rome, FAO. 2013. 207 p.

ABSTRACT

This is the report of the national consultation organized by the Fisheries Division of the Trinidad and Tobago Ministry of Food Production, in collaboration with FAO and the Caribbean Regional Fisheries Mechanism (CRFM), held in Chaguanas, Trinidad on 12 September 2012. The consultation was organized as part of the Case study on the shared stocks of the shrimp and groundfish fishery of the Guianas-Brazil Shelf of the Caribbean Large Marine Ecosystem Project. The meeting was attended by representatives of the governmental agencies (fisheries, environment, energy, cooperative development), fishing processing companies, artisanal and industrial fisherfolk, NGOs, fisherfolk organizations, Universities, CRFM, and FAO.

Participants were provided with an overview of the CLME Project and the case study on shrimp and groundfish. A general overview of the key principles of the Ecosystem Approach to Fisheries was provided. The baseline report was presented and participants provided inputs and comments. Prior to the national consultation, four community consultations were held in Cacandee, Otaheite, Erin and Moruga to identify and prioritize issues occurring in the fishery. The results of these consultations are presented in detail in the report. The issues were discussed and validated during the national consultation; actions suggested by the stakeholders to address these issues were also discussed during the meeting and are reported at the end of the document.

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1. BACKGROUND

This National Consultation was organized in the framework of the Caribbean Large Marine Ecosystem (CLME) Case Study on the Shrimp and Groundfish fisheries of the Guianas-Brazil shelf. It was attended by 173 participants belonging to fisherfolk organizations, fishing industry, nongovernmental organizations, governmental organizations, academic institutions and regional or international organizations. The list of participants is in Appendix 1, and the agenda in Appendix 2.

The CLME Project is a four-year project (May 2009 to April 2013) involving 23 countries in the region and funded by the Global Environment Fund (GEF) with the aim of facilitating management reforms that will promote sustainable development and effective management of their shared living marine resources, most of which are considered to be fully or over-exploited. The CLME Project has conducted a transboundary diagnostic analysis which has identified three priority transboundary issues, namely, unsustainable exploitation of fish and other living resources; habitat degradation and community modification; and pollution. The Project is in the process of developing a Strategic Action Programme (SAP) to address these issues.

The Shrimp and Groundfish Case Study which is just one of the six case studies and pilot projects under the CLME Project, was implemented by the Food and Agriculture Organization of the United Nations (FAO) in collaboration with the Caribbean Regional Fisheries Mechanism (CRFM), the Centre for Resource Management and Environmental Studies (CERMES) of the University of the West Indies (UWI) in Barbados, and the Caribbean Natural Resources Institute (CANARI). This Case Study started in July 2011 and ended in December 2012.

The Case Study involves six countries (Venezuela, Trinidad and Tobago, Guyana, Suriname, French Guiana, Brazil) of the Guianas-Brazil continental shelf. The output of the Case Study will feed into the SAP with a shared vision for the region with required priority interventions, reforms and investments agreed to. As part of the SAP, the Project will promote a management and governance framework, based on linked policy cycles at multiple levels.

Each of the six countries participating in the Shrimp and Groundfish Case Study are to host similar national consultations to validate the priority issues (from an ecological, socio-economic and governance perspective) in the fishery and key actions to address them. These priority issues and proposed solutions were to be identified during preparatory meetings with key stakeholders through the establishment of a Task Group. A regional meeting was then held to present the results of national/regional activities for validation and to provide recommendations for inclusion in the SAP.

2. OPENING OF THE NATIONAL CONSULTATION

- ***Opening by the Director of Fisheries (Mrs. Christine Chan A Shing)***

The National Consultation was opened with remarks by the Director of Fisheries, Mrs. Christine Chan A Shing. The Director referred to the 'loss of soul' as it relates to fisheries management which she defined as the insensitivity of stakeholders to their individual responsibility for both the problems and solutions in fisheries, ultimately resulting in the collective breakdown of management systems. She stressed the importance of co-operation, genuine interaction and collaboration among the various stakeholders to the efficient operation of the management system and sustainability of the fishery, particularly since different stakeholders would be affected in a myriad of ways depending on their level and manner of investment in the industry.

The issue of the exploitation of the fuel subsidy, where some have taken advantage of the subsidy for their own benefit, was raised to illustrate how a lack of personal responsibility compromised the legitimacy of a system put in place to aid local fishing communities. The potential fallout is the removal of the subsidy altogether, or the implementation of a quota system.

The Director mentioned the critical role stakeholders have to play in the management process, particularly on finalization of the new Fisheries Management Bill which makes special provisions for this.

In closing, the staff of the Fisheries Division was thanked for their efforts in facilitating the day's proceedings. The Director also reiterated that we could only 'find our souls' through the recognition and acceptance of our responsibilities both in the creation of the problems and in the development of solutions through co-operation and collaboration for the collective interests of the fishery.

- ***Remarks by CRFM (Mr. Terrence Phillips, Programme Manager, Fisheries Management & Development)***

Mr. Phillips opened by expressing his appreciation to the Food and Agricultural Organization (FAO) and the Ministry of Food Production for including the CRFM in the proceedings.

He noted the importance of the shrimp and groundfish fisheries, both commercially and socially, to the shelf region as well as the fully to overexploited status of these resources in general, and hence the importance of incorporating the Ecosystem Approach to Fisheries (EAF) through this project.

Mr. Phillips highlighted some of the features of the EAF and that it should be seen as an evolution of the existing fisheries management systems.

The importance of the current case study to development of the Strategic Action Plan (SAP) was noted.

- ***Remarks by FAO (Mr. Barton Clarke, FAO representative)***

Mr. Clarke opened by stressing the importance of working together to secure the marine resources of the region and livelihoods dependent on them. He indicated that, apart from the CLME Project, the FAO has been working on a number of projects, primarily in the promotion and advocating of the regulation of Illegal, Unregulated and Unreported (IUU) fishing. Mr. Clarke closed by reiterating the need to continue working together to contribute to the wellbeing and growth of the region and to alleviate the symptoms and causes of poverty.

3. PLENARY PRESENTATIONS

1.1 INTRODUCTION TO THE CLME PROJECT AND THE CASE STUDY FOR THE SHARED STOCKS OF THE SHRIMP AND GROUNDFISH FISHERY IN THE NORTH BRAZIL-GUIANAS SHELF

Ms. Tarub Bahri opened by acknowledging and commending the large turnout of stakeholders to the consultation. The scope and objectives of the CLME project were described: 23 countries involved throughout the Caribbean region with the objectives of identifying, analyzing and agreeing on root causes and actions required to achieve sustainable management of the region's fishery resources. This particular case study covered the shrimp and groundfish resources of the Guianas-Brazil shelf and spanned 6 countries: Venezuela, Trinidad & Tobago, Suriname, Guyana, France (French Guiana) and Brazil. It was being implemented by the FAO in collaboration with CERMES, CRFM and CANARI with a budget of US$253,000.00. The Case Study would be the platform for consultations with stakeholders for the identification of problems facing the shrimp and groundfish fishery and the determination of appropriate solutions. As such the Strategic Action Plan (SAP) to be produced by the CLME Project with inputs from the two (2) Pilot Studies and six (6) Case Studies including this Shrimp and Groundfish Case Study would contain institutional and policy reforms to facilitate the derived solutions necessary to achieve sustainability.

1.2 BASIC PRINCIPLES OF THE ECOSYSTEM APPROACH TO FISHERIES

The aim of the EAF approach *"…is to strike a balance by taking into account the knowledge and uncertainty about biotic and abiotic components of the ecosystem and their interactions and applying it to an integrated approach within ecological meaningful boundaries."* The implementation of the EAF occurs in a series of steps:

- The first step is the Initiation and Planning phase where baseline information about the resource is gathered.
- The second step involves the identification of problems conducted through consultation with stakeholders.
- The third step involves the development of management systems.
- The final step involves the implementation and monitoring of management plans.

These steps are carried out on the basis of best available knowledge and in constant consultation with the industry stakeholders. The case study is currently transitioning between the first and second steps with the first national consultation held in Suriname marking the beginning of this transition. The priority issues and key actions are being identified for each country and will be presented at the regional meeting in October 2012. The SAP, with input from the case study, would then be submitted to policy makers for their endorsement. Once endorsed this would set the stage for legal, policy and institutional reforms.

The basic principles of the Ecosystem Approach to Fisheries are defined as the following:

- Ecological relationships between species should be maintained.
- Governance should ensure both human and ecosystem well-being and equity.
- Fisheries should be managed to limit their impact on the ecosystem to an acceptable level.
- Management measures should be compatible across the entire distribution of the resource.
- Precaution in decision-making and action is needed because the knowledge on ecosystems is incomplete.

1.3 WORKSHOP OBJECTIVES AND EXPECTED OUTPUTS

The objectives of the National Consultation were as follows:

- To validate the priority issues (both national and transboundary) for the sustainable management of shrimp and groundfish fisheries, based on the EAF framework
- To identify the key actions required to address the priority issues

The expected outcomes of the National Consultation were as follows:

- EAF Baseline Report presented
- Priority issues validated
- Actions to address priority issues identified and recommendations made

1.4 OVERVIEW OF THE BASELINE REPORT ON THE ECOSYSTEM APPROACH TO FISHERIES FOR TRINIDAD AND TOBAGO

Ms. Lara Ferreira, Fisheries Officer, provided a description of the fleets (vessel and gear types) exploiting the shrimp and groundfish fisheries in Trinidad and Tobago as well as the fishing areas and species targeted and caught. She indicated the numbers of vessels comprising each fleet and the estimated total number of fishers and land-based workers. Shrimp to bycatch ratios and percentage of discards were given for the various trawl fleets. Estimated quantity of landings and ex-vessel value by fleet for shrimp and some major species of groundfish, namely croaker and weakfish were graphically represented. The stock status of the shrimp and major groundfish species targeted by the fisheries was outlined as well as the results of bio-economic assessments of the fisheries and management measures recommended. The results of a UWI -Fisheries Division study on the socio-economic importance of trawl by-catch were also mentioned.

The interactions between the shrimp and grounfish fisheries and other fisheries were highlighted as well as the ecosystem impacts of trawling including the high discard rates and physical disturbance of the seabed. The major findings of a review conducted by the UWI (commissioned by the Fisheries Division and the FAO) on the impact of land-based pollution on the fisheries of the Gulf of Paria and Columbus Channel were presented.

The current management measures and legislation in place for the shrimp and groundfish fisheries were described, and the general policy objectives outlined. Some of the management initiatives including the testing of by-catch reduction devices in the various trawl fleets were also mentioned.

Ms. Ferreira indicated that the EAF baseline report would be disseminated to stakeholders for review and comment.

- ***Clarifications/Questions***

Mr. Gary Aboud of the NGO, Fishermen and Friends of the Sea (FFOS), thanked Ms. Ferreira for her presentation and commended the Fisheries Division but raised several concerns including the following:

- He indicated that the FFOS membership had strong objections to the information presented by Ms. Ferreira and was of the view that there were technical deficiencies in the figures presented referring specifically to the bycatch discards from the various trawl fleets.
- He stressed that trawling is unsustainable and destructive to the marine environment and that alternatives must be found.
- He noted that the fisherfolk from the north coast of Trinidad were not invited to any of the preliminary stakeholder meetings leading up to this National Consultation.

Mr. Terrence Phillips of the CRFM, who chaired this session, thanked Mr. Aboud for his comments and indicated that some of his concerns could be discussed further in the working group sessions later in the day and that the FFOS and all stakeholders would have an opportunity to document their comments on the baseline report presented by Ms. Ferreira when the document is disseminated for review subsequent to the National Consultation.

Mr. Kishore Boodram, President of Claxton Bay Fishing Association and Assistant President of Trinidad and Tobago United Fisherfolk (TTUF) made several comments and expressed some concerns as follows:

- He stressed the issues of pollution in the Gulf of Paria, the destruction of mangroves, and piracy.

- He noted the lack of representation from Tobago as well as industrial companies responsible for pollution in the Gulf of Paria.

1.5 PRESENTATION OF EAF PROCESS & ISSUES IDENTIFIED

Ms. Shandira Ankiah, Fisheries Officer, opened by stressing the importance of the EAF, particularly where it pertains to its potential for maximizing efficient resource utilization and inclusion of the human component.

Differences between conventional management and EAF were drawn to highlight the benefits of the latter over the former.

The EAF framework for the CLME project was described in terms of component trees as a method of simplifying the broad scope of the project.

Ms. Ankiah proceeded to elaborate on the structure of the EAF tree, discussing the hierarchical structure under which issues within the fishery are arranged as components and sub-components of larger aspects.

In closing, the previous community-based consultations were discussed including the locations of said consultations and the method of issue identification and prioritization used. It was stated that this would be the same method to be used later that day to re-prioritize the list of issues.

The process for establishment of the Task Group of stakeholders is attached as Appendix 3; lists of attendees and the agenda for each of the four Task Group meetings are given in Appendix 4; and lists of attendees, priority ranking of issues, and proposed solutions to issues from each of the four community meetings are provided in Appendix 5.

4. METHODOLOGY & OUTCOMES

4.1 Issue identification

The issues identified at the previous Task Group and community-based stakeholder meetings were compiled into a national list, sorted alphabetically and colour-coded according to the EAF component under which they fell. This list was included in the information package provided to each participant at the National Consultation.

The stakeholders (by table) were given some time to review the issues listed and to identify any additional issues. A representative from each table was then given the opportunity to present these additional issues. It was considered by the resource persons from the FAO, CRFM and the Fisheries Division that all suggestions were already covered by the issues previously listed. Some of the suggestions were used to modify/rephrase/expand the existing issues and are captured in the final component tree given at Appendix 7.

4.2 Risk assessment and issue prioritization

Five ranking stations were set up with each station comprising all the issues displayed on the wall (each issue printed on a separate sheet of paper).

Each stakeholder was given five coloured tabs and asked to place one tab only on each of the five issues they considered most critical. Each of the tables were assigned to one of the five ranking stations and, under the supervision of staff of the Fisheries Division, the stakeholders were encouraged to consider all of the issues before making their decisions.

Following the ranking process, a lunch break was taken during which staff of the Fisheries Division took tallies for each station by counting the number of tabs placed on each issue. The total number of

votes for each issue was then calculated by combining the results of all five stations, and the issues ranked in order of priority, with the most critical first. Following the lunch break, the final ranking of the issues (given in Appendix 6) was presented to the stakeholders for their review and validation.

Photo 1: One of the stations at the National Consultation for the ranking of issues in the shrimp and groundfish fishery.

4.3 Proposed actions to address priority issues

Each of the twenty most pressing issues was then assigned to its corresponding table; Table 1 was assigned issue # 1,etc, so that each of the 20 tables were assigned a specific issue . The members of each table were asked to deliberate and propose possible solutions to the assigned issue. The members of each table were given a large sheet of paper and a marker in order to document their solutions which were presented by a selected member of their table at the end of the deliberation. These solutions, as well as those proposed in the previous Task Group and community meetings, were collated along with their respective issues and the final component tree is given in Appendix 7.

Photo 2: Stakeholder presenting her group's proposed solutions to its assigned priority issue.

5. CLOSING REMARKS & NEXT STEPS

Ms. Elizabeth Mohammed, Senior Fisheries Officer, thanked all stakeholders for their participation in the National Consultation and indicated that the day's proceedings would be compiled into a report and disseminated to stakeholders. In addition, she reiterated that the EAF Baseline Report for the Shrimp and Groundfish Fisheries of Trinidad and Tobago, an overview of which was presented by Ms. Ferreira in the morning, would also be disseminated to stakeholders for their review and comments.

The outputs of this and similar national consultations being held in the participating countries on the Guianas-Brazil Shelf are to be validated and inputs to the SAP recommended from this Shrimp and Groundfish Case Study at a regional meeting planned for October 2012. This SAP is to be endorsed by the relevant Ministers in the participating countries of the CLME Project.

Appendix 1: List of participants

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
1	Hudson Roberts	Alcan Bay	Chaguaramas	General	53
2	Horale Parris	Almoorings	-	Banking, a-la-vive	15
3	Dexter Black	Blanchisseuse	Blanchisseuse Fishing Association	Towing, a-la-vive	15
4	Azard Mohammed	Blue River	Blue River Bamboo Cunupia Fishers (BBC) - Pres.	Banking, a-la-vive	42
5	Ahmad Hosein	Blue River	Blue River Bamboo Cunupia Fishers (BBC)	Banking	5
6	Charran Baldeo	Blue River	Blue River Bamboo Cunupia Fishers (BBC)	Gillnet, a-la-vive	33
7	Nawaz Akaloo	Blue River	Blue River Bamboo Cunupia Fishers (BBC)	Banking	6
8	Nazrudeen Akaloo	Blue River	Blue River Bamboo Cunupia Fishers (BBC)	Banking	6
9	Victor Nanan	Cacandee	Cacandee Fishing Association	Net, banking, trawl	10
10	Hardeo Ramsundar	Cacandee	Cacandee Fishing Association	Trawl	25
11	Adesh Simbhu	Cacandee	Felicity-Charlieville Fishing Association	Palangue, banking	16
12	Amal Ramarace	Cacandee	Felicity-Charlieville Fishing Association	Banking, switchering, drift net, a-la-vive	2
13	Chandraka Jairam	Cacandee	Felicity-Charlieville Fishing Association	Banking	25
14	David Bachan	Cacandee	Felicity-Charlieville Fishing Association	Banking, a-la-vive	15
15	Latchman Ramdass	Cacandee	Felicity-Charlieville Fishing Association	Palangue, banking, a-la-vive	12
16	Manniram Tirbanie	Cacandee	Felicity-Charlieville Fishing Association	Trawl	15

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
17	Soomraj Balram	Cacandee	Felicity-Charlieville Fishing Association	Trawl	22
18	Stanley Doon	Cacandee	Felicity-Charlieville Fishing Association	Trawl	20
19	Taju Mahase	Cacandee	Felicity-Charlieville Fishing Association	Trawl	10
20	Tirbanie Tageram	Cacandee	Felicity-Charlieville Fishing Association	Trawl	8
21	Lewis Padarath	Cedros	Cedros Fisherfolk United	Live bait, fish pot, banking, shark palangue	35
22	Donald Dipchand	Cedros/Moruga	Cedros Fisherfolk United	Fishpot, transparent, a-la-vive	32
23	Mary Dipchand	Cedros/Moruga	Cedros Fisherfolk United	Fishpot, transparent, a-la-vive	-
24	Bhadose Sooknanan	Claxton Bay	Claxton Bay Fishermen Association	Drift net, banking	>40
25	Keshore Boodram	Claxton Bay	Claxton Bay Fishermen Association	Transparent, fillet	35
26	Andre Pitilal	Cocorite	Cocorite Fishing Association	Fillet, Transparent	21
27	Diane Christian	Cocorite	Cocorite Fishing Association	Transparent, a-la-vive	18
28	Hubert Phillip	Cocorite	Cocorite Fishing Association	Net	50
29	Jomo Akinyele	Cocorite	Cocorite Fishing Association	Banking, trawl	34
30	Augustin Mahabir	Erin	Erin Fishing Association	Line, net	35
31	Benjamin Fuller	Erin	Erin Fishing Association	Fillet, Transparent	28
32	Courtland Phillip	Erin	Erin Fishing Association	Banking, switchering, transparent, fillet	18
33	Horsford Charles	Erin	Erin Fishing Association	Trawl	35
34	Jude Ready	Erin	Erin Fishing Association	Transparent, fillet	17

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
35	Cecil McClean (Vice-President)	-	Fishermen & Friends of the Sea	-	-
36	Gary Aboud (Secretary)	-	Fishermen & Friends of the Sea	-	-
37	Terrence Beddoe (President)	-	Fishermen & Friends of the Sea	-	-
38	Esook Ali	Fullerton	Fullerton Fisherfolk	Bottom net, banking	50
39	Jerry Padarath	Fullerton	Fullerton Fisherfolk	Bottom, floating net, a-la-vive, palangue	30
40	Kemran Ramcharan	Fullerton	Fullerton Fisherfolk - Pres.	Drift net	20
41	Ramdass Sookram	Icacos	Cedros Fisherfolk United	Shrimp net, a-la-vive, banking	>40
42	Keith Schneider	Icacos	Icacos Fishing Association	Net	35
43	Amitab Mendoza	Icacos	Icacos United Fishermen	Beach seine, banking	7
44	Azim Ali	Icacos	Icacos United Fishermen	Beach seine, banking, shrimp	50
45	Danke Edwards	Icacos	Icacos United Fishermen	Net	20
46	Darryl Ramdeen	Icacos	Icacos United Fishermen	Transparent, trawl, banking, line	15
47	Deonan Bisoo	Icacos	Icacos United Fishermen	Transparent	25
48	Dunan Dissoon	Icacos	Icacos United Fishermen	Trasparent	25
49	Francis Cozier	Icacos	Icacos United Fishermen	Transparent, banking	>20
50	Gary Edwards	Icacos	Icacos United Fishermen	Net	20
51	Goolbahar Mohammed - rep. for Vishal Mohammed	Icacos	Icacos United Fishermen	Seine, a-la-vive, transparent, banking	12
52	Henry James	Icacos	Icacos United Fishermen	Banking, trawl, towing,	45

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
				transparent	
53	Justin Edwards	Icacos	Icacos United Fishermen - Sec.	Transparent	5
54	Kevin Ali	Icacos	Icacos United Fishermen	Beach seine, banking, palangue	6
55	Peter Dookie	Icacos	Icacos United Fishermen	Transparent, trawl, line	44
56	Ragoonanan Bhola	Icacos	Icacos United Fishermen	Transparent, banking, trawl, fillet	43
57	Victor Lemessy	Icacos	Icacos United Fishermen	Net	30
58	Gopaul Balkissoon	La Brea	La Brea Fisherfolk Association	Trolling, banking, diving	30
59	Hugo Learmont	La Brea	La Brea Fisherfolk Association	Trolling, banking	40
60	Inshan Hosein	La Brea	La Brea Fisherfolk Association	Trolling, diving, a-la-vive	15
61	Sherwin Germia	La Brea	La Brea Fisherfolk Association	Transparent, bottom	12
62	Wayne Henry	La Brea	La Brea Fisherfolk Association	General	14
63	Dindial Seepersad	Marabella	Marabella Fishing Association	Banking, trawl, palangue, switchering	28
64	Cathy Ann Samuel	Matelot	King Fishermen	Handline	2
65	Renwick Roberts	Matelot	Kingfishers Association Matelot	Transparent, fillet banking	25
66	Sean Samuel	Matelot	King Fishermen	Handline	8
67	Ancil Mohan	Morne Diablo	Morne Diablo Association	Trasparent	20
68	Danesh Ramnath	Morne Diablo	-	Net	25
69	Kelvin Deonarine	Morne Diablo	Morne Diablo Association	Trawl, banking, net, line, fillet	25

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
70	Ranel Bharose	Morne Diablo	-	Net	20
71	Rawle Bharose	Morne Diablo	-	Net	15
72	Anil Ramadar	Moruga	Grand Chemin Fishing Association	Fillet, transparent, banking, towing, switchering	18
73	Clever Blackwill	Moruga	Grand Chemin Fishing Association	General	35
74	Dkundayo Ochiabuto	Moruga	Grand Chemin Fishing Association	Drift net, banking, switchering	7
75	Guyadwen George	Moruga	Grand Chemin Fishing Association	Trasparent	30
76	Kesher Sinanan	Moruga	Grand Chemin Fishing Association	Fillet, a-la-vive	28
77	Kyle Neptune	Moruga	Grand Chemin Fishing Association	Fillet, transparent	14
78	Lawrence Toussaint	Moruga	Grand Chemin Fishing Association	Fillet, floating net, banking, towing	14
79	Leston Douglas	Moruga	Grand Chemin Fishing Association	Fillet, towing	30
80	Linda Ramdhanie	Moruga	Grand Chemin Fishing Association	Transparent, fillet, banking, a-la-vive	-
81	Melissa Graham	Moruga	Grand Chemin Fishing Association	Transparent, fillet, towing, switchering	5
82	Odmo Ramdhanie	Moruga	Grand Chemin Fishing Association	Transparent, fillet, banking, a-la-vive	15
83	Renny Nicholas	Moruga	Grand Chemin Fishing Association	Switchering, net, fillet	35
84	Shariff Jairam	Moruga	Grand Chemin Fishing Association	Trasparent	15
85	Yaro Steele	Moruga	Grand Chemin Fishing Association	Transparent, fillet, a-la-vive	7
86	Andre Cunin	Moruga	La Rufin Fishing Association	Switchering, gillnet, towing, banking	22
87	Casey Primus	Moruga	La Rufin Fishing Association	Drift net, banking, switchering	25

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
88	James Roberts	Moruga	La Rufin Fishing Association	Trasparent	44
89	Jerry Silverton	Moruga	La Rufin Fishing Association	Transparent, towing	20 (owner - 12)
90	Leon Joseph	Moruga	La Rufin Fishing Association	Switchering, gillnet, towing	24
91	Peter Glodon	Moruga	La Rufin Fishing Association	Switchering, gillnet, towing	64
92	Wayne Marlman	Moruga	La Rufin Fishing Association	Palangue, fillet, transparent, a-la-lvive	20
93	Betty Ann Ramlochan	Moruga	-	Transparent	15
94	Denise Ali	Moruga	-	Transparent	5
95	Jennil John	Moruga	-	-	-
96	Amir Boodoo - rep. for Salida Boodoo	Orange Valley	Bayside Seafood Products	Fillet, palangue, seine	15
97	Heeralal Bachan	Orange Valley	Orange Valley Fishing Association	Trawl	40
98	Sooklal Gajadhar	Otaheite	Orange Valley	Trawl	42
99	Damaroo Seepersad	Otaheite	Otaheite Fisherfolk Association	Trawl, banking, line	24
100	Kamla Moonilal	Otaheite	Otaheite Fisherfolk Association	Trawl	20
101	Michael Ramnath	Otaheite	Otaheite Fisherfolk Association	A-la-lvive, trawl, banking	20
102	Mitra Harbance	Otaheite	Otaheite Fisherfolk Association	Trawl, banking	20
103	Oudit Ramjattan	Otaheite	Otaheite Fisherfolk Association	Trawl, banking, line	20
104	Raymond Ramlal	Otaheite	Otaheite Fisherfolk Association	Trawl	14

NON-GOVERNMENTAL ORGANISATIONS - FISHERFOLK ORGANISATIONS / FISHING INDUSTRY					
-	***Name***	***Home Port/Site of Operation***	***Fishing Organization***	***Fishing Methods***	***No. of years fishing***
105	Richie Mohan	Otaheite	Otaheite Fisherfolk Association	A-la-lvive, trawl, banking	10
106	Sharaz Gafoor	Otaheite	Otaheite Fisherfolk Association	Line, net	30
107	Steve Farinha	Otaheite	Otaheite Fisherfolk Association	Trawl, banking, fillet	25
108	Suresh Seepersad	Otaheite	Otaheite Fisherfolk Association	Trawl	35
109	Rahaman Mohammed	Otaheite	-	Banking, trawl	40
110	Selwin Kola	Otaheite/Oropouche	Oropouche Fishing Industry	Trawl	30
111	Vincent Ferreira	San Fernando	San Fernando Trawlers Association	Trawl	35
112	Faizal Hosein	San Fernando - King's Wharf	San Fernando Fish Co-operation	Artisanal trawl	38
113	Amjad Khan	Sea Lots	T&T Industrial Fishing Association (TTIFA)	Trawl	15
114	Henry Meyer	Sea Lots	T&T Industrial Fishing Association (TTIFA)	Longline, trawl	42
115	Ian Maharaj	Sea Lots	T&T Industrial Fishing Association (TTIFA)	Trawl	25
116	Lincoln Maharaj	Sea Lots	Trawlers Association	Trawl	35

NON-GOVERNMENTAL ORGANISATIONS - OTHER					
Name	***Organisation***	***Postion***	***Contact Tel. #***	***Email Address***	***Mailing Address***
Eddison Baptiste	Council of Presidents of the Environment (COPE)	-	645-2237 / 624-8017 / 695-2264	copett2011@gmail.com	Carib Brewery, Eastern Main Rd, Champs Fleurs. P.O. Box 1381, POS
	T&T Field Naturalists Club	Representative for the Secretary	-	admin@ttfn.org	P.O. Box 642, POS

GOVERNMENTAL ORGANISATIONS - MINISTRY OF FOOD PRODUCTION - FISHERIES DIVISION						
-	***Name***	***Unit***	***Position***	***Contact Tel. #***	***Email Address***	***Mailing Address***
1	Christine Chan A Shing	Head Office	Director of Fisheries	623-8542,623-8525; 623-6028	cchanashing@fplma.gov.tt	35 Cipriani Blvd, Newtown, Port of Spain
2	Elizabeth Mohammed	Head Office	Senior Fisheries Officer	623-8525; 623-6028	emohammed@fplma.gov.tt	35 Cipriani Blvd, Newtown, Port of Spain
3	Lara Ferreira	Marine Fishery Analysis Unit (MFAU)	Fisheries Officer	634-4504-5	lferreira@fplma.gov.tt	Western Main Rd., Chaguaramas
4	Nerissa Lucky	Extension	Fisheries Officer	623-8525; 623-6028	-	35 Cipriani Blvd, Newtown, Port of Spain
5	Recardo Mieux	Head Office	Fisheries Officer	623-8525; 623-6028	-	35 Cipriani Blvd, Newtown, Port of Spain
6	Shandira Ankiah	Marine Fishery Analysis Unit (MFAU)	Fisheries Officer	634-4504-5	sankiah@fplma.gov.tt	Western Main Rd., Chaguaramas
7	Sarika Maharaj	Fisheries Monitoring, Surveillance, and Enforcement Unit (FMSEU)	Fish Inspection Officer	623-8525; 623-6028	smaharaj2@fplma.gov.tt	35 Cipriani Blvd, Newtown, Port of Spain
8	Vikhana Maraj	Fisheries Monitoring, Surveillance, and Enforcement Unit (FMSEU)	Fish Inspection Officer	623-8525; 623-6028	vmaraj@fplma.gov.tt	35 Cipriani Blvd, Newtown, Port of Spain
9	Christian Persad	Fisheries Monitoring, Surveillance, and Enforcement Unit (FMSEU)	Fish Inspector	623-8525; 623-6028	-	35 Cipriani Blvd, Newtown, Port of Spain
10	Ravi Maharaj	Marine Fishery Analysis Unit (MFAU)	Biologist	634-4504-5	rmaharaj2@fplma.gov.tt	Western Main Rd., Chaguaramas
11	Abigail Dowden	Marine Fishery Analysis Unit (MFAU)	Associate Professional	634-4504-5	adowden@fplma.gov.tt	Western Main Rd., Chaguaramas
12	Terrance Greig	Marine Fishery Analysis Unit (MFAU)	Biological Data Collector	634-4504-5	tgreig@fplma.gov.tt	Western Main Rd., Chaguaramas
13	Kieron Draper	Marine Fishery Analysis Unit (MFAU)	Transhipment Monitoring Supervisor	634-4504-5	-	Western Main Rd., Chaguaramas
14	Wendy Thomas	Marine Fishery Analysis Unit (MFAU)	Fisheries Assistant	634-4504-5	-	Western Main Rd., Chaguaramas
15	Ruth Davis	Extension	Fisheries Assistant	623-8525; 623-6028	-	35 Cipriani Blvd, Newtown, Port of Spain
16	Anand Bissessar	Extension	Fisheries Assistant	623-8525; 623-6028	-	35 Cipriani Blvd, Newtown, Port of Spain
17	Annette Homer	Marine Fishery Analysis Unit (MFAU)	Checker	634-4504-5	-	Western Main Rd., Chaguaramas
18	Lendell Webster	Marine Fishery Analysis Unit	Data Entry/Scanning	634-4504-5	-	Western Main Rd.,

GOVERNMENTAL ORGANISATIONS - MINISTRY OF FOOD PRODUCTION - FISHERIES DIVISION						
-	***Name***	***Unit***	***Position***	***Contact Tel. #***	***Email Address***	***Mailing Address***
		(MFAU)	Technician/IT Assistant			Chaguaramas
19	Kurt Ramdial	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Blanchisseuse)	-	-	-
20	Kenneth Nehore	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Bonasse)	-	-	-
21	Anthonio Martinez	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Brickfield, Cacandee)	-	-	-
22	Randolph John	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Grand Chemin, La Ruffin)	-	-	-
23	Cheryl Singh	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Guayaguayare)	-	-	-
24	Stephen Alfred	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Icacos)	-	-	-
25	Anthony Ambrose	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Maracas)	-	-	-
26	Sheldon Achong	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Matelot)	-	-	-
27	Krishendath Singh	Marine Fishery Analysis Unit (MFAU)	Statistical Data Collector (Mayaro, Grand Lagoon)	-	-	-
28	Bertram Percival	Head Office	Driver	623-8525; 623-6028	-	35 Cipriani Blvd, Newtown, Port of Spain
29	Eldon Ramadeen	Marine Fishery Analysis Unit (MFAU)	Driver	634-4504-5	-	Western Main Rd., Chaguaramas
30	Jaggernath Thakoor	Marine Fishery Analysis Unit (MFAU)	Driver	634-4504-5	-	Western Main Rd., Chaguaramas
31	Isaiah Sweene	Marine Fishery Analysis Unit (MFAU)	Driver	634-4504-5	-	Western Main Rd., Chaguaramas

GOVERNMENTAL ORGANISATIONS - MINISTRY OF FOOD PRODUCTION - OTHER DIVISIONS / PARA-STATAL ORGANISATIONS						
-	***Name***	***Division***	***Position***	***Contact Tel. #***	***Email Address***	***Mailing Address***
1	Bhaghirathe Maharaj	Lands & Surveys Division	Land Surveyor III	625-3013 / 681-2671	-	-
2	Laurelle Ralph	Legal Unit	Legal Counsel	622-2058	lralph@fplma.gov.tt	-
3	Neela Maharaj	Agricultural Planning Division	Planning Officer III	622-1221	-	-
4	Doon Ramsaroop	Seafood Industry Development Company LTD (SIDC)	CEO	665-7081 / 781-8798	dramsaroop@sidc.tt.com	6 Bejucal Extension 1, Uriah Butler Highway, Charlieville, Chaguanas
5	Alvin Seereeram	The National Agricultural Marketing & Development Corporation (NAMDEVCO)	Deputy CEO	647-3218	aseereeram@namdevco.com	-

GOVERNMENTAL ORGANISATIONS - OTHER						
-	***Name***	***Attachment (Ministry/Organisation)***	***Position***	***Contact Tel. #***	***Email Address***	***Mailing Address (of the Ministry/Organisation)***
1	David Ramjohn	Environmental Management Authority (EMA)	Executive Technical Assistant to MD/CEO	622-9270 ext. 2246 / 790-0456 / 628-9123	dramjohn@ema.gov.tt	8 Elizabeth St, St. Clair. P.O. Box 5071, POS
2	Rosemarie Kishore	Institute of Marine Affairs (IMA)	Senior Research Officer	634-4292 ext. 1117	rkishore@ima.gov.tt	P.O. Box 3160, Carenage Post Office, Chaguaramas
3	Rachel Shoy	Institute of Marine Affairs (IMA)	Research Officer	634-4292 ext. 1114	rshoy@ima.gov.tt	P.O. Box 3160, Carenage Post Office, Chaguaramas
4	Aldo Hope	Ministry of Energy	Energy Security Officer	384-2390	ahope@energy.gov.tt	1 Wrightson Rd, POS
5	Rointra Hosein	Ministry of Energy	Energy Professional Assistant	710-1672	rhosein@energy.gov.tt	Maska Building, South Trunk Rd, La Romaine
6	Shiva Singh	Ministry of Energy	HSE	391-8108	s.singh@energy.gov.tt	Maska Building, South Trunk Rd, La Romaine
7	Angela Ramkissoon	Ministry of Labour and Small & Micro-Enterprise Development (Cooperative Development Division)	Cooperative Officer	755-1050	-	10 Hibiscus Circle, St. Clair Gardens
8	Avelon Perry	Ministry of Labour and Small & Micro-Enterprise Development (Cooperative Development Division)	Cooperative Officer II	671-1917	avelonp@gov.tt	Corner of Lange & John St, Chaguanas
9	Mala Sookoo	Ministry of Labour and Small &	Cooperative Officer	341-1721	-	Anva Plaza, 16-20 Eastern

GOVERNMENTAL ORGANISATIONS - OTHER						
-	***Name***	***Attachment (Ministry/Organisation)***	***Position***	***Contact Tel. #***	***Email Address***	***Mailing Address (of the Ministry/Organisation)***
		Micro-Enterprise Development (Cooperative Development Division)				Main Rd, Tunapuna
10	Rhonda Joseph	Ministry of Labour and Small & Micro-Enterprise Development (Cooperative Development Division)	Cooperative Officer	330-3546		124 Immortel St, Couva
11	Shelley Charles	Ministry of Labour and Small & Micro-Enterprise Development (Cooperative Development Division)	Cooperative Officer	645-6543		Anva Plaza, 16-20 Eastern Main Rd, Tunapuna
12	Julius Smith	Ministry of the Environment & Water Resources	Environmental Biologist	333-3003	julius.smith@mhe.gov.tt	Corner of El Socorro Main Rd & Hasanali St

UNIVERSITIES							
-	***Name***	***University / School***	***Faculty / Department***	***Position***	***Contact Tel. #***	***Email Address***	***Mailing Address***
1	Sharon Hutchinson	UWI	Food & Agriculture	Deputy Dean of Department	684-4432	Sharon.Hutchinson@sta.uwi.edu	St. Augustine, T&T
2	Faraad Hosein	UWI	Food & Agriculture	Part-time Lecturer & Technical Assistant	797-7607	faraad.hosein@sta.uwi.edu	St. Augustine, T&T
3	Candice Sankarsingh	UWI	Engineering	Researcher	744-2647	candice.sankarsingh@sta.uwi.edu	St. Augustine, T&T
4	Goopiechand Boodhan	UWI	Social Sciences	Research Assistant	763-1868	gboodhan@gmail.com	St. Augustine, T&T
5	Malini Maharaj	UWI	Social Sciences	Instructor	299-4360	malini.maharaj@sta.uwi.edu	St. Augustine, T&T
6	Zaheer Hosein	UWI	Science & Technology	Teaching Assistant	724-2550	zaheer.hosein@sta.uwi.edu	St. Augustine, T&T

REGIONAL / INTERNATIONAL ORGANISATIONS							
-	***Name***	***Organisation***	***Position***	**-**	***Contact Tel. #***	***Email Address***	***Mailing Address***
1	Barton Clarke	Food & Agriculture Organisation (FAO)	Representative	-	625-0467	barton.clarke@fao.org	134-138 Frederick St, POS
2	Tarub Bahri	Food & Agriculture Organisation (FAO)	Fishery Research Officer	**Resource personel for the National Consultation**	4390657055233	tarub.bahri@fao.org	Via delle Terme di Caracalla 00153, Rome, Italy
3	Terrence Phillips	Caribbean Regional Fisheries Mechanism (CRFM)	Programme Manager		7844573474	terrencephillips@vincysurf.com	-

Appendix 2: Meeting Agenda

Objectives of the national consultation

- Validation of priority issues (both national and transboundary) for the sustainable management of shrimp and groundfish fisheries, based on the EAF framework
- Identification of key actions required to address the priority issues

Expected outcome of the national consultation

- EAF Baseline Report presented
- Priority issues validated
- Actions to address priority issues identified and recommendations made

Agenda

08:30 Registration of Participants

09:00 Opening by the Director of Fisheries (Mrs. Christine Chan A Shing)

09:10 Remarks by CRFM (Mr. Terrence Phillips, Programme Manager, Fisheries Management & Development)

09:15 Remarks by FAO (Mr. Barton Clarke, FAO representative)

09:20 Coffee break

09:30 CLME Case Study and purpose of the meeting (Ms. Tarub Bahri, Fishery Resources Officer, Fisheries & Aquaculture Department, FAO)

09:40 Presentation of the baseline report (Ms. Lara Ferreira, Fisheries Officer)

10:00 Clarifications / Questions

10:15 Presentation of EAF Process & Issues identified (Ms. Shandira Ankiah, Fisheries Officer)

10:40 Clarifications / Questions

10:45 Review of the Issues (by table – Chair & Rapporteur)

11:15 Validation & Presentation of any additional Issues

11:30 Ranking of Issues (using stickers)

12:00 *Lunch break*

1:00 Results of Ranking of Issues and Working Group Assignment

1:15 Working Group Discussion of possible solutions

2:00 Group presentations and discussions

3:00 Wrap up & Follow-up

4:00 Closure of the meeting

Appendix 3: Process of Stakeholder Engagement for the Establishment of the Shrimp & Groundfish Task Group of Trinidad &Tobago

The first step in the process of stakeholder engagement was stakeholder identification. This involved the following steps:

- Identification of the fishing fleets which capture shrimp and groundfish
- Identification of fish landing sites for shrimp and groundfish
- Identification of fisherfolk associations which comprise the operators of the relevant fishing fleets and landing sites
- Communication with the relevant operators via letters to the fisherfolk associations (where these existed) and/or meetings at the landing sites
- Identification of key stakeholder representatives to be members of a Task Group

Identification of Fishing Fleets Exploiting Shrimp and Groundfish

These were considered to be the trawl fleets (artisanal inshore pirogues using outboard or inboard engines, stern trawlers and the large double-rigged trawlers) as well as pirogues using a range of net and line methods including gillnets, bank lines, beach seines.

Identification of Fish Landing Sites for Shrimp and Groundfish

Based on fish landing data collected by the Fisheries Division, the major fish landing sites for shrimp and groundfish were identified as given in the following table.

Major Shrimp &Fish Landing Sites for the Shrimp and Groundfish Fishery

Shrimp Fishery	Groundfish Fishery
Sea Lots (NP Compound)	Port-of-Spain
Cacandee	San Fernando
Orange Valley	Erin
San Fernando	Gran Chemin (Moruga)
Otaheite	La Ruffin (Moruga)
South west peninsula (Bonasse, Fullerton, Icacos)	

Identification of Fisherfolk Associations

The relevant Fishing Cooperatives/Associations were identified as follows:

- Trinidad and Tobago Industrial Fishing Association
- Orange Valley Fishing Association Limited
- Otaheite Fishing Association
- San Fernando Fishing Cooperative Society Limited
- Cacandee/Felicity Fishing Association Limited
- Moruga/La Ruffin Fishing Association Limited
- Erin Fishing Cooperative Limited

Identification of Key Stakeholder Representatives to Attend Workshop in Suriname and be Members of a Shrimp and Groundfish Fishery Task Group

The implementing agency for the Case Study, ie. the Food and Agriculture Organization of the United Nations (FAO) was willing to fund two key stakeholder representatives to attend an Ecosystem Approach to Fisheries Workshop in Suriname in October 2011. The Fisheries Division sought to identify these representatives from the shrimp trawl fleet (which it considered to be the major fleet exploiting these resources) and as such requested nominations via letter in September 2011 to the Trinidad and Tobago Industrial Fishing Association and the Orange Valley Fishing Association Limited. A meeting was held at the Otaheite landing site (which is the major artisanal trawl landing site) on August 12, 2011 (there did not exist at that time an active/functional fishing association) and volunteers were requested. Fisheries Division staff also visited the other trawl landing sites and spoke to fishers and disseminated information packages on the project. The fishing industry representatives who attended the Suriname workshop were: Mr. Lincoln Maharaj (industrial trawl operator, Sea Lots) and Mr. Sooklal Gajadhar (artisanal and stern trawl operator, Orange Valley and Otaheite).

With respect to the Task Group, in addition to the fishing industry representatives who attended the Suriname workshop, the Fisheries Division sought to have all major fleets and landing sites represented. The Division's staff liaised with the relevant fishing associations to assist in identifying relevant stakeholder representatives, both primary and alternate. Meetings were held at the fish landing sites during which relevant information on the Project was disseminated via packages, and persons in attendance were asked to indicate their interest in representing the fishers as a member of the Task Group. These stakeholder representatives are expected to communicate with, and disseminate information on the activities of the Task Group to the other members of their fishing associations and landing sites. The Fisheries Division also sought to have expertise in socio-economics and environmental matters on the Task Group and thus obtained a representative from the Agricultural Planning Division of the Ministry of Food Production, and the Environmental Management Authority, respectively. By the time these representatives were identified by their respective agencies however, four meetings of the Task Group were already convened. The non-governmental organization, CANARI (Caribbean Natural Resources Institute) which "seeks to create avenues for the equitable participation and effective collaboration of Caribbean communities and institutions in managing the use of natural resources critical to development" was also invited to attend the Task Group meetings, though due to other commitments was unable to attend.

The establishment of this Task Group of Shrimp and Groundfish Stakeholders is considered to be a work in progress and it is expected that the Group will continue to meet on relevant issues beyond the life of the CLME project.

Appendix 4: Task Group Meetings (Attendees and Notes)

Four meetings of the Task Group of Shrimp and Groundfish Stakeholders were convened in preparation for the National Stakeholder Consultation under the Caribbean Large Marine Ecosystem (CLME) Project Case Study for the Shared Stocks of the Shrimp & Groundfish Fishery of the Guianas-Brazil Shelf. These meetings were held on March 23, June 8, June 27, and July 17 of 2012. Some notes on the proceedings of these meetings, including lists of attendees, are provided below.

MFPLMA South Regional Office, March 23, 2012

List of Attendees

Name	**Home Port/Site of Operation**	**Fishing Methods (if Gillnet: Transparent or Fillet; if Trawl: Outboard, Inboard, Stern or Large)**	**# Years Fishing**
Sooklal Gajadhar	Otaheite Orange Valley	Artisanal Inboard trawl; Stern Trawl	40 years
Clever Blackwill	Grand Chemin, Moruga	Banking, Trolling, A la vive, Fillet	30 years
Lincoln Maharaj	Sea Lots	Industrial Trawl	25 years
Gobadhan Maharaj	La Ruffin, Moruga River	Transparent & fillet drift net fishing	16 years
Daniel Fraser	Sea Lots Fishing Port	Fillet, Banking, Trolling	55 years
Faizal Hosein	San Fernando	Artisanal Trawl inboard	38 years
Eugene Benjamin	Erin	Transparent gillnet, Beach seine	40 years
Jude Ready	Erin	Fillet, some Transparent gillnet	17 years
Albert Taylor	Grand Chemin, Moruga	Towing	20 years
Colins Peters	Port of Spain	Fillet, banking trolling, some transparent gillnet	29 years

Fisheries Division Staff:
Ms. Elizabeth Mohammed, Senior Fisheries Officer (Ag.)
Ms. Lara Ferreira, Fisheries Officer
Mr. Anand Bissessar, Fisheries Assistant

Absent:
Fishing Industry
Akesh Bisnath, Port of Spain
Anand Beharrylal, San Fernando
Randy Soomir, Cacandee
David, Cacandee
Marlon Sinanan, La Ruffin, Moruga
Nazim Ramrattan, Grand Chemin, Moruga
Martin Jones, Erin
Shaffie Mohammed, Orange Valley
Raffick Khan, Otaheite
Richie Roy Mohan, Otaheite

Fisheries Division
Nerissa Lucky, Fisheries Officer
Shandira Ankiah, Fisheries Officer
Wendy Thomas, Fisheries Assistant
Ruth Davis, Fisheries Assistant
Maria Long, Checker

Other
Keisha Sandy, CANARI

AGENDA
The objective of this meeting was to provide feedback to key stakeholders on the Ecosystem Approach to Fisheries (EAF) Workshop held in Suriname in October 2011 and attended by the country's primary and alternate focal points, Fisheries Officers Ms. Lara Ferreira and Ms. Shandira Ankiah, respectively, as well as artisanal/semi-industrial and industrial trawl industry representatives, Mr. Sooklal Gajadhar and Mr. Lincoln Maharaj, respectively. Ms. Ferreira made several presentations as follows:

1. Overview of CLME Project and Shrimp & Groundfish Case Study
2. Overview of the Ecosystem Approach to Fisheries (EAF)
3. Introduction to EAF plans
4. Output of TT-Venezuela Working Group exercises at Suriname Workshop
    i. Fishery Definition & Broad Objectives
    ii. Identification of Issues
    iii. Prioritization of Issues
    iv. Operational Objectives

Ms. Ferreira urged the attendees to pass on the information to other members of their fishing communities.

The representatives of the artisanal multi-gear (nets and lines) fleet on the Gulf of Paria coast and the south coast were asked to identify one representative per coast who would attend future meetings. Mr. Colins Peters of Port of Spain was nominated to represent the Gulf coast, and Mr. Clever Blackwill the south coast. Ms. Ferreira also asked the fishers present to provide contacts of processors/exporters as the Division sought to engage this sector of the fishing industry.

Waterloo Community Facility, June 8, 2012

List of Attendees

Name	**Home Port/Site of Operation**	**Fishing Methods (if Gillnet: Transparent or Fillet; if Trawl: Outboard, Inboard, Stern or Large)**	**No. of Years Fishing**
Duane Ramharack	Icacos; Cedar Bay Fisheries Limited	Shrimp & Fish processing (Kingfish, Carite, Catfish, Cro-Cro, Salmon)	
Faizal Hosein	San Fernando	Artisanal Trawl inboard	38 years
Shaffie Mohammed	Orange Valley	Trawl	20 years
Sooklal Gajadhar	Otaheite Orange Valley	Artisanal Inboard trawl; Stern Trawl	40 years

Fisheries Division Staff:
Ms. Elizabeth Mohammed, Senior Fisheries Officer (Ag.)
Ms. Lara Ferreira, Fisheries Officer
Ms. Shandira Ankiah, Fisheries Officer
Ms. Cheyvonne James, Associate Professional
Ms. WendyThomas, Fisheries Assistant
Ms Ruth Davis, Fisheries Assistant
Mr. Anand Bissessar, Fisheries Assistant

Absent:
Fishing Industry
Lincoln Maharaj, Sea Lots
Anthony Byer, Exporter
Krishna Ramdass, Exporter
Jaiwant Sooknanan, Exporter

Fisheries Division
Nerissa Lucky, Fisheries Officer

Other
Keisha Sandy, CANARI

AGENDA
Ms. Ferreira gave a brief overview of the last meeting of shrimp and groundfish industry stakeholders held on March 23, 2012 to provide feedback on the Ecosystem Approach to Fisheries (EAF) Workshop in Suriname, October 2011, which included the following

a. Overview of CLME Project and Shrimp & Groundfish Case Study
b. Overview of the Ecosystem Approach to Fisheries (EAF)
c. Introduction to EAF plans
d. TT-Venezuela Working Group exercises

A scoping exercise on the shrimp and groundfish fishery of Trinidad and Tobago was conducted to agree on the scope of the fishery, fishing activities to be managed, and community objectives to be achieved (values important to the fishery/community). The results were as follows:

<u>Fishery</u>: Trinidad & Tobago Shrimp & Groundfish: eg. snappers, croaker, catfish

<table>
<tr><td>Category</td><td>Details</td></tr>
<tr><td>Fishers involved</td><td>

Industrial Trawlers for Trinidad (32 vessels)
Semi-industrial trawlers for Trinidad (10 vessels)
Artisanal trawlers (95 vessels Trinidad; at least 155 vessels Venezuela)
Artisanal Net and Line fishers (Trinidad and Venezuela)

</td></tr>
<tr><td>Methods involved</td><td>

Industrial & Semi-industrial Trawling (Trinidad)
Gears for Artisanal fishery:

<table>
<tr><td>Trinidad</td><td>Venezuela</td></tr>
<tr><td>Gillnets</td><td>Gillnets</td></tr>
<tr><td>Fishpots</td><td>Fishtraps</td></tr>
<tr><td>Lines: Banking and Palangue</td><td>Lines: Handlines</td></tr>
<tr><td>Seines</td><td></td></tr>
<tr><td>Trawl nets</td><td></td></tr>
</table>
</td></tr>
<tr><td>Areas involved</td><td>

Columbus Channel
Gulf-of-Paria
North coast Trinidad

</td></tr>
<tr><td>Values to achieve</td><td>

Food security particularly in fishing communities
Sustainability of the resource
Maximizing employment (fishers and processing sectors)
Economic efficiency

</td></tr>
<tr><td>Primary agenc(ies)/groups (those who are directly involved). Those who have to take direct responsibility</td><td>
<table>
<tr><td>Trinidad</td><td>Venezuela</td></tr>
<tr><td>MFPLMA, Fisheries Division</td><td>Consejos de Pescadores</td></tr>
<tr><td>Trinidad and Tobago Industrial Fishing Association</td><td>INSOPESCA (Instituto socialista de la pesca)</td></tr>
<tr><td>All Fishing Associations for relevant Landing Sites</td><td>Direccion de circuito pesquero y acuicola, Ministerio de Agricultura y Tierras</td></tr>
</table>
</td></tr>
<tr><td>Other Agencies/Groups (those who are only indirect – or who manage related aspects) – ie they will not take direct responsibility</td><td>
<table>
<tr><td>Trinidad</td><td>Venezuela</td></tr>
<tr><td>Ministry of Environment</td><td></td></tr>
<tr><td>Ministry of Foreign Affairs</td><td>INIA (Instituto Nacional de Investigationes Agricola)</td></tr>
<tr><td>Ministry of Trade</td><td>Universities, ONG’s</td></tr>
<tr><td>Ministry of Energy</td><td>INEA (Instituto Nacional de Espacios Acuaticos)</td></tr>
<tr><td>Maritime Services Division</td><td>Ministerio de Energia y Minas</td></tr>
<tr><td>Coast Guard</td><td>Maritime Division</td></tr>
<tr><td>UWI</td><td>Coast Guards</td></tr>
<tr><td>Environmental/Conservation Groups: Fishermen and Friends of the Sea</td><td></td></tr>
</table>
</td></tr>
<tr><td>Time frame(s)</td><td>3 Years</td></tr>
</table>

The process of issue identification was begun utilizing the component tree template. Several solutions were also proposed by the stakeholders to the issues raised.

MFPLMA South Regional Office, June 27, 2012

List of Attendees

Name	**Home Port/Site of Operation**	**Fishing Methods (if Gillnet: Transparent or Fillet; if Trawl: Outboard, Inboard, Stern or Large)**	**No. of Years Fishing**
Faizal Hosein	San Fernando	Artisanal Trawl inboard	38 years
Lincoln Maharaj	Sea Lots	Industrial Trawl	25 years
Sooklal Gajadhar	Otaheite Orange Valley	Artisanal Inboard trawl; Stern Trawl	40 years

Fisheries Division Staff:
Ms. Lara Ferreira, Fisheries Officer
Ms. Nerissa Lucky, Fisheries Officer, Fisheries Officer
Ms. Cheyvonne James, Associate Professional
Ms. WendyThomas, Fisheries Assistant

Absent:
Fishing Industry
Shaffie Mohammed, Orange Valley
Richie Roy Mohan, Otaheite
Soomraj Balram Cacandee
Anthony Byer, Exporter
Sylvester Andalcio, Exporter
Salida Boodoo, Exporter
Jaiwant Sooknanan, Exporter
Dockside Seafoods
Stingrae Caribbean
TriFish Cold Storage

Fisheries Division
Ms. Elizabeth Mohammed, Senior Fisheries Officer (Ag.)
Ms Ruth Davis, Fisheries Assistant
Mr. Anand Bissessar, Fisheries Assistant

Other
Keisha Sandy, CANARI

AGENDA
The objective of this meeting was to continue the process of identification of issues in the shrimp and groundfish fisheries which was begun at the last meeting held on June 8, 2012, and to continue discussion on the implementation of a closed season for trawling which is a management recommendation coming out of shrimp stock assessments conducted in recent years.

Ms. Ferreira presented the trawl industry preferences for the closed season based on the 43 ParFish interviews conducted during the period April to October 2008. The preferred months for the closed season according to the artisanal trawl industry were May, June; according to the semi-industrial trawl industry, July, August, September; and the industrial, July, August. The preferred months were August and September overall for all trawl fleets.

The trawl operators present at the meeting made proposals as to their preferences for the closed season and agreed to discuss this matter with their fishing community/association and provide feedback to the Fisheries Division.

The process of issue identification was completed and several solutions proposed, all of which would be included in the component tree template.

Waterloo Community Facility, July 17, 2012

List of Attendees

Name	**Home Port/Site of Operation**	**Fishing Methods (if Gillnet: Transparent or Fillet; if Trawl: Outboard, Inboard, Stern or Large)**	**# Years Fishing**
Tackpoor Ramsudar	Cacandee	Artisanal Inboard Trawl	40 years
Soomraj Balram	Cacandee	Artisanal Trawl	20 years
Sooklal Gajadhar	Otaheite Orange Valley	Artisanal Inboard Trawl Stern Trawl	40 years
Clever Blackwill	Grand Chemin Moruga	Banking, Trolling, A la vive, Fillet	30 years
Lincoln Maharaj	Sea Lots	Industrial Trawl	25 years
Azard Mohammed	Blue River	Gillnet, transparent & fillet drift net fishing	38 years
Roma Andalcio (Sylvester Andalcio)	Processing/Export (to St. Vincent)	Shrimp Processing	

Fisheries Division Staff:
Lara Ferreira, Fisheries Officer
Nerissa Lucky, Fisheries Officer
Cheyvonne James, Associate Professional
Abigail Dowden, Associate Professional
Wendy Thomas, Fisheries Assistant
Ruth Davis, Fisheries Assistant
Anand Bissessar, Fisheries Assistant

Absent:
Fishing Industry
Colins Peters, Port of Spain
Anand Beharrylal, San Fernando
"Black", San Fernando
Shaffie Mohammed, Orange Valley
Richie Roy Mohan, Otaheite
Faizal Hosein, San Fernando
Eugene Benjamin, Erin
Gobadhan Maharaj, La Ruffin, Moruga River
Salida Boodoo
Jaiwant Sooknanan
Anthony Byer
Dawn Pierre
Wendell Raeburn
Gregorio Gonzalez

Processors/exporters

Fisheries Division
Shandira Ankiah, Fisheries Officer

Other
Agricultural Planning Division, Ministry of Food Production
Environmental Management Authority (EMA)
Keisha Sandy, CANARI

AGENDA

The generic component trees for the Shrimp & Groundfish Fishery of the Guianas-Brazil Shelf were first briefly revisited to lay a background framework for the meeting objective. The objective of the meeting was to prioritize previously identified issues occurring in the fishery as well as identifying any additional issues which stakeholders may have that were not previously identified.

METHODS

Cards describing issues were posted on a board for all stakeholders to read, reflect and discuss in a group setting. Each individual was then given 15 tags. These tags would be used to highlight the issues of highest importance to each individual. A maximum of 2 tags were allowed per individual per issue if the respective issue was of extreme importance to them. The number of tags placed on each card was then tallied in order to devise a system of ranked priority.

With 7 stakeholders present and a maximum of 2 tags allowed per individual per card, the highest rank achievable for any given issue was 14. All ranks obtained are therefore out of 14, with 14 being the highest possible ranks and 0 being the lowest possible rank.

RESULTS

Table 1: Ranking of issues in the Shrimp & Groundfish Fishery as prioritized by stakeholders

#	Issue	Ranking (/14)
1	Piracy	12
2	Competition from imported shrimp	10
3	Lack of facilities at landing sites & lack of port facilities for industrial fleets	9
4	Habitat damage due to the fishery's activities	7
5	Disagreement between fisherfolk and Government on some of the current fisheries laws	6
6	Loss of catch in trawl when TEDs used	6
7	Inadequate national enforcement of fishery regulations	5
8	Pollution: land & ocean-based pollution as well as air & water pollution from the fishery itself	5
9	High equipment prices due to limited suppliers	4
10	Outdated fishing laws	4
11	Lack of health insurance & pension	3
12	Conflict: between different types of fleet owners & between local and Venezuelan fishers	3
13	Dependence on fishery for food and livelihood	3
14	Lack of collaboration between TT & Venezuela	3
15	Stock-depletion of by-catch	2
16	Lack of alternative employment	2
17	Overcapitalization of fleets	2
18	Desire for increased subsidies from the Government	2

19	Limited community interest & involvement in fishery employment	2
20	Too many steps in the processing chain	2
21	Change in political parties leading to postponement of certain projects	2
22	Climate change	2
23	Reduction in catch due to seismic surveys	2
24	Reduced fishing areas due to multi-sectoral use	2
25	Desire to trawl on the East Coast of Trinidad by industrial trawlers	2
26	Full/Over-exploitation of target species	1
27	Accidents: collisions with other users of the sea	1
28	Injury/death as many fishermen do not have "safety at sea" training	1
29	Inadequate fisher organizations	1
30	Lack of participation by some stakeholders due to a lack of resources to facilitate education & organizations	1
31	Loss of markets (e.g. EU & US) due to non-compliance with international standards	1
32	Inadequate scientific research to make informed management plans	1
33	Degradation of coastal habitats due to urban & industrial development	1

DISCUSSION OF POSSIBLE SOLUTIONS

Piracy

Regarding piracy, some instances involve stolen catch and nets, whereas others involve the stealing of boats and engines.

There is a need for increased Coast Guard patrols and more collaboration with the Coast Guard. Offshore/floating stations were suggested as a means to enhance the spread of the Coast Guard presence. It was also suggested that old boats no longer in active use by the fishery, be used as monitoring stations. This is a preventative measure to reduce the frequency of piracy.

Regarding stolen boats and engines, phone networking is a possible mitigating action. Fishing associations from different areas could set up a system of contacts to be activated in the event of a stolen boat. Boat sightings could be reported to the concerned party. This would aid in the prompt location of stolen boats as a collaborative effort from stakeholders themselves.

Technology could be used to prevent a piracy event, or aid in the recovery of stolen capital. GPS locators could be installed on engines as a tracking device. However, there is an issue with the availability of a power source on smaller artisanal trawlers (Type I & II). VHF Radio communication systems would enhance safety and communication with fellow stakeholders and the Coast Guard in the event of attempted attacks. Calls for help can be made, or warnings sent out quickly and efficiently. A system could be set up making it mandatory for all members of fishing associations to

take a radio out with them before launching. In the event of a lost or unreturned radio, compensation should be paid to the association by the responsible stakeholder.

There is also an extreme lack of policing onshore. Surveillance officers could be trained to carry out random checks once or twice a week to verify the legality of landing boats. An alternative method would be to train stakeholders themselves to be estate constables, whose purpose would be to boost the enforcement of regulations within their given area.

Competition from imported shrimp

Imported shrimp is cheaper than local shrimp. As many consumers may not know the difference, imported shrimp can out-compete the locally-caught, fresh shrimp. There is also the issue of shrimp being brought in illegally creating competition with the local market.

The shrimp quality of imported shrimp can be tested for preservatives and other chemicals. If imported shrimp is found to be of a poor quality, there can be an initiative to increase awareness of the consumer. This would be a marketing strategy promoting purchase and consumption of local shrimp.

The shrimp being smuggled into Trinidad & Tobago illegally highlights a national security issue. Addressing this issue would require cooperation among different sectors to ensure compliance and there should be repercussions for perpetrators.

Habitat damage due to the fishery

It was indicated that the regulation prohibiting trawling within 2 nautical miles (nm) of the coast has the potential to do great damage to the fishery resource. Fishermen indicated a high frequency of juvenile catch of red fish beyond this delineation. Adult fish return to shallow waters to spawn. When juvenile individuals hatch, they return to deeper waters to feed. These deeper waters tend to be outside the 2 nm limit resulting in a high catch of immature individuals.

It was suggested that there be protection of spawning zones rather than the 2 nm limit. Zonal protection should be done based on depth. Fishermen, based on their traditional knowledge, identified zones where spawning occurs year-round, and there is a high occurrence of coral. Fisherfolk from Cacandee suggested a protected area one quarter mile offshore north of the Caroni area, a seagrass area where redfish spawn. The Caroni Bird Sanctuary was identified as a spawning area. A fisher from Otaheite suggested a protected area from Point-a-Pierre to La Brea (including locations between such as San Fernando, Mosquito Creek, Otaheite, Oropouche and Aripero) between depths of 3 – 7 fathoms. It was stressed that the existing 2 nm limit was ineffective due to depths greatly varying with coastal distance. Additionally, certain species of shrimp (e.g. white shrimp) can only be obtained within 1 nm.

A closed season could be implemented to protect the resource, allowing sufficient time for populations to grow. During this time, fishermen could possibly be compensated by the Government. Most fishermen trawl for red shrimp from the end of November to June. During this time, it is believed that white shrimp spawn. It was suggested that different zones should be closed to fishing and shrimping at different times. However, there is currently inadequate scientific knowledge of life history of species to put such a measure into place.

Fishermen disagree with current laws (e.g. prohibition on sale of herrings and sardines for purposes other than bait fish)

Bait fish include Silver Sardines, Red Sardines, Jashua and Herrings. The only species sold as food fish is Silver Sardines. Fishermen have indicated that often they catch more sardines than shrimp, and

must use the sardines to earn income. There is no disagreement regarding the other species' classification as bait fish.

The fishermen also voiced concerns with respect to the over-exploitation of bait fish as a negative influence on the resource. It was indicated that tuck seines are the most destructive type of seining. Tuck seines hold all species of bait fish including juveniles. This may lead to a significant disruption in food webs. These bait fish are a significant source of food for other fish, as well as sea birds such as pelicans. The appropriate mesh size for tuck seines should be evaluated and enforced. A large proportion of the fish obtained in the tuck seine are thrown away. Additionally, fish mortality due to tuck seining is high as many fish tire and die when left in the nets for long periods of time. This indicates high inefficiency and wastage.

Monitoring on the water is crucial. Onshore monitoring may not be as effective as many fish die in the water when left in nets too long. Regulations should allow for a maximum of one day for fish to be kept in nets before being released so as to avoid fatigue, weakness and death of the fish.

Loss of catch in trawl when TEDs used

Debris and sting rays can get stuck in the TEDs leading to the loss of catch.

Pollution: land & ocean-based pollution as well as air & water pollution from the fishery itself

Pollution from industrial activity is a significant issue. Fishermen have reported underground pipes dumping waste directly into the ocean. Subsequent reports to the EMA were not followed up. Associations need more organization in order to lobby for their cause. Additionally, testing for water quality should be carried out in these areas as well as testing the quality of fish being consumed. Results may lend itself to the cause to reduce pollution.

Conflict: between different types of fleet owners & between local and Venezuelan fishers

There is conflict between trawlers and other fishermen (e.g. fillet fishermen). A ban on night trawling was suggested, in order to allow the fillet fishermen to work effectively. However, shrimp are sometimes caught at night only. Proper signaling of gillnets should be enforced so as to avoid conflict when improperly signaled nets are cut by other fleet types.

Overfishing

Many fishermen adopt the philosophy that the more fish that can be caught at any particular time the better. However, this leads to wastage and rotting fish can pollute an area. Additionally, excess quantities lower market prices reducing profits attained by the stakeholders. There needs to be a balance. This can be achieved by perhaps enforcing bag limits and quotas per fleet.

COMMENTS

Insightful discussion occurred during this meeting. Participation must continually be encouraged so as to achieve a solid consensus on how to solve the issues which arise in this fishery.

Appendix 5: Shrimp and Groundfish Stakeholder Community Consultations

Objectives and Agenda

Four community consultations were held at four major landing sites for the shrimp and groundfish fishery: two on the west coast of Trinidad, namely Cacandee and Otaheite; and two on the south coast, namely Erin and Moruga. The objective of the community meetings was to prioritize previously identified issues occurring in the fishery (as identified by the TT-Venezuela stakeholder working group at the Suriname EAF Workshop in October 2011, and the Shrimp and Groundfish Stakeholder Task Group established in March 2012) as well as to identify any additional issues stakeholders may have that were not previously identified. The case study was described, and the importance of involvement and feedback from fishermen was highlighted as extremely significant.

Methods

Cards stating the issues were posted on the wall in alphabetical order. There were a total of 43 issues at the first meeting in Cacandee and a total of 44 at subsequent meetings. These issues were also listed in a handout given to each attendee to read, reflect on and discuss in a group setting. The discussion was aimed at clarification of any misunderstanding of the issues, as well as any helpful comments regarding solutions. Each individual was then given tags to highlight the issues of highest importance to them. A maximum of 1 tag was allowed per individual per issue. An individual could tag as many of the issues as he considered significant. The number of tags placed on each card was then tallied in order to prioritize the issues.

Photo: Meeting of Shrimp and Groundfish Stakeholders in Cacandee in August 2012 to identify and prioritize issues in the fishery.

For each of the community meetings the following are provided: list of attendees; priority ranking of the issues; and any solutions to the issues proposed.

Cacandee (Trinidad's west coast): 2 August 2012

List of Attendees at Cacandee Stakeholder meeting

	Name	Home Port/Site of Operation	Fishing Methods	# of Years Fishing
1	Dave A. Seeram	Cacandee		15
2	Randhir Ramjatan	Cacandee		20
3	Romel Ali	Cacandee		20
4	Mark Sumair	Cacandee		20
5	Randy Sumair	Cacandee		
6	Vicky Chotoo	Cacandee	Transparent gillnet, banking (flat bottom boats)	15
7	Soogrim Bansen	Cacandee	Transparent gillnet, banking	20
8	Anderson Singh	Cacandee	Banking	18
9	Johnathan Ramdas	Cacandee	Banking	30
10	Deoley Mahase	Cacandee	Trawl, banking, A-la-vive	35
11	Soomraj Balram	Cacandee	Trawl	20
12	Taju Mahase	Cacandee	Trawl	9
13	Pageram Tirbanie	Cacandee	Trawl	8
14	Nicholas Seerattan	Cacandee	Transparent gillnet, banking	8
15	Herdeo Ramsundar	Cacandee	Trawl	25
16	Sherwin Seepersad	Cacandee	Transparent gillnet	15
17	Randy Lochan	Cacandee	Trawl	5
18	Renhu Dataran	Cacandee	Trawl	11
19	David Bachan	Felicity	Trawl	
20	Dhalochan Bolan	Felicity	Trawl	
21	Maniram Tirbanie	Felicity	Trawl	12
22	Thakoor Ramsundar	Cacandee	Trawl	40
23	Taradath Lochan	Cacandee	Trawl, banking	30
24	Adesh Simbhu	Cacandee	Palangue, banking	16
25	Haymar Ramsaran	Felicity	Banking	20
26	Lachhman Ramdass	Cacandee, Felicity	Banking, A-la-vive	2
27	Anand Ramponee	Cacandee, Felicity	Banking, A-la-vive	1

Fisheries Division Staff:

Shandira Ankiah, Fisheries Officer

Kieron Draper, Transhipment Monitoring Supervisor

Abigail Dowden, Associate Professional

With 27 stakeholders present and a maximum of 1 tag allowed per individual per card, the highest rank achievable for any given issue was 27. All ranks obtained are therefore out of 27, with 27 being the highest possible rank and 0 being the lowest possible rank.

Results

Ranking	Issue	Score (/27)
1	Piracy	25
2	High equipment prices due to limited suppliers	22
3	Desire for increased subsidies from the Government, including access to fuel & approved fuel container sizes	22
4	Competition from imported shrimp	21
5	Disagreement between fisherfolk and Government on some of the current fisheries laws	20
6	Injury/death as many fishermen do not have "safety at sea" training	17
7	Lack of facilities at landing sites & port facilities for industrial fleets	16
8	Outdated fishing laws	16
9	Conflict: between different types of fishing fleet operators; between local and Venezuelan fishers; between fishermen and operators of other vessel types	15
10	Inadequate national enforcement of fishery regulations	14
11	Full/Over-exploitation of target species	14
12	Inadequate regional & international collaboration regarding the fishing industry	14
13	Capture of juvenile species of resources already fully/over-exploited	13
14	Change in political parties leading to postponement of certain projects	12
15	Reduced fishing areas due to multi-sectoral use	12
16	Inadequate existing legislation for effective fisheries management, need inspection of boatyards to ensure boat quality	12
17	Lack of funding leading to: gaps in landing data collection & irregular data collection	12
18	Lack of health insurance & pension	11
19	Stock-depletion of by-catch	11
20	Increased land & ocean-based pollution affecting resources	11
21	Lack of alternative employment	10

Ranking	Issue	Score (/27)
22	Too many steps in the processing chain (from hook to plate)	10
23	Climate change	10
24	Lack of participation by some stakeholders due to a lack of resources to facilitate education & organisation	10
25	Inadequate scientific research to make informed management plans	10
26	Impacts of seasonality (low catch, low prices). Desire to create price standards so price is not dependent on quantity landed	10
27	Habitat damage due to the fishery	9
28	Limited community interest & involvement in fishery employment	9
29	Degradation of coastal habitats due to urban & industrial development	9
30	Non-compliance due to inadequate awareness of regulations	9
31	Accidents: collisions with other users of the sea	8
32	Inadequate fisher organizations	8
33	Loss of markets (e.g. EU & US) due to non-compliance with international standards	8
34	More scavenger species due to discards	8
35	Lack of collaboration between TT & Venezuela	7
36	Desire to trawl on the East Coast of Trinidad by industrial trawlers	7
37	Profits not equally distributed (harvesters receive less money than processors)	7
38	Loss of catch in trawl when TEDs used	6
39	Fishing communities dependent on fishery as a food source – overexploitation of the resource, yet communities rely on it as a cheap source of protein	6
40	Reduction in catch due to seismic surveys	5
41	Overcapitalisation of fleets	3
42	Limited contribution of fishing to national economy (Gross Domestic Product – GDP)	3
43	Noise, air & water pollution from the fishery itself	1

All issues received a score. No issue received a score of '0' = No priority.

Discussion

It was a strong belief of many attendees that horsepower regulations for trawlers must be revised, restricted and enforced. As many trawlers do not obey zoning rules, horsepower regulations are the best option to minimise damage to the habitat and the resource. Additionally, in order to reduce wastage of unwanted by-catch, processing for fish meal would be an alternative option as opposed to dumping. This has the potential to increase income, and decrease the negative impact on the environment.

Erin (Trinidad's south coast): 16 August 2012

List of Attendees at Erin Stakeholder meeting

	Name	Home Port/Site of Operation	Fishing Methods	# of Years Fishing
1	Jude Ready	Erin, Siparia	Transparent & fillet gillnet	17
2	Horsford Charles	Erin		34
3	Eugene Benjamin	Erin	Transparent gillnet, beach seine	40
4	Akbea Benjamin	Erin	Transparent gillnet, beach seine	10
5	Allister Garrick	Erin	Net, line	10
6	Courtland Phillip	Erin	(Everything)	16
7	Augustin Mahabir	Erin	Banking, switchering	35
8	Rhona Bali	Erin	(Everything)	>20
9	Sharma Abdool	Erin	Nets	>35
10	Sunil Chadia	Erin	Nets	15
11	Chaucer St. Louis (representing David St. Louis)	Erin	Transparent & fillet gillnet	>10
12	Martin Jones	Erin	Transparent & fillet gillnet	>40

Fisheries Division Staff:

Shandira Ankiah, Fisheries Officer

Abigail Dowden, Associate Professional

With 12 stakeholders present and a maximum of 1 tag allowed per individual per card, the highest score achievable for any given issue was 12. All scores obtained are therefore out of 12, with 12 being the highest possible score and 0 being the lowest possible score.

Results

Ranking	Issue	Score (/12)	Comments
1	Conflict: between different types of fishing fleet operators; between local and Venezuelan fishers; between fishermen and operators of other vessel types	9	A GPS coordinate system should be used to increase communication between T&T and Venezuela; increase dialogue with a written agreement.
2	High equipment prices due to limited suppliers	8	
3	Lack of alternative employment	8	
4	Piracy	8	
5	Impacts of seasonality (low catch, low prices). Desire to create price standards so price is not dependent on quantity landed	7	
6	Inadequate regional & international collaboration regarding the fishing industry	7	Closer relationships needed.
7	Increased land & ocean-based pollution affecting resources	7	
8	Lack of collaboration between TT & Venezuela	7	
9	Lack of health insurance & pension	7	
10	Non-compliance due to inadequate awareness of regulations	7	
11	Outdated fishing laws (e.g. cannot currently limit the number of vessels)	7	Limiting the number of vessels may lead to unfair prices when transfer of vessels occurs.
12	Profits not equally distributed (harvesters receive less money than processors)	7	
13	Accidents: collisions with other users of the sea	6	Mostly occur at night. View that it cannot be avoided.
14	Capture of juvenile species of resources already fully/over-exploited	6	E.g. carite & salmon. Continuous problem for years.
15	Degradation of coastal habitats due to urban & industrial development	6	Not enough research; Pollution from the oil industry; Waste water from the Erin pig farm (even though treated) kills mangroves, leads to illness of fishermen and no spawning grounds at Erin.
16	Desire for increased subsidies from the Government, including access to fuel & approved fuel container sizes	6	Subsidies for nets also desired.
17	Full/Over-exploitation of target species	6	

Ranking	Issue	Score (/12)	Comments
18	Inadequate existing legislation for effective fisheries management, need inspection of boatyards to ensure boat quality	6	
19	Inadequate scientific research to make informed management plans	6	Especially regarding mangroves & sardines.
20	Injury/death as many fishermen do not have "safety at sea" training	6	Need a training unit based in each community. Communication must be enhanced to utilise feedback.
21	Lack of participation by some stakeholders due to a lack of resources to facilitate education & organisation	6	
22	More scavenger species due to discards	6	
23	Disagreement between fisherfolk and Government on some of the current fisheries laws	5	
24	Inadequate fisher organisations	5	
25	Limited community interest & involvement in fishery employment	5	Education must increase to encourage employment in the fishery. There are less fishermen than in the past.
26	Loss of markets (e.g. EU & US) due to non-compliance with international standards	5	
27	Reduction in catch due to seismic surveys	5	
28	Stock-depletion of by-catch	5	
29	Too many steps in the processing chain (from hook to plate)	5	
30	Climate change	4	Rise in sea levels lead to the loss of coast at Palo Seco; Less nutrient-rich water coming from the top side of Moruga leading to less plankton; Difference in colours of water not observed anymore; change in winds; temperature differences of red fish bodies indicate if more/less fish are coming.
31	Fishing communities dependent on fishery as a food source – overexploitation of the resource, yet communities rely on it as a cheap source of protein	4	
32	Habitat damage in the Gulf due to the fishermen's activities	4	Trawling is the major destructive force.

Ranking	Issue	Score (/12)	Comments
33	Inadequate national enforcement of fishery regulations	4	
34	Lack of facilities at landing sites & port facilities for industrial fleets	4	
35	Lack of funding leading to: gaps in landing data collection & irregular data collection	4	
36	Overcapitalisation of fleets	4	Recreational fishers are selling on the market, leading to less profit for commercial fishermen. This must be addressed.
37	Concern over the desire of many to ban trawling as some claim there has been a decrease in catches due to Venezuelan trawl ban (due to lack of "fresh" ie. fish discards)	4	Note that this issue was recorded on the card by Fisheries Division as "Desire to ban trawling" and was subsequently clarified for these notes.
38	Change in political parties leading to postponement of certain projects	3	There was a previous move to ban transparent nets. Government change led to the allowance of such nets. Most believe that transparent nets should not be used.
39	Competition from imported shrimp	3	View that T&T needs inland farming of shrimp.
40	Desire to trawl on the East Coast of Trinidad by industrial trawlers	3	
41	Reduced fishing areas due to multi-sectoral use	3	
42	Limited contribution of fishing to national economy (Gross Domestic Product - GDP)	2	
43	Noise, air & water pollution from the fishery itself	2	
44	Loss of catch in trawl when TEDs used	1	

All issues received a score. No issue received a score of '0' = No priority.

Discussion

The importance of **coastal lights** was highlighted as not only a national need, but particularly for Erin. These lights are important to vessels coming and going out of the country, as well as for fishermen. Lights would indicate the location of reefs so that vessels do not run aground. This would mitigate environmental damage and damage to capital. These lights are very rare, perhaps only existing in the Grand Bocas, and are vital.

Moruga (Trinidad's south coast): 22 August 2012

List of Attendees at Moruga Stakeholder meeting

	Name	Home Port/Site of Operation	Fishing Methods	# of Years Fishing
1	Clever Blackwill	Grand Chemin	Switchering/Fillet gillnet, transparent gillnet, a-la-vive	30
2	Kyle Nephue	Grand Chemin	Switchering/Fillet gillnet, a-la-vive	10
3	Albert Taylor	Grand Chemin	Switchering/Fillet gillnet, a-la-vive	20
4	Casey Primus	La Ruffin	Transparent & fillet gillnet, a-la-vive	23
5	Peter Glodon	La Ruffin		70
6	Leon Joseph	La Ruffin	Transparent gillnet/Towing	24
7	Leston Douglas	Grand Chemin	Towing, fillet gillnet	34
8	Jerry Silverton	La Ruffin	Transparent gillnet, towing, switchering	12
9	Lawrence Toussaint	Grand Chemin	A-la-vive/Towing	10
10	Anil Ramadar	Grand Chemin	A-la-vive/Banking, fillet gillnet	15
11	Remy Nicholas	Grand Chemin	Fillet gillnet, switchering, banking, a-la-vive	35
12	Avalon Bethel	La Ruffin	Fillet/Transparent gillnet	2
13	Shariff Jairam	La Ruffin	Transparent gillnet	20
14	Randolph John	Grand Chemin	fillet/transparent gillnet, a-la-vive	23
15	Ronald Harripersad	Grand Chemin	Gillnet, palangue, line	10 to 15
16	Melissa Graham	Grand Chemin	Transparent/fillet gillnet, towing	10
17	James Roberts	La Ruffin	Transparent gillnet	45

Fisheries Division Staff:

Shandira Ankiah, Fisheries Officer

Abigail Dowden, Associate Professional

With 17 stakeholders present and a maximum of 1 tag allowed per individual per card, the highest score achievable for any given issue was 17. All scores obtained are therefore out of 17, with 17 being the highest possible score and 0 being the lowest possible score. Attendees chose to arrange groups according to their respective associations. As such, the meeting consisted of 2 groups: one table seating Grand Chemin members; and the other seating La Ruffin members. Discussion was thus carried out in this setting.

Results

Ranking	Issue	Score (/17)	Comments
1	Disagreement between fisherfolk and Government on some of the current fisheries laws	17	Fishermen want some kind of insurance provision in the law in the case of lost/stolen equipment. Nothing is in place for losses, only penalties are laid out and they would like compensation options.
2	Lack of collaboration between TT & Venezuela	15	
3	Piracy	15	
4	Reduction in catch due to seismic surveys	15	
5	Lack of facilities at landing sites & port facilities for industrial fleets	14	Desperate need for a facility. Lack of a proper facility promotes accidents, as the river is used as a channel, leading to accidents on the river (loss of life & limbs). Members want ONE port facility instead of division in Moruga among associations. Lights & beach security are also vital, as well as the availability of gas - more gas stations are needed in the area.
6	Accidents: collisions with other users of the sea	13	Occur most often at night as fishermen hesitate to use lights due to piracy. Accidents also occur when floating nets are not seen and are cut up accidentally by users who come out later in the day.
7	Injury/death as many fishermen do not have "safety at sea" training	13	Training is needed in Moruga, but the community needs the training to come into the community.
8	Lack of alternative employment	12	More institutions needed. The community has no banks/financial institutions, which would be very beneficial and would also encourage saving by the fishermen. Trade schools would also be a welcome initiative.
9	Capture of juvenile species of resources already fully/over-exploited	11	Land seine catches a high volume of juveniles which are then discarded on the beach.
10	Desire for increased subsidies from the Government, including access to fuel & approved fuel container sizes	11	The rebate process in inadequate - cheques expire before they each to the fishermen. Extension officers need to communicate more. Subsidies must also be increased/revised. Engine incentives are desired, as well as subsidies to purchase safety equipment (e.g. lifejackets).
11	Fishing communities dependent on fishery as a food source – overexploitation of the resource, yet	11	Moruga is completely dependent on the fishery & agriculture. It is the livelihood of the entire community.

Ranking	Issue	Score (/17)	Comments
	communities rely on it as a cheap source of protein		
12	Inadequate fisher organizations	11	Better communication & unification of the community is needed.
13	Outdated fishing laws	11	
14	Increased land & ocean-based pollution affecting resources	10	There needs to be more cleaning of large rivers.
15	Change in political parties leading to postponement of certain projects	9	
16	Conflict: between different types of fishing fleet operators; between local and Venezuelan fishers; between fishermen and operators of other vessel types	9	Conflict among the local fishers themselves enhances division in the community. Regarding conflict with Venezuelan fishers, the Government must increase its collaboration with Venezuela.
17	Full/Over-exploitation of target species	9	Transparent nets catch too large a volume of fish (e.g. Racando, Blinch)
18	Inadequate existing legislation for effective fisheries management, need inspection of boatyards to ensure boat quality	9	Inspection of nets BEFORE sale is needed. Fishermen are paying for nets with certain mesh size, unaware that the nets they purchase may not be regulation size.
19	Inadequate national enforcement of fishery regulations	9	
20	Lack of health insurance & pension	9	Safety issues regarding catfish discards. Bones with bacteria severely injure fishermen who do not have any health insurance to compensate for death or losses while sick.
21	Limited community interest & involvement in fishery employment	9	
22	Limited suppliers - high cost; not enough suppliers; need more equipment in showroom	9	High engine prices & long waiting times. Would like to import their own engines for the community.
23	Noise, air & water pollution from the fishery itself	9	When nets are left for too long, fish spoil and are discarded causing pollution at sea. Fishermen report instances where at least 700-800 lbs of fish are discarded
24	Non-compliance due to inadequate awareness of regulations	9	
25	Inadequate regional & international collaboration regarding the fishing industry	8	
26	Lack of funding leading to: gaps in landing data collection & irregular data collection	8	Lack of data leads to insufficient information to influence subsidy changes, equipment grants and management plans.

Ranking	Issue	Score (/17)	Comments
27	Climate change	7	
28	Inadequate scientific research to make informed management plans	7	The Fisheries Division must take more of an aggressive role in this aspect.
29	Profits not equally distributed (harvesters receive less money than processors)	7	
30	Degradation of coastal habitats due to urban & industrial development	6	Moruga is affected by the "Guayaguayare Block". Exploration occurs near Moruga affecting the resource, but Moruga is never mentioned simply due to the name of the block.
31	Habitat damage in the Gulf due to the fishermen's activities	6	Collective belief that most Gulf damage is due to trawling. Loss of mangroves in the Moruga river due to activities of fishers. The lack of port leads to the use of the river as a channel, causing pollution.
32	Reduced fishing areas due to multi-sectoral use	6	Rigs are not the only issue reducing fishing areas. Noise & chemical pollution from industries have a widespread effect, that may affect a greater area than presently perceived.
33	Too many steps in the processing chain (from hook to plate)	6	Desire for a local processing industry based in the community
34	Concern over the desire of many to ban trawling as some claim there has been a decrease in catches due to Venezuelan trawl ban (due to lack of "fresh" ie. fish discards)	5	Note that this issue was recorded on the card by Fisheries Division as "Desire to ban trawling" and was subsequently clarified for these notes.
35	Impacts of seasonality (low catch, low prices). Desire to create price standards so price is not dependent on quantity landed	5	Vendors form alliances with one another (monopoly by the vendors) & refuse to pay above a certain price. Fishers that come in late get a lower price as vendors have already made their quota. As such, fishermen must pay the price put forward by the vendor since fish are perishable & there is no cold storage or industry (e.g. salting) in the community to preserve catch. Price standards may be useful to this community.
36	Desire to trawl on the East Coast of Trinidad by industrial trawlers	4	Strongly opposed to any trawling on the East coast
37	Lack of participation by some stakeholders due to a lack of resources to facilitate education & organisation	4	
38	Stock-depletion of by-catch	4	

Ranking	Issue	Score (/17)	Comments
39	Competition from imported shrimp	1	
40	Limited contribution of fishing to the national economy (Gross Domestic Product - GDP)	1	Moruga is the largest contributor of fish to Trinidad's public & economy. Fishermen would like mandatory data submissions monthly from vendors to map fishing's contribution to the GDP. Additionally, the fishermen highlighted the fishing industry as a unique culture, and believe that its national significance should not only rely on its economic contribution.
41	Loss of markets (e.g. EU & US) due to non-compliance with international standards	1	
42	More scavenger species due to discards	1	
43	Loss of catch in trawl when TEDs used	0	
44	Overcapitalisation of fleets	0	Fishermen claim that this cannot be considered an issue in Moruga as it is the only business option for a livelihood in this community, and you cannot limit the people to reduce their only source of income.

Two issues received a score of '0': Loss of catch in trawl when TEDs used; and Overcapitalisation of fleets.

Discussion

A major issue brought forward by both associations was the lack of the communication between their community and the Government. They described multiple attempts to contact the Ministry of Food Production. The absence of a reply has left many community members frustrated. The community necessitates enhanced communication as there are a number of plans they have devised to improve the community, including the desire to participate in aquaculture. They are interested in educational programs regarding aquaculture.

Comments

Fishermen voiced concerns at the start of the meeting that they were completely unaware of the CLME Case Study for the Shared Stocks of the Shrimp & Groundfish Fishery of the Guianas-Brazil Shelf. However, the representative for this area had delivered material to both associations prior to the meeting date. Members of the both associations acknowledged their failure to familiarise themselves with the information provided to them. This highlights a need for more efficiency within the fishing associations and the need for better communication between members.

Otaheite (Trinidad's west coast): 27 August 2012

List of Attendees of Otaheite Stakeholder meeting

	Name	Home Port/Site of Operation	Fishing Methods	# of Years Fishing
1	Sharaz Gaffoor	Otaheite	Line, trawl, transparent gillnet	28
2	Saeid Khan	Otaheite	Outboard trawl	20
3	Rickie Ramsawak	Otaheite	Inboard trawl	20
4	Ryan St. Paul	Otaheite	Inboard trawl	20
5	Kamla Moonilal	Otaheite	Outboard trawl	20
6	Sookraj Kisto	Otaheite	Outboard trawl, banking	3
7	Radesh Mohan	Otaheite	Outboard trawl	25
8	Beepat Ramsawak	Otaheite	Outboard trawl	40
9	Mohammed Khan	Otaheite	Trawl	30
10	Anton Seepersad	Otaheite	Trawl	20
11	Suresh Seepersad	Otaheite	Trawl	30
12	Indarjit Sookraj	Otaheite	Trawl	20
13	Oudit Ramjattan	Otaheite	Trawl, banking, a-la-vive	20
14	John Mohan	Otaheite	Trawl, banking, towing	35
15	Masasmoon Khan	Otaheite	Banking	24
16	Rajesh Beharry	Otaheite	Trawl, fishnet	5
17	Raymond Ramlal	Otaheite	Trawl	13
18	Mitra Harbance	Otaheite	Trawl	20
19	Adesh Cassie	Otaheite	Line	35
20	Rocky Mohan	Otaheite	Trawl	13
21	Sooklal Gajadhar	Otaheite	Inboard stern trawl	40
22	Balram Ramkaran	Otaheite	Trawl	15
23	Ramcharan Partap	Otaheite	Trawl, banking	15
24	Damaroo Seepersad	Otaheite	Trawl	24

Fisheries Division Staff:

Shandira Ankiah, Fisheries Officer

Abigail Dowden, Associate Professional

With 24 stakeholders present and a maximum of 1 tag allowed per individual per card, the highest score achievable for any given issue was 24. All scores obtained are therefore out of 24, with 24 being the highest possible score and 0 being the lowest possible score.

Results

Ranking	Issue	Score (/24)	Comments
1	Piracy	24	
2	Reduction in catch due to seismic surveys	24	After surveys, there is an extended period of time required for an ecosystem to acquire its balance. Fisherfolk want long-term compensation because their fishing grounds are affected for a long period after the survey is done.
3	Climate change	23	Current patterns are changing.
4	Injury/death as many fishermen do not have "safety at sea" training	23	
5	Inadequate regional & international collaboration regarding the fishing industry	22	
6	Competition from imported shrimp	19	
7	Desire for increased subsidies from the government, including access to fuel & approved fuel container sizes	19	Need revised standard sizes for fuel containers & volumes. Cannot restrict fuel as different fishing methods travel different distances, and some stakeholders claim that they may not be able to get home after fishing all day due to fuel restrictions. Fisherfolk would like set permission applications so that they can get fuel anywhere.
8	Increased land & ocean-based pollution affecting resources	19	Claims that industrial pollution has killed off the majority of resources in the river
9	Disagreement between fisherfolk and Government on some of the current fisheries laws	18	
10	Fishing communities dependent on fishery as a food source – overexploitation of the resource, yet communities rely on it as a cheap source of protein	18	
11	Conflict: between different types of fishing fleet operators; between local and Venezuelan fishers; between fishermen and operators of other vessel types	17	Need zoning & forbidden grounds for all activities
12	Degradation of coastal habitats due	17	Highway extension will affect them

Ranking	Issue	Score (/24)	Comments
	to urban & industrial development		
13	Inadequate scientific research to make informed management plans	17	
14	Lack of alternative employment	16	The area needs more options for employment. For example: At present, the repairs being done at the Otaheite Landing Site should incorporate at least 25% employment from the community and not one or two persons. This agreement should be made mandatory between the Ministry of Food Production , Fisheries Division and the hired contractor.
15	Lack of collaboration between TT & Venezuela	15	
16	Lack of health insurance & pension	15	
17	Profits not equally distributed (harvesters receive less money than processors)	15	
18	Reduced fishing areas due to multi sectoral use	15	
19	Inadequate existing legislation for effective fisheries management, need inspection of boatyards to ensure boat quality	14	Standards must be set for boatyards, and materials used to make boats must be described.
20	Lack of participation by some stakeholders due to a lack of resources to facilitate education & organisation	14	
21	Limited suppliers - high cost; not enough suppliers; need more equipment in showroom	14	Need access to spare parts, especially the option for foreign-used spare parts. Machine shops that specialise in engine repairs are also vital.
22	Desire to trawl on the East Coast of Trinidad by industrial trawlers	13	Small trawlers would prefer if the industrial trawlers moved to the East coast to allow small trawlers a greater fishing area & catch. However, times & areas must be segmented on the East Coast for industrial trawlers.
23	Inadequate fisher organisations	13	
24	Full/Over-exploitation of target species	12	Drift nets cause too much destruction and should be banned. Ghost nets chase fish from an area. It is not a case of overfishing regarding small scale fishermen.

Ranking	Issue	Score (/24)	Comments
25	Habitat damage in the Gulf due to the fishermen's activities	12	Trawling destroys fishing grounds.
26	Loss of markets (e.g. EU & US) due to non-compliance with international standards	12	
27	Non-compliance due to inadequate awareness of regulations	12	
28	Overcapitalisation of fleets	11	
29	Accidents: collisions with other users of the sea	10	
30	Inadequate national enforcement of fishery regulations	10	
31	Limited community interest & involvement in fishery employment	10	Limited catch volumes affect fishing employment. Supply affects employment.
32	Outdated fishing laws	10	
33	Loss of catch in trawl when TEDs used	9	
34	Impacts of seasonality (low catch, low prices). Desire to create price standards so price is not dependent on quantity landed	8	
35	Lack of funding leading to: gaps in landing data collection & irregular data collection	8	
36	Stock-depletion of by-catch	8	
37	Lack of facilities at landing sites & port facilities for industrial fleets	6	Transport for fuel is an issue for those fisherfolk without vans. Fishermen want a subsidised fuel depot & security for fishermen at the landing facility.
38	Too many steps in the processing chain (from hook to plate)	6	MFP Fisheries Division/SIDC could purchase all of their catch and then process & resell, OR a storage/port facility would allow them to do their own processing.
39	Capture of juvenile species of resources already fully/over-exploited	5	
40	Concern over the desire of many to ban trawling as some claim there has been a decrease in catches due to Venezuelan trawl ban (due to lack of "fresh" ie. fish discards)	5	Must differentiate between big & small trawlers. Desire to ban Type IV trawlers, but not smaller trawlers. Zoning must be implemented efficiently. Note that this issue was recorded on the card by Fisheries Division as "Desire to ban trawling" and was subsequently

Ranking	Issue	Score (/24)	Comments
			clarified for these notes. Based on the fishers' comments on this issue, it appears the issue may have been interpreted by fishers exactly as written on the card as opposed to the issue initially articulated at the Erin consultation.
41	Change in political parties leading to postponement of certain projects	4	
42	Limited contribution of fishing to national economy (Gross Domestic Product - GDP)	4	They may not contribute to the economy significantly, but they feed the public & their community.
43	More scavenger species due to discards	2	
44	Noise, air & water pollution from the fishery itself	1	

No issue received a score of '0'.

Discussion

A major issue brought forward by the stakeholders was the high-risk lifestyle in the community. Some individuals expressed a great concern and desire for institutions, such as Alcoholics Anonymous (AA), which would enhance the productivity of the community.

Overall Comments on Community Consultations

All community meetings showed high interest and involvement in Government initiatives. Insightful discussion occurred during the meetings. Group discussions were lively, and interactions were plentiful, with many questions being raised. Participation must continually be encouraged so as to achieve a solid consensus on how to solve the issues which arise in this fishery and to ensure that all issues have been addressed.

Appendix 6: Priority ranking of issues obtained at national consultation

Issues in Shrimp & Groundfish Fishery	# Votes	Priority Ranking
Piracy	60	1
Habitat damage in the Gulf due to the fishermen's activities	30	2
Degradation of coastal habitats due to urban & industrial development	29	3
Reduction in catch due to seismic surveys	29	3
Capture of juvenile species of resources already fully/over-exploited	28	5
Increased land & ocean-based pollution affecting resources	26	6
Outdated Fishing Laws	26	6
Inadequate subsidies from the government (including inadequate access to subsidized fuel)	25	8
Lack of health insurance & pension	24	9
Disagreement between fisherfolk and Government on some of the current fisheries laws	22	10
Full/Over-exploitation of target species	22	10
Lack of facilities at landing sites & port facilities for industrial fleets	22	10
Accidents: collisions with other users of the sea	21	13
Inadequate national enforcement of fishery regulations	20	14
Injury/death as many fishermen do not have "safety at sea" training	18	15
Concern over the desire of many to ban trawling as some clam there has been a decrease in catches due to Venezuelan trawl ban (due to lack of "fresh" ie. fish discards)*	17	16
Change in political parties leading to postponement of certain projects	16	17
Lack of collaboration between Trinidad & Tobago & Venezuela	16	17
Lack of alternative employment (dependence on fishery for food and livelihood)	15	19
Limited suppliers - high cost; not enough suppliers; need more equipment in showroom	15	19
Inadequate scientific research to make informed management plans	12	21
Competition from imported shrimp	11	22
Inadequate fisher organizations	11	22
Inadequate regional & international collaboration at the fishing industry level	10	24
Lack of participation by some stakeholders due to a lack of resources to facilitate education & organisations	10	24
Climate change	9	26
Lack of funding leading to: gaps in landing data collection & irregular data collection	8	27
Impacts of seasonality (low catch, low prices). Desire to create price standards so price is not dependent on quantity landed	7	28
Overcapitalisation of fleets	7	28
Reduced fishing areas due to multisectoral use	7	28
Conflict: between different types of fishing fleet operators; between local and Venezuelan fishers; between fishermen and operators of other vessels types	6	31
Limited community interest & involvement in fishery employment; difficulty getting captains and crew to work boats	6	31
Loss of catch in trawl when TEDs used	6	31
More scavenger species due to discards	6	31
Loss of markets (e.g. EU & US) due to non-compliance with international standards	5	35
Noise, air & water pollution from the fishery itself	5	35
Desire to trawl on the East Coast of Trinidad by industrial trawlers	4	37
Profits not equally distributed (harvesters receive much less money than processors)	4	37
Poor/Unsafe Building of Boats and Gears	3	39
Limited contribution of fishing to national economy (Gross Domestic Product - GDP)	2	40
Stock-depletion of by-catch	2	40
Non-compliance due to inadequate awareness of regulations	1	42
Too many steps in the processing chain (from hook to plate)	0	43

*** This issue, first raised by Erin fishers, was initially recorded by Fisheries Division as "Desire to ban trawling" and was subsequently clarified. The initial phrasing of the issue "Desire to ban trawling" remained in error at Station 3 and received 23 votes. These votes were counted under the issue "Habitat damage due to fishmen's activities".**

Ecological wellbeing | **Social & economic wellbeing** | **Ability to achieve: Governance**

Appendix 7: EAF Component Tree with Issues Identified and Possible Solutions

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
Ecological wellbeing					
Retained Species	Target Species		Decrease in catches of artisanal multi-gear fleet due to Venezuelan ban on industrial trawling (as a result of decrease in fish discards or "fresh")	Note: Venezuelan ban may result in decreased catches temporarily but nevertheless the benefits of the ban in conserving the resources and preventing a collapse outweigh any resulting decrease in catch.	16 (17)
		F. subtilis & *F.notialis* (red), *F. brasiliensis* (hoppers), *X. kroyeri* (honey), *L. schmitti* (white, cork). IV: hoppers, honey on south coast; red (dry season, Jan-Jun), white (rainy) & honey in Gulf; red (notialis) on north coast; (fish not targeted, more in wet season). III: red (notialis); fish in wet season. II: red & some white (Apr-Jun); white (rainy season, Jun- Sep); (fishing hard Sep- Mar)	Fully-exploited to over-exploited state of resource Stocks are being depleted	Ban all trawling or large trawlers. Government should offer compensation to trawl fishers to stop operating. Implement zoning such that different zones are closed to fishing and shrimping at different times. Enforce bag limits and quotas per fleet. Implement depth restrictions Closed Season for trawling: - Industrial trawl fleet, Orange Valley, proposed a 2 month ban on all fishing during period July, August, Sept. - Industrial trawl association proposed Jul-Aug ban. - Artisanal inboard trawler from San Fernando proposes mid-Sep to mid Nov ban. - a possible compromise is mid-Aug to mid Oct for ban. - closed season should be for 3 months and for all fishing, not just trawling. - During closed season industrial trawlers can fishpot or operate on east coast. Artisanal rep from San Fernando proposed compensation of at least $150 for each of 2 crew, so $300/day for crew and $250 per day for owner, so $550 per day per boat for 5 days per week. Stern trawler asks for twice the artisanal figure, and large trawlers, three times the artisanal figure in	10 (22)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
				compensation. Mariculture of shrimp should be considered as an alternative to wild caught shrimp The following areas should be designated protected areas all year round: - one quarter mile offshore, north of Caroni area (redfish spawn in seagrass); - 3-7 fathoms in the area of Pointe-a-Pierre, San Fernando, La Romain, La Brea, Otaheite, Aripero ; - Caroni Bird Sanctuary (spawning area).	
		Lutjanus sp. (Snappers), *Micropogonias furnieri* (croaker), *Cynoscion* sp. (salmon)	Fully-exploited state of resources. Stocks being depleted. Transparent monofilament gillnets catch too large a volume of fish (e.g. Racando, Blinch) and much is thrown away.	Ban gillnets. Government should offer compensation to fisherfolk to stop fishing. See other proposed solutions in row above	10 (22)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
	Bycatch Species / Groups	Small fish –blinch, plato, crocro, salmon, snapper, catfish, moonshine	Stocks being depleted. (Blinch, plato and crocro also caught a lot by gillnets.) Transparent monofilament gillnets catch too large a volume of fish (e.g. Racando, Blinch) and much is thrown away). High catches of immature red fish beyond 2 nautical miles (nm) of the coast where trawlers are allowed to operate.	Fisheries Division should continue additional testing of the monofilament trawl net, fisheye and square mesh panel BRDs to determine their effectiveness in reducing discards. Tests on the semi-industrial and industrial fleets using new experimental nets that are lighter in weight and made of Dyneema netting and new otter boards were also recommended. The Fisheries Division needs to enhance its technical capabilities with regard to fishing gear technology in order to effectively support the fishing industry through future testing and introduction of more efficient trawl gear . Protection of spawning zones (where there is often a high occurrence of coral) rather than the 2 nm limit. Zonal protection should be done based on depth.	40 (2) 5 (28)
		Herring (year round), sardine (sometimes)	No issue. Stocks in abundance.		
Discarded species	Direct capture	Juvenile (under 6") salmon, croaker, blinch, cutlass fish, snapper caught by trawls and gillnets Juveniles of commercial species such as the mackerels which are targeted by pelagic gears are caught and discarded by trawlers	Capture of juvenile species of already fully-exploited and over-exploited resources Capture of juveniles which should have been allowed to grow and be captured at a larger size by pelagic gears. Wastage of fish.	Ban monofilament gillnets. In 5-10 years after fish have had a chance to grow, allow use of gillnets with larger mesh sizes. (Middle-aged and elderly fishers who cannot be trained for alternative employment due to the ban should be compensated by government.) Oversee the quality of gears being sold to and used by fishermen (monofilament mesh sizes) Processing of unwanted by-catch for fish meal would be an alternative to dumping. This has the potential to increase income. Trawlers should use Bycatch Reduction Devices (BRDs). Operation of trawlers in deeper waters is expected to reduce the catch of juveniles, in the absence of BRDs. Trawling at slower speeds catches more shrimp and can	5 (28)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
				allow smaller species and younger fish to swim out of the net. Educate consumers, fisherfolk and vendors on the biology and spawning habits of important species to increase awareness.	
General Ecosystem	Impacts of fishing on Ecosystem Structure	Community Structure (trophic impacts)	Proliferation of scavenging species which feed on the discards	Processing of unwanted by-catch for fish meal would be an alternative to dumping. This has the potential to decrease the negative impact on the environment	31 (6)
		Ghost Fishing	Lost monofilament (transparent) nets continue catching fish and contributing to overexploitation	Ban monofilament nets. Encourage use of biodegradable materials and/or better materials for net anchorage to mitigate ghost fishing.	
		Habitat Damage	Damage to the seafloor, and too large a volume of resources can be caught in one haul. A red seaweed (which grows on rocks) no longer seen in Gulf. Loss of mangroves in the Moruga river as fishers use the river as a channel and landing site due to the lack of port facilities.	Ban all trawling or large trawlers and bottom nets. Buy-back/compensation from Government and re-tooling of trawler vessels. Implement zoning such that different zones are closed to fishing and shrimping at different times. Horsepower regulations for trawlers must be revised, restricted & enforced. As many trawlers do not obey zoning rules, horsepower regulations are the best option to minimise damage to the habitat and the resource. Support and subsidize local shrimp aquaculture and export, Ban boats from operating out of landing sites in rivers to decrease mangrove damage	2 (30) 2 (30)
	Other impacts of fishing	Waste Disposal Impacts on water &air quality	When nets are left for too long, fish spoil and are discarded causing pollution at sea. Fishermen report instances where at least 700-800 lbs of fish are discarded. Bilge waste pumped out into the sea. Pollution from engines (noise, air)		35 (5) 35 (5)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
Social and economic wellbeing					
Community Wellbeing	Industry – Fishing (directly employed)	Income Interaction with the gear	Over-capitalization of fleets. Loss of catch due to blockage of TED by large sting ray, garbage and lost fishing gear (semi-industrial & industrial trawlers) Mud attaches to ropes and gear	 Need for study on turbidity with respect to the health of the ecosystem	28 (7) 31 (6)
		Injuries	Fishers suffer financial losses and injuries/death from interactions with pirates	Government /Fisheries Division should compensate fishermen for loss of fishing equipment through piracy (not pay the entire cost price, but meet fishers more than half way). Make provisions in the law for insurance in the case of lost/stolen equipment. Government should supply fishermen with flares, with colour coding to identify distress. There should be a collaborative effort between the Trinidad and Tobago and Venezuela coast guards. Increase Coast Guard patrols. Establish offshore/floating monitoring stations for Coast Guard especially on south coast (old boats no longer in active use can be used). Establish phone networking among fishing associations (re: stolen boats and engines). Install GPS locators on engines as a tracking device (issue re: power source on small trawlers) Use VHF Radio communication systems for communication with fellow stakeholders and coast guard (provide Government subsidy for VHF or rental to fishing associations; make it mandatory for all members of fishing associations to use radio; responsible stakeholder to pay association for lost or unreturned radio) Fisheries surveillance officers should be trained to carry out	1 (60)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
				random checks once or twice a week to verify the legality of landing boats. Train stakeholders to be estate constables to boost the enforcement of regulations within their given area.	
			Many do not have or use safety equipment (life jackets, radios) Many fishermen not trained in swimming, safety at sea and navigation Accidents due to interaction within the fishery sector and with other sectors (water taxis, tugs/barges, oil supply vessels, etc.) which **<u>may</u>** be caused by: -negligence of fishers (operating boats under the influence of alcohol or falling asleep or not having the required knowledge) -fishers using insufficient lighting at night due to piracy issue -floating nets not seen because they are not marked properly	Stringent inspection of fishing vessels (annual basis) to ensure that the vessel is in good working order and that the proper equipment is on board. Regular training and refreshers/seminars for fishermen in safety at sea, navigation, etc. There should be a training unit based in each community. Communication must be enhanced. Training for captains and crew to ensure responsible behavior. Need for institutions, such as Alcoholics Anonymous (AA) in fishing communities, Adjust legislation to outline dangerous behaviours. Monitor fishermen behaviour at sea through enforcement arm of Fish. Div. More patrols by coast guard to ensure safety practised at sea. Use of radar reflectors should be made mandatory and should be provided to fishers at a subsidized cost initially.	15 (18) 13 (21)
			Lack of social security (health insurance [workmen's compensation], pension) Risk associated with the handling of large quantities of cash from sale of fish (robbery)	Better organization and planning among fishermen in co-operatives. Group plans for co-ops through private insurance companies. Revision of NIS mandate to cater for private entrepreneurs such as fishermen. Programs to educate fisherfolk about importance of insurance and pension for themselves and their families	9 (24)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
		Food	Catch is a cheap source of food for many fishers but resource being overexploited		19 (15)
		Conflicts	Fishers competing for the same resource: -Industrial, semi-industrial and artisanal trawlers - Commercial and recreational fishers -Trinidad and Venezuela fishers	A GPS coordinate system should be used to increase communication between T&T and Venezuela; increase dialogue with a written agreement.	31 (6)
			Conflicts for space among: -Trawlers and other types of fishers esp. Gillet (T&T) -Fishers using lights and fishers not using lights due to piracy	Proper signaling should be enforced for gillnets so as to avoid conflict when improperly signaled nets are cut by other fleet types.	31 (6)
			Conflict among fishers and government agencies re: regulations on gear and fishing areas	More effective zoning & forbidden activities for all are needed	31 (6)
			Conflict among fishers and other sectors (e.g. the energy sector), and any other vessels using the area, or passing through the area		31 (6)
		Employment	Dependence on the fishery for a livelihood. Many fishers have no alternative means of employment.	Agriculture and/or construction training and jobs. Establish banks/financial and other institutions or port facilities in rural fishing communities to create jobs and encourage saving by fisherfolk. Fisherfolk should be trained at trade schools. Middle-aged and elderly fishers who cannot be trained should be compensated by government.	19 (15)
			Difficulty to get crew due to inconsistency of catch and resulting pay	Education must increase to encourage employment in the fishery.	31 (6)
		Seasonality	Seasonality impacts on quantity of landings and hence price (high abundance, low	Obtain cold storage or establish processing industry (e.g.	28 (7)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			price.)Vendors form alliances with one another (monopoly by the vendors) & refuse to pay above a certain price.	salting) in the community to preserve catch. Create price standards, so that fisherfolk are not dependent on the quantity of catch landed. Fisheries Division/Seafood Industry Development Company (SIDC) could purchase fish catch and then process & re-sell	
		Cultural Values (including social capital)	Decreased market for shrimp/fish at Divali time (2 week period) (small catch also). Many boats do repairs at this time		
	Industry-Processing		Competition from imported shrimp (Cheaper to import processed shrimp than purchase the freshly caught shrimp locally) Competition between local trawlers and importers of processed (frozen headless) shrimp re: sale at same venue		22 (11) 22 (11)
		Income	Too many steps in the processing chain and middle men benefit the most. Inadequate marketing of local species	Local processing industries should be established in the fishing communities. There is potential to increase value added of product. There is potential for primary processing in communities and for under-utilized species including peeling of small honey shrimp, fish filleting, drying. Fisheries Division/SIDC could purchase all fish catch and then process & resell. Establish cooperatives.	43 (0)
		Injuries			
		Employment	Limited community involvement in fish processing.	Education must increase to encourage employment in the fishery.	31 (6)
	Local Dependent Communities	Food	Fishing communities dependent on fish (particularly low priced fish or at no cost) as food source but resource being overexploited		19 (15)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
		Employment	In many fishing communities there are limited employment opportunities	See solutions for this Component under Category "Industry – Fishing (directly employed)"	19 (15)
		Cultural Values	Decreased market for shrimp/fish at Divali time (2 week period) Lack of fish/shrimp availability during Lent (between Carnival and Easter Reduced entry of younger generation into fishing industry: Fishing considered an employer of last resort. Younger generation getting jobs in non-fishing sector	Education must increase to encourage employment in the fishery.	31 (6)
National Wellbeing	Economic	Net Economic Return	Negligible contribution to national GDP. There is potential to increase value added of product and foreign exchange earnings.	There should be mandatory monthly data submissions from vendors to map fishing's contribution to the GDP. Fisherfolk in general highlight the fishing industry as a unique culture, and believe that its national significance should not only rely on its economic contribution.	40 (2)
		Subsidies	From the perspective of the fishing industry, there could be increased financial support from Government with respect to purchase of fishing gear in particular. Alternatively there could be some Governmental control on pricing of fishing gear. Difficulty accessing fuel and approved fuel container sizes for subsidized fuel are too small. Amount of fuel cannot be restricted as travel distances vary depending on fishing method. The rebate process is inadequate/inefficient as cheques expire before they are received by	Revise/Increase existing subsidies. Introduce subsidies for nets. Make insurance (hulls, engines, etc.) and essential safety equipment (flares, life preservers etc.) and engines accessible to fisherfolk at subsidized rates. Increase approved subsidized fuel container size (15 to 20 gallons from Ministry of Energy & Energy Affairs) and allowable volume from gas stations (from 100L to 200L). Fishermen would like set permission applications so that fuel can be obtained anywhere. The location of gas stations in fishing ports to be operated by co-ops/fishing associations would be convenient. Increase communication among Fisheries staff and fisherfolk with respect to the rebate process	8 (25) 8 (25)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			fishers. Government currently provides some subsides to the fishing industry that may be considered globally (by the WTO) to contribute to overfishing of the resource.		
		Fees			
	Social	Employment	The fishing industry provides opportunities for downstream employment for unskilled (in particular, and especially in rural communities) as well as skilled labour	See solutions for this Component under Category "Industry – Fishing (directly employed)"	19 (15)
		Food	Fish is an important contributor to food security at national level Lack of monitoring of fish quality (both local and foreign).		19 (15)
		Cultural values	Decreased market for shrimp/fish at Divali time (2 week period) Lack of fish/shrimp availability at Carnival Reduced entry of younger generation into fishing industry Fishing considered an employer of last resort. Younger generation getting jobs in non-fishing sector	Education must increase to encourage employment in the fishery.	31 (6)
Ability to achieve					
Governance	Management	Treaties	Bearing in mind the shared nature of the resource, there is inadequate collaboration between Trinidad and Tobago and Venezuela with respect to assessment and management of fisheries. Vessels sometimes drift into Venezuelan waters and are held by the Guardia Nacional.	Need to re-activate 1989 TT/Venezuela Protocol on Joint Research/ Fishing Agreement. Have agreement between T&T and Venezuela for joint patrol of Columbus channel and Gulf (to curtail drug and contraband trade, and piracy)	17 (16)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			Currently vessels are restricted to operate in National waters. There are no access agreements. Inadequate resources to meet obligations under international conventions. Inadequate regional & international collaboration regarding the fishing industry.	Develop fishing agreement between T&T and Venezuela: allow Venezuela to fish on east coast of T&T: allow T&T to fish in Orinoco delta	24 (10)
		Legislation	There are conflicts of interest with fishing communities in response to present/ implementation of legislation: Owner held liable for contravention of TED Act (TEDs not used in trawl nets) when Captain is the one in control of vessel at sea. Artisanal trawler cannot use mesh size in codend greater than 1.25", 1.125" (minimum of 1.5" required by law) as they will not catch anything. White shrimp is caught only within 1 mile of Gulf of Paria coastline which is prohibited by law. Trawling by non-artisanal vessels beyond 2 nautical miles of north and south coasts (which is required by law) is not profitable. Trawlers operate within the 2 mile restricted area. 2 nm limit is ineffective due to greatly varying depths with distance from coast. Industrial trawlers would like new harvesting areas (eg. East coast where trawling is currently prohibited) Herrings & sardines are sold as food fish but by law should only be sold as bait. Proposed ban on transparent nets will greatly	This will be modified under the new Fisheries Management Act (Draft 2011 currently before the Legislative Review Committee). Industrial trawler owners propose: -Gulf of Paria: Jan to Jun - 24hr fishing; Jun to Dec- no night trawling, trawling 6am to 6pm. -South Coast: no night trawling; trawling 5am to 6pm with no restriction on distance of operation from coast. -North Coast: trawling in first and second Boca from Oct to Dec from 5am to 6pm. The only bait species sold as food fish is Silver Sardines (not Red Sardines, Jashua and Herrings). This is necessary to earn income. Mariculture of bait-fish by licensed vendors Adjust legislation to allow larger mesh size (4.25") instead	10 (22) 37 (4)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			affect livelihoods in particular fishing communities.	of complete ban.	
			Existing legislation is outdated and inadequate for fisheries management (Draft Bill currently being finalized)	Education about existing fishing laws to enable open discussion about necessary future modifications. New legislation drafts need to be simplified and taken to all stakeholders for consultation.	6 (26)
			Poor/ unsafe building of boats and fishing gear	Provisions for the inspection/registration of boatyards are needed to ensure that the quality of the boats being provided to fisherfolk are of a high standard. Standards must be set for boatyards, and materials used to make boats must be described. Legislation must also address inspection of net retailers to ensure compliance with the law regarding mesh sizes.	39 (3)
		Management Plan/ Policy Development	Inadequate scientific information to inform management plans /policies. No management plans are currently in place (only Draft Plans for the Trawl Fishery and Coastal Pelagic Fishery exist). No approved fisheries policy (in draft only)	New legislation will make provisions for development and implementation of management plans.	21 (12)
	Allocation	Catch/Effort restrictions	Current legislation does not make full provisions for implementation of catch/effort restrictions.	New legislation will make provisions for this.	6 (26)
		Compliance / Enforcement	There are conflicts of interest with fishing communities with respect to regulations, which may lead to non-compliance Inadequate awareness of existing regulations, which may lead to non-compliance. Lack of collaboration between the enforcement arms of Trinidad & Tobago and Venezuela	Conduct community-based activities to impart the objectives of the regulations and the consequences of not abiding by them. Education campaigns via media, at schools and in communities to increase national awareness. Have agreement between T&T and Venezuela for joint patrol of Columbus channel and Gulf (to curtail drug and	10 (22) 42 (1) 17 (16)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
				contraband trade, and piracy)	
			Inadequate enforcement of fisheries regulations nationally.	Rejuvinate enforcement arm of Fisheries Division (train inspectors for marine ecosystems)	14 (20)
				Revisit and amend existing legislation (with proper stakeholder consultation) to increase enforcement capabilities of Fisheries Inspectors and encourage collaboration and sharing of resources with other enforcement agencies (coast-guard)	
		Monitoring and Review	There are gaps in collection of landing data throughout the coast due to extensive distribution of fishing activities along coastline. There is a lack of resources for continuous data collection and research.	Fish vendors should be mandated to submit data with respect to their purchases.	27 (8)
			Lack of continuous research for reviews of management plans	Priority should be given to research on mangroves & sardines.	21 (12)
				Fisheries Division should take a more aggressive approach to research.	
		Human and other resources	There are inadequate resources for the administration and management of fisheries.	Increased corporate support to the fisheries sector	
			Inadequate corporate support to the fisheries sector		
	Consultation	Industry/Community	Lack of capacity in fishing communities to sustain viable fisherfolk organizations	Better communication within communities is needed.	22 (11)
			There is a lack of resources/ capacity to mobilize /educate stakeholders in the industry to be able to engage in the participatory process. This may result in non-attendance of some industry stakeholders in consultation meetings.		24 (10)
			There is a lack of meeting facilities in rural fishing communities		
			Currently, there are no functional multi-stakeholder management committees.	Representation of fisherfolk on the boards of organizations such as fisheries , IMA or the EMA	

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			(There is a short term cabinet-appointed committee for review and finalisation of new fisheries legislation.)		
		Other Govt. Agencies / Non-Gov. Agencies	Inadequate collaboration among the relevant stakeholders. Currently, there are no functional multi-stakeholder management committees.	Establish formal mechanism for collaboration. Representation of fisherfolk on the boards of organizations such as fisheries , IMA or the EMA	
External Drivers	Environmental	Oceanography	The effects of Climate Change such as global warming can negatively impact on the abundance and productivity of the resource, and the ability to fish. Rise in sea levels lead to the loss of coast (eg at Palo Seco); Less plankton; Difference in colours of water not observed anymore; change in winds; temperature differences of red fish bodies indicate if more/less fish are coming; Current patterns have changed		26 (9)
		Pollution/ Water Quality	Increase of land-based sources of pollution (Industries, agriculture, and urban development) and ocean-based pollution (marine traffic, hydro-carbon activities, derelict vessels) This negatively impacts on resources and spawning. Fishers claim: Desalination Co. of T&T Ltd. (Pt. Lisas) destroyed cork shrimp ground in Gulf FedChem & Steel Mill (Pt. Lisas) destroyed red shrimp ground in Gulf Waste water from the Erin pig farm (even though treated) kills mangroves, leads to illness of fishermen and no spawning grounds at Erin. Increase of land-based sources of pollution (cont'd)	Identify pollutants and hotspots (to help determine source and impacts). Testing should be implemented for water quality and fish quality. Research should be done on impact of pollutants. Identify polluters to determine responsibility (legal, financial etc.) Legislation should set pollution/ emission standards and enforce legislation to ensure compliance. Enforce existing water pollution rules. Penalties should be harsher. Oil should be transported in proper receptacles to avoid spills. Cleaning programmes for large rivers should be	6 (26) 6 (26)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			La Ruffin river is polluted.	implemented/ increased. Better supervision for waste management by the EMA & Fisheries Division. More facilities for waste management, on or off-site of waste production (storage etc.). Alternative means for utilization of waste (e.g. animal waste as fertilizer) Need for more collaboration among relevant agencies. Fishing organizations need to be more organized in order to lobby for their cause. Public Awareness and Education of impacts of pollution to foster cultural values.	
			Less fish/catch due to impact of seismic surveys. Fishers claim: -fish move away from the traditional fishing areas and it takes years for them to return -surveys kill fish eggs and fish larvae and destroy seabed	Fisheries Division should conduct studies on impact of surveys on ecosystem well-being (including monitoring of the survey area) and findings should be communicated. Fisheries Division should research the pros and cons of the survey and provide the information before the survey starts. EIA should be conducted before surveys occur including stakeholder consultations. Monitoring of survey by relevant authorities to ensure survey complies with predetermined goals and objectives of EIA. Increased and longterm compensation to fisherfolk for negative impacts from seismic surveys. All fishers (including crew), jostlers and downstream dependents on the industry should be compensated.	3(29)
		Access to fishing grounds	Reduction of fishing areas, due to the multi-sectoral use of fishing areas (For example: shipping, oil and gas industry, and noise & chemical pollution). Reduced access to traditional fishing areas due	EIA should be conducted before surveys occur including stakeholder consultations. Monitoring of survey by relevant authorities to ensure survey complies with predetermined goals and objectives	28 (7)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			to the conduct of seismic surveys (reduction in fish catch)	of EIA. Seismic surveys should be restricted to the initial planned time periods	3 (29)
		Habitat removal	Degradation of the coastal habitat including clearing of mangroves is continuously increasing due to industrial and urban development	EMA and Fisheries Division should play a greater role to ensure that fisherfolk are not disadvantaged by developments Regulations of the EMA should be more stringent. Re-plant mangroves More research needs to be done Fishermen should be notified about planned activities potentially destructive to ecosystem	3 (29)
	Economic/Social	Exchange rates			
		Pricing	Limited suppliers of fishing equipment hence suppliers have a monopoly resulting in high prices. High engine prices & long waiting times. More equipment is needed in showrooms	Some communities would like the option to import their own engines for the community. Need access to spare parts, especially the option for foreign-used spare parts. There should be machine shops that specialise in engine repairs.	19 (15)
		Fuel Costs			
		Market Prices	Inequitable distribution of the profits from the fishing industry (direct harvesters receive minimal revenues as compared to middle men/vendors further up the chain.) Competition from imported shrimp (which is cheaper so it lowers the value of the domestic shrimp)	The shrimp quality of imported shrimp can be tested for preservatives and other chemicals. If imported shrimp is found to be of a poor quality, there can be an initiative to increase awareness of the consumer. This would be a marketing strategy promoting purchase and consumption of local shrimp. Conduct inland farming of shrimp	37 (4) 22 (11)

Key EAF Components	Category	Component	Issue	Solutions	Rank (# of Votes)
			Shrimp being smuggled into Trinidad & Tobago illegally (a national security issue). Loss of markets (US due to non-compliance with use of TEDs and EU due to non-compliance with sanitary and phyto-sanitary standards	Cooperation among different sectors (Fisheries Division, Coast Guard, Customs) required to ensure compliance and repercussions for perpetrators.	35 (5)
		Political	Priorities change depending on the present administration. As a result some activities may be stymied.	No solution	17 (16)
		Port Facilities	Inadequate facilities at landing sites lack of port facilities for the Industrial Fleet	More and upgraded facilities are required as follows: change rooms& toilet facilities; flood-lights, running water & electricity; cold-storage and ice machines; slipway & winch; water breaks and moorings; Overnight bunkers, Proper access roads, Vending stalls; Net sheds; Security from private enterprise; Handyman to maintain site; Gas station, with subsidized fuel. Dredging & jetties required at Orange Valley and Sea Lots for industrial vessels. One port facility required at Moruga. Training required for fishermen on maintenance of facilities.	10 (22) 10 (22)

APPENDIX 8: Ecosystem Approach to Fisheries (EAF) baseline report for the shrimp & groundfish fisheries of Trinidad and Tobago

Prepared by the Fisheries Division, Ministry of Food Production

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1. Is there a Management Plan for the fishery?

A Draft Management Plan for the Trawl fishery was developed by the Fisheries Division in collaboration with the FAO in 1992 which proposes the implementation of a licensing regime under which owners of trawlers should be required to hold entitlements to the fishery. These entitlements should be transferable provided the replacement vessel does not have a greater horsepower or fishing power, and provided that replacement of the vessel is in keeping with the level of fishing effort approved in the Plan. This draft management plan was never approved by Cabinet and implemented and will need to be reviewed and updated.

2. Where there is no management plan, are there stated or *de facto* objectives for the fishery?

A new Draft Policy for the fisheries sector of Trinidad and Tobago was completed in 2011 (Fisheries Division, 2011a) for inclusion in the formal Ministry of Food Production Policy for the food production sector, to be approved by the Cabinet. The general policy objective is to maintain a cost effective fisheries management structure in pursuit of the goal of ensuring that the exploitation of the fisheries resources and the conduct of related activities, are consistent with ecological sustainability (e.g. of target species, non-target species, and marine environments). Government's policy is to move from an open access regime to one of a limited entry regime in order to alleviate overcapitalization and overexploitation across all fishing fleets. Policies relating to the main fleets are presented in Table 1. The policy also considers the socio-economic implications of management measures for fisherfolk.

Table 1: Management policy related to fishing fleet
(as outlined in the Draft Policy Document (Fisheries Division, 2011a)).

Fishing Fleet	Management Policy
Trawl (artisanal, semi-industrial, industrial)	Alleviate the negative impact of trawling through the introduction of more environmentally friendly trawl gear. Favour the introduction of BRDs that will reduce discards by up to 50% Ensure that fish trawling is conducted with an appropriate net.
Artisanal multi-gear	Phased introduction of an increased stretched mesh size for gillnets. Promotion of line fishing as a more sustainable fishing method over gillnetting.

The management objectives for the shrimp and groundfish fisheries are still to be clearly defined.

At a Regional meeting of Fisheries Ministers and Managers of the FAO WECAFC (Western Central Atlantic Fishery Commission) *ad hoc* Working Group on Shrimp and Groundfish Fisheries of the Brazil-Guianas Continental Shelf held in Trinidad in 2001, the Honourable Minister of Food Production and Marine Resources made a statement indicating that the "Government of Trinidad and Tobago proposes to consider freezing the numbers of artisanal, semi-industrial and industrial trawlers operating in local waters at current levels and the implementation of a phased programme of reduction of the local trawl fleet to 80% of current levels of effort" and "in terms of the groundfish fishery, to consider freezing the numbers of vessels engaged in this fishery (trawlers, vessels employing monofilament and multifilament gillnets, lines including banking, a-la-vive and palangue) at current levels" in accordance with the recommendations from the assessments. The Minister also noted that "the implementation of a limited

entry regime represents a dramatic shift in Government's policy" and that "it would therefore be necessary to put in place the appropriate legal framework and adequate administrative and extension support coupled with appropriate monitoring mechanisms to implement the system".It was also agreed that the adoption of environmentally friendly techniques and practices to reduce bycatch and discards in the trawl fishery will be promoted. Such initiatives are in fact listed as implementation strategies under the Government's draft policy objectives to maintain ecosystem health and sustainable fisheries for the future (see Section 13 which includes details of work done on development of more environmentally friendly trawl gear).

In 2005 a stakeholder consultation was held to present the results of a joint Trinidad and Tobago shrimp assessment and management recommendations including the reduction of fishing effort and the implementation of a closed season. The fishing industry stakeholders agreed that stocks of shrimp and fish have been declining and that fishing effort should be controlled. However, it was the common view of the industry that pollution and coastal developmental activities have contributed in a major way to the decline in fish resources. They also proposed that some form of compensation would have to be provided for fishers during the closed season. The introduction of regulations for closed seasons for trawling is one of the management measures included in the Action Plan of the Fisheries Division developed based on the stakeholder retreat for fisherfolk, held in Claxton Bay in June 2010.

3. What is the legal framework within which the fishery is operating?

The principal legislation governing domestic fishing in Trinidad and Tobago is the *Fisheries Act 1916* and the subsequent 1966 and 1975 amendments. The Act empowers the Minister responsible for fisheries to make regulations to prescribe mesh size of nets; to restrict the size of fish, shrimp, crabs and turtles caught, and prohibit their sale or prevent the catching of these species either absolutely or by season or area.

The *Fisheries [Control of Demersal (Bottom) Trawling Activities] Regulations 2004; Fisheries (Conservation of Marine Turtles) Regulations, 1994; Fisheries (Amendment) Regulations, 2002*) and a 1988 Cabinet decision all govern the management of the trawl fishery. The *Fisheries Regulations* and the *Fisheries (Amendment) Regulations, 1998, 2000* and *2002*, provide for gillnet and seine specifications, minimum fish sizes and prohibited areas. The management measures in place are detailed in Section 9. The Protection of Turtle and Turtle Eggs (Amendment) Regulations 2011prohibits the taking, removing or selling of any turtle eggs, as well as the killing, harpooning, or selling of any turtle at any time.

The *Fishing Industry (Assistance) Act, 1955*, makes provisions for the granting of financial assistance to the fishing industry by such means as fuel rebates, tax waivers and subsidies on fishing equipment.

The Marine Areas (Preservation and Enhancement) Act 1970, provides for the designation of restricted areas, and the *Marine Areas (Preservation and Enhancement) Regulations 1973*, require the permission of the Minister to enter and remove fauna from the restricted area. The Act is currently applied only to the management of coral reefs.

The Archipelagic Waters and Exclusive Economic Zone Act of 1986 provides for the declaration of archipelagic waters and the establishment of a 200-mile exclusive economic zone (EEZ). The Act charges the Minister with responsibility for the conservation and management of living resources. Within this context, it provides for the determination of the allowable catch in respect of each fishery in the EEZ, and determination of the proportion to be harvested by citizens of Trinidad and Tobago. Access of foreign fishing vessels to the archipelagic waters, territorial sea or EEZ is allowed only through licences issued by the Minister who also provides the authority for surveillance and enforcement of regulations pertaining to foreign fishing.

The *Fish and Fishery Products Regulations, 2009* under Section 25 of the *Food and Drugs Act Chapter 30:01*. authorizes the Minister with responsibility for health to grant licences for the import and export of fish which have been handled and packed under conditions conforming to health and safety standards prescribed under the Act. The Regulations specify the requirements for handling fish, the general and specific operating requirements for establishments handling or processing fish, the requirements for vessels used for fishing or transporting fish and, for vehicles and equipment used for unloading, handling, holding and transporting fresh fish for processing.

The 2011 *Draft Fisheries Management Bill,* on finalization will repeal the *Fisheries Act of 1916* and the relevant sections of the *Archipelagic Waters and Exclusive Economic Zone Act of 1986*. The new Act will provide for the preparation of fishery management plans and will, in accordance with these plans, control and limit access to fish resources through the establishment of a licensing system for both local and foreign fishing vessels.

4. What are the institutional and administrative frameworks for fisheries management in the country?

Much of the following information in this section is taken from the Draft Fisheries Management Policy for the Republic of Trinidad and Tobago (Fisheries Division, 2011a).

4.1 Governmental Organizations

Ministry of Food Production

The Ministry of Food Production, through the Fisheries Division, has central authority and responsibility for the management and sustainable development of the fisheries sector of Trinidad and Tobago. This role includes the acquisition of information relevant to the industry and application of this information to the formulation and implementation of policies, plans and programmes that protect marine fish stocks and their habitats while supporting viable exploitation of the marine living resources in the waters under national jurisdiction.

Fisheries Division (FD)

The Fisheries Division is charged with the responsibility for overseeing the rational development and management of the fisheries sector (inland and marine) of Trinidad and Tobago (T&T) including: the formulation and implementation of policy and legislation, delivery of training to fisherfolk and fisheries personnel, administration of an incentive programme, provision of extension services, research and management; promoting proper post-harvest technologies; monitoring, surveillance and enforcement and the provision and management of fishing facilities. The Division also plays an advocacy role with respect to the sectors which impact the industry. Another key function of the FD is the promotion of aquaculture - as an additional means of fish production/alternative source of fish protein to mitigate against excessive fishing pressures on wild fish stocks.

Caribbean Fisheries Training and Development Institute (CFTDI)

The CFTDI is located in Chaguaramas and is the training arm of the FD and offers training in fishing technology and fish processing to fisherfolk. The CFTDI also offers some basic maritime training courses to fisherfolk to deal with the navigation and the safety aspects of fishing at the ratings level.

Seafood Industry Development Company (SIDC)

In 2004 the MTI established the Seafood Industry Development Committe to develop a strategic plan for improving the fish harvesting and processing sector of Trinidad and Tobago. This Cabinet-Appointed Committee comprising stakeholders (fishing and fish processing interests) and Government identified a list of essential activities that needed to be implemented. The SIDC, a corporate entity currently in operation, emerged from this Committee. Currently under the Ministry of Food Production, the mandate of this company is "to increase the competitiveness and long term development of the domestic seafood industry".

National Agricultural Marketing and Development Corporation (NAMDEVCO)

The National Agricultural Marketing and Development Corporation (NAMDEVCO) is the Statutory Body created by Act of Parliament No. 16 of 1991 with a mandate "to create, facilitate and maintain an environment conducive to the efficient marketing of agricultural produce and food products through the provision of marketing services and the stimulation of business investment in the agro-industrial sector of Trinidad and Tobago". In 2005, NAMDEVCO's mandate was revised to include value added product development and marketing of these products (http://www.namdevco.com/aboutus/).

The core functions of the Corporation are as follows (http://www.namdevco.com/aboutus/):

(i) To develop and expand markets, marketing opportunities and agribusiness investments.

(ii) To develop and manage a comprehensive Agricultural Market Information System.

(iii) To develop and expand production and investment in Value Added and Primary Food Products.

(iv) To develop and maintain Market Infrastructure and Systems to facilitate agricultural and food marketing in accordance with global standards.

(v) To develop and manage a Quality Assurance System aimed at supplying safe and wholesome foods.

(vi) To establish, manage and promote investments in agriculture through commercial ventures and/or a Subsidiary Company.

Agricultural Development Bank

This financial institution provides the major source of funding for the agricultural and agro-industrial sectors in Trinidad and Tobago.

Ministry of Trade, Industry and Investment (MTI)

Interface with the MTI is on matters related to trade in fish and fishery products and international trade negotiations including subsidies. The grant of a Minister's License to permit duty free entry of vessels is based on a recommendation made on behalf of nationals by the Fisheries Division to the MTI.

Ministry of Environment and Water Resources

Forestry Division - Wildlife Section

The Conservation of Wildlife Act (1958) addresses issues that deal with the conservation and protection of marine mammals, turtles, shorebirds and all other Environmentally Sensitive Species (ESS). The Wildlife Section is the National Management Authority for CITES and within recent times CITES has placed greater emphasis on fish and other aquatic species.

Environmental Management Authority (EMA)

The Environmental Management Authority is a statutory body with a Board of Directors reporting to the Ministry of Environment and Water Resources. It operates under Act No. 3 of 2000 which states that the environment is "all land, area beneath the land surface, atmosphere, climate, surface water, ground water, marine and coastal areas, sea bed, wetlands and natural resources within the jurisdiction of Trinidad and Tobago". It is thus mandatory for designated developmental activities to require a Certificate of Environmental Clearance (CEC). The most important of these activities which impact fisheries pertain to coastal developments and in particular, the energy sector. Where an application for a CEC is with respect to an activity that poses significant environmental risks, a developer is required to conduct an Environmental Impact Assessment (EIA). The EMA maintains a National Register of all the CECs granted and has two Compliance Departments (one each in Port of Spain and San Fernando) which accept complaints from the public with regard to issues of environmental concern. The EMA has declared several species considered endangered as ESS and several areas some of which are protected under international conventions as Environmentally Sensitive Areas (ESAs).

Ministry of National Security

Trinidad and Tobago Coast Guard; Trinidad and Tobago Police Service

The Trinidad and Tobago Coast Guard (TTCG) and the Trinidad and Tobago (T&T) Police Services are the national security agencies empowered to conduct fisheries surveillance and to enforce the fisheries legislation applicable to Trinidad and Tobago. The Coast Guard patrols the marine areas around the islands, has the authority to board, search, seize vessels and detain their crew for infractions committed in the waters under the jurisdiction of Trinidad and Tobago. The Coast Guard also conducts air and sea search and rescue operations, investigates fishing incidents, piracy and other illegal activities occurring at sea. It also offers training courses in marine safety.

Ministry of Transport

Maritime Services Division

The Maritime Services Division of the Ministry of Transport houses the Maritime Unit and the IMO Safety Advisor, all of which are involved in matters pertinent to the fishing industry. The Division is responsible for maintenance of channels and navigational aids and implementation of the International Maritime Organization (IMO) conventions, as well as several International Labour Organization (ILO) Conventions. It is responsible for the registration of all fishing craft that operate in international waters and licensing of all fishing vessels operating in the fishery waters of Trinidad and Tobago that are less than 24m in length overall. The Fisheries Division however issues Certificates of Registry to fishing vessels and provides a unique number for each vessel according to port of mooring. Appropriate systems for implementing the statutory responsibilities of the MSD remain to be implemented.

The Maritime Services Division is the accreditation agency for maritime training courses offered locally and also receives complaints from fishermen concerning damage to their vessels and fishing equipment resulting from the operations of other vessels.

Ministry of Finance and the Economy

Based on Government's annual budget, this Ministry allocates capital and recurrent funding to all the Government Ministries.

The FD requests funding from the Ministry of Finance and the Economy through the Ministry of Food Production, at the beginning of each quarter of the financial year. Monthly funding releases are based on the Fisheries Division's annual approved budget and expenditure performance

Customs and Excise Division (Marine Interdiction Unit)

The FD collaborates with the Marine Interdiction Unit of the Customs and Excise Division in at-sea fisheries monitoring, surveillance and enforcement.

Ministry of Foreign Affairs (MFA)

The MFA is the lead Ministry for:

- boundary delimitations with adjacent states;
- bilateral fisheries agreements between Trinidad and Tobago and neighboring countries;
- regional/international agreements/arrangements on fisheries conservation and management
- maritime dispute settlements involving Trinidad and Tobago and other states.

Pursuant to Trinidad and Tobago becoming a signatory to UNCLOS, an Inter-Ministerial Committee on the Law of the Sea (IMCLOS) was established under the MFA. Several sub-committees were set up, however, currently only the Marine Scientific Research Committee, which is responsible for granting approval for foreign vessels to conduct research in the waters of Trinidad and Tobago, is in operation.

Ministry of Health

Chemistry, Food and Drugs Division

The Fish Regulations made pursuant to the Food and Drugs Amendment Act (1998) have provisions for the proper handling, storage, processing of fish and fish products for local use and export, the requirements for implementing food safety standards at Fish Processing establishments as well as for the certification of fishing vessels in relation to sanitary standards. The Chemistry, Food and Drugs Division is the competent authority for implementing the legislative requirements related to access to some export markets (EU).

Environmental Health Division

Under this Division, Public Health Inspectors are responsible for, *inter alia*, the following (http://www.health.gov.tt/):

- Monitoring of environmental conditions to identify and control risks to human health
- Investigation of public health complaints and abatement of nuisances
- Monitoring of wastewater treatment and disposal systems
- Monitoring of drainage systems
- Monitoring solid and liquid waste management and disposal systems
- Inspection of factories, workshops, garages, public buildings and other commercial establishments
- Inspection, monitoring and registration of food establishments
- Conducting lectures on public health matters to various groups including food handlers
- Registration of food handlers
- Inspection of building plans and layouts to ensure compliance with public health requirements
- Monitoring and sampling of water supplies
- Inspection of containerized cargo (foods) at ports, and/or premises of importer
- Surveillance at ports to prevent the introduction and exportation of disease and vectors
- Identification and control of disease vectors in the general environment
- Collaboration with other agencies to address environmental/public health issues
- Enforcement of public health laws, regulations and bye-laws

Ministry of Labour and Small and Micro Enterprise Development (Cooperatives Division) (ML)

This Ministry collaborates with the Fisheries Administration and fisherfolk in promoting the establishment of national fisherfolk organizations (fishing associations, cooperatives). The ML is also the focal point for the implementation of the OSH Act and assistance can be sourced in the provision of safety guidelines for the fishing industry.

The Tobago House of Assembly (THA)

Division of Agriculture, Marine Affairs and Environment (DAMAE), Department of Marine Resources and Fisheries (DMRF)

The THA is funded by the Central Government through the Ministry of Finance. The DAMAE, through its Department of Marine Resources and Fisheries, has administrative responsibility for Tobago's fishing industry to six miles from shore and for flying fish over a distance of 12-15 miles.

Collaboration between the DMRF and the FD must be strengthened for effective fisheries management. The development of a rational and feasible national Fisheries Policy must consider the situation in Tobago. For example the reporting of national statistics on fisheries requires integration of data from Trinidad and Tobago fisheries; however data on Tobago fisheries are limited. The THA has a significant

role to play in the gathering of fisheries data for Tobago and in conjunction with the FD, clear guidelines will be provided for the type and quality of fisheries data required from Tobago.

Division of Health, Social Services and the Environment

The Division of Health, Social Services and the Environment addresses environmental issues associated with the marine areas around Tobago.

4.2 Research Institutions

Research institutions involved in fisheries research at the national and regional levels are as follows:

The University of the West Indies (UWI)

The UWI is involved in fisheries research at all three campuses at St. Augustine in Trinidad and Tobago, Cave Hill in Barbados, and Mona in Jamaica. At the St. Augustine campus, specifically, the Department of Life Sciences in the Faculty of Science and Technology, the Faculty of Food and Agriculture, the Department of Surveying and Land Information and the Department of Electrical and Computer Engineering in the Faculty of Engineering, and the Sustainable Economic Development Unit (SEDU) in the Department of Economics, Faculty of Social Sciences, all support the work of the Fisheries Division. The Centre for Resource Management and Environmental Studies (CERMES) at the Cave Hill Campus and the Centre for Marine Sciences at the Mona Campus, have both been involved in fisheries research through graduate research students and academic staff.

The University of Trinidad and Tobago (UTT), Ministry of Science, Technology and Tertiary Education

Research that could have a positive impact on the living resources of the marine environment and the sustainable activities of fishermen can emerge from the work of graduate students registered at the UTT, from the research of its academic staff and from organizations that fall under the University's jurisdiction.

The major focus of the UTT was initially engineering, specifically with reference to supplying the immediate and near-future skilled human resource needs of the energy sector of Trinidad and Tobago. The rapid expansion of this sector into off-shore natural gas exploration, production, liquefaction and export as well as the continued oil drilling, refining and export all affect the marine environment and the continued and free operation of local fishermen in waters under national jurisdiction.

The Institute of Marine Affairs (IMA)

The roles of the IMA include advising Government on a variety of aspects of marine affairs and the planning and implementation of marine-related research programmes. Some of these research activities revolve around the biological aspects of fish stocks that are being exploited, the potential for culture of fish and shellfish, and issues concerned with the coastal and marine environment. Research results are shared with the national, regional and international user-community and the general public. The IMA also has a Technical Advisory Services (TAS) programme which provides consultancy services and which is supported by other programmes, such as Research.

4.3 Non-Governmental Organizations (NGOs)

NGOs include special interest groups that are directly involved in fisheries and environmental issues. Some are legally registered bodies while others are not, however, they both function satisfactorily with regard to their particular objectives.

Fisherfolk Organizations

These organizations comprise commercial and recreational fishermen. Some are informal organizations while others are legally registered with the Ministry of Community Development, Co-operatives Division of the Ministry of Labour, or the Ministry of Legal Affairs. Most of them are financially viable with effective organizational structures, goals and planned activities that serve the interests of their membership.

The more vibrant of these groups include: Trinidad and Tobago Game Fishing Association, Trinidad and Tobago Industrial Fishing Association, Fishermen and Friends of the Sea, Alcan Bay Fishing Association, Almoorings Fishing Cooperative, Cocorite Fishing Association, Claxton Bay Fishermen Association, Felicity-Charlieville Fishing Association, Blue River Bamboo Cunupia Fishers (BBC), Otaheite Fisherfolk Association, Orange Valley Fishing Association, La Ruffin Fishing Association, Grand Chemin Fishing Association, La Brea Fisherfolk Association, Icacos United Fishermen, Cedros Fisherfolk United, Erin Fishing Association, Toco Fishing Association, Blanchisseuse Fisherfolk and Marine Life Association, Trinidad and Tobago Unified Fisherfolk (TTUF), and the All Tobago Fisherfolk Association (a representative umbrella group from Tobago).

Wildlife Conservation and Environmental Protection Organizations

These organizations include such groups as: Council of Presidents for the Environment (COPE) (umbrella group for NGOs involved with environmental issues), the Crusoe Reef Society and Environment Tobago (conservation of Tobago's coral reefs and wetlands), Buccoo Reef Trust, Nature Seekers Inc. (turtle conservation) and the Foundation for the Environment (corporate sector involvement in management of the environment).

The fisheries and environmental NGOs are important organizations for acquiring information on the state of affairs in their particular localities and sub-sectors of the industry, for testing new fisheries management and policy approaches and also for directly disseminating relevant information to their memberships.

5. Overview of the fishery and resources exploited: The soft-substrate demersal fishery (shrimp and groundfish)

The soft-substrate demersal fishery in the Gulf of Paria and Columbus Channel targets mainly shrimps and groundfish resources. Several species of shrimps (mainly Penaeidae) are caught including *Farfantepenaeus subtilis* (brown shrimp), *F. notialis* (pink shrimp), *F. brasiliensis* (pink-spotted shrimp, hoppers), *Litopenaeus schmitti* (white/cork shrimp), and *Xiphopenaeus kroyeri* (honey/jinga shrimp, seabob). Key groundfish species in this fishery are Sciaenidae (e.g. *Cynoscion jamaicensis, C. acoupa, Macrodon ancylodon, Micropogonias furnieri*), Clupeidae, Engraulidae, Gerreidae (e.g. *Diapterus* spp.), Lutjanidae (e.g. *Lutjanus* sp., *Rhomboplites aurorubens*), Haemulidae (e.g. *Haemulon* spp., *Genyatremus luteus*, *Orthopristis* spp.) and Ariidae (*Bagre* spp., *Arius* sp.) (Kuruvilla, Ferreira & Soomai, 2001).

The shrimp and groundfish resources in the main trawling grounds in the Gulf of Paria and Columbus Channel are considered to be shared stocks exploited by the fleets of both Trinidad and Tobago and

Venezuela. While the higher-valued shrimp are targeted, certain species of finfish may, however, be targeted according to market demand or during the wet season when shrimp abundance decreases. During periods of consistently low shrimp catches groundfish may also be targeted by industrial trawlers.

Lutjanus synagris (lane snapper), although considered a target species in the hard-substrate demersal fishery, is also landed as trawler bycatch from the soft-substrate demersal fishery operating on the west and south coasts of Trinidad or as gillnet bycatch from the coastal pelagic fishery operating in shallow waters off the south coast of Trinidad. The species is more commonly associated with muddy-bottom substrates than other snapper species which are associated with hard-substrates on the south-east coast of Trinidad. *L. synagris* is also landed predominantly on the south and south-west coasts of Trinidad, in the Gulf of Paria and the Columbus Channel, where environmental conditions are characteristic of the Brazil-Guianas Continental Shelf.

Appendix 1 presents a summary of the species exploited in the soft-substrate demersal fishery of Trinidad and Tobago and covers the target/main species, the fish population/stock to which it belongs, its biological/physiological status, and other species associated with the fishery including discard species and incidental catches.

5.1 Details of fishing gear used and areas fished

Shrimps are caught mainly by demersal trawlers, while groundfish are either targeted or caught as bycatch in the trawl nets and by the artisanal multigear fleet, using gears such as gillnets, fish pots, demersal handlines and demersal longlines. To a lesser extent, shrimp are also caught by beach/land seines, as part of the artisanal multigear fishery. Trawlers operate only in Trinidad, mainly in the Gulf of Paria with non-artisanal vessels operating in the Columbus Channel and a designated area on the north coast (west of Saut D'eau). The artisanal multigear fleet, which targets soft-substrate demersal fish, operates mainly off the west (Gulf of Paria) and south (Columbus Channel) coasts of Trinidad. Appendix 2 provides a map of some popular fishing areas by gear type. The shrimp fishery is seasonal, with shrimp catches being greatest in the dry season from January to June.

An overview of the gear types and vessels used in the fishery based on international standard statistical classifications of fishing gear and vessels (FAO, 1999) is provided in Appendix 3.

Trawl fleet

In Trinidad, the shrimp and groundfish resources are exploited by artisanal, semi-industrial and industrial trawl fleets. Artisanal vessels include a smaller vessel (Type I) between 6.7 and 9.8 m which usually carries two 45-75 Hp outboard engines; and larger vessels (Type II) 7.9 to 11.6 m, generally equipped with inboard diesel engines ranging from 90 to 150 Hp. Artisanal trawl nets have an average head rope length between 10.4 and 10.7 m, with 3 cm mesh size at the cod end. Semi-industrial vessels are larger in size (9.3 to 12.2m) and are equipped with inboard diesel engines ranging from 165 to 275 Hp. Both artisanal and semi-industrial vessels operate stern trawls. In artisanal vessels the stern trawl is manually retrieved; in semi-industrial vessels the stern trawl is operated using a hydraulic winch. Each semi-industrial vessel deploys one net of 12.9 m average head rope length with mesh size at the cod end averaging 3.5 cm. The industrial trawler ranges between 10.9 and 23.6 m, with powerful inboard diesel engines of 325 to 425 Hp. Each industrial trawler carries two nets each with an average head rope length of 15 m and with the same mesh size as semi-industrial nets; industrial trawl nets are fastened to outriggers and retrieved with a hydraulic winch (Maharaj et al., 1993; Kuruvilla, Ferreira, & Soomai, 2001).

Measurements and observations of the trawl gear were made in 2006 during the experimental gear testing under the global bycatch reduction project EP/GLO/201/GEF (Soomai & Seefoo, 2006). The general specifications for the artisanal net appear unchanged however smaller dimensions were recorded for the semi-industrial net used in the gear testing. Based on the measurements made in 2006, the artisanal trawl net consists of a flat trawl net made of multifilament twine with a head rope length of 10.4 m and mesh size of 3.2 cm**.** The main characteristics of the semi-industrial trawl net system were: head rope length, 10.4 m; foot rope length: 11.6 m; tickle chain length, 10.7 m; mesh size: 4.45 cm; otter boards made of wood and steel, 1.82 m long, 0.9 m high, at an angle of approximately 24 degrees; bridles, 20 fathoms long, made of 1.1 cm diameter steel wire. The industrial trawl fishing gear and its rigging (otter boards, bridles, tickle chain) was slightly larger in 3 dimensions to those of the semi-industrial vessels, except in the case of the former, because of the outriggers, two equal nets are towed at each side of the vessel (Soomai & Seefoo, 2006).

Artisanal vessels conduct one-day trips (8-20 hours), while semi-industrial vessels make trips of one to five days, and industrial vessels five to eleven days (Fisheries Division catch and effort records 1992-2002). The average number of hauls per day for a Type I artisanal trawler is six with the average duration of a haul being 0.5-1hr, while a Type II artisanal trawler would make an average of 4-5 hauls/day at about 1-2 hrs/haul. Semi-industrial trawlers also make an average of 4-5 hauls/day but with an average duration of 3-4 hrs/haul, while the industrial trawlers make 3-4 hauls/day at 2-4 hrs/haul. The average vessel speed for an artisanal, semi-industrial and industrial trawler is one, two and three knots, respectively. The average stretched mesh size in the cod end of the trawl net is 3.5 cm for the semi-industrial and industrial trawlers, and 3 cm for the artisanal (interviews with vessel owners 2004).

Vessel numbers have remained more or less constant since 1991 except for the artisanal Type I fleet which showed a decline of 88% in the 1998 vessel census as compared to the 1991 census (from 113 to 13 vessels). The decline resulted from the termination of access to fish in the Orinoco Delta of Venezuela in 1995 under a bilateral fishing agreement between Trinidad and Tobago and Venezuela. The numbers of vessels in the Type I artisanal fleet are currently estimated to be about 38 (34% of the 1991 fleet); the Type II artisanal fleet about 57 vessels; the semi-industrial fleet, 10 vessels; and the industrial fleet, 32 vessels; a grand total of about 137 trawlers.

All trawlers operate in the Gulf of Paria on the west coast of Trinidad year round. The industrial trawlers, and to a much lesser extent the semi-industrial trawlers, also operate in the Columbus Channel on the south coast year round, and on the north coast. Since 1998 operations on the north coast have been restricted to the area west of Saut D'eau from November 15 to January 15 in daylight hours (6am to 6pm). The areas and depths exploited by the various categories of trawlers are given in Appendix 2 and Table 2. The fishing areas were obtained through interviews with trawl fishermen in 1991 and 1997.

Table 2: Areas exploited by the trawler fleets (Kuruvilla, Ferreira, and Soomai, 2000; Maharaj, Ferreira, and Lum Young 1993).

Trawler Type	Region Fished	Depths (m)	Area of Fishing Ground (km^2)	Average Annual Area Swept (km^2)*
Artisanal	Gulf of Paria	1.8-18.0	607	2,092
Semi-industrial	Gulf of Paria	9.0-41.4	1,793	905
Industrial	North Coast	37.8-57.6	184	3,826
	Gulf of Paria	9.0-48.6	1,269	
	Columbus Channel	18.0-41.4	826	

*Total area dragged by the trawl nets of a particular trawl fleet during commercial fishing operations in a year

Artisanal multi-gear fleet

The multi-gear fleet is composed of pirogues similar to the artisanal trawlers, and are wooden, fibreglass, or fibreglass-coated, open boats 7-10 m in length, propelled by outboard engines ranging from 40 to 75 Hp; two 60 Hp engines being the fleet average (Chan A Shing, 1999a). A number of gear types are utilised in the fleet and fishermen typically switch fishing gears according to the seasonality or availability of resources. In general one gear type is deployed per fishing trip.

Gillnet and line gear more commonly catch groundfish associated with the demersal soft-substrate fishery. The 2003 census recorded 266 vessels using gillnets (133 monofilament and 133 multifilament), 106 vessels using demersal lines (65 handlines, 41 demersal longline), and 88 vessels using live bait lines (which occasionally land groundfish) in the Gulf of Paria and Columbus Channel. This represents approximately 63% of the total number of vessels in the artisanal multigear fleet. The numbers of vessels using gillnets and lines remain almost the same as those recorded in the 1998 vessel census.

Gillnets

Artisanal gillnets are either monofilament or multifilament (fillet) drifting nets. The former are made of transparent nylon, while the latter are heavier nets commonly made of nylon and other synthetic twines. Monofilament nets are used either by day or night and are set below the surface of the water. Multifilament nets are generally fished at night at the surface of the water. One or two net sets may be made per trip (Hodgkinson-Clarke, 1990). The nets are left to soak for an average of 3 to 5 hours; the soak time range for monofilament nets is 2 to 12 hours and for multifilament nets 0.5 to 6 hours (Hodgkinson-Clarke, 1994). Monofilament gillnets carry a mesh size (stretched) ranging between 9.5 and 12.7 cm and the average stretched mesh size is 9.5 cm, with net lengths ranging between 450 m and 1,098 m. Multifilament gillnets carry an average mesh size (stretched) of 10.2 cm, and the length of the net ranges between 732m and 1,190 m. (Hodgkinson-Clarke, 1994; Chan A. Shing, 1999a, 2002). Various styles of combination mono/multifilament gillnets appear to have been introduced during the early 1990's. The combination nets are used for net strengthening or reinforcement or to improve fishing power (Hodgkinson-Clarke, 1994). Gillnets target the small pelagic species such as mackerels and it is the primary gear used in the mackerel fishery (*Scomberomorus brasiliensis* and *S. cavalla*). Gillnets are fished year round on all coasts but more in the latter part of the year during the rainy season when *S. brasiliensis* (carite) landings are generally higher (Chan A Shing, 1999a, 2002; Hodgkinson-Clarke, 1994). Fishing area is influenced by season Hodgkinson-Clarke, 1994).

Demersal lines

The demersal line methods are locally termed banking and palangue. Banking gear consists of one (1) to several hooks attached to a weighted main handline. The line is set on banks. Banking is done mostly on the west and south coasts. The palangue is a demersal longline operated at both the artisanal and industrial levels. Vessel size, trip duration, fishing depth, hook size and guage of the main line differentiate artisanal and industrial activity levels. The gear consists of a mainline, which carries a number of branch lines with hooks. The number and size of hooks used vary depending on the species being targeted. There are two (2) types: a "small palangue" (1,000 – 5,000 hooks) used for small snappers and sharks and a "large palangue" (200-500 hooks) generally for sharks. The palangue is used mostly on the west coast (Mohammed *et al*., 2011).

5.2 Information on Shrimp and Groundfish Resources Exploited

Data collection

Shore-based biological sampling was initiated in 1991 for the five shrimp species (*Farfantepenaeus subtilis, F. notialis, Litopenaeus schmitti, F. brasiliensis, Xiphopenaeus kroyeri*) exploited by the artisanal, semi-industrial, and industrial trawl fleets landing at all five major landing sites: NP Fishing Complex; Orange Valley Wholesale Fish Market; the Otaheite and San Fernando Fish Markets; and Waterloo. Length frequency distributions are available for 1992 to 2002 for each of the shrimp species by gender and by trawl fleet, fishing area and month.

Catches of groundfish are considered trawler bycatch from the soft-substrate demersal fishery operating on the west and south coasts of Trinidad or as gillnet bycatch from the coastal pelagic fishery operating in shallow waters off the south coast of Trinidad (Ferreira and Soomai, 2001; Mohammed *et al*., 2011). In this regard, landings of groundfish are often not sorted to the individual species level. Furthermore challenges in species identification at the markets often result in the grouping of several species of fish (eg.,*Cynoscion jamaicensis, C. acoupa, and C. viriscens*) into landed categories (e.g., "mixed fish" and "choice fish") based on size.

In 1991, a logbook system was introduced for the semi-industrial and industrial shrimp trawlers to obtain catch data for each of the shrimp and fish components of the catch, including discards. By May 1992, however, vessel owners stopped submitting logbook returns. Amid plans to implement an observer/at-sea sampling programme to obtain information on fish discards, the Fisheries Division conducted at-sea biological sampling of trawl catches between July 1999 and July 2000. Trips were made on board artisanal, semi-industrial and industrial vessels operating in the Gulf of Paria and the Columbus Channel. Trawl hauls were sorted at-sea to determine the species composition of the catch and the discards. Over the period 2003 to 2006, the at-sea sampling was supplemented by laboratory analysis of samples of the unsorted trawl hauls, from each trawler type, to record length and weight data of retained and discarded species.

Over the period 2003 – 2007, a biological sampling programme was implemented for two of the main landed bycatch species in the trawl fishery, *Micropogonias furnieri* (whitemouth croaker) and *Lutjanus synagris* (lane snapper). Length frequencies and weight by species were recorded at the fish markets at Orange Valley and at Otaheite, and covered the artisanal, semi-industrial and industrial trawl fleets (Soomai, 2006). Bycatch is often landed in broad market categories where several groundfish species are combined. In 2003, a programme of sorting of landed bycatch categories in the market was initiated to determine the species composition of the retained catch by each of the trawl fleets. The output from the market-based sorting of landed catch, and the at-sea sampling and laboratory analysis of unsorted trawl

catches, were used to refine estimates of total landings by species and fleet (Soomai, 2008a). Updated biological data sets were used by the Fisheries division in completing stock assessments for *M. furnieri* (Soomai *et al*., 2008; Yanagawa *et al*., 2006) and *L. synagris* (Soomai & Porch, 2006).

Estimates of landings for groundfish are however determined primarily from catch statistics collected on a daily basis at the major landing sites along the west and south coasts of Trinidad. Fish landings from the various gear types have been computerized since 1992. Total landings are estimated for each enumerated beach by gear and species / species group. Total landings and effort are also estimated by fleet type and species/species group for Trinidad.

Catch composition

Shrimp Species Composition

Biological sampling of trawl landings from artisanal, semi-industrial and industrial fleets at five major landing sites in the Gulf of Paria conducted by the Fisheries Division over an eleven year time period from 1992 to 2002 indicates that *F. subtilis* and *F. notialis* are the two most dominant shrimp species, comprising 38% and 31%, respectively, of the shrimp landings followed by *L. schmitti* (20%) and then *X. kroyeri* (10%) with only negligible quantities of *F. brasiliensis* (Figure 1).

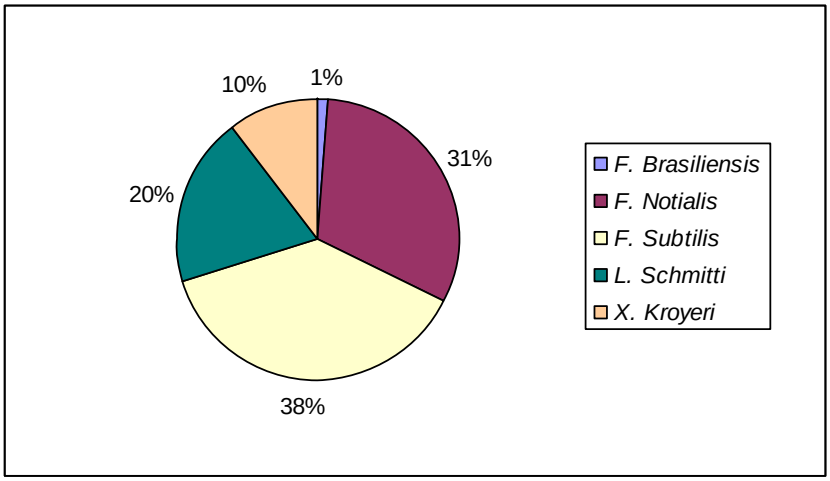


Figure 1: Species Composition of Shrimp Landings in Trinidad (1992-2002)

Also based on data from 1992 to 2002, Figure 2 shows the proportions of each of the five shrimp species that are landed by the various trawl fleets. Over the period, the industrial trawl fleet landed the majority of the *F. subtilis* and *F. notialis*, 62% and 52%, respectively. The semi-industrial trawl fleet landed 26% of the total *F. notialis* landed in the country, with this particular shrimp species dominating the shrimp catch of this fleet. The majority of the country's *X. kroyeri* landings (70%) were captured by the artisanal trawl fleet operating in the southern Gulf of Paria. *L. schmitti* was also captured largely by the artisanal trawl fleets, with this species being particularly dominant in the catches from the northern Gulf. Catches from Venezuela by the artisanal fleet from Trinidad comprised largely *F. subtilis* and *L. schmitti*.

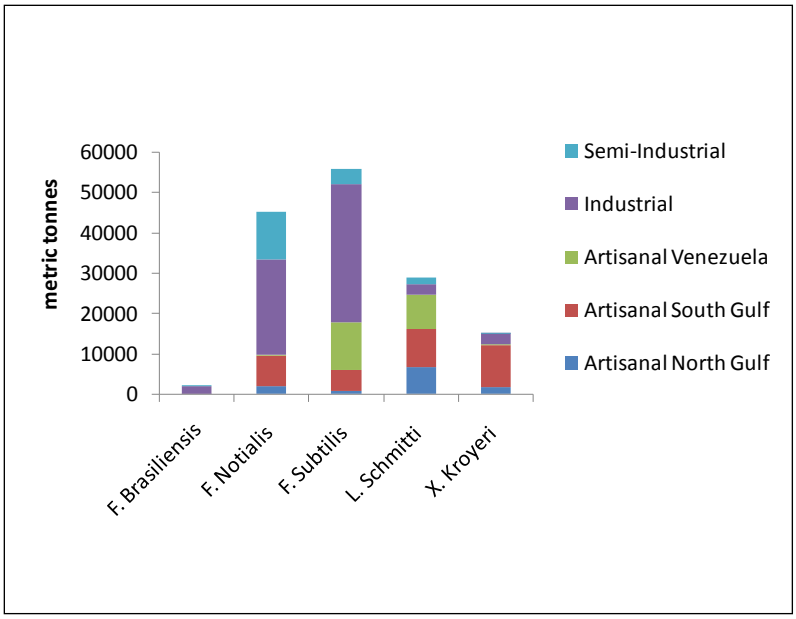


Figure 2: Proportions of Shrimp Species Captured by the Various Trawl Fleets over the Period 1992-2002

The size compositions for the various species of shrimp by gender have been used in several stock assessments (see Section 6.3).

Groundfish Species Composition

All categories of trawlers land a large quantity of mainly juvenile fin-fish of several different families apart from demersal species and are termed "mixfish". The bycatch landed by artisanal trawlers comprises mainly Clupeids, Engraulids, Gerrids, Lutjanids, Sciaenids and Portunid crabs. The bycatch landed by semi-industrial trawlers comprises mainly Clupeids, Lutjanids, Sciaenids and Portunid crabs. The industrial vessels land mainly Sciaenids, Lutjanids, Gerrids and Carangids. The species composition of trawl catches, including the bycatch and discards, was obtained from samples of unsorted catches from the artisanal, semi-industrial, and industrial trawlers between 1999 and 2000 (Appendix 4). The number of species found in the trawl bycatch was: 89 species of finfish from 39 families; three species of batoid fish from three families; two species of cephalopods from one family; five species of crustaceans from 3 families; and six species of molluscs from five families (Appendix 4).

Size compositions of Micropogonias furnieri and *Lutjanus synagris*

Refinements to the groundfish data collection systems began in 2003 (as indicated in the section on Data Collection above, Section 5.2). The size composition of *M. furnieri* (croaker or cro-cro) and *L. synagris* (redfish) is available from the market-based sorting of bycatch from the trawl fleets over the period 2004-2006 (Appendix 5). The species are sold in three main categories: unsorted, mixed, and choice. The "mixed" and "choice" fish categories can also be further sorted into a "small mix", "big mix, "small choice", and "big choice" categories. There are no formal size specifications by category; the size ranges in each category varies from year to year and are very subjective, based on the average sizes of the species in the total catch of the individual trawler. "Choice" fish are often the largest fish in the landed

catch and generally there is overlap in the size composition of the "big mixed fish" and "choice" fish categories. The "mixed fish" and "choice fish' contain several of the other main groundfish species. Two other landed categories, "cro-cro" and "redfish", contain individuals of the respective species only. The upper limit of the size ranges of *M. furnieri* and *L. synagris* landed in Otaheite were generally lower than that for Orange Valley.

Overall, *M. furnieri* landed by artisanal trawlers, operating out of Otaheite and Orange Valley, ranged from 10.0 - 57.0 cm in length; semi-industrial trawlers landed fish ranging from 16.5 - 57.0 cm; and industrial trawlers landed fish 18.0 - 58.0 cm in length. *L. synagris* landed by artisanal trawlers ranged from 13.0 - 47.0 cm in length; semi-industrial trawlers landed fish 13.0 – 42.5 cm; and industrial trawlers landed fish 14.0 - 49.0 cm in length. See Appendix 5 for the size ranges of *M. furnieri* and *L. synagris* in each of the categories landed by the three trawl fleets 2004-2006). 8.

Further analysis of the "mixed" and "choice" fish categories from the trawl fleet showed the presence of four main groundfish species: *M. furnieri, L. synagris, C. jamaicensis*, and *M. ancylodon* (Appendix 6. In the unsorted catches of the artisanal fleet, *M. furnieri* made up 18-25%, *L. synagris* made up 8-9%; *M. ancylodon* was 5-49%, and *C. jamaicensis* made up between 8-21%. The percentage composition of these four groundfish species in the mixed and choice fish categories landed by the artisanal, semi-industrial, and industrial fleets fluctuate considerably from year to year (Appendix 6). In general, the landings of groundfish in the semi-industrial and industrial fleets were recorded in the mixed and choice fish categories and not in the unsorted category. This may be due to the larger sizes of the species which allowed for sorting of the bycatch.

Given the size at maturity data provided in Section 6.1, the size ranges of *M. furnieri* and *L. synagris* observed in the market categories clearly indicate that all trawl fleets are catching and landing juveniles of the both species. Juveniles of *M. ancylodon* and *C. jamaicensis* are also landed by the trawl fleets. See Section 6.1 for details on the biology of these four species.

5.3 Number of fishers and land-based workers by sector. Indicate full-time and part-time.

Based on the numbers of vessels by fleet and the number of crew per vessel type provided in Section 5.1 and Appendix 3, there are an estimated 1,092 fishers employed on some 509 vessels involved in the shrimp and groundfish fishery in the Gulf of Paria and Columbus Channel. These fishers comprise some 744 persons in the artisanal multi-gear fleet (266 using monofilament gillnets, 266 using multifilament gillnets, 130 using handlines, and 82 using demersal longline) and about 348 persons in the trawl fleet (76 employed on artisanal Type I, 114 on artisanal Type II, 30 on semi-industrial trawlers, and 128 on industrial trawlers).

In addition to the 1,092 fishers, it is estimated that the shrimp and groundfish industry on the west and south coasts of Trinidad employs some 566 land-based individuals, with the majority of these workers (over 80%) operating on the west coast. This figure comprises several categories of persons who provide a range of services to the fishermen, on land. These include vendors, who come to the landing sites or the markets to purchase the catch wholesale from the fishermen; net and boat builders and repairers; hustlers/jostlers who assist fishermen with sundry tasks such as washing boats and the loading and offloading of equipment onto and from their boats; and processors and exporters. With the exception of a few hustlers/jostlers, these persons work full-time in their respective trades. Hustlers/jostlers and vendors are the two largest categories of land-based workers (each of these categories, separately, comprising 31% of the total land-based workers). The hustlers/jostlers who work part-time usually seek alternative employment when there is a lull in the fishing industry. Figure 3 provides a breakdown by categtory of worker of the estimated 566 land-based workers while Appendix 7 provides a breakdown by category of worker (excluding processors/exporters) and landing site.

In order to put the above figures into perspective, it should be noted that a total of 1,153 vessels was recorded during the 2003 fishing vessel census for Trinidad (conducted by the Fisheries Division), and some 306 vessels were estimated for Tobago in early 2006 (based on personal communication with staff of the Department of Marine Resources and Fisheries of the Tobago House of Assembly (THA)). In 2002 it was estimated that there were some 3,500 fishermen in Trinidad and Tobago with over 6,000 persons estimated to be involved in the fisheries sector as a whole (80 in the input industry, 3,908 in capture fisheries, 76 in aquaculture, 1,225 in processing, and 1,245 in marketing and distribution) (Kuruvilla et al. 2002).

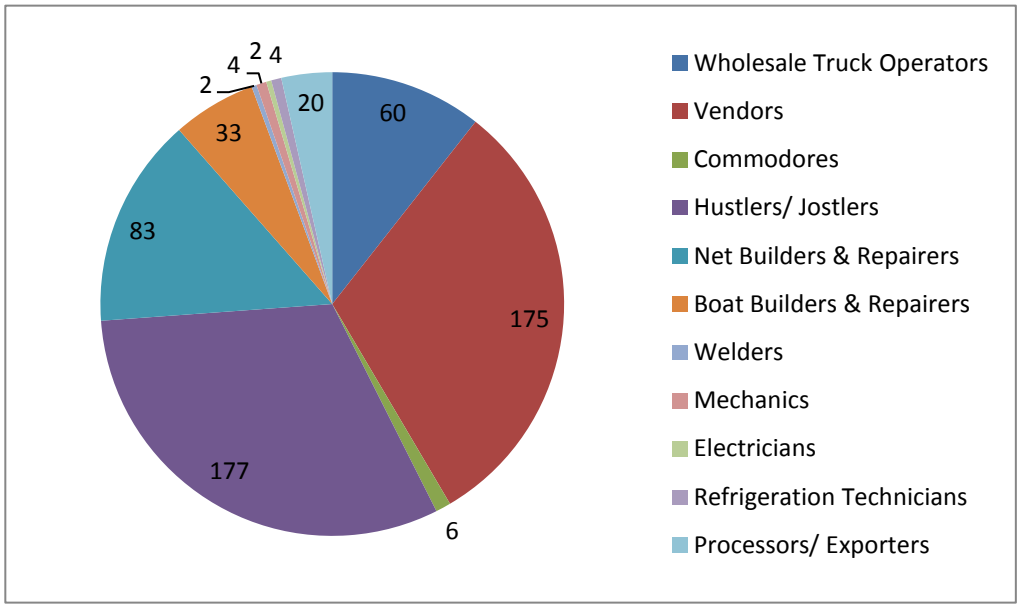


Figure 3: Breakdown of Land-Based Workers by Category in the Shrimp and Groundfish Industry of Trinidad and Tobago (West and South Coasts of Trinidad)

5.4 Direct interactions with other fisheries (e.g. competing for same target species, target species taken as bycatch in another fishery, bycatch in this fishery)

Fishing gear and areas

At the local level there are significant interactions between fleets within the trawl fishery and with other mainly artisanal fisheries operations. Management of the trawl fishery is complicated by the importance of the fishery, to both artisanal operators and fishing communities and to the fleet of industrial trawl vessels that operate on the west and south coasts and on the north west coast in close proximity to the artisanal fishing grounds and in particular those for gillnetting. In addition, the importance of the shrimp and groundfish fishery to both Trinidad and Tobago and Venezuela requires a collaborative approach to the management of the resource.

Areas of conflict exist between the artisanal and industrial components of the fishery which essentially target the same stocks despite a zoning regime that delimits the fleets operating in the Gulf of Paria by depth and distance from shore. The industrial fleet perceives the operations of the artisanal fleet as unsustainable because of the proximity to shore, the lack of effort control and the large proportion of juvenile shrimp and fish taken in the catch. The industrial fleet, because of its harvesting capacity is perceived by the artisanal fishermen to be responsible for overfishing of the resources (Ramjohn, 1995).

Overall, the trawl fleets are viewed by the other gear operators and by the national public and environmental groups as being responsible for environmental degradation of the sea bed and the depletion of marine resources.

Bycatch and Discards

The high level of bycatch and discards in the trawl fishery is one of the most significant sources of conflict between the trawl fishery and other coastal fisheries in national waters (Kuruvilla Ferreira, Soomai, & Jacque, 2000). Discarding is generally viewed as a result of poor fishing practices, however, there are a number of factors that influence the selectivity of fishing gear and the ratio of landings to discards. This aspect of trawl fisheries is the result of two main factors. First, the shrimp trawl fishery is a tropical, multispecies coastal fishery targeted by relatively unselective gear. Second, the physical structure of the vessels, i.e. limited hold capacity and the economics of operation, supports the holding and landing of the shrimp target species and a portion of the bycatch only for which there is commercial value (Kuruvilla *et al*., 2000).

A study of the artisanal trawl fishery was conducted from 1986 to 1987 and identified 70 species of finfish from 40 families in the bycatch as well as several species of portunid crabs (Maharaj, 1989). Of the fish caught, commercially important species accounted for only 15-33% of the total finfish catch. About 80% of the finfish component of the bycatch comprised juveniles belonging to the families Ariidae, Carangidae, Clupeidae, Engraulidae, Gerreidae and Sciaenidae. The bycatch to shrimp ratio was estimated at 15:1 and the finfish to shrimp ratio was 9:1. It was estimated that approximately 94% of the bycatch of artisanal trawlers was discarded in 1986. Commercial landings statistics for the period 1987-1991 indicate that the bycatch landed by artisanal vessels is comprised of *Sardinella brasiliensis*, *Anchoa* sp., *Diapterus* sp., *Lutjanus* sp., *Micropogonias* sp. and Portunid crabs. Clupeids such as *Sardinella* spp., *Anchoa* spp and *Cetengraulis* spp. are landed occasionally, based on seasonal abundance, by the artisanal fleet only.

A study of the semi-industrial trawl fishery in 1989 identified 25 species of finfish in the bycatch from 14 families (Amos, 1990). The most abundant families were the Carangidae, Gerreidae, Lutjanidae, Sciaenidae, Triglidae and Portunidae. Approximately 60 % of the fin-fish caught during this study was discarded and the bycatch to shrimp ratio was estimated at 12:1 and the finfish to shrimp ratio was within the range of 5-10:1. The bycatch landed by semi-industrial trawlers during the period 1987-1991 was comprised mainly of adults and juveniles of *Harengula jaguana*, *Opistonema oglinum*, *Lutjanus* sp., *Cynoscion* sp., *Micropogonias* sp., and portunid crabs. Length frequency data for *Micropogonias furnieri* and *Cynoscion jamaicensis* showed that 95 % of the individuals sampled were immature.

Data for the industrial trawl fleet, available from logbook returns for November 1991 to April 1992, estimated a bycatch to shrimp ratio of 0.6:1. It should be noted that these months comprise the shrimping season and hence catches would have comprised larger quantities of shrimp. Logbook returns from the industrial fleet also indicated that approximately 66% of the total bycatch is discarded and this was often comprised of commercially important groundfish species. The estimated value of finfish to shrimp obtained from landing statistics for the industrial fleet for the period 1992-1996 was 1.7:1 (Kuruvilla *et al*., 2000). These vessels landed mainly *Decapterus* sp., *Diapterus rhombeus*, *Lutjanus* sp., *Cynoscion* sp., *Micropogonias* sp., several species of sharks and 'mixed fish'. Details of the species composition of discards for the industrial fleet are not available however the data obtained from logbook returns indicated that some of the commercially important species were discarded.

An at-sea sampling programme to update the studies on the artisanal (Maharaj, 1989) and semi-industrial fisheries (Amos, 1990) was conducted by the Fisheries Division between July 1999 and July 2000. In 1999, the estimated annual discards from the trawl fishery were 8,800 tonnes. Analyses of the total

catches of artisanal vessels identified 30 species of fin-fish from 20 families and several species of Portunid crabs in the bycatch (Kuruvilla *et al*., 2000). An estimated 90% of the bycatch of artisanal vessels is discarded and the total bycatch to shrimp ratio is estimated at 12:1 and the bycatch landed to shrimp ratio as 1:1 (Kuruvilla *et al.*, 2000). From analyses of the total catch of semi-industrial vessels, 26 species of fin-fish from 18 families were identified in the bycatch. For the semi-industrial fleet, the estimated total bycatch to shrimp ratio is 9:1 and the bycatch landed to shrimp ratio is approximately 3:1. Approximately 71% of the bycatch of the semi-industrial fleet is discarded. The composition of the bycatch landed by artisanal and semi-industrial vessels in this study is similar to the findings for the 1980's (Maharaj, 1989) with the most common families being Carangidae, Gerreidae, Lutjanidae, Sciaenidae, Triglidae and Portunidae (Kuruvilla *et al*., 2000).

In summary, the ratio of bycatch to shrimp, estimated for the artisanal trawl fleet in the late 1980s, was 15:1 (Maharaj, 1989). The ratio of bycatch to shrimp in catches of the semi-industrial fleet was estimated at 12:1 in the early 1990s (Amos, 1990). In 1999, the bycatch to shrimp ratios for the artisanal fleet was 12:1, the ratio for the semi-industrial fleet was 9:1 and 0.6: 1 was observed for the industrial fleet; most of the discarded fish from all trawl fleets were juveniles of other important coastal fisheries (Kuruvilla Ferreira, & Soomai, 2001).

The issue of incidental catch and the high rate of discards in the fishery has caused great concern nationally and internationally and is seen as a potential source of trade-related action against the trawl fishery. A global review of fisheries bycatch and discards by Alverson *et. al.* (1994), ranked the shrimp trawl fishery of Trinidad and Tobago among the highest for bycatch and discards. This ranking was based primarily on the results of the Maharaj (1989) study on the artisanal trawl fishery. The lack of capacity to monitor activities at sea, the poor data on catches and on economics of the fishery, and limited alternative technological options in the harvest sector, have hampered the implementation of management actions to improve selectivity and limit discards.

Over the period 2003-2008, Trinidad and Tobago participated in the FAO global Project EP/GLO/201/GEF *"Reduction of Environmental Impact from Tropical Shrimp Trawling, through the Implementation of Bycatch Reduction Technologies and Change of Management"*. This project aimed to reduce the impact of tropical shrimp trawl fisheries on the environment through the removal of barriers to the introduction of environmentally friendly trawl gear and fishing practices. Under the Project, the biological data collection system for groundfish was initiated and gear trials were conducted in the artisanal, semi-industrial and industrial fleets, overall covering an estimated 25% of the national trawl fleet (Soomai, 2008). See Section 13 for results of experimental gear testing using gear trials with two bycatch reduction devices (BRDs), namely the fisheye and square mesh panel, and testing of a new monofilament trawl net (Soomai, 2008b).

Impact on non-fish bycatch of present fishing practices

There is limited information on the non-fish bycatch of the trawl fishery. Populations of portunid crabs which form a significant component of this category are thought to have increased as a result of the discards from the trawl fishery, which are thought to be beneficial to scavenger species (Kuruvilla *et al*. 2001). This observation is based on normal fishing practices where much of the bycatch of crabs is returned to the sea alive. In addition, anecdotal accounts from interviews with the fishing industry have described this change in the fauna of the Gulf of Paria. There may also be incidents of turtle capture by the fishery but the areas commonly trawled do not appear to be important routes for turtle migration and records do not indicate a high incidence of turtle capture in the areas where trawling is permitted(Kuruvilla & Chan-A-Shing, 2002)

Socio-economic and Trade-related Issues

Access to foreign markets is influenced by the ability of the industry to conform to international standards for reducing the incidental capture of non-target species. The imposition of Turtle Excluder Devices (TEDs) on regional shrimp trawl fisheries was initiated by the US as a pre-requisite to international trade in shrimp. Similar concerns related to fin-fish bycatch in tropical shrimp trawl fisheries are already being expressed at international fisheries fora. Access to the US market for shrimp, is now dependent upon annual re-certification by the US Department of State and is based on a condition of complete compliance by all semi-industrial and industrial shrimp trawl vessels. There are claims by the local industry that the use of the TED lowers the efficiency of the nets and results in generally poorer catches.

Shared Stocks

The shrimp and groundfish resources of the Guianas-Brazil Shelf are considered to be shared by the countries on the shelf. As a result, recruitment and population dynamics of the shrimp and groundfish species in Trinidad and Tobago waters are affected by activities/ conditions in neighbouring countries on the shelf. It is assumed that Trinidad and Tobago and Venezuela target the same stocks of shrimp and groundfish and within the framework of the Western Central Atlantic Fisheries Commission (WECAFC) Working Group on the Shrimp and Groundfish Resources of the Brazil-Guianas Shelf, a series of sub-regional workshops have supported collaboration on assessment of shared stocks of shrimp and groundfish. Results of studies using data derived from the fishing fleets of both countries have indicated the need for a comprehensive management strategy at the sub-regional level and the need to regulate effort in the fishery.

The shared nature of the stocks and the close proximity in which the fleets of both countries operate can complicate management efforts. Collaboration with the Venezuelan Government on the development of a management regime for the resources is essential to the well-being of the fishery. A 1989 Protocol on Co-operation in Fisheries Research between Trinidad and Tobago and Venezuela exists which outlines a collaborative approach to the management of shared resources. This Protocol has not however been activated.

6. Available scientific and traditional knowledge on the resources

The taxonomic classification of the main species exploited in the soft-substrate demersal fishery of Trinidad and Tobago is given in Appendix 8 and includes the main species or types of discards and the state of exploitation of the resources. Species characteristics are given in Cervigon et al. (1993). Biological parameters for the five commercially important shrimp species (*F. subtilis, F. notialis, L. schmitti, X. kroyeri* and *F. brasiliensis*) and four main species of groundfish (based on landings and value), namely *Micropogonias furnieri, Lutjanus synagris, Macrodon ancylodon, and Cynoscion jamaicensis*, are described below. Details on the biological parameters for the shrimp species are given in Appendices 9 - 13, while those for *M. furnieri* and *L. synagris* are given in Appendices 14 and 15 respectively, and those for the two weakfish species, *M. ancylodon* and *C. jamaicensis* in Appendices16 and 17, respectively.

6.1 Brief biology of the major shrimp and fish species

Shrimp

Appendices 9 - 13 include estimates for a number of biological parameters of the shrimp stock (including length at first catch, fecundity, a vast array of growth parameters, recruitment, natural mortality and MSY where available) along with ecological and habitat characteristics recorded by the authors. A summary of the most pertinent biological information from this literature review follows.

All five species spend a substantial amount of time either inshore associated with mangrove lagoons or offshore in shallow water, over mud and clay dominated substrate. These habitats pervade the Guianas-Brazil shelf, particularly due to the heavy riverine influence of the large Amazon and Orinoco rivers on the northern coast of the South American continental landmass. All species are active nocturnally, feeding at night and burrowing during the day (Dragovich, Jones and Boucher, 1980; Talbot *et al.*, 1996)

The metrics used for each species to determine length at first maturity in the available literature varies substantially making side-by-side comparisons difficult. Perez Farfante (1967) noted a TL of 100-126 mm at first maturity for *L. schmitti* while in stocks of *F. notialis*, individuals attained a TL of 73 mm. For *F. brasiliensis*, Khandker & Lares (1972) observed petasmel fusion at 114 mm in sampled individuals. In *F. subtilis* females, L50 (the average length at which 50% of sampled individuals attain maturity) was noted at 110 mm while L100 was observed at 140mm (Cayenne Workshop, 1998).

Morphometric relationships have been explored extensively for these very commercially important species with many area specific studies having been conducted throughout the region. These are highlighted under the sections Morphometric Relationships, Length/Weight Parameters and Length/Age Parameters.

Spawning is similar among the five species, occurring year-round but with variable peak spawning periods. For *L. schmitti*, Perez *et al.* (1988) observed spawning in shallow water from March-November in Guyana while in Venezuela Novoa (1982) observed the highest percentage of mature individuals during the period of April-May. Additionally, Benfield (1995) drew a potential connection between late-spring – early-summer spawning and warmer water temperatures experienced at this time. Stocks of *F. notialis* show year-round spawning (Calvacante & Dragovich, 1984) with two periods of major reproduction in April-June and September-November (Larghi 1981). *F. brasiliensis* spawns through the year with a maximum intensity around April-August (Novoa & Cadima, 1972). *F. subtilis* stocks show two peaks, a major peak in the second trimester and a minor peak in the third (Calvacante & Dragowich, 1984). *X. kroyeri* show a more even distribution of spawning through the year compared to the other four species, but Mota Alves & Rodriguez (1977) observed that 100% of sexually mature individuals in their samples were spent by December, January and February.

Information on fecundity was only found for *L. schmitti* and *X. kroyeri*. Average egg production for *P. schmitti* was seen to vary between 214,000-500,000 eggs per spawning (Perez Farfante, 1920; Bendazoli, MS). Studies on *X. kroyeri* were conducted to elucidate correlations between egg production and measurable metrics such as Cuban Length, Total Weight and Gonad Weight.

Recruitment among the five species takes place throughout the year but usually with two or more main pulses. Stocks of *L. schmitti* in Venezuela have two major recruitment events during the periods of March-May and September-November (Penchaszadeh, *et al.*, 1986) while in Brazil there is only one major recruitment pulse in February (Das Chagas-Soares *et al.*, 1995). *F. notialis* stocks have two main recruitment pulses in April and October as noted by Jones & Dragovich (1977). Recruitment periods in *F. brasiliensis* are not well defined, but concentrated in the second trimester (Boddeke *et al.*, 1977; Cavacante & Dragovich, 1984). *F. subtilis* shows two distinct pulses in the first and third trimesters. In Brazil, there is a primary pulse in Dec-May and a secondary pulse in Jul-Aug while in French Guiana the primary pulse is between March-June and the secondary pulse between September-October

(FAO/WECAFC, 1995). *X. kroyeri* has a more evenly distributed recruitment pattern through the year during April, July-August and October-November (Lhomme, 1992).

Information on natural mortality was present in the explored literature for *L. schmitti, F. brasiliensis* and *F. subtilis*. For *L. schmitti* stocks in the northern Gulf of Paria, M was seen to be 2.21 though units and sex were not specified (Gayanilo et al., 1989). For *F. brasiliensis*, M was calculated to be 2.4 (Garcia, 1984). Issac et al. (1992) extensively explored natural mortality in *F. subtilis*, utilizing a number of methods and arriving at a range of possible values. For females, M ranged from 1.37-2.5, for males 1.33-2.11 and mixing the sexes put M at 1.36-2.01.

***Micropogonias furnieri* (whitemouth croaker)**

Micropogonias furnieri (Desmarest, 1823) is a euryhaline sublittoral species of the Western Central and Southwestern Atlantic. It is distributed from the Yucatan Peninsula along the Antilles, the southern Caribbean and the South American coast to the Gulf of San Matias, Argentina, at 410S (Isaac,1988). Western Atlantic: Greater Antilles and from Costa Rica to Argentina (Chao, 1978). Biological parameters for *M. furnieri* are available from studies conducted for the species caught in Trinidad and Tobago waters (Appendix 14). The lengths at maturity for females and males range between 28.2-32.0 cm and 24.7-28.0 cm total length (TL), respectively (Manickchand-Heileman & Kenny, 1990). The maximum size at age (L_∞) was estimated at 82.9 cm TL for both sexes and in another instance it was estimated at 65.3 TL for females (Manickchand-Heileman & Kenny (1990). Spawning is estimated to be occurring year round with a peak in the dry season, from February to August (Manickchand-Heileman & Julien-Flus, 1990; Manickchand-Heileman& Ehrhardt (1996). The species is recruited to the trawl fishery at 3 years however overexploitation occurs with small mesh nets 3.8 cm in size; the recommended cod-end mesh size is 8.75 cm (Manickchand-Dass, 1980).

***Lutjanus synagris* (lane snapper)**

In the Western Atlantic, *Lutjanus synagris* (lane snapper) ranges from approximately North Carolina south to Brazil including Bermuda, the Gulf of Mexico, and the Caribbean. It is most abundant near the Antilles, off Panama, and on the northern coast of South America. Llane snapper is landed by fishpots, handlines, bottom longlines (palangue) and trawl gear. In Trinidad and Tobago, studies on the biology of *L. synagris* were conducted in the 1980s, using landings from several gear types. Between February 1980 and June 1981, Dass (1983) examined species caught in the fish pot and trawl fisheries operating in the north-eastern Gulf of Paria and the north coast of Trinidad. Results showed that the species spawns throughout the year, supported by the year round presence of juveniles in the catch, with peak activity from February to September. The ratio of males to females was approximately 1:1. From November 1979 to November 1981, Manickchand-Dass (1987) examined fishpot and trawl catches of *L. synagris*. Males mature at between 31 and 37cm and females between 25 and 41cm total length (TL). However, the smallest observed animals with developing gonads were 22.5 cm TL (males) and 23.0cmTL (females). All males were mature at 37 cm and all females at 41cm TL.The age at maturity was estimated at two years for females. Conversion parameters for the length/weight equation, von Bertalanffy growth equation and fecundity/length relationship were derived. Size at recruitment, size at maturity and mortality parameters were also estimated. The results are presented in Appendix 15.

Surveys conducted by the R.V. Fridtjof Nansen (Institute of Marine Research, 1988) provided estimates of biomass and catch rates for some of the major groundfish species. *L. synagris* was not represented in the catch from trawl sampling stations off the north coast of Trinidad. Sampling at 11 randomly selected trawl stations on the east coast, between Galera Point and Manzanilla Bank, indicated a mean catch rate of 25kg/hr for the species. Off the south coast mean catch rate from 49 hauls was 10kg/hr for *L. synagris*

(86 percent in the 1 to 30 kg size range and the remaining 14 percent greater than 30 kg), with the species occurring in 57 percent of the hauls. The mean catch rate for snappers overall was 11kg/hr. *L. synagris* accounted for 8 percent of the total commercial demersal catch. Snapper biomass was estimated at 450 tonnes (5 percent total biomass of demersal fish).

***Macrodon ancylodon* (King weakfish)**

Macrodon ancylodon (Bloch and Schneider, 1801) is found in the Western Atlantic from the Gulf of Venezuela to northern Argentina (Chao, 1978). Biological parameters for *M. ancylodon* are not available for the Gulf of Paria or Columbus Channel region but are provided for the Guianas-Brazil Shelf (Appendix 16). Studies of *M. ancylodon* report that the species lives up to six to seven years (Haimovici, 1988; Leta, 1987). There were no estimates for the value of natural mortality for *M. ancylodon* in the literature. An assessment conducted for the species in this region (Alio, Marcano, Costa, and Cochrane, 2001) considered natural mortality of 0.3 to be an appropriate value as provided by the Rikhter & Efanov formula for species with a longevity of 5-7 years (Sparre & Venema 1992). The estimated size at which *M. ancylodon* recruits to the fishery is 17 cm TL and it is fully captured by the fishing gear at 25 cm TL. The species reaches maturity at 27 cm TL (Garcia, 1996), and Juras and Yamaguti (1989) found sizes of first maturity at 21.5and 27.4 cm TL for males and females, respectively, in southern Brazil.

M. ancylodon feeds mainly on shrimp and small fish; *Xiphopenaeus kroyeri* (seabob) is its main prey and its distribution is closely associated with this shrimp (Bianchi, 1992). Stomach content analyses of larger specimens caught in trawlers operating off Guyana recorded the presence of penaeid and mantis shrimp, small anchovies and *Stellifer* spp. (Lowe-McConnell 1966) (Table 10).

***Cynoscion jamaicensis* (Jamaica weakfish)**

Cynoscion jamaicensis (Vaillant and Bocourt 1883) is the only *Cynoscion* species found around the Lesser Antilles and Puerto Rico; also from Panama along the Caribbean and Atlantic coasts of South America to Argentina (Chao, 1978). Biological parameters for *C. jamaicensis* are available from studies conducted for the species caught in Trinidad and Tobago waters (Appendix 17). The length at maturity for the species, determined from samples of trawl catches in Trinidad, was 21.6 cmTL (female) and 22.4 cm TL (male) (Manickchand-Heileman & Julien, 1983). Spawning is continous and a peak is observed during dry season based on the prescence of juveniles year-round in the Gulf of Paria and North Coast (Manickchand B Heileman & Julien-Flus, 1990). Peak spawning is in February for Gulf of Paria fishes, while fishes on the North coast peak between March and May. This difference is thought to be related to higher temperatures in the Gulf. Also, younger spawners are found in the Gulf while the older ones occur off the north coast. Peak spawning in both areas coincides with the periods of highest salinity and temperature which occur in the dry season (Shim, 1981). The species may also migrate inshore toward less saline waters for spawning. Otolith increment, sex ratio and catch data show a sudden change in July and a return to previous levels in August. This strongly suggests that fish from outside areas possibly the Orinoco waters, pass through Trinidad's waters during July (Shim, 1983).

6.2 Geographical distribution of the species

The environmental characteristics and the geographic distribution of the species exploited in the soft-substrate demersal fishery within the territorial waters of Trinidad and Tobago are described below. The artisanal trawl, gillnet, and line fleets in Trinidad operate in the littoral-inshore area between 0-20 m in depth while the semi-industrial and industrial trawl fleets operate in the littoral- near shore area of the

coast between 0-50 m in depth. The average temperature range for the water temperature in which the shrimp and groundfish fishery operates is 25-29 ˚ C and the substrate consists of mud or sand. Based on FAO's distribution guidelines, the shrimp and groundfish resources exploited by Trinidad are within the FAO statistical area 31 and the resources are considered to fall within the Large Marine Ecosystem (LME) 12.

The groundfish stocks exploited by Trinidad are considered to be also shared by countries on the Brazil-Guianas continental shelf along the north coast of South America and situated between the Amazon and Orinoco Rivers, namely Venezuela, Guyana, Suriname, and Brazil. Within each country's jurisdiction, the groundfish resources are harvested in multi-gear and multispecies fisheries (Booth et al. 2001). The geology of the region greatly influences the distribution of groundfish. The width of the continental shelf varies between 80 and 200 km and the continental break is situated at a depth of around 100 m. The groundfish fisheries in these countries operate on the shore side of the continental break (Charlier, 2001). The region is heavily influenced by the run-off from the Amazon River and the ecosystem in most of the coastal area of the Brazil-Guianas region presents fairly continuous features related to substrate, salinity, and temperature which are characteristic of the Amazon delta. The type of sea-floor substrate may play a more important role than the depth gradient in the distribution of fish assemblages (Charlier, 2001).

6.3 Estimated status of the stocks

Several assessments have been conducted since 1992 on the major shrimp and groundfish species. Many of these have been done jointly with Venezuela and have been and continue to be facilitated and supported both technically and financially by the Food and Agriculture Organization of the United Nations (FAO) Western Central Atlantic Fisheries Commission (WECAFC) as well as the CRFM (Caribbean Regional Fisheries Mechanism) / CFRAMP (CARICOM Fisheries Resource Assessment and Management Program through projects and regional working groups. Analyses conducted have addressed research/management issues regarding the current status of the major shrimp and groundfish stocks and the appropriate level of fishing effort to avoid over-exploitation of the resources and attain economic efficiency in the operation of the fleets.

Fisheries surveys

Demersal resources were investigated under a demersal trawl survey programme conducted by the Norwegian fisheries research vessel, R/V Dr. Fridtjof Nansen, in 1988 (Institute of Marine Research, Bergen, 1989). Biomass estimates for the major soft-bottom demersal groundfish species were calculated from the swept area trawl surveys conducted on the south coast of Trinidad. Additional data on groundfish species have been derived from several discrete surveys conducted between 1986 and 2000 (Manickchand-Dass 1980; Amos 1990; Maharaj 1989; Fisheries Division 1986, Fisheries unpublished data, 1999 and 2000). Many of these surveys examined the impact of trawling on groundfish species by investigating the general catch composition information on shrimp trawl bycatch (Amos, 1990; Maharaj, 1989; Fisheries unpublished data 2000).

Stock assessments

Shrimp

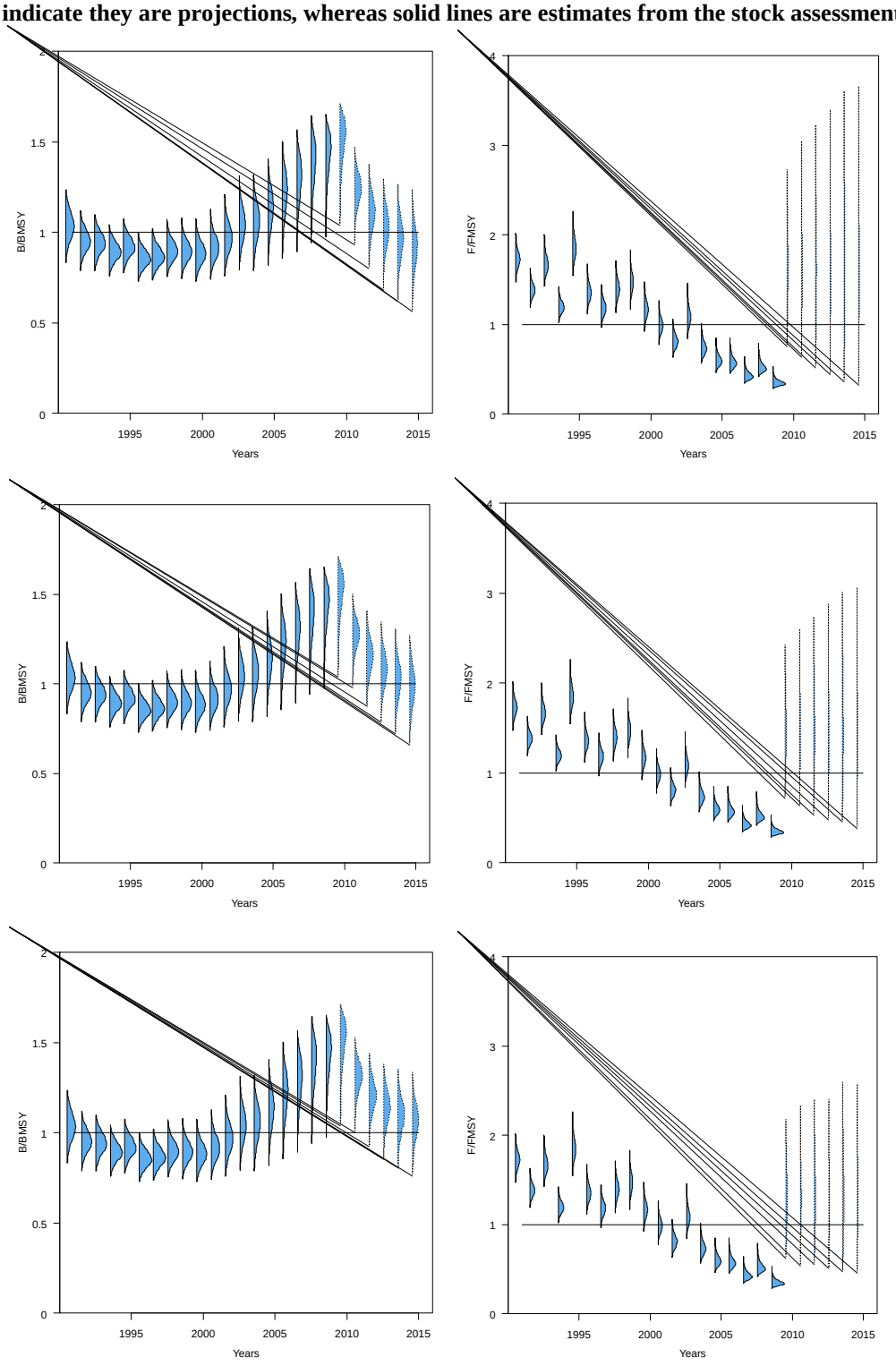
In general, results of assessments conducted on the shrimp stocks indicate full to overexploitation with recommendations for management being to limit and not increase fishing effort for all the fleets exploiting the resource, and in fact to reduce the effort in some cases to allow the stocks to rebuild.

The most recent assessment of the shrimp stock used data from the Trinidad and Tobago and Venezuela trawl fleets for 1988-2009 and for 1975 as well as data from ParFish (Participatory Fisheries Stock Assessment) interviews (43) conducted with fisherfolk in the Trinidad artisanal, semi-industrial and industrial trawl fleets in 2008 **(**Ferreira and Medley, 2011). The general results indicate the state of the stock is likely to be above maximum sustainable yield (MSY) and the current fishing mortality is well below MSY. The overall stock biomass is therefore likely to be stable or increasing. However, local depletion in Trinidad waters could still be taking place. The maximum sustainable yield is in the region of 1,800 t and catches higher than this will not be sustainable. This is a marked change of status compared to previous assessments (see Appendix 22) which indicate that the stock is either fully exploited or overexploited to severely overfished, with overfishing taking place since the 1970s, and stock biomass declining, with catches which probably cannot be maintained in the long term (Alió *et al*., 1999a; Dié *et al*., 2004; Ferreira and Medley, 2005; Ferreira and Medley, 2006). These studies are discussed further, later on in this section. However, it should be noted that there are severe and increasing limitations on the available data.

Ferreira and Medley (2011) recommend that a harvest control rule should be implemented for Trinidad in order to control the amount of fish caught. At the very least, a fixed seasonal closure of one to two months each year (though three or four would be more effective), which is considered a relatively crude measure, should be implemented to reduce fishing effort. The stock is likely to decline below MSY without management action while closures of one and two months greatly improve the likely status of the stock in the medium term (Figure 4), although the resulting levels of effort will likely still cause overfishing in the longer term as fishing mortality is too high. Projections for the annual catch per vessel and catch per day were explored by Ferreira and Medley (2006) under a range of management scenarios including: no change; 2% increase in effort per year; and a closed season ranging from one month (January) to four months (November to February) (Figures 5 and 6). The months for the closed season are those when the greatest percentage of small shrimp is landed based on the length frequency data which shows that the catch is predominantly young shrimp. The results suggest that there could be considerable benefit from rebuilding the stock. The disadvantage is that there will be an initial loss to the fishery during the rebuilding process (Figure 6).

A more sophisticated and complex feedback-control rule, for example, a control on effort in response to changes in shrimp biomass (or a biomass indicator such as CPUE) such that exploitation is reduced as the stock declines, is recommended if the monitoring system can support it (Ferreira and Medley, 2011). This kind of harvest control rule is more conservative resulting in higher CPUE and biomass, but possibly lower catches at least in the medium term. Ferreira and Medley (2006) recommend a limit on the numbers of trawlers with a view to reducing the fleet size, and strict enforcement of the current regulations for the trawl fishery, as well as a target sustainable yield between 1,583 and 1,905t to avoid overexploitation.

Figure 4: Projections of biomass and fishing mortality relative to MSY under 0 (top), 1 (middle) and 2 (bottom) month season closures. The shaded area graphs represent probability density, so low flat graphs indicate very high uncertainty, and narrow pointed graphs relative certainty. A dotted outline to graphs indicate they are projections, whereas solid lines are estimates from the stock assessment.



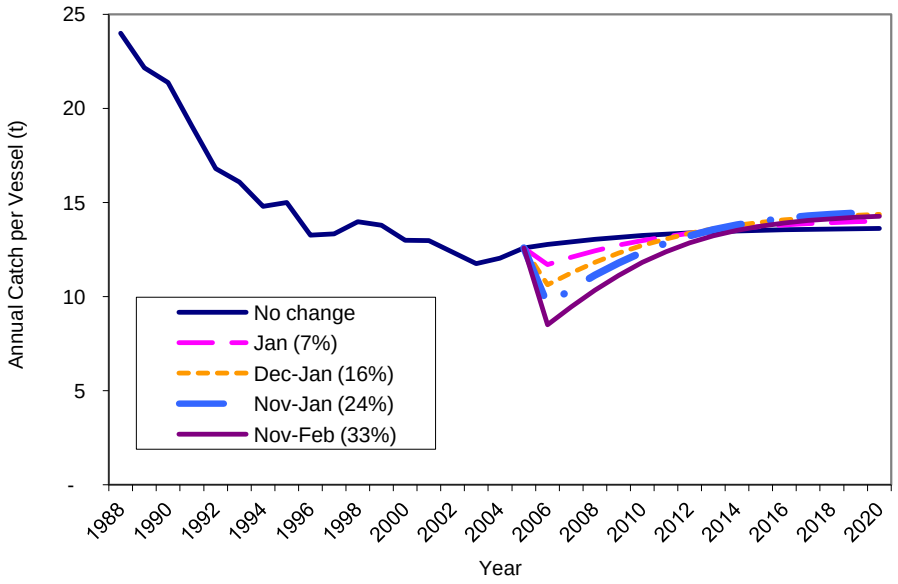


Figure 5: Estimates of the impact of implementing different closed seasons on the average shrimp catches for a representative reference vessel. The total catches and therefore annual earnings from a vessel will show an initial dip, but this should be followed by a longer term recovery increasing above the "no change" trajectory after 6 years.

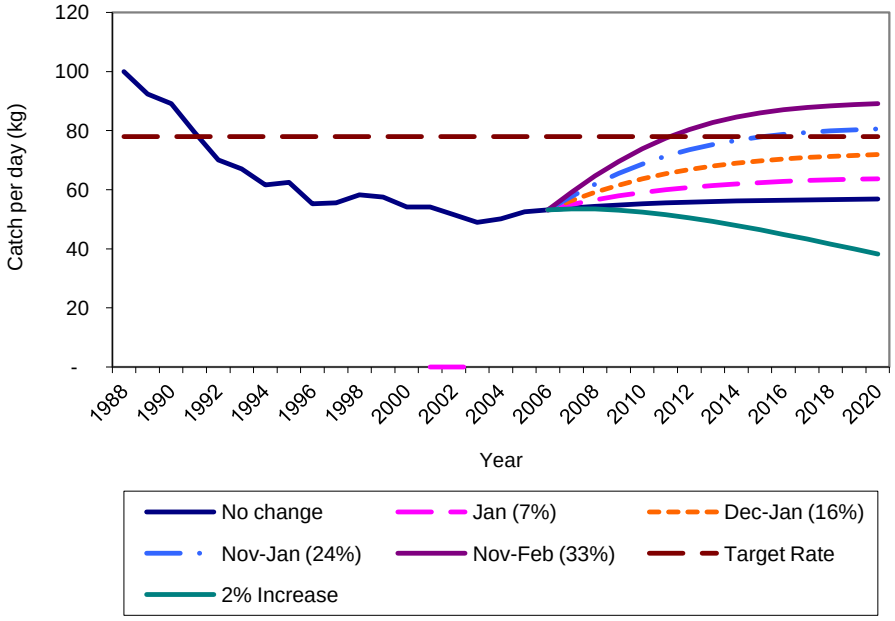


Figure 6: Projected shrimp catch rate under different management actions. The target rate is the catch per day at the MSY. Closures of one to four months should bring about a recovery.

F. subtilis (brown shrimp) is one of the dominant species exploited by both the Trinidad and Venezuelan trawl fleets in the Orinoco-Gulf of Paria region. Joint biological analyses were conducted for 1973 to 1996 (Alió *et al*., 1999a) and 1973 to 2001 (Dié *et al*., 2004). It is to be noted that the data obtained from the Trinidad industrial fleet for these assessments were limited. Alió *et al*. (1999a) reports a maximum sustainable yield (MSY) of approximately 1,300 metric tonnes at a fishing effort of 13,000 days-at-sea for both fleets combined, and recommends that the fishing effort should be maintained sufficiently below 13,000 days-at-sea for several years to allow the stocks to rebuild. Dié *et al*. (2004) indicates that the resource is severely overfished and that overfishing has been taking place since the 1970s. The fishing mortality at the time was estimated to be more than three times greater than Fmsy (the fishing effort at which the MSY is achieved) and the biomass less than one quarter (23%) of Bmsy (the biomass at which the MSY is achieved) with MSY being approximately 1,000 to 1,200 tonnes. The study recommends that measures be introduced to reduce fishing mortality and that Venezuela and Trinidad and Tobago should develop a common strategy for effort control.

The status of exploitation of the *F. notialis* and *X. kroyeri* stocks was determined using yield per recruit and biomass per recruit based on catch and effort data as well as monthly length frequency data for the two species by trawl category for Trinidad for 1992 to 2002 (Ferreira and Medley, 2005). Recruitment appears to be relatively stable over the period for *F. notialis* males and females, as well as *X. kroyeri* males, while there seems to be a general decline over the period in the case of *X. kroyeri* females. The yield per recruit for the two species combined suggests that the stocks are close to full exploitation with Fmsy being 1.4 times higher than the current effort. The biomass per recruit for the *F. notialis* females is 39% at the current effort suggesting that the stock is fully exploited while the biomass per recruit for the *X. kroyeri* females is 22% at the current effort and biomass per recruit being 40% at less than 60% of the current effort suggesting that this stock is overexploited. (Biomass per recruit refers to the biomass of the female of the species at a particular exploitation level as a proportion of the biomass of the unexploited stock. The rule of thumb is that the biomass per recruit should not fall below 40%.) Results of this assessment are considered preliminary due to the limitations of the models as a result of gaps in the data. Management recommendations were to limit fishing effort and in fact to attempt to reduce fishing effort; and to target larger shrimp as the catch is predominantly young shrimp.

A bio-economic analysis of the Trinidad and Tobago / Venezuela trawl fleets for 1995 to 1998 conducted by Seijo *et al*. (2000) indicate that at the then current levels of effort (8,175 days at sea for the Trinidad fleet and 9,348 for Venezuela) there is a 39% probability of the biomass of *F. subtilis* falling below sustainable levels. The study suggests that the shrimp resources were over-exploited and the fishery over-capitalized, and that a reduction to 80% of then current levels of effort will reduce this probability to 15% and improve profits to the fishery by 12%. The optimum effort at which the Maximum Economic Yield of US$46.1 million (US$28.5 million for Venezuela and US$17.6 million for Trinidad) for the shared fishery is attained is estimated to be 5,000 days for the Trinidad fleet and 7,697 days for the Venezuelan fleet (Figure 7)

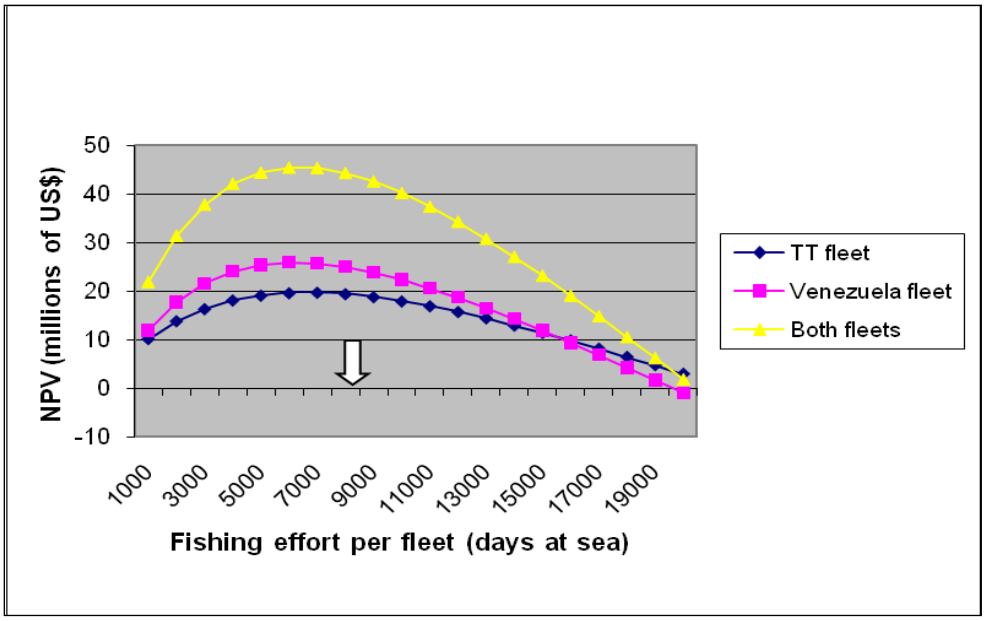


Figure 7: Present value of rent of Trinidad and Tobago/ Venezuela trawl fishery

Economic performance of shrimp trawl fleets

A costs and earnings study was conducted for the trawl fishery by the Fisheries Division in 2012 for the 2010 calendar year. The value of investment in the fishery was estimated at about $TT79,000 for an average artisanal inboard trawler; about $TT441,000 for a semi-industrial trawler; and about $TT909,000 for an industrial trawler. These figures include: hull, engine, deck, electronic equipment, and shore-based equipment (electronic and office equipment, dory and engine, tools, fish bins). Estimated annual revenue from catch for an average vessel was $TT152,846 for an artisanal inboard trawler; $TT338,721 for a semi-industrial trawler; and $TT1,285,875 for an industrial trawler. Total annual running (variable) costs were estimated at $TT88,841 for an average artisanal inboard trawler; $TT199,594 for a semi-industrial trawler; and $TT826,099 for an industrial trawler. Annual labour (crew) costs were $TT45,176, $TT67,570, and $TT 251,256 respectively for the various trawler types, while annual fixed costs were $TT103, $TT3,880 and $TT11,280 respectively. The average annual gross cash flow was $TT18,726, $TT67,678, and $TT197,240 for the respective trawl types, while the profits, after taking into consideration depreciation and interest charges, were $TT11,695, $TT42,684, and $TT131,998 respectively.

Similar costs and earnings studies were conducted/reported for the trawl fishery of Trinidad by Ferreira (1998), Kuruvilla *et al.* (2000), and Kuruvilla *et al.* (2002)

Groundfish

The biological status of *Micropogonias furnieri* (croaker), *Cynoscion jamaice*nsis (salmon), and *Lutjanus synagris* (snapper) have been examined as they constitute a large proportion of the groundfish landings of the shrimp trawl bycatch. Some assessments were conducted jointly with Venezuela. Assessments were conducted using primarily catch per unit effort (CPUE) data. In 2004 a biological sampling programme was established for two species of groundfish, *M. furnieri* (Whitemouth croaker) and *L. synagris* (Lane snapper) landed as bycatch in the shrimp trawl fishery. Length frequencies were collected from the

artisanal, semi-industrial and industrial trawl fleets between 2004 and 2006. Assessments indicate that the majority of the fisheries are either fully or overexploited. However, the results of groundfish assessments are considered preliminary because of limitations of the data and models, which are expected to be addressed in future research and stock assessments. However, a precautionary approach should be applied to the management of the trawl fishery, based on the best scientific evidence available. Several regional reviews of the status of groundfish are also available (Booth *et al*., 2000).

Data collection under Project EP/GLO/201/GEF helped to fill data gaps in the industrial trawl fishery. National stock assessments for whitemouth croaker (*Micropogonias furnieri*) and lane snapper (*Lutjanus synagris*) were completed and showed the stocks to be fully to over-exploited (Soomai & Porch 2006; Yanagawa *et al*., 2006).

Micropogonias furnieri (Whitemouth croaker)

A 1990 stock assessment of the whitemouth croaker, *Micropogonias furnieri* indicated that the maximum sustainable yield was already being obtained, and any increase in fishing mortality would result in overexploitation (Manickchand-Heileman and Kenny, 1990).

In 1999, a joint analysis by Trinidad and Tobago and Venezuela on *M. furnieri* in the Gulf of Paria and the Columbus Channel was conducted using the trawl fleets data from 1987 to 1998 in a surplus production model (Alió *et al*., 1999). The data sources included the Venezuelan industrial and artisanal fleets (1987 to 1997), and the Trinidad and Tobago industrial trawl fleet (1992 to 1995) and artisanal trawl and multi-gear fleets (1989 to 1997). Results show that the current level of effort exceeds the levels at which yields are maximized. MSY for croaker is 1,500 tonnes and was generally exceeded from 1987 to 1994 and in 1998, with landings ranging from 1,800 to 2,800 tonnes per year. These analyses used limited information from Trinidad and Tobago's industrial trawl fleet, as well as information on the size structure of the species caught by the gillnet and line fleets. Recommendations were made to limit the level of exploitation of groundfish species and to replace the open access fishery with a limited effort regime (Alió *et al*., 1999).

A biological assessment of *Micropogonias furnieri* (croaker) from the groundfish fishery in the Gulf of Paria and the Columbus Channel of Trinidad and Tobago was also conducted in 1999 (Soomai *et al*., 1999). This assessment was based on a depletion model using catch and effort data from 1989 to 1997 from the artisanal and semi-industrial trawl fleets as well as the artisanal multi-gear fleet (monofilament gillnet, multifilament gillnet, banking, palangue and a-la-vive) catching groundfish. Fishing mortality (F) estimates for *M. furnieri* were estimated from biological years constructed for the species for the nine-year period. The fishing mortality values ranged between 3.4 - 4.84 for the biological years constructed for the period 1994 to 1997. However, the fishing mortality values for the earlier years were abnormally high and ranged between 1.7 - 40.34. A yield per recruit (YPR) analysis shows that a yield per recruit (Y/R) of 28 g is estimated at the $F_{0.1}$ level of 0.192 (Figure 8). $F_{0.1}$ indicates the level of fishing mortality (F) at which the slope of the YPR curve is 10 percent of its slope at the origin. $F_{0.1}$ is a precautionary management tool to ensure that fishing mortality remains at sustainable levels. The high fishing mortality estimates obtained from the depletion model (F greater than 0.192) were well above the optimum biological condition of the species and indicate that the resources are not generating optimum yield and are most likely experiencing potential spawning decreases. Results clearly indicate an extremely intensive exploitation of these resources. The biomass and F values generated may also be influenced by migration of the species and not mortality as well as the unavailability of information from the Trinidad and Tobago industrial trawl fleet or other fleets operating in the Gulf of Paria (Soomai *et al*., 1999).

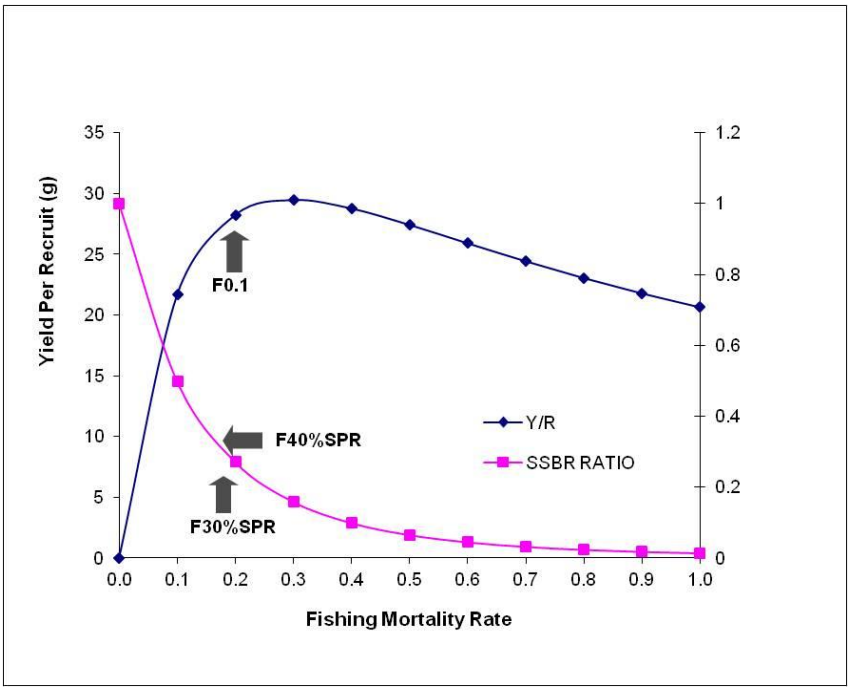


Figure 8: Yield per recruit (YPR) plot for *Micropogonias furnieri*.
(Y/R- Yield per recruit; SSBR- Standing stock biomass per recruit)

In 2008, an assessment of *M. furnieri* was conducted using CPUE data from the trawl and multi-gear fleets for 1995-2007 and biological data collected from the trawl fleets between 2005 and 2007 (Soomai, Hoenig, Gedamke, & Cummings, 2008). The assessment involved the estimation of total mortality of the species based on a mean size model, a length-converted catch-curve model, and standardized CPUE information. There was an observed increase in landings over time, however both the observed and standardized CPUE trend does not reveal large changes in CPUE over the time series (Figure 9). Mean lengths from the trawl samples showed that selection of fish began from a mean length of 32 cm. Total mortality (Z), which is the sum of fishing mortality (F) and natural mortality (M), was estimated at 0.99 yr-1 in 2005 and 0.8 yr-1 in 2006. The results indicated mortality rates that were similar to the values estimated by the mean length method with a Z value of 0.92 recorded for the year 2005 and Z of 0.68 in 2006. The croaker population appears to be experiencing stable but high levels of fishing mortality which exceeds a sustainable level estimated in an earlier assessment of the species. A previous yield per recruit analysis suggested growth over-fishing, i.e., reductions in fishing effort would result in little long term change in yield. Expansion of the fishery is not advisable. An assessment of spawning biomass per recruit has not yet been done and this hampers the ability to determine the risk associated with the current management measures.

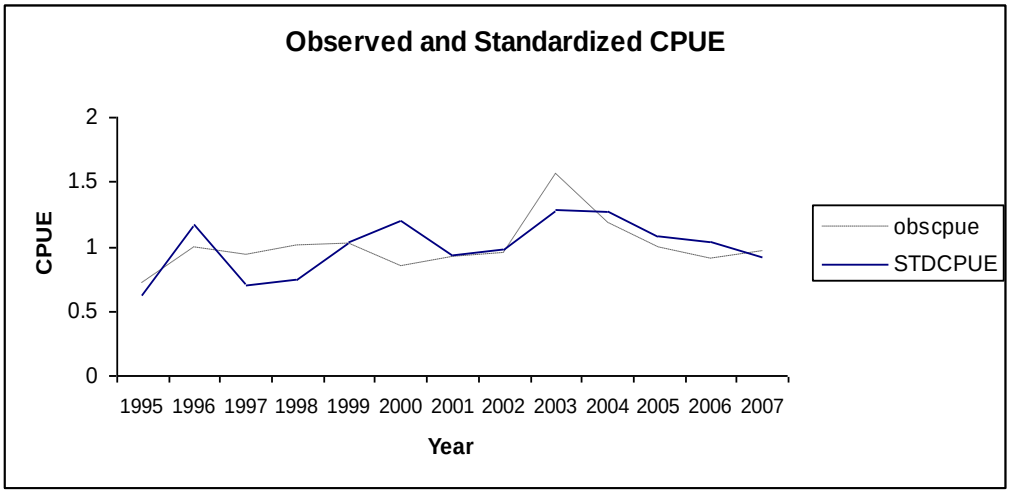


Figure 9: Observed and standardized CPUE (tonnes per day) for croaker obtained from gillnets, trawls and lines.

A bioeconomic assessment of *M. furnieri* was conducted for the artisanal groundfish fishery of Trinidad and Tobago, using data for 1989–97 in a biodynamic economic model (Soomai & Seijo, 2000). This multispecies, multigear dynamic bio-economic model used data for five artisanal fleets (trawl, two gillnet, and two demersal line fleets) and two species (*M. furnieri* and *C. jamaicensis*). Results show that a major decline in yield, net revenues and biomass of both species was expected if open access is continued. Initial biomass levels for *M. furnieri* were estimated at 6,322 and forecast to be 198 tonnes at the end of the twenty-year period. Simulated and observed yields forecasted for this period show that the fishery reaches maximum yield at year 11 (corresponding to 1999). The fishery was also generating maximum rent in 1997 with the average vessel making approximately US$101 per day. Net present value forecasted for the fishery over the twenty-year period (1989-2009) was estimated at US$11 million giving a final biomass of 198 tonnes for *M. furnieri*. The net present value and the biomass of *M. furnieri* were examined under alternative management strategies, including combinations of limiting or banning certain artisanal gears. The recommended management option was to limit effort of all fleets to maintain the resource and the profits for the fishery at sustainable levels.

Lutjanus synagris (lane snapper)

Manickchand-Dass (1987) examined fishpot and trawl catches of *Lutjanus synagris* from November 1979 to November 1981. Comparison of sizes caught by sex and gear type showed that trawl nets caught smaller fish and females, while significantly outnumbering males, were generally smaller than males for both gears. Males matured at one year of age, at 37cm; females matured at two years at 41cm. Males grew slightly faster, and achieved a larger size than females. The rapid growth and early maturation of the lane snapper in Trinidad indicate that the *L. synagris* population in north-west Trinidad may be able to withstand a higher rate of exploitation than the long-lived, slow-growing populations in the north and south. Future studies on mortality, recruitment, and yield were recommended to fully understanding the biology of the species.

A yield per recruit analysis of *Lutjanus synagris* was performed using the biological parameters derived from Dass (1983) (Maingot and Manickchand-Heileman, 1987). Results indicated that at all values of natural mortality (M) the lane snapper was under-exploited. At the estimated value of M and age of first

capture (tc) for this study a 462% increase in F (from 0.17 to 0.8 year-1) was predicted to give a 160% increase in yield per recruit (from 70g to 112g). Management recommendations were therefore to increase the age of first capture from 1.38 years to 2 years at a total length of 30cm (above size at maturity of 22.5cm TL and 23.0cm TL for males and females respectively) and to increase F to 0.8 which would result in a YPR of 122g.

An assessment of *Lutjanus synagris* exploited on the west and south coasts of Trinidad was conducted in 2006 which observed growth using a mean length model and observed fishing mortality in a catch-free model which utilized recent historical catch per unit of effort (Soomai & Porch, 2006). The analysis used catch and effort data from 1995 to 2004 for the artisanal multi-gear, fishpots, and trawl fleets; 2000 to 2004 for the industrial trawl fleet; historical catch and effort data (1963, 1975) and reconstructed (1908 to current) annual catch per unit effort (CPUE) levels for artisanal gillnet, line and trawl fleets operating in Trinidad. The analysis also used length data obtained from fishpot and banking (handline) in 1996-1997. Five CPUE indices showed relatively flat trends (multifilament gillnet, monofilament gillnet, a la vive, semi-industrial trawl, banking) while two indices suggested recent increases in abundance (artisanal trawl, fish pot) (Figure 10). Results indicate a high fishing mortality rate which may have affected the overall biomass however it appears that recruitment has not been affected. Results suggest that growth overfishing is occurring; the landings of *L. synagris*, are largely comprised of fish less than 2 years old and before they can spawn. Results also suggest that the population of *L. synagris* in Trinidad is not a unit stock, but part of a larger population on the adjacent continental shelf that is perhaps not so heavily exploited and supplies a steady stream of recruits into Trinidad waters.

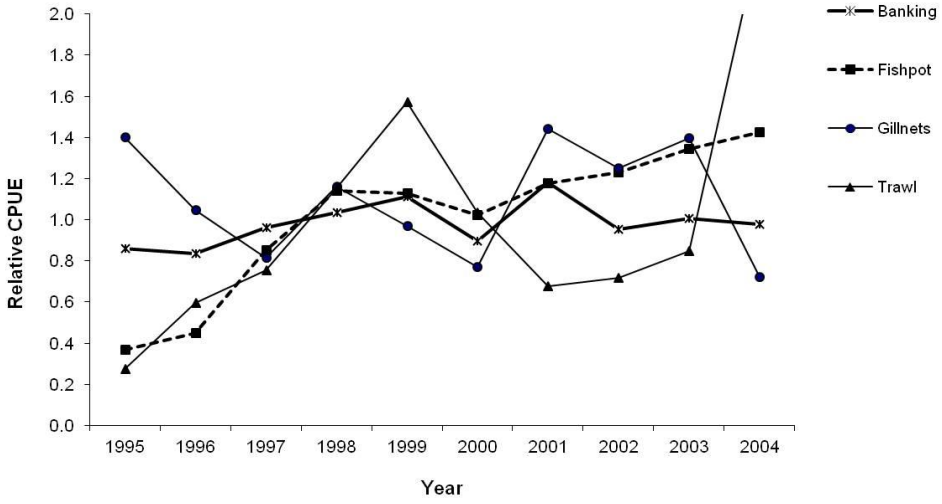


Figure 10: Relative catch per unit effort (CPUE) for artisanal gears including gillnets (monofilament and multifilament), lines (banking), fishpot and trawl (artisanal fleet only) for the period 1995-2004.

Cynoscion jamaicensis (Weakfish)

A stock assessment for *Cynoscion jamaicensis* was performed using monthly catch and effort data for the period 1989 to 1997, from trawl fleets and the artisanal gillnet and line methods operating in the Gulf of Paria and the Columbus Channel of Trinidad and Tobago (Soomai *et al*., 1999). This assessment was based on a similar depletion model as described for *M. furnieri* (above). Fishing mortality (F) estimates

for *C. jamaicensis* estimated from biological years constructed for the species over the period 1994 to 1997, were abnormally high and ranged between 0.62-7.05. From a yield per recruit (YPR) analysis, an $F_{0.1}$ of 0.255 produces a YPR of 39.8 g (Figure 11). The high fishing mortality (F) values for *C. jamaicensis* obtained from the depletion model were well above the precautionary level of exploitation indicated by the $F_{0.1}$ (i.e., F is greater than 0.255) and the optimum biological condition of the species. The results of this assessment clearly indicated a very intensive exploitation of these resources. The resources are not generating optimum yield and are most likely experiencing potential spawning decreases.

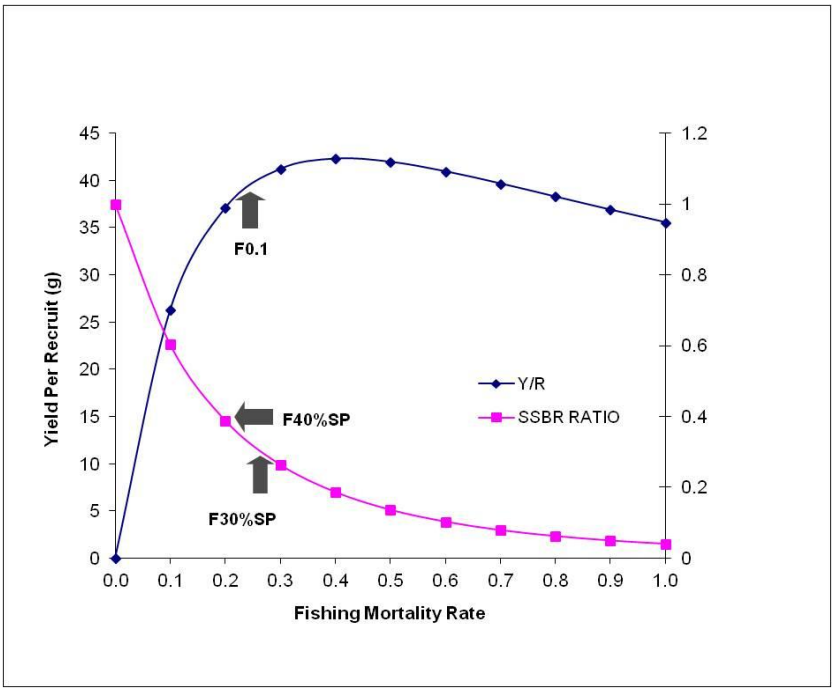


Figure 11: Yield per recruit plot for *Cynoscion jamaicensis.* (Y/R- Yield per recruit; SSBR- Standing stock biomass per recruit)

A bio-economic assessment of *C. Jamaicensis* was conducted using a biodynamic economic model which included data for *M. furnieri* (Soomai & Seijo, 1999). Several scenarios observed the temporal fluctuations in performance variables (e.g. profits, yield, and biomass) under several management strategies over a twenty-year period (1989-2009). Results were similar for those of *M. furnieri*, where yield, net revenues, and biomass are expected to decrease over time in an open access fishery. Initial biomass levels for *C. jamaicensis* was estimated at 602 tonnes and forecast to be 109 tonnes at the end of the twenty-year period. As for M. furnieri, forecasted yields show that the fishery reached maximum yield in 1999 and generated maximum rent in 1997. Net present value forecasted for the fishery over the twenty-year period (1989-2009) was estimated at US$11 million giving a final biomass of 109 tonnes for *C. jamaicensis*. The recommended management option is to limit effort for all fleets to 1997 levels to maximise the minimum final biomass attainable and minimizes the loss of opportunity to the fishery.

Soomai and Siejo (2001) also observed the risk and uncertainty associated with management strategies to limit or restrict various gears used in inshore artisanal fisheries that catch *M. furnieri* and *C. jamaicensis*. The two groundfish species have lower biomass levels than the targeted pelagic species in thegillnet and

line fishery or the high-valued shrimp in the trawl fishery. Therefore, in this multispecies, multifleet fishery context, the level of effort at which the biomass of less abundant species is not threatened should be established. The recommended management option was to limit effort of all fleets to maintain the resource and the profits to the fishery at sustainable levels.

Economic performance of artisanal fleets landing groundfish

A cost and earnings study was conducted in 2000 for the artisanal gillnet and line fisheries of Trinidad. The study was based on interviews conducted with ten monofilament gillnet operators, four multifilament gillnet, eight banking, four a-la-vive and six palangue operators. The interview methodology was similar to that used in the cost and earnings survey of the trawl fishery (Ferreira, 1998). The average vessel revenues, costs and profits for 1999 were estimated for each of the gillnet and line fleets. Annual net profits to monofilament gillnet operators were estimated at TT$65,943, TT$5,716 for the multifilament gillnet, TT$57,552 for the banking, TT$69,809 for the a-la-vive and TT$67,313 for palangue. While most of the vessel owners who participated in the survey were operating at a profit, 20% of the monofilament gillnet operators, 25% of the multifilament gillnet, 25% of the banking, and 17% of the palangue were operating at a loss.

6.4 Provide information on any direct interactions with the ecosystem (impact on sea bottom, pollution caused by the fishery, affects of coastal zone development or land-based pollution, etc.).

In addition to fishing that exceeds the natural rate of regeneration, such activities as dredging, dumping, discharge of pollutants, coastal infrastructure and coastal tourism undermines the conditions required for healthy marine ecosystems, thereby threatening their sustainability (United Nations Development Fund, 2011). Miloslavich *et al*. (2010) notes that rising population densities in conjunction with coastal development, increased fishing pressure, agricultural and industrial activities, increased river sediment loading, alien species and climate change are the major sources of anthropogenic pressure on Caribbean marine life. Some sources of pressure on the marine ecosystem supporting the shrimp and groundfish fisheries are examined further in the following sections.

Physical Impacts of Trawling on the Sea Floor

Soft bottom habitats can be negatively influenced by trawling activities. According to Valdemarsen *et al*. (2007) sweeps/bridles in bottom trawl equipment have the largest contact area with the bottom, and trawl doors are often considered the most significant source of bottom impact. Valdemarsen *et al*. (2007) notes that while the impact of dragging sweeps is poorly understood, they clearly have an effect on protruding objects on the bottom. Lokkeborg (2005) explains that alteration of the seafloor topography occurs due to furrows created by trawl doors, and that repeated trawling over the same bottom increases surface roughness, but does not affect sediment texture. These disturbances decrease habitat complexity by destroying upper level organisms in the sediment such as tubes (Lokkeborg, 2005). According to Valdemarsen *et al*. (2007), short-term declines in some individual taxa may occur, but no large changes in the benthic assemblage are noticed in experimental trawling on sandy bottoms of the Atlantic. Recovery can occur, however, if all trawling ceases for a period of time, depending on the nature of the ecosystem (Lokkeborg, 2005). Valdemarsen *et al*. (2007) notes that soft bottom habitats are also subjected to a high degree of natural disturbances like strong currents & temperature fluctuations, and as a result, clear and consistent effects of trawling may be hard to verify.

Ecosystem Analysis of the Gulf of Paria

Preliminary ecosystem statistics and network flow indices were derived, and the possible impacts of trawling on the biomass of model components were explored using a trophic model for the Gulf of Paria (Manickchand-Heileman et al., 2004). Results indicate that the trawl fleet operates as a predator with a trophic level of 2.97 and almost 80 percent of the catch is derived from trophic levels two and three. The associated primary production required for the 1997 total catch was 28.3 tonnes per km^2 (about 2 percent of net primary production). For the major component of the catch, comprising several shrimp species, the associated primary production required for the 1997 catch was 8 tonnes per km^2 (0.56 percent of net primary production). The total system throughput of biomass was 2,285 tonnes per km^2, of which 25 percent was attributed to all consumption, 16 percent to respiration and the remaining 59 percent to input of detritus. The system is thought to exhibit bottom-up control i.e. the food web is dominated by the detrital pathway. Estimated high ecotrophic efficiencies for many system components suggest efficient utilization of secondary production by predators. Mean transfer efficiency was 12.2 percent.

Results indicate that an increase in the fishing effort of the trawl fleet by 50% for 5 years would result in decrease in biomass of fish groups and an increase in biomass of invertebrate groups, notably penaeids and crabs. Penaeid shrimp and crabs increased in abundance in response to reduced predatory pressure due to a decrease in the biomass of their natural predators. Trawling shows mixed trophic impacts where increasing fishing mortality has a negative impact on some finfish species including trichiurids, serranids, haemulids; and rays and shrimps. Discards appear to have no positive impacts on the other groups, and therefore may not be an important food source for consumers, despite the large quantities discarded. The model also showed that fish biomass recovers once fishing effort is reduced. A comparison of the 1997 ecosystem components with those obtained from a 1945 trawl survey showed significantly higher biomass in 1945, and a possible shift towards a system dominated by lower trophic levels. The estimate of Finn cycling index (7.2 percent) suggests that the Gulf of Paria is a relatively mature ecosystem. However, some instability may be experienced due to exploitation and large seasonal variation in salinity, among other factors.

Ghost fishing

Derelict fishing gear, such as gillnets and fishpots, whether lost or abandoned, retains its capture function in water and continues inducing mortality of aquatic organisms without human control (Matsuoka, 2005). The main reasons for loss of gear include: theft, forgotten location, and interaction with vessel propellers (man-made causes); as well as storms and currents (natural causes). Ghost fishing leads to needless wastage of fish and other organisms and contributes to the overexploitation of fish resources.and impacts negatively on the surrounding ecosystem. Solutions to this problem include training of fishermen on the impacts of ghost fishing, retrieval of lost fishing gear, and the introduction of time-release devices and biodegradable panels in fishpots.

Pollution

A desktop study on the effects of pollution and coastal development on the fisheries resources in the Gulf of Paria and Columbus Channel was conducted by Seepersad *et al*. (2007) of the UWI, St. Augustine. The study was commissioned by the Fisheries Division and funded by the FAO based on stakeholder recommendations made at the April 2005 bilateral assessment workshop held between Trinidad and Tobago and Venezuela under the auspices of the WECAFC ad hoc Working Group on Shrimp and Groundfish. The study focused on issues related to pollution and habitat destruction as a result of human activities in the coastal zone. These coastal zones are bordered by Trinidad and Tobago and Venezuela and are also main fishing areas exploited by trawl and other fishing fleets of both countries. The study

found that average pollution levels were below standards, but in some cases measurements exceeded safe levels.

Agricultural Wastes

Production of food crops necessitates the use of fertilizers, herbicides and a variety of pesticides. Runoff from these applications flows to drainage basins of rivers which discharge into the Gulf of Paria (Seepersad *et al*., 2007). Fertilizers contribute nitrates and phosphates to aquatic environments, while some herbicides and pesticides show levels of persistence and toxicity that can be harmful to animals and fish (Seepersad *et al*., 2007). These chemicals can concentrate along the food chain until concentrations become high enough to harm consumers of the flesh (Seepersad *et al*., 2007).

Pesticide resistance leads to heightened levels of pesticides being used (Seepersad *et al*., 2007). This adds to the chemical load reaching marine ecosystems, which has the ability to persist long term (Seepersad *et al*., 2007). Organochlorines which are no longer in use as a pesticide still show a presence in marine species (Seepersad *et al*., 2007). Pesticide residues directly affect the marine ecosystem by causing fish death, affecting growth rate, reproduction and behaviour (Seepersad *et al*., 2007). Fish can also become more vulnerable to predation, less able to compete with other fish for resources, or less able to adapt to environmental fluctuations with juvenile stages being the most vulnerable (Seepersad *et al*., 2007). Overall, the ultimate consequence is a decreased survival rate and reduction in the fish stock.

The potential impact of agrochemicals on fisheries has also been studied/ reviewed by Esack (1991) and Boodoosingh (1992). The application of large amounts of potentially hazardous chemicals, particularly in large-scale sugar cane estates, is reported as well as occasional fish kills observed in inshore waters, connected with the use of insecticides.

Industrial Waste from the Heavy Manufacturing Industries

The Point Lisas Industrial Estate in Trinidad is the location of several heavy manufacturing industries including ammonia, methanol, chemical fertilisers, and iron and steel (Seepersad *et al.*, 2007). Some of these operations are known to release gaseous and liquid waste into the environment (Seepersad *et al*., 2007). The desalination plant at Point Lisas also returns waste from the process back into the sea (Seepersad *et al*., 2007).

The Institute of Marine Affairs (IMA) carried out the baseline surveys for a Programmatic Environment Impact Assessment of the expansion of the Point Lisas Industrial Estate (IMA, 1999). The report recommended that the cooling water from Farmlands MissChem Ltd. be placed one nautical mile from the shoreline (IMA, 1999). However, despite recommendations, fishers report concerns and challenges. Discussions with fishers in Orange Valley in October 2006 unveiled reports of completely sterile areas after a chemical release from a plant in the Estate area (Seepersad *et al.*, 2007). They reported that an area of approximately one mile had no fish or algae for several years (Seepersad *et al.*, 2007).

Petroleum Hydrocarbon Contamination of the Marine Environment

Contamination from petroleum hydrocarbons is evident on all coasts of Trinidad, with hot spots at Point Fortin, Point-a-Pierre and Point Lisas (Seepersad *et al*., 2007). Oil production and mining of the sea bed can disrupt marine habitats (Seepersad *et al*., 2007). Both land and marine oil spills also have the potential to damage ecosystems (Seepersad *et al*., 2007). Land spills have eventually reached the sea, carried by floods, rivers and smaller streams (Seepersad *et al*., 2007). Impacts of oil spillage include damage and/or death to marine life and birds (Seepersad *et al*., 2007).

Heavy Metals in the Coastal Sediments and Waters

A 2006 study by the Point Lisas Industrial Port Development Corporation Limited (PLIPDECO 2006) cited by Seepersad *et al*. (2007) assessed the water and sediments in the marine environment off the industrial estate from 1.5 km upstream of the Couva River mouth to south off Cliff and Associates, south of the Savonetta pier, 1 km south of Yara's Turning Basin. Some of the results are presented in Table 3. Of all the heavy metals assessed, only mercury levels may have exceeded safe limits. Levels of ammonia, nitrates, nitrites and iron, as well as values for temperature, salinity, pH, dissolved oxygen and suspended solids, were also determined; however there were no WSSQC limits available for comparison.

Table 3: Values for pollutants and other components at seven sample stations at Pt Lisas

Parameter	WSSQC limits *(ppm)*	Minimum	Maximum	Mean
Cadmium (µg g^{-1})	5.1	<1.0	<1.0	<1.0
Chromium (µg g^{-1})	260.0	1.43	2.74	2.35
Copper (µg g^{-1})	290.0	0.14	0.25	0.20
Lead (µg g^{-1})	450.0	0.23	1.85	0.78
Mercury (µg g^{-1})	0.41	<1.0	<1.0	<1.0
Zinc (µg g^{-1})	410.0	1.02	3.22	1.76

Source: Report for the Monitoring programme at Point Lisas Industrial Port Development Corporation Ltd. 26th October 2006. Marine Water and Sediment Analysis

Notes: µg g^{-1} = ppm; WSSQC limits - Sediment Quality Chemical Criteria. Accessed 6 Oct 2007. <http://www.ecy.wa.gov/programs/tcp/smu/sed_chem.htm#a>

Seepersad *et al*. (2007) cited assessments of the heavy metals in the sediments of the Gulf of Paria undertaken by Norville (2005) looking at sediments in the coastal area of Trinidad (37 sampling stations, which included the mouths of 11 major rivers that flow into the Gulf of Paria, as well as near shore and offshore, in both wet and dry seasons), and Rojas de Astudillo *et al*. (2005) looking at sediments in Trinidad and Venezuela. Concentration levels were judged against the interim Canadian Sediment Quality Guidelines (CSQG) where the threshold effect level (TEL) for a given sediment parameter is the concentration below which adverse biological effects are expected to occur only rarely. According to the Norville (2005) study, lead, zinc, and copper exceeded the standards (Table 4), while the Rojas de Astudillo *et al* (2005) assessment found high levels of zinc and copper in oyster (*Crassostrea* sp.) tissues, and zinc, copper and cadmium in the sediments at several sites (Table 5).

Table 4 : Heavy metal concentration ranges in surficial sediments of the Gulf of Paria with comparative Canadian Sediment Quality Guidelines

Metal *(units)*	Wet Season	Dry Season	CSQG
Iron ($mg\ g^{-1}$)	3.2 - 18.9	1.9- 16.9	-
Manganese ($\mu g\ g^{-1}$)	46.1 – 1174.7	43.3 – 1564.2	-
Aluminium ($mg\ g^{-1}$)	0.5 – 3.1	0.2 – 3.2	-
Chromium ($\mu g\ g^{-1}$)	5.4 – 28.4	3.7 – 24.4	52.3
Cadmium ($\mu g\ g^{-1}$)	bdl – 0.50	0.02 – 0.46	0.7
Lead ($\mu g\ g^{-1}$)	3.1 – 73.3	0.8 – 58.3	30.2
Zinc ($\mu g\ g^{-1}$)	13.6 – 170.3	7.1 – 313.9	124
Copper ($\mu g\ g^{-1}$)	0.8 – 39.7	1.6 – 35.5	18.7
Mercury ($\mu g\ kg^{-1}$)	0.2 – 71.2	4.0 – 99.7	130
Nickel ($\mu g\ g^{-1}$)	1.6 – 7.3	0.9 – 27.2	-

Notes: units: (bdl) – below detection limit; (-) none available *Source: Norville, W. (2005)*

Table 5: Mean concentrations of heavy metals in tissues of oyster and mussels and surficial sediments at specific sites in the Gulf of Paria

Location	Concentration ($\mu g\ g^{-1}$ *wet wt*)					
	Cadmium	Copper	Chromium	Mercury	Nickel	Zinc
	Crassostrea sp.					
Guiria *C. virginica*	0.29	7.8	0.09	0.01	0.16	275
Chaguaramas *C. rhizophorae*	0.43	14.6	0.23	0.04	0.17	488
Caroni *C. rhizophorae*	0.39	16.7	0.34	0.05	0.43	171
La Brea *C. rhizophorae*	0.52	52	0.64	0.06	0.31	429
Cedros *C. rhizophorae*	0.67	53	0.25	0.07	0.22	385
	Perna viridis					
Guiria	<0.01	2.3	0.32	0.04	1.4	16.4
Chaguaramas	0.21	1.8	0.22	0.11	0.41	18.3
Caroni	--	--	--	--	--	--
La Brea	0.51	1.9	0.22	0.07	0.66	10.9
Cedros	0.12	2.1	0.35	0.07	0.18	10.2
	Sediments					
Guiria	<0.01	19.8	23	0.41	21.1	99
Chaguaramas	0.02	19.7	36.5	1.6	20.2	158
Caroni	<0.01	13.2	30	0.36	24.1	126
La Brea	1.44	5.1	10	0.82	4.7	82.6
Cedros	0.92	5.6	24	0.72	9.7	55
CSQG	0.7	18.7	52.3	130	-	124

Source: Rojas de Astudillo (2005)

The high levels of some of the heavy metals found in oysters, filter feeders which accumulate pollutants, suggest that the impact that pollution is having on marine life needs more investigation.

Sewage and Faecal Waste

Organic and nutrient pollution (particularly from sewage) is the most widespread and possibly the most serious marine pollution in the Caribbean (Seepersad *et al*., 2007). Sewerage systems exist in three main urban areas in Trinidad: Port of Spain and environs; Eastern Main Road communities from San Juan to Arima; San Fernando and environs (Seepersad *et al*., 2007). All plants, except the Arima plant, discharge into rivers at points below any drinking water treatment sites (Seepersad *et al*., 2007).

Maintenance of treatment plants is the major problem regarding environmental impacts (Seepersad *et al*., 2007). Inefficient systems eventually lead to the discharge of untreated sewage into water courses such as the Caroni River, Cipero River, Mausica River, St. Joseph River and the Tacarigua River, increasing the bacteriological load, turbidity, nutrient input, and Biological Oxygen Demand (BOD) (Seepersad *et al*., 2007). These rivers all drain into the Gulf of Paria (Seepersad *et al*., 2007). This impacts the marine ecosystem with higher nutrient inputs that can produce algal blooms, in turn increasing turbidity which then affects light penetration (Seepersad *et al*., 2007). This shows pronounced effects in seagrass beds. Competition with algae results in reduced growth and stature, higher shoot mortality, and a decline in the total habitat area of seagrass beds (Juman, 2010b). Mapping over time shows increased fragmentation of this habitat type particularly at the Bon Accord Lagoon in Tobago (Juman, 2010b). The loss of seagrass beds can significantly damage fisheries (Juman, 2010b). Higher bacteria inputs can be biomagnified through filter feeders leading to human health hazards when consumed. Increased BOD will also affect all biota (Seepersad *et al*., 2007).

Sea Dumping Operations

A variety of materials and substances can be considered under sea dumping operations. In Trinidad, most commonly, oil tankers dump their ballast water upon arrival at loading ports (Seepersad *et al*., 2007). Small quantities of oil may disperse in coastal waters (Seepersad et al., 2007). The ballast water may also likely introduce exotic, non-indigenous species into the country's fishery, some of which may be beneficial and others potentially harmful to the environment and the fishery (Seepersad *et al*., 2007).

A range of household garbage, both floating and sunken, has been reported in the Gulf by fishermen of Otaheite and Orange Valley (Seepersad et al., 2007). Direct pollution of this form can impact and/kill the biotic components of the ecosystem and contaminate the abiotic component of the ecosystem.

A more recent problem arises from ships carrying radioactive material that frequent Caribbean waters (Seepersad *et al*., 2007). While deliberate dumping is prohibited under the London Convention, a lack of monitoring and water testing may allow spills or dumping events to go unnoticed (Seepersad *et al*., 2007). Additionally, the dumping of dredge spoil in the Gulf of Paria can also negatively affect the ecosystem (Seepersad *et al*., 2007). This dredge spoil tends to come from channels dredged to facilitate access to jetties at coastal industrial estates (Seepersad *et al*., 2007).

Ship Wrecks

While shipwrecks tend to provide new habitat for many marine species, there can also be harmful impacts on marine ecosystems. Wrecks can be a source of contaminants like oil and fuel, metallic objects, or heavy metals (Seepersad *et al*., 2007). These chemicals would serve as pollutants. Accumulation of these pollutants in marine species will eventually negatively impact the ecosystem (Seepersad *et al*., 2007).

Jetties, Landing Sites and Other Marine Structures

Jetties that have fallen into disrepair, been abandoned or collapsed into the sea are numerous in areas such as Sea Lots, Port of Spain, Chaguaramas, San Fernando and La Brea (Seepersad *et al*., 2007). Derelict petroleum exploration structures also exist in the Gulf of Paria (Seepersad *et al*., 2007). These derelict vessels have the potential to release paints, metals and various chemicals into the environment, which may accumulate in marine organisms (Seepersad *et al*., 2007).

Land Reclamation

The western Trinidad coast is being developed at a rapid pace (Seepersad *et al*., 2007). This development includes residential, commercial, and industrial development as well as port expansion, and has led to the reclamation of large areas of land, particularly wetlands (Seepersad *et al*., 2007). In 2001, Landsat imagery detected 170 ha of mangrove dieback at Caroni (Juman, 2010a). Mangroves serve as habitats for larvae, juveniles and adults of estuarine and marine organisms, and strongly influence the community structure of fish on neighbouring coral reefs in the Caribbean (Mumby *et al*., 2004). The biomass of several species more than doubled when the reefs were connected to rich mangrove resources (Juman, 2010a). Mangrove removal will decrease coastal water quality, reduce biodiversity, eliminate fish and crustacean nursery habitat, and adversely affect adjacent coastal habitats (Juman, 2010a). Current rates of mangrove deforestation are likely to have stark injurious consequences for the ecosystem function, fisheries productivity and resilience of reefs (Juman, 2010a).

Seagrass beds have also been reclaimed in Cocorite and North Claxton Bay in Trinidad, and in La Guira Bay and the Nylon Pool in Tobago for reasons such as development and creation of recreational swimming areas (Juman, 2010b). These losses directly also affect marine fisheries in a negative way (Juman, 2010b).

IMA (1999) stated that the addition of land based sediments to marine environments can increase the turbidity of the water column. Siltation will most greatly affect the near shore environment by reducing the organic content of the bottom substrate (IMA, 1999). A reduction in the organic content of the bottom substrate reduces the quantity of food available to benthic organisms, which are a food source for demersal fish and other detritivores (IMA, 1999). A direct impact on the food chain in the marine environment can be initiated. Additionally, some species whose entire life cycle is within this near shore environment can be negatively impacted (IMA, 1999). The possibility of release of pollutants into the marine environment during the pre-operational stage also exists (IMA, 1999).

South American River Discharge

A 1999 study by Siung-Chang and Lum-Kong (2001) reported that higher than normal fish mortality was observed on the Atlantic coasts in several countries including Trinidad and Tobago between July and October 1999. The causative agent of these fish kills suggested by the study was associated with freshwater flow from South American rivers. Low salinity sea water can kill adult reef fish after prolonged exposure, or stress individuals to an extent at which they are more susceptible to bacterial infection (Siung-Chang and Lum-Kong, 2001).

6.5 Summarize the traditional knowledge about the fishery and the resources exploited

Local Knowledge

In a 1994 local knowledge survey, an estimated 5% of the population of fishermen (all gear types) were interviewed, based on stratified sampling according to a 1991 census of fishing vessels and fishermen. The results of the 1994 local knowledge survey indicated that the fishermen interviewed, perceived the greatest threat to the Gulf of Paria to be the trawling activity occurring there. Fishers noted a decline in catches and the general perception was that trawling was responsible for destruction of the seafloor and juvenile fish (Ramjohn 1995). Trawl respondents however indicated that the major cause was pollution however 39% felt that trawling was responsible.

The general perceptions of fishermen in the 1994 survey appear to have remained unchanged based on a survey of trawl fishers conducted in November 1999 in the preparatory phase of Project EP/GLO/201/GEF to examine the perceptions of individuals in the shrimp industry of issues related to shrimp exploitation and the impact of this fishery on the resources and environment (Kuruvilla, Ferreira, & Soomai, 2000). Key fishers operating at the major trawl landing sites on the west coast were interviewed and the overall view was that pollution of the in-shore area, due to industrial and agricultural run-off, has resulted in a significant decrease in fish populations. Many fishers were also of the view that trawling for shrimp in inshore areas, which is prohibited under national legislation, is responsible for a further decrease in resources, due to the removal of large amounts of juvenile fish as bycatch, and physical damage to fishing grounds. Fishers were generally of the view that the Government should introduce controls in the form of zonation, restricted areas and times of operation for trawling for shrimp and fish, open/closed seasons for trawling in the Gulf of Paria, as well as limiting fishing effort through monitoring the entry of new trawlers into the fisheries. Fishers also urged the Government to enforce the existing regulations governing area/zone restrictions, particularly regarding artisanal vessels. Artisanal fishers also believe that educating younger fishers in resource management and increasing awareness of the impacts of fishing and land-based activities on the marine environment will contribute to the management of marine resources.

A National Workshop on Shrimp and Groundfish Fisheries held in 2000 reiterated these views and emphasized the importance of collaboration between the industry and the Fisheries Department– in improving data- and information-collection systems in order to inform management approaches– and the need for regular consultation with the fishing industry. The industry recommended a review of current fisheries consultative arrangements and increased stakeholder participation in management decision-making (FAO, 2000b).

7. Annual catches from the earliest time available (by species or lowest available taxonomic group where landings are multispecies).

Estimated annual shrimp landings from the trawl fleets ranged from 712 to 1,500 tonnes, with an average of 933 tonnes over the period 1988 to 2010, showing a general decline over the entire period, with an average of 49% being taken by the industrial trawl fleet, 40% by the artisanal trawl fleet, and 11% by the semi-industrial trawl fleet on an annual basis over the period (Table 6 and Figure 12).

Table 6: Estimated Annual Shrimp Landings (tonnes) by Trawl Fleet for Trinidad (1988-2010) (Fisheries Division records)

Year	Trawl Fleet			Total
	Artisanal	Semi-Industrial	Industrial	
1988	605	173	721	1,500
1989	329	109	517	955
1990	653	162	403	1,218
1991	618	162	396	1,176
1992	396	93	313	802
1993	482	83	352	917
1994	403	97	312	811
1995	689	135	484	1,308
1996	376	62	456	894
1997	280	111	435	826
1998	321	110	451	882
1999	335	111	483	929
2000	299	118	498	916
2001	390	126	419	935
2002	309	115	517	940
2003	296	118	385	799
2004	272	105	334	712
2005	362	70	346	779
2006	289	79	510	877
2007	214	77	483	774
2008	241	80	547	869
2009	239	68	462	770
2010	336	59	483	879
min	214	59	312	712
max	689	173	721	1,500
avg	380	105	448	933

The estimated annual landings of *Micropogonias furnieri* (croaker) (the most dominant of the groundfish species) for Trinidad for the period 1998 to 2010 ranged from 747 tonnes to 1,869 tonnes (Table 7 and Appendix 18). The vast majority of these landings are from the west and south coasts of Trinidad, with the greatest proportion being taken by monofilament gillnets (Appendix 18 and Figure 13). Figure 14 shows the proportion of the croaker landings taken by gear type for 2010, with 56% taken by monofilament gillnets, 19% by multifilament gillnets (fillet), 12% from the industrial trawl fleet, and 7% from the artisanal and semi-industrial trawl fleets.

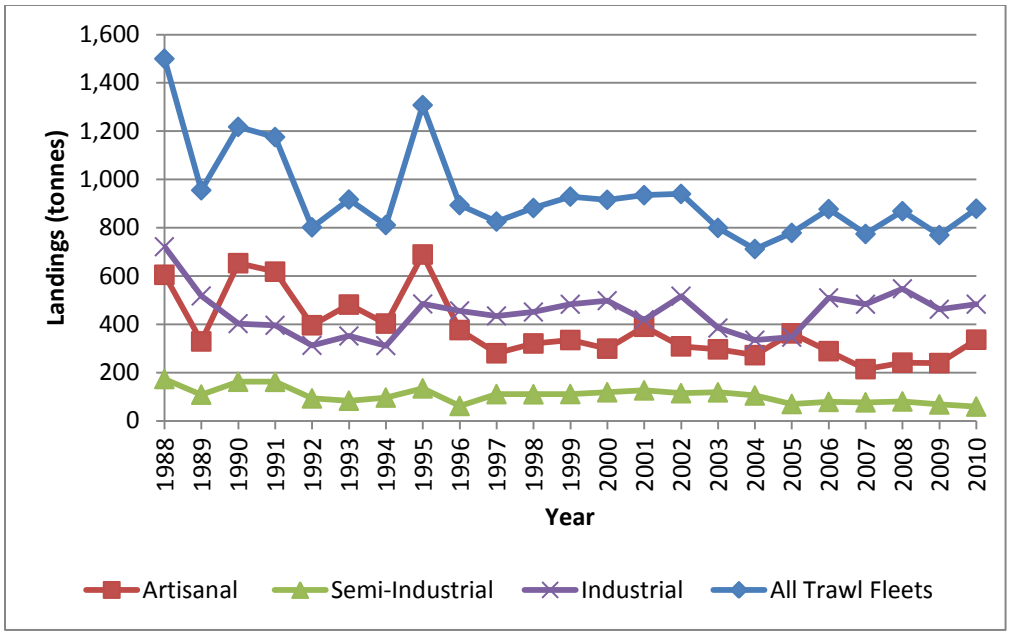


Figure 12: Estimated Annual Shrimp Landings by Trawl Fleet for Trinidad (1988-2010) (Fisheries Division records)

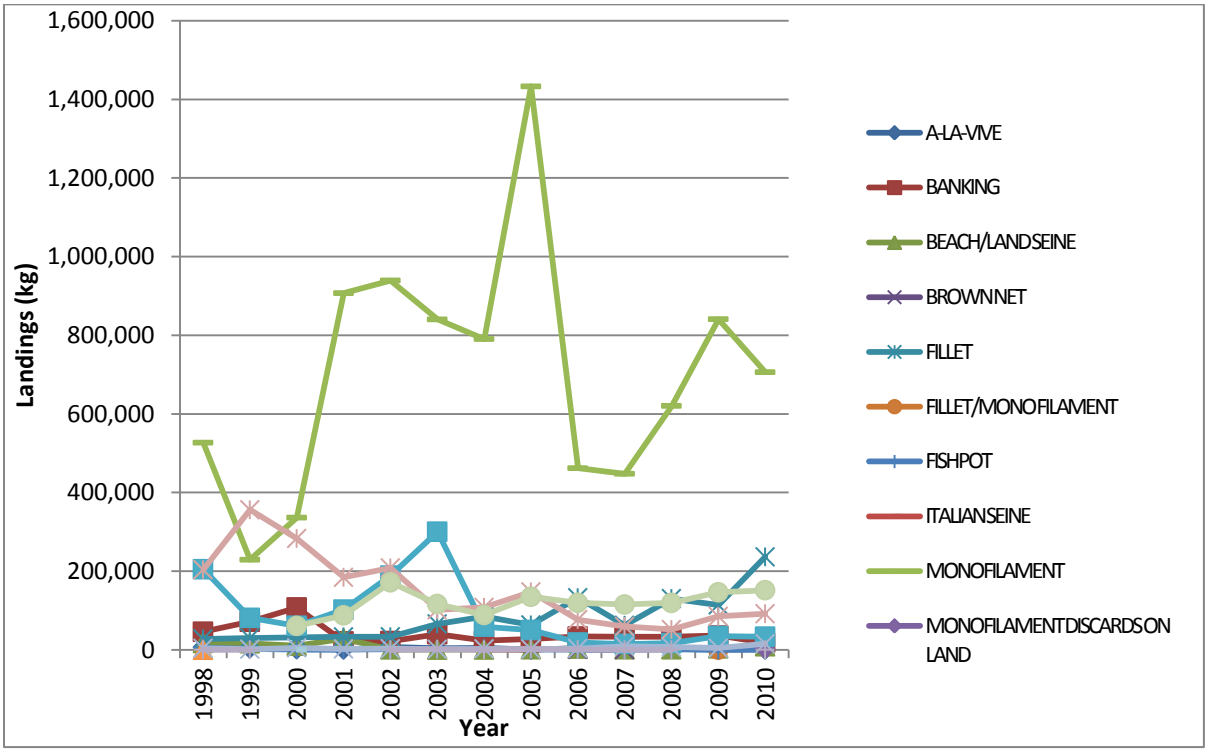


Figure 13: Estimated Annual Croaker Landings for Trinidad (1998-2010) by Gear Type (Fisheries Division records). Note: Landings of Croaker from the industrial trawl fleet for 1998-1999 are not available.

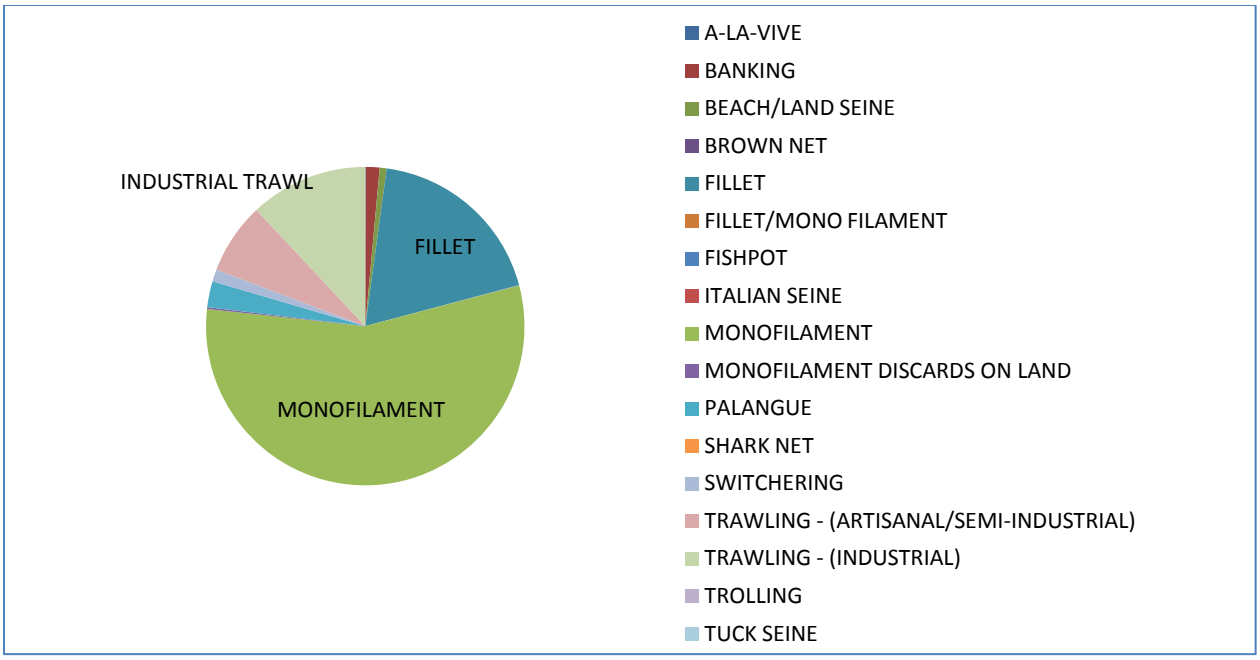


Figure 14: Proportion of Total Croaker Landings for Trinidad for 2010 by Type of Fishing Gear (Fisheries Division records)

The estimated landings of weakfish (a major groundfish species group) for Trinidad for the period 1998 to 2010 range from 372 to 579 tonnes (Table 7 and Figure 15).

Table 7: Estimated Annual Landings (tonnes) of Croaker (*M. Furnieri*) (the most dominant groundfish species), and Weakfish (another major groundfish species group) for Trinidad (1998-2010) with Shrimp Landings for Comparison (Fisheries Division records)

Year	Shrimp	Croaker	Weakfish
1998	882	1,045	418
1999	929	1,008	476
2000	916	1,034	546
2001	935	1,367	579
2002	940	1,575	472
2003	799	1,472	448
2004	712	1,166	420
2005	779	1,869	449
2006	877	854	397
2007	774	747	372
2008	869	983	458
2009	770	1,266	444
2010	879	1,262	383

Note: Landings of Croaker and Weakfish from the industrial trawl fleet for 1998-1999 are not available.

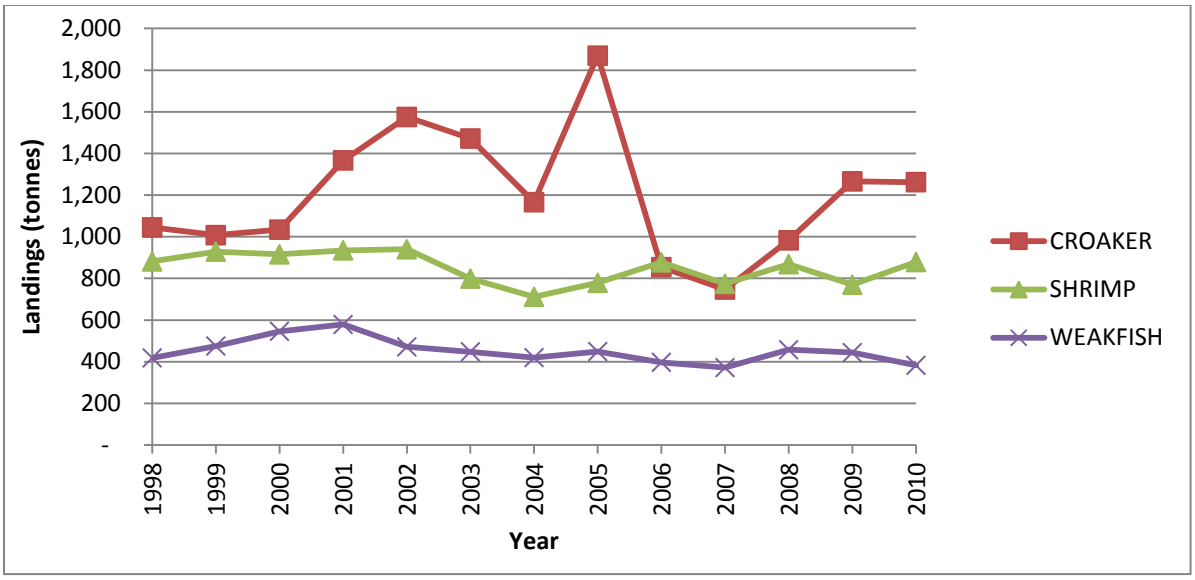


Figure 15: Estimated Annual Landings (tonnes) of Croaker (*M. Furnieri*) (the most dominant groundfish species), and Weakfish (another major groundfish species group) for Trinidad (1998-2010) with Shrimp Landings for Comparison (Fisheries Division records). Note: Landings of Croaker and Weakfish from the industrial trawl fleet for 1998-1999 are not available.

The average annual landings of groundfish from the trawl, gillnet, and multi-gear fleets operating on the west coast (Gulf of Paria) and the south coast (Columbus Channel) of Trinidad over the period 1995-2002 is 1,562 tonnes with an estimated value of $TT10.3M. Over this period trawlers contributed 53% of the groundfish landings and 39% of the value; 24.5% of landings were from gillnets (monofilament, 21.3%; multifilament, 3.2%) which contributed to 21% of the value; and 14 % of landings were from demersal lines (banking 9% and palangue, 5%) which contributed to 22% of the total value. The remaining 8.5% of the total landings of groundfish on the west and south coasts are accounted for by statistics from fishpots, live bait lines (a-la-vive), and beach seines. The annual landings generally increased over this eight year period (1995-2002) (Figure 16).

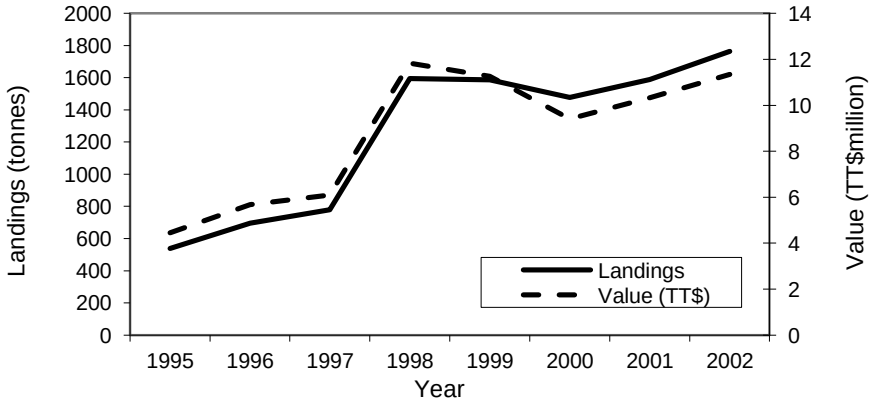


Figure 16. Landings of groundfish for the period 1995-2002 from gillnets, trawl, lines, fishpots and beach seines.

Landing statistics over the period 1995-2002 also indicate that whitemouth croaker (*Micropogonias furnieri*) is the most important groundfish species landed by weight and value for gillnets (mono- and multifilament), trawl, and lines (palangue) operating on the west and south coasts. This is followed by weakfish (*Cynoscion* spp and *Macrodon ancylodon*), catfish (*Arius* spp), lane snapper (*Lutjanus synagris*), mojarras (*Diapterus* spp), and grunts (*Haemulon* spp), in that order. Other groundfish species, mainly groupers and snook (*Centropomus* spp.), are commonly landed by these gears. With respect to lines (banking), lane snapper is most important, followed by croaker, weakfish, grouper, and catfish.

Over the period 1995-2002, the average annual landings of croaker, weakfish, lane snapper, grunt, catfish, grouper, mojarras, and snook from gillnets, trawl and lines, accounted for 815 tonnes (52 % of the total groundfish landings by weight) at a value of TT $5.11 million (49% of the total value). Of this average annual landings of commercially important species, landings of croaker from gillnets, trawl, and line accounted for 40% by weight (326 tonnes) and 33% by value ($TT1.7). Lane snapper (redfish) caught by these three main gear types, accounted for 16% by weight (131 tonnes) and 37% by value ($TT1.9M), while weakfish accounted for 19% by weight (152 tonnes) and 19% by value ($TT0.96M).

8. Assessment of the importance of the fishery in the national economy

8.1 Value of the catches from the fishery per year for the last five years (by species or lowest available taxonomic group where landings are multispecies). Time series of market prices for the landings.

Value added of fishing was $TT98.9 million ($US15.5 million) in 2008, with fishing contributing 0.07% to total GDP, and 21.2% to agriculture GDP (CSO records). Estimated total landings from the marine capture fisheries of Trinidad and Tobago was 13,845 tonnes, valued at about $TT 179 million (US$28 million) in 2009. Estimated trawl landings were 1,681 tonnes (12% of total landings) valued at $TT 31.9 million ($US5 million) (18% of total landings) in 2009. The shrimp, which comprised 46 percent of the quantity of the trawl landings, contributed 79 percent of the value of the landings. Sixty percent of the estimated trawl landings (1,012 tonnes) were from the industrial fleet, 28 percent (475 tonnes) from the artisanal fleet and 12 percent (194 tonnes) from the semi-industrial.

Shrimp is by far the most valuable species group exploited in the shrimp and groundfish fisheries with the annual ex-vessel value over the period 2006 to 2010 averaging $TT26.5 million compared to that for croaker (the most dominant groundfish species in the landings) which averaged $TT7.8 million, and weakfish which averaged $TT6.8 million. The average annual ex-vessel value of the trawl bycatch for the same period was estimated at $TT6.6 million. Table 8 and Figure 17 provide the ex-vessel values for these species groups for 2006 to 2010. With respect to the average annual ex-vessel value for shrimp for the period, 60% was derived from the industrial trawl fleet, 30% from the artisanal trawl fleet, and the remainder from the semi-industrial fleet. Table 9 and Figure 18 provide the estimated ex-vessel values for shrimp and bycatch by trawl fleet for 2006 to 2010.

Table 8: Ex-Vessel Value (TT$) for Shrimp and Bycatch from Trawl Fleets, Croaker (*M. furnieri*), and Weakfish for Trinidad for 2006-2010 (Fisheries Division records)

Year	Croaker	Weakfish	Shrimp	Trawl bycatch
2006	6,867,150	5,436,273	25,381,910	7,368,961
2007	6,457,191	5,873,678	24,874,998	6,654,022
2008	7,842,150	7,666,662	27,751,366	5,999,780
2009	9,641,381	7,667,743	25,276,942	6,636,039
2010	8,178,225	7,125,799	29,347,894	6,560,843

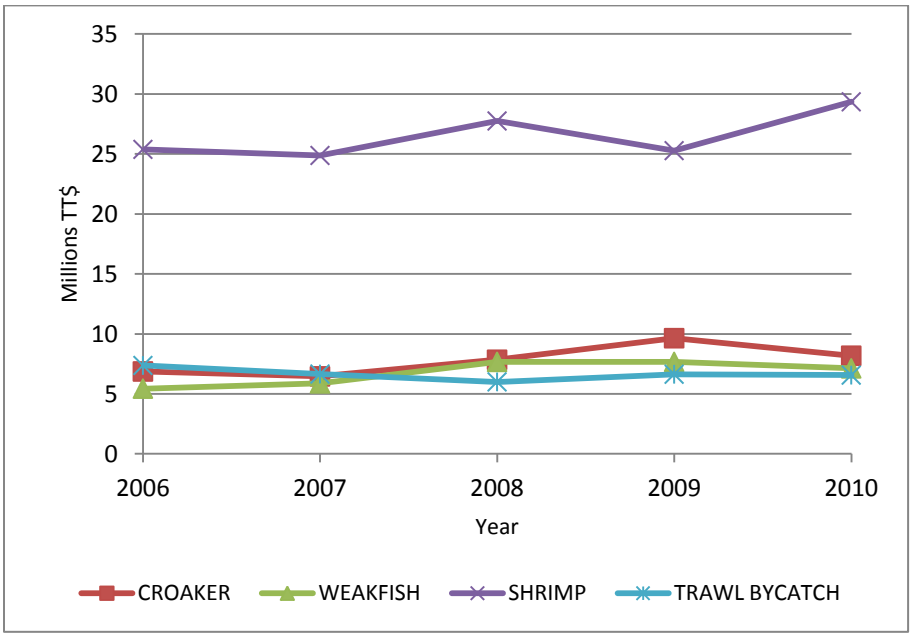


Figure 17: Ex-Vessel Value (TT$) for Shrimp and Bycatch from Trawl Fleets, Croaker (*M. furnieri*), and Weakfish for Trinidad for 2006-2010 (Fisheries Division records)

Table 9: Ex-Vessel Value ($TT) of Shrimp and Bycatch by Trawl Fleet for Trinidad (2006-2010) (Fisheries Division records)

Trawl Type	Data	2006	2007	2008	2009	2010
Artisanal	Shrimp	8,527,642	6,516,563	7,075,938	7,313,319	10,814,779
	Bycatch	697,659	800,772	958,829	1,268,312	1,320,892
Semi-Industrial	Shrimp	2,592,044	2,702,533	2,858,226	2,278,671	2,121,001
	Bycatch	1,678,069	1,466,708	1,023,938	912,107	777,527
Industrial	Shrimp	14,262,224	15,655,902	17,817,202	15,684,952	16,412,113
	Bycatch	4,993,232	4,386,541	4,017,013	4,455,620	4,462,425
Total Shrimp Ex-Vessel Value		25,381,910	24,874,998	27,751,366	25,276,942	29,347,894
Total Bycatch Ex-Vessel Value		7,368,961	6,654,022	5,999,780	6,636,039	6,560,843

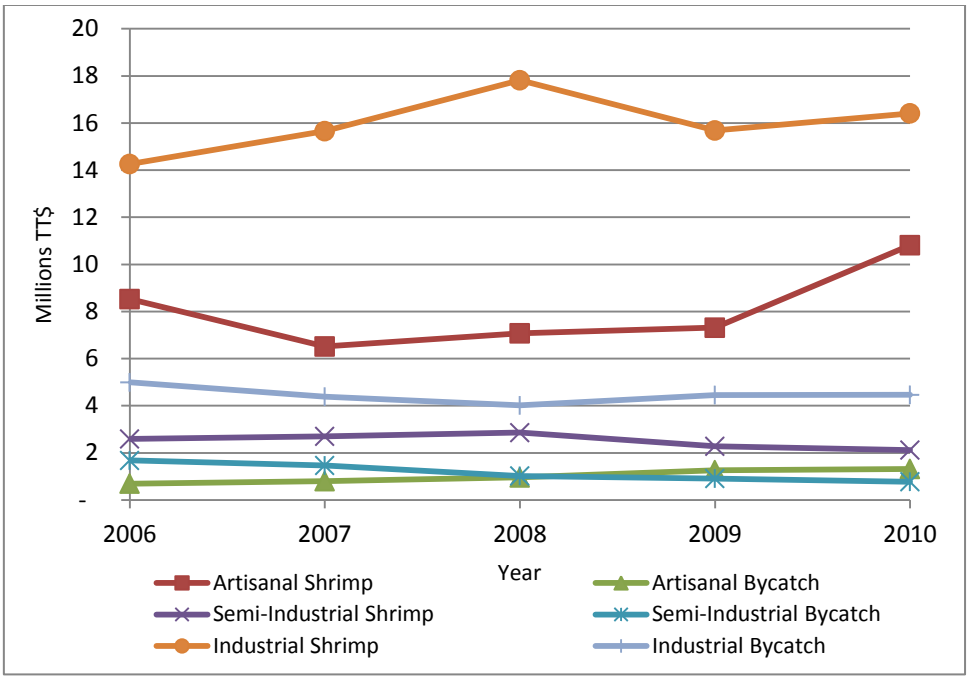


Figure 18: Ex-Vessel Value (Millions of $TT) of Shrimp and Bycatch by Trawl Fleet for Trinidad (2006-2010) (Fisheries Division records)

Ex-vessel values of the landings of groundfish for the period 1995-2002 from gillnets, trawls, lines, fishpots and beach seines are given in Section 7 above (penultimate paragraph and Figure 17) as well as the ex-vessel values for the commercially important groundfish species groups from gillnets, trawls and lines (last paragraph of Section 7).

The average ex-vessel prices by species group for 2006 to 2010 based on Fisheries Division records for the Trinidad artisanal fleets, and semi-industrial and industrial trawl fleets are given in Appendix 19. The average wholesale prices by species group at the Orange Valley Fish Market for the period 2007 to 2011 based on The National Agricultural Marketing and Development Corporation (NAMDEVCO) records are provided in Appendix 20. The species groups listed in Appendices 19 and 20 include shrimp and groundfish species as well as some of the species caught by the fishing gears which capture shrimp and groundfish.

Socio-Economic Value of Trawl Bycatch

A study on the importance of landed trawl bycatch to the social and economic wellbeing of the associated fishing communities of two major landing sites for the trawl fishery, namely Orange Valley and Otaheite, was completed under the FAO global Project EP/GLO/201/GEF by the Fisheries Division, in collaboration with the University of the West Indies (UWI) (Hutchinson, Seepersad, Singh, & Rankine, 2007). Interviews of fishers and processors were conducted in 2005 and 2006. A formal Rapid Appraisal Household Survey was conducted within the Orange Valley and Otaheite communities (Hutchinson *et a*l., 2007). A total of 248 and 250 households were identified in the Orange Valley and Otaheite communities of which 80 households were surveyed in Orange Valley and 83 in Otaheite.

In Orange Valley the most popular shrimp trawl bycatch species consumed was croaker (*Micropogonias furnieri*). Approximately 17% of households at OrangeValley caught their own seafood, while 68%

purchased seafood and 28% received seafood as gifts from family and friends who fish. Overall, approximately 90 percent of the Orange Valley households purchased fresh fish (assumed bycatch in the trawl fishery) that was landed at Orange Valley. It is estimated that the entire Orange Valley community (248 households) consumes 46, 941.44 lbs of fresh fish annually at an estimated value of $TT 271,321.52.

For Otaheite, an estimated 66% of families purchased fish from a fresh fish market, compared to other sources such as supermarkets; of this group, 96% bought their fish at the Otaheite Fish Market. Bechine (*Sphyraena guachancho*) and salmon (*Cynoscion* sp.) were the most consumed species of seafood in Otaheite. The average number of fresh fish meals consumed per day, per household was 1.67, and fresh fish meals are prepared an average of 2.97 days per week per household.

Based on individual consumption and the market prices of fish, the study estimated the minimum annual bycatch landed by the shrimp fishers in Orange Valley and Otaheite at $695,641.52. Based on the value of shrimp trawl bycatch in 2003, it is estimated that the bycatch landed in Orange Valley and Otaheite, accounts for approximately 19% of the total bycatch value in Trinidad and Tobago. The Total Economic Value of shrimp trawl bycatch in Trinidad and Tobago is comprised of its: Use Value and Non-Use Value. This study measured the Direct Use Value of shrimp bycatch as ex-vessel prices were used in the analysis; the value added component of processing and retailing activities was not included.

Retained fish from the shrimp bycatch is a very important source of food and livelihood for both communities. Forty-five percent (45%) of Orange Valley households and 34% of Otaheite households reported at least one person was employed in the local fisheries either as a fisher or a fish vendor. Policies to reduce bycatch in the shrimp fishery must recognize these important roles of bycatch in local communities. Trawl bycatch species are relatively cheaper fish compared to the mackerels and other pelagic species, and fish is also often cheaper compared with other sources of protein, likely due to the close proximity of homes to the landing sites which also increases the possibility of family members catching their own fish, or obtaining fish as gifts from family or friends.

8.2 Products, markets and quantitative assessment of the value and employment of activities in value-addition and linked to the sector.

With respect to shrimp, the products sold locally include fresh-chilled shrimp, peeled, and breaded shrimp. Exports include fresh-chilled/frozen shrimp, whole, heads-off or peeled. Wild shrimp exports from Trinidad and Tobago have steadily declined from 163 tonnes valued at $TT10 million in 1998, to 13.5 tonnes valued at $TT0.4 million in 2010 (Table 10 and Figure 19). During the period 1998 to 2010, over 90% of the shrimp was exported to the CARICOM region with the remainder going to South America, Canada, United States and territories, European Union (EU) and territories, and others.

With regard to groundfish, the products are mainly chilled or frozen, with processing technology generally limited to primary processing and packaging. Exports are mainly to the CARICOM countries, United States, and Canada.

There are estimated to be about eight shrimp processors/exporters and about five croaker processors/exporters currently in operation based on Fisheries Division records.

Table 10: Quantity and Value of Wild Shrimp Exports from Trinidad and Tobago (1998-2010)

YEAR	QUANTITY (KG)	VALUE (TT$) FOB
1998	162,822	9,994,982
1999	146,811	9,619,951
2000	116,303	7,483,360
2001	183,077	8,780,049
2002	101,852	4,821,915
2003	119,083	5,015,342
2004	83,997	3,596,962
2005	85,947	3,117,875
2006	60,488	1,513,812
2007	40,301	1,452,557
2008	28,229	816,866
2009	21,446	594,439
2010	13,531	448,307

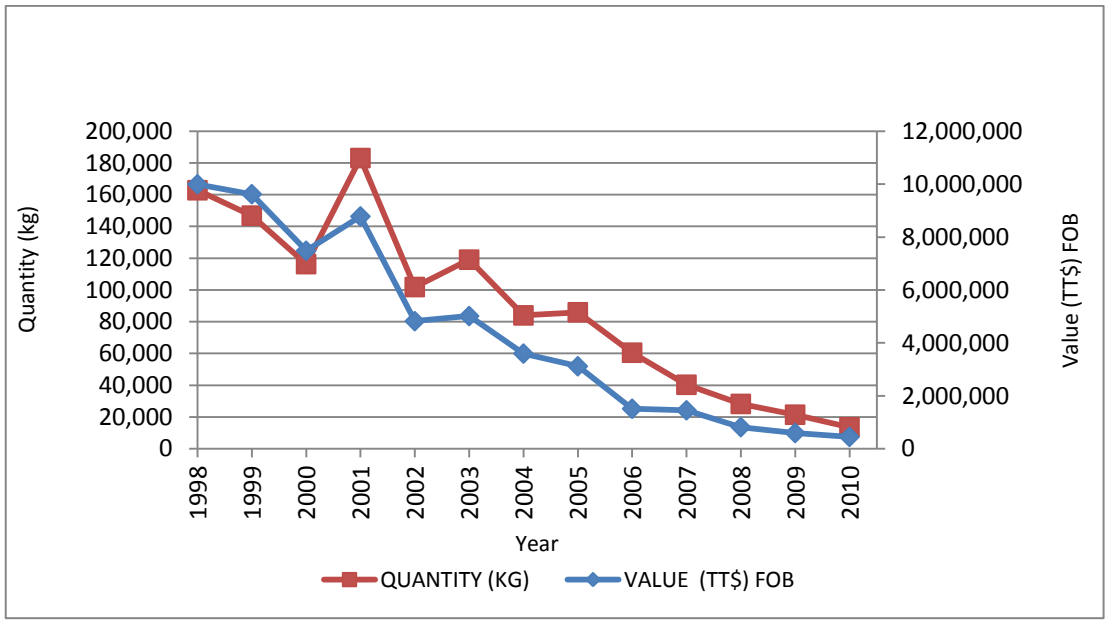


Figure 19: Quantity and Value of Wild Shrimp Exports from Trinidad and Tobago (1998-2010)

9. Full set of management measures/primary management tools currently being used in the fishery/sector.

A management regime is in place for the trawl fishery involving areas of operation and gear specifications (*Fisheries [Control of Demersal (Bottom) Trawling Activities] Regulations 2004; Fisheries (Conservation of Marine Turtles) Regulations, 1994; Fisheries (Amendment) Regulations, 2002*) as well as numbers of vessels (1988 Cabinet decision) as follows:

- Trawling is permitted on the north coast of Trinidad outside of 2 nautical miles from the coast in the area west of Saut D'eau from November 15 to January 15, between 6am and 6pm.

- Trawling is permitted on the south coast of Trinidad outside of 2 nautical miles from the coast.
- Trawling is subject to a zoning regime in the Gulf of Paria:
  - Artisanal trawlers are permitted to operate outside of 1 nautical mile from the coast.
  - Non-artisanal trawlers with engine size of 180Hp or less are permitted outside the 6 fathom isobath;
  - Non-artisanal trawlers with engine size in excess of 180Hp are permitted outside the 10 fathom isobath.
- Trawling is prohibited on the east coast of Trinidad and within 12 nautical miles of the coast of Tobago.
- The diagonal stretched mesh of the trawl net must not be less than 3 inches (7.6 cm) when trawling for fish, and not less than 1.5 inches (3.8 cm) when trawling for shrimp, and chafing gear must cover not less than 25% of the codend.
- Semi-industrial and industrial trawlers are required to use Turtle Excluder Devices (TEDs) on their nets to prevent the capture of turtles. This conservation measure is also subject to US inspection and certification to facilitate trade between Trinidad and Tobago and the United States.
- A ceiling was placed on the numbers of artisanal, semi-industrial and industrial trawlers by a1988 Cabinet decision. Since then there have been controls on the entry to the fishery of industrial and semi-industrial trawlers.

According to the Fisheries Regulations and the Fisheries (Amendment) Regulations, 1998, 2000 and 2002, the following management measures are in place:

- Minimum diagonal stretched mesh of 4.25 inches (10.8 cm) for gillnets (except where mullet and flyingfish are targeted). Maximum net length is 900 feet and maximum width at centre is 15 feet.
- Minimum diagonal stretched mesh of 3.5 inches (8.9 cm) for monofilament gillnets catching mullet. No species, other than mullet, may be landed in excess of 15% of the weight of the catch. Maximum net length is 900 feet and maximum width at centre is 12 feet.
- No carite (Spanish mackerel, *Scomberomorus brasiliensi**s***), kingfish (king mackerel, *Scomberomorus cavalla*), grouper (Serranidae), codfish **(**cobia, *Rachycentron canadum*), sorb (Mutton snapper, *Lutjanus analis*), pargue (snapper, Lutjanidae), or zeblan (Palometa pompano, *Trachinotus goodei*) less than 12 inches (30.5 cm) in length shall be taken, sold, or exposed for sale.
- No salmon (weakfish), redfish (vivanot, *Lutjanus vivanus*; walliacke, *L. synagris*), tête-ronde (Atlantic bigeye, *Priacanthus arenatus*), pomfano (Carangidae, *Selene sp*. or *Trachinotus sp*.), or cola (*L. purpureus, L. vivanus*, or *Ocyurus chrysurus*) under 8 inches (20.3 cm) in length shall be taken or sold or exposed for sale.
- No sardine shall be sold except to a *bona fide* fishermen for the purpose of bait.
- Minimum mesh size and maximum net length and width are also specified for the various seine types. Several areas are demarcated where the taking of fish and shellfish is prohibited.

Appendix 21 provides a summary of the types of management tools implemented in the Trinidad and Tobago shrimp and groundfish fisheries including when they were introduced.

An "Agreement to promote the sustainable management and optimal utilization of the fisheries resources on the North and South Coasts of Trinidad and in the Gulf of Paria" was ratified on October 21, 1997 by

key fishing industry stakeholders (the then Ministry of Agriculture, Land and Marine Resources, Trinidad and Tobago Coast Guard, UWI, IMA, EMA and several commercial and non-commercial fishing interest groups) (Fisheries Division, 2000). A Monitoring and Advisory Committee (MAC) was established to ensure the successful implementation of the Agreement, which was to be strictly enforced by the provisions under existing legislation and through a process of self-imposed penalties. The latter however were not enforced.

Management recommendations of completed stock assessments and the measures taken to date

Appendix 22 provides the main management recommendations based on joint stock assessments for what (up to the current time) is considered to be a sub-regional shrimp stock shared by Trinidad and Tobago and Venezuela. Appendix 23 summarizes the main management recommendations made from stock assessments conducted for the major groundfish species and the measures taken to date. Thus far, most attention has been given to many of the research recommendations related to implementing new data collection programmes and refining data and information on catches and discards.

10. Assess the effectiveness of the current management measures in relation to the fishery itself, including effectiveness in ensuring sustainable utilization.

The effectiveness of current management regulations would be difficult to assess at the current time due to non-compliance of the fishing industry,as resources for fisheries surveillance and enforcement have been very limited over the years. Further details are provided in the following section.

11. Compliance or Enforcement Problems being experienced in the fishery. Complaints or dissatisfaction amongst fishers/rights holders. Scientific Monitoring and MCS (Monitoring, Control and Surveillance)

The Trinidad and Tobago Coast Guard and the Trinidad and Tobago Police Service (which are the national security agencies empowered to conduct fisheries surveillance and to enforce the fisheries legislation) have limited resources to devote to the fisheries sector. This has led to the establishment of the Fisheries Monitoring, Surveillance and Enforcement Unit (FMSEU) of the Fisheries Division in 2004 which has unfortunately suffered from a loss of staff over the years. The FMSEU was however re-staffed in early 2012 and comprises two Fish Inspection Officers, seven Fish Inspectors, a Vessel Engineer, two Drivers and an Administrative Officer (the Vessel Captain post is vacant). To date the Unit has been involved in a number of training activities, has embarked on a programme to increase the awareness of fisherfolk of existing legislation, conducts patrols at fish landing sites as well as joint patrols with the Trinidad and Tobago Coast Guard to ensure compliance with fisheries laws and regulations.

Some of the common problems with respect to non-compliance of the fishing industry with the existing regulations are as follows:

- TEDs not being used in semi-industrial and industrial trawlers, or escape flap in trawl net being sewn down and hence preventing the escape of turtles and other catch.
- Turtles being landed
- Use of mesh size in gillnets (ie. diagonal stretched mesh of 3.5” and 3.75” in monofilament; 4” in multifilament) which is less than the minimum mesh size
- Use of mesh size in trawl nets which is less than the minimum mesh size.

- Operation of artisanal trawlers within one nautical mile of the Gulf of Paria coastline. Markers are required to delimit the one mile boundary.

Some fisherfolk have expressed dissatisfaction with some of the current fisheries legislation as follows (Fisheries Division, 2013):

- A vessel owner is held liable for contravention of the TED Act (for example if TEDs are not used in the trawl nets) while it is the Captain who is in control of the vessel at sea. This however will be modified under the new Draft Fisheries Management Bill (2011) currently before the Legislative Review Committee.
- Some artisanal trawler owners claim that the use of a mesh size in the codend of the trawl net which is greater than 1.25" or 1.125" (a minimum of 1.5" is required by law) will result in no catch. They claim that white shrimp is caught only within one mile of the Gulf of Paria coastline which is prohibited by law.
- Some non-artisanal trawler owners claim that trawling beyond two nautical miles of the north and south coasts (which is required by law) is not profitable. They claim that the two nautical mile limit is ineffective due to greatly varying depths with distance from the coast.
- Some industrial trawlers are interested in new harvesting areas (eg. East coast) where trawling is currently prohibited)
- Herrings and sardines are sold as food fish but by law should only be sold as bait. Fishers claim that this is necessary to earn income.

12. Is there a national or regional forum for discussions on management of this or other resource? If yes, give a short description of the forum (nature, frequency, subject of discussions, outcomes, etc.)

12.1 National Fora

The involvement of fishers, fisher organizations, fishing communities and other stakeholders including governmental, non-governmental and research agencies, at the national level, in the management of fishery resources has largely been through two cabinet-appointed committees, namely the Monitoring and Advisory Committee (MAC) on the fisheries of Trinidad and Tobago and the National Monitoring Committee on Foreign Fishing and Related Matters (NMCFFRM). These two fisheries-related stakeholder committees were appointed by Cabinet in the 1990s to advise on the management of fisheries; the former with responsibility for domestic fisheries (though initially established in 1997 to resolve conflicts between artisanal (non-trawling) fishers and the industrial trawling fleet)., and the latter for matters relating to the activities of foreign fishing entities. Neither of these Committees is currently functional nor have they functioned for the last five or so years, as there was a change in the administration of the Fisheries Division and there was also a need to reconstitute the committees.

The Monitoring and Advisory Committee (MAC) on the fisheries of Trinidad and Tobago was established in 1997. The MAC was established to promote the sustainable management and optimal utilization of the inshore/coastal resources on the north and south coasts of Trinidad and in the Gulf of Paria, taking into consideration the need for conflict resolution and management among resource users. Its terms of reference was later expanded to encompass the fisheries of the east coast. The National Monitoring Committee on Foreign Fishing and Related Matters (NMCFFRM) was established in 1991 to

monitor the operations and characteristics of all foreign fishing vessels in the waters under the jurisdiction of Trinidad and Tobago as well as those that use Trinidad and Tobago for transshipment or landing, to ensure their compliance with the terms and conditions of access as well as international regulations and national policies and regulations of Trinidad and Tobago.

The intention however, under the Draft Fisheries Management Bill 2011, is to establish the Trinidad and Tobago Fisheries Advisory Board which is to comprise representatives of government, fishing industry, scientific community, and non-govenmental organizations (NGOs) advocating on either fisheries or environmental matters. The primary function of the Board will be to advise the Minister, and where appropriate the Secretary of the Tobago House of Assembly (THA) and Local Fisheries Management Authorities, on matters relating to the development and management of fisheries in Trinidad and Tobago, including the: preparation, review and implementation of management plans; mechanisms for the promotion of public awareness and education and involvement in fisheries management; obligations under regional and international treaties and agreements to which Trinidad and Tobago is a party and to which the management plans must conform; accepted international standards and practices with which management plans must be consistent as well as the aims and aspirations of the communities to which they are to apply; research activities for the responsible management of fisheries; strategies for the protection and security of persons engaged in fishing, their vessels, gear or equipment against damage or loss and resulting economic loss sustained from collision with other vessels, natural disasters, rough seas, banditry or activities related to oil and gas exploration, development or production; subsidy and incentive programmes for fisherfolk and for the fisheries in general.

The establishment of stakeholder groups is also used as a mechanism to involve the participation of the fishing industry in the co-management of fisheries resources. A Task Group of stakeholders of the shrimp and groundfish fishery of Trinidad was established, and four meetings were held over the period March to July 2012. The aim of the Task Group was to identify and prioritize the issues in the shrimp and groundfish fishery and articulate the management objectives for the fishery and to propose solutions to address the priority issues. The establishment of the Group was an initiative under the Caribbean Large Marine Ecosystem (CLME) Project. In addition, a National Steering Committee (NSC) comprising trawl fishers and vessels owners was established under FAO global Project EP/GLO/201/GEF *"Reduction of Environmental Impact from Tropical Shrimp Trawling, through the Implementation of Bycatch Reduction Technologies and Change of Management"* during the period 2003-2008. Involvement of fishers in research in collaboration with the Government was an initial attempt at participatory management. Fishing community meetings are often held to obtain the input of fishers on fisheries development and management matters.

At the national level, the Fisheries Division is represented on a twelve-member Integrated Coastal Zone Management (ICZM) Committee which was established in April 2012 by the Minsitry with responsibility for the environment. The committee facilitates the co-ordination and cooperation among the relevant government agencies as well as non-governmental stakeholders with the objective of managing human activities within the coastal zone with a view to ensuring the sustainability of resources and protection of coastal areas.

12.2 Regional Fora

Trinidad and Tobago is a member of two regional shrimp and groundfish assessment working groups, namely the FAO WECAFC (Western Central Atlantic Fishery Commission) *ad hoc* Working Group on Shrimp and Groundfish Fisheries of the Guianas-Brazil Continental Shelf, and the Caribbean Regional Fisheries Mechanism (CRFM) Shrimp and Groundfish Resource Assessment Working Group. The FAO group comprises Trinidad and Tobago, Venezuela, Guyana, Suriname, French Guiana, and Brazil, while

the CRFM group comprises Trinidad and Tobago, Guyana, Suriname, Jamaica, Haiti and Belize. Analyses conducted under the Working Groups have addressed research/management issues regarding the current status of the major shrimp and groundfish stocks and the appropriate level of fishing effort to avoid over-exploitation of the resources and attain economic efficiency in the operation of the fleets. Participation in these Working Groups has contributed to capacity building in the area of stock assessment and bio-economic analysis; provided a mechanism for the interaction of scientists and fisheries managers on a regional and bilateral (Trinidad and Tobago and Venezuela) level; and provided a basis for more informed decision-making with regard to the sustainable management of these shared resources.

Trinidad and Tobago has participated in all eight (8) regional assessment workshops of the FAO/WECAFC *ad hoc* Working Group since 1986, with the support of the CFRAMP (CARICOM Fisheries Resource Assessment and Management Program) since 1996. A National Consultation was held in 2000 to present the findings of the Working Group to the stakeholders and to initiate their participation in the management of these fisheries. A Regional meeting of Fisheries Ministers and Managers of the WECAFC *Ad Hoc* Working Group was held in Trinidad in 2001 to inform decision-makers on the status of shrimp and groundfish resources in the Brazil-Guianas Shelf and identify an appropriate strategy for the implementation of effective co-operation in research and management. A Regional meeting of Stakeholders on the Sustainability of Fisheries in the Brazil-Guianas Shelf was subsequently held in Suriname in 2002. The main aim of this meeting was to increase and improve communication and dialogue among the various stakeholders (representatives of the fishing industry, fisheries managers and scientists of the countries) of the resources in order to achieve their sustainable utilisation.

Since 2004, scientific meetings of the Shrimp and Groundfish as well as other fishery working groups are held annually by the CRFM.

It should be noted that joint fisheries research efforts between Trinidad and Tobago and Venezuela have been facilitated and supported both technically and financially by the FAO as well as the CFRAMP/CRFM although there is an existing 1989 Protocol on Co-operation in Fisheries Research between Trinidad and Tobago and Venezuela, which has not yet been activated.

13. Any other comments relevant to current management of the fishery and the way forward for the introduction of EAF.

13.1 Bycatch reduction: Gear testing in the trawl fleets

Trinidad and Tobago participated in a Global Environment Facility Project (2003-2008) aimed at reducing fish bycatch and discards in catches of the trawl fleet, EP/GLO/201/GEF *"Reduction of Environmental Impact from Tropical Shrimp Trawling, through the Implementation of Bycatch Reduction Technologies and Change of Management"*. The Project attempted to introduce improved fishing technologies in order to reduce the high incidental catch of finfish and other species. The project tested several bycatch reduction devices (BRDs) with a view to introduction in the respective fisheries. Trinidad and Tobago's participation in this Project facilitated the work being carried out nationally on shrimp and groundfish fisheries and the attempts in the region to develop mechanisms for the management of shared stocks of the Guyana-Brazil continental shelf.

Gear trials provided data from the use of bycatch reduction devices (BRDs) in 25% of the national trawl fleet (Soomai 2008a; Soomai, 2008b; Soomai, 2007; Soomai & Seefoo, 2006). The data recorded during paired trawling (using two vessels) to test experimental gear against existing trawl gear can reveal some of the biological impacts of the existing trawl gear on the shrimp and fish resources and some economic

aspects related to the efficiency of trawling. With assistance from the National Fisheries Institute (INP) of Mexico, gear testing involved: modifying the existing trawl nets; testing of the fisheye and square mesh panel BRDs; and testing of a new monofilament artisanal trawl net. Trawl fishermen and vessel owners collaborated with government in this activity through their participation in a National Steering Committee (NSC) for Project EP/GLO/201/GEF.

Modifications to the existing artisanal multifilament net and the use of the experimental artisanal monofilament appeared to make fishing operations more efficient (Soomai, 2007; Soomai & Seefoo, 2006). The use of the fish eye and the square mesh panel BRDs showed a reduction in discards in the existing multifilament net and in the experimental monofilament net. Unwanted bycatch was reduced in the new monofilament net with a 13% decrease in the ratio of discarded bycatch to retained bycatch and a 27% decrease in the ratio of discarded bycatch to the total catch. Larger shrimp catches were recorded overall, however smaller sizes of shrimp were caught in the monofilament net compared to the catch in the multifilament net. The monofilament net was able to operate efficiently (i.e., the movement of the net over the seabed) in a variety of water conditions and at speeds of 2.5 - 3.0 knots. Trawling with the monofilament net was also more fuel efficient (personal observation of fishermen). In the case of the semi-industrial and industrial nets, there was a 32% reduction in the average weight of the total catch in the experimental net (fisheye or square mesh installed) and the shrimp to retained bycatch ratio was estimated at 1:1 (Soomai, 2008a). However it was estimated that 90% of the bycatch was discarded from both the control net and from the experimental net.

The period of gear testing was insufficient to determine the effectiveness of each BRD (fisheye and square mesh panel) in reducing discards in each of the trawl fleets (Soomai, 2008b). However, the gear testing highlighted the urgency of implementing current management measures such as enforcing areas of operation as prescribed under national regulations. It was apparent that the artisanal fleet was operating in very shallow waters and movement to deeper waters is expected to reduce the catch of juveniles, even in the absence of a BRD. Trawling at slower speeds also catches more shrimp and can allow smaller species and younger fish to swim out of the net. Modifications to the semi-industrial and industrial fleets were recommended regarding the use of lighter weight nets and otter boards.

Continued involvement of the trawl vessel owners in research is necessary both in terms of ensuring the success of these fisheries management initiatives and in reducing the negative perception of the trawl fishery by the public and environmental groups.

The Ministry of Food Production, in November 2012, indicated to the FAO its interest in participating in the second phase of Project EP/GLO/201/GEF, another regional project for the Sustainable Management of Bycatch in Caribbean and Latin American Multispecies Bottom / Shrimp Trawl Fisheries.

13.2 Use of Scientific Information

The flow of information between multiple stakeholders- the fishing industry, scientists, fisheries, managers, policymakers, and fisheries advisory bodies (FAO and CRFM)- was studied through a surveyof key individuals to document each of their roles in the creation, distribution, and use of fisheries information produced for the shrimp and groundfish fishery (Soomai, MacDonald, & Wells, 2010). Knowledge about the fishery has increased and technical capabilities have been strengthened through research and through technical assistance from the FAO and the CRFM. Salience, credibility, and legitimacy of the information were however shadowed by barriers that decreased these attributes. The highly technical content of fisheries information reduced its usefulness to some stakeholders. Inspite of the availability of such information, the survey showed limited evidence of the extent to which the information contained in the fisheries technical stock assessment reports is being used in fisheries management inTrinidad and Tobago. Formal systems do not exist for distributing or measuring the use

and influence of such information in decision making. Communication strategies to promote awareness of the scientific information and aligning scientific information with fisheries policy could increase its use and influence. Institutional support for partnerships and education to encourage stakeholder involvement could also facilitate increased influence of scientific information.

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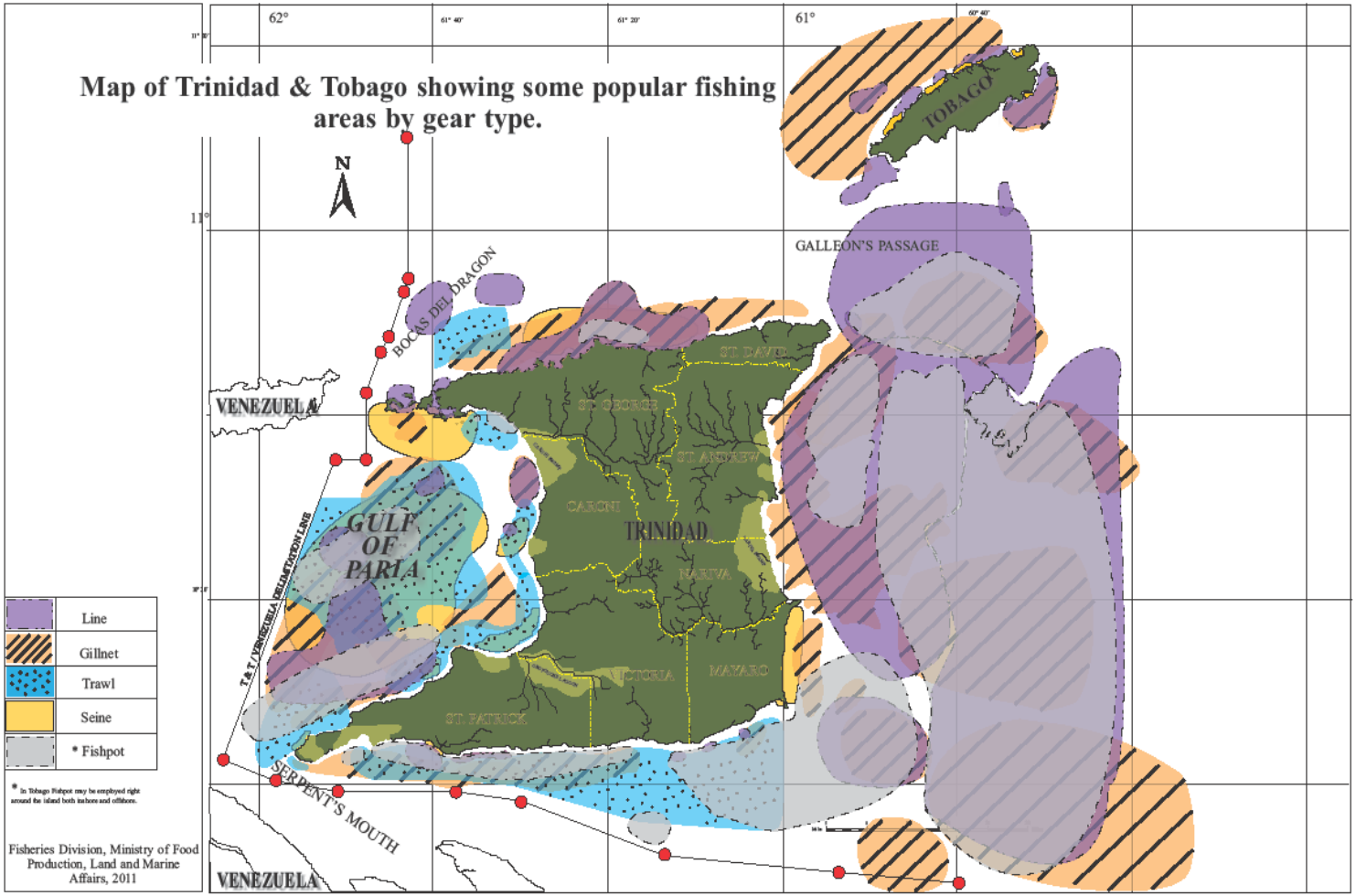
Appendix 1: Resources exploited in the soft-substrate demersal fishery of Trinidad and Tobago.

SPECIES						
FISHERY TITLE	**Target/Main species**	**Specific fish population/Stock and resource**	**Biological/ Physiological status of target species**	**Associated species**	**Discard Species**	**Incidental Catches**
Artisanal Trawl Fishery	*Farfantepenaeus subtilis*, *Farfantepenaeus notialis*, *Litopenaeus schmitti*, *Xiphopenaeus kroyeri* (Penaeid Shrimp)	Resources of the Gulf of Paria to the Orinoco Delta-crustaceans	adults, juveniles	Sciaenidae, Lutjanidae, Clupeidae, Engraulidae	Portunidae, Bothidae/ Cynoglossidae, Soleidae	Dermochelys coriacea
Semi-industrial Trawl Fishery	*Farfantepenaeus subtilis*, *Farfantepenaeus notialis*, *Litopenaeus schmitti*, *Xiphopenaeus kroyeri* (Penaeid Shrimp)	Resources of the Gulf of Paria to the Orinoco Delta-crustaceans	adults, juveniles	Sciaenidae, Lutjanidae, Clupeidae, Engraulidae	Portunidae, Bothidae/ Cynoglossidae, Soleidae	Dermochelys coriacea
Industrial Trawl Fishery	*Farfantepenaeus subtilis*, *Farfantepenaeus brasiliensis*, *Farfantepenaeus notialis*, *Litopenaeus schmitti*, *Xiphopenaeus kroyeri* (Penaeid Shrimp)	Resources of the Gulf of Paria to the Orinoco Delta and north coast of Trinidad west of Saut D'eau-crustaceans	adults, juveniles	Sciaenidae, Lutjanidae, Clupeidae, Engraulidae	Portunidae, Bothidae/ Cynoglossidae, Soleidae	Dermochelys coriacea
Artisanal Gillnet Fishery	*Scomberomorus brasiliensis* (Spanish Mackerel/Carite), *Micropogonias furnieri* (Whitemouth Croaker/Cro-cro, Racando), *Cynoscion spp.* (Weakfish/Salmon)	Resources of the Gulf of Paria to the Orinoco Delta-demersal fish and pelagic fish	adults, juveniles	Sciaenidae, Lutjanidae	Ariidae, juveniles of pelagic and groundfish species	Dermochelys coriacea
Artisanal Line Fishery	*Lutjanus synagris* (Lane Snapper/Redfish), *Micropogonias furnieri* (Whitemouth Croaker/Cro-cro, Racando), *Cynoscion* spp. (Weakfish/Salmon)	Resources of the Gulf of Paria to the Orinoco Delta-demersal fish and pelagic fish	adults, juveniles	Haemulidae	Ariidae	

Appendix 2: Some popular fishing areas around Trinidad and Tobago by gear type.



Appendix 3: Fishing gears used in the soft-substrate demersal fishery of Trinidad and Tobago.

(ISSCFG-International Standard Statistical Classification of Fishing Gear; ISSCFV-International Standard Statistical Classification of Fishery Vessels)

FISHERY TITLE	FISHING GEAR		FISHING VESSEL			EXPLOITATION			FLEET SIZE	
	Gear Type (ISSCFG Standard terms)	**Description**	**Vessel Type (ISSCFV Standard terms)/Description**	**On-board processing facilities**	**Crew number**	**Fishing season**	**Port of origin/landing**	**Trip duration (days)**	**No. of Vessels**	**No. of fishermen**
Artisanal Trawl Fishery	Bottom pair trawls 03.1.5	Bottom Trawls. Minimum cod end mesh size of 3 cm and average headrope length: 10.6m	Stern trawler (01.2.0) Vessels 6.7-11.6 m in length with 90-150 HP inboard diesel engine or two 45-75 HP outboard engines	Barrels with ice	2-3	Year round	Otaheite, San Fernando, Orange Valley, Cacandee, Bonasse, Fullerton, Icacos	1	About 95	190
Semi-industrial Trawl Fishery	Bottom pair trawls 03.1.5	Bottom Trawls. Minimum cod end mesh size of 3.5 cm and average headrope length: 11.6m.	Stern Trawlers (01.2.0) 9.3-12.2 m in length with 165-275 HP inboard diesel engine; electronic fishing and navigation aids	Ice holds, Barrels with crushed ice	2-3	Year round	Orange Valley	1-5	10	30
Industrial Trawl Fishery	Bottom pair trawls 03.1.5	Bottom Trawls. Two nets with minimum cod end mesh size of 3.5 cm, average headrope length 15m.	Otter Trawlers (01.4.0). Vessel length 10.9-23.6 m with 325-425 Hp inboard diesel engine; electronic fishing and navigation aids	Ice holds, Barrels with crushed ice, some have freezers	4	Year round	Orange Valley, Port of Spain, San Fernando, Icacos	5-11	32	128
Artisanal Gillnet Fishery	Gillnets and entangling nets (nei) 07.9.0	Gillnets and Entangling Nets (not specified)	multipurpose vessels (09.0.0) (artisanal)	Barrels with ice	2	Year round	Icacos, Erin, Moruga, Port of Spain	1	266	532
Artisanal Line Fishery	Hooks and lines (nei) 09.9.0	Hooks and Lines (not specified)	multipurpose vessels (09.0.0)(artisanal)	Barrels with ice	2	Year round	Icacos, Erin, Moruga, Brickfield, Port of Spain	1	106	212

Appendix 4: Species composition of trawl catches (artisanal, semi-industrial, and industrial) observed over the period 1999-2000.

Family	Species	Family	Species
FINFISH			
Albulidae	*Albula vulpes*	Haemulidae	*Anisotremus virginicus*
Ariidae	*Ariopsis bonillai*		*Conodon nobilis*
	Arius parkerii		*Genyatremus luteus*
	Arius felis		*Haemulon bonariense*
	Arius sp.		*Haemulon steindachneri*
	Bagre bagre		*Pomadasys corvinaeformis*
	Cathorops spixii	Lutjanidae	*Lutjanus synagris*
Batrachoididae	*Batrachoides surinamensis*	Mugilidae	*Mugil curema*
	Porichthys plectrodon	Muraenesocidae	*Cynoponticus savanna*
Bothidae	*Cyclopsetta chittendeni*	Muraenidae	*Gymnothorax sp.*
	Citharichthys sp.	Ogcocephalidae	*Ogcocepphalus sp.*
	Etropus crossostus	Ophichthidae	*Echiophis intertinctus*
	Syacium papillosum	Ophidiidae	*Lepophidium profundorum*
	Syacium micrurum	Ostrachidae	*Lactophrys polygonius*
Carangidae	*Caranx hippos*	Polynemidae	*Polydactylus virginicus*
	Caranx crysos	Priacanthidae	*Heteropriacanthus cruenstatus*
	Chloroscombrus crysurus		*Priacanthus arenatus*
	Selene brownii	Pristigasteridae	*Chirocentrodon bleekerianus*
	Selene setapinnis		*Odontognathus mucronatus*
	Selene vomer		*Pellona haroweri*
Centropomidae	*Centropomus undecimalis*	Scaeinidae	*Cynoscion jamaicensis*

Family	Species	Family	Species
	Centropomus parallelus		*Cynoscion acoupa*
	Centropomus pectinatus		*Cynoscion steindachneri*
Clupeidae	*Harengula clupeola*		*Micropogonias furnieri*
	Harengula jaguana		*Macrodon ancylodon*
	Sardinella aurita		*Menticirrhus americanus*
	Sardinella sp.		*Stellifer griseus*
	Opisthonema oglinum		*Stellifer microps*
Cynoglossidae	*Symphurus plagusia*		*Stellifer rastrifer*
	Symphurus plagiusa		*Bairdiella rhonchus*
Dasyatidae	*Dasyatis americana*		*Ctenosciaena gracilicirrhus*
	Dasyatis guttata		*Larimus breviceps*
Echineididae	*Echeneis neucratoides*	Scombridae	*Scomberomorus brasiliensis*
Elopidae	*Elops saurus*	Scorpaenidae	*Scorpaena brasiliensis*
Engraulidae	*Anchoa spinifer*		*Scorpaena plumieri*
	Anchoa lyolepis	Serranaidae	*Diplectum radiale*
	Anchoviella lepidentostole	Soleidae	*Achirus achirus*
	Lycengraulis grossidens		*Achirus lineatus*
	Cetengraulis endentulus		*Trinectes paulistanus*
Ephippidae	*Chaetodipterus faber*	Stromateidae	*Peprilus paru*
Gerreidae	*Diapterus rhombeus*	Synodontidae	*Synodus*
	Eucinostomus havana	Tetraodontidae	*Sphoeroides testudineus*
Gymnuridae	*Gymnura micrura*	Torpinidae	*Narcine brasiliensis*
Grammistidae	*Rypticus saponaceus*	Trichiuridae	*Trichiurus lepturus*

Family	Species	Family	Species
		Triglidae	*Prionotus punctatus*
BATOID FISH		**CEPHALOPODS**	
Rhinobatidae	*Rhinobatus percellens*	Loliginidae	Loligo pleia
Dasyatidae	*Dasyatis guttata*		Lolliguncula brevis
Sphyraenidae	*Sphyraena guachancho*		
CRUSTACEANS		**MOLLUSCS**	
Calappidae	*Calappa sulcata*	Veneridae	*Mytella* sp.
	Hepatus pudibundus		*Perna* sp.
Leucosiidae	*Persephona lichtensteinii*	Olividae	*Oliva pecticularis*
Portunidae	*Callinectes sp.*	Melongenidae	*Melongena melongena*
	Lupella forceps	Muricidae	*Haustellum chrysostoma*
Penaeidae	*Farfantepenaeus brasiliensis*	Strombidae	*Strombus pugilis*
	Litopenaeus schmitti		
	F. notialis		
	F. subtilis		
	Xiphopenaeus kroyeri		

Appendix 5: Size composition (total length in cm) of trawl landed categories of *Micropogonias furnieri* and *Lutjanus synagris* over the period 2004-2006. (n/a indicates no occurrence of the respective category).

Year	Trawl Fleet	*Micropogonias furnieri*				*Lutjanus synagris*			
		Length ranges in landed categories (Total length (TL) in cm)				Length ranges in landed categories (Total length (TL) in cm)			
		Unsorted	Mixed Fish	Choice Fish	Cro-cro	Unsorted	Mixed Fish	Choice Fish	Redfish
2004	Artisanal-Otaheite	15.5-33.0	17.0-28.0 (mixed); 25.0-42.0 (big mixed)	n/a	25.0-36.0	14.0-19.5	13.0-18.5 (mixed); 13.0-36.0 (big mixed)	n/a	15.5-22.5 (mixed);15.5 - 33.0 (big redfish)
	Artisanal-Orange Valley	16.0-50.0	16.5-27.0 (mixed); 27.0-45.0 (big mixed)	28.0-50.0	n/a	15.0-18.5	16.0-19.0	19.0-23.0	n/a
2005	Artisanal-Otaheite	17.5-45.0	15.5-25.0 (small mixed); 24.5-49.5 (big mixed)	n/a	n/a	13.5-30.0	13.0-24.5	n/a	22.5-40.0 (redfish); 18.0-20.0 (medium redfish)
	Artisanal-Orange Valley	15.0-45.5	10.0-29.5(mixed); 20.5-55.0 (big mixed)	29.5-37.0	n/a	16.0-20.0	14.0-23.0 (mixed); 14.0-47.0 (big mixed)	19.5-23.0	n/a
	Semi-industrial	n/a	16.5-31.0	28	21.0-57.0	n/a	13.0-28.5 (small mixed);14.0-32.0 (mixed)	20.0-26.0 (small choice); 17.0-42.5 (choice)	21.0-42.0 (big redfish)
	Industrial	19.0-22.0	18.0-33.5	n/a	22.5-58.0	18	14.0 - 22.0 (small mixed);14.0-29.5 (mixed)	18.0-38.0	15.5-24.0 (small redfish); 24.0-45.0 (redfish)
2006	Artisanal-Otaheite	21.8-36.5	16.5-25.5 (small mixed); 24.5-41.0 (big mixed)	n/a	n/a	15.5-30.0	16.0-19.0	n/a	24.0-40.0 (redfish); 18.0-20.0 (medium redfish)
	Artisanal-Orange Valley	n/a	16.5-30.5	28.0	21.0-57.0	16.0	14.0-20.0 (small mixed); 14.5-23.0 (mixed); 17.5-31.0 (big mixed)	n/a	n/a
	Semi-industrial	n/a	16.5-30.0 (small mixed); 17.0-30.5 (mixed)	28	21.0-57.0	n/a	15.0-27.50 (mixed)	17.0-42.5	22.0-40.5 (redfish); 21.0-42.0 (medium redfish)
	Industrial	n/a	18.0-33.5	n/a	22.5-58.0		14.0-22.0 (small mixed); 16.5-29.0 (mixed)	18.0-38.0	15.5-24.0 (small redfish); 26.0-45.0 (redfish); 20.0-49.0 (big redfish)

Appendix 6: Percentage composition by weight of *Micropogonias furnieri*, *Lutjanus synagris*, *Cynoscion jamaicensis*, and *Macrodon ancylodon* in trawl landed categories over the period 2004-2006. (n/a indicates no occurrence of the respective category; -- indicates the categories where no data were recorded).

Year	Trawler type	Micropogonias furnieri			Lutjanus synagris			Cynoscion jamaicensis			Macrodon ancylodon		
		% of landed category			% of landed category			% of landed category			% of landed category		
		Unsorted	Mixed	Choice	Unsorted	Mixed	Choice	Unsorted	Mixed	Choice	Unsorted	Mixed	Choice
2004	Artisanal- Otaheite	24.63	19.1	n/a	7.49	14.82	n/a	--	--	--	49.13	20.1	78.85
	Artisanal- Orange Valley	20.41	11.8	27	9.2	15.75	62.54	--	--	--	5.69	31.78	n/a
	Semi-industrial	n/a	37.36	65.6	n/a	6.37	24.75	--	--	--	n/a	27.95	17.09
	Industrial	n/a	40.74	n/a	n/a	10.76	32.1	--	--	--	n/a	17.26	n/a
2005	Artisanal- Otaheite	17.76	24.54	n/a	19.18	13	n/a	n/a	9.43	n/a	n/a	n/a	n/a
	Artisanal- Orange Valley	7.72	31.75	35.55	9.25	19.05	n/a	10.05	13.71	n/a	5.1	16.82	n/a
	Semi-industrial	n/a	36.17	n/a	n/a	11.39	29.18	n/a	10.75	23.4	n/a	35.65	n/a
	Industrial	n/a	67.76	n/a	n/a	n/a	44.06	n/a	5.5	5.5	n/a	12.74	n/a
2006	Artisanal- Otaheite	16.65	31.36	n/a	29.28	5.74	n/a	21.29	24.82	n/a	33.37	32.43	n/a
	Artisanal- Orange Valley	9	32.89	48.06	1.37	23.56	n/a	8.09	54.38	72.1	n/a	26.05	25.86
	Semi-industrial	n/a	38.63	1.97	n/a	12.36	35.08	n/a	42.23	38.7	n/a	13.21	13.84
	Industrial	n/a	35.11	n/a	n/a	15.76	44.78	n/a	11.57	32.44	n/a	25.78	4.8

Appendix 7: Numbers of Land-based Workers (excluding Processors/Exporters) in the Trinidad and Tobago Shrimp and Groundfish Industry (West and South Coasts of Trinidad) by Landing Site and Category of Worker

Landing Site	Wholesale Truck Operators[1]	Vendors	Commodores[2]	Hustlers/ Jostlers	Net Builders & Repairers	Boat Builders & Repairers	Welders	Mechanics	Electricians	Refrigeration Technicians	Total[3]
Alcan	-	3	-	20[4]	5	1	-	-	-	-	29
Cocorite	-	2	-	5	5[5]	4[6]	-	-	-	-	16
NP Complex	-	3[7]	-	30	4	1[8]	2	4[9]	2	4	50
PoS Market	-	5	4	12	10	1	-	-	-	-	32
Blue River/ Bamboo/ Cunupia[10]	-	-	-	-	-	-	-	-	-	-	-
Cacandee	-	-	-	1	-	2[11]	-	-	-	-	3
Brickfield	-	1	-	2[12]	2	3[13]	-	-	-	-	8
Orange Valley	10	65	-	10	6	5[14]	-	-	-	-	96
Carli Bay	-	-[15]	-	1	2[16]	-[17]	-	-	-	-	3
Claxton Bay	-	3	-	1[18]	2	-	-	-	-	-	6
Otaheite	-	12	-	25	1[19]	5	-	-	-	-	43
San Fernando	50	52	2	10	2	2	-	-	-	-	118
Ste. Marie/ Bonasse[20]	-	3	-	2[21]	-	2	-	-	-	-	7
Fullerton	-	3[22]	-	10	12	4[23]	-	-	-	-	29
Icacos	-	4	-	3	2	2[24]	-	-	-	-	11
Subtotal (West Coast)	*60*	*156*	*6*	*132*	*53*	*27*	*2*	*4*	*2*	*4*	*446*
Erin	-	3	-	10[25]	15	3	-	-	-	-	31
Morne Diablo	-	5	-	12	5	-	-	-	-	-	22
Moruga- La Ruffin	-	7	-	10[26]	6	3	-	-	-	-	26
Moruga- Grand Chemin	-	4	-	13	4	3[27]	-	-	-	-	24
Subtotal (South Coast)	-	*19*	-	*45*	*30*	*6*	-	-	-	-	*100*
Total (West & South Coasts)	60	175	6	177	83	33	2	4	2	4	546

[1] Trucks come with catch purchased from other sites and sell wholesale

[2] Commodores act as middlemen between the fishermen and the vendors. Fishermen give commodores the catch to auction to the highest bidding vendors and are paid a commission per pound of catch sold.

[3] Totals are for individual sites only and the numbers cannot be added across sites as there are a number of persons who work at more than one site.

[4] Some have other sundry jobs

[5] 1 of these is also a hustler

[6] 1 of these is the same person who works at Alcan

[7] The exact number of vendors is not known. There is however a constant lot of vendors who purchase from the fishermen to sell retail. An estimate is given.

[8] Same individual as at PoS Market

[9] 2 are permanent and 2 work on contract when needed

[10] Fishermen at this site do everything for themselves

[11] These persons do not work from site but fishermen access their services in the nearby village

[12] At the time of the survey both hustlers were involved in alternative employment and it is uncertain whether they plan on returning to hustle on the site.

[13] These persons do not work from site but fishermen access their services in the nearby village. They are not the same persons as at Cacandee.

[14] 4 persons repair boats and 1 person builds boats

[15] Fishermen do not sell to any specific vendors. They go to Orange Valley and San Fernando and sell to whomever bids the highest

[16] Fishermen also go to Orange Valley and Claxton Bay for these services

[17] Fishermen also go to Orange Valley and San Fernando for these services

[18] This person is part-time

[19] Collector Ralph Edoo does the net building and repair at Otaheite

[20] All persons are the same for Ste Marie and Bonasse within each category

[21] 1 person works part-time

[22] 1 of these is the collector, Kenrick Moodie

[23] 2 of these are the same 2 at Ste Marie and Bonasse

[24] 1 of these also works at Ste Marie and Bonasse

[25] Most are part-time

[26] All are part-time

[27] These are the same as at La Ruffin

Appendix 8: Taxonomic Classification of the resources exploited in the soft-substrate demersal fishery of Trinidad and Tobago including summary of exploitation status.

FAO Marine Resource Title	Marine Resource Title	Local Marine Resource Title	Order	Family	Environmental Group	State of Resources	Bibliography
Crustaceans							
Brown shrimp	*Farfantepenaeus subtilis*	Brown shrimp,	Decapoda	Penaeidae	Demersal Invertebrate	Fully exploited	Alio et al. (1999a), Die et al. (2004); FAO (2001b), Ferreira et al. (2004)
Pink shrimp	*Farfantepenaeus notialis*	Pink shrimp,	Decapoda	Penaeidae	Demersal Invertebrate	Fully exploited	Alio et al. (1999a), Die et al. (2004), Ferreira et al. (2004), Ferreira & Medley (2007),
Hoppers	*Farfantepenaeus brasiliensis*	Hoppers,	Decapoda	Penaeidae	Demersal Invertebrate	Fully exploited	Alio et al. (1999a),Die et al. (2004), Ferreira et al. (2004)
White shrimp	*Litopenaeus schmitti*	White, Cork, Cock shrimp	Decapoda	Penaeidae	Demersal Invertebrate	Fully exploited	Die et al. (2004), FAOFR651-A, Lum Young et al. (1992), Alio et al. (1999a), Ferreira et al. (2004)
Seabob	*Xiphopenaeus kroyeri*	Honey or Jinga shrimp, Seabob, Camarron titi	Decapoda	Penaeidae	Demersal Invertebrate	Fully exploited	Alio et al. (1999a), Die et al. (2004), Ferreira & Medley (2007), Ferreira et al. (2004)
Blue crab	*Callinectes sapidus*	Sea/ swimming crab, Cirrique	Decapoda	Portunidae	Demersal Invertebrate	Unknown	Ferreira et al. (2004), Kuruvilla et al. (2000)
Demersal Fish							
Whitemouth croaker	*Micropogonias furnieri*	Croaker, Cro Cro, Racando	Perciformes	Sciaenidae	Demersal Fish	Fully exploited	Alio et al. (1999b), Ferreira et al. (2004), Kuruvilla et al (2001), Soomai et al. (1999), Soomai et al. (2000)
Southern kingcroaker	*Menticirrhus americanus*	Salmon	Perciformes	Sciaenidae	Demersal Fish	Unknown	Alio et al. (1999b), Ferreira et al. (2004)
King weakfish	*Macrodon ancylodon*	German salmon	Perciformes	Sciaenidae	Demersal Fish	Unknown	Alio et al. (1999b), Kuruvilla et al. (2000), Ferreira et al. (2004)
Jamaica weakfish	*Cynoscion jamaicensis*	Silver salmon, cacique	Perciformes	Sciaenidae	Demersal Fish	Fully exploited	Booth et al. (2001), Soomai et al. (1999), Alio et al. (1999b), Ferreira et al. (2004)

Smalltooth weakfish	*Cynoscion steindachneri*	Salmon	Perciformes	Sciaenidae	Demersal Fish	Unknown	Alio et al. (1999b), Ferreira et al. (2004)
Acoupa weakfish	*Cynoscion acoupa*	Salmon	Perciformes	Sciaenidae	Demersal Fish	Unknown	Alio et al. (1999b), Ferreira et al. (2004)
Mojarras	*Diapterus spp; Eucinostomus spp*	Blinch, mojarra	Perciformes	Gerreidae	Demersal Fish	Unknown	Alio et al. (1999b), Ferreira et al. (2004)
Grunts	*Haemulon spp*	Grunts	Perciformes	Haemulidae	Demersal Fish	Unknown	IMA1992, Alio et al. (1999b), Ferreira et al. (2004)
Torroto grunt	*Genyatremus luteus*	Grunt, Torroto	Perciformes	Haemulidae	Demersal Fish	Unknown	Alio et al. (1999b), Ferreira et al. (2004)
Largehead hairtail	*Trichiurus lepturus*	Cutlass Fish	Perciformes	Trichiuridae	Demersal Fish	Unknown	Alio et al. (1999), Ferreira et al. (2004)
Lane snapper	*Lutjanus synagris*	Pargue, Pargo guanapo	Perciformes	Lutjanidae	Demersal Fish	Fully exploited	IMA1992, Alio et al. (1999b), Ferreira et al. (2004), Soomai et al. (2008)
Sea catfish	*Arius parkeri; Arius felis*	Catfish, Bagre	Siluriformes	Ariidae	Demersal Fish	Unknown	Alio et al. (1999b), Ferreira et al. (2004)
Cephalopods							
Scaled squids	*Loligo pealei; Loliguncula brevis*	Squid	Teuthoidea	Loliginidae	Pelagic Invertebrate	Unknown	Kuruvilla et al. (2001), Ferreira et al. (2004)
Molluscs							
West Indian crown conch	*Melongena melongena*	Sea conch	Neogastropoda	Melongeniidae	Demersal Invertebrate	Unknown	Kuruvilla et al. (2001)

Appendix 9: Biological parameters for *Farfantepenaeus subtilis* stocks of the Guianas-Brazil Shelf.

PARAMETER	INFORMATION	REFERENCE
Length/Age at First Maturity	Brazil- Sexual maturity is reduced after five months	Lhomme ,1992
	Brazil- Females: 110mm for L50, 195mm for L100 -140mm and 85 mm(tail length) were used to calculate fecundity per recruit.	Cayenne Workshop (1988) FAO/WECAFC 1995
	Brazil- Periods of maximum reproductive activity occur from March to July and from September to October	FAO/WECAFC 1995
	Northern Brazil- The length at which 50% of females are mature is <70 mm t.l. and 195 mm at 100% sexual maturity.	Isaac *et al*, 1992
Fecundity	No information obtained in available literature	
Spawning season	Pará, Brazil- Sexually mature individuals are found throughout the year peaking from July to September; a higher intensity of spawning occurs in these months.	SUDEPE/PDP, 1986
	Northern Brazil- Two spawning seasons. Principal spawning between March and July, and shorter period between September and October.	Isaac *et al*, 1992
	French Guiana- Throughout the year with spawning peaks during March, August and November to December	Lhomme, 1992
	Guyana- Throughout the year	Cavalcante and Dragovich, 1984
Morphometric Relationships	Northern coast of Brazil- Total weight (W/g) and tail weight (Wt/g) relationship, Females: W = -0.133 + 1.606 Wt Males: W = 0.044 + 1.515 Wt Total length (L/mm) and carapace length (Lc/mm) relationship, Females: L = 12.432 + 3.850 (Lc) Males: L = 6.843 + 4.265 (Lc)	Barbosa and da Rocha, 1977
	Coast of Bahia, Brazil- Total length (L) to carapace length (Lc) relationship, Females: $L = 7.315\ Lc^{0.848}$ Males: $L = 5.859\ Lc^{0.927}$ (Units not specified).	Zenger (1975) in Barbosa and da Rocha, 1977

PARAMETER	INFORMATION	REFERENCE
	Maranhão, Brazil- Tail weight corresponds, on average, to 60.5 and 58.1 % of the total weigth for males and females respectively. Tail length corresponds, on average, to 64.2 and 63.4 % of total length for males and females respectively.	Porto and Fonteles-Filho (1984) in SUDEPE/PDP, 1986
	Northern Brazil- Total length (L/mm) to tail length (Lt/mm) relationship, Combined sexes: $L = 1.60\ Lt$ Tail length (Lt/mm) to total length (L/mm) relationship, Combined sexes: $Lt = 0.62\ L$ Brazil- Total weight (g) to total length (mm): Sexes combined: $W = 5.103 \times 10^{-6}\ L^{3.09}$	Isaac *et al*, 1992
	Brazil- Total weight (g) to total length (mm): Females: $W = 4.357 \times 10^{-6}\ L^{3.126}$ Males: $W = 6.658 \times 10^{-6}\ L^{3.024}$ Tail weight (g) to carapace length (mm) relationship: Females: $W = 1.15 \times 10^{-3}\ L^{2.690}$ Males: $W = 0.871 \times 10^{-3}\ L^{2.803}$ Tail weight (g) to total length (mm) relationships: Females: $W = 3.610 \times 10^{-6}\ L^{3.068}$ Males: $W = 4.387 \times 10^{-6}\ L^{3.022}$ Total weight (g) to carapace length (mm) relationships: Females: $W = 1.582 \times 10^{-3}\ L^{2.734}$ Males: $W = 1.377 \times 10^{-3}\ L^{2.792}$ Total weight(g) to tail weight (g) relationship: Females: $W_1 = -0.133 + 1.606\ W_2$ Males: $W_1 = 4.4 \times 10^{-2} + 1.515\ W_2$ Total length(mm) to carapace length(mm) relationships: Females: $L_1 = 12.432 + 3.850\ L_2$ Males: $L_1 = 6.843 + 4.265\ L_2$	Barbosa and daRocha (not dated) in FAO/WECAFC, 1995
	French Guiana- Total weight (g) to total length (mm): Females: $W = 3.89 \times 10^{-6}\ L^{3.14}$ Males: $W = 8.31 \times 10^{-6}\ L^{2.98}$ Total length (mm) to tail length(mm) relationships: Females: $L_1 = -0.09 + 1.60 L_2$ Males: $L_1 = 5.67 + 1.49\ L_2$ Total length(mm) to carapace length(mm) relationships: Females: $L_1 = 24.33 + 3.49\ L_2$ Males: $L_1 = 7.49 + 4.23\ L_2$	Venaille (not dated) in FAO/WECAFC, 1995

PARAMETER	INFORMATION	REFERENCE
	French Guiana Region- Total weight (g) to total length (mm): Females: $W = 3.997 \times 10^{-6} L^{3.146}$ Males: $W = 4.738 \times 10^{-6} L^{3.105}$ Tail weight(g) to total weight(g) relationships: Females: $W_1 = 0.5408 + 0.592 W_2$ Males: $W_1 = 0.2671 = 0.612 W_2$ Carapace length(mm) to total length(mm)relationships: Females: $L_1 = -5.862 + 0.277 L_2$ Males: $L_1 = -3.020 + 0.249 L_2$	Dragovich *et al*.(not dated) in FAO/WECAFC, 1995
	French Guiana- Length (mm) to weight (g) relationship: Males: $W = 1.634 \times 10^{-3} L^{2.74}$ Females: $W = 1.732 \times 10^{-3} L^{2.717}$	Dintheer and Rosé, 1989
	French Guiana- Tail weight (g) to tail length(mm) relationship: Females: $W = 1.504 \times 10^{-5} L^{2.990}$ Males: $W = 4.127 \times 10^{-5} L^{2.757}$	Dintheer *et al*(not dated) in FAO/WECAFC,1995
	French Guiana- Total weight(g) to tail weight (g) relationship: Females: $W_1 = -1.31 + 1.75 W_2$ Males: $W_1 = -0.14 + 1.64 W_2$	Venaille (not dated) in FAO/WECAFC, 1995
	Guyanese Shelf, Guyana- Total length (L/cm) to tail length (Lt/cm) relationship, Combined sexes: $L = 0.0102 + 1.59 Lt$ Cuban length (L_{cub}/cm) to tail length (Lt/cm) relationship, Combined sexes: $L_{cub} = 0.1363 + 1.131 Lt$ Total length (L/cm) to Cuban length (L_{cub}/cm) relationship, Combined sexes: $L = -(0.0807 - 1.403 L_{cub})$	Giménez, Paez and Guitart, 1980
	Guyana- Tail weight (g) to tail length(mm) relationship: Sexes combined: $W = 5.15 \times 10^{-2}$? $L^{3.63}$ Total length (mm) to tail length(mm) relationships: Sexes combined: $L_1 = 1.02 \times 10^{-2} + L_2^{1.59}$	Gimenez *et al* (not dated) in FAO/WECAFC, 1995
	Off the Guianas and northern Brazil- Carapace length (Lc/mm) to total length (L/mm) relationship, Combined sexes: $L = 33.5 + 3.36 Lc$ Total weight (W/g) to tail weight (Wt/g) relationship, Combined sexes: $W = 1.6 Wt$	Kawahara, 1983

PARAMETER	INFORMATION	REFERENCE
	Guianas-Brazil Shelf- Carapace length (Lc) to total length (L) relationship, Females: L = 24.33 + 3.49 Lc Males: L = 7.93 + 4.23 Lc (Units not specified). Total weight (W) to tail weight (Wt) relationship, Females: W = -1.31 + 1.75 Wt Males: W = -0.14 + 1.64 Wt (Units not specified). Total length (L) to tail length (Lt) relationship, Females: L = -0.09 + 1.60 Lt Males: L = 5.67 + 1.49 Lt (Units not specified).	Venaille, 1979
	North-eastern coast of South America- Tail weight (Wt/g) to total weight (W/g) relationship, Females: Wt = 0.5408 + 0.5921 W Males: Wt = 0.2671 + 0.6118 W Carapace length (Lc/mm) to total length (L/cm) relationship. Females: Lc = -5.862 + 0.277 L Males: Lc = -3.020 + 0.249 L	Dragovich, Jones and Boucher, 1980
	Trinidad & Tobago- Total weight (g) to total length (mm): Sexes combined: $W = 2.49 \times 10^{-6} L^{3.252}$ Tail weight (g) to tail length(mm) relationship: Females: $W = 1.60 \times 10^{-5} L^{3.093}$ Males: $W = 3.20 \times 10^{-5} L^{2.875}$ Tail weight (g) to tail length(mm) relationship: $W = 1.70 \times 10^{-5} L^{3.057}$ Tail weight (g) to carapace length (mm) relationship: Females: $W = 1.789 \times 10^{-3} L^{2.638}$ Males: $W = 1.089 \times 10^{-3} L^{2.800}$ Sexes combined: $W = 1.744 \times 10^{-3} L^{2.649}$ Total weight (g) to carapace length (mm) relationships: Females: $W = 2.150 \times 10^{-3} L^{2.710}$ Males: $W = 1.155 \times 10^{-3} L^{2.908}$ Sexes combined: $W = 2.056 \times 10^{-3} L^{2.726}$ Tail weight(g) to total weight(g) relationships: Females: $W_1 = 0.6820 + 0.614 W_2$ Males: $W_1 = 0.3741 + 0.639 W_2$ Sexes combined: $W_1 = 0.6344 + 0.6175 W_2$ Total length(mm) to carapace length(mm) relationships: Females: $L_1 = 21.690 + 3.813 L_2$ Males: $L_1 = 24.239 + 3.924 L_2$ Sexes combined: $L_1 = 24.012 + 3.7875 L_2$ Tail length (mm) to carapace length(mm)relationship: Females: $L_1 = 14.2449 + 2.330 L_2$ Males: $L_1 = 4.8184 + 2.938 L_2$ Sexes combined: $L_1 = 14.6078 + 2.381 L_2$	Fabres (not dated) in FAO/WECAFC, 1995

PARAMETER	INFORMATION	REFERENCE
	Trinidad & Tobago- Asymptotic length is given as total length. Asymptotic length estimates were transformed to tail length and to carapace length when required according to following morphometric relationships given in the literature: Males and Females: Tail length = 0.62*TL	Isaac *et al*, 1992
	Females: Carapace Length = -5.862 + 0.277* TL Males: Carapace Length = -3.020 + 0.249* TL	Dragovich, Jones and Boucher,1980.
Length/Weight Parameters	Guyanese Shelf, Guyana- Tail weight (Wt/g) to tail length (Lt/cm) relationship, Combined sexes: $Wt = 0.00515\ Lt^{3.63}$	Giménez, Paez and Guitart, 1980
	Guyanas-Brazil Shelf- Total weight (W) to total length (L) relationship, Females: log W = -5.41 + 3.14 log L Males: log W = -5.08 + 2.98 log L (Units not specified).	Venaille, 1979
	Northern coast of Brazil- Total weight (W/g) and total length (L/mm) relationship, Females: $W = 4.357 \times 10^{-6} (L)^{3.126}$ Males: $W = 6.668 \times 10^{-6} (L)^{3.024}$ Tail weight (Wt/g) and carapace length (Lc/mm) relationship, Females: $Wt = 1.151 \times 10^{-3} (Lc)^{2.690}$ Males: $Wt = 8.710 \times 10^{-4} (Lc)^{2.803}$ Tail weight (Wt/g) and total length (L/mm) relationship, Females: $Wt = 3.610 \times 10^{-6} (L)^{3.068}$ Males: $Wt = 4.397 \times 10^{-6} (L)^{3.022}$ Total weight (W/g) and carapace length (Lc/mm) relationship, Females: $W = 1.582 \times 10^{-3} (Lc)^{2.734}$ Males: $W = 1.377 \times 10^{-3} (Lc)^{2.792}$	Barbosa and da Rocha, 1977
	Northern Brazil- Total weight (W/g) to total length (L/mm) relationship, Sexes combined: $W = 5.103 \times 10^{-6} L^{3.09}$	Isaac *et al*, 1992
	North eastern coast of South America- Total weight (W) to total length (L) relationship, Females: ln W = -12.43 + 3.146 ln L Males: ln W = -12.26 + 3.105 ln L	Dragovich, Jones and Boucher, 1979
	Off the Guianas and Northern Brazil- Total weight (W/g) to carapace length (Lc/mm) relationship (also used in this paper to make conversions for *P. subtilis*), Sexes combined: $W = 0.00311\ Lc^{2.566}$	Kawahara, 1983

PARAMETER	INFORMATION	REFERENCE
	Venezuela(Atlantic Zone) Cumana, Guiria- Total weight and total length relationship Females: $W=3.21 \times 10^{-5} \times (TL)^{2.8009}$ (N=2863, R=0.96 Males: $W=2.59 \times 10^{-5} \times (TL)^{2.84678}$ (N=336, R=0.92 (regression model type I)	Marcano *et al*, 1996
Length/Age Parameters	Maranhão, Brazil- Maximum theoretical size 238 mm (over 3 years old).	Porto (1984) in SUDEPE/PDP, 1986
	Northern Brazil- For both sexes: $L_\infty = 220$ mm K = 0.208 (units not specified)	Damasceno (in press) in SUDEPE/PDP, 1986
	Brazil/Guiana- Using ELEFAN Females: $L_\infty = 225$mm(TL), K = 1.00 year^{-1} Males : $L_\infty = 187$mm(TL), K = 1.08 year^{-1} Using Powell: Females: $L_\infty = 208$mm Males : $L_\infty = 178$ mm Modal progression analysis ETAL: Females: $L_\infty = 216$mm K = 1.12 year^{-1}, $t_o = -0.441$ Males: $L_\infty = 172$mm, K = 1.2 year^{-1}, $t_o = -0.537$ Modal progression analysis, Allen Females: $L_\infty = 218$mm, K = 1.07 year^{-1}, $t_o = -0.441$ Males: $L_\infty = 171$mm, K = 1.23 year^{-1}, $t_o = -0.528$	Isaac *et al*, 1992
	Brazil/Guiana Shelf (French Guiana, Suriname and Brazil)- Females: Head-on values obtained $L_\infty = 205$, 205 and 195 mm (t.l.) Respective tail values obtained $L_\infty = 130$, 128 and 125 mm K values obtained 0.19 and 0.20 month^{-1}.	WECAFC Report, 1989
	French Guiana- Females: $L_\infty = 115.2$ - 150.0 mm (tails) Males: $L_\infty = 97.5$ - 121.9 mm (tails) Powell and test on cohort analysis: Females: $L_\infty = 120$-135mm (tail length), K = 1.5-3.6 year-¹ Males: $L_\infty = 105$-115mm, K = 1.8-4.2 year-¹	Dintheer and Le Gall (1988) in WECAFC Report, 1989

PARAMETER	INFORMATION	REFERENCE
	French Guiana- Ford-Walford method Females: L_∞ = 55, K= 0.19 , M = 0.2 Males: L_∞ = 45, K = 0.155, M = 0.2 Females: L_∞ = 63.6, K = 0.52 Males: L_∞ = 48.6, K = 0.52 (Units not specified)	FAO/WECAFC, 1995
	Trinidad & Tobago- Munro and Pauly equation (1983) Females: L_∞ = 205mm(total length), K = 1.65 year^{-1} Males: L_∞= 185mm, K = 2.27 year^{-1}	Fabres, unpublished data, in WECAFC, 1995
Recruitment	Northern Brazil- Recruitment starts in November with a peak between February and April.	Lira-Cavalcante, 1988
	Maracana, Brazil- Occurs up to 110mm TL	Cavalcante and Dragovich, 1984
	Pará, Brazil- Recruitment to the offshore fishery year round but increasing from November attaining a maximum between February and April of the following year.	SUDEPE/PDP, 1986
	Brazil- Primary season from December to May, a secondary season from July to August French Guiana- Primary season from March to June, a secondary season from September to October.	FAO/WECAFC, 1995
	French Guiana- Principal recruitment occurs between December and March with a secondary maximum in August.	Rossignol (1972) in Garcia, Lebrun and Lemoine, 1984
	French Guiana- Peak recruitment occurs at age 4.5 months in the period March - June at total lengths of 110 - 115 mm. A secondary peak occurs in September of individuals of the same age.	Garcia, Lebrun and Lemoine, 1984
	French Guiana- Recruitment observed in February and May to June.	SOLDAG in Garcia, Lebrun and Lemoine, 1984
	French Guiana- April - May, September - October and January in French Guiana Cayenne, French Guiana- Emigration occurs at 70mm TL Cayenne Estuary and Sinnamary Estuary, French Guiana- The annual cycle of abundance in the two estuaries shows a main peak in April-May and some smaller peaks in June, September and December.	Lhomme 1992

PARAMETER	INFORMATION	REFERENCE
	Guianas-Brazil Shelf (Northeastern South America)- Appear to be recruited mainly in April and October off French Guiana, Brazil and Guyana.	Jones and Dragovich, 1977
	Suriname- Recruitment year round, with a peak in July-September and possibly a secondary peak in February-March.	Charlier, Samson-Pawironadi & Babb-Echteld, 1995
	Gulf of Paria, Trinidad and Tobago- Occurs at 25mm carapace length (CL)	Fabres, 1988
Natural Mortality (M)	Brazil/Guyana- M was obtained by Paloheimo's (1958) method using f and Z data by Beverton and Holt (1956) as follows: Females: M = 1.37 yr^{-1} Males: M = 1.33 yr^{-1} Combined sexes: M = 1.36 yr^{-1} M was obtained by Paloheimo's (1958) method using f and Z data by Ssentengo and Larkin (1973) as follows: Females: M = 1.86 yr -1 Males: M = 1.86 yr^{-1} Combined sexes: M = 1.87 yr^{-1} Using Pauly's (1980) method: Females: M = 1.90 yr -1 Males: M = 2.11 yr^{-1} Combined sexes: M = 2.01 yr^{-1} Using Rickter and Efanov (1980): Females: M = 2.50 yr -1 Males: M = 1.81 yr -1 The average value given was as follows: Combined sexes: M = 1.82 yr^{-1} Females: 1.75/yr Males: 1.96/yr	Isaac *et al*, 1992
	Maranhão, Brazil- M = 0.2 (units not specified)	Porto (1984) in SUDEPE/PDP, 1986
	Guianas - Brazil Shelf (French Guiana, Surinam and Brazil)- M = 0.2 $month^{-1}$	WECAFC Report, 1989
	French Guiana- (taken from compilation, Garcia, 1988) For both male and females ,M = 2.40	Dintheer and Legall,1988 in WECAFC,1989.
	Suriname- M = 0.2 (units not specified)	Willmann and Garcia (1985) in SUDEPE/PDP, 1986
Maximum Sustainable Yield (MSY)	Brazil- MSY estimated at 11 337 t whole weight using Schaefer's model for the *P. subtilis* fishery.	Ehrhardt, 1986

PARAMETER	INFORMATION	REFERENCE
	Northern Brazil- MSY estimated at 18 580 tonnes (live weight) /year.	WECAFC/FAO (1979) in Damasceno *et al.*, 1986
	Northern Brazil- MSY estimated at 8 499 and 9 106 tonnes of whole weight using Schaefer's and Fox's Model respectively.	Isaac *et al*, 1992
	Brazil and French Guiana- MSY estimated at 11 337 tonnes/year (whole weight) of *P. subtilis* for the Guianas-Brazil Shelf. MSY of 7 900 tonnes/year (whole weight) or 5 064 tonnes/year (tail weight) of *P. subtilis* for Brazil. Both estimates were made using Schaefer's model.	SUDEPE/PDP, 1986
	Brazil and French Guiana- MSY estimated at 8 400 tonnes (live weight)/year of *P. subtilis*. For this fishery, *P. subtilis* constitutes 13.8% of the total 15.8% of crustaceans landed.	SUDEPE (1981) in Damasceno *et al.*, 1986
	French Guiana- MSY estimated at 4 400 t using the Fox model for the shrimp fishery and 4 500 t using the Schaefer model. For a fishing area of 23 510 km^2, potential yield per unit area values are calculated at 0.19 t/km^2.	Venaille, 1979
	French Guiana- MSY estimated at 4 700 - 5000 t in 1981 giving a potential yield per unit area of approximately 0.2 t/km^2 for all shrimp species.	Stevenson (1981) in Garcia, Lebrun and Lemoine, 1984
	French Guiana- MSY of 4 300 tonnes/year (whole weight) of all shrimp species captured there.	IFREMER in SUDEPE, 1986
	Guianas-Brazil area- MSY estimated at 17 900 t using the Fox model and 19 600 t using the Schaefer model for shrimp resources in this area. For a fishing area of 99 135 km^2, the potential yield per unit area values are calculated at 0.18 t/km^2 and 0.20 t/km^2. Note: The shrimp resources of the Guyana - Brazil area include *P. brasiliensis, P. subtilis, P. notialis* and *P. schmitti*.	Venaille, 1979
	Guianas-Brazil area- MSY estimated at 20 - 21 000 t (whole weight) in 1981 using the surplus production model. This gives values of 0.20 - 0.21 t/km^2 for all shrimp species combined.	Jones and Dragovich 1977
	Guianas-Brazil area- MSY for shrimp resources in this area was estimated at 18 580 t using linear surplus production modelling giving a value of 0.19 t/km^2 potential yield per unit area.	WECAFC (1978) in Stephenson, 1981.

PARAMETER	INFORMATION	REFERENCE
	Guianas-Brazil Shelf (northeastern South America)- MSY estimated at 28.7 million pounds (13 045 metric tonnes) using an exponential surplus yield model (Fox 1970) and 27.1 million pounds (12 318 metric tonnes) using a linear surplus yield model applied to the same data. These values were obtained for the four principal species found on the grounds (*P. subtilis* (70 %), *P. brasiliensis* (23 %), *P. notialis* and *P. schmitti* (7%)).	Jones and Dragovich, 1977
	Suriname- MSY estimated at 3200 tons of tails (same results for Fox and Schaefer models), using the years 1978 to 1987. Using the "favorable" years (high apparent abundance) only, from the same period, an MSY of 3700 tons of tails is calculated (Schaefer model). Using the other " bad" years only, a figure of 3100 tons of tails was obtained (Schaefer model).	Charlier, 1989
	Trinidad- MSY quoted for all penaeid species as 870 metric tonnes and consists of the average landings of years with high stabilised effort.	Turner (1977) in Pauly and Ingles, 1986
Species Habitat Preferences	Guiana-Brazil continental shelf- Associated with mud substrate with a high organic content. In the Guiana-Brazil continental shelf this species was found mainly over sandy bottom	Dragovich, Jones and Boucher, 1980
	Guiana-Brazil continental shelf- Found at a depth 12.8 to 91m (Dragovich *et al*, 1980). Always found in the shallower section of the shelf relative to the deeper distribution of the pink-spotted shrimp, *P. brasiliensis*	Ehrhardt, (1986) in Talbot *et al* ,1996
	Guiana-Brazil continental shelf- Several nursery areas in French Guiana and Brazil have been confirmed.	Talbot *et al* 1995
	Guiana-Brazil continental shelf- Nocturnal but caught during the day	Holthius, 1983
Species Composition	Nearshore coast of Gulf of Paria- Highest in November to May	Maharaj,1989

Appendix 10: Biological parameters for *Farfantepenaeus notialis* stocks of the Guianas-Brazil Shelf.

PARAMETER	INFORMATION	REFERENCE
Length/Age at First Maturity	Not specified- Males: Minimum size of males with joined petasmal endopods is 16 mm carapace length (c.l.) and 73 mm total length (t.l). Females: Fully developed thelica are observed at 16 mm c.l. and 73 mm t.l.	Pérez Farfante, 1967
Fecundity	No information obtained in available literature	
Spawning season	Guyana- Ripe female shrimp were noted year-round in commercial catches.	Calvacante and Dragovich, 1984
	Georgetown, Guyana- Some year round spawning	Villegas and Dragovich, 1984
	Golfo Triste, Venezuela- Two periods of major reproductive activity from April to June and September to November although reproduction occurs throughout the year.	Larghi (1981) in Penchaszadeh *et al.*, 1986
Morphometric Relationships	French Guiana- Carapace length(mm) to total length(mm): Females: $L_1 = -6.063 + 0.277\ L_2$ Males: $L_1 = -0.158 + 0.227\ L_2$	Dragovich *et al.*,(not dated) in FAO/WECAFC, 1995
	Northeastern coast of South America- Carapace length (Lc/mm) to total length (L/mm) relationship, Females: Lc = -6.063 + 0.277 Lt, Males: Lc = -0.158 + 0.227 Lt	Dragovich, Jones and Boucher, 1980

PARAMETER	INFORMATION	REFERENCE
	Trinidad & Tobago- Total weight(g) to total length(mm): Females: $W = 10.00 \times 10^{-6} L^{3.058}$ Males: $W = 4.00 \times 10^{-6} L^{3.172}$ Sexes combined: $W = 1.96 \times 10^{-6} L^{3.067}$ Tail weight(g) to tail length(mm): Females: $W = 2.20 \times 10^{-5} L^{3.079}$ Males: $W = 1.200 \times 10^{-5} L^{3.131}$ Sexes combined: $W = 0.0211 L^{3.083}$ Tail weight(g) to carapace length(mm): Females: $W = 1.335 \times 10^{-3} L^{2.846}$ Males: $W = 1.24 \times 10^{-3} L^{2.826}$ Sexes combined: $W = ? L^{2.851}$ (?- figure not given) Total weight(g) to carapace length(mm): Females: $W = 1.820 \times 10^{-3} L^{2.884}$ Males: $W = 1.84 \times 10^{-3} L^{2.822}$ Sexes combined: $W = 0.839 \times 10^{-3} L^{2.879}$ Tail weight(g) to total weight(g): Females: $W_1 = 0.3591 + 0.632 W_2$ Males: $W_1 = 0.1268 + 0.676 W_2$ Sexes combined: $W_1 = 0.4702 + 0.636 W_2$ Total length(mm) to carapace length(mm): Females: $L_1 = 10.7214 + 4.115 L_2$ Males: $L_1 = 15.119 + 4.234 L_2$ Sexes combined: $L_1 = 12.9146 + 4.137 L_2$ Tail length(mm) to carapace length(mm): Females: $L_1 = 8.8194 + 2.639 L_2$ Males: $L_1 = 8.5997 + 2.832 L_2$ Sexes combined: $L_1 = 9.6142 + 2.766 L_2$	Fabres (not dated)in FAO/WECAFC, 1995

PARAMETER	INFORMATION	REFERENCE
Morphometric Relationships	Tail weight (Wtail/g) to total weight (Wtot/g): Females: Wtail = 0.3591 + 0.6325 Wtot Males: Wtail = 0.1122 + 0.6763 Wtot Sexes combined: Wtail = 0.4286 + 0.6377 Wtot Total length (Ltot/mm) to carapace length (Lcar/mm): Females: Ltot = 10.7214 + 4.1151 Lcar Males: Ltot = 12.9244 + 4.3097 Lcar Sexes combined: Ltot = 12.5459 + 4.1484 Lcar Rostral length(Lros/mm) to carapace length(Lcar mm): Females: Lros = 1.4178 + 1.5302 Lcar Males: Lros = 1.7163 + 1.5866 Lcar Sexes combined: Lros = 1.8321 + 1.5392 Lcar Tail length with telson (TLtel/mm) to carapace length(Lcar mm): Females: TLtel = 8.8194 + 2.6391 Lcar, Males: TLtel = 7.3683 + 2.8745 Lcar Sexes combined: TLtel = 9.3410 + 2.6837 Lcar Tail length without telson (TL/mm) to carapace length(Lcar/mm): Females: TL = -0.0551 + 2.4720 Lcar Males: TL = 7.7287 + 2.2453 Lcar Sexes combined: TL = 1.9973 + 2.4246 Lcar Tail length with telson (TLtel/mm) to total length (Ltot/mm): Females: TLtel = 1.9434 + 0.6413 Ltot, Males: TLtel = -1.2521 + 0.6670 Ltot Sexes combined: TLtel = 1.2247 + 0.6470 Ltot Tail length without telson (TL/mm) to total length (Ltot/mm): Females: TL = -6.4956 + 0.6007 Ltot Males: TL = 0.9953 + 0.5210 Ltot Sexes combined: TL = -5.3355 + 0.5845 Ltot	Lum Young *et al.*, 1992b

PARAMETER	INFORMATION	REFERENCE
Length/Weight Parameters	Trinidad & Tobago- Total weight(g) to total length (mm, tip of rostrum to posterior edge of telson): Females: $W = 0.1017 \times 10^{-4}L^{3.0582}$ Males: $W = 0.0533 \times 10^{-4}L^{3.1196}$ Sexes combined: $W = 0.0876 \times 10^{-4}L^{3.0637}$ Total weight (g) to carapace length (mm): Females: $W = 18.1956 \times 10^{-4}L^{2.8839}$ Males: $W = 16.7569 \times 10^{-4}L^{2.8589}$ Sexes combined: $W = 17.3640 \times 10^{-4}L^{2.8824}$ Tail weight (g) to tail length with telson (mm): Females: $W = 0.2171 \times 13^{-4}L^{3.0789}$ Males: $W = 0.1400 \times 13^{-4}L^{3.1119}$ Sexes combined: $W = 0.1926 \times 10^{-4}L^{2.9852}$ Tail weight (g) to tail length without telson (mm): Females: $W = 0.7072 \times 10^{-4}L^{2.9339}$ Males: $W = 0.1839 \times 10^{-4}L^{3.2077}$ Sexes combined: $W = 0.5309 \times 10^{-4}L^{2.9852}$ Tail weight (g) to carapace length (mm): Females: $W = 13.3496 \times 10^{-4}L^{2.8463}$ Males: $W = 10.9612 \times 10^{-4}L2.8804$ Sexes combined: $W = 12.3830 \times 10^{-4}L^{2.8584}$	
Length/Age Parameters	Guyana- For females: L_∞ = 149 mm (tail) K = 0.2268 $month^{-1}$ For males: L_∞ = 115 mm (tail) K = 0.248 $month^{-1}$ These parameters were derived using the average of values in the literature from Cuba excluding outliers identified by plotting L_∞ vs K independently for females and males. This was necessary since growth parameters have not been determined for the Brazil-Guianas region.	Shepherd and Ehrhardt (2000)

PARAMETER	INFORMATION	REFERENCE
Recruitment	Guianas-Brazil Shelf- Recruitment mainly in April and October and mainly off French Guiana, Brazil and Guyana.	Jones and Dragovich, 1977
Maximum Sustainable Yield (MSY)	Orinoco Delta- 2.6t km^{-2} using Swept Area Method	Novoa, 1982
Species Habitat Preferences	Brazil/Guyana- Found at depths 27 - 62 m, mainly over sandy bottom substrate	Dragovich, Jones and Boucher, 1980
	Brazil/Guyana- Appears to be nocturnal coming out only to feed.	Penn, (1984 personal obs) in Talbot *et al*, 1996
Species Composition	Inshore Gulf of Paria, Trinidad- Highest in the catch from January to May and lowest from October to January	Maharaj, 1989

Appendix 11: Biological parameters for *Litopenaeus schmitti* stocks of the Guianas-Brazil Shelf.

PARAMETER	INFORMATION	REFERENCE
Length/Age at First Maturity	Not specified- Males: Length at first maturity between 21-27 mm carapace length (cl) and 100-126 mm total length (tl) though minimum size of males with joined petasmal endopods is 21 mm cl. Females: Well developed thelica are observed at 21 mm cl, 100 mm tl though only individuals of cl > 21 mm have been found carrying spermatophores (Pérez Farfante, 1967). Smallest impregnated individuals were 30 mm cl.	Pérez Farfante, 1967
Fecundity	Guyana- Average number of eggs per spawning was 500,000 eggs.	Pérez Farfante (1970) in Guitart and Reyes, 1979
	Guyana- Average number of eggs per spawning was 214,000 eggs	Bendazoli (MS) in Guitart and Reyes, 1979.
Spawning season	Bahia de Sepeliba, Brazil- Extended spawning period from March to the end of summer.	Da Silva (1965) in Pérez Farfante, 1967
	Central and Southern coast of Brazil- Spawning starting in August and ending in January.	Neiva, 1969
	Guyana- Spawns throughout the year with elevated spawning activity during late-spring and early-summer, possibly triggered by warm water.	Benfield, 1995
	Guyana- Spawning occurs nearshore in shallow (3 - 10m) water in March-September.	Perez *et al*, (1988) in Benfield, 1995
	Orinoco Delta, Venezuela- Highest percentage of sexually mature males and females in April and May (sampling from February to November only).	Novoa, 1982
	Golfo de Venezuela, Venezuela- Spawning in the second trimester of the year	Ewald (1965) in Pérez Farfante, 1967
Morphometric Relationships	French Guiana- Carapace length(mm) to total length(mm): Females: $L_1 = -8.64 + 0.29\ L_2$, Males: $L_1 = -9.261 + 0.28\ L_2$	Dragovich *et al*.,(not dated) in FAO/WECAFC, 1995

PARAMETER	INFORMATION	REFERENCE
	Guyanese Shelf, Guyana- Total length (L/cm) to tail length (Lt/cm) relationship, L = -(1.624 - 1.726 Lt) Cuban length (L_{cub}/cm) to tail length (Lt/cm) relationship, L_{cub} = -(1.4452 - 1.28 Lt) where L_{cub} is the Cuban length measured from the base of the post orbital notch to the mid-dorsal point of the last abdominal segment. Total length (L/cm) to Cuban length (L_{cub}/cm) relationship, L = -(0.751 - 1.359 L_{cub})	Giménez, Paez and Guitart, 1980
	Guyana- Tail weight (g) to tail length (mm): Sexes combined: $W = 5.15 \times 10^{-2} L^{3.63}$	Gimenez *et al* (not dated) in FAO/WECAFC, 1995
	Northeastern coast of South America- Carapace length (Lc/mm) to total length (L/mm) relationship, Females: Lc = -8.636 + 0.287 L, Males: Lc = -9.261 + 0.281 L	Dragovich, Jones and Boucher, 1980

PARAMETER	INFORMATION	REFERENCE
	Trinidad & Tobago- Total weight(g) to total length(mm): Females: $W = 3.90 \times 10^{-6} L^{3.203}$, Males: $W = 5.30 \times 10^{-6} L^{3.112}$ Sexes combined: $W = 4.80 \times 10^{-6} L^{3.150}$ Tail weight(g) to tail length(mm): Females: $W = 1.60 \times 10^{-5} L^{3.102}$, Males: $W = 2.30 \times 10^{-5} L^{2.993}$ Sexes combined: $W = 1.8 \times 10^{-5} L^{3.066}$ Tail weight(g) to carapace length(mm): Females: $W = 0.435 \times 10^{-3} L^{3.121}$, Males: $W = 0.52 \times 10^{-3} L^{3.103}$ Sexes combined: $W = 0.491 \times 10^{-3} L^{3.099}$ Total weight(g) to carapace length(mm): Females: $W = 7.010 \times 10^{-4} L^{3.116}$, Males: $W = 7.11 \times 10^{-4} L^{3.132}$ Sexes combined: $W = 7.48 \times 10^{-4} L^{3.106}$ Tail weight(g) to total weight(g): Females: $W_1 = 0.5355 + 0.610 W_2$ Males: $W_1 = 0.4933 + 0.638 W_2$ Sexes combined: $W_1 = 0.6745 + 0.6130\ W_2$ Total length(mm) to carapace length(mm): Females: $L_1 = 11.8829 + 4.209 L_2$, Males: $L_1 = 8.6707 + 4.611\ L_2$ Sexes combined: $L_1 = 13.2168 + 4.2694\ L_2$ Tail length(mm) to carapace length(mm): Females: $L_1 = 6.2040 + 2.746 L_2$, Males: $L_1 = 3.6772 + 3.059 L_2$ Sexes combined: $L_1 = 7.1304 + 2.796\ L_2$	Fabres (not dated) in FAO/WECAFC, 1995
	Gulf of Venezuela- Total weight (W/g) to tail weight (Wt/g) relationship, W = 1.67 Wt used for all commercial shrimp landings.	Cadima *et al.*, 1972
	Western Zone of Venezuela- Total length (L/cm) to carapace length (Lc/mm) relationship, L = 1.9429 + 0.4425 Lc (for individuals of Lc less than 28 mm). L = 5.8570 + 0.3082 Lc (for individuals of Lc greater than 28 mm). L = 0.5168 + 0.3275 Lc (for both sexes). Total weight (W/g) and tail weight (Wt/g) relationship, W = 1.6194 Wt - 0.3789	Cadima *et al.*, 1972

PARAMETER	INFORMATION	REFERENCE
	Venezuela- Total weight(g) to total length(mm): Females: $W = 2.012 \times 10^{-6} L^{3.27}$, Males: $W = 3.45 \times 10^{-6} L^{3.16}$ Total length(mm) to carapace length(mm): Females: $L_1 = 42.215 + 3.304 L_2$, Males: $L_1 = 31.719 + 3.721 L_2$	Altuve *et al*,.1992
Length/Weight Parameters	Guyanese Shelf, Guyana- Tail weight (W/g) to tail length (L/cm) relationship, $W = 0.018 L^{3.06}$	Giménez, Paez and Guitart, 1980
	Golfo de Venezuela and Lago de Maracaibo, Venezuela- Total weight (W/g) to total length (L/cm) relationship, $W = 0.0034 L^{3.264}$	Cadima *et al*, 1972
	Atlantic Zone of Venezuela- Total weight (W/g) and total length (L/mm) : Females: $W=1.03 \times 10^{-6} \times (TL)^{3.4147}$ (N=960, r=0.98) Males: $W=1.19 \times 10^{-6} \times (TL)^{3.3948}$ (N=525, r=0.98)	Marcano *et al*, 1996
	Venezuela- Females: $W = 3.02 \times 10^{-6} L^{3.189}$ r = 0.97 Males: $W = 1.90 \times 10^{-5} L^{2.790}$ r = 0.98	Alio (1992) in WECAFC, 1992
Length/Age Parameters	North-western coast of the Gulf of Paria- Using ELEFAN: Males: $L_\infty = 20.5$cm (TL) $K = 1.18$ year^{-1} Females: $L_\infty = 22.5$cm (TL) $K = 1.55$ year^{-1} Von Bertalanaffy equation.	Altuve *et al*, 1992
	Trinidad and Tobago- Using Munro and Pauly equation (1983): Females: $L_\infty = 218$mm (total length) K = 1.59 year-¹ Male $L_\infty = 207$ (total length) K= 2.06 year-¹	Fabres (unpublished data) in FAO/WECAFC 1995
Recruitment	Lagoon-estuarine region of Cananeia, Sao Paulo, Brazil- Enters the estuary from October until January (mainly in November) and goes back to sea mainly in February.	Das-Chagas-Soares *et al*, 1995
	Guianas-Brazil Shelf (northeastern South America)- Mainly in April and October and mainly off French Guiana, Brazil, and Guyana, in shallow waters.	Jones and Dragovich, 1977

PARAMETER	INFORMATION	REFERENCE
	Golfo Triste, Venezuela- Major recruitments were recorded from March to May and from September to November. The smallest recruitment size was 24.5 mm (0.17 g).	Penchaszadeh *et al.*, 1986
	Orinoco Delta, Venezuela- Peak recruitment occurs in the months of April and May.	Novoa and Cervigón, 1986
	Cabo Codera to Morro de Barcelona, North-eastern Zone of Venezuela- Recruitment to the offshore fishery occurs after 14 mm (t.l.) between October and February.	Novoa, Rabinovich and Urbaneja, 1980
	Lake Maracaibo, Venezuela- Recruitment of larvae from the Gulf of Venezuela extends all year round peaking in April and August. Juvenile stage is spent in the lake.	Cadima *et al*,1972
Natural Mortality	Northern Gulf of Paria- M = 2.21 (unit not specified) where F = 2.58 using Pauly's empirical equation	Gayanilo *et al.*(1989) in Altuve *et al*, 1992
Maximum Sustainable Yield (MSY)	Western Venezuela- MSY estimated at 2,309 t of *L. schmitti* for Lake Maracaibo using Fox's model (1970).	Montesinos, 1974
	Lake Maracaibo, Venezuela- MSY quoted for all Penaeid species as 12,900 t and consists of the average landings of years with high stabilised effort.	Turner (1977) in Pauly and Ingles, 1986.
	Orinoco Delta, Venezuela- Using the Swept Area method, potential yield determined at 2,340 t for an area of 900 km^2. Yield per unit area calculated is 2.6 t/km^2.	Novoa, 1982
Specific Habitat Preferences	Guiana/Brazil Shelf- Over Guiana/Brazil Continental shelf, this species was found over soft bottom consisting mainly of clay Found throughout region at depth of 4 - 48m	Dragovich, Jones and Boucher, 1980
	Guiana/Brazil Shelf- It is associated with mud substrate that is relatively high in organic content. Found in very turbid waters such as areas of riverine discharge	Talbot *et al*, 1996
	Guiana/Brazil Shelf- May school, generating high levels of turbidity themselves at times of reduced turbidity, eg. slack water in the tidal cycle. It is non burrowing and its activity is not restricted to night	Penn, (1984) in Talbot *et al*, 1996
	Guiana/Brazil Shelf- U.S. port sampling at Georgetown between 1976- 1978 indicates that at all stages of maturity (females) occurred during each month of the year, suggested year round spawning	Villegas and Dragovich, 1984

PARAMETER	INFORMATION	REFERENCE
Impact of Environmental Factors	Near-shore Gulf of Paria- Higher occurrence in Northern Gulf is because it is an inshore species with a preference for areas of muddy substrate and high organic content	Amos, 1990
Species Composition	In shore Gulf of Paria- Most abundant from September to October and very low from November to May	Maharaj , 1989
	Oropouche Bank, Trinidad- Most common species during the period of peak rainfall and river discharge, June and July	Ramcharan , 1989

Appendix 12: Biological parameters for *Xiphopenaeus kroyeri* stocks of the Guianas-Brazil Shelf.

PARAMETER	INFORMATION	REFERENCE
Length/Age at First Maturity	Coast of Ceará State, Brazil- Minimum size at first sexual maturity is 31.5 and 33.0 mm carapace length for males and females respectively.	Mota Alves and Rodríguez, 1977
	Guyanese Shelf, Guyana- Length at first maturity for both males and females lie between 6.1 and 6.5 cm total length (t.l.) though 50% of the females sampled were in the 6.6 - 7.0 cm t.l. class.	Guitart and Fraga, 1980
	Inshore waters of Gulf of Paria, Trinidad- Mature females and males present in the commercial catch throughout the year peaking in July to September and March and April for the former and August to March for the latter. Earliest sexual maturity in females is attained in size range 8.1 -8.5 cm total length. Smallest mature male was 6.3 cm.	Henry, 1987
Fecundity	Santos Bay, Brazil- At least in the tens of thousands per female.	Neiva and Wise, 1963
	Guyana- Equations were derived for calculating the number of eggs using different variables. Number of eggs (N_e) to Cuban length (L_{cub}/cm) relationship, $\ln N_e = 9.0639650 + 0.3020821\ L_{cub}$ Number of eggs to total weight (W) relationship, $\ln N_e = 9.9539792 + 0.1569405\ W$ Number of eggs to weight of gonad (W_g/g) relationship, $\ln N_e = 10.3405761 + 1.8439791\ W_g$ Using the equation above, average number of eggs were determined for an individual of average length 7.4 cm - 74 800 eggs. Largest number of eggs observed for an individual of length 8.0 cm -285 300 eggs. Least number of eggs observed for individual of length 6.7 cm - 25 600 eggs.	Guitart and Reyes, 1979
Spawning season	Santos Bay, Brazil- Peak spawning, early November to the end of January. Mature females present in the population all year round.	Vieira, 1947
	Santos Bay, Brazil- Peak spawning, early November to the end of January as above with another peak in March and April of some years.	Neiva and Wise, 1963
	Northern Brazil- Females with ripe eggs appeared between April and November, peaking in June.	Lira Cavalcante, 1988

PARAMETER	INFORMATION	REFERENCE
	Coast of São Paulo, Brazil- Largest proportion of sexually mature females caught from November to January.	Vieira, 1947
	Coast of Ceará State, Brazil- Females: Mature females were found from April to December, none in January to March. Spent females were present in January, February and December. Histological aspects of the ovaries indicated that the species has a total spawning. Males: Mature males occurred from January to November. One hundred (100) percent spent males were found in December and a small percentage from January to October. Immature individuals predominated from January to April. Male sexual cycle shorter than female.	Mota Alves and Rodríguez, 1977
	Northeastern coast of Brazil- October - December	Alves and Rodrigues, 1977
	French Guiana- June and November - December, September - October	Lhomme, 1992
	Inshore waters of the Gulf of Paria, Trinidad- Spawning occurs when the number of mature females in the catch is highest between July and September and March and April Mates all year round.	Henry,1987
Morphometric Relationships	Santos Bay, Brazil- Total length (L/mm) to carapace length (Lc/mm) relationship, Combined sexes: $Lc = 0.230\ L - 1.61$ No significant difference was found between the sexes.	Neiva and Wise, 1963
	Guyanese Shelf, Guyana- Total weight (W/g) to tail weight (Wt/g) relationship, Females: $Wt = 0.460 + 0.5649\ W$ Males : $Wt = 0.064 + 0.6512\ W$ Total length (L/cm) to Cuban length (L_{cub}/cm) relationship, Females: $L = 1.1665 + 1.3615\ L_{cub}$ Males: $L = 1.2906 + 1.3151\ L_{cub}$	Giménez, Paez and Guitart, 1980

PARAMETER	INFORMATION	REFERENCE
	Trinidad and Tobago- Tail weight(Wtail/g) to total weight(Wtot/g) relationship, Females: Wtail = 0.1521 + 0.5958 Wtot Males: Wtail = 0.0411 + 0.6628 Wtot Sexes combined: Wtail = 0.1732 + 0.6006 Wtot Total length(Ltot/mm) to carapace length(Lcar/mm) relationship, Females: Ltot = 20.9434 + 3.6354 Lcar Males: Ltot = 40.5805 + 2.5332 Lcar Sexes combined: Ltot = 20.541 + 3.6886 Lcar Rostral length(Lros/mm) to carapace length(Lcar/mm) relationship, Females: Lros = 4.6022 + 1.8058 Lcar, Males: Lros = 2.433 + 1.9076 Lcar Sexes combined: Lros = 3.9068 + 1.835 Lcar Tail length with telson (TLtel/mm) to carapace length (Lcar/mm) relationship, Females: TLtel = 15.9005 + 1.873 Lcar, Males: TLtel = 8.3728 + 2.4646 Lcar Sexes combined: TLtel = 15.1706 + 1.9574 Lcar Tail length without telson (TL/mm) to carapace length (Lcar/mm) relationship, Females: TL = 14.9239 + 1.3668 Lcar Males: TL = 7.4344 + 1.8974 Lcar Sexes combined: TL = 13.7967 + 1.4544 Lcar Tail length with telson (TLtel/mm) to total length(Ltot/mm) relationship, Females: TLtel = 5.1102 + 0.5152 Ltot Males: TLtel = -0.7738 + 0.6037 Ltot Sexes combined: TLtel = 4.2705 + 0.5306 Ltot Tail length without telson (TL/mm) to total length(Ltot/mm) relationship, Females: TL = 7.0496 + 0.376 Ltot Males: TL = 0.3927 + 0.4648 Ltot Sexes combined: TL = 5.6975 + 0.3943 Ltot	Lum Young *et al.*, 1992b

PARAMETER	INFORMATION	REFERENCE
	Suriname & Guyana- Total weight (units not stated) to peeled weight (units not stated) relationship, $W_T = 2.1285W_P$ Peeled weight to total weight relationship, $W_P = 0.4677W_T$ Total weight to tail weight (units not stated) relationship, $W_T = 1.6592Wt$ Tail weight to peeled weight relationship, $Wt = 1.2819W_P$ Tail length (mm) to carapace length (mm) relationship, $L_t = 1.3897L_c + 11.1228$ Peeled weight to carapace length (mm) relationship, $\ln W_p = 2.1440 \ln L_c - 5.5930$ Peeled weight to tail length (mm) relationship, $\ln W_p = 2.8410 \ln L_t - 9.5736$ Peeled weight to tail length (mm) relationship, $\ln W_p = 3 \ln L_t - 10.1691$ Total weight to tail length (mm) relationship, $\ln W_T = 2.8466 \ln L_t - 8.8753$ Tail weight to tail length (mm) relationship, $\ln W_t = 2.7321 \ln L_t - 8.9376$ Total weight to carapace length (mm) relationship, $\ln W_T = 2.2210 \ln L_c - 5.0857$ Tail weight to carapace length (mm) relationship, $\ln W_t = 2.0973 \ln L_c - 5.1997$	Ferreira *et al.*, 2009, pg. 119
Length/Weight Parameters	Santos Bay, Brazil- Total weight (W/g) to total length (L/mm) relationship, Combined sexes: $\log W = -4.996 + 3.34 \log L$	Neiva and Wise, 1963
	Guyanese Shelf, Guyana- Tail weight (Wt/g) to tail length (Lt/cm) relationship, Females: $Wt = 0.102272\ Lt^{2.164825}$ Males: $Wt = 0.842094\ Lt^{2.250824}$ Total weight (W/g) to tail length (Lt/cm) relationship, Females: $W = 0.133991\ Lt^{2.239166}$ Males: $W = 0.10047\ Lt^{2.322113}$ Total weight (W/g) to Cuban length (L_{cub}/cm) relationship, Females: $W = 0.1109\ L_{cub}^{2.116364}$ Males: $W = 0.0782\ L_{cub}^{2.260712}$	Giménez, Paez and Guitart, 1980

PARAMETER	INFORMATION	REFERENCE
	Trinidad and Tobago- Total weight (g) to total length (mm, tip of rostrum to posterior edge of telson) relationship, Females: $W = 0.0333 \times 10^{-4} L^{3.1681}$ Males: $W = 0.0599 \times 10^{-4} L^{3.0074}$ Sexes combined: $W = 0.0346 \times 10^{-4} L^{3.1524}$ Total weight(g) to carapace length(mm) relationship, Females: $W = 45.6641 \times 10^{-4} L^{2.3887}$ Males: $W = 31.3561 \times 10^{-4} L^{2.5010}$ Sexes combined: $W = 41.6606 \times 10^{-4} L^{2.4164}$ Tail weight(g) to tail length with telson(mm) relationship, Females: $W = 0.0701 \times 10^{-4} L^{3.3093}$ Males: $W = 0.2161 \times 10^{-4} L^{2.9788}$ Sexes combined: $W = 0.0840 \times 10^{-4} L^{3.2507}$ Tail weight(g) to tail length without telson(mm) relationship, Females: $W = 0.0448 \times 10^{-4} L^{3.6354}$ Males: $W = 0.2855 \times 10^{-4} L^{3.0946}$ Sexes combined: $W = 0.0700 \times 10^{-4} L^{3.5047}$ Tail weight(g) to carapace length(mm) relationship, Females: $W = 50.3200 \times 10^{-4} L^{2.1956}$ Males: $W = 22.8649 \times 10^{-4} L^{2.4732}$ Sexes combined: $W = 43.0690 \times 10^{-4} L^{2.2499}$	Lum Young *et al.*, 1992b
Length/Age Parameters	Santos Bay, Brazil- $L_{\infty} = 155$ mm (t.l.) for both sexes.	Neiva and Wise, 1963
Recruitment	Santos Bay, Brazil- Females: Commencement of recruitment in females is at 2 months at total lengths of 40 - 50 mm. Recruitment to the trawl grounds is complete at age 4 months and total lengths of 70 - 80 mm. Males: Commencement of recruitment in males is at age 3 months at total lengths of 40 - 50 mm. Recruitment to the trawl grounds is complete at age 6 months at total lengths of 70 - 80 mm.	Neiva and Wise, 1963
	Cayenne estuary, French Guiana- 3 peaks in April, July - August, October – November Sinnamary river, French Guiana- Peaks in November, lower in other months.	Lhomme, 1992
Natural Mortality (M)	No information found in available literature	
Maximum Sustainable Yield (MSY)	Southeast and South Brazil- Surplus model adjusted for the period 1972-1987 showed a sustainable yield of 14,405t for a maximum effort of 605.380 fishing hours.	Valentini *et al*,1991

PARAMETER	INFORMATION	REFERENCE
	Southeast and South Brazil- 14160 t for a maximum effort of 570.07 x 10^3 hrs of trawling (using Schaefer's model).	Jablonski, 1983
	Suriname- 9,293-12,068 t $year^{-1}$ for a maximum CPUE of 1.38 t day^{-1}	Medley, 2011, pg. 29
	Guyana- 21,424-34,676 t $year^{-1}$ for a maximum CPUE of 1.46 t day^{-1}	Ferreira *et al.*, 2009, pg. 102
Species Habitat Preferences	Brazil/Guiana Shelf- Adults are confined to a narrow coastal strip Juveniles do not travel very far into estuaries	Garcia and Le Reste, 1981
	Brazil/Guiana Shelf- They are found throughout the region, at depths of 4 - 44m	Dragovich, Jones And Boucher, 1980
Impact of Environmental Factors	Inshore waters of Gulf of Paria,Trinidad- Highest in the catch when salinities ae about 32% Reduction in total numbers of X. kroyeri in rainy season may be the result of environmental conditions acting to trigger short lateral migrations of the population within its depth range to perhaps facilitate spawning Temperature did not appear to influence the distribution or abundance of shrimps generally or the catch	Henry ,1987
Species Composition	Inshore Bank adjacent to mangroves of South Oropouche Swamp,Trinidad- Dominates between September and April	Ramcharan, 1989
	Inshore Gulf of Paria, near Orange Valley- Appears sporadically in the catches being highest from August to January and almost absent from mid- January to May	Maharaj, 1989

Appendix 13: Biological parameters for *Farfantepenaeus brasiliensis* stocks of the Guianas-Brazil Shelf.

PARAMETER	INFORMATION	REFERENCE
Length/Age at First Maturity	Guyana- Petasmel fusion occurs in shrimp as small as 114mm TL	Khandker and Lares, 1972
Fecundity	No information obtained in available literature	
Spawning season	Brazil /Guiana Shelf- Major spawning grounds appear to be the eastern section of the Brazil-Guiana shelf with larval drift supplying recruits to estuaries along Suriname and Guyana	Benfield, 1995
	Guianas-Brazil Shelf- Total weight (W/g) to total length (L/mm) relationship, Females: log W = -5.25 + 3.08 log L Males: log W = -5.04 + 2.98 log L	Venaille, 1979
	Off the Guianas and northern Brazil- Total weight (W/g) to carapace length (Lc/mm) relationship (also used in this paper to make conversions for *P. subtilis*), Combined sexes: $W = 0.00311\ Lc^{2.566}$	Kawahara, 1983
	Guyana- Low level year round spawning	Cavalcante and Dragovich, 1984
	Northeastern coast of South America- Total weight (W/g) to total length (L/mm) relationship, Females: ln W = -12.25 + 3.121 ln L Males: ln W = -11.13 + 2.892 ln L	Dragovich, Jones and Boucher, 1980
	Margarita Island, Venezuela- Total weight (W/g) to total length (L/mm) relationship, Females: log W = -5.4991 + 3.1937 log L for females in total length range 100 - 250 mm. Males: log W = -5.2477 + 3.0720 log L for males in total length range 99 - 196 mm. Combined sexes: log W = -5.4103 + 3.1518 log L for individuals of both sexes in the total length range 99 - 250 mm.	Lares and Khandker, 1976
	Northeastern Zone of Venezuela- Spawning area appears to be off the northeast coast of Margarita Island. Spawning is indicated throughout the year with a maximum intensity from April to August.	Novoa and Cadima, 1972

PARAMETER	INFORMATION	REFERENCE
Morphometric Relationships	French Guiana- Total weight(g) to total length(mm) relationships: Females: $W = 5.623 \times 10^{-6} L^{3.08}$ Males: $W = 9.120 \times 10^{-6} L^{2.98}$ Total weight (g) to tail weight(g) relationships: Females: $W_1 = -5.43 + 1.77 W_2$ Males: $W_1 = -1.21 + 1.60 W_2$ Total length(mm) to tail length(mm) relationships: Females: $L_1 = -10.34 + 1.64 L_2$ Males: $L_1 = 0.59 + 1.52 L_2$ Total length(mm) to carapace length(mm): Females: $L_1 = 4.38 + 3.18 L_2$ Males: $L_1 = 4.99 + 4.19 L_2$	Venaille (not dated) in FAO/WECAFC, 1995
	French Guiana- Total weight(g) to total length(mm) relationships: Females: $W = 4.785 \times 10^{-6} L^{3.121}$ Males: $W = 1.467 \times 10^{-6} L^{2.892}$ Tail weight(g) to total weight(g) relationships: Females: $W_1 = 2.986 + 0.561 W_2$ Males: $W_1 = 0.674 + 0.638 W_2$ Carapace length(mm) to total length(mm): Females: $L_1 = -9.235 + 0.297 L_2$ Males: $L_1 = -1.192 + 0.239 L_2$	Dragovich *et al* (not dated) in FAO/WECAFC, 1995
	French Guiana- Tail weight(g) to tail length(mm) relationships: Females: $W = 2.401 \times 10^{-5} L^{2.902}$ Males: $W = 1.154 \times 10^{-5} L^{2.557}$	Dintheer (not dated) in FAO/WECAFC, 1995
	Guianas-Brazil Shelf- Total length (L/mm) to carapace length (Lc/mm) relationship, Females: $L = 24.33 + 3.49 Lc$ Males: $L = 7.93 + 4.23 Lc$ Total weight (W/g) to tail weight (Wt/g) relationship, Females: $W = -1.31 + 1.75 Wt$ Males: $W = -0.14 + 1.64 Wt$ Total length (L/mm) to tail length (Lt/mm) relationship, Females: $L = -10.34 + 1.64 Lt$ Males: $L = 0.59 + 1.52 Lt$	Venaille, 1979
	Off the Guianas and northern Brazil- Carapace length (Lc/mm) to total length (L/mm) relationship, Combined sexes: $L = 33.5 + 3.36 Lc$ Total weight (W/g) to tail weight (Wt/g) relationship, Combined sexes: $W = 1.6 Wt$	Kawahara, 1983
	Northeastern coast of South America- Tail weight (Wt/g) to total weight (W/g) relationship, Females: $Wt = 2.9857 + 0.5614 W$ Males: $Wt = 0.6745 + 0.6385 W$	Dragovich, Jones and Boucher, 1980

PARAMETER	INFORMATION	REFERENCE
	Trinidad and Tobago- Tail weight(g) to carapace length(mm) relationships: Females: $W = 0.565 \times 10^{-3} L^{2.987}$ Males: $W = 0.958 \times 10^{-3} L^{2.774}$ Sexes combined: $W = 0.644 \times 10^{-3} L^{2.926}$ Total weight(g) to carapace length(mm) relationships: Females: $W = 7.960 \times 10^{-4} L^{3.000}$ Males: $W = 1.153 \times 10^{-3} L^{2.881}$ Sexes combined: $W = 9.080 \times 10^{-4} L^{2.958}$ Tail weight(g) to total weight(g) relationships: Females: $W_1 = 0.0701 + 0.673W_2$, Males: $W_1 = 0.0381 + 0.685 W_2$ Sexes combined: $W_1 = 0.0838 + 0.6741 W_2$ Tail length (mm) to carapace length(mm): Females: $L_1 = 3.0029 + 2.804 L_2$ Males: $L_1 = 6.8501 + 2.691 L_2$ Sexes combined: $L_1 = 4.6537 + 2.760L_2$ Total length(mm) to carapace length(mm): Females: $L_1 = 9.5814 + 4.177L_2$ Males: $L_1 = 0.8521 + 4.627 L_2$ Sexes combined: $L_1 = 6.0072 + 4.3636L_2$	Fabres (not dated) in FAO/WECAFC, 1995
	Gulf of Venezuela, Venezuela- Total weight (W/g) to tail weight (Wt/g) relationship for both sexes. W = 1.67 Wt used for all commercial shrimp landings.	Cadima *et al*,1972
	Northeastern Zone of Venezuela- Total weight (W/g) to tail weight (Wt/g) relationship, Combined sexes: W = 1.5 Wt Note: This conversion was used for all shrimp in the commercial fishery in the Northeastern Zone of Venezuela at that time.	Novoa and Cadima, 1972
Length/Weight Parameters	Guianas-Brazil Shelf- Total weight (W/g) to total length (L/mm) relationship, Females: log W = -5.25 + 3.08 log L Males: log W = -5.04 + 2.98 log L	Venaille, 1979
	Off the Guianas and northern Brazil- Total weight (W/g) to carapace length (Lc/mm) relationship (also used in this paper to make conversions for *P. subtilis*), Combined sexes: $W = 0.00311 Lc^{2.566}$	Kawahara, 1983
	Northeastern coast of South America- Total weight (W/g) to total length (L/mm) relationship, Females: ln W = -12.25 + 3.121 ln L Males: ln W = -11.13 + 2.892 ln L	Dragovich, Jones and Boucher, 1980

PARAMETER	INFORMATION	REFERENCE
	Margarita Island, Venezuela- Total weight (W/g) to total length (L/mm) relationship, Females: log W = -5.4991 + 3.1937 log L for females in total length range 100 - 250 mm. Males: log W = -5.2477 + 3.0720 log L for males in total length range 99 - 196 mm. Combined sexes: log W = -5.4103 + 3.1518 log L for individuals of both sexes in the total length range 99 - 250 mm.	Lares and Khandker, 1976
Length/Age Parameters	French Guiana- Females: L_∞ = 143.4 - 151.1 mm (tails) Males: L_∞ = 125.4 - 133.2 mm (tails) Using Powell and test on cohort analysis, Females: L_∞ = 145-153 mm (tail length) K = 1.8-4.2 year^{-1} Males: L_∞ = 130-137mm (tail length) K = 1.8-4.2 year^{-1}	Dintheer and Le Gall (1988) in WECAFC Report, 1989
	French Guiana- Ford-Walford method Females: K = 0.30 ,L_∞ = 70, M = 0.2 Males: K = 0.266, L_∞ = 53, M = 0.2 Females : K = 1.09, L_∞ = 56.3 Males: K = 0.72, L_∞ = 52.9 (Units not specified).	FAO/WECAFC, 1995
Recruitment	Alazio Lake, Brazil- Emigrates from lake in October – May	Boddeke *et al.*, 1977
	French Guiana- Minimum recruitment size 130 mm total length.	Vendeville, 1984
	Guianas-Brazil Shelf (North-eastern South America)- Appears to be recruited mainly in April and October and mainly off French Guiana, Brazil and Guyana	Jones and Dragovich, 1977
	Eastern Suriname- Early spring recruitment in estuarine area during April - June	Cavacante and Dragovich, 1984
	North-eastern Zone of Venezuela- Largest recruitment seems to occur between August and December.	Novoa and Cadima, 1972
Natural Mortality (M)	French Guiana region- Taken from compilation from Garcia, (1984.) For both sexes, M = 2.40	FAO/WECAFC,1995

PARAMETER	INFORMATION	REFERENCE
Maximum Sustainable Yield (MSY)	Off Suriname and French Guiana- Three separate cruises over 21 526 n mi^2 gave 1.7, 2.3 and 3.1 thousand tonnes and potential yields of 0.023, 0.031, 0.042 tonnes/km^2	Kawahara *et al.*, 1983
	Gulf of Venezuela, Venezuela- MSY calculated using Fox's model (1970) was 3 126 metric tonnes for "brown" shrimp (*P. brasiliensis, P. duorarum* and *P. aztecus*).	Montesinos, 1974
Species Habitat Preferences	Brazil/Guyana- Associated with sandy substrate and is mainly found over the sandy bottom of the Guiana/Brazil continental shelf	Dragovich, Jones and Boucher, 1980
	Brazil/Guyana- Found in sandy substrate and burrows during the day. Active at night.	Penn personal obs. (1984) in Talbot *et al* 1996
Species Composition	Inshore Gulf of Paria, Trinidad- Caught in minimal quantities in the Gulf of Paria	Amos, 1990
Impact of Environmental Factors	Near shore Gulf of Paria- Prefers more saline and deeper water environment and substrate of high sand composition as is found on the south portion of the Gulf of Paria along the South Coast of Trinidad	Amos, 1990

Appendix 14: Biological parameters for *Micropogonias furnieri* stocks in Trinidad and Tobago.

PARAMETER	INFORMATION	REFERENCE
Sex ratios	Female:Male ratio: 1: 1.3	Manickchand-Heileman & Kenny (1990)
Length/Age at First Maturity	Length at maturity (mm): 320 TL (female), 280 TL (male) Age at maturity (yr): 2 (both sexes) (From otoliths and analysis of length-frequency distributions)	Manickchand-Heileman & Kenny (1990)
	Length at maturity (mm): 282 TL (female), 247 TL (male)	Manickchand-Dass & Julien (1983)
Fecundity	17 x 10^{3} to 37 x 10^{5} eggs for fish measuring 27.6-52.2cm. Fecundity-size relationship: F = 2 x 10^{B4} $TL^{5.56}$ (r^2 = 0.90); F = 0.81 $W^{1.88}$(r^2 = 0.89) F = 22525Wg-81355 (r^2 = 0.99)	Manickchand-Heileman & Ehrhardt (1996).
	BF = 2.9 $TL^{3.2}$ BF = 641 BW- 43285.1 Where :BF = No. of hydrated eggs in ripe ovaries; TL = Total length; BW = Body weight(without ovaries)	Manickchand-Heileman & Kenny (1990)
	In one season, fish 57.2 cm in size may release 3672330 eggs.	Manickchand-Dass (1980)
Spawning season	Spawning frequency was based on the frequency of females with hydrated eggs and is estimated to be 12 per year, occurring year round with a peak from February to August.	Manickchand-Heileman& Ehrhardt (1996)
	Spawning on the north-east coast of Trinidad is year round but peaks during the dry season	Manickchand-Heileman & Julien-Flus (1990)
	Ripe gonads in February, June, October.	Manickchand-Dass & Julien, 1983
Maximum size/age	L infinity (cm): 82.9 TL (both sexes); 65.3 TL (female)	Manickchand-Heileman & Kenny (1990)
Morphometric Relationships	W = 0.030 $TL^{2.69}$ (both sexes) W = 0.035 $TL^{2.66}$ (female) W = 0.03 $TL^{2.64}$ (male)	Manickchand-Heileman & Kenny (1990)
	W = 0.0000499 $L^{3.040}$ (r = 0.971) (both sexes) W = 0.0000458 $L^{3.033}$ (r = 0.988) (female)	Manickchand-Dass (1980)
Length/Age Parameters	Von Bertalanffy Growth Equation derived from otolith analysis: $l_t = 82.9\ (1\text{-}e^{-0.13(t+0.55)})$ (male) Where L_∞= 82.9 cm TL, K yr^{-1}= 0.13, t_0=-0.13 $l_t = 60.3(1\text{-}e^{-0.20(t+0.68)})$ (female) Where L_∞= 65.3 cm TL, K yr^{-1}= 0.16, t_0=-0.16	Manickchand-Heileman & Kenny (1990)
Recruitment	Recruited to trawl fishery at 3 years	Manickchand-Dass (1980)
Age/length at first capture	t_c = 3 yr	Manickchand-Heileman & Kenny (1990)
	Overexploitation occurs with small mesh nets 3.8 cm in size.Recommended cod-end mesh size is 8.75 cm.	Manickchand-Dass (1980)

PARAMETER	INFORMATION	REFERENCE
Natural Mortality	M= 0.4/year	Manickchand-Heileman & Kenny (1990)
Instantaneous Fishing Mortality	F= 0.8/ year	Manickchand-Heileman & Kenny (1990)
Instantaneous Total Mortality	F= 1.2/year (r^2 = 0.96)	Manickchand-Heileman & Kenny (1990)
Yield per recruit	Overexploited. MSY = 1 500 tonnes. F_{msy} achieved between1987–1993. F_{1998} = 0.4–3.2; Y_{1998} = 1 800 tonnes	Alió et al. 1999
	Fully exploited. Y/R_{max} = 175 g t_c = 3 yrs, Y/R = 181	Manickchand-Heileman & Kenny (1990)

Appendix 15: Biological parameters for *Lutjanus synagris* stocks in Trinidad and Tobago.

PARAMETER	INFORMATION	REFERENCE
Sex ratios	Female :Male ratio based on catches from fishpots and trawl nets. 1:1.13 (fishpot) 1:1.65 (trawl) More females caught from March to May and August to December.	Dass 1983 Manickchand-Dass 1987
Length/Age at First Maturity	Length at maturity: 31.0 cm TL (female), 25.0cm TL (male Age at maturity (yr): 2 (female), 1 (male) Smallest individuals observed with developing gonads were 22.5 cm TL (males) and 23.0cmTL (females)	Dass 1983
Fecundity	Ranged from $2.82x10^4$ to 5.95×10^5 for fish between 29.4cm TL and 41.9cm TL. Fecundity-size relationship: Log F = 6.07+7.15 log TL where r = 0.93 and TL = total length	Dass 1983
Spawning season	Spawning year round, with period of increased activity from February to September with a peak in March.	Manickchand-Dass 1987 Dass 1983
Maximum size/age	L infinity (cm): 48.5 TL (male); 43.1 TL (female)	Manickchand-Dass 1987
Morphometric Relationships	Log W = Log 0.5325 + 2.92 Log TL, r=0.96 (males) Log W = Log 0.4162 + 2.84 Log TL, r=0.97 (females) Log W = Log 0.4618 + 2.86 Log TL, r=0.95 (both)	Dass, 1983
Length/Age Parameters	Von Bertalanffy Growth Equation from aging using whole sagittae: $l_t = 70.8(1-e^{-0.22(t+0.55)})$ (male) Where L_4= 70.8 cm TL, K yr^{-1}= 0.22 $l_t = 60.3(1-e^{-0.20(t+0.68)})$ (female) Where L_4= 60.3 cm TL, K yr^{-1}= 0.20 $l_t = 66.7(1-e^{-0.27(t+0.19)})$ Where L_4= 66.7 cm TL, K yr^{-1}= 0.27	Manickchand-Dass 1987
Recruitment	Full recruitment to the pot fishery at 31.0cm TL (males) and 25.0cm TL (females) and to the trawl fishery at 27.1cm TL (males) and 21.0 cm TL (females)	Dass 1983
Age/length at first capture	1.38yrs, 23cm TL (individuals from fish pots, handlines and trawling)	Maingot and Manickchand 1987
Feeding	Analysis of stomach contents of 33 fish showed approximately 60.6% consisted of shrimp, 36.4% of crabs and 3.0% of fish remains.	Dass 1983
Natural Mortality	M=0.59 per year Using Pauly's Empirical Formula, L_4=66.7 cm TL (Dass, 1983) and T=27.5 ºC	Maingot and Manickchand 1987
Instantaneous Fishing Mortality	F=0.17 per year	Dass 1983

PARAMETER	INFORMATION	REFERENCE
Instantaneous Total Mortality	Z=0.76 per year (using Beverton and Holt 1950) Estimates for individuals caught using fish pots and trawl gear: Fishpots: 1.43 (males); 0.71 (females) Trawl: 0.96 (males); 0.58 (females)	Dass 1983
Yield per recruit	For all values of M, the species was under-exploited. Parameters used for Y/R were: L_4= = 66.7 cm (Dass, 1983), t_c = 1.38 years, k = 0.27 $year^{-1}$, M = 0.59 $year^{-1}$, F = 0.17 $year^{-1}$, Z = 0.76 $year^{-1}$, t_o = -0.19 years, W_4= 4810.62g.	Maingot and Heileman 1987

Appendix 16: Biological parameters for *Macrodon ancylodon*. (Limited bioprofiles available from Trinidad and Tobago and data available for South America are provided).

PARAMETER	INFORMATION	REFERENCE
Sex ratios		
Length/Age at First Maturity	Guyana: 20. 23 cm for both sexes.	Lowe-McConnell, 1966
	Brazil: 21.5and 27.4 cm TL for males and females respectively.	Acia (1996)
Fecundity	Brazil: For 199 females, number of eggs varied from 59850 for 33.4cm TL to over 358450 eggs for 37.2 cm TL. Mean fecundity per female was 165273 eggs. Fecundity-size relationship: $F = 17056.25 + 425.3712\ W_t$($r^2 = 0.6434$)	Juras & Yamaguti, 1989
Spawning season	Guyana: Ripe fish in inshore catches in southeast regions in August, October and February.	Lowe-McConnell, 1966
	Brazil: December and February based on from macroscopic examination of gonads and analysis of gonadal index.	Juras & Yamaguti, 1989
Maximum size/age		
Morphometric Relationships	Brazil: W = 0.00272 L 3.35	Yamaguti, 1966
Length/Age Parameters	Surinam: L_∞= 48.9 cm TL, K yr^{-1}= 0.55, r=-0.33 Guyana: L_∞ = 43.57 cm, K=0.66 yr^{-1},	FAO, 1997
Recruitment		
Age/length at first capture	Guyana: 15/17 cm to 33/36 cm (SL/TL)	Lowe-McConnell, 1966
Feeding	Shrimp and small fish; *Xiphopenaeus kroyeri* (seabob) is its main prey	Bianchi, 1992
Natural Mortality	Natural mortality rate= of 1.20 yr-1	FAO, 1997
Instantaneous Fishing Mortality	Guyana: F= 1.5 yr-1 estimated from data from Chinese seines. F= 2.9 yr-1 was estimated for the trawl fishery.	Hackett, Cochrane, & Booth (2000)
Instantaneous Total Mortality	Guyana: Z= 2.7 yr^{-1}(Chinese seine), Z= 4.1 yr^{-1}(trawl),	Hackett, Cochrane, & Booth (2000)
Yield per recruit		

Appendix 17: Biological parameters for *Cynoscion jamaicensis*. (Limited bioprofiles available from Trinidad and Tobago and data available for South America are provided).

PARAMETER	INFORMATION	REFERENCE
Sex ratios	Trinidad: 1:1. However the Gulf of Paria showed more females while North coast showed more males.	Shim, 1981
Length/Age at First Maturity	Trinidad: 20 cm TL (both sexes)	Shim ,1981
	Trinidad: 21.6 cmTL (female) 22.4 cm TL (male)	Manickchand B Heileman & Julien, 1983
	Guyana: 15/17 cm (SL/TL)	Lowe- McConnell, 1966
	Northern Paria, Sucre, Venezuela: 15.3 cm TL (females) 20.6 cm TL (males) 50% of the population (male and female) is mature at an estimated 25.1 cm TL. Beyond 26.5 cm TL, more than 75% of individuals are sexually mature	Márcano, L., J. Alió and D. Altuve, 2002.
Fecundity		
Spawning season	Trinidad: Spawning is continous, a peak is observed during dry season based on the prescence of juveniles year-round in the Gulf of Paria and North Coast	Manickchand B Heileman & Julien-Flus, 1990
	Trinidad: Peak spawning in February for fish in the Gulf of Paria and between March and May for fish on the North coast. Younger spawners are found in the Gulf and older spawners occur off the north coast. Peak spawning in both areas coincides with the periods of highest salinity and temperature.	Shim, 1981
	Demerera River, Guyana: Mature fish found throughout the year, but fry found only in January at the mouth of the river.	Lowe-McConnell, 1966
Maximum size/age		
Morphometric Relationships	Trinidad: W = 0.00449 L 3.297 (combined sexes)	Shim, 1981
	W = 5,147 x 10-6 TL3,151 March and August-December, corresponding to periods of greatest gonad development and sizes of individuals.	Márcano, L., J. Alió and D. Altuve, 2002.

PARAMETER	INFORMATION	REFERENCE
Length/Age Parameters		
Recruitment	Trinidad: Recruitment of juveniles begins early in May and continued until November in the Gulf and at Maracas. Juveniles 5-10 cm in length are recruited into the fishery within a few months of hatching.	Shim, 1981
Age/length at first capture	Trinidad: Gear selectivity- overexploitation occurs with the use of small mesh nets 3.8cm in size.	Manickchand -Dass & Julien,1983.
Migration	Trinidad: Otolith increment, sex ratio and catch data strongly suggest that fish from outside areas possibly the Orinoco waters, pass through Trinidad's waters during July. Migrate inshore toward less saline waters for spawning.	Shim, 1981
	Guyana: High turbidity levels due to Northeast Trades, force an offshore migration.	Mitchell and McConnell, (1959) in Shim, 1981
Natural Mortality	Trinidad: Female mortality is greater than that of males based on increasing percentages of males with increasing age.	Shim, 1981
Instantaneous Fishing Mortality		
Instantaneous Total Mortality		
Yield per recruit		

Appendix 18: Estimated Annual Landings (kg) of *Micropogonias furnieri* for Trinidad (1998-2010) by Gear Type.

YEAR	TRAWLING (ARTISANAL /SEMI-INDUSTRIAL	TRAWLING (INDUSTRIAL)	MONO-FILAMENT	MONO-FILAMENT DISCARDS ON LAND	FILLET/ MONO-FILAMENT	FILLET	BROWN NET	SHARK NET	BEACH/ LAND SEINE	ITALIAN SEINE	TUCK SEINE	BANKING	PALANGUE	A-LA-VIVE	SWITCHER-ING	TROLLING	FISHPOT	Grand Total
1998	203,735		526,683			27,574		75	17,057			45,830	204,773	6,485	3,697	61	5,564	1,041,534
1999	355,995		228,980			29,734			16,462			71,313	81,067	3,571	1,635	112	2,213	791,081
2000	282,940	60,690	336,081			31,203			10,511		123	107,581	61,014	1,372	5,002		735	897,253
2001	184,195	87,468	907,021			32,792			28,486			21,168	102,051	609	2,143		746	1,366,678
2002	208,192	171,525	939,237			33,092			1,011	13		22,060	188,639	7,038	2,672	150	1,408	1,575,038
2003	101,717	116,390	840,176			65,709			356			39,558	300,259	3,527	1,227	1,133	1,571	1,471,623
2004	107,929	88,490	790,252			84,260			605	337		23,036	58,752	4,802	2,452	26	2,094	1,163,034
2005	147,232	134,611	1,432,834			63,127			1,261	446		27,081	50,156	493	1,656	2,168	382	1,861,446
2006	76,696	119,388	461,779			132,381	971		2,845			33,602	18,415	3,799	3,184	308	569	853,937
2007	59,395	115,127	447,581			62,211	169		1,298	127		33,292	14,830	3,230	9,070	204	163	746,697
2008	51,546	119,193	620,226			130,289			1,242			32,924	16,988	2,173	6,912	203	1,185	982,880
2009	85,019	146,140	840,771		379	114,159			3,496			36,087	35,042	474	4,301		50	1,265,919
2010	91,720	151,510	706,039	2,392		236,291			8,915			17,702	33,314	618	15,481	40	620	1,264,643

Note: Landings of Croaker from the industrial trawl fleet for 1998-1999 are not available.

Appendix 19: Average Ex-vessel Prices (TT$/kg) by Species/ Species Group for the Trinidad Artisanal Fleets, and Semi-industrial and Industrial Trawl Fleets (2010 - 2006) (Source: Fisheries Division records)

SPECIES GROUP	2010	2009	2008	2007	2006
AFRICAN POMPANO	13.42	12.23	16.19		
AMERICAN HARVESTFISH	5.19	7.54	6.67	31.18	
ANCHO	29.30	24.44	22.92	19.83	15.67
ANCHOVY (SARDINE)	4.84	4.26	5.01	3.83	3.02
ATLANTIC BIGEYE	21.09	17.75	23.17	18.99	
ATLANTIC BUMPER (PLATO)	3.37	3.47	3.88	3.80	3.04
ATLANTIC CUTLASSFISH	3.64	20.61	5.58	5.39	3.64
ATLANTIC SPADEFISH (PAOUA)	4.40	4.42	4.27	4.41	3.77
ATLANTIC TRIPLETAIL			6.66	8.03	
BAR JACK	6.67	7.67	8.50		7.58
BARRACUDA	23.02	22.16	15.84		16.49
BECHINE	16.90	13.89	15.24	14.23	11.01
BLINCH	3.13	5.39	5.44	6.15	5.33
BONEFISH (BANAAN)	2.54	7.84	2.71	2.41	1.89
CARITE	29.76	24.04	24.01	24.45	19.11
CAVALLI	12.69	14.12	12.88	10.76	11.63
CENTER FIN	6.67	8.89		13.31	7.74
COBIA (CODFISH)	12.55	5.37	15.95	13.16	12.19
CROAKER	6.48	7.62	7.98	8.65	8.04
DOG SALMON		21.43	20.91	20.24	15.68
DRUM (BOKUM)	2.22	6.67	3.34		
FLOUNDER (SOLEFISH)			6.67		
GAR (NEEDLEFISH)		4.12	7.87	3.66	9.90
GROUPER	22.77	20.78	22.66	19.31	13.56
GRUNT	5.09	5.66	6.23	7.51	7.07
HERRING	2.07	1.63	2.98	2.12	2.18
JACKS	5.53	6.21	4.86	5.62	5.69
KINGFISH	33.96	30.38	29.97	29.93	22.62
LEATHERJACK (SAPATE)	2.66	2.66	3.00	2.67	2.52
LIPPE	6.47	6.97	9.87	10.18	9.93
MAWAN		4.44			
MOONSHINE	12.49	12.30	11.81	11.41	11.27
MULLET	3.65	3.75	3.00	2.51	2.39
PERMIT (SOFT PAMP)	12.93	13.53	18.10	14.75	8.89
POMPANO (ZELWON)	11.93	10.70	13.34	7.28	8.14
RAINBOW RUNNER	22.22				
SEA CATFISH	3.07	2.61	2.89	2.41	2.40
SEA/SWIMMING CRAB	4.41	4.55	4.76	4.36	3.14
SHARK	10.23	10.29	9.28	7.94	6.78
SHRIMP	33.39	32.84	31.95	32.13	29.55
SNAPPER	28.75	28.37	27.69	26.06	23.75
SNOOK	18.90	16.99	18.16	18.46	16.34
SQUID	9.84	6.76	9.95	11.06	5.73
SQUIRRELFISH (MARIE-ANN)	4.87	4.44	8.42	3.33	2.90
TARPON	5.55	5.28	6.18	5.12	4.80
THREADFIN (BA BAY)		2.15	0.00		4.44
WEAKFISH (SALMON)	18.62	17.27	16.75	15.79	13.68

Appendix 20: Orange Valley Fish Market Wholesale Prices - Average Monthly Prices (TT$/kg) by Species/Species Group (2007-2011) (Source: The National Agricultural Marketing and Development Corporation, NAMDEVCO)

Species Group	2007	2008	2009	2010	2011
Ancho	20.58	27.51	32.34	24.57	35.43
Bachin	11.82	15.33	NA	16.49	17.09
Bannan	3.86	7.28	NA	NA	NA
Barracuda	18.74	26.46	NA	NA	NA
Blanche	7.79	7.07	7.72	4.41	4.23
Brochet	22.10	21.58	21.52	21.47	21.11
Carite	29.94	33.84	33.84	33.29	39.63
Cat Fish	5.73	7.91	7.33	7.14	6.19
Cavali	17.40	17.3	19.35	20.44	20.82
Cro Cro	11.47	10.39	9.23	7.52	9.71
Cutlass Fish	6.42	7.35	NA	NA	NA
Gar Fish	NA	NA	NA	NA	NA
Grouper	17.32	22.05	NA	NA	25.36
Grunt	NA	NA	NA	NA	NA
Herring	5.13	8.91	6.25	4.34	4.56
Jacks	NA	6.61	NA	NA	NA
Jashua	3.97	NA	NA	NA	NA
King Fish	35.64	40.44	37.66	39.2	42.53
Mixed Fish	4.82	6.01	4.46	3.98	4.53
Moonshine	15.48	15.26	14.69	16.01	17.53
Mullet	7.72	8.28	9.31	7.17	8.27
Palimet	8.82	11.06	10.29	6.61	6.61
Pampano	8.31	12.97	11.39	11.51	24.3
Paoua	5.26	8.67	5.51	NA	NA
Plato	5.35	4.12	3.77	NA	2.76
Raccando	22.05	NA	NA	NA	NA
Red Fish	25.66	29.51	29.8	35.22	35.87
Salmon	20.11	20.13	21.79	24.78	27.28
Sapate	22.05	5.22	NA	NA	NA
Sea Crab	4.41	NA	NA	NA	NA
Shark	14.95	15.36	13.44	13.11	13.06
Shrimp (m)	45.31	40.27	30.29	32.48	41.7
Tarpon	6.34	10.1	9.37	NA	7.17
White Fish	NA	6.88	NA	NA	NA

Appendix 21 : Types of management tools implemented in the Trinidad and Tobago Shrimp and Groundfish fisheries.

Type of management tool	Tick	Comments (e.g. when introduced, effectiveness, compliance, etc.)
Spatial (area) restrictions and closures such as:		
○ Marine protected areas where fishing is prohibited		
○ Nursery area closures	√	Introduced in 1930. No fish or shellfish to be taken from Caroni River mouth to one thousand feet seaward from the sewerage outfall thence to Diego Martin River mouth and the shore, as well as between Claxton's Bay and Cipero River mouth for half a mile seawards from low water mark. Not enforced.
○ No-take zones	√	See Nursery Area Closures above. Zoning for trawling introduced in 1989 in Gulf of Paria, North and South coasts of Trinidad and prohibited on east coast. Regulations amended in 1998 to, *inter alia*, prohibit trawling east of Saut D'eau on north coast Trinidad (See details in Section 9). Limited enforcement.
○ Marine reserves where fishing is sometimes allowed		
○ Other temporary areas closures for specific purpose (e.g. spawning aggregations)	√	Closure of area west of Saut D'eau on north coast Trinidad, to trawling, from 16 Jan to 14 Nov each year, and under cover of night (6pm to 6am) during the open season. Introduced in 1998. Limited enforcement.
Temporal restrictions such as:		
○ Defined fishing season(s)	√	Trawling allowed on north coast Trinidad, west of Saut D'eau, outside 2 nautical miles from 15 Nov to 15 Jan from 6am to 6pm. Introduced in 1998. Limited enforcement.
○ Defined number of days fishing		

Type of management tool	Tick	Comments (e.g. when introduced, effectiveness, compliance, etc.)
o Defined number of hours per day fishing		
o defined number of hours fishing		
Gear restrictions such as:		
o Engine size restrictions		
o Gear size restrictions	√	Maximum length and width, and minimum mesh sizes introduced for gillnets and seines in 1930 and amended in 1998, 2000 and 2002. Mesh size for trawl nets introduced in 1989. Not enforced.
o Gear type restrictions	√	Gears not specified in Fisheries Regulations 1930 cannot be used.
Size/age restrictions (i.e., minimum or maximum sizes)	√	Minimum lengths for specified fish species were introduced in 1930. Limited enforcement.
Participatory restrictions such as:		
o Licences		
o Limited entry	√	Specified for all trawlers in a 1988 Cabinet Decision. Enforced for semi-industrial and industrial trawlers only.
Catch restrictions such as:		
o Total allowable catch (TAC) limits		
o Vessel catch limits		
o Individual vessel quotas		

Type of management tool	**Tick**	**Comments** (e.g. when introduced, effectiveness, compliance, etc.)
Rights/incentive-adjusting regulations such as:		
o Individual effort quotas		
o Individual fishing quotas		
o Individual transferable quotas		
o Individual transferable share quotas		
o Group fishing rights (including community development quotas)		
o Territorial use rights		
o Stock use rights		

Appendix 22: Management Recommendations for what is considered to be a sub-regional shrimp stock shared by Trinidad & Tobago and Venezuela.

REFERENCE DOCUMENTS	SPECIES	STOCK STATUS	MANAGEMENT RECOMMENDATIONS
FAO Fisheries Report No 651; FAO Fisheries Report No 650	***Farfantepenaeus subtilis*** (brown shrimp)	MSY is around 1300 t which should be reached at an effort level of 13 000 days-at-sea for the Trinidad and Venezuelan fleets combined.	1. A precautionary approach would suggest that effort should be reduced by 10%, hence a maximum effort level of 11 700 d-a-s should be applied for this species. The allocation of effort between the two country's' fleets should be agreed within the framework of the Fishing Agreement between both countries or through a negotiating process.
FAO/FishCode Review. No. 3.	***Farfantepenaeus subtilis*** (brown shrimp)	Stock is being severely overfished, with the 2002 biomass ratio equal to 0.23, less than one-quarter of the Bmsy. Fishing mortality estimates for the entire period (1973-2002) have been greater than Fmsy, indicating that overfishing has been taking place since the 1970s. The 2002 fishing mortality ratio is 3.42, more than three times greater than Fmsy. The maximum sustainable yield is estimated around 1 100 tonnes. (Die et al 2004)	1. Managers should introduce measures to reduce fishing mortality on the brown shrimp stock of the Gulf of Paria-Orinoco Delta region. Tools include: controlling the number of licenses/vessels; seasonal closures; and gear and vessel restrictions. The mix of measures that should be used to control fishing mortality in each fishery depends on the capacity and management priorities set for each country. However, the presence of shared stocks between Venezuela and Trinidad and Tobago requires that both countries develop a common strategy for effort control. This strategy should clearly establish the type of management tools that each country will use to control fishing effort and how this effort will be monitored in the future. (Die et al 2004)
FAO/FishCode Review. No. 3.	**Shrimp**		1. Development of catch-at-size matrices for shrimp landings should be completed and length-based VPA assessments conducted for *F. subtilis* and *L. schmitti* jointly for Trinidad and Tobago and Venezuela, and for *F. notialis* and *X. kroyeri* for Trinidad and Tobago in this order of priority.(Die et al 2004).
Ferreira and Medley (2011)	**Shrimp**	Overall stock biomass is likely to be stable or increasing. However, local depletion could still be taking place. The state of the stock is likely to be above MSY and the current fishing mortality is well below MSY. MSY is in the region of 1800t and catches higher than this will not be sustainable.	A harvest control rule should be implemented for Trinidad in order to control the amount of fish caught. At the very least, a fixed seasonal closure of 1-2 months each year, which is considered a relatively crude measure, should be implemented to reduce fishing effort. The stock is likely to decline below MSY without management action while closures of one and two months greatly improve the likely status of the stock in the medium term, although the resulting levels of effort will likely still cause overfishing in the longer term as fishing mortality is too high.
			A more sophisticated and complex feedback-control rule, for example, a control on effort in response to changes in shrimp biomass (or a biomass indicator such as CPUE) such that exploitation is reduced as the stock declines, is recommended for Trinidad if the monitoring system can support it. This kind of harvest control rule is more conservative resulting in higher

REFERENCE DOCUMENTS	SPECIES	STOCK STATUS	MANAGEMENT RECOMMENDATIONS
			CPUE and biomass, but possibly lower catches at least in the medium term.
		It should be noted that there are severe and increasing limitations on the available data.	Implement a trip reporting system for the semi-industrial and industrial trawl fleets of Trinidad and Tobago Implement an Observer Programme for the semi-industrial and industrial trawl fleets of Trinidad and Tobago to verify the trip reporting system. Structure data collection in Trinidad and Tobago to allow individual shrimp species to be monitored. Review historical records and consult with Trinidad industrial trawl fleet operators in an attempt to verify or refine shrimp catch estimates prior to the year 2000 when sampling of this fleet was very low or non-existent.
		It should also be noted that although lower catches in Venezuela (due to the ban on industrial trawling effective 2009) are likely to have benefited the stock overall, it is suspected that parts of the stock in Trinidad will remain depleted. Specifically, although CPUE in Trinidad waters shows a slight upward trend, this is not as significant as that which might be expected given the decrease in catches.	Re-evaluate stock structure as the current assumed structure, effectively a single stock shared between Venezuela and Trinidad, may not be accurate enough to protect fleets from depleting the resources they have access to. The shrimp stock distribution in Trinidad and Tobago waters should be investigated. Salinity, water temperature, depth, chlorophyll distribution, shrimp species composition, and any other data which would assist in determining the stock distribution should be collated. Obtain more detailed information, including on species life history, to account for other factors affecting productivity, such as pollution, which was suggested as a contributing factor by stakeholders.

REFERENCE DOCUMENTS	SPECIES	STOCK STATUS	MANAGEMENT RECOMMENDATIONS
Medley, Alió, Ferreira and Marcano 2006	**Shrimp**	The stock is overfished relative to the maximum sustainable yield. The MSY is in the region of 1700 t. For many of the years since 1988, the shrimp catches have been unsustainable with landings being greater than the estimated MSY. Current catches probably cannot be maintained in the long term. The stock biomass is stable or declining. The biomass since 1988 has been below that expected to produce the MSY and the current fishing mortality is causing the stock to continue to decline. Rebuilding the stock could realize 35-80% increase in the current catch rate, while making the same catch as currently being landed. (Medley et al 2006)	The target sustainable yield should be between 1583 and 1905t to avoid overexploitation. It is recommended that new fishing controls be introduced in both Trinidad and Tobago and Venezuela to decrease the total number of days at sea permanently in order to allow the stock to rebuild. Two such controls are recommended below followed by two general recommendations for the management of the trawl fishery of Trinidad (Medley et al 2006)
		Fishers noted that, from their observations, industrial and coastal pollution was also a major cause for the decline of fish stocks in the Gulf of Paria (Stakeholder Meeting).	1. Implement a closed season for trawling. A closed season ranging from one month (January) to four months (November to February) should bring about a recovery. The months for a closed season should be those when the greatest percentage of small shrimp is landed. The disadvantage is that there will be an initial loss to the fishery during the rebuilding process.
		The April 2005 Trinidad and Tobago-Venezuela Stakeholder Meeting agreed that the destruction of habitats and nursery areas, such as mangroves, was also a major cause of decline in fish stocks in the Gulf of Paria.	2. Limit the numbers of trawlers with a view to reducing the fleet size. In the case of Trinidad and Tobago this will involve the following: Update fisheries legislation to facilitate a limited entry fishery; and Implement a licensing system for trawlers.
			3. Strictly enforce the current regulations for the trawl fishery in Trinidad and Tobago as this will contribute to the sustainability of the stocks. The Fisheries [Control of Demersal (Bottom) Trawling Activities] Regulations 2001 specify a minimum cod-end mesh size as well as areas of operation including a zoning regime in the Gulf of Paria according to trawler type.

REFERENCE DOCUMENTS	SPECIES	STOCK STATUS	MANAGEMENT RECOMMENDATIONS
			4. Set appropriate and specific reference points for the fishery, that is, constraints within which the fishery must operate, since (in the case of Trinidad and Tobago) the management objectives for this fishery outlined in the draft policy document (Fisheries Division and FAO, 1994) and draft management plan (Fisheries Division and FAO, 1992) are very broad. Key issues to be considered are how the fishery will be monitored and how and what controls can be applied to affect the performance. This should be addressed through discussions among all stakeholders.
			Statistics Recommendations (Medley et al 2006):
			1. Review historical records and consult with Trinidad industrial trawl fleet operators in an attempt to verify or refine shrimp catch estimates prior to the year 2000 when sampling of this fleet was very low or non-existent.
			2. Continue and complete computerization of the Trinidad historical catch and effort data from the 1950s to the present.
			3. Obtain more detailed information, including on species life history, to account for other factors affecting productivity, such as pollution, which was suggested as a contributing factor by stakeholders.
			Research Recommendations (Medley et al 2006):
			1. Develop a species-specific population model which would provide more detailed management advice. Activities would include developing software, improving growth parameter estimates and morphometric relationships, and developing time series of environmental variables, including levels of pollution. This model will provide the basis to address the concerns of stakeholders as it would be able to include pollution effects.
			2. Determine growth parameters from the Trinidad shrimp length frequency data (1992-2002) using such software as Length Frequency Distribution Analysis (LFDA). These parameters will be input for the model in (1) above.
			3. Refine morphometric relationships for input to the population model in (1) above.
			4. Re-run the current model to provide better estimates of parameters. If management action is introduced resulting in a reduction of the fishing mortality, the recovery in CPUE should improve the model's ability to detect the state of the stock and predict optimum management actions. No other special action, apart from implementing the recommended management controls, will be needed.
			Stakeholder Recommendations:

REFERENCE DOCUMENTS	SPECIES	STOCK STATUS	MANAGEMENT RECOMMENDATIONS
			1. Pollution in the Gulf of Paria should be monitored for its impact on fisheries and it should be controlled by the relevant government authorities, including the industry.
			2. A literature search should be conducted and existing information on pollution in the Gulf of Paria compiled, with emphasis on the fisheries sector. This report should be distributed to all relevant government agencies and fisher groups. Note that this has since been conducted by Seepersad *et al*. (2007)
			3. Critical areas such as fish habitats and nursery areas should be identified and monitored and significant nursery areas should be protected and closed to fishing.
			4. Bilateral cooperation in the management of the fish stocks shared between Trinidad and Tobago and Venezuela should be pursued with assistance of FAO/WECAFC. This could be achieved under the 1989 Protocol on Cooperation in Fisheries Research between Trinidad and Tobago and Venezuela.
			Recommendations for Follow-up (Stakeholder Meeting):
			1. The report of the April 2005 Trinidad and Tobago- Venezuela Stakeholder meeting should be distributed to the participants and to relevant government agencies, especially those that have responsibility for development planning, the environment and research on the marine environment. In sending the report to these agencies their attention should be called to specific aspects of the report, such as coastal development, pollution and habitat destruction, that fall under their responsibility and do not fall under the portfolio of the Fisheries Division of Trinidad and Tobago.
			2. Communication and dialogue with stakeholders should be improved through regular consultations on matters relevant to the fisheries sector with the goal of achieving co-management and auto regulation.
			3. A similar stakeholders' meeting should be convened in Venezuela. The Venezuelan scientists and manager attending the meeting planned to use the materials produced by the assessment workshop to hold a similar stakeholder meeting later in the year and to invite the Fisheries Division of Trinidad and Tobago.

REFERENCE DOCUMENTS	SPECIES	STOCK STATUS	MANAGEMENT RECOMMENDATIONS
FAO Fisheries Report No 651; FAO Fisheries Report No 650	Shrimp Trawl Fishery (includes Groundfish)	The optimum allocation of fishing effort between the two fleets, which would yield maximum profits to this shared fishery, is 61% of the current effort of the Trinidad fleet and 82% of the current effort of the Venezuelan fleet.	1. The fishing effort of both the Trinidad-Tobago and Venezuela fleets should not be increased beyond the current level.
FAO/FishCode Review. No. 3.			1. The next bio-economic assessment for Trinidad and Tobago and Venezuela should cover both shrimp and groundfish, and data should be treated separately for each of the various trawls fleets.(Die et al 2004)

Appendix 23: Management recommendations for groundfish and measures taken to date

Status of Species/Fishery	National /Regional recommendations	Status of Implementation of Recommendations	Reference Documents
Cynoscion jamaicensis (salmon), *Micropogonias furnieri* (croaker) Recommendations 1-3 are common for both salmon and croaker.	1. Limit the level of fishing effort on groundfish resources with a view to reduction over time. The combined effort of all fleets impacting on groundfish resources (trawl, gillnets, and lines), should not be allowed to exceed current levels. Given the number of groundfish species that are being exploited, limiting effort to current levels will ensure that the biomass of less abundant groundfish species is not threatened.	Government policy to move from an open access regime to a limited entry regime to alleviate overcapitalization and overexploitation across all fishing fleets is articulated in the Draft Policy for the Fisheries Sector of Trinidad and Tobago 2011 to be approved by Cabinet.	FAO (1999a,1999b; 2000a, 2000b; 2001a, 2001b; 2002)
Micropogonias furnieri (croaker) The Maximum Sustainable Yield (MSY) for croaker is 1500 tonnes and has been exceeded from 1987-1993 and in 1998.	2. Expand the data collection programme to collect catch and effort data for groundfish from the industrial trawl fleet.	An ongoing catch and effort data collection programme began in 2000 at one major trawl landing site to derive estimates for the total industrial fleet.	FAO (1999a,1999b; 2000a, 2000b; 2001a, 2001b; 2002)
Cynoscion jamaicensis (salmon), *Micropogonias furnieri* (croaker) Current levels of fishing effort exceed the levels at which MSY is obtained. Maximum profits to the artisanal groundfish fishery were observed in 1997 and are currently decreasing.	3. Implement a biological data collection programme for the groundfish fishery.	An at-sea biological sampling programme for trawl fleets ran from 1999-2000. A biological sampling programme at landing sites ran from 2003-2007. - Length frequencies of *M. furnieri* and *Lutjanus synagris* (lane snapper) were collected from the artisanal, semi-industrial and industrial trawl fleets. - Landed market categories weer sampled to determine the species composition of bycatch species in landed catch by trawl fleet. - Catch landed in various size categories was sorted to determine the species composition of weakfish (Cynoscion spp). - Monthly purchases of samples of the landed catch from each trawl fleet to determine species composition and collect biological data - At-sea trips were conducted on board commercial trawlers operating in the Gulf of Paria between 2003 and 2005. Hauls from each trawl were purchased and sorted in the laboratory to determine species composition of catch including discards. Length and weight by species was recorded and where possible, the stage of maturity.	FAO (1999a,1999b; 2000a, 2000b; 2001a, 2001b; 2002) Soomai, 2008

Status of Species/Fishery	National /Regional recommendations	Status of Implementation of Recommendations	Reference Documents
Macrodon ancylodon (bangamary), Micropogonias furnieri (croaker), Cynoscion virescens (salmon), Cynoscion jamaicensis (salmon), Lutjanus synagris (redfish/snapper)	4. Greater national priority should be placed on biological sampling (length frequency, ageing and maturity) for groundfish species. - Trinidad and Tobago scientists can benefit from examining the biological programme in place in Venezuela. - Biological and fishery sampling of fish species should be designed to satisfy the data needs of current assessment models which include: determination of the species composition of the landings of various fleets; characterization of fish bycatch and target species; and assessment of discarding rates of priority species.		Die et al. (2004)
	5. Research into the use of bycatch reduction devices and utilization of bycatch should be conducted together with the stakeholders.	Trinidad and Tobago participated in the global project funded by the GEF and co-ordinated by the FAO, Project EP/GLO/201/GEF "Reduction of Environmental Impact from Tropical Shrimp Trawling, through the Introduction of Bycatch Reduction Technologies and Change of Management" from 2003 to 2008. Modifications to existing trawl gear and gear trials to test bycatch reduction devices (BRDs) were conducted in the artisanal, semi-industrial and industrial trawl fleets in 2006 and 2007. A new prototype artisanal trawl net was also tested.	Soomai & Seefoo (2006); Soomai (2007, 2008a, 2008b)
	Stakeholder participation in the management and development of the fishing sector. - Stakeholders support the need for accurate data and information for policy formulation and making management decisions and agreed to collaborate with the Fisheries Division, who should adopt a more participatory approach in obtaining fisheries data and information, and in undertaking research studies.	A National Steering Committee, comprised of fishers and vessels owners representing each of the trawl fleets, was established in 2004 to 2007 to collaborate with the government in research activities under FAO Project EP/GLO/201/GEF. The activities under Project EP/GLO/201/GEF complemented the national efforts and the attempts in the region to develop mechanisms for the management of shared stocks of the Guyana-Brazil continental shelf.	FAO (2000b) Soomai (2008b)

This document presents the results of the national consultation tha twas organized in Trinidad and Tobago in the framework of the Case Study on the Shared Stocks of the Shrimp and Groundfish Fishery of the Guianas-Brazil Shelf of the Caribbean Large Marine Ecosystem Project (CLME). It is the eighth of ten reports that were produced as a result of the case study activities. These documents summarize the outputs of the different steps undertaken to mainstream the Ecosystem Approach to Fisheries (EAF) in the management of the shrimp and ground fish resources of the Northern Brazil Shelf Ecosystem.