Report of the

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

Belem, 11-13 September 2012

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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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 Ministry of Fisheries and Aquaculture of Brazil, in collaboration with FAO and the Caribbean Regional Fisheries Mechanism (CRFM), held in Belem, Brazil, from 11 to 13 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 and 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.

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Report of the National Consultation in Brazil, Belem, 11-13 September 2012
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ABSTRACT

This is the report of the national consultation organized by the Ministry of Fisheries and Aquaculture of Brazil in collaboration with FAO and the Caribbean Regional Fisheries Mechanism (CRFM), held in Belem, Brazil, from 11 to 13 September 2012. The consultation was organized as part of the Case study on 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 key stakeholders in the shrimp and groundfish fisheries of northern Brazil, from the States of Amapa, Para and Maranhão, coming from Ministries, fisherfolk organizations, academic institutions, NGOs and FAO.

Participants were provided with an overview of the CLME Project and the case study on shrimp and groundfish, as well as the key principles of the Ecosystem Approach to Fisheries. The baseline report was presented and participants were encouraged to contribute to the finalization of the report. During the discussions that followed the presentations, priority topics that needed to be addressed to improve the management of shared stocks were identified. They include monitoring and control of fishing activities, characterization of fisheries systems, identification and assessment of the shared stocks in the Brazil-Guianas continental shelf, governance, and impacts of fishing on the ecosystem. These topics were discussed in detail to identify key actions to be undertaken to ensure sustainable management of the shrimp and groundfish stocks.

CONTENTS

1. Introduction

The National Consultation held in Belem, from 11 to 13 September 2012, was part of the Caribbean Large Marine Ecosystem Project (CLME)[1] which aims to improve the management of the shared living marine resources in the Wider Caribbean Region. The main objective of the CLME Project is to improve knowledge about the existing legal and institutional framework in order to facilitate the strengthening of the management and governance of fisheries in the Caribbean at the regional, subregional and national levels. Pilot projects and case studies on specific transboundary fisheries were implemented to verify models of governance at local, national and subregional levels, to provide additional knowledge about the means of applying the ecosystem approach to fisheries management and to determine the socio-economic and the sensitivities of the fisheries.

Within the context of the CLME Project, the "Case Study on shared stocks of shrimp and groundfish fisheries of the Guianas-Brazil shelf" involved six countries: Brazil, France (French Guiana), Guyana, Suriname, Trinidad & Tobago and Venezuela. The case study aimed to fill the knowledge gaps that contribute to the Transboundary Diagnostic Analysis (TDA) of the final CLME Project and as a basis for the elaboration of the Strategic Action Programme (SAP) for the region. Taking the Ecosystem Approach to Fisheries (EAF) as a methodological framework, the case study was also aimed at integrating the concept and practice of EAF into the management of shrimp and groundfish fisheries on the Guianas-Brazil continental shelf. These goals were addressed through desk studies, assessments and consultations with stakeholders at national and regional levels, following some of the key steps in the planning process under the EAF.

Participants in the National Consultation in Brazil were representatives of key stakeholders in the shrimp and groundfish fisheries of northern Brazil, from the states of Amapa, Pará and Maranhão. The list of participants and agenda of the meeting are in Annexes 1 and 2.

2. Objectives of the National Consultation

The National Consultation was held with the following objectives:

- ✓ To familiarize participants with the principles and practices of the Ecosystem Approach to Fisheries (EAF)
- ✓ To review the draft Brazil Baseline Report, prepared for the case study
- ✓ To identify themes/priority issues (domestic and cross-border) for the sustainable management of shrimp and groundfish fisheries, based on the EAF
- ✓ To identify key actions for the management of fisheries for shared stocks of shrimp and demersal fish

3. Presentations

On the first day of the meeting presentations were made to contextualize the case study within the CLME Project and to report on the outcomes of two training workshops held within the framework of the Project: the Regional Training Workshop on Facilitation held in Port of Spain, July 2011, and the Regional Training Workshop on the Ecosystem Approach to Fisheries, held in Paramaribo,17-21 October 2011. A summary of the information gathered and gaps in knowledge about fishing for shrimp and groundfish in the north of Brazil was also presented, which were part of the Brazil Baseline Report (Annex 7).

During the discussions that followed the presentations, some initial priority topics that needed to be addressed to improve the management of shared stocks were identified, including monitoring and

[1] Caribbean Large Marine Ecosystem Project, www.clme.org

control of fishing activities, identification of shared stocks within the Brazil-Guianas continental shelf, the characteristics of fisheries, governance, conflicts and impacts on the ecosystem. These topics were later reviewed at the end of the meeting to identify key actions necessary for the fisheries management of shared stocks of shrimp and groundfish.

4. Identification of issues affecting the achievement of objectives of the main fisheries

Four main fisheries foron the shared resources in northern Brazil were identified: industrial shrimp trawling; bottom gillnet fisheries targeting demersal fish; line/trap fisheries directed towards the snapper; and trap (covo or manzuá) fisheries for lobsters. Whereas the lobster was not the purpose of the case study, this fishery was not analyzed in detail during the consultation. However, given the importance of the fishery to Brazil and other Caribbean countries, it was recommended that it be properly addressed in the future by the CLME Project. In this sense, a summary of available information on lobster fishing in Brazil was prepared and included in Annex 6 of this report.

As a starting point for the identification of issues affecting the achievement of objectives of these fisheries, the following three objetives, originally defined in the national shrimp fishery management plan, were adopted as relevant for all fisheries addressed in the case study:

- ✓ **Fisheries & Biological**: maintain stock biomass off northern Brazil within environmentally sustainable levels
- ✓ **Ecologic**: minimize the impact of fishing operations and other human activities on the ecosystems where populations occur on the north coast
- ✓ **Socioeconomic:** promote optimal economic use of resources by industrial, medium-scale and small-scale fisheries off the northern coast, as well as the equitable distribution of economic and social benefits of the income generated

The identification of issues was carried out using tables (contruídas) to the case study, containing a preliminary list of categories of issues relevant to the region. The fisheries for shrimp and demersal fish were analyzed in working groups and the results subsequently validated in plenary. The snapper fishery was discussed in plenary. The results are described in Annexes 3, 4 and 5.

5. Risk assessment and issues prioritization

A preliminary qualitative assessment of risks associated with each of the issues identified was made by consensus using the following risk levels and descriptors as a reference:

- ✓ **Low**: Low level of impact, or low probability of a significant impact occuring due to this issue. Objectives will be achieved even if no action is taken
- ✓ **Moderate**: Current level of acceptable impact. Objectives may be compromised if actions are not taken or enforced
- ✓ **High**: Severe impacts are already occurin or will occur in the near future. Management measures in force ineffective. Goals will not be achieved if new actions are not taken

Issues with Moderate and High risk levels were considered priority issues for management. The results are described in Annexes 3, 4 and 5.

6. Identification of key actions for the management of fisheries on shared stocks of shrimp and groundfish

Based on the results of the risk assessment and the discussions during the consultation, a specific set of actions considered key for improving fisheries management of shared stocks were defined.

Monitoring and control

Establishment of a comprehensive programme of monitoring and control, taking into account the need for systematic collection of fisheries data, with standardized methodology, contemplating fisheries, environmental and socioeconomic information.

- ✓ Standardization of methodology for collecting and analyzing data, creating an information system (software) for data storage
- ✓ Assignment of powers and responsibilities in the existing institutional arrangement for monitoring, considering aspects ranging from data collection to the use of information
- ✓ Allocation of budgetary resources to monitoring and control activities: ensuring that these activities are included in Annual and Multiyear National Budgterary Plans (PPA and POA)
- ✓ Qualification and training of human resources
- ✓ Improving compliance with existing tools for fisheries monitoring: log-books, production maps, production reports of fishing activity, invoices, etc.
- ✓ Adequacy and strengthening of mechanisms for control and tracking of fishing vessels, including the Satellite Tracking Program of Fishing Vessels (PREPS)
- ✓ Definition of a policy for accessing the data collected within the control and monitoring programmes, to broaden the base of information available for research and to ensure its proper dissemination to interested parties. In principle it should be sought to universalize the access of users to secondary data

Characterization of fisheries systems

Improve knowledge of the fishery systems exploiting the shared stocks, characterizing the dynamics of fishing fleets, the typology of boats and fishing gear, as well as the support (ports) and processing structures, aimed at understanding the current fishing and processing capacities.

- ✓ Description of fishing gear, including materials and technologies in use: traps, trawls, gill-netting and line (longline and “pargueira”)
- ✓ Description of vessels used in the fishery: type of hull, deck arrangement, gross tonnage, propulsion, crew, equipment to support fishing, etc.
- ✓ Survey of fleet size and characterization of the capacity and power of fishing vessels
- ✓ Survey of installed capacity for landing and processing fish, to identify needs for improvement of infrastructure for receiving, handling, transportation and fish processing
- ✓ Characterisation of working conditions on board fishing vessels, to identify the main risk factors for safety at sea and the necessary measures to improve working conditions
- ✓ Improving handling and packaging of fish on board and disembarkation, in accordance with sanitary standards and requirements
- ✓ Adjustment of credit and development policies to allow the renewal of the fleet, keeping fishing and processing capacities commensurate with the productive capacity of stocks, and to improve infrastructure for unloading, storage, processing and marketing of fish
- ✓ Develop and/or improve credit policies for the artisanal sector adjusted to the local conditions and realities

Assessment of the status of shared stocks in the Guianas-Brazil shelf

Conduct stock assessment studies to assess the state of the main shared stocks and to define fishery-biological parameters (e.g. maximum sustainable yield), with a view to establishing management measures in accordance with the precepts of sustainable exploitation of fisheries resources.

- ✓ Create, in accordance with the EAF framework, demand for studies aiming to: (1) define fishery-biological parameters for target and accessory species; (2) assess the impacts of fisheries on the ecosystem; and (3) assess the socioeconomic conditions of fisheries
- ✓ Develop or revive regional working groups for information exchange and joint evaluation of shared stocks
- ✓ Identification and evaluation of management actions for fisheries, based on updated information about their biological, ecological and socio-economic conditions

Ecosystem impacts

Identification and quantification of major fishery-ecosystem interactions aimed at developing strategies to minimize the impacts of fishing on the ecosystem and reducing the sector's vulnerability to external factors.

- ✓ Improve knowledge about the bycatch species and non-retained species, in order to evaluate the impacts of incidental catches on the state of stocks
- ✓ Improve knowledge about the interaction and incidental capture of protected and/or vulnerable species, such as sea turtles, marine mammals, seabirds, elasmobranchs, etc.
- ✓ Improve knowledge about the impacts of trawl(ing) fisheries on bottom habitats
- ✓ Evaluate and implement management measures to minimize fisheries impacts on the ecosystem
- ✓ Evaluate the degree of exposure and vulnerability of the fishing sector to external impacts arising from environmental changes or economic factors, aimed at developing adaptation strategies to these impacts.

Governance

Knowledge and recognition of the institutional arrangements and the existing legal framework, aiming at the identification and fulfillment of institutional responsibilities, and the identification of the necessary adjustments to improve the system of governance and the empowerment and participation of stakeholders directly and indirectly involved with the fisheries in question.

- ✓ Evaluation and description of the institutional arrangements, skills and responsibilities required in the context of the case study, with the establishment of formal relations
- ✓ Evaluation and description of the legal framework required in the context of the case study
- ✓ Strengthen mechanisms for stakeholder participation in management through the operationalization of existing mechanisms (e.g. Standing Committees for the Management of Shrimp and Demersal Fisheries) and/or development of alternative mechanisms
- ✓ Knowledge, recognition and description of conflicts between fisheries and other economic sectors in order to identify necessary adjustments in institutional arrangements to improve the ability to manage conflict
- ✓ Develop and/or enhance communication strategy between government and the fisheries sectors
- ✓ Identify opportunities and demands for adequate funding / institutional apparatus to carry out the functions of planning and control.

7. Next steps

- ✓ Review of the Report of the National Consultation and EAF Baseline Report considering the contributions of the participants and other stakeholders (contributions to be received until the end of September 2012).
- ✓ Nationally, promote and disseminate the results of the case study to serve as a basis for defining priority actions and synergies between governments (federal, state and municipal) and other stakeholders for the management of shared resources.
- ✓ Regionally, the results of national consultations will inform the development of a regional Strategic Action Programme (SAP) which should be finalized by the CLME Project Coordination Unit before the end of 2012.
- ✓ The SAP developed must be approved by the Ministries of all countries involved, before April 2013 in order to mobilize resources for its implementation.

Annex 1. List of participants

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Annex 2. Agenda of the National Consultation

TUESDAY, 11/09/2012		
PERIOD	**TIME**	**ACTIVITY**
MORNING	9h00	Opening: - Welcome and background: Sérgio Mattos (MPA) - Objectives of the consultation - Work plan and adoption of the agenda
	10h00	Presentation: - Brazil Baseline Report, stakeholder and institutional analysis: Sergio Mattos, MPA
	10h45	**BREAK**
	11h15	Plenary discussion on the topics and key actions for the management of shared resources
	12h30	**LUNCH**
AFTERNOON	14h00	Plenary discussion on the topics and key actions for the management of shared resources
	16h00	**BREAK**
	16h30	Plenary discussion on the topics and key actions for the management of shared resources
	18h30	End of Day 1
WEDNESDAY, 12/08/2012		
PERIOD	**TIME**	**ACTIVITY**
MORNING	9h00	Group work: ✓ Issues identification ✓ Risk assessment and issues prioritization
	10h45	**BREAK**
	11h15	Group work: ✓ Issues identification ✓ Risk assessment and issues prioritization
	12h30	**LUNCH**
AFTERNOON	14h00	Group work: ✓ Issues identification ✓ Risk assessment and issues prioritization
	16h00	**BREAK**
	16h30	Group work: ✓ Issues identification ✓ Risk assessment and issues prioritization
	18h30	End of Day 2
THURSDAY, 13/09/2012		
PERIOD	**TIME**	**ACTIVITY**
MORNING	9h00	Plenary: ✓ Report of working groups on priority issues ✓ Discussion/recommedation on key actions for priority issues
	10h45	**BREAK**
	11h15	Plenary: ✓ Report of working groups on priority issues ✓ Discussion/recommedation on key actions for priority issues ✓ Next steps
	12h30	Closure of the National Consultation

Annex 3. Table of issues and risk levels in the shrimp trawling fishery

Key EAF components	Category	Component/Issue	Threats - impacts	Risk
Ecological wellbeing				
Retained species	Target species	Pink shrimp, *F. subtilis*	- Stock moderately exploted - Lack of control of fishing effort - Number of licenses above the number of vessels in operation	High
		Pink shrimp, *F. brasiliensis*	- Lack of information on exploitation status - Sparse occurrence on the coast of Pará; more frequent in Amapá	High
		Seabob shrimp, *Xiphopenaeus kroyeri*	- Species not targeted in Pará and Amapá, only in Maranhao State	Moderate - High
			- Lack of information on the exploitation status of the stock	High
		White shrimp, *Litopennaeus Schmitti*	- Lack of information on the exploitation status of the stock	High
	Retained bycatch	Various species	- Seasonality in the volume of catches (need for optimization of the catches) - Lack of information on catch compostions (need to identify species by economic importance) - Lack of measures to improve selectivity, including Bycatch Reduction Devices (BRDs)	Low - High
Discarded species	Direct capture	Sea turtles	- Incidental catch insignificant (Tamar Project and Management Plan - IBAMA)	Low
		Marine mammals	- Incidental catch insignificant	Low
		Sea birds	- No interaction with the fishery	Low
General ecosystem	Impacts of fishing on ecosystem structure	Community structure	- Impact of removal of target and bycatch species on the structure of biological communities. There are no mitigation measures in place	High

Key EAF components	Category	Component/Issue	Threats - impacts	Risk
		Habitat	- Impact and modification of bottom habitats. Impact level varies with type of substrate. In the States of Pará and Maranhão: soft (mud) substrate with large load of sediments (low impact). In the State of Amapa sparse hard substrates, with very scanty information on impacts (moderate impact)	Low - Moderate
	Other impacts of fishing	Waste from fishing activity	- Age of the fleet: scrapping of fishing vessels - Spill of diesel and lubricants - Garbage disposal	Low
	Impacts of other economic activities	Impacts on estuaries and mangroves: nursery areas and Protected Areas	- Urban and industrial pollution - Siltation/Deforestation	High
Social and economic wellbeing				
Community well-being	Industry – fishing	Income/jobs (capture sector)	- Decreasing income - Competition with aquaculture - Decrease in the price of shrimp - Employment level stable	High
		Safety at work (capture sector)	- Poor conditions and risk of work on board - Worsening (precariousness) of working conditions due to the state of the fleet	High
	Industry – processing	Income/jobs (processing industry)	- Generally in decline because the catch is sold locally without processing - Decrease in the number of jobs due to the reduced number of industries - Fishing season is currently reduced: economic closure (because of the drop in profitability –average in September) and biological closure - Individual income increased due to the increase in the national minimum wage	Moderate - High
		Safety at work (processing industry)	- Working conditions stable or improving	Moderate

Key EAF components	Category	Component/Issue	Threats - impacts	Risk
	Local dependent communities	Food security	- Sanitary controls less efficient, affecting consumers - Ageing fleet - Lack of legal instrument to regulate the points/places of landing	Moderate
		Access to social services	- Informality of working relations(hips) - Precarious nature of technical assistance and extension services in fisheries and aquaculture - ATEPA: government	Moderate
		Commercialization	- Informality and lack of regulation - Increased informality because of the large number of landing points	High
		Conflicts between fishing sectors	- Conflict between shrimp trawling and bottom gillnet (muruada) for demersal fishes in Maranhão	Low
		Infrastructure	- Inadequate infrastructure: warehouses, fishing terminals, etc.	Moderate
		Credit	- Productive sector (capture and processing) with limited capital - Although there is credit available for fleet renewal, the sector cannot access it due to its poor financial record - More than 30 years without fleet renewal	High
		Piracy	- Occurrence, but without good and reliable records	High
Ability to achieve				
Governance	Management	Management plan	- IBAMA's proposal for a national plan needs endorsement to respond to regional realities	High
		Co-management System	- Division of responsibilities between MPA and MMA and the need to enhance coordination by MPA, which affects the operation of the sector	High
	Consultation/participation	Consultation with industry and other parties concerned.	- Development of policies without proper consultation with all parties concerned - Advisory bodies provided (CPGs) but not yet established - Need for institutionalization: federal, state, municipal, NGOs, industries, etc.	Moderate
	Monitoring	Fisheries monitoring and	- Weak monitoring and control .Need to implement a MCS	High

Key EAF components	Category	Component/Issue	Threats - impacts	Risk
		control	programme - Incipient system of collection of fisheries statistics - Prioritize tools: log books; production report on fishing activity; observers on board, etc.	
	Communication	Flow of information between government and industry	- Lack of a communication programme, with negative impacts on fisheries statistics	High
	Enforcement	Enforcement capacity	- Limited enforcement capacity - Low level of sanctions in the law leads to low level of compliance (e.g. exclusion areas)	High
		Vessel Monitoring System	- Lack of disclosure of VMS (PREPS) data precludes use of data, the evaluation of the system and the improvement in fleet management - Need to improve control and management	High
	Public policies	Policies for fisheries sector	- Need for adaptive public policies - Policies that take into account the dynamic nature of the sector and the dynamics and characteristics of each fleet	Moderate
	International agreements/arrangements	Regional arrangements	- Lack of knowledge about the importance of regional arrangements for fishing - Need to improve intra and inter sector communication in the region	Moderate
		Regional Fisheries Management Organizations	- Groups and regional organizations working to assess the status of stocks and support the shared decision- making no longer active - Need to revive working groups	High
External drivers	Economic/Social	Export markets	- Unfavourable exchange rate for the export products from Brazil - Market instability in importer countries decreased exports	High
		Conflicts with other sectors	- There is no record	Low
		Fuel prices	- Fuel prices caused a sharp increase in the cost of operating the fleet	High

Key EAF components	Category	Component/Issue	Threats - impacts	Risk
	Environment	Environmental/climatic changes	- Need for further studies on the relationship between the discharge from the Amazon River and the abundance of fish stocks and catches - The impacts of other environmental phenomena: ENSO, etc.	High

Annex 4. Table of issues and risk levels in the demersal bottom gillnet fishery

Key EAF Components	Category	Component/Issue	Threat - Impacts	Risk
Ecological wellbeing				
Retained species	Target species	Bagre, *Bagres* spp.	Unlimited growth in fishing effort (many boats - mainly from Pará) Use of multiple vessels working in groups (mother boat and "lices") increases fishing capacity Visible diversification (and reduction) in the size of meshes in use (from 100/90/80 to 70/ 65 mm today) Lack of information about the active fleet (source/ destination/owners) Lack of information about the species and status of stocks Lack of scientific research centred on the management of fisheries resources Need to consider the impacts of the licensed trawling fleet for "multiple fishes"	High (based on the low fecundity and reproductive strategy of the catfishes and sharks that make them more vulnerable to overfishing)
		Gurijuba, *Arius sp.*	Idem	High
		Bandeirado, *Bagre* sp.	Idem	High
		Pescada gó, *Cynoscion* spp.	Idem	Moderate
		Pescada Cambuçu (corvina), *Cynoscion virescens*	Idem	Moderate
		Pescada amarela, *Cynoscion acoupa*	Idem	High
	Retained bycatch	Elasmobranchs (sharks)	Fishing for utilization of by-products (fins). In Amapa this directed fishery is more controlled/inhibited by measures adopted by the ICMBio. In Para it remains uncontrolled	High
Discarded species	Direct capture	Dolphin (*Sotalia* sp.)	Incidental catch. There are studies reporting catches	Moderate
		Cangatá (bagre), *Aspistor* spp.	Lack of information on species and stocks. Species not well appreciated by the market	Moderate

Key EAF Components	Category	Component/Issue	Threat - Impacts	Risk
		Cambéua (bagre), *Notarius grandicassis*	Lack of information on species and stocks. Species not well appreciated by the market	Moderate
General ecosystem	Impacts of fishing on ecosystem structure	Impacts of fishing gear	Fishing corral capturing juveniles of target species in inshore nursery areas. Needs more research	Moderate
	Other impacts of fishing	Ghost fishing	Impact of lost or abandoned gear on fauna	Low
Social and economic wellbeing				
Community well-being	Industry-fishing	Income/jobs	- Fishing hosts people without qualification and without opportunity to work/employment in other sectors (e.g.: ex-miners in Amapa) - At the industry level income is reasonable. Income situation is more critical in Maranhão.In Amapa, the monthly family income of fishers under traditional fishing regime is 1 to 2 times the minimium wage - Concentration and inadequate distribution of income (large difference between shipowner,skipper and crew)	Moderate
		Manpower	- Lack of skilled workers with expertise in different fisheries functions (master, boatswain, fisherman, mechanic, etc.) - Causes loss of production and / or production value - Initiative to create Fisheries Schools is not operational Good example of a Shipyard School in Maranhao	High
		Credit	- There are lines of credit aimed at artisanal fisheries (Pronaf), but with inadequate limits and access conditions - In Amapa there is a state fund for financing small-scale fisheries (FRAP). No such funds exist in the other states - The lack of documentation of fishers hinders access to the available credit	High, for artisanal fisheries
		Conflicts between fishing sectors	- Competition for the same fishing areas by fishing fleets of different scales from the different states in the region - Conflicts between fisheries using different technlogies operating in the same areas (gill-nets/longline/trawling)	High

Key EAF Components	Category	Component/Issue	Threat - Impacts	Risk
			- In Maranhao, conflicts over space between fishers in the fixed gillnet fishery ("muruada"). In Para, driftnet fishing hinders the operation of longline fishing - Theft of fishing tackle and boats (Maranhão) - Illegal activity of foreign fleets (French Guiana and Venezuela)	
		Access to social services	- In the industry access is formalized. In urban centres access is facilitated, whereas in remote areas access is difficult - Absence of itinerant health care services to fishers -The lack of documentation often prevents fishermen from accessing social services. In Amapá most fishers have the national fishery registry document (RGP). In Para most fishers do not even have a national registry (RG).Necessary to carry out itinerant documentation efforts -Lack of knowledge about fisheries occupational health hazards by professionals of the public national social security system (INSS)	Moderate
		Commercialization	Lack of support infrastructure: landing port, warehouse, distribution points, etc. Existence of many links in the market chain from fishers to consumers (middlemen). Dependence of fishers on the one funding the activity Large proportions of fishery products do not pass through sanitary inspection. Absence of sanitary inspection can cause health risk to the consumer High risk generates an issue for the wider community Low utilization of fisheries by-products Misuse of refrigerated trucks provided by the MPA programme	Moderate
		Infrastructure	Lack of basic infrastructure to support production (roads, ports, electricity, communications). The issue is more serious in Amapa	Moderate

Key EAF Components	Category	Component/Issue	Threat - Impacts	Risk
Ability to achieve				
Governance	Management	Management plan	- Lack of organized system oriented towards research and planning - Insufficient scientific research to support management measures - Lack of culture/practice of fisheries management planning (local instances of discussion and planning) - Lack of specific legislation for regulating the use of the main species - There is information available on some of the species, however not published or disclosed - For "piramutaba", it is necessary to review the control measures with a view to facilitating access by artisanal and industrial fishers	High
		Financial management	Low financial and operational capacity of the institutions responsible for planning and management Federal government should allocate funds to finance fisheries management	High
	Consultation/ Participation	Industry participation in management decisions	- Relations(hips) between institutions excessively dependent on people - Lack of operational mechanisms for participation in the planning process (e.g. CPG) - Need to strengthen the participation of fishers - It is necessary to improve communication channels between actors - MPA's policy on Fisheries Territories needs to the revived and enhanced	High
	Monitoring, Control and Surveillance	Monitoring	- Lack of a system of collection of fisheries statistics - Lack of basic information about the fleet - System of identification of the origin and quality of fish insufficient - It is necessary to establish/enhance a global fisheries monitoring system, covering aspects of production, labour, environment, etc.	High
		Enforcement	- Inadequacy of the Navy in inspecting documentation, and in the salvage and the control of foreign fleets in the EEZ	High

Key EAF Components	Category	Component/Issue	Threat - Impacts	Risk
			Lack of operational capacity for monitoring, control and surveillance Enforcement of environmental laws by state and federal authorities insufficient	
	Public policies	Policies to fishing sector	- Ineffective implementation of public policies for the sector - Mismatch between the definition of public policies and their actual need and applicability	High
External factors	Economic/Social	External markets	- Negative impact of imported fish on the price of fish products in the domestic market - Exchange rates - World financial crisis	Low
		Fuel prices	- Variation in fuel prices - High fuel prices increase cost of production. Price of diesel in Oiapoque (BRL 2.55/litre). - Lower prices in neighbouring countries encourage the smuggling of fish across the border.	High
		Conflicts with other sectos	-Possible impacts of seismic research (for the oil and gas industry) along the northern coast - Studies carried out in northeastern Brazil showed no clear impacts of seismic activity on fish and shellfish	Low
	Environment	Environmental/Climatic changes	- Reported presence (occurrence) of higher volumes of jellyfish along the northern coast in recent years, possibly reflecting unknown environmental changes - Rainfall patterns affect fisheries production differently across the region (heaviest rainy season affects artisanal fisheries positively in Amapa and negatively in Para) - Scanty knowledge	Low

Annex 5. Table of issues and risk levels in the line/trap fisheries for snapper

Key EAF Components	Category	Component/Issue	Threats - Impacts	Risk
Ecological wellbeing				
Retained species	Target species	Snapper, *Lutjanus purpureus*	- Stock overexploited - Control of fishing effort ineffective. Illegal fishing by unlicensed fishing vessels significant but not quantified. Weak enforcement capacity allows the operation of unlicensed vessels and the commercialization of illegal catches - Establishment of a fishing exclusion zone beyond 50 meters provides some level of protection. Fishing closure from 15/12 to 30/04 - Juveniles caught by the licensed and unlicensed vessels - Incidental catch of juveniles in the shrimp trawling fishery not quantified	High
		Cioba, *L. analis*	- Need for stock assessment	Moderate
		Ariaco, *L. synagris*	- Need for stock assessment	Moderate
		Dentao, *L. jocu*	- Need for stock assessment	Moderate
		Garoupa, *Epinephelus spp.*	- Need for stock assessment	Moderate
Discarded species	Direct capture	Mero, *Epinephelus itajara*	- Threatened species. Some evidence of incidental catches but not quantified	High
General Ecosystem	Habitat	Impact and modification of bottom habitat	- Incidence of corals in the catch resulting from the contact of the traps with bottom structures	Moderate
	Other impacts	Ghost fishing of lost traps	- Some evidence; need more studies	Moderate
Human well-being				
Community well-being	Industry - fishing	Income/jobs	- Stable situation. No impact on the large-scale fishery. Need to investigate the impact on artisanal fisheries caused by the seasonal fishing closure	Moderate
		Working conditions	Safety at sea is an issue in the fishery with “caique”	High

Key EAF Components	Category	Component/Issue	Threats - Impacts	Risk
		Credit	- Difficulty in accessing formal credit. Informal credit available - Although there is credit available for fleet renewal, access is hindered by poor financial records, registration and required guarantees	High
		Conflicts between fishing sectors	- Conflicts between licensed and illegal fleets - Capture of juvenile snapper in the lobster fishery (with "caçoeira" nets used in lobster fishery)	High
	Industry - processing	Income/jobs	- Apparently stable. Processing industries are not exclusively dependent on snapper	Moderate
		Working conditions (processing industry)	- Need for adjustments in regulation	Moderate
	Local dependent communities	Access to social services	- Informality of labour relations	Moderate
		Commercialization	- Laws that regulate internal and external markets	Moderate
		Infrastructure	- Suitable fish processing on board and ashore: well-organized market chain	Low
		Manpower	Qualification of manpower in the entire production chain	Moderate
Ability to achieve				
Governance	Management	Management plan	- Need to develop management plans that respond to regional realities	High
		Co-Management System	- Shared responsibilities between MPA and MMA and lack of coordination by MPA affects operation of the industry	High
	Consultation/ participation	Participation of industry in management decisions	- Development of policies without proper consultation with all parties concerned - Advisory bodies provided (CPGs) but not yet established - Need for institutionalization: federal, state, municipal, NGOs, industries, etc.	Moderate
		Communication	- Inadequate flow of information, especially between government and industry - Lack of a communication programme, with negative impacts on fisheries statistics	High

Key EAF Components	Category	Component/Issue	Threats - Impacts	Risk
	Monitoring, Control and Surveillance	Monitoring	- Weak monitoring and control - Need to implement a MCS programme - Incipient system of collection of fisheries statistics - Prioritize tools: log books; production report on fishing activity; observers on board, etc.	High
		Enforcement	- Limited enforcement capacity - Low level of sanctions in the law leads to low level of compliance (e.g.: exclusion areas) - Lack of disclosure of VMS data (PREPS) precludes use of data, the evaluation of the system and the improvement in fleet management	High
	Public policies	Policies to fisheries sector	- Need for adaptive public policies. Policies that take into account the dynamic nature of the sector and the dynamics and characteristics of each fleet	Moderate
External drivers	Economic/Social	External market	- Currently the fishery is not dependent on the external market. Internal market more attractive to the industry Fishery affected by the laws of the market	Moderate
		Fuel prices	- High fuel price increased operational costs - Subsidies are important, but not determinant for profits - High value of the product worth the risks	Moderate
		Conflict with other sectors	- There are no reports of conflicts in the region	Low
	Environment	Environmental/climatic changes	- There are no studies in the region	-

Annex 6. Importance of including the fishery for spiny lobster, *Panulirus argus* (Latreille, 1804), as pontential case study in the application of the ecosystem approach to the Guiana-Brazil shelf and transboundary analysis

The case study on "Shared fish stocks on shrimp and demersal fish on the Brazil-Guianas continental shelf", part of the CLME Project, clearly highlights the need to prioritize the shared stocks mentioned above. However, participants of the National Consultation recognized the need to identify other resources that are widely distributed on the continental shelf in question and that, even if there are no targeted fisheries in each of the other five countries, they would deserve more attention in the analysis of transboundary issues.
In this context, the fishery for red lobster, *Panulirus argus* (Latreille, 1804), was considered a potential case study for further analysis. The species is of high socio-economic importance in Brazil. Available information indicates that there is a single population widely distributed along the Brazilian coast and the Caribbean.

Brazil has five species of lobster. Red lobsters *Panulirus argus* and Cape Verde lobsters *Panulirus laevicauda* are the most important fisheries in the northeast and the main targets of fishing. The other species are: "lagostinha", lobster and crab-shoe which are captured on a smaller scale.

The lobster fishery operates along the Brazilian coast, from Amapá to Espirito Santo state (Figure 1). It is an activity of high social and economic importance to the country, involving about 15 000 fishers, and generating foreign exchange between USD 70 and 80 million in the last three years.

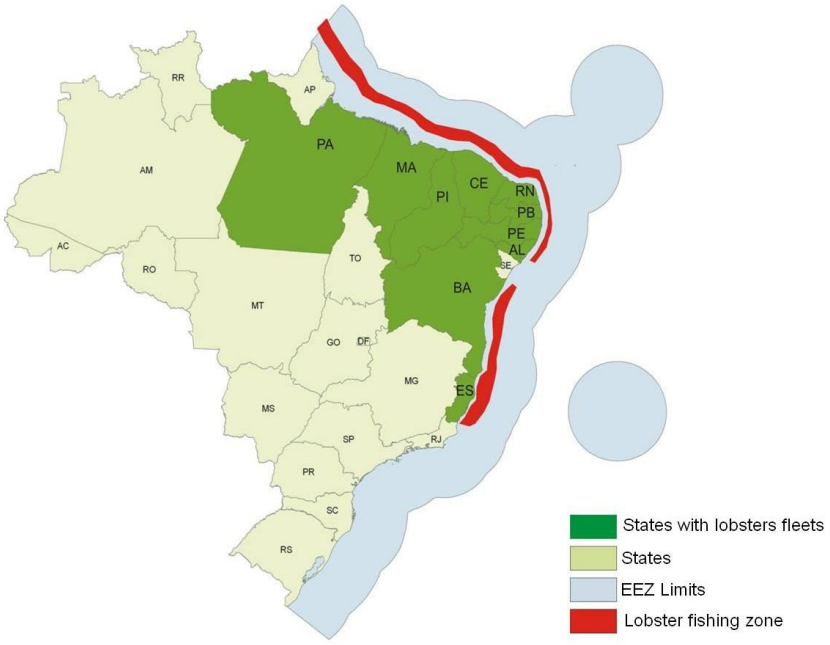

Figure 1 – Lobster fishing area off Brazil, expanded after 2000

The frantic search for the resource, coupled with the failure of management measures and a lack of controls, led to instability in production and signs of overfishing. The production, which reached 11 059 tonnes in 1991, is today approximately 7 000 tonnes. This decrease in production is due to increasing fishing effort, which can lead to a stock collapse in the short term. Brazil is the third largest exporter of lobster in the world and to reverse this situation of falling production, the need for implementation of management measures was recognized in the Lobster Management Plan. In addition, actions for certification of fishing activity, through campaigns for conscious consumption of crustaceans and a plan with measures to prevent overfishing were put in place. Prepared by the

Management Committee for the Sustainable Use of Lobster, coordinated by IBAMA and with the participation of civil society, the Management Plan reflects the concern for this important natural resource. The Management Plan provides a set of measures such as the re-registration of vessels, training of fishermen and enforcement actions. The "caçoeira" net was banned and the fishery is currently only allowed to use traps (traps or manzuás). The closed season was increased from four to six months, established from 01 December to 31 May each year, allowing more time for reproduction of the species.

The measures in force, provided by the Management Plan, aimed at restoring and sustaining this traditional fishery are: control of fishing effort according to the rebuilding (renewal) capacity of the lobster stocks resizing and licensing of the fleet, substantially reducing the number of boats operating illegally; allowing fisheries to use only traps; ban on fishing within four miles of the coast, establishing a nursery area of juvenile lobsters; expansion of the reproductive closed season from December to May, and determination of minimum catch sizes and marketing of red lobsters: 13 cm tail and Cape Verde lobster: 11 cm tail (Normative Instructions or Code IBAMA nº 138, 2006, No. 144 and No. 159 of 2007).

The exploitation of lobsters along the Brazilian coast began in 1955 in the state of Ceará, reaching the states of Pará and Amapá in the late 90s. Studies conducted by Porto, Cintra & Silva (2005)[2] on certain aspects of the red lobtser fishery in northern Brazil indicate that this species is the most abundant, followed by *Scyllarides delfosi*. The cities of Bragança and Augusto Corrêa, in Pará, are the main landing ports in the north. The size of the captured individuals showed a maximum amplitude of 6.1 to 17.4 cm carapace length observed in males, with an average length of 10 cm for sexes grouped together.

There are two distinct fishing grounds, located off the states of Amapá and Pará, between latitudes 03°50'N (Amapá) and 01°30'N (Para) (Figure 2). Fishing grounds off Amapa are situated at depths from 80 to 100 m, with bottom substrate usually consisting of sand, rocks and coral, and located approximately 115 miles from Cape North. Fishing grounds off Para are situated at depths between 60 and 92 m and the substrate is variable, sometimes consisting of sand, and sand stones and corals, being located at a distance of about 140 miles from the city of Bragança (Porto, Cintra & Silva, 2005)[2].

The fishing area is shared by artisanal and industrial fleets. Artisanal boats are usually made of wood and of varying sizes, usually ranging from 10 to 15 m, using ice as a means of conservation in fishing operations conducted with "caçoeira" nets. The industrial vessels, five in number in 2001, are of steel hull, with an average length of 22 m. They are equipped with navigation devices and communication system, have onboard freezing capacity, and fish with traps. In the years 2002 and 2003 there were only records of artisanal vessels operating in the fishery (Porto, Cintra & Silva, 2005)[2].

Export

It is estimated that only 10 percent of the lobster is consumed in the country, with the majority, 90 percent of production exported to the United States. Currently there are actions for maintaining the live lobster that, when captured in the size permitted by law, comes to the industry with a 30 percent higher value. There is a need to diversify and search for other markets, but for this, it is necessary to improve the quality of the product.

[2] Porto, V.M.S.; Cintra, I.H.A.; Silva, K.C.A. Sobre a Pesca da Lagosta-Vermelha, Panulirus argus (Latreille, 1804), Na Costa Norte do Brasil. Bol. Téc. Cient. CEPNOR, Belém, v. 5, n. 1, p. 83-92, 2005

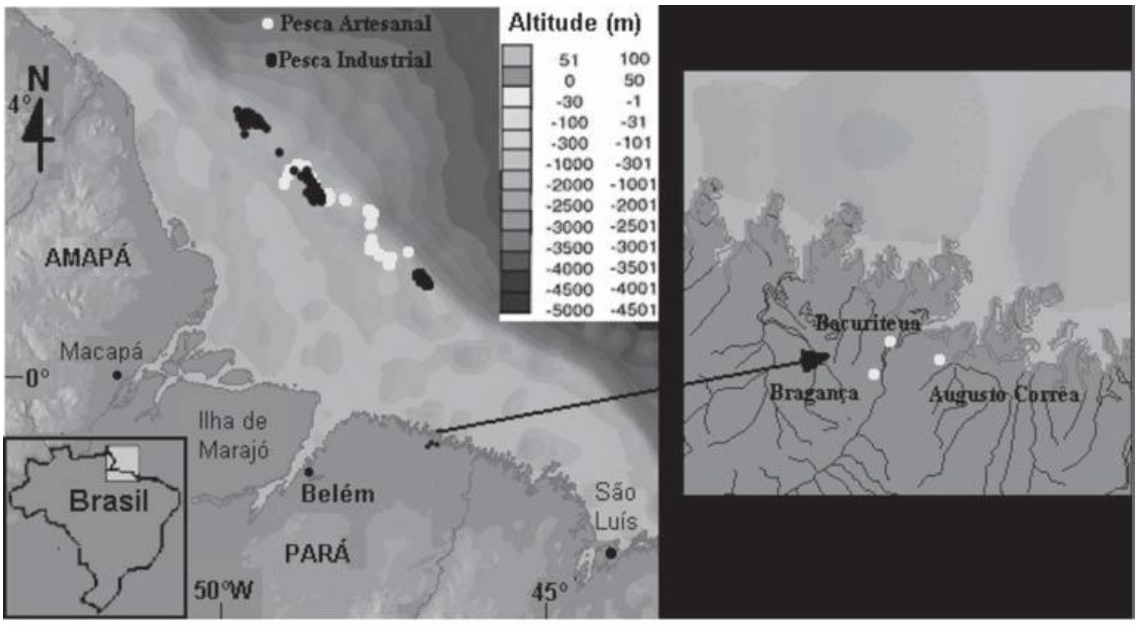

Figure 2 – Area of operation of lobster fisheries off northern Brazil (Porto, Cintra & Silva, 2005)[2]

Annex 7. Baseline report

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Ministério da Pesca e Aquicultura (MPA)[3]

Foreword

As part of the Caribbean Large Marine Ecosystem Project (CLME), pilot projects and case studies on specific transboundary fisheries were implemented to verify models of governance at local, national and subregional levels, to provide additional knowledge about the means of applying the Ecosystem Approach to Fisheries management and to determine the socio-economic and the sensitivities of the fisheries for improving knowledge on shared stocks of the shrimp and groundfish fishery on the Guianas-Brazil shelf.

One of the activities to be undertaken under the Caribbean Large Marine Ecosystem Project (CLME) is desk studies on the management of the main fisheries, including their socio-economic significance. For the areas under the project, a review will be undertaken for every major fishery type in each country and at the regional/subregional level. The EAF-Baseline (EAF-BL) is an agreed baseline for the fishery before introducing EAF in the management of the resource in question. It should be a reference material for EAF planning and should provide reference points for monitoring and evaluation of EAF activities and management actions.

In the case of Brazil, the baseline report includes relevant information to support the implementation of the ecosystem approach to shrimp and groundfish fisheries of the Guianas-Brazil shelf fisheries, more specifically to the fisheries that operate off the northern Brazilian coast.

The information provided in this report was gathered from that already available in the documents listed below:

- ✓ Proposta de Plano de Gestão do Uso Sustentável de Camarões do Brasil (Draft of a National Management Plan for the Sustainable Use of Marine Shrimp Species in Brazil), proposed by Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA)[4]
- ✓ Pesca Industrial de Camarões na Costa Norte do Brasil: Síntese do Conhecimento (Industrial Fishery of Marine Shrimps off Brazil's North Coast: synthesis on the state-of-the-art), prepared by the Secretaria de Planejamento e Ordenamento da Pesca do Ministério da Pesca e Aquicultura[5]
- ✓ Diagnóstico da Pesca e Aquicultura do Estado do Pará (Diagnostic of the Fishery and Aquaculture of the State of Pará, Northern Brazil), prepared by a team of researchers linked to the Universidade Federal Rural da Amazonia (UFRA)[6] and technicians linked to the Sindicato da Indústria de Pesca dos Estados do Pará e Amapá (Sinpesca)[7]
- ✓ Boletim Estatístico de Pesca e Aquicultura 2010 do Ministério da Pesca e Aquicultura[8]

Introduction

The serious problems facing Brazil's extractive fishing industry are relatively easy to identify and stem mainly from the over-sizing of the means of production in the face of relatively low abundance of marine fisheries resources, as a result of reduced productivity of Brazilian waters, a situation exacerbated by environmental degradation of coastal environments resulting from human activity, particularly pollution (urban, agricultural and industrial). Aggravating the problems is the use of

[3] Ministry of Fisheries and Aquaculture.
[4] Brazilian Institute of Environment and Renewable Natural Resources.
[5] Secretariat of Fisheries Management and Regulation of the Ministry of Fisheries and Aquaculture.
[6] Federal Rural University of the Amazon(ia).
[7] Pará and Amapá States Fishing Industry Union.
[8] Statistical Bulletin of Fisheries and Aquaculture of 2010 of the Ministry of Fisheries and Aquaculture.

inappropriate fishing methods, with a high incidence of catches of juveniles and inappropriate management measures, in some cases incompatible with the sustainability of the activity. On the other hand, the maximum sustainable yield of many fish stocks is simply unknown, especially their biological characteristics, essential basic information for a proper management of their sustainable exploitation. This deficiency further complicates the already poor awareness on the part of the productive sector about the natural limits of sustainable exploitation.

The exploitation of fishing resources in Brazil was historically developed based on an excessive fishing effort and concentrated on a small group of fishing resources traditionally fished on the continental shelf. The fisheries also developed in a disorganised manner, poorly planned and without the participation of the productive sector. As a result, most coastal marine stocks are currently fully exploited or overfished, with their fisheries presenting low yield, while the fishing industry is facing a serious economic and social crisis. Lack of statistical data on the fishing activity constitutes a serious problem for its diagnosis and for the implementation of management measures.

Brazil, despite its long coastline (about 8 500 km) and large marine area (nearly 4 million km^2 of Exclusive Economic Zone, EEZ), produces about 500 000 tonnes through marine fisheries, which represents only 0.5 percent of world fishing production. The fish production in Brazil showed rapid growth from 1967, due to an intense process of industrialization promoted by subsidies introduced by the Decree-Law Nº 221 of 28 February 1967. The recent registration of the marine fishing fleet carried out by the Secretaria Especial de Aquicultura e Pesca da Presidência da República (SEAP/PR)[9] and IBAMA, registered 63 868 fishing vessels, of which 41 838 propelled by rowing and/or sails (65.5 percent); 20 287 small motorized boats with a wooden hull (31.8 percent); and only 433 medium and large-sized motorized boats with a steel hull. It can be inferred that the fleet that operates in Brazilian waters is predominantly artisanal and small-scale.

In the context of the fishing sector as a whole, the artisanal and small-scale fisheries contribute the largest share of production for direct consumption by the local population, as the industrial segment is dedicated mostly to satisfying the export market. The overexploitation of coastal ecosystems has, on the one hand, significantly decreased productivity and individual income per fisher/boat, pushing the semi-industrial and industrial fishing fleet to expand their activities to more distant waters, including oceanic areas.

In some areas, particularly in the north and northeast regions of Brazil, deficiencies in infrastructure (harbour, ice factory, storage and processing), hinder or even prevent the development of-coastal fishing, compromising the quality of the fish and reducing, at the same time, the activity's competitiveness. The extent to which the fish has to be marketed (in nature), tends to increase the involvement of middlemen in the value chain, consequently reducing fishers' profitability. The traditional fishing communities have, in general terms, a low human development index, lacking basic services such as education, health and sanitation. As a result, fishers generally have a low level of education, demanding specifically customized programmes for capacity building, training, and conservation, which are not readily available. Furthermore, deficiencies in training and qualification of skilled labour to perform tasks on board, hamper the introduction of new and modern fishing technologies, such as (GPS, echo sounder, autopilot, etc.).

Brazilian fish production in 2010 reached 1 264 765 tonnes, an increase of 2 percent over 2009, when 1 240 813 tonnes of fish were produced. Marine fishing remained the main source of national fish production, accounting for 536 455 tonnes (42.4 percent of the total catch), followed successively by continental aquaculture (394 340 tonnes, 31.2 percent), inland (248 911 tonnes, 19.7 percent) and marine aquaculture (85 057 tonnes, 6.7 percent). In 2010, there was a reduction of 8.4 percent in marine extractive fishing over 2009, resulting in a decrease of 49 217 tonnes. On the other hand, the production of inland extractive fishing, as well inland and marine aquaculture increased as compared to 2009, by 3.9 percent, 16.9 percent and 9 percent, respectively.

[9]Special Secretariat of Aquaculture and Fisheries of the Presidency of Brazil.

In 2010, the Northeast Region was the largest fish producer in the country with 410 532 tonnes, accounting for 32.5 percent of national production, followed by the South, North, Southeast and Midwest Regions, with 311 700 tonnes (24.6 percent); 274 015 tonnes (21.7 percent); 185 636 tonnes (14.7 percent) and 82 881 tonnes (6.6 percent), respectively. In the Northern Region of Brazil, where the shrimp and groundfish fisheries are located, in 2010 the marine fishing production reached 93 450 tonnes of fish (17.4 percent of the total catch), behind the Northeast (195 842 tonnes, 36.5 percent) and the Southern Regions (156 574 tonnes; 29.2 percent) and ahead of the Southeast Region (90 589 tonnes; 16,9 percent).

Analyzing the historical series (1950-2010) of data on fisheries production in Brazil, there is a marked increase in the catch from 1950 until 1985 when the highest production was recorded, reaching 956 684 tonnes. During this period, the most important political events were the industrialization programme, implemented through the creation of the Superintendência do Desenvolvimento da Pesca (SUDEPE)[10] in 1962 and the promulgation of the new Fisheries Code (Decree-Law # 221, of 28 February, 1967), which have driven the growth of the fishery until 1985. Between 1986 and 1990, there was a gradual decline in catches when fish production decreased from 946 560 to 619,805 tonnes, evinced by the beginning of the process of overfishing of some important commercial fishing stocks, such as the sardine, shrimp and groundfishes in the Southeast and Southern Regions. In addition, in the mid 1980s, there was the removal of subsidies, which also contributed to the decline in fish production between 1985 and 1990. From 1990 to 2000, fish production was characterized by a period of stability. From 2000, production increased again, from 666 846 to 825 164 tonnes in 2009. This increase is mainly due to the recovery, although slight of some stocks, such as sardine (Figure 1).

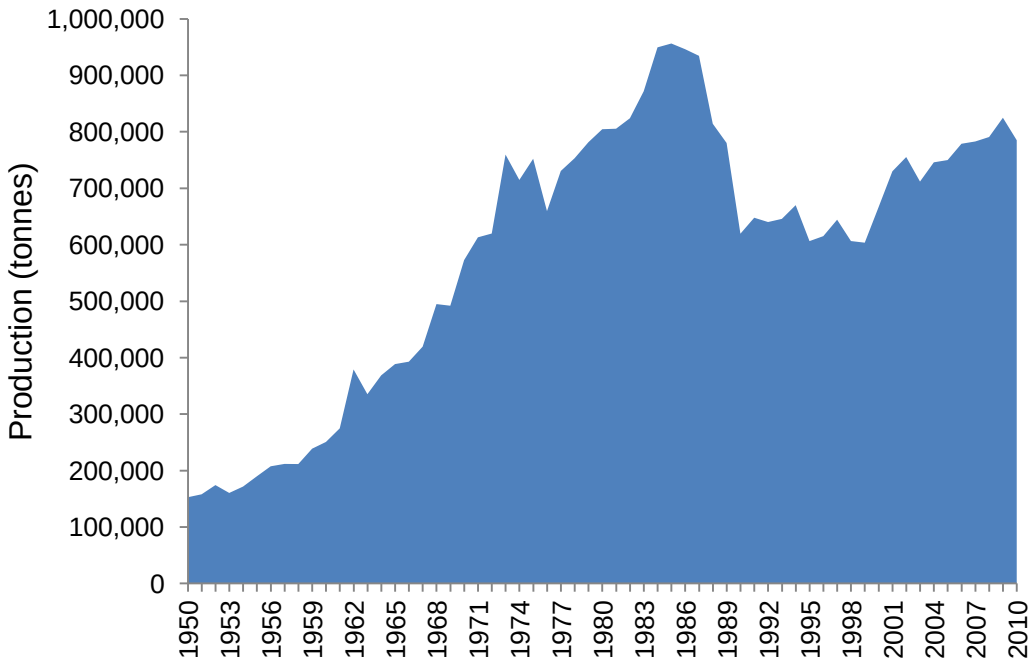

Figure 1. Capture fisheries production of Brazil (marine and inland), in tonnes, from 1950 to 2010

Moreover, it is noteworthy that since 2003, through SEAP/PR[6] and then MPA[3] together with the Ministry of Environment (MMA) in a process of shared co-management, the promotion of public policies has not only enhanced the national fishing production sector, but also boosted the country's investment in the sector. Although there was a decline in the catch between 2009 and 2010, when production amounted to 785 366 tonnes, the period between 2000 and 2010 was characterized by a recovery in national fish production, compared with the previous decade (Figure 1).

[10] Superintendency for the Development of Fisheries

According to FAO, the aquaculture production in Brazil started in 1968 with less than 0.5 tonnes. Since then, the domestic aquaculture has shown a gradual increase, attaining, in 2003, a production as high as 273 268 tonnes. After a slight drop in 2004 and 2005, production rose again, registering the highest values in 2008, 2009 and 2010, with 365 367 tonnes, 415 649 tonnes and479 39 tonnes, respectively (Figure 2).

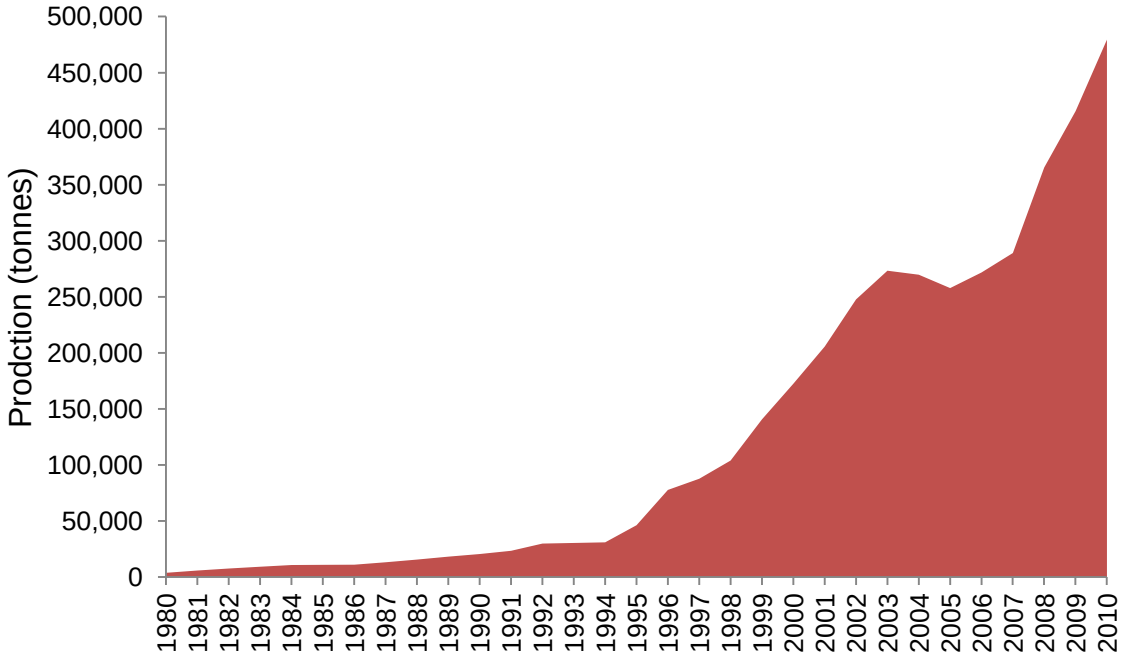

Figure 2. Aquaculture production of Brazil, in tonnes, from 1950 to 2010

1. Is there a Management Plan for the fishery?

Evaluating the process for the management of the fishery sector, the Ministry of Fisheries and Aquaculture of Brazil highlights the need to define spaces, territories, and ecosystems where each of the economic segments – artisanal, industrial and recreational fishery – exist and/or co-exist, with each other in their specific areas, with institutional legitimacy and through a transparent, orderly and robust process. Initially we recognized the need to define basic concepts and methodological frameworks for the establishment of Steering Management Committees and the definition of Management Units, with a holistic view on the potentialities and fragilities of the fishery sector, both for marine and inland waters. Presently, there is a draft national management plan for shrimps that, although finalized, has not been officially approved. Five shrimp species, considered overexploited, were assessed: *Farfantepenaeus brasiliensis* (Latreille, 1817), *Farfantepenaeus paulensis* (Pérez-Farfante 1967), *Farfantepeaneus subtilis* (Pérez-Farfante, 1967), *Litopenaeus schmitti* (Burkenroad, 1936), and *Xiphopenaeus kroyeri* (Heller, 1862).

According to the management plan, the management of the shrimp fisheries in Brazil has as its main objectives: (a) restoration and maintenance of ecologically sustainable levels of stock biomass; (b) minimizing the impacts of fishing operations on the ecosystem, with emphasis on the reduction of bycatch and incidental catches; and (c) ensuring optimal resource utilization and equitable distribution of economic benefits.

Management measures for the shrimp fishery off northern Brazil have been adopted since 1980 and are aimed primarily at industrial fishing, based on the results of the studies conducted by the Centro de

Pesquisa e Gestão dos Recursos Pesqueiros do Norte do Brasil (CEPNOR)[11]. The measures are intended, primarily, to control the fishing effort of the industrial fleet and to protect the recruitment of juveniles in breeding and fishing areas and, to some extent, the spawning stock.

Therefore, considering the need to define specific objectives, and adopt strategies to achieve these objectives, and corresponding performance indicators, the proposed management plan considers the following overarching topics:

- ✓ *Fishing & Biological*, in order to maintain ecologically sustainable levels of stock biomass of the shrimp resources off Brazil's north coast.
- ✓ *Ecological*, to minimize the impact of fishing operations and other human activities on ecosystems where the shrimp resources can be found off the northern coast.
- ✓ *Socioeconomic*, to promote optimal economic utilization of shrimps by the small and medium-sized and industrial fishing systems off the northern coast and the equitable distribution of economic and social benefits of the generated income.

There are no management plans for groundfish fisheries.

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

The Brazilian Government is trying to establish public policies and development plans that are inextricably linked, but their implementation requires the appropriation of the basic principles of participatory management or comanagement. The concepts of participatory management are not new, but efforts to put them into practice started only recently in Brazil, seeking to involve the community and their agents, in a sustainable development agenda. Thus, one important challenge facing the government is to facilitate access to the existing public policies by the more distant fishers and stakeholders. Even though the current policies of increased societal participation in management decisions represent an advance over past policies, their implementation still poses a challenge. Only by establishing the conceptual foundations of participatory management, will it be possible to break down the barriers to the implementation of any existing policy. Otherwise, the adoption of these fundamentals will still seem inaccessible to artisanal fisheries, which are also incorporated by social researchers and national planning institutions studying the activity. It can be seen that there is a global trend, rather than recognition, to put on the agenda the current situation and development prospects of small-scale fisheries.

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

- ✓ *Law No.11958 of 29 June 2009*. Provides for the transformation of the Special Secretariat of Aquaculture and Fisheries of the Presidency into the Ministry of Fisheries and Aquaculture, among other measures. The legal instruments mentioned define the responsibilities of the Ministry of Fisheries and Aquaculture and the Ministry of Environment (Article 27, Sections XV and XXIV).
- ✓ *Law No.11959 of 29 June 2009*. Provides for the National Policy for Sustainable Development of Aquaculture and Fisheries, regulates the fishing activities, abolishes Law No.7679 of 23 November 1988, and articles of Decree-Law No. 221, of 28 February 1967, and other measures.
- ✓ *Decree No.6981 of 13 October 2009*. Establishes the "system of shared management of sustainable use of fisheries resources", in which the Ministry of Fisheries and Aquaculture and the Ministry of Environment have joint responsibility, under the coordination of the former, for

[11] Research and Management Centre of Fishing Resources for the North Region of Brazil.

setting rules, criteria, standards and measures for the development and sustainable use of fishing resources. To implement the system the Ministries must: (a) define a management plan; (b) set up (define) a management unit; (c) establish a system of shared management of the sustainable use of fisheries resources, in order to support the development and implementation of rules, criteria, standards and measures for development; (d) state that "in the absence or insufficiency of scientific data, the precautionary principle should be applied"; (e) ensure that "the rules, criteria, standards and measures for managing the fisheries are established in all acts by both Ministries, based on information provided by the shared management system"; (f) establish the Technical Committee for the Management of Shared Fishing Resources (CTGP), an advisory forum to coordinate the activities of the shared management system; (g) ensure that the coordination and the necessary administrative support of CTGP is provided by the Ministry of Fisheries and Aquaculture; and (i) provide that a joint act of MPA and MMA may create committees, technical councils and working groups related to CTGP, among other things.

- ✓ *Inter-ministerial Normative Code No.2, of 13 November 2009*, of the Ministry of Fisheries and Aquaculture and the Ministry of Environment, states that among the various aspects worth highlighting: (a) the activities under the responsibility of the Ministry of Environment relating to the Shared Management System may be implemented by IBAMA[2] and Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio)[12]; (b) states that the Shared Management System is composed of committees, technical councils and working groups; (c) provides that the committees are advisory and consultative bodies designed to define rules, criteria, standards and measures to regulate the sustainable use of fisheries resources; (d) states that the committees and boards have equal representation in terms of state representatives and civil society; (e) provides that each committee should be formed in accordance with the management unit; (f) states that each committee will be assisted by scientific subcommittees, monitoring subcommittees and technical councils; (g) defines the profile of members of the subcommittees and technical councils; and (h) provides that the Management Plans for the Sustainable Use of Fishing Resources should be developed by each specific committee, taking into consideration the management unit and any measures or long-term actions, and where possible, the ecosystem approach, which may be revised periodically.
- ✓ *Normative Code No 9, of 14 September 2004*, of the Ministry of Environment. Every year, from 15 October to 15 February, the practice of trawling with motorized boats for catching pink shrimp (*Farfantepenaeus brasiliensis* and *Farfantepenaeus subtilis*), white shrimp (*Litopenaeus schmitti*) and seabob shrimp (*Xiphopenaeus kroyeri*) is prohibited in the area between the border of French Guiana with Brazil (the line that has the true bearing of 41°30': from the point defined by latitude 4°30'30"N and longitude 51º38'12"W) and the border between the States of Piauí and Ceará (meridian 41°12'W).
- ✓ *Normative Code nº06 of IBAMA, of 7 June 2004.* To establish closed seasons for the trawling fleet that target catfish (piramutaba, *Brachyplatistoma vaillanti*), limits the fishing fleet involved in the capture of piramutaba and other catfishes (order Siluriforme) at the mouth of the Amazon River and Pará State and others measures. The main management measures are: (a) to prohibit, every year, from 15 September to 30 November, the practice of trawling targeting piramutaba, in its entire catchment area; (b) prohibit trawling, under any system, in a natural habitat of aquatic species in estuarine areas of the Amazon River and the State of Pará, in the area stretching from the limits defined by the parallel 00°05'N and meridian 048°00'W; and (c) to limit the trawling fleet targeting piramutaba and other catfishes (order Siluriforme), outside the defined area mentioned above, to forty-eight vessels.
- ✓ *Ordinance nº73, of 9 September 1996, of IBAMA.* To prohibit in the State of Amapá the capture catch of catfish (gurijuba, *Tachystrus* spp), annually, from 1 November to 31 March, in the area between the mouths of the Araguari and Cunani Rivers, up to the limit of three nautical miles; and around the Islands of Maracá and Jipióca (up to 3 miles). In the area previously mentioned, only fishing with the hook & line and longline shall be permitted.
- ✓ *Interministerial Normative Code nº1, of 1 November 2009*, of the Ministry of Fisheries and Aquaculture and the Ministry of Environment. To permit, in the area between the northern

[12]Chico Mendes Institute for the Conservation of Biodiversity.

boundary of the State of Amapá and the border between the states of Alagoas and Sergipe (Foz do Rio São Francisco), the fishing of red-snapper (*Lutjanus purpureus*), beyond the isobaths of fifty-metre depth. The vessels authorized to fish for snapper in the area mentioned are obliged to use a satellite tracking device fitted on board each vessel, under the National Programme of Vessel Monitoring System (VMS), during the fishing operations and to hand over the logbooks.

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

According to Brazilian Law No. 11958/2009, the authority to set rules, criteria, standards and management measures for the development of sustainable use of fisheries resources is the Ministry of Fisheries and Aquaculture (Ministério da Pesca e Aquicultura: MPA), jointly with the Ministry of Environmental (Ministério do Meio Ambiente: MMA), coordinated by MPA.

As mentioned above, the Decree No.6981 of 13 October 13 2009, established the "system of shared management of sustainable use of fisheries resources", in which the Ministry of Fisheries and Aquaculture and the Ministry of Environment have joint responsibility, under the coordination of the former, and the Inter-ministerial Normative Code No.2, of 13 November 2009, of the Ministry of Fisheries and Aquaculture and the Ministry of Environment, settled that the responsibility of the Ministry of Environment for the Shared Management System may be implemented by IBAMA[2] and ICMBio[10].

The National Policy of Sustainable Development of Fisheries and Aquaculture, established by Law # 11959/2009, defines as general objectives for national fisheries:

I. Sustainable development of fisheries and aquaculture as a source of food, employment, income and leisure, ensuring the sustainable use of fisheries resources, as well as optimizing the resulting economic benefits, in harmony with the preservation and conservation of the environment and the biodiversity.
II. The regulation, the promotion and the inspection of the fishing activity.
III. The preservation, the conservation and the restoration of the fisheries resources and the aquatic ecosystems.
IV. The socio-economic, the cultural and professional development of those involved in the fishing activity, as well as of their communities.

This same Law also states, in its Article # 3, that the Ministry of Fisheries and Aquaculture should decide on:

- ✓ The access scheme
- ✓ Total allowable catch
- ✓ Sustainable fishing effort
- ✓ Closed (Fenced) seasons
- ✓ Fisheries seasons
- ✓ Size of the catches
- ✓ Prohibited areas or reserves
- ✓ Gear, equipment, methods and systems of fishing and farming
- ✓ Carrying capacity of the environments
- ✓ The necessary actions for monitoring, control and surveillance of the fishing activity
- ✓ The protection of individuals in the process of reproduction or rebuilding of stocks.

5. *Overview of the fishery and resources exploited*

Four main fisheries on shared resources in northern Brazil are identified: industrial shrimp trawling; bottom gillnet fisheries targeting demersal fish; line/trap fisheries focused on the snapper; and trap (covo or manzuá) fisheries for lobsters. Whereas the lobster was not the purpose of the case study, this fishery was not analyzed in detail during the consultation. However, given the importance of the fishery to Brazil and other Caribbean countries, it was recommended that it be properly addressed in the future by the CLME Project. In this regard, a summary of existing information on lobster fishing in Brazil was prepared and included in this baseline report.

Coastal areas are characterized by an extensive continental shelf, shallow waters, high water nutrients and a broad fringe mangrove forest. These conditions combine to create an area of high potential biological productivity. Estimates of total biomass suggest that the productivity is high and this is supported by the available statistics, although the commercial fisheries resources are fully or over-exploited. Also, available scientific information indicates that there is seasonality within the catches taken locally, but these tend to reflect local migrations, because a production/productivity fall in one area may be, to an extent, compensated by a rise elsewhere. The abundance of shrimp and groundfish resources is also influenced by environmental factors affecting general productivity.

A general overview of the fisheries can be found in Campbell & Temple (1987)[13]. Vessels vary considerably in size and the gear used by each fishery and is determined by economics, physical space and the propulsion method used.

5.1. *Details of fishing gear used and areas fished*

According to Aragão, Cintra, Silva & Vieira (2001)[14], the shrimp fisheries on the northern coast of Brazil are conducted by small and medium-scale boats, as well as industrial iron-hulled boats. Information on artisanal and small scale fisheries in the region is scarce and often outdated. There are no reliable statistics on the landings or the number of boats in operation. Descriptive information of such fisheries is available for the States of Maranhão and Pará, where they operate intensively. The artisanal fisheries are conducted in estuaries, bays and shallow waters near the coast. Fishing operations are carried out with fixed fishing gear called "zangaria" (scoop net), deployed depending on the tide, and small towed trawl nets ("puçá-de-arrasto" and "puçá-de-muruada"), operated manually, as well as larger trawl nets, also operated manually, aided by a small boat. One of the greatest difficulties in obtaining data is the wide dispersion of the landing sites. The lack of basic information on these fisheries makes it impossible to assess the level of exploitation of the target resources and any impacts of the activity on the environment.

According to those same authors, the types of boats used in the industrial shrimp fisheries are generally similar to the ones operating in the Gulf of Mexico. They are iron or steel-hulled boats, of about 24 m long, 6.5 m wide and main engine power ranging from 365 to 425 Hp. They are equipped with modern navigation equipment, communication system and on board freezing capability. They generally use double trawl nets and usually undertake four hauls per day, lasting about 5-6 hours during the period of higher productivity, and two night hauls, lasting slightly longer in the off season undertaking, usually, between 4-6 trips during the year, lasting 40 to 60 days. Their crew are composed of five men, on average. Industrial boats are mainly based in Belém, Pará State, but some are based in the State of Ceará. The total fleet was more than 250 boats, but in 2006 the fleet consisted of only 123 units: 108 in Pará State and 15 in Ceará State. Today, 101 industrial fishing boats are licensed, but only 60 are in operation, probably due to economic circumstances.

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[13]Campbell, J.; Temple, C. 1987.Report On The Fact Finding Mission To Brazil: O.D.A. Field Trials Of Artisanal Fishing Vessels. Macalister Elliot And Partners Ltd.

[14]Aragão, J.A.N.; Cintra, I.H.A.; Silva, K.C.A.; Vieira, I.J.A. A explotação camaroeira na costa Norte do Brasil. Bol. Téc. Cient. CEPNOR, Belém, v.1, n.1, p. 7-40, 2001.

Groundfish fisheries are manly conducted by small and medium-sized boats, which may be sail or engine powered. The boats are typically 8-12 m in length, with a crew of four, on average, using bottom drift gillnet and longlines, targeting catfishes, croakers, mullet, snappers and groupers. The exception is the snapper vessels that are the largest in size ranging from 15 to 20 m and powered by inboard diesel engines. Some villages operate large stationary fish traps made from galvanized chain link fence supported by mangrove posts and the traps usually have long wings, which guide the fish into a series of central traps.

The commercial fishery (fishing) targeting demersal fish species in the Brazil-Guianas shelf started using bottom longline as the main fishing gear aimed at catching catfish species. The use of gillnet was incipient until the mid 1950s and the existing gillnets were made of cotton line (Meschkat, 1960)[15]. Subsequently, the use of the nylon gillnet of monofilament or multifilament line became widespread, currently the fishing device more commonly used in shallower areas (<20 m) off the coast. Recently, the Brazilian Government allowed the operation of otter twin trawls fishing in a specific polygon of the shelf for the catch of several fish, mainly marine croakers (Sciaenidae) and catfishes (Ariidae).

5.2. Give brief information on the resources exploited

Industrial shrimp trawling

In the Brazil-Guianas shelf there is a large shrimp stock, extending from the State of Maranhão in Brazil up to near the mouth of the Orinoco River, in Venezuela. The industrial exploitation of the resource began in 1959 with the operation of a foreign fleet with a maximum number of 421 vessels in 1970 (Naidu & Boerema, 1972)[16]. The fishery operates in an area between the mouth of the Parnaíba River (02º53'S), in the state of Piauí, and the mouth of the Oiapoque River (04°23'N), on the border with French Guiana, along the coast of the States of Maranhão, Pará and Amapá (Figure 3).

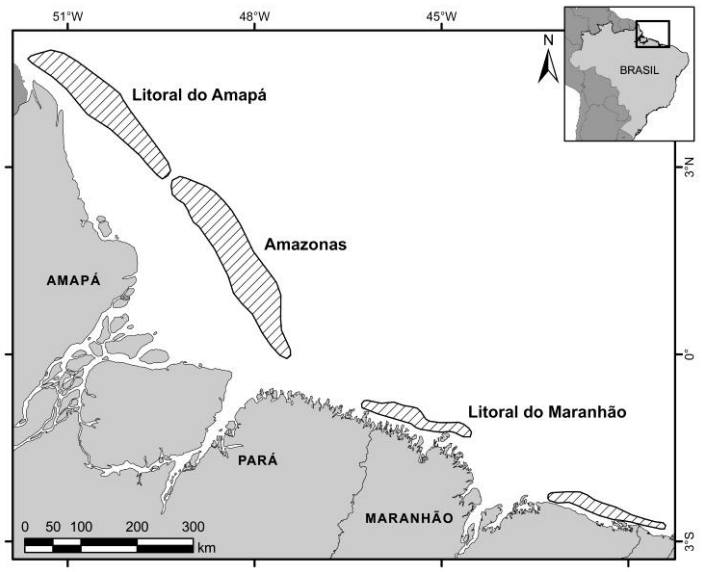

Figure 3. Area of occurrence of the shrimp stock off northern Brazil, showing trawling areas for pink shrimp (Source: ARAGÃO et al., 2001)[14]

The industrial shrimp fisheries with a Brazilian fleet based in Belém, State of Pará, started its operations in 1969, with only six boats. Between 1972 and 1977, a United States shrimp fleet

[15] Meschkat, A.*Report to the Government of Brazil on the Fisheries of the Amazon Region*. Rome, FAO/TA Fisheries Officer- Report No. 1305. 94 p, 1960.
[16]Naidu, K. S., Boerema, L.K. The High Seas Shrimp Resources Of The Guianas And Northern Brazil. Fao Fish. Circ. 141, 18 P. 1972.

operated on the northern coast of Brazil, between 1ºN and Cabo Orange (Cape Orange), frontier of the French Guiana, under a fishing agreement (regime) (Paiva, 1981)[17]. After the fishing agreement with the USA the Brazilian fleet in operation was composed of only 48 vessels, and the Brazilian Government authorised fishing companies to lease foreign vessels aiming at fishing in the area under Brazilian jurisdiction, a joint venture that lasted until 1989. After, only boats flying the Brazilian flag could fish in the entire area off Brazil's north coast, targeting pink shrimp.

The main species caught by the industrial fisheries, commercially known as pink shrimp, are *Farfantepenaeus subtilis* (Farfante Pérez, 1967) and *Farfantepenaeus brasiliensis* (Latreille, 1817), with absolute predominance of the former. Other species such as seabob shrimp (*Xiphopenaeus kroyeri*, Heller, 1862), as well as a great diversity of groundfishes and other aquatic organisms comprise the bycatch of these fisheries.

Although there is a well developed industrial fleet that operates offshore, from 40 to 80 m depth, these shrimp resources are also exploited by small and medium-sized trawlers operating in coastal waters and estuarine zones. According to Studart-Gomes (1988)[18], landings of these fleets take place in many communities along the entire coast of the region and are especially significant from the standpoint of food security, but also as a source of income for a great number of fishermen. The catches in these fisheries are mainly composed of seabob shrimp, white shrimp (*Litopenaeus schmitti*, Burkenroad, 1936) and also of juveniles of pink shrimp.

Studart-Gomes (*op. cit.*) also stressed that the industrial shrimp fisheries constitute today one of the most important activities of the regional and national fisheries, notably generating foreign exchange. Belémis is the main port, where the majority of the landings take place, and the base of the shrimp processing industry. These fisheries operate in three main subareas, with distinguishing characteristics: (a) Coast of Maranhão, between the mouth of the Parnaíba River (02º53'S) and Cape Gurupi (00º53'S), where mud and sand bottoms can be found and fishing grounds are closer to shore; (b) the Amazon, that ranges between latitudes 00º50'N and 02º30'N, with substrate composed mainly of mud; and (c) Amapá State Coast, between the latitudes 02º30'N and 04º23'N (Cape Orange), with predominantly hard and rocky substrates.

Bottom gillnet fisheries

The commercial fishing activity off Brazil's north coast (Figure 3) has taken place since the nineteenth century, and is characterized by traditional bottom longline fishing targeting catfishes (Verissimo 1970)[19]. Fishing in this region was limited to the use of the bottom longline and drift gillnet until the late 1960s, whose production supplied the regional market with fresh and salted fish. A fleet of trawler boats has settled in the region since 1968 to exploit freshwater catfish abundant in the Amazon estuaries (piramutaba, *Brachyplatystoma vaillantii*) (Barthem, 1990)[20]. Although its production is relevant to the region, this resource is confined to the Amazon basin and abounds in the innermost part of the estuary, not a stock shared with other countries within the Brazil-Guianas shelf.
The fishery targeting the acoupa weakfish (*Cynoscion acoupa*), also known as acoupa toeroe and locally as pescada amarela, is carried out by wooden vessels of various sizes, many of them with ice box capacity above 25 tonnes (Barthem, 2004)[21]. The fishing gear employed is mainly the drift gillnet, which can reach lengths higher than 4 km and mesh size varying from 18 to 20 cm between opposite knots. The acoupa weakfish represents about 34-48 percent of the total catch from these

[17]Paiva, M.P. Recursos Pesqueiros Marinhos e Estuarinos no Norte do Brasil, Brasília, SUDEPE, 1981.
[18]STUDART-GOMES, P. R. 1988. A pesca industrial de camarão rosa no Norte do Brasil, *in*: Associação dos Engenheiros de Pesca do Estado do Ceará, Ed. in: V Congresso Brasileiro de Engenharia de Pesca, p. 419-434.
[19] Veríssimo, J. A Pesca na Amazônia. Universidade Federal do Pará. Belém, Brasil. 130 p. 1970.
[20] Barthem, R.B. Descrição da pesca da piramutaba (Brachyplatystoma vaillantii, Pimelodidae) no estuário e na calha do Rio Amazonas. *Boletim do Museu Paraense Emilio Goeldi, Antropologia*. 6: 117-130. 1990.
[21] Barthem, R.B. O desembarque na região de Belém e a pesca na foz amazônica. In M.L. Ruffino, ed. A pesca e o recursos pesqueiros na Amazônia brasileira, pp. 137-167. Manaus, Brazil. Ibama/ProVárzea. 272 pp. 2004.

vessels (Matos & Lucena, 2006)[22]. In addition to being widely appreciated due to its flavor, this species has a swim bladder that is also valuable for the beverage industry, especially breweries and wineries, and its commercialization can raise the fishery revenue by up to 35 percent (Mourão *et al.*, 2009)[23].

Corvine, green weakfish or croaker (*Cynoscion* spp.) is a larger fish of the Sciaenidae family and apparently three species are known by that common name, Cynoscion virescens (Pinheiro & Frédou, 2004)[24], C. steindachneri (Matos & Lucena, 2006)[22], and C. microlepdotus (Mourão *et al*., 2009)[23]. It is marketed fresh, with a high value. Its swim bladder is being used to make glue. This group of species is fished by gillnets, being considered a complementary catch of the fishery targeting the acoupa weakfish, and represents 8-10 percent of the fish landings of that fleet and its swim bladder is highly valued, like that ofthe acoupa weakfish (Mattos & Lucena, 2006)[22].

Gillbacker sea catfish (*Aspistor parkeri*), also known as mâchoiron jaune and locally as gurijuba, is the largest of the marine catfish family Ariidae found in the Brazil-Guianas Shelf. It feeds mainly on fish and presents a highly specialized reproduction, with males incubating the eggs in their mouths (Acero, 2002)[25]. Gillbacker sea catfish is one of the most traditional fisheries on the north coast of Brazil (Verissimo, 1970)[19] and was usually caught with bottom longlines, but currently it is fished mainly with gillnets along with catches of acoupa weakfish and corvina, and its production represents 22-28 percent of the total catch of these vessels (Matos & Lucena, 2006)[22].

The crucifix sea catfish (*Sciades proops*), as known as mâchoiron crucifix and locally as uritinga, is one of the largest marine catfish of the Ariidae family caught in the Brazil-Guianas Shelf, presenting a specialized reproduction, with females producing from 63 to 217 eggs, and males incubating them in the mouth (Acero, 2002)[23]. It is caught along with gillbacker sea catfish in gillnet fisheries, representing up to 10 percent of the total catch (Matos & Lucena, 2006)[22].

The king weakfish (*Macrodon ancylodon*), also known as acoupa chasseur and locally as pescada gó, is a medium-sized species of the Scianidae family. The species spends much of its life cycle in estuaries, the younger individuals being more abundant in the coastal area, and larger individuals in deeper waters (Camargo & Isaac, 2005)[26]. Small individuals only prey on shrimp, and larger individuals on shrimp and small fish of the Engraulidae, Scianidae and Gobiidae families (Lowe-McConell, 1966[27], Piorski *et al*., 2004[28]). It has a lengthy reproductive period, with two spawns per year, between May and June and between December and January (Santana, 1998)[29]. The size at first maturity is, on average, 22 cm and approximately 1.5 years of age (Camargo & Isaac, 2005)[26].

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[22] Matos, P. de & Lucena, F.M. Descrição da pesca da pescada-amarela, Cynoscion acoupa, da costa do Pará. Arquivo de Ciências do Mar, Fortaleza. 39: 66-73. 2006.

[23] Mourão, K.R.M., Frédou, F.L., Espírito-Santo, R.V., Almeida, M.C. de, Silva, B.B. da, Frédou, T., & Issac, V. Sistema de produção pesqueira - Cynoscion acoupa Lacèpede (1802): Um estudo de caso no litoral nordeste do Pará, Brasil. B. Inst. Pesca, São Paulo, 35(3): 497-511. 2009.

[24] Pinheiro, L.A. & Frédou, F.L. Caracterização geral da pesca industrial desembarcada no Estado do Pará. Revista Científica da Ufpa, 4: 1-16. 2004.

[25] Acero, P.A. Ariidae. In: FAO by K.E. Carpenter, ed. The living marine resources of the Western Central Atlantic. Volume 2: Bony fishes part 1 (Acipenseridae to Grammatidae, pp. 831-852. Rome. FAO Species Identification Guide for Fishery Purposes and American Society of Ichthyologists and Herpetologists Special Publication No. 5: 601-1374. 2002.

[26] Camargo, M. & Isaac, V. Reproductive biology and spatio-temporal distribution of Stellifer rastrifer, Stellifer naso and Macrodon ancylodon (Sciaenidae) in the Caeté estuary, northern Brazil.Braz. J. Oceanogr., 53(1-2): 13-21. 2005.

[27] Lowe-McConnell, R.H. 1966. The sciaenid fishes of British Guiana. Bulletin of Marine Science, 16: 21-57.

[28] Piorski, N.M., Maranhão, F.R.C.L., Rocha, R.M.V. & Nunes, J.L.S. Análise da estratégia alimentar de Macrodon ancylodon (Bloch & Schneider, 1801) - (Perciformes: Sciaenidae) de um estuário do litoral ocidental do Maranhão- Brasil. Boletim do Laboratório de Hidrobiologia, 17: 49-52. 2004.

[29] Santana, J.V. Aspecto da pesca e da biologia da pescada-gó, Macrodon ancylodon (Bloch & Schneider, 1801) da costa Norte do Brasil. Universidade Federal do Ceará, Fortaleza, Brazil (MSc thesis). 106 p. 1998.

The couma sea catfish (*Sciades couma*), also known as mâchoiron couma and locally as bagre, is one of the largest marine catfishes of the Ariidae family caught in the Brazil-Guianas Shelf, presenting a specialized reproduction with males incubating eggs in the mouth, similar to others like Ariidae (Acero, 2002)[23]. The couma sea catfish is caught along with gillbacker sea catfish in gillnet fisheries and its catch represents up to 10 percent of the total catch (Matos & Lucena, 2006)[22]. It is also caught by trawl nets targeting the piramutaba, in the freshest part of the estuary, and its catch represents 4-11 percent of the total of this fishery, being the dominant species of the accompanying fauna of the bottom pair or triple trawl fishing (Pinheiro & Fredou, 2004)[24].

Line/trap fisheries

Since 1974, a longline fleet coming from Brazil's northeast coast started fishing in the outer shelf and continental slope off the north coast (Figure 3) targeting red snapper (*Lutjanus purpureus*). Then this same fleet introduced, in 1997, the fish trap targeting the same species (Holland, 2001[30]; Asano-Filho *et al*., 2002[31]; Costa, 2012[32]).

The red snapper (*Lutjanus purpureus*), also known as pargo, colorado and caribbean red snapper, is one of best studied species of the Brazil-Guianas Shelf and throughout its life cycle, as juveniles and/or adults, adopts strategies of dispersion between oceanic banks and the continental shelf. Strategies of dispersion of juveniles and adults occur within oceanic banks and the continental shelf throughout its life cycle. The larvae produced in the reproduction areas, from the spawning of several cohorts, are taken to places nearest the Amazon Gulf coast by the South Equatorial Current and other currents that move nearer and parallel to the coast line (Ivo & Hanson, 1982)[33].

The fishery targeting red snapper occurs along the north Continental Shelf, in depths between 60 and 120 m (Costa, 2012)[32], which, along with the dog snapper (*Lutjanus jocu*), accounts for about 85 percent of the catches. The remainder of the catch is composed of the species horse-eye jack (*Caranx latus*), yellowtail snapper (*Ocyurus chrysurus*), red grouper (*Epinephelus morio*), snowy grouper (*Hyporthodus niveatus*), rainbow runner (*Elagatis bipinnulata*), black grouper (*Mycteroperca bonaci*), cobia (*Rachycentron canadum*), and wahoo (*Acanthocybium solandri*) (FAO, 2001)[34].

Trap (covo or manzuá) fisheries for lobsters

The case study on "Shared fish stocks of shrimp and demersal fish on the Brazil-Guianas continental shelf", part of the CLME Project, clearly highlights the need to prioritize the shared stocks mentioned above. However, participants of the National Consultation recognized the need to identify other resources that are widely distributed on the continental shelf in question and that, even if there are no targeted fisheries in each of the other five countries, they would deserve more attention in the analysis of transboundary issues.

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[30] Holanda, F.C.A.F. *Análise da estratégia de pesca e capacidade de carga da população do pargo, Lutjanus purpureus Poey, nos bancos oceânicos e plataforma continental do norte e nordeste do brasil*. Universidade Federal do Ceará, Fortaleza, Brazil (MSc thesis). 97 p. 2001.

[31] Asano-Filho, M., Furtado-Junior. I. & Brito, C. S. F. Avaliação do poder de pesca do covo para peixe, quanto ao tempo de imersão na pescaria do pargo (*Lutjanus purpureus* POEY) na região norte do Brasil. Boletim *Técnico Científico CEPNOR/IBAMA*, 2: 191-198. 2002.

[32] Costa, G.F. *Sistemática de pesca e análise da relação entre comprimento total médio e profundidade de captura do pargo, Lutjanus purpureus Poey 1875, explotado pela frota bragantina*. Universidade Federal do Pará, Bragança, Brazil (Bachelor thesis). 57 pp. 2012.

[33] Ivo, C.T.C. & Hanson, A. J. Aspectos da biologia e dinâmica populacional do pargo, *Lutjanus purpureus* Poey, no Norte e Nordeste do Brasil. *Arquivo de Ciências do Mar, Fortaleza,* 22(1/2): 1-41. 1982.

[34] FAO. *Regional reviews and national management reports. Fourth Workshop on the Assessment and Management of Shrimp and Groundfish Fisheries on the Brazil-Guianas Shelf. Cumaná, Venezuela, 2-13 October 2000*. Rome, FAO Fisheries Report. No. 651.152 pp (available at www.fao.org). 2001.

In this context, the fishery for red lobster, *Panulirus argus* (Latreille, 1804), was considered a potential case study for further analysis. The species is of high socioeconomic importance in Brazil. Available information indicates that there is a single population widely distributed along the Brazilian coast and the Caribbean.

Brazil has five species of lobster. Red lobsters *Panulirus argus* and Cape Verde lobsters *Panulirus laevicauda* are the most important fisheries in the northeast and the main targets of fishing. The other species are: "lagostinha", lobster and crab-shoe which are captured on a smaller scale.
The lobster fishery operates along the Brazilian coast, from Amapá to Espirito Santo state (Figure 4). It is an activity of high social and economic importance to the country, involving about 15 000 fishers, and generating foreign exchange between USD 70 and 80 million in the last three years.

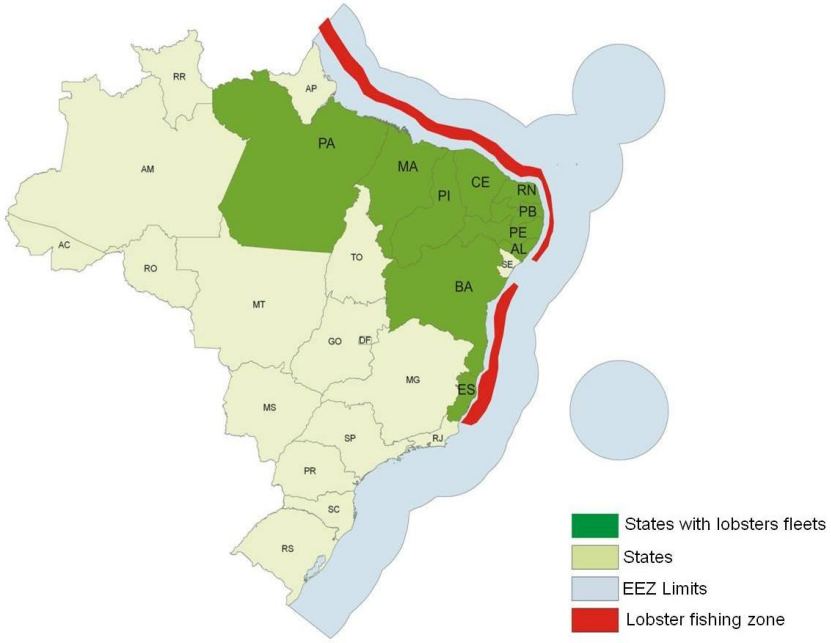

Figure 4. Lobster fishing area off Brazil, expanded after 2000

The frantic search for the resource, coupled with the failure of management measures and a lack of controls, led to instability in production and signs of overfishing. The production, which reached 11 059 tonnes in 1991, is today approximately 7 000 tonnes. This decrease in production is due to increasing fishing effort, which can lead to a collapse in the short term. Brazil is the third largest exporter of lobster in the world and to reverse this situation of falling production, the need for implementation of management measures was recognized in the Lobster Management Plan. In addition, actions for certification of fishing activity, through campaigns for conscious consumption of crustaceans and a plan with measures to prevent overfishing were put in place. Prepared by the Management Committee for the Sustainable Use of Lobster, coordinated by IBAMA and with the participation of civil society, the Management Plan reflects the concern for this important natural resource. The Management Plan provides a set of measures such as the re-registration of vessels, training of fishermen and enforcement actions. The "caçoeira" net was banned and the fishery is currently only allowed to fish with traps (traps or manzuás). The closed season was increased from four to six months, established from 1 December to 31 May each year, allowing more time for reproduction of the species.

The measures in force, provided by the Management Plan, aimed at recovering and sustaining this traditional fishery are: control of fishing effort according to the renewal capacity of the stocks of lobsters; resizing and licensing of the fleet, substantially reducing the number of boats operating illegally; allowing fisheries to fish only with traps; ban on fishing within four miles of the coast,

nursery area of juvenile lobsters; expansion of the reproductive closed season from December to May, and determination of minimum catch sizes and marketing of red lobsters: 13 cm tail and Cape Verde lobster: 11 cm tail (Normative Instructions IBAMA n º 138, 2006, No. 144 and No. 159 of 2007).

The exploitation of lobsters along the Brazilian coast began in 1955 in the state of Ceará, extending to the Pará and Amapá in the late 1990s. Studies conducted by Porto, Cintra & Silva (2005) on aspects of the red lobtser fishery in northern Brazil indicate that this species is the most abundant, followed by *Scyllarides delfosi*. The cities of Bragança and Augusto Corrêa, in Pará, are the main landing ports in the north. The size of the captured individuals showed a maximum amplitude of 6.1 cm to 17.4 cm carapace length observed in males, with an average length of 10 cm for sexes grouped together.

There are two distinct fishing grounds, located off the states of Amapá and Pará, between latitudes 03 50'N (Amapá) and 01°30'N (Para) (Figure 2). Fishing grounds off Amapa are situated at depths from 80 to 100 m, with bottom substrate consisting usually of sand, rocks and coral, and located approximately 115 miles from Cape North. Fishing grounds off Para are situated at depths between 60 and 92 m and the substrate is variable, sometimes consisting of sand, and sand stones and corals, located at a distance of about 140 miles from the city of Bragança (Porto, Cintra & Silva, 2005)[35].

These authors also mentioned that the fishing area is shared by artisanal and industrial fleets. Artisanal boats are usually made of wood and of varying sizes, usually ranging from 10 to 15 m, using ice as a means of conservation in fishing operations conducted with "caçoeira" nets. The industrial vessels, five in number in 2001, are of steel hull, with an average length of 22 m. They are equipped with navigation devices and communication system, have on board freezing capacity, and fish with traps. In the years 2002 and 2003 there were only records of artisanal vessels operating in the fishery.

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

During the Training Workshop on Ecosystem Approach to Fisheries, under the Caribbean Large Marine Ecosystem Project (CLME), held in Paramaribo, Suriname, from 17 to 21 October 2011, a scoping exercise was carried out on the shrimp and groundfish fisheries for the study in the subregion which defined the scope of the fishery and values important to the fishery/community. A summary description of the fishing activities to be managed, community objectives to be achieved, societal values to be observed, and other useful information, is provided in Table 1 below.

Table 1. Description of the fishing activities, community objectives and societal value of the shrimp and groundfish fisheries along Brazil's north coast

Category	Details
Fishers involved	Industrial and artisanal fishers: 80 thousand people
Methods involved	Shrimp trawling, pair trawling, fish traps and vertical long lines
Areas involved	From 0 to 4º latitude north
Values to achieve	*Economic* ✓ Shrimp = USD 30 million ✓ Cat fish = USD 18 million ✓ Red Snapper = USD 25 million *Social* ✓ Reach Full Employment = 100 000 people *Ecological* ✓ Total allowable catches ✓ Sustainable biological productivity

[35]Porto, V. M. S.; Cintra, I. H. A.; Silva, K. C. A. Sobre a pesca da lagosta-vermelha, panulirus argus (Latreille, 1804), na costa norte do Brasil. *Bol. Téc. Cient. CEPNOR*, Belém, v. 5, n. 1, p. 83-92, 2005.

Category	Details
Primary agency(ies)/group(s) (those who are directly involved). Those who have to take direct responsibility	*Government* ✓ Ministries of Fisheries and Aquaculture (MPA) and the Environment (MMA) *Private Sector* ✓ Fisheries Company Association (SINPESCA) *Fishers Organizations* ✓ Artisanal Fishing Guilds ✓ Unions of Fishers and Fishing Industry Employees.
Other Agencies/Groups (those who are only indirect involved – or who manage related aspects) – i.e. they will not take direct responsibility	*Government* ✓ Marine Coastal Guard ✓ Fisheries State Secretariat ✓ Research Centres *Academia (Universities)* ✓ Federal Rural University of Amazonia ✓ Federal University of Pará ✓ Federal University of Amapá
Time frame(s)	✓ 2 years

5.4. *Provide information on direct interactions with other fisheries e.g. competing for same target species, target species taken as bycatch in another fishery, bycatch in this fishery*

The relatively high catches of large accompanying fauna in shrimp fisheries constitute one of the main problems caused by industrial shrimp fishing trawlers on the north coast of Brazil. Part of the catches is composed of species of commercial value, but only a relatively small proportion is utilized, the majority is discarded. These bycatches constitute one of the major impacts generated by this fishery.

Recent studies indicate that for every kilogramme of shrimp, 6.93 kg of accompanying fauna are caught, comprising 61.1 percent of finfishes, 29 percent of crustaceans, 2.9 percent of elasmobranchs and the reminder a "mixture" of small fishes, crustaceans and molluscs. It is estimated that, in 2003, the total amount of bycatches was 24 800 tonnes of accompanying fauna in these fisheries, and 20 600 tonnes from the States of Pará and Amapá (Paiva, *et al.*, 2009)[36].

The literature indicates that the greatest obstacles to the use of the accompanying fauna of commercial value are (a) the small space available for handling the fish on board; (b) the low market price of the bycatch species; (c) the need for a larger crew; and (d) the possible impairment of quality of shrimp due to the common use of the freezing and refrigerating chambers.

Although there was a growing proportion of accompanying fauna utilised in recent years, it is still unacceptable to waste the vast majority of the bycatch. Solutions for its use have been developed, mainly in tropical countries, such as: handling at sea, by-products, collection and transportation from the boats, and processing of the mixture of species (Morais, 1981[37]; Ogawa & Maia, 1999[38]).

In the pink shrimp fishery on the north coast of Brazil, a detailed multidisciplinary study to assess alternative use of accompanying fauna has been carried out since the 1980s. The research activities considered three aspects: biological, socio-economic and technological analysis. The biological analysis was aimed at determining the composition, structure and volume. The socio-economic analysis evaluated the economic feasibility of the use of accompanying fauna, either by the shrimp

[36] Paiva, K. S.; Aragão, J. A. N.; Silva, K. C. A.; Cintra, I. H. A. Fauna acompanhante da pesca industrial do camarão-rosa na plataforma continental norte brasileira. *Bol. Téc. Cient. CEPNOR*, Belém, v. 9, 2009.
[37] Morais, C. Aproveitamento da fauna acompanhante na captura do camarão. Bol. ITAL, Campinas, v.18, n.2, p.129-144, 1981.
[38] Ogawa, M.; Maia, E.L. Manual de Pesca. Livraria Varela, 430 p., São Paulo, 1999.

fleet, or for the use of the boat (collector or owner), as well as any conflicts with artisanal fisheries. The technological analysis then characterized the active fleet, conducted the survey of storage capacity; determined freezing rates for shrimp and fish; and characterized the fauna in technological terms: approximate composition, yield and anatomical study, study on the lifespan of the stored fish in ice and products produced with more incidental species of accompanying fauna (IBAMA, 1994)[39]. The results were quite consistent, especially regarding the qualification and quantification of the accompanying fauna, and suggested regulatory measures and estimated that a quantity of bycatch not less than 3 000 kg could be landed by each fishing trip per boat.

For small and medium-scale fisheries the same problem with accompanying fauna arises, although to a lesser degree, worsened by a considerable portion of the catch composed of juveniles of some fish species. ARAUJO *et al*. (2005)[40] reported that the bycatch of the small-scale trawl shrimp fishery in the Salgado River estuary at Alcantra, State of Maranhão, was made up of 16 species belonging to 12 families and 15 genera of fishes, crustaceans, molluscs and other marine organisms found in the early stages of the life cycle. The authors suggest the need for implementation of measures to mitigate the impact of shrimp trawling on the ichthyofauna communities, because estimates suggest that many species of the accompanying fauna can have their stocks threatened by fishing pressure.

Dolphins and turtles are caught accidentally or intentionally by groundfish commercial fishing, despite their catch being prohibited in Brazilian territory. Of the four species of dolphins that are found in the region, *Sotalia guianensis* is the most affected by fishing, due to its vulnerability to the gillnet. Five species of turtles migrate to the north Brazilian coast beaches to spawn: leatherback sea turtle, *Dermochelys coriacea*, *Caretta caretta*, *Chelonia mydas*, *Eretmochelys imbricate*, and *Lepidochelys olivacea*. Their catch by commercial fisheries is less common compared to the bycatch in other regions of Brazil, and reports have only recorded the bycatch of the last four species. *Chelonia mydas* was the most common turtle caught with fish-traps on the beaches of Pará. Vessels which use bottom trawls and are more than 11 m in length are required to use Turtle Excluder Devices (TED) throughout the Brazilian coast.

6. Available scientific and traditional knowledge on the resources

6.1. Brief biology of the major fish species

The main issues of interest to study in the life cycle of a species are the place and time that the various life cycle phases occur, the periodicity of reproduction and, consequently, the recruitment and the asymptotic values of the maximum size and rate of growth.

Shrimps of the genera *Farfantepenaeus* and *Litopenaeus* present the two main life cycle phases (development of juveniles and adults), geographically separated in coastal/estuarine zones and the outer continental shelf (40-100 metres in depth). Other species of the Penaeidae family have similar cycles with the development of the following stages: larvae (nauplii) protozoeal, misis, post-larvae, juvenile and sub-adult/adult according to the migration cycle. Recruitment in the oceanic areas, although it occurs throughout the year, has an intensity clearly more pronounced in the first quarter of the year for both species: *F Subtilis* and *L schmitti*. Nevertheless, the reproductive cycle of these species presents a different pattern: the pink shrimp reproduces more intensively from February to April, with a second peak in July and August, whilst the main reproduction period for the white shrimp is from July to September and the second from January to March. Otherwise, females of both species mature and spawn offshore, the eggs are benthic, and planktonic larvae develop in the water

[39]IBAMA. Camarão Norte e Piramutaba. – Brasília: IBAMA – Coleção meio ambiente. Série estudos – pesca; n° 9. 148 p. il. 1994.

[40]Araújo Junior, E.S.; Pinheiro Junior, J.R.; Castro, A.C.L. Ictiofauna acompanhante da pesca do camarão branco, Penaeus (Litopenaeus) schmitti Burkenroad (1936) no estuário do Rio Salgado, Alcântara-MA. Bol. Lab. Hidrobiol., São Luís, v.18, p.19-24, 2005.

column passing through several stages of development until the post-larvae stage, when they are able to penetrate the estuary and acquire the benthic habit. Juveniles inhabit coastal and estuarine areas and, in the pre-adult stage, return to the pelagic zone to reproduce and thereby end the life cycle.

There is controversy over the migratory cycle of the seabob shrimp, with three possibilities: (a) complete cycle performed inside bays; (b) cycle taking place in estuaries and part of it on the continental shelf; and (c) full cycle performed on the continental shelf. It seems definite that this species does not undertake recruitment migration, so the growth area coincides with the occurrence of the adult stock in water up to 30 m deep. The reproduction pattern shows similar trends as for the previous species, showing a peak from March to July and a second one in October and November. Penaeid shrimps generally adopt nocturnal behaviour and remain buried in the sediments during the day, with the apparent exception of *X. kroyeri*, which is mainly diurnal, judging by the higher yield from trawls carried out during this period (Santosetal, 2004)[41].

Estimates of the length of first sexual maturity have discrepancies between regions, which may be due to: (1) biological issues related to the richness of the food supply; (2) methodological defects relating to the identification of gonadal stages and/or relative frequency of immature and mature females; and (3) the existence of several populations of the same species along the coast. The latter hypothesis seems likely to occur, although genetic studies of various molecular species are inconclusive in this regard (Baptista-Metri, 2007)[42]. Although there is information on the size at first maturity for pink (39.6 cm total length) and white (17.5 cm total length) shrimp species that inhabit the Brazilian north continental shelf, those on the growth parameters (maximum theoretical length: L; and growth coefficient: K) and life expectancy (tmax) of shrimp are only available for pink shrimp: *F. subtilis*., even though many studies on this species and other shrimps were conducted along the Brazilian coast. According to Issac *et al.* (1992)[43], this species has a maximum theoretical length of 177 mm TL for males and 217 mm for females; a growth coefficient of 1.17 for males and 1.06 for females; and a life expectancy of 2.6 years for males and 2.8 years for females. Since there is a direct relationship between intraspecific growth and natural mortality, the strategy adopted by shrimps to resist high predation by benthic and nektonictaxa is to maintain a high growth rate and accelerate the rate of renewal of cohorts, whose life expectancy rarely goes beyond 2 years.

The size at first maturation for red snapper takes place at sizes between 39.5 cm (Sarmento, 2012)[44] and 47.4 cm (Moraes, 1970)[45]. The growth parameters of the red snapper were estimated for the north coast as well as for the continental shelf and slopes in the north and northeast of Brazil (Table 4). The asymptotic maximum length (L) estimated by Sarmento (*op. cit.*) and Ximenes & Fonteles-Filho (1988)[46] varied between 92.9 and 96 cm, whereas the estimation of Menezes & Gesteira (1974)[47] and Souza (2002)[48] varied between 127.5 and 150.2 cm. The constant of growth (K) varied between 0.1

[41]SANTOS, M.C.F.; PEREIRA, J.A.; IVO, C.T.C. Sinopse de informações sobre a biologia e pesca do camarão-branco, Litopenaeus schmitti (Burkenroad, 1936) (Crustacea, Decapoda, Penaeidae), no Nordeste do Brasil. Bol. Téc. Cient. CEPENE, Tamandaré, v. 12, n.1, p.149-185, 2004.

[42]BAPTISTA-METRI, C. Biologia pesqueira de Artemesia longinaris Bate, 1988 (Decapoda, Dendrobranchiata, Penaeidae) e de Pleoticus muelleri (Bate, 1988), no Sul do Brasil. Tese de Doutorado, Universidade Federal do Paraná, 245 p., Curitiba, 2007.

[43] ISAAC, V. J.; DIAS NETO, J.; DAMASCENO, F. G. Camarão-rosa da costa norte. Biologia, dinâmica e administração pesqueira. IBAMA, Série Estudos de Pesca, Brasília, n.1, p.1-187, 1992.

[44]Sarmento, G. C. 2012. *Bioecologia do pargo Lutjanus purpureus (Poey, 1985) comercialmente explotado na costa norte do Brasil: aspectos gerais*. Universidade Federal do Pará, Bragança, Brazil (Bachelor thesis). 90 pp.

[45] Moraes, N.U.A. 1970. Sobre a desova e fecundidade do pargo, *Lutjanus purpureus* Poey, no nordeste do brasileiro. *Boletim do Estado da Pesca*. 10:7-19.

[46] Ximenes, M.O.C. and Fonteles-Filho, A.A. 1988: Estudo da idade e crescimento do pargo *Lutjanus purpureus* Poey (Pisces: Lutjanidae) no Norte e Nordeste do Brasil. *Arquivo de Ciências do Mar*. 27: 69-81.

[47] Menezes, M.F. and Gesteira, T.C.V. 1974. Idade e crescimento do Pargo, *Lutjanus purpureus* Poey, do Norte e Nordeste do Brasil. Arquivo de Ciências do Mar. 14: 81-83.

[48] Souza, R.F.C. 2002. Dinâmica populacional do pargo *Lutjanus purpureus*, Poey, 1875 (Pisces Lutjanidae) no Norte do Brasil. Universidade Federal do Pará, Belém, Brazil. (MSc thesis). 92 p.

and 0.13 year[1]. Its diet is based mainly on fish and, to a lesser extent, on crustaceans, mollusks, and tunicates (Menezes & Figueiredo 1980)[49].

6.2. Geographical distribution of the species

The geographical distribution of shrimps Dendrobranchiata that occurs in the western Atlantic has been studied by several authors, especially Farfante Pérez (1969), Holthuis (1980)[50] and D'Incao (1995[51], 1999[52]).

Farfantepenaeus brasiliensis (pink shrimp): is widely distributed, from the east coast of the United States (Virginia) to southern Brazil (Rio Grande do Sul). In Brazil, the species is observed along the Brazilian coast, from the States of Amapá to Rio Grande do Sul.

Farfantepenaeus paulensis (pink shrimp): is distributed from southern Bahia (Brazil) to the north coast of Argentina (Mar del Plata). It is observed in Brazil in the States south of Bahia.

Farfantepenaeus subtilis (pink shrimp north): has a more tropical distribution, extending from Cuba to the State of Rio de Janeiro (Brazil).

Litopenaeus schmitti (white shrimp): is found in the western Atlantic from the Bay of Matanzas (Cuba) to the State of Rio Grande do Sul (Brazil), including the Caribbean and Central America. In Brazil, it can be found along the entire coast from, Amapá to Rio Grande do Sul.

Xiphopenaeus kroyeri (seabob shrimp): is distributed along the U.S. Pacific coast (Mexico to Peru) and is widely distributed in the western Atlantic (North Carolina, United States; in Rio Grande do Sul, Brazil, including the Caribbean and Central America). In Brazil, it has been found along the entire coast, from the State of Amapá to the State of Rio Grande do Sul. For the latter it occurs only occasionally.

Cynoscion acoupa (acoupa weakfish or acoupa toeroe): is one of the major species of the Sciaenidae family caught in the Brazil-Guianas Shelf. This species is found in Panama and Argentina and feeds on fish and crustaceans in coastal shallow waters, near river mouths and estuarine lagoons, and is sometimes found in freshwater (Menezes & Figueiredo, 1980)[49].

Cynoscion spp. (corvine, green weakfish or croaker): they are distributed from Nicaragua to Santos, São Paulo-Brazil, and are usually found on sandy mud bottoms in coastal waters near river mouths; the adults stay in deep waters during the day and swim to the surface at night; and the juveniles inhabit estuaries.

Aspistor parkeri (gillbacker sea catfish or gurijuba): inhabits turbid waters over mud bottoms along the coast and estuaries and it can be found from the Guianas to northeastern Brazil (Acero, 2002[25]).

Sciades proops (crucifix sea catfish or uritinga): occurs off the north coast of South America, from Colombia to the Brazilian Northeast Region, in brackish waters of estuaries and lagoons, as well as in hyper-saline waters of shallow lagoons.

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[49] Menezes, N.A. & Figueiredo, J.L. 1980. *Manual de peixes marinhos do sudeste do Brasil. IV. Teleostei (3).* São Paulo, Brazil, Museu de Zoologia/USP. 96 p.

[50]HOLTHUIS, L.B. FAO Species Catalogue. Shrimps and Prawns of the World. An annotated catalogue of species of interest to fisheries. FAO Fish. Synop., Roma, v.125, n.1, p.1-271, 1980.

[51]D'INCAO, F. Taxonomia, padrões distribucionais e ecológicos dos Dendrobranchiata (Crustacea: Decapoda) do Brasil e Atlântico Ocidental. Tese de Doutorado, Universidade Federal do Paraná, 300 p., Curitiba, 1995.

[52]D'INCAO, F. Subordem Dendrobranchiata (camarões marinhos), p.275-299, in Buckup, L e Bond-Buckup, G. (eds.), Os crustáceos do Rio Grande do Sul. Editora da Universidade Federal do Rio Grande do Sul, Porto Alegre, 1999.

Macrodon ancylodon (king weakfish or pescada gó): is widely distributed in the Western Atlantic, from Bahia Blanca, in Argentina, to the Gulf of Paria, in Venezuela (Acero, 2002)[25]. However, a recent genetic study indicates the possibility of occurrence of two species, one with tropical distribution, from Venezuela to the State of Pernambuco (Brazil), and other with subtropical distribution, from the coast of the State of Sergipe-Brazil to Argentina (Santos *et al.*, 2003)[53].

Sciades couma (couma sea catfish or bagre) – occurs off the north coast of South America, from the Gulf of Paria (Venezuela) to the mouth of the Amazon River, in turbid and brackish waters of estuaries and river mouths (Acero, 2002)[25].

Lutjanus purpureus (red snapper): belongs to the Lutjanidae family and it is widely distributed along the coastal and oceanic environments of rocky and/or coralline bottom, from the Caribbean Sea to the Brazilian Southeast Region (Menezes & Figueiredo 1980)[49].

6.3. *Estimated status of the stocks (especially over the last five years)*

There is scanty localized information on the small and medium-scale fisheries or even reliable statistics on landings for the region as a whole. Thus, it is not possible to properly assess the level of exploitation of the resources targeted or potential impacts on the environment. Regarding the fishing industry, given its importance in terms of production (volume), economic value and impacts on the ecosystem, there is a greater knowledge on the exploitation of the targeted stocks, which has been rather intense.

Estimates of maximum sustainable yield of the stock of pink shrimp were made in the past with the application of production models. In all cases, the standard catch per unit of effort (CPUE) used was calculated by dividing the total catch from the effort of a fishing fleet referred as standard. A comprehensive study on the northern stocks of pink shrimp was developed by Ehrhardt, Aragão & Silva (1999)[54] using estimates of catch and monthly samples of the length, to which was applied the method of "cohort analysis" using the process of "calibration". The main results indicate that: intense recruitment follows the seasonal trend of rainfall, while maintaining consistency with the overall dynamics of the environment and species; the catch per unit of fishing effort is related to how the catchable biomass is distributed between units of effort, and the amount that the fleet is capable of capturing seems to depend more on the level of abundance of the stock than the amount of fishing effort applied. The estimated maximum sustainable yield (MSY) ranged from 7.3 to 9.6 million tonnes of total weight and a maximum annual fishing effort of 32 000 to 72 298 days-at-sea, whilst validity of these estimates is questionable, given the uncertainties in the application of production models, which consider the equilibrium conditions.

A more recent study on stock assessment through the biomass dynamic model is being published by the team from CEPNOR, entitled "Biomass Dynamics of Pink Shrimp in the Northern Region of Brazil" indicates a maximum sustainable yield (MSY) of 4 057.18 tonnes of tail and an optimum effort (E_MSY) of 19 315 days-at-sea (for *Bo =K*) (Aragão; Silva, Cintra, 2004)[55]. The results of a simulated projection showed that if the present level of fishing effort is maintained, there is virtually no chance that the population will collapse. In fact, the probability of biomass levels falling below the level of 2005, for example, is high only for fishing effort levels that are much higher. The high fluctuation

[53] Santos, S., Schneider, H. & Sampaio, I. 2003. Genetic differentiation of Macrodon ancylodon (Sciaenidae, Perciformes) populations in Atlantic coastal waters of South America as revealed by mtDNA analysis. Genetics and Molecular Biology, 26(2): 151-161.

[54] Ehrhardt, N; Aragão, J.A.N; Silva, K.C.A. Stock assessment of the industrial Pink shrimp (*Penaeus subtilis*) fishery in Northern Brazil. In: CFRAMP/FAO/DANIDA STOCK ASSESSEMENT WORKSHOP ON THE SHRIMP AND GROUNDFISH ON THE GUYANA-BRASIL SHELF, Port o Spain, Trinidad and Tobago, Proceedings 7-18 April,1999, p.99-111.

[55] ARAGÃO, J. A. N.; CINTRA, I. H. A.; SILVA, K. C. A. Revisão dos dados de esforço de pesca e captura das pescarias industriais de camarão-rosa, *Farfantepenaeus subtilis* (Pérez Farfante, 1967) (Crustacea, Decapoda, Penaeidae) na região Norte do Brasil. Bol. Téc. Cient. CEPNOR, Belém, v.4, n.1, p.31-44, 2004.

in levels of recruitment as evidenced by Ehrhardt, Aragão & Silva (1999)[52] is an indication that there is strong environmental influence on the level of abundance of the population and this influence needs to be further investigated, as well as the stock/recruitment relationship.

The estimates of *MSY* and *E_MSY* should be considered maximum points of reference for management purposes, because it does not mean they are suitable for any level of stock biomass. Higher or lower catches can be obtained over the years due to the strong annual fluctuations in the levels of biomass. These values are consistent with the historical performance of the fishery and the current standard, but due to the high degree of uncertainty, should be interpreted with caution, and the precautionary approach should guide the management of the exploitation of the resource.

It is worth noting, finally, that the assumptions of the biomass dynamic model are also quite limited and do not consider changes in population structure or the influence of environmental factors, requiring the application of other models structured by age/length to validate their results. Otherwise, it can be inferred from the previous study conducted by Ehrhardt, Aragão & Silva (1999)[52] and a more recent one conducted by Aragão (2012) that "*the stock is at a somewhat moderate level of exploitation during the period analyzed with an exploitation rate of 0.557, slightly higher than the value considered optimum (F/Z = 0.5). It must be emphasized that the reduction of fishing effort in recent years points to a decrease in the exploitation rate after 2006*".

Studies on the assessment of the stocks of white shrimp and seabob shrimp in northern Brazil have not been conducted and therefore there is no information on the level of stock exploitation. For groundfishes, population parameters are only available for red snapper and king weakfish.

The annual mortality rates of red snappers, caught by the commercial fleet on Brazil's North Coast and within the period from May 2009 to August 2011, were estimated by Sarmento (2012)[42] based on the composition in size of the landings and were estimated in 0.366 $year^{-1}$ and the fishing mortality (F) in 0.506 $year^{-1}$, attaining a total mortality (Z) of 0.872 $year^{-1}$. The estimated exploitation rate for this resource was 0.58, slightly above 0.5 the desirable theoretical value (Pauly, 1984)[56], probably indicating that the stock is slightly overexploited.

The growth parameters estimated for king weakfish (*Macrodon ancylodon*) were $L\infty$= 45.5 cm and K=0.491 $year^{-1}$ (Camargo, 1999)[57]. Mortality rates estimated by Souza & Fonseca (2008) (M=0.78 $year^{-1}$, F=0.5 $year^{-1}$ and Z=1.28 $year^{-1}$) result in a rate of exploitation (E) of 0.4, below the desirable theoretical value (Pauly, 1984)[54], probably indicating that the stocks are not fully exploited, considering the fishing effort applied.

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

There is not enough available data and information to assess the impact of these fisheries on the ecosystem, but it is well known that benthic organisms are often caught by the trawling fleets, so some impacts do exist, both for the industrial and for the artisanal fleets. Still, for trawling, the juveniles are mainly caught by the artisanal fleet, that fish in shallower waters, especially for catfish. The red snapper fishery is quite selective, due to the use of long-lines and traps.

[56]Pauly, D. 1984.*Fish population dynamics in tropical waters: A manual for use with programmable calculators*. ICLARM. Studies and Reviews. 8: 325 p.

[57] Camargo, M. 1999. *Biologia e estrutura populacional das espécies da família Sciaenidae (Pisces: Perciformes), no estuário do rio Caeté município de Bragança, Pará - Brasil*. Universidade Federal do Pará, Belém, Brazil (M.Sc. thesis). 87 pp.

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

Topics	Brazil
Importance of the fishery	· The shrimp and groundfish fisheries off the north coast of Brazil are well consolidated and the main species caught by industrial fisheries is the pink shrimp. Other species such as seabob shrimp and a great diversity of fish and other aquatic organisms make up the accompanying fauna of these fisheries. The artisanal fishing fleet explore shallow waters, mainly in the Marajó Island, Pará State, and off the coast of Amapá State, mainly targeting croaker, hake, weakfish and catfish, using driftnets. Industrial shrimp fisheries now constitute one of the most important activities at national and local levels, considering the fishing environment
Main fisheries, fishing methods, target species	Shrimp Fisheries (trawling) The pink shrimp *Farfantepenaeus brasiliensis* (Latreille, 1817), and *Farfantepeaneus subtilis* Pérez-Farfante, 1967; the white shrimp *Litopenaeus schmitti* Burkenroad, 1936; and the sea bob shrimp *X iphopenaeus kroyeri*, Heller,1862 Groundfish Fisheries Red snapper *Lutjanus purpureus* (Poey,); Catfish (*Brachyplatystoma vaillantii*); Hake (*Cynoscion spp.)*
Social and economic importance	· The marine shrimp and groundfish fisheries in Brazil, on the Brazil-Guianas shelf, is a very important social and economic activity that should employ, directly and indirectly, 80 000 fishers and stakeholders involved in processing and other related services, that generate approximately USD 73 million in total income per year.
Management objectives	· Sustainable development of fisheries and aquaculture as a source of food, employment, income and leisure, ensuring the sustainable use of fisheries resources, as well as optimizing the resulting economic benefits, in harmony with the preservation and conservation of the environment and the biodiversity · The regulation, the promotion and the inspection (control) of the fishing activity · The preservation, the conservation and the recovery of the fisheries resources and the aquatic ecosystems · The socio-economic, the cultural and professional development of those that undertake the fishing activity, as well as their communities.
Legal and/or management measures	· Closed area for trawling: trawling is only allowed beyond 10 nm from shore · Access rights: fishing effort is established for the industrial fleet, for pink shrimp and red snapper · Closed season: a 4 month closed season is established for shrimp and for red snapper; 2.5 months for catfish (from 15 September to 30 November, each year) · Monitoring, control and surveillance, considering use of vessels monitoring systems (VMS), logbooks, observers, scientific personnel and landings controls
Stock status	· Although fully exploited, the biomass of the stocks herein considered (shrimp, red snapper and catfishes) seems stable, as yearly fluctuations in the catches are not high, with leads us to consider the fishing stocks off the Brazilian north coast to be in good health, as stated in current studies
Fisheries interactions	· There are no interactions, as a result of conflict, for the industrial fleet, but conflicts occur between the industrial catfish fishery and the artisanal driftnet fishery
Fisheries impacts on ecosystems	· There is insufficient available data and information to assess the impact of these fisheries on the ecosystem, but it is well known that benthic organisms are often caught by the trawling fleets, so some impacts do exist, both for the industrial and for the artisanal fleets. Still, for trawling, the juveniles are mainly caught by the artisanal fleet, that fish in shallower waters, specially for catfish. The red snapper fishery is quite selective, due to use of long-lines and traps
Other ecosystem concerns	- Very few artisanal fishing boats still enter these fisheries. Since those boats are made of wood, they still use the natural forest to obtain the raw material
Institutions responsible for FM and main concerns	- Fishery management is a shared responsibility between the Ministry of Fisheries and Aquaculture (MPA) and the Ministry of Environment (MMA), being coordinated by the former. Legal instruments govern the joint operations of MPA and MMA, for aspects related to the sustainable use of the fishing resources: *they establish rules, criteria, standards and management measures for the sustainable use of fishing resources, based on the best scientific data and on specific regulations*.

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

The volume of landings of the national industrial fleet targeting shrimp showed an increasing trend from 1978 to reach the highest levels in 1987 and 1988, but, since then, the landings of the fleet have shown a decreasing trend tendency and the annual volume of landings fluctuated with peaks in 1993, 1998 and 2006, and the lowest levels recorded in 2002, 2007, 2009 and 2010 (Figure 5) (ARAGÃO *et al*., 2005[58]; ARAGÃO, 2012[59]).

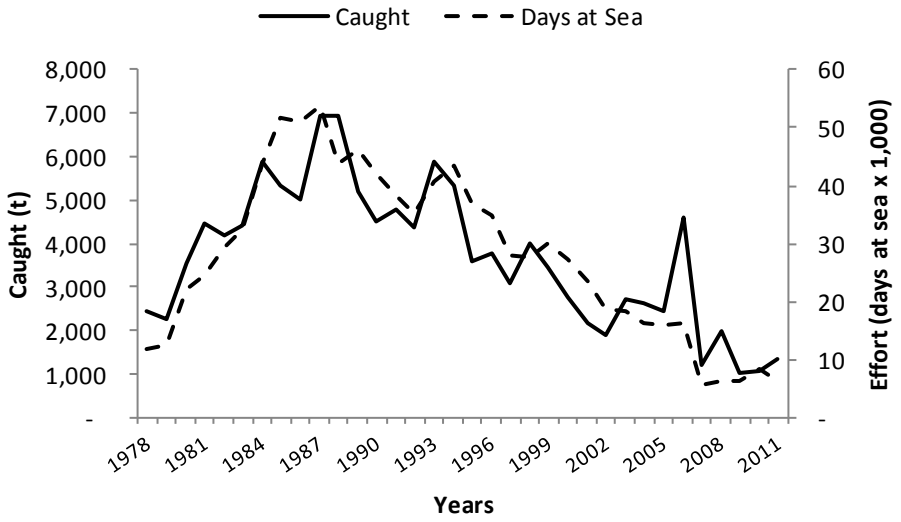

Figure 5. Trends of catches and fishing effort of shrimp resources, from 1980 to 2011 (Aragão, 2012)[58]

The fishing effort in terms of number of vessels per day-at-sea shows a trend somewhat similar to that of the landings. It rose continuously until 1985, when it reached 49 677 days-at-sea and, from then on, underwent a gradual decrease to reach 36 015 days-at-sea in 1992. After 1994, when fishing effort was 44 069 days-at-sea, a continuous decline was observed, reaching 15 529 days-at-sea in 2006, a level similar to that observed at the beginning of the fishery in the late 1970s. In the following year, the level of fishing effort was reduced to 5 783 days at-sea and is oscillating around 7 000 days-at-sea in recent years (Figure 5).

The catch per unit of fishing effort (CPUE), defined here as kilogrammes per day-at-sea (kg/DS), shows an oscillating trend, with peaks around 150 kg per day-at-sea in the years 1988, 1993, 1998 and 2003 and lower values, around 95 kg per day-at-sea, in the years 1986, 1990, 1995, 1999 to 2001 (Figure 6). It is interesting to note a cyclical pattern with a difference of about five years between each peak (ARAGÃO *et al*., 2005)[58]. It can be observed that in 2004 a new cycle began, resulting in a marked recovery of CPUE that reached 265.2 kg per day-at-sea in 2006. This level of CPUE is only comparable to that obtained at the beginning of the fishery in the late 1970s and early 1980s, when the level of effort was close to the lowest historical values, which leads to a preliminary conclusion that the low level of fishing effort applied in recent years combined, probably, with the favourable environmental conditions, contributed decisively to the recovery of the stock, and suggests that there is no evidence of overfishing of the pink shrimp stock off Brazil's north coast (ARAGÃO *et al*., 2009)[58]. It seems that whenever there is an increase inCPUE, it is followed by a rise in the level of fishing effort in the following years, which leads to a further decrease in the level of CPUE.

[58] ARAGÃO, J. A. N.; SILVA, K. C. A.; CINTRA, I. H. A. A pesca industrial do camarão na costa norte. In: OLIVEIRA, Geovânio Milton de. (Org.). Pesca e aquicultura no Brasil, 1991-2000: produção e balança comercial. Brasília, 9:260 p., 2005.

[59] ARAGÃO, J. A. N. Dinâmica populacional e avaliação do estoque do camarão rosa (*Farfantepenaeus subtilis* Pérez-Farfante 1967) na plataforma continental amazônica brasileira. 2012. Tese (Doutorado) - Escola de Engenharia de São Carlos da Universidade de São Paulo, São Carlos, SP, 242p., 2012.

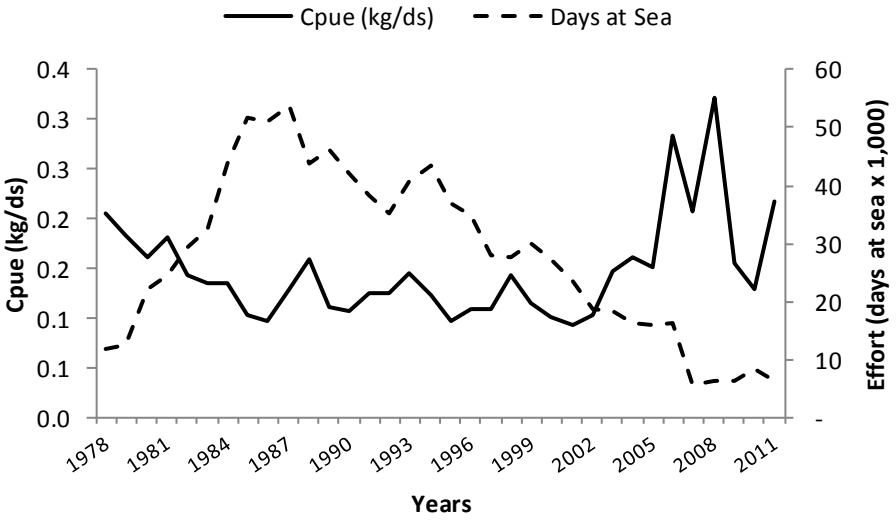

Figure 6. Catch per unit of effort: CPUE (kg/days at sea) of industrial pink shrimp fisheries in the Northern Region of Brazil, from 1980 to 2006 (Aragão et al., 2005)[58]

The best yields are obtained from February to June, during which fishing operations are carried out during the day and night. In the second half of the year, the operations mainly take place at night and some boats move to fish off the Maranhão coast. Handling of the catch on board begins immediately after the hauling of the nets, and sorting the shrimps from the accompanying fauna. The shrimp is then washed and taken to the basement where it is immersed in an aqueous solution of sugar, salt and sodium metabisulfite. It is then frozen by a process of forced air, placed in polythene bags and stored in chambers. In parallel, the bycatch species of commercial value are separated from the ones that will be discarded and taken to freezing storage chambers.

The production of acoupa weakfish caught in the Brazilian part of the Brazil-Guianas Shelf decreased from more than 25 000 tonnes in the years of 2002-2003 to less than 20 000 tonnes from 2005-2007 (Figure 7). Despite its economic relevance and the decreasing trend of its catch, there are no studies analyzing its CPUE or its population parameters that would allow inferences to be drawn regarding its state of exploitation.

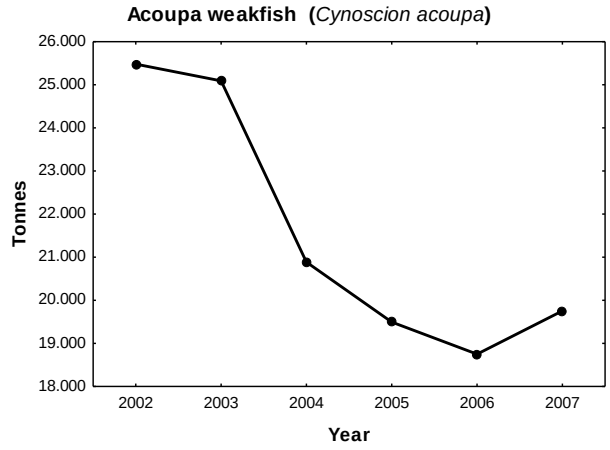

Figure 7. Annual production of acoupa weakfish (*Cynoscion acoupa*) in the Brazilian part of the Brazil-Guianas Shelf

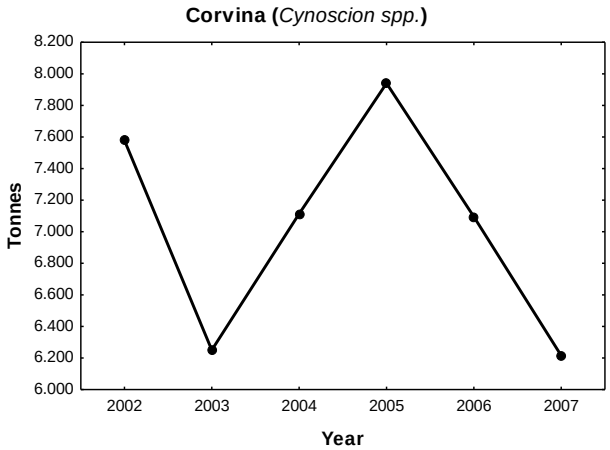

Figure 8. Annual production of corvina (*Cynoscion* spp. on the Brazilian part of the Brazil-Guianas Shelf

The production of *Cynoscion* spp. (corvina) caught in the Brazilian part of the Brazil-Guianas Shelf ranged between 6 000 and 8 000 tonnes from 2002-2007 (Figure 8). There are no studies analyzing its

CPUE or its population parameters that would allow inferences to be drawn regarding the state of exploitation of the species.

The production of gillbacker sea catfish (*Aspistor parkeri*) in the Brazil-Guianas Shelf fluctuated in the years from 2002 to 2007 between 5 500 and 9 600 tonnes, with a downward trend (Figure 9). There are no studies on the catch per unit of effort (CPUE) or its population parameters that would allow inferences to be drawn regarding the state of exploitation of the species.

Crucifix sea catfish (*Sciades proops*) production in the Brazil-Guianas Shelf fluctuated in the years from 2002 to 2007, between 5 200 and 7 700 tonnes (Figure 10). There are no studies on the catch per unit of effort (CPUE) or its population parameters that would allow inferences to be drawn regarding the state of exploitation of the species.

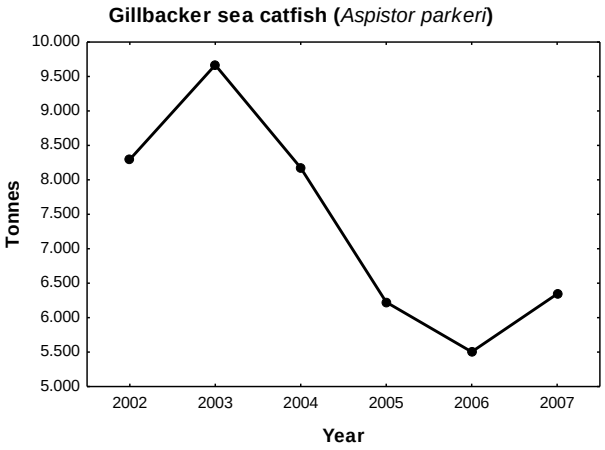

Figure 9. Annual production of gillbacker sea catfish (*Aspistor parkeri*) in the Brazilian part of the Brazil-Guianas Shelf

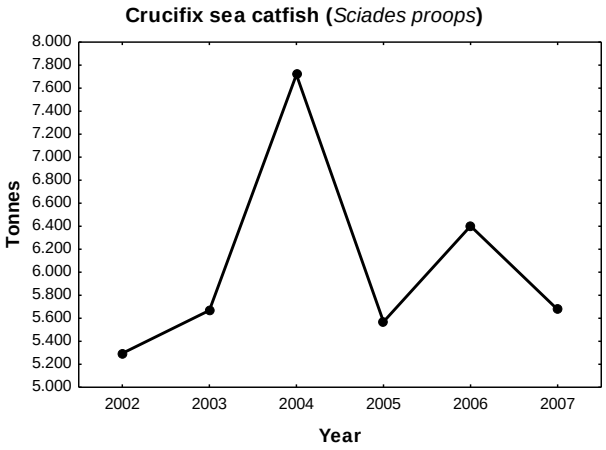

Figure 10. Annual production of crucifix sea catfish (*Sciades proops*) in the Brazilian part of the Brazil-Guianas Shelf

Production of king weakfish in the Brazil-Guianas Shelf luctuated in the years from 2002 to 2007 between 3 700 and 11 200 tonnes, with a trend for growth (Figure 11). The production of couma sea catfish in the Brazil-Guianas Shelf fluctuated in the years from 2002 to 2007 between 4 600 and 7 900 tonnes (Figure 12). There are no studies on the catch per unit of effort (CPUE) or its population parameters that would allow inferences to be drawn regarding the state of exploitation of the species.

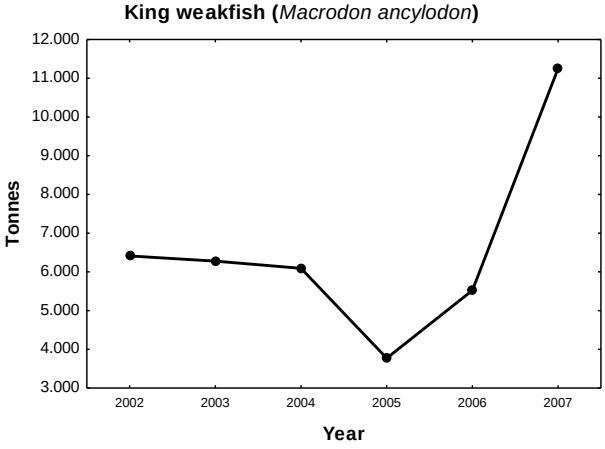

Figure 11. Annual production of king weakfish (*Macrodon ancylodon*) in the Brazilian part of the Brazil-Guianas Shelf

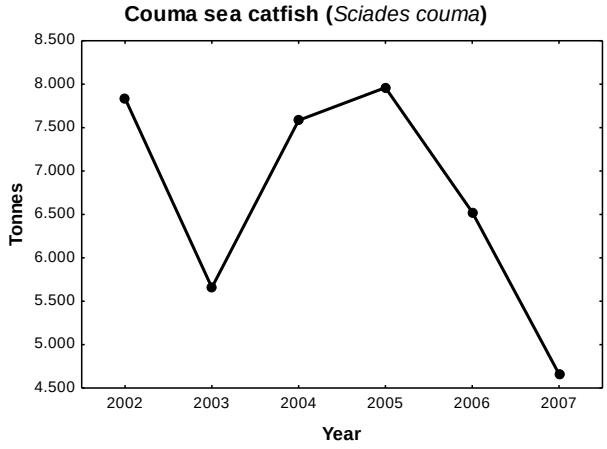

Figure 12. Annual production of couma sea catfish (*Sciades couma*) in the Brazilian part of the Brazil-Guianas Shelf

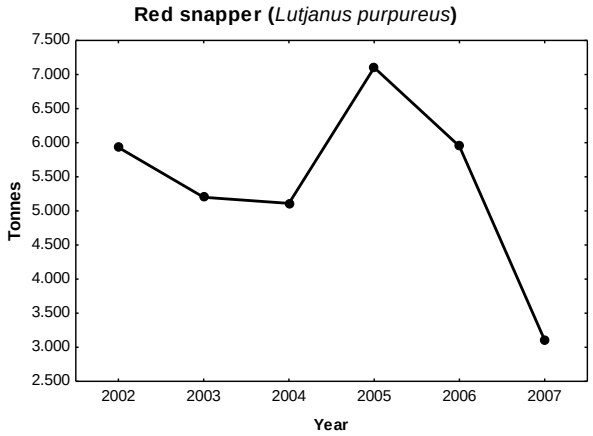

Figure 13. Annual production of red snapper (*Lutjanus purpureus*) in the Brazilian part of the Brazil-Guianas Shelf

The red snapper is caught in the Brazil-Guianas Shelf between the depths of 30 and160 m, however the major part of the red snapper catch by pots occurs at depths of 60-100 m and the longline catch occurs between 90 and 120 m (Costa, 2012). Red snapper production along the north Brazilian coast ranged between 3 000 and 7 000 tonnes between 2002-2007 (Figure 13).

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). Also add time series of market prices for the landings

Traditionally, most of the industrial production of shrimp was directed towards the foreign market in the form of frozen tails. A small portion is processed and exported as a whole product, primarily for the Japanese market. Exports reached the highest value during 1987and 1988, with USD 73.2 and USD 75.4 million, respectively. Since then exports followed the same declining trend observed in the landings, in 1997 and 1998 the fall was more pronounced, with annual exports of USD 22.7 and USD 26.2 million, respectively.

The recent decline in export volume and revenue is mainly due to falling prices in the international market. As a consequence, in recent years major changes have occurred in the industrialization and commercialization of the pink shrimp. The number of processing companies has drastically reduced. Currently, only two companies operate in the State of Pará, both based in Belem, and one in Fortaleza, Ceará State. The internal market, in turn, became a prime target of producers such that export is no longer as profitable as before.

There is no information available for groundfishes.

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

The pink shrimp processing industry consists basically of a mechanical sorting process in accordance with the number of tails (parts) per pound. After classification, the shrimps are packed in cardboard boxes in amounts of 5 pounds or 2 kilogrammes, and then frozen and stored. Headed shrimps are classified in the following categories: M/71, 61/70, 51/6041/50 31/40, 26/30, 21/25, 16/20 and 10/15 pieces per pound. For the whole shrimp, the categories are U/6, 6/8, 8/12, 13/15, 16/20, 21/25 and 26/30 pieces per pound.

The catches of the small and medium-scale fleet are usually marketed fresh, and preserved with ice. Only a relatively small portion, consisting mainly of seabob shrimp and young individuals of other species, is processed as a salted product. Most of this production is destined for the domestic and regional markets and a relatively small portion is sold to other States. In fact, there are no reliable statistics on the catch or on the amount commercialized.

There is no information available for groundfishes.

9. *Full set of management measures/primary management tools currently being used in the fishery/sector including those indicated in table below*

Management measures for shrimp fishing in northern Brazil have been adopted since 1980 and are aimed primarily at industrial fishing, based on the results of studies conducted by Centro de Pesquisas e Gestão dos Recursos Pesqueiros do Norte do Brasil: CEPNOR/IBAMA[9]. The measures are designed primarily to control the fishing effort of the industrial fisheries and to protect the recruitment of juveniles in growth and fishing areas, and, somehow, to protect the spawning stock.

Over the years, there have been changes and adjustments in the management measures due to attempts to cope with the effects on the sector's economy. Currently, the main regulatory measures in force for the industrial fishery targeting pink shrimp in the northern region of Brazil are:

- ✓ Limit of fleet size to 110 boats
- ✓ Closed season during peak recruitment months, from October 15 to February 15
- ✓ Trawlers mandated to use Turtle Excluding Devices (TED)
- ✓ Fishery forbidden to use motorised boats up to 10 nm from the coast

Although management plans are still being developed for the main fisheries resources off the Brazilian coast, some measures are already being enforced for the groundfish fishery of the northern continental shelf, such as:

- ✓ For the catfish piramutaba (*Brachyplatistoma vaillanti*) the main management measures are: (a) to prohibit, each year, from 15 September to 30 November, the practice of trawling targeting piramutaba (*Brachyplatistoma vaillanti*), in its entire area of occurrence; (b) to prohibit trawling, under any system, in a natural habitat of aquatic species in estuarine areas of the Amazon River and the State of Pará, in the area within the limits defined by the parallel 00°05'N and meridian 048°00'W; and (c) to limit to 48 vessels, the trawling fleet in operation targeting piramutaba and other catfish (order Siluriforme), outside the defined area mentioned above
- ✓ To prohibit, in the State of Amapá, the catch of Gurijuba (*Tachystrus* spp), each year from 1 November to 31 March, in the area between the mouths of the Araguari and Cunani rivers, up to the limit of three nautical miles, and around the Islands of Maracá and Jipióca (up to 3 miles)
- ✓ To permit, in the area between the northern boundary of the State of Amapá and the border between the states of Alagoas and Sergipe (Foz do Rio São Francisco), the catch of red snapper (*Lutjanus purpureus*), beyond the isobaths of 50 metres in depth. The vessels authorized to fish for snapper in the area mentioned are obliged to use a Vessel Monitoring System (VMS), through a satellite tracking device, fitted on board each vessel, under the National Tracking Programme of Fishing Vessels, during the fishing operations and to present the logbooks for inspection

10. *From the table below, assess the effectiveness of the current management measures in relation to the fishery itself, including effectiveness in ensuring sustainable utilization. "Effectiveness" may be in terms of better status of the stocks (increasing CPUE), decreasing conflicts, increasing value, level of compliance, etc. It is important to note that, in the State of World Fisheries and Aquaculture (SOFIA), FAO defines fisheries governance as "the sum total of the legal, social, economic and political arrangements used to manage fisheries"*

By nature, research on fisheries requires an understanding of fishers' interactions with fisheries resources and aquatic environments. From a specific point of view, there is collaboration with a broad range of stakeholders, including fishers, traditional ethnical communities, government officials, policy makers, environmental groups and leisure organizations. Partnership with these groups and

organizations in research and other related activities is an important part of Brazil's fishing policies. These are mainly fishing guilds, whose criticisms help in directing research activities for fisheries development projects. It is important to highlight the integration of women's leadership to enable them to collaborate and participate in actions for the implementation of marine and fishing policies, so as to promote good governance.

At institutional level, the discussion of management measures to be implemented in marine protected areas is being prioritized, as part of a process of comanagement with fishers and community members, especially women, who are actively engaged in the research project. Such an action has greatly enhanced the capacity of women and contributed to the subsequent establishment of a rather influential women's fishing group, which special emphasis on comanagement of small-scale fisheries.

Brazil is trying to consolidate social and economic advances, recognising the efforts of the Brazilian Government to take from poverty more than 16 million people hitherto marginalized, living in rural communities, including fishing communities, with public policies relating to small-scale production, food security, basic education and health, and livelihood. It is also important to recognize that it is possible, through the involvement of fishers in a comanagement process, to establish participatory mandates for fishing guilds in many steering committees for fishing stock management.

The effectiveness shall be seen through the opportunity to implement public policies for the management and regulation of fisheries, especially if we consider the 8 500 km of Brazilian coastline, where we can find a variety and a diversity of fishing communities and small-scale fishing activities, each with strong cultural and ethnical characteristics, in a bottom-up process, incorporated into such a public policy and appropriated by government agents, technicians, extension service agents, and decision-makers; that is enabling the empowerment of fishers and fishing communities; and that could provide and generate information and knowledge on any partnership project.

Receiving feedback from the community would help the Brazilian Government to adjust public policies, address the challenges to implementing these policies, and empower the fishing communities, so as to enhance the ability of the fishers to take ownership of their own development process and not simply be at its receiving end.

11. *Any compliance or enforcement problems being experienced in the fishery, and any complaints or dissatisfaction amongst fishers/rights holders. You need to consider scientific monitoring (e.g. of catches against permitted exploitation) as well as MCS (monitoring, control and surveillance)*

Based on the results of the risk assessment and the discussions held during the Brazilian national consultation with stakeholders, a specific set of actions considered key for improving fisheries management of shared stocks was defined. This set of actions was based on the experience of stakeholders in fisheries-related issues and their appreciation of the problems associated with the implementation of management measures.

Monitoring and control

Establishment of a comprehensive programme of monitoring and control, taking into account the need for the systematic collection of fisheries data, with standardized methodology, contemplating aspects related to fisheries, environmental and socioeconomic information:

- ✓ Standardization of methodology for collecting and analyzing data, creating an information system (software) for data storage
- ✓ Assignment of powers and responsibilities within the existing institutional arrangement for monitoring, considering aspects ranging from data collection to the use of information

- ✓ Allocation of budgetary resources to monitoring and control activities: ensuring that these activities are included in Annual and Multiyear National Budgetary Plans (PPA and POA)
- ✓ Qualification and training of human resources
- ✓ Improving compliance with existing tools for fisheries monitoring: log-books, production maps, production reports of fishing activity, invoices, etc.
- ✓ Adequacy and strengthening of mechanisms for control and tracking of fishing vessels, including the Satellite Tracking Program of Fishing Vessels: PREPS (Vessel Monitoring System–VMS)
- ✓ Definition of a policy for accessing the data collected within the control and monitoring programmes, to broaden the base of information available for research and to ensure its proper dissemination to interested parties. In principle it should be sought to universalize the access of users to secondary data

Characterization of fisheries systems

Improve knowledge of the fishery systems exploiting the shared stocks, characterizing the dynamics of fishing fleets, the typology of boats and fishing gear, as well as the support (ports) and processing structures, aimed at understanding the current fishing and processing capacities.

- ✓ Description of fishing gear, including materials and technologies in use: traps, trawls, gill netting and line (longline; etc.)
- ✓ Description of vessels used in the fishery: type of hull, deck arrangement, gross tonnage, propulsion, crew, equipment to support fishing, etc.
- ✓ Survey of fleet size and characterization of the capacity and power of fishing vessels
- ✓ Survey of installed capacity for landing and processing fish, to identify needs for improvement of infrastructure for receiving, handling, transportation and fish processing
- ✓ Characterisation of working conditions on board, to identify the main risk factors for safety at sea and the necessary measures to improve working conditions
- ✓ Improving handling and packaging of fish on board and during landings, in accordance with sanitary standards and requirements
- ✓ Adjustment of credit and development of policies to allow the renewal of the fleet, keeping fishing and processing capacities commensurate with the productive capacity of stocks, and to improve infrastructure for unloading, storage, processing and marketing of fish
- ✓ Develop and/or improve credit policies to the artisanal sector adjusted to the local conditions and realities

Assessment of the status of shared stocks in the Guianas-Brazil shelf

Conduct stock assessment studies to assess the state of the main shared stocks and to define fishery-biological parameters (e.g. maximum sustainable yield), with a view to establishing management measures in accordance with the precepts of sustainable exploitation of fisheries resources.

- ✓ Create, in accordance with the EAF framework, demand for studies aiming to: (1) define fishery-biological parameters for target and accessory species; (2) assess the impacts of fisheries on the ecosystem; and (3) assess the socio-economic conditions of fisheries
- ✓ Develop or revive (reactivate) regional working groups for information exchange and joint evaluation of shared stocks
- ✓ Identification and evaluation of management actions for fisheries, based on updated information about their biological, ecological and socio-economic conditions

Ecosystem impacts

Identification and quantification of major fishery-ecosystem interactions aimed at developing strategies to minimize the impacts of fishing on the ecosystem and reducing the sector's vulnerability to external factors.

- ✓ Improve knowledge about the bycatch species and non-retained species, in order to evaluate the impacts of incidental catches on the state of stocks
- ✓ Improve knowledge about the interaction and incidental capture of protected and/or vulnerable species, such as sea turtles, marine mammals, seabirds, elasmobranchs, etc.
- ✓ Improve knowledge about the impacts of trawling fisheries on bottom habitats
- ✓ Evaluate and implement management measures to minimize fisheries impacts on the ecosystem
- ✓ Evaluate the degree of exposure and vulnerability of the fishing sector to external impacts arising from environmental changes or economic factors, aiming at developing adaptive strategies to deal with these impacts

Governance

Knowledge and recognition of the institutional arrangements and the existing legal framework, aimed at the identification and fulfilment of institutional responsibilities, and the identification of the necessary adjustments to improve the system of governance and the empowerment and participation of stakeholders directly and indirectly involved with the fisheries in question.

- ✓ Evaluation and description of the institutional arrangements, skills and responsibilities required in the context of the case study, with the establishment of formal relations
- ✓ Evaluation and description of the legal framework required in the context of the case study
- ✓ Strengthening mechanisms for stakeholder participation in management through the operationalization of existing mechanisms (e.g. Standing Committees for the Management of Shrimp and Demersal Fisheries) and/ or development of alternative mechanisms
- ✓ Knowledge, recognition and description of conflicts between fisheries and other economic sectors in order to identify necessary adjustments in institutional arrangements to improve the ability to manage conflict
- ✓ Developing and/or enhancing communication strategy between government and the fisheries sectors
- ✓ Identifying opportunities and demands for adequate funding/ institutional apparatus to carry out the functions of planning and control

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

Considering the macro-process of regulation coordinated by the Ministry of Fisheries and Aquaculture, a Standing Management Committee (CPG: Comitê Permanente de Gestão) will be established, within the concept of the sustainable use of fisheries resources and ecosystem approach to fisheries.

In the maritime macro-spatial context, four aspects are considered: ecosystem approaches; oceanographic conditions; the dynamics of fisheries resources; and fishing methods and techniques. These four aspects are closely related and are crucial for the identification of the biological behaviour that drives the spatial and seasonal distribution of marine species. Similar patterns may be drawn to consider the ecological definitions of the three marine macro zones – coastal, demersal and pelagic – that often overlap. So, in the marine area, a Standing Management Committee will be created to manage the fishing resources whose entire life cycle, or most of it, takes place in the coastal zone, including estuaries and lagoons; in the demersal zone; and in the pelagic zone (Figure 14).

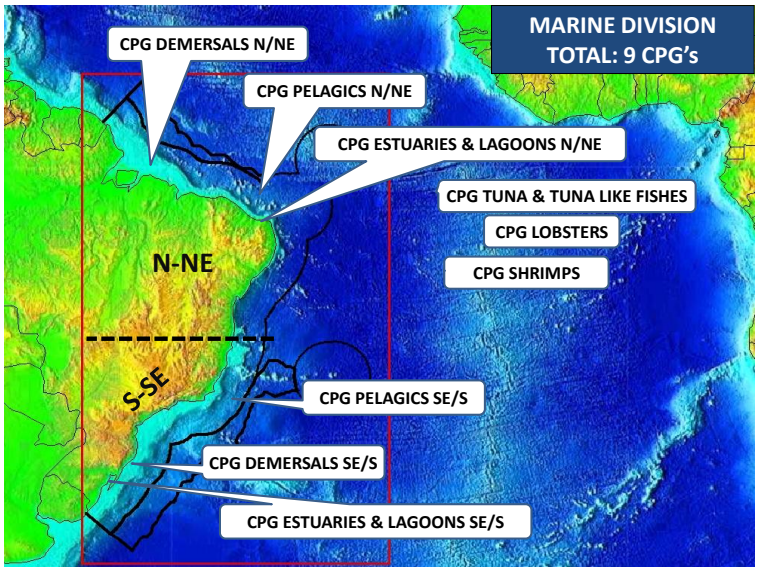

Figure 14. Standing Management Committee for the marine area in Brazil, within the context of the sustainable use of fisheries resources and ecosystem approach to fisheries

A National CPG on Shrimps and a North and Northeast CPG on Groundfishes are being implemented under the fishing policy and the fisheries regulations established by the Decree #6981, of 13 October 2009. There is the necessity to establish rules, criteria, standards and regulatory measures:

- ✓ *That should deal with*:
  - The access scheme
  - Total allowable catch
  - Sustainable fishing effort
  - Closed (Fenced) seasons
  - Fisheries seasons
  - Size of the catches
  - Prohibited areas or reserves
  - Gear, equipment, methods and systems of fishing and farming
  - The protection of individuals during the process of reproduction or rebuilding of stocks
- ✓ *And that should be established:*
  - Jointly between the Ministry of Fisheries and Aquaculture (MPA) and the Ministry of Environment (MMA)
  - Based on better technical and scientific data

All these procedures must be incorporated into a co-management system for the sustainable use of the fisheries resources, understood as:

- ✓ *Definition*: Sharing responsibilities and tasks between the state and the representatives of civil society organizations
- ✓ *Objectives*: To subsidize the elaboration and implementation of rules, criteria, standards and measures for the development of the sustainable use of fisheries resources
- ✓ *Composition*: composed of committees, technical councils and working groups in a consultative and advisory process, consisting of government agencies for the management of fishing resources and the society that is formally organized
- ✓ *System Coordination*: Inter-ministerial Technical Committee for the Management of Shared Fisheries Resources (CTGP) formed by MPA (SEPOP[60]/SEMOC[61]/SEIF[62]) and MMA (IBAMA/ICMBio)

[60]Secretaria de Planejamento e Ordenamento da Pesca (Secretariat of Fisheries Planning and Regulation).
[61]Secretaria de Monitoramento e Controle da Pesca e Aquicultura (Secretariat of Fisheries and Aquaculture Monitoring and Control).

- ✓ *Committees*: parity between consultative and advisory bodies for the definition of rules, criteria and standards related to the regulation of the sustainable use of fisheries resources
- ✓ *Main Committees Objectives*: to prepare Management Plans for the Sustainable Use of Fisheries Resources, considering the management unit and looking at all the measures or long-term actions that can be reviewed periodically
- ✓ *Committee Constitution*: in a joint Act of the Ministers of Fisheries and Aquaculture and the Environment

The Standing Committee of Management will be formed according to the management unit framework and will be assisted by a scientific subcommittee, a monitoring subcommittee and technical councils:

- ✓ *Management Unit*: comprises the species or group of species, the ecosystem, the geographic area, the watershed and the system of production or fishery
- ✓ *Scientific Subcommittee*: should provide technical advice to the Committee, composed of researchers and technicians with adequate knowledge of in the related issues
- ✓ *Monitoring Subcommittee*: should monitor the level of compliance with management measures and shall be composed of representatives of the committee
- ✓ *Technical Council*: created to address specific issues within the committees, and shall be composed of equal numbers of representatives of the various Committees
- ✓ *Working Groups*: should be formed to provide advice on specific issues agreed upon by the MPA and the MMA

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

Although it seems straightforward, it's important to understand the complexities of geopolitical and regional diversities that should be incorporated into fishery management for the balance of social, economic and environmental issues, gender (equality) equity, and culture and knowledge dimensions.

The first step is to take into consideration the *political composition* according to demands and appropriations in the development of basic guidelines and fundamentals of fisheries regulations; parity between government representatives and civil society organizations; and a technical-political balance, to take political decisions based on existing technical and scientific knowledge. The second step is to ensure the overall balance between *economic and social approaches*, since it is important to understand the existing economical and social imbalance within the fishery sector, and the necessity to address the issue of cultural rights. Within these dimensions, knowledge is generated according to the following vectors: the *empirical-traditional*, as each of the actors involved provides information, denounces and especially announces, and defines and establishes an understanding of issues; and *technical-scientific*, to establish procedures and provide support to decision-makers.

So, we strongly believe that such institutional procedures may help the empowerment of fisheries comanagement, aimed at the implementation and enforcement of public policies for the management and regulation of fisheries, enhancing the importance that it should be:

- ✓ Incorporated into a bottom-up process
- ✓ Appropriated by government agents, technicians, extension service agents, and decision-makers
- ✓ Empowered by stakeholders, especially by fishers and fishing communities
- ✓ Supported by stakeholders to generate information and knowledge

[62]Secretaria de Infra-estrutura e Fomento da Pesca e Aquicultura (Secretariat of Fisheries and Aquaculture Infrastructure and Promotion).

Management tools currently implemented

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	√	- Fishing prohibited up to a limit of 10 nm for motorized boats
○ Nursery area closures	√	- Protection of natural habitats ofaquatic speciesofestuarine areas of the Amazon River and the State of Pará and Amapá. Red snapper is only allowed to be fished beyond 50 m depth
○ No-take zones		
○ Marine reserves where fishing is sometimes allowed		
○ Other temporary area closures for specific purpose (e.g.: spawning aggregations)	√	- It is prohibited to fish with any fishing gear in area between longitudes 46°50'W and 48º00'W and parallel 0°00 and 1º30'N-mouth of the Amazonas and Pará Rivers ("trash" area)
Temporal restrictions such as:		
○ Defined fishing season(s)	√	- Pink shrimp: recruitment, from 15 October to 15 February - Piramutaba (*Brachyplatistoma vaillanti*): recruitment, annually, from 15 September to 30 November - Gurijuba (*Tachystrus*spp), annually, from 1 November 1 to 31 March
○ Defined number of fishing days		
○ Defined number of fishing hours per day		
○ Defined number of fishing hours		
Gear restrictions such as:		
○ Engine size restrictions		
○ Gear size restrictions	√	- Gillnet length and mesh size for catfishes
○ Gear type restrictions	√	- Red snapper can be only be fished by longlines and traps
Size/age restrictions (i.e., minimum or maximum sizes)	√	- Studies indicate the management measure needed to ensure that species being fished are above the size at first maturation
Participatory restrictions such as		
○ Licences	√	- Limit of fleet size to 110 boats targeting pink shrimp - Limit of fleet size to 48 boats targeting catfish (piramutaba)
○ Limited entry	√	- Increase in the fleet size and capacity is not allowed
Catch restrictions such as:		
○ Total allowable catch (TAC) limit		
○ Vessel catch limits		
○ Individual vessel quotas		
Rights/incentive-adjusting regulations such as:		
○ Individual effort quotas		
○ Individual fishing quotas		
○ Individual transferable quotas		
○ Individual transferable share quotas		
○ Group fishing rights (including community development quotas)		
○ Territorial use rights		
○ Stock use rights	√	- It is only allowed to renew fishing licenses for those that already have one. So, it can be said that a “stock use rights” for any group that enters the fishery is enforced

This document presents the results of the national consultation that was organized in Brazil 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 sixth 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 Eacosystem Approach to Fisheries (EAF) in the management of the shrimp and ground fish resources of the Northern Brazil Shelf Ecosystem.