Thesis for the Degree of Master of Fisheries Science

Implementation of Responsible Fisheries and Foreign Vessel Management System in Senegal

by

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Abbreviations

ACP	African, Caribbean, and Pacific Countries
APA	The Agency for the Promotion of Aquaculture
ATLAFCO	Atlantic Regional Convention for Fisheries Cooperation
BCLME	Benguela Large Marine Ecosystem Program
BENEFIT	Benguela Environment Fisheries Interaction and Training
CCAMLR	International Commission for the Conservation of Antarctic Marine Living Resources
CDS	Catch Documentation System
CFECA	Committee on Fisheries of the Eastern Central Atlantic
CFTC	Commonwealth Fund for Technical Cooperation
CIFA	Committee for Inland Fisheries and Aquaculture
COMAHFAT	Ministerial Conference on Fisheries Cooperation among The riparian states of the Atlantic Ocean
CRODTO	Oceanographic Research Center Dakar-Thiaroye
DANIDA	Danish International Development Agency
ECOWAS	Economic Community of African States
EEZ	Exclusive Economic Zone

EU	European Union
FAO	Food and Agriculture Organization
FOC	Flags of Convenience
FOP	Fisheries Observer Program
GDP	Gross Domestic Product
GRT	Gross Register Tonnage
GEF	Global Environment Facility
HACCP	Hazard Analysis Critical Control
ICCAT	International Committee for the Conservation of Atlantic Tuna
IOC	Inter-governmental Oceanographic Commission
ISDS	the Inter-state Struggle against Drought in the Sahel
IUU	Illegal, Unregulated and Unreported fishing activities
LAAF	Local Advisory on Artisanal Fishing
LDC	Least Developed Countries
MCS	Monitoring, Control and Surveillance
MFD	Maritime Fisheries Directorate
MFMR	Ministry of Fisheries and Marine Resources
NACF	the National Council on Fisheries

NORAD	Australian International Development Assistance
NPAD	National Program for Aquaculture Development Bureau
OMVG	Organization for the Development of the Gambia River
OMVS	Organization for the Development of the Senegal River
RID	Research Institute for Development
SADC	Southern African Development Community
SEAFO	South EAST Atlantic Fisheries Organization
SRFC	Sub-Regional Fisheries Commission
TAC	Total Allowable Catch
UCAD	Cheikh Anta Diop University
UEMOA	African Economic and Monetary Union
UNPE	United Nation Program for Environment
VMS	Vessel Monitoring System
WAEMU	West African Economic and Monetary Union
WTO	World Trade Organization

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Abstract

Since the 1960s Senegal has been a significant player in the sub regional and international fisheries sector. However, Senegal lack of implementing responsible fisheries has led some foreign vessels to employ less conventional methods in harvesting fisheries resources mainly tuna resources. In addition, Senegal lack of well managing foreign vessel's catches has allowed foreign vessels which signed agreements with Senegal to make more benefits by exporting the catches in their countries for processing and marketing in order to maximize their benefits. Meanwhile, Senegal has been experiencing the painful cost of its fisheries agreements with foreign vessels operating in its waters. This study analyses the status and management system of Senegalese fisheries in order to see if the policies implemented are in accordance with the international management instruments and fisheries resources compliance requirements and domestic laws. This study also examines

the main issues of which Senegal's fisheries sector has been facing which prevent it to develop its fisheries industries. Finally this study gives some recommendations and policy actions derived from some successful fisheries management system of some countries case study. These recommendations focus on making a strong controlling system in accordance with the international regulations and laws. It is also necessary to insist on sharing the catches instead of leaving the whole catches exported by only foreign vessels. This study also strongly recommends developing fisheries industries in order to maximize profits by creating employments and processing the total production in Senegal.

1. Introduction

1.1 Background

Senegal is well endowed with abundant natural resources from aquatic resource base. On the marine side the country has a coastal line of 718 km and an Exclusive Economic Zone (EEZ) covering an area of 200,000 km² providing the country with additional marine area and fishery. The fisheries sector is among the important economic sub-sectors of the economy in Senegal. The sector provides substantial employment, income, livelihood, foreign earnings and revenue to the country.

The industry employs more than 2,000,000 people engaged in fisheries and fisheries related activities while more than 600,000 fisheries operators are directly and indirectly employed in the sector. In 2011 the fisheries sector contributed 1.3% to the Gross Domestic Product (GDP) while the per capita fish consumption in Senegal is 26 kg which is higher than the world average. However, this contribution to food security is following a downward trend in recent years, from 41 kg in 2003 to 26 kg in 2010, due to population growth and scarcity of fish.

In recent decades, inland fisheries have been declined in catches mainly due to consecutive rainfall deficits like drought and the modification of hydrological regimes of major rivers like dams and irrigation schemes (FAO, 2008). At the same time, the development of industrial agriculture like tomato and sugar, and rice culture in the northern region of the country have forced good number of fishermen to retrain, temporarily or permanently, in the area of agriculture (FAO, 2008).

Despite individual initiatives and the many projects implemented, aquaculture, usually introduced in the context of projects mainly with fish, shrimp, and oysters, has not yet yielded encouraging results due to the lack of monitoring and coordination, lack of control of popularized techniques. Aquaculture and inland fisheries have changed little during the last two decades and remained sluggish due to an unfavorable ecological and socio-economic context despite the existing potential.

To all these problems the Senegalese fisheries facing, comes the issue of overexploitation. Nevertheless, overexploitation of the main fish stocks of economics interest has dramatically declined global fisheries since the early 1970s. Senegal has not escaped this process of transformation of economies and societies, particularly in the vital sectors of fisheries and aquaculture.

Indeed, qualitative and quantitative changes in the abundance of consecutive fisheries resources abusive exploitation of biological resources and to significant environmental changes have emerged on bio-ecological perspectives. The overexploitation of the main stocks, and the development of threats and attacks, in multiple forms, anthropogenic origin, is remarkable in most of the Senegalese waters and in coastal areas. Such overexploitation, threats and attacks have affected fishery resources and Senegalese government should recognize the issue, and discuss and improve the current management system. However, the main issue of Senegal's fisheries sector is related to its several fisheries agreements with some foreign countries which benefit more from these agreements. Then in to highlight the issue, this study aimed to deal with the implementation of responsible fisheries and foreign vessels management system in Senegal by taking into account social, economic and ecological aspects of marine environments.

1.2 Objectives of the study

The main objective of this study is to examine the way Senegalese government deals with foreign vessels in Senegalese waters to strengthen management of fisheries resources to a better understanding so as to sustain

the resources in a harmonized manner socially, economically and environmentally. All stakeholders should also benefit to the resources by improving compliances with fisheries management measures to prevent habitat destruction and overexploitation. This benefit of resources should also be obtained by improving ecosystem integrity, socioeconomic development among fishery communities through the adoption of a participatory approach system.

This study also reviews and examines the status of the Senegalese fisheries resources and the way these resources are managed.

This study also aims on identifying the problems mainly facing by the Senegalese fisheries sector such as over-fishing, over-capacity, conflicts of fishermen, illegal, unregulated and unreported (IUU) fishing activities, and lack of capacity to manage the resource.

This study also aims to examine whether or not the case studies management system conforms to Senegal standards for responsible fisheries management.

This study also intends to give some relevant recommendations derived from the successful case studies management system of some countries in order to implement a better management system for the preservation of

resources and also for a sustainable development of the Senegalese fisheries industries to the benefits of the population.

1.3 Significance of the study

Nowadays fisheries resources play an important part in the economy of Senegal. These resources make a significant contribution to the gross domestic product (GDP), foreign exchange earnings, provision of employment and most obvious use of fish is as food for human consumption. Fish is an important source of animal protein and "provides only 33 calories per capita per day" (Halwart, 2013).

This study will also provide economic analysis through loyalty of the sustainable use of marine resources in Senegal with regards to the international fisheries regimes. This research also expects to assist policy makers and hence decision making about the economic management on fisheries in Senegal.

1.4 Research methodology

The achievements of this study are through visiting and compiling data from the libraries, and access them into my related field of study.

Various discussions with my supervisors and my colleagues in this study are also one of the major methods used to make up this paper.

Table 1.1 General economical and geographical data on Senegal

Area	718 km
Scope of plateau	198 000 km²
Coastlines	718 km
Population (2013)	13, 300,410
GDP at purchasers' prices (2011)	14700 millions USD
GDP per capita (2012)	2100 USD
Agricultural GDP (2011)	15.4% of GDP
GDP fishing (2013)	1.3% of GDP

Source: FAO 2008, overview of fisheries sector in Senegal

Table 1.2 Data relative to fisheries in Senegal (2012)

Data	Production (t)	Imports (t)	Exports (t)	Total supply (t)	Per capita consumption (kg/ year)
Fish for consumption	447 961	1125	128 190.76	405974	26

Table 1.3 Data relative to fisheries in Senegal

Number of employment (2012)	
1 Primary sector (including aquaculture)	58 505 artisanal More than 5 000 fishermen in the sector of industrial fishery
2 Secondary sector	around 600 000 fisheries operators
Gross value of fisheries production (2005)	247, 344,674.73 USD
Trades (2012)	
Value of fisheries imports	1 072 000 USD
Value of fisheries exports	168.12 billion USD

Source: FAO 2008, overview of fisheries sector in Senegal

2. Status of Senegalese fisheries

2.1 Overview of Senegalese fisheries

Landing sites are identified in many part of the country. Indeed, more than 226 fishing centers are identified between St. Louis in the north and Boudiédiéte in the south while 77 centers and fishing areas have been identified in the area on Senegal River including sixty between Diama dams and Podor and around Lake Guiers. Sea fishing sites are classified into large, medium and small centers depending on the volume of landings, level of activity and canoe fleet. Fisheries infrastructures are poorly developed in centers located in continental area.

Major fishing centers are permanent sites where the annual average landings are greater than 2500 tons. Among these permanent sites are St. Louis, Kayar, Yoff, Soumbedioune, Hann, Rufisque, Mbour, Joal and Djiffere (Figure 1 Below). They polarize about 80% of Artisanal fishing activities, and most are easily accessible. They have (except Soumbedioune (Dakar), a dock for landing catches, processing sites (except Soumbedioune and Hann),

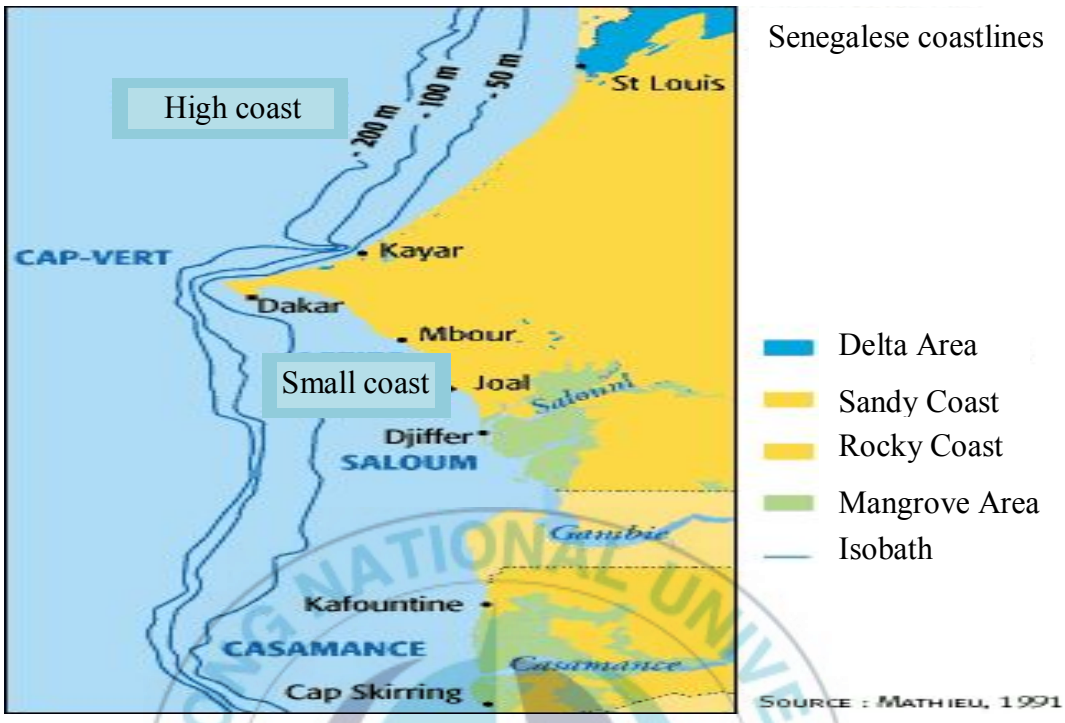
good station of distribution of fuel and a site of construction of artisanal canoes.

Other fishing centers consist of medium and small centers which are temporary sites or priority clusters of decongestion of urban centers. Planned investments in these localities are on the development of landing sites, processing sites and opening pathways. The most prominent are: Ouakam, Thiaroye, Diamnadio, Potou, Dionewar and Bargny.

Inland fisheries centers or estuarine are located in the delta areas of Senegal, Saloum and Casamance Rivers. It is not easy to access. Access is difficult in the rainy season and is made by water or track. The most important are in Richard Toll, Ziguinchor and Missirah.

Source: Overview of fisheries sector in Senegal

Figure 2.1 Administrative map of Senegal.



Source: Overview of fisheries sector in Senegal

Figure 2.2 Configuration of the Senegalese coast.

2.2 Fishermen community

According to FAO report (2008) fishermen come from three major communities: the Wolof of Guet-Ndar (Saint Louis), the Lebous of Cape Verde and the Small Coast, the Sereres Nyominkas of Saloum Islands.

Artisanal fishers are exclusively composed of 99% of Senegalese and their youth (the majority between 18 and 35 years) advocates for the sustainability of this activity. Some fishermen (Guet-Ndariens) have their activities exclusively focused on the sea, others engage in seasonal activities such as rained agriculture (Nyominkas Islands of Saloum) or gardening (Lebous of Dakar and the large coast).

The wholesalers are the professional category fulfilling various functions: financing of artisanal fisheries, buy fish on beaches, packaging and transport to factories, inside and outside the country. Fish trade is an activity heavily dominated by middle-aged men, 40 to 45 years. Some wholesalers have integrated throughout the fishing industry strongly diversifying their activities.

Artisanal processors are mostly women. Scale processing represents an important social function. Some processors, certainly in limited number, involve in the industry and are mainly present in Joal and Kafountine. These

are mostly migrants from the countries of the sub region, which value species such as shark and rays not falling into the habits of Senegalese. The region of Thies remains the focus area of this activity.

Millers have strongly influenced the direction of artisanal fisheries. Under their pulse, much type of artisanal fisheries have emerged and developed only for export (including cephalopods). Overall, nearly 60% of the supply of fish exporting industries is provided by units of artisanal fisheries. The prospect of quick profits has led many millers to join this sector. But the scarcity of the resource and the existence of capacity already important have created significant overcapacity and underutilization of capacity production which has weakened many companies .

2.3 Fishing effort

Senegal Ministry report shows that artisanal fishing activities are mainly practiced in 7 regions representing the half of the regions in Senegal. Among these main fishing regions are Dakar, Thies, and Saint-Louis, Ziguinchor, Fatick, Louga and Kaolack. In these regions fishing activities are done during the whole year from January to December. The number of fishermen cannot stop increasing every year.

The evolution of the number of fishermen shows that Thies is the region where the number of fishermen is more important with 19237 fishermen followed by Dakar with 15164, then Ziguinchor with 8415 fishermen. The region of Fatick comes in the fourth position with 7680 fishermen, followed by Saint-Louis with 6566 fishermen. Kaolack arrives at the sixth position with 822 fishermen and finally Louga with 621 fishermen.

So according to the results of these regions, the evolution of the number of fishermen in 2012 in Senegal is estimated to a total of 58505 fishermen. In 2011, the number of fishermen was estimated to 58116 fishermen. From these two results we clearly notice that the number of fishermen has increased to 389 fishermen which represent an evolution of 1% from 2011 to 2012.

Table 2.1 Evolution of number of active fishermen in 2012

Regions	Number of Fishermen
Dakar	15164
Thies	19237
Saint-Louis	6566
Ziguinchor	8415
Fatick	7680
Louga	621
Kaolack	822
Total	58505
2011 number of fishermen	58116
Percentage %	1%

Source: Maritime fisheries directorate (MFD) Report, 2012

In Senegal there are thousands of pirogues which are active in Senegalese waters from January to December. These pirogues practiced fishing activities in the seven main fishing regions we mention above. There are two kinds of pirogues in Senegal: motorized pirogues and other kind of pirogues. For motorized pirogues, Thies has the highest number with 3026 pirogues followed by Dakar with 2406 pirogues, then Saint-Louis with 1370 pirogues, and after we have Fatick with 1031 pirogues. Ziguinchor comes in the fifth position with 637 pirogues followed by Louga 125 pirogues and finally Kaolack with 60 pirogues.

As for the other kinds of pirogues, Ziguinchor comes first with a total of 1583 pirogues. Fatick comes in the second position 296 pirogues, followed by Dakar with 102 pirogues. Kaolack comes in the fourth position with 91 pirogues, followed by Thies with 35 pirogues. Saint-Louis and Louga has not other of pirogues.

According to our results, the total number of pirogues is estimated to 8656 and the number of other kind of pirogues is estimated to 2107 pirogues for a total of 10763 pirogues in 2012. In 2011, the total number of pirogues was estimated to 10455. From 2011 to 2012 the number of pirogues in Senegalese waters has increased to 308 pirogues for an evolution of 3%. This situation shows that the fishing effort is gradually increasing per year.

Table 2.2 Evolution of number of active pirogues 2012

Regions	Number of pirogues	
Dakar	Motorized pirogues	2406
	Other pirogues	102
Thies	Motorized pirogues	3026
	Other pirogues	35
Saint-Louis	Motorized pirogues	1370
	Other pirogues	0
Ziguinchor	Motorized pirogues	637
	Other pirogues	1583
Fatick	Motorized pirogues	1031
	Other pirogues	296
Louga	Motorized pirogues	125
	Other pirogues	0
Kaolack	Motorized pirogues	60
	Other pirogues	91
Total	Motorized pirogues	8656
	Other pirogues	2107
General Total		10763
2011 number of pirogues		10455
Percentage %		3%

Source: MFD, Report 2012

According to the Maritime Fisheries Directorate (MFD), fuel represents an important resource for the development of artisanal fisheries in Senegal. It is used in the seven main fisheries regions for fishing activities. The consumption of fuel is made the whole year by fishermen for their pirogues

according to their fishing activities. The consumption of fuel is higher in Thies then any other region with 15460 liters for a commercial value of 3172759 CFA francs (African Financial Community franc). Dakar has a consumption of 6051 liters for a commercial value of 379357 follow by Ziguinchor with 5395 liters for a commercial value of 3558365 CFA francs. The consumption of fuel in Thies is equal to 4346 liters for 2694579 CFA francs followed by Fatick with 3027 liters for 1985787 CFA francs, and then comes Louga with 122 liters for a commercial value of 78316 CFA francs. As for the region of Kaolack, it does not present any consumption of fuel.

In 2012, the total quantity of fuel consumption in Senegalese artisanal fisheries is estimated to 34401 liters for a commercial value of 15283378 CFA francs. In 2011 the total consumption was estimated to 33733 for a commercial value of 20872995 with an increase of 668 liters representing 2% and 5589617 of decrease for the commercial which is equal to -27%.

Table 2.3 Consumption of fuel of artisanal fishing in thousands of liters and francs 2012

Regions	Quantity	Commercial value
Dakar	6051	3793571
Thies	15460	3172759
Saint-Louis	4346	2694579
Ziguinchor	5395	3558365
Fatick	3027	1985787
Louga	122	78316
Kaolack	0	0
Total	34401	15283378
2011's consumption	33733	20872995
Percentage %	2%	-27%

Source: MFD, Report 2012

Senegal maritime fishing is divided into two parts: Senegalese fishing and foreign fishing. In Senegalese fishing we have artisanal fishing and industrial fishing. In 2012 landings are estimated to 405974 tons for artisanal fishing against 372956 in 2011 with an approximate increase of 9% (MFD Report, 2012). The general tendency of captures is very rare due to the variability of sardinella capture on the west coast of Senegal, the emergence of some kind of species and also access agreement in the neighboring countries.

The regions of Kaolack, Saint Louis and Dakar have registered high increases in terms of landings with respectively 110%, 31% and 26% (MFD Report, 2012). Kaolack has also registered significant increases due to the catches of white shrimps. Except Thies where the landings have decrease 3%, the other entire regions have registered a moderate increase. As for the industrial fishing, landings are estimated to 41987 tons in 2012 against 47923 tons in 2011, a decrease of 12%. There are three kind of fishing vessels operating in Senegal's waters: fishing trawler, fishing sardine and tuna fishing. The main species fished in Senegalese waters for industrial fishing are pelagic, sardine and tuna. The number of Senegalese industrial fishing vessels has decreased from 87 to 98 vessels in 2011. Indeed, this is due to the scarcity of resources in these last ten years in Senegalese waters. In 2012, the industrial fishing is mainly composed of 79 trawlers, one sardine vessel and 7 tuna vessels.

As for the foreign fishing trawler catches are estimated to 129094 tons in the Senegalese Exclusive Economic Zone (EEZ). And tuna landings are estimated to 12212 tons. For Senegalese fishing, tuna catches out of Senegalese EEZ is estimated to 410 tons.

Table 2.4 Senegalese fishing 2012

	Catches and landings		Catch out of Senegalese EEZ
	Quantity in ton	Value in CFA	
Artisanal fishing	405974	98991923	
Industrial fishing	41987	52639364	
-Trawler	35626	49913786	
-Sardine	177	17740	
-Tuna	6184	2707837	410
Total	447961	151631287	
Catches and landings 2011	420879	151391703	
Percentage %	6.4%	0.16%	

Source: MFD, Report 2012

Table 2.5 Foreign fishing 2012

	Catch in Senegalese EEZ in tons	Landing in tons
Industrial fishing		
-Trawler	129094	
		12212

Source: MFD, Report 2012

In Senegal the direction in charge of administration and surveillance of fisheries is so much aware about the crew of vessels. Each vessel should not take more than 15 fishermen. The crew also includes sailors and ship-owners. In Senegal fishing is practiced during 12 months and renewable. During this time, fishermen and sailors can go and come back several times in their fishing areas or sites. For industrial fishing, fishermen can stay in seas for 3 months according to the average. After spending 3 months of fishing in the seas, fishermen have 10 to 21 days off in order to take rest.

2.4 Fishing method

According to United Nations Program for the Environment (UNPE), many types of artisanal fishing are practiced in the maritime zone of Senegal. These types are netting sleeping, where the net is maintained stretched across the bottom with a weight for research demersal. There is also gillnet which is based on a web of nets placed between two selvedges, one being leading, the other floating net profile surface for deep sea species. Single line is a type of fishing with bait and hooks which remains more practiced in Senegal. Another type is cooler or ‘’tide’’ that uses the same technique as the single line but it includes canoes tides with lines. This type of fishing

requires the use of ice because of the number of days spent in the seas. The purse seine or ‘’turning over’’ requires the use of two large canoes: one carrying the net several meters long, containing the crew and the other for storing the catch. Beach seine is also a thread usually placed off the beach if heyday not very far and does not require a canoe but many persons to pull the net. The record is used for catching the crustaceans or mollusks like octopus and cuttlefish. There are also long line hooks set of a certain size chosen knotted on intermediate strings that are attached with a certain distance to a single string.

In Senegal fishing activity is divided into three types of fishing. The first type is composed of fishermen who fish with line representing 36.9% of all fishermen. The second type gathers fishermen fishing with sleeping net or gill representing respectively 25.9% and 16% of the total while the purse is practiced by 15.9% of them. The third type is about trap, long lines and other types of fishing are less performed. They represent 4/9%. Traps and long lines are almost non-existent types of fishing that are found mostly in the small coast, which are devoted to fishing for crustaceans.

In artisanal fishing the main fishing methods or techniques allowed in Senegalese maritime waters are gillnet, the surface gillnet, shrimp nets,

beach seine, purse seine, the encircling gillnet and the sparrow hawk. For gillnet, we distinguish sleeping nets with fish which target sardinella or mullet and sleeping nets of which targeting cymbium. However, the use of gillnets has some consequences on ecological, social and biological plan. On the ecological plan, the use of gillnets is source of ecological tensions and threats. On the social plan, it causes technological and areas conflicts between fishermen. On the biological plan, the use of engines threats the reproduction areas of several species. For the surface gillnet, the increase of the length from 300 m to more than 1000 m has allowed fishermen to access fish at the same time in the surface and at the bottom. This fishing method makes two main problems: the first one is the rise of social tensions between fishermen for area and technological conflict, and the second is a threat on the sustainable reproduction of resources.

Regarding the shrimp net, fishermen use net with mesh 8 instead of mesh 12 which is allowed according to Senegalese fisheries regulation. As for beach seine, it is at the same time practiced at the coastal area and continental zone. Its catches are essentially composed of juveniles measuring from 3 to 15 cm. They have an impact on fisheries resource due to the use of very small meshes. The exploitation units have also considerably decreased and most

of them are private property. The size of pirogues and nets has also strongly decreased. All these mutations should necessary encourage reducing the effort of fishing. Regarding the continental fishing, beach seines represent an important part of the total number of pirogues with nets long of more than 100 m. Indeed, beach seines have a negative impact on fisheries resources. That is the reason why "the group of consultation recommends a total ban of beach seines in maritime zone. The project 'Narou Euleuk' is working in this direction of compensating the owner of beach seines in the area Rufisque-Bargny in order to destroy these tools and create alternative activities for fishermen" (UNPE, 2004).

As for the purse seine, the length of the seine has double these twenty last years from 200 to 400 m for a fall of 42 to 48m and the length of mesh increased is from 28 to 30 mm. The length of pirogues has increased from 14 to 21m. To maximize their profits, artisanal fishermen use small meshes collecting everything on their way. The competent service of fishery remains weak in front of these wastes of fisheries resources. Indeed, the high pressure exercised by this fleet caused an overexploitation of small coastal pelagic mainly found in the Small Coast of Senegal. This is the reason why "the consultation group of encourages the initiatives taken by

fishery communities in order to regulate fishing effort of purse seines. They recommend an institutionalization of such measures" (UNPE, 2004). The encircling gillnets measures 250 to 450 m of length with a fall going from 7 to 12 m and going from 60 to 80 mm of stretched meshes. They are used with pirogues long of 12 to 15m with a crew composed of six to eight persons. Regarding this fishing technique, it is difficult to appreciate exactly their impact on fisheries resources. However, the development of making fish activities favored by the big quantities of bonga landed causes degradation or even a total destruction of the mangrove. Hence "the consultation group recommends the conduct of researches in the estuarial areas in order to appreciate better fishing effort and the state of resources exploitation. An impact study of the development of smoking fish in the mangrove has also been proposed" (UNPE, 2004).

As for the sparrow hawk, it is also a tool used in the coastal area alone or combined with other fishing tools. However, the high pollution of the coastal area stops the development of this type of fishing. The impact of this engine on the resource has not really been determined. Furthermore, a regulation should be applied on it by doing a close control. In other words to reinforce the number of fishery agents, to grant them an adequate training,

to give more tasks to the technicians of fisheries and to recommend fine that are more convincing.

As for the industrial fishing, it causes less problems regarding to the height of species landed compared to artisanal fishing. Indeed, the presence of observers in vessels in the framework of fisheries agreements guaranties a better application of regulations dispositions governing their activities. That is not the case for Senegalese vessels. Many infractions have been noticed such as incursion in exclusive zones, non respect of net meshes, use of fishing engines none authorized by the given license, etc. Most of these infractions noticed, recover from the competence of the national units control.

However, some fishing methods are banned in artisanal fishing as well as in industrial fishing. In artisanal fishing, the techniques and engines banned by the regulation and still used by the artisan fishermen are responsible for the destruction of marine fauna and flora. Among them we have fishing with explosives and fish and use of monofilament threads and multi-monofilament. These techniques are considered as dangerous because they cause many damages to resources and environment. Indeed, the use of explosive destroys rocky areas which represent yet an area of reproduction

for many important species. According to article 13 of the United Nations Convention on the right of Sea, the use of explosive and poison is not allowed. But some artisan fishermen still insist on the use of fishing explosive and poison. If this situation is still going on in Senegal, it is because of lack of severe punishment by the government, and also the weakness of imposed fines which turns around 15000 and 50000 CFA francs, an amount which is very low compared to the damage they have caused (UNPE, 2004).

Though ban by article 30 of the application decree, the use of monofilament threads and multi-monofilament are banned as well as fishing with explosive and fish. These techniques are still used in Senegal. Their non biodegradable nature is very dangerous for the environment. The more they stay in waters, the more they encourage overfishing. Many conflicts happen between fishermen communities due to the non respect of the regulation. However, some artisanal fishermen communities are gradually changing their attitudes. Indeed, they become more aware of their responsibility in the overexploitation of fisheries resources by conforming to the regulation. For example the case of Cayar, a village located on the northern Senegalese coast, 58 km from Dakar (Sinclair and Valdimarson, 2005), is a perfect

illustration. Indeed, in the village of Cayar, fishery authorities have decided simply to ban the use of monofilament threads or multi monofilament. This is one the reasons which explain the success of Cayar local management success as it is recognized that the particular features of fishing and of the environment in Cayar helped the implementation of 'good' resource management practiced. These features concern socioeconomic, ecological and human dimensions (Sinclair and Valdimarson, 2005). Regarding to the used of industrial fishing engines banned, they mainly represent five types. Among them we have trawl beef, gillnet rights lobster or fish, gillnet in tuna, trawlers over 400 tons for shrimp fishing and sardine trawlers over 1500 tons.

Trawl beef was used by Russian and Chinese in Senegal before their ban. Indeed, this type of fishing does not allow the sustainability of fisheries resource, because their consequences cause so many damages.

As for the gillnet rights lobster or fish, it has contributed to reduce a big stock of lobster. Regarding gillnet in tuna, their use is banned by the International commission for the Conservation of Atlantic Tuna (ICCAT). This international measure has been taken back in Senegalese regulation.

Trawler over 400 tons for shrimp fishing are banned by fishery regulation due to their big carrying capacity. Indeed, the more a vessel is big, the more its fishing effort becomes important.

And finally regarding to the sardine trawlers over 1500 tons, they have been banned in order to maintain the equilibrium of catches between artisanal and industrial fishing. Indeed, artisanal fishing did not have enough catches compared to industrial fishing for the exploitation of the target resource. For example Norwegian vessels have been banned to fish in Senegalese waters because it happened that one of their big vessels succeeded to catch almost 400 tons of sardinella in just one tide. Such fishing is banned by the Senegalese regulation. That is the reason why the Senegalese authorities banned them in the waters under Senegalese jurisdiction.

2.5 Production and marketing

2.5.1 Artisanal and industrial fishing

In Senegal, more than 13 903 fishing units are identified with 90.8 % fished with a canoe and 9.2 % operate on foot usually with nets hawk. In addition, 66.2 % of fishing vessels operating exclusively are identified in the marine

environment against 27.2% for estuarine and 1.0% either of these two media. The vast majority (85.2%) of fishing vessels identified is active. Inactive units, as a whole, working in the marine environment and generally belong to the owners and / or crew.

In 2012, landings totaled 405,974 tons against 372,956 tons in 2011, an increase of nearly 9%. The general trend of catches in recent years is very erratic due to the variability in catches of sardines on the south coast of Senegal, the occurrence of certain species categories and access agreements in neighboring countries. Kaolack, Saint-Louis and Dakar, strong gains in terms of landings, with 110%, 31% and 26% respectively. Kaolack region has also increased significantly due to the catch of white shrimp. With the exception of the Thies region which decreased by 3%, all other regions experienced moderate increases.

Table 2.6 Distribution of catches of artisanal fisheries by region 2012

	Landings (tons)	Fresh Products (tons)	Trade (tons)	Processed (tons)
Dakar	54087	22215	23795	1058430
Thies	209797	18375	70214	8008543
Saint-Louis	79854	3618	30659	1917609
Ziguinchor	48374	7413	3164	6422023
Fatick	10287	1228	2692	1043513
Louga	2264	180	358	124881
Kaolack	1312	647	103	12271

Source: MFD, Report 2012

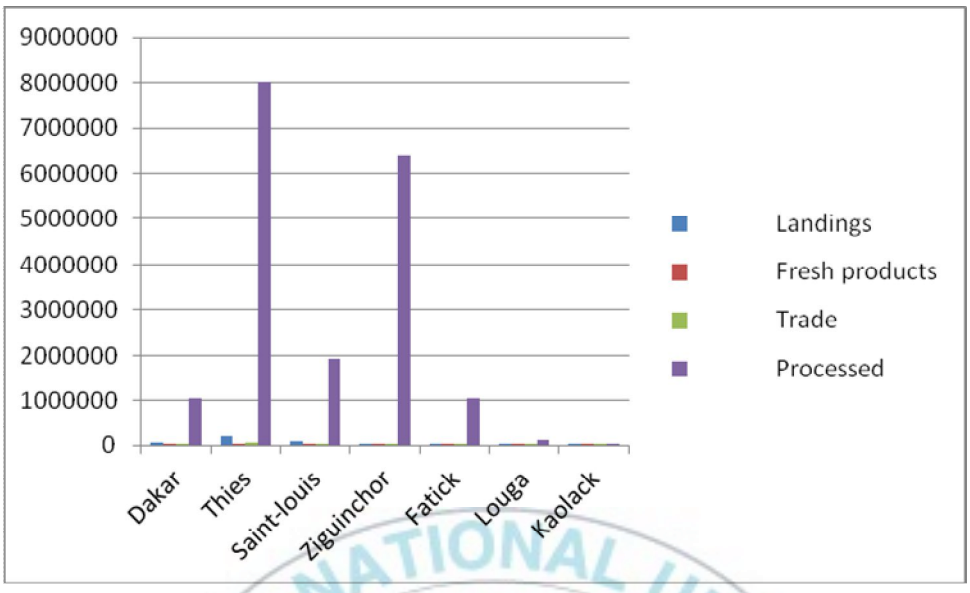


Figure 2.3 Distribution of catches of artisanal fisheries by region 2012.

The distribution of landings of the artisanal fishery catches by region shows that Thies remains the leading maritime region. This is partly explained by the presence of a larger number of canoes and artisanal fishing, an area of extensive fishing and the presence of major fishing centers (Mbour, Joal and Cayar). This region accomplishes alone more than half of landings. However, changes in the annual tonnage landed at the national level depends more on the level of catches in other regions such as St. Louis, Dakar and Ziguinchor because of access agreements in the fishing zones of neighboring countries particularly Mauritania.

Local consumption of fishery products from catches landed remains very low in the Louga and Kaolack. The inter-regional fish trade has declined compared to 2011.

Industrial fishing is dominated by trawling representing 85% of landings. In 2012, the volume of landings of trawlers has decreased by 15% compared to 2011. This decrease may be due to the decrease in the number of trawlers in activity fell by 12 units and difficulties access in areas of neighboring countries.

Regarding tuna, we note that the number of vessels remains constant. Landings have increased very little or 1% compared to 2011. The scarcity of target species (tuna) due to unfavorable hydro meteorological conditions in Senegalese waters and the low presence of these species in our fishing could explain this slight increase. In the end, for the sardine fishery landings have more than doubled compared to the year previous.

- Fishing trawler

This part concerns the Senegalese trawlers operating in the Exclusive Economic Zone of Senegal. According to the Ministry of fisheries report (2012), there are a total number of 79 trawlers operating in Senegalese

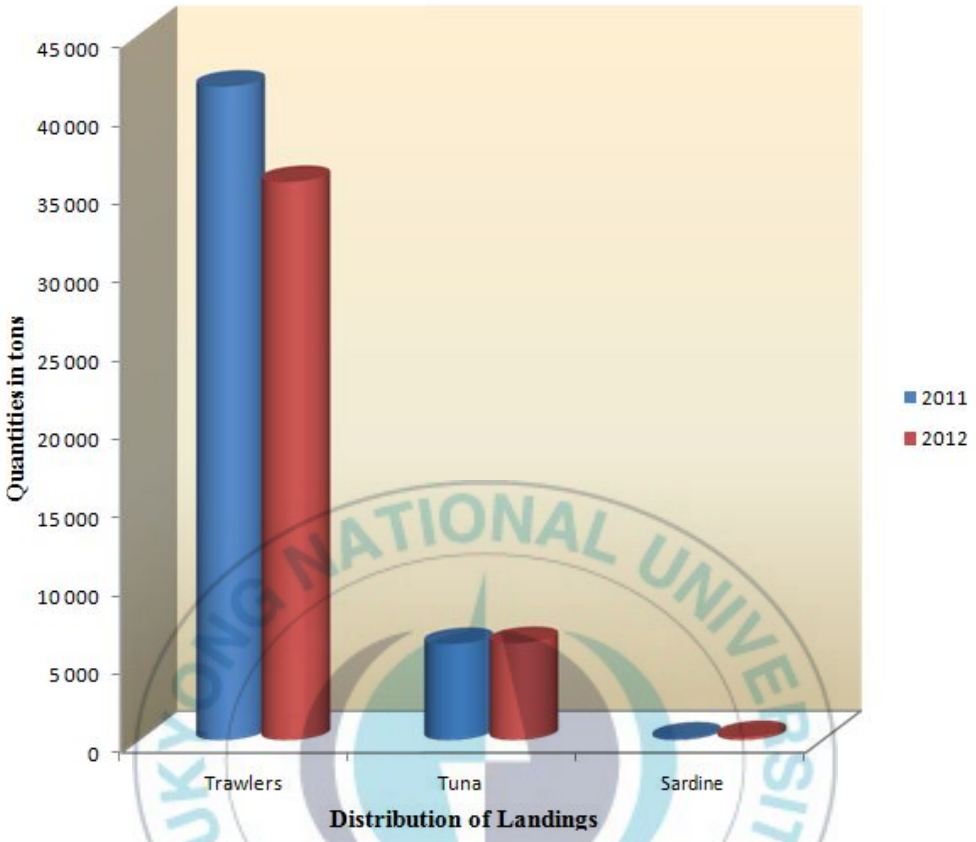
Exclusive Economic Zone. Landings are estimated to 35.626 tons. And the estimated market values are (x1000 CFA francs) 49913786.

- Fishing sardine

According to the Ministry of fisheries, sardine fishing is almost nonexistent. There is only a total of 1 sardine vessel. Landings are about 177 tons for an estimated sales of (x1000 CFA francs) 17.740.

- Tuna fishing

This section covers the activity of tuna long liners and Senegal. According to the Ministry of Fisheries, the total number of tuna vessels is equal to 7. And the tuna landings are estimated to 6184 tons for an estimated market value of (x1000 CFA francs) 2 707 837.



Source: MFD, Report 2012

Figure 2.4 Distribution of landings by the type of industrial fishing.

2.5.2 Fisheries and national economy

In 2013, the fisheries sector represents about 1.3% of GDP. It contributes 11% to GDP of the primary sector. The gross value of production, including processing, marketing and related services, is about 200 billion FCFA. Domestic value added is about 117 billion FCFA (Ministry of Fisheries, 2013).

An estimated 40% of the sector's GDP could be generated by the fishing fleet, while 60% come from processing and exports. Between 25 and 30% of total exports of Senegal are related to the fisheries sector and an estimated 1% its contribution to public revenue. These estimates are based on prices of ordinary transfer and should be considered with caution.

Fishing and artisanal processing generate many jobs in coastal areas, particularly for women. According to the Ministry, the part-time activities such as processing and marketing create about 600,000 jobs. People working in artisanal fisheries are estimated at 52,000 fishermen while 5,000 are in the fishing industry.

2.5.3 Trade, demand and offer

The balance of fishery exports surplus despite a lack of reliable data on imports.

The situation of total trade is characterized by a structural trade deficit. To promote export development and take a best benefit from access to international markets agreed by the World Trade Organization (WTO), the Partnership Agreement between the African, Caribbean, and Pacific Countries (ACP) countries, the European Union (EU), and access to regional markets within the framework of regional agreements, increased investment in sectors with high export potential such as fishing is strongly considered, particularly in the Strategy Document for poverty Reduction (PRSP) and the Accelerated Strategy Growth (ASG).

The demand for fish products occurs at two levels: the internal and external markets. The contribution of fish to the needs of animal protein is predominant in Senegal, although difficult to quantify. There is a wide variation between the coasts and inland; the average consumption per capita per year is estimated at 26 kg. However, since the devaluation of the CFA

franc in 1994, there is a clear pressure on prices noble species facing increasing exports.

For domestic distribution, the central fish market in Dakar appears to be the most important. It receives products from all regions and countries of the sub region (including Guinea and Mauritania).

It is also a platform of redistribution of these products to the domestic markets and secondary markets of Dakar. The factors that influence the demand for fish products are:

- The estimated 3% average annual population growth in Senegal; - Urbanization; - The evolution of income; - Relative prices compared to export.

It is believed that urbanization and income growth, induced by economic growth, should lead to an annual increase in demand at constant prices higher than the population growth. However, demographic and economic factors in the countries where fish is exported from Senegal are the same as in Senegal, and in these countries the demand should push prices up.

Export competition should increase the average demand at a slightly higher population growth rate is 4% per year. In this case, domestic demand will continue to increase.

Considering this assumption and assuming that the proportion of losses after landing remains unchanged, the total demand for fish products should evolve as follows (in tones equivalent costs).

Domestic consumption of fish products is provided to more than 90% of domestic production and marginally products from neighboring countries such as Mauritania and Guinea Bissau.

The European Union (EU) remains the main trading partner of Senegal and the market demand still exceeds supply. However, the transition to international standards has been severely affected exports, the main destinations are:

• The European market it absorbs up to 26% of the volume of exports of fishery products. The devaluation of the CFA franc has greatly contributed to the development of these exchanges;

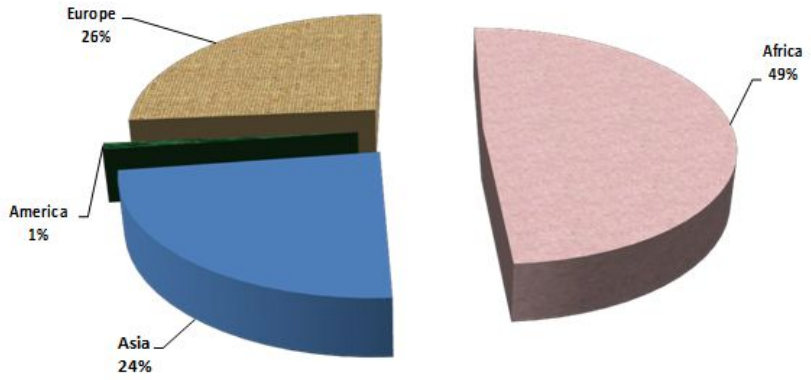
• The African market absorbs 49% of exports of frozen and processed products; Industries do not find it profitable market, but remain there to meet fixed charges. Processed products are beginning to take a larger share. However, this market remains untapped;

• The Asian market is growing up to the Senegalese industrial. Its share in exports is 24%. The targeted products are shark fins, frozen cephalopods and gastropods. A desire to better understand the market opens the share increase and diversifies products. This translates into a farm product once without interest such as the murex, cymbium, periwinkles, mussels and shark fins;

• Nowadays access in the U.S market is not very easy for many West African countries such as Senegal. Indeed, the U.S. market remains inaccessible to Senegalese economic operators (less than 1%), while there are real opportunities. Exported products are still limited to whole fish (fresh or frozen) and mollusks.

Fishery products exported consist mainly of fish (fresh, chilled or frozen) fillets (fresh, chilled or frozen), meats, fish, shrimp and shellfish.

In general, the main market for Senegal is the EU (81%). There is no erosion of preferential fear regarding to the EU and the Least Developed Countries (LDCs) margins, their access conditions are identical to those enjoyed by Senegal.



Source: MFD, Report 2012

Figure 2.5 Distribution of quantities exported by continent 2012.

Table 2.7 Export of fresh products to other regional countries
quantity (Qty) in tones and value (CVE) in thousands FCFA

Destinations	Qty/CVE	Fish	Crustaceans	Molluscs	Total
Gambia	Qty	6525.73	0.00	11.84	6537.57
	CVE	1305146.00	0.00	11425.60	1316571.60
Mali	Qty	425.98	0.00	0.00	425.98
	CVE	117144.50	0.00	0.00	117144.50
Rep. Guinea	Qty	3041.35	341.74	1087.62	4470.70
	CVE	836370.15	546777.60	1087621.00	2470768.75
Total	Qty	9993.06	341.74	1099.46	11434.25
	CVE	2258660.65	546777.60	1099046.60	3904484.85

Source: DPM, Rap-2012

Table 2.8 Senegal fishing industries exports in the world 2012

Nature		Quantities in tons	Commercial Values Estimated in thousands FCFA
Fish:			
Frozen	Whole	82522.90	54984253.42
	Elaborated	17719.44	36334239.56
Fresh	Whole	4284.24	21338434.79
	Elaborated	1567.07	8505815.65
Subtotal 1		106093.65	121162742.42
Crustaceans:			
Frozen	Whole	4007.56	12115064.02
	Elaborated	485.65	1518947.88
Fresh	Whole	32.77	338691.38
	Elaborated	0.21	1045.50
Subtotal 2		4526.19	13973748.78
Molluscs:			
Frozen	Whole	12456.52	23841427.54
	Elaborated	2488.71	6220029.56

Fresh	Whole Elaborated	71.26 6.22	352513.08 32533.88
Subtotal 3		15022.72	30446504.05
Processed Products:	Dried salted Fishmeal Dried fish Canned fish	1077.66 485.62 585.81 399.12	1041116.96 58816.00 490088.02 944132.60
Subtotal 4		2548.20	2534153.58
Total Exports of Fishing Industries		128190.76	168117149.82
Remembrance 2011		112421	243011792
Evolution		14%	-31%

Source: MFD, Report 2012

In 2012, exports of fishery products totaled 128 190.76 tons against 112 420.58 tones in 2011, a slight increase of 14.03%. Export growth can be explained mainly by the importance of frozen products that are past 99

702.55 tones in 2011 to 119 680.78 tones in 2012, an increase of 20.04%. In contrast, the estimated market value dropped 30.82% from 243.01 billion to 168.12 billion in 2012 despite the impact of the quantities exported (MFD Report, 2012). Also species of low and declining market products with high commercial value exacerbated the fall in the value of exports.

The quantities of exported canned represent only 399 tons against 921 tons in 2011 a net decrease of almost 57% in relative value (MFD Report, 2012). It is clear that the only existing unit tuna cannery was facing operational difficulties during the year 2012. Regarding the export of fresh products, it is falling in recent years due to supply problems raw businesses and deficit airfreight capacity materials. The main species are mainly exported or belt scabbard fish, horse mackerel and octopus. They alone account for approximately 65% of total export quantities.

2.5.4 Food security, employment and rural development

Already, the requirements of eco-labeling, traceability and packaging multiply as eco labels that directly target production. This is the case for canned fish. Traditionally, Senegal is a fishing country. For a long time, its

ocean ecosystem contributes to its population food security. Indeed, the oceans' ecosystems contribute substantially to human food security. Costal ecosystems are the source of more than 90% of the food provided by the ecosystem (Sinclair and Valdomarsson, 2003).

In Senegal, nearly 60,000 direct jobs are provided by the small-scale fisheries sector. The total direct employment in the fisheries sector is estimated at 650,000, mainly in artisanal fisheries, particularly artisanal transformation, for instance one out of six working people (Diouf, 2011).

Impoverishment in rural areas since the 70s, with recurrent droughts ; deteriorating terms of trade to the detriment of certain products such as groundnuts; New Agricultural Policy (NPA), and the decline of monoculture that gave identity to the Senegalese agriculture have resulted in a strong migration to city centers and outside the country .

The contribution of fisheries to rural development, to be effective and cost must be based on some strategic areas of the sector. These include:

- Capacity building of the rural world; - Pulse productivity of fisheries in rural areas; - Assurance of food security; - The development of trade in fishery products; - Maintaining a sustainable environment.

Moreover, the overall objective of the National Program for the Development of Aquaculture (NADP) is to boost aquaculture to make a quick alternative to fight against poverty, but also to satisfy the national demand for products fish. The specific objectives are:

- An increase in aquaculture production;
- A reduction in fishing effort of capture;
- Resorption food gap populations;
- An anchor of livestock rural techniques; - Development of the interest of the rural population to the practice of aquaculture; - An increase in income poor by creating jobs and sustainable and productive resources (reducing the rural exodus).

2.5.5 Education, research and external assistance

It is made to the administration and professional fisheries scientific knowledge base on resource and fishery operating systems to optimize

strategies and create conditions conducive to a management sustainable development of fisheries.

Education aims to develop the fish production in order to increase the supply and generate income and employment.

The programs identified are:

- Support for fisheries research programs;
- Support for the restructuring of the system of collection, processing and dissemination of statistics;
- The restructuring of national training tools (CNFTPA, and at last IUPA);
- Support for the training of human resources;
- Support for the technical capacity of the artisanal fishing;
- The study of conditions for the development of aquaculture.

Support for fisheries research should be directed towards strengthening links with fisheries management operations as well as conducive to the sustainability of budgets funds. Research should focus in improving knowledge about the state and dynamics of fisheries resources.

Most marine research in Senegal is conducted by the Centre for Oceanographic Research of Dakar- Thiaroye (CRODT) which is part of the

Senegalese Agricultural Research Institute of the Ministry of Agriculture. It became the first Institute of Fisheries Research of West Africa in the 80s but is now faced with structural problems, including human resources.

In addition, Unit Studies and Planning (CEP) Department performs statistical analysis of the sector and carries out strategic studies to support the efforts of sector planning , including analysis of the transformation , the impact of macroeconomic phenomena etc.

Operations conducted by donors in the framework of international or bilateral cooperation does not always seem to be planned and in accordance with sector priorities.

This does not necessarily mean that their usefulness is uncertain, but the benefits that can legitimately expect will be reduced due to pre still not guaranteed by the management system in place.

This is why the pre- consolidation management principles should be prioritizing and strengthening institutional capacity must be increased to allow the sector level and in close consultation with other relevant ministries, to define the better, priorities and proposed interventions by external donors.

Currently, in the field of fisheries, Senegal has defined areas of cooperation with many countries. Among these, we quote: France, Japan, Belgium, Spain, Saudi Arabia, Kuwait, Iran and others.

However, Senegal is working with major financial institutions in the realization of some of these programs or development projects in the fisheries sector. It is, in particular, the World Bank (WB), the European Union (EU), the French Development Agency (AFD), the African Development Bank (ADB), the European Investment Bank investment Bank (EIB), UNESCO and others.

2.5.6 Obstacles and institutional constraints

Like other primary sector activities, fishing is facing a number of obstacles that can be summarized as follows:

The size of fishing zones against the importance of activities and the depletion of resource, which increase the pressure and exacerbates conflicts;

The state of obsolescence of arms and the national fleet;

The lack of basic infrastructure in the fishing centers (area landing, means of storage and transport products etc);

Inadequate training and organizational weakness of actors in different sectors;

The supply difficulties of land units;

Low value added and productivity;

Lack of competitiveness of some products on the international market and;

Inadequate systems of financing the activities of artisanal and industrial fisheries;

In Senegal, as in most developing countries, sanitary standards today are the main obstacles to access to developed country markets.

In Senegal a highlight is the absence of complicity between government and the professionals of the sector. This situation has a negative impact on the behavior of actors in terms of enforcement and difficulties in mobilizing them to sustainably manage fisheries.

We also note the weakness of the relationship between the fisheries administration and other administrations, so that many problems are the responsibility of the government (Ministry of Economy and Finance, Ministry of Commerce, ministry of Equipment and transport, Ministry of Water and Energy etc).

There is a lack of information in Inland fisheries and aquaculture from the fishermen on the fishing regulations, conflicts trades, lack of means of surveillance gear and fishing activities. Finally, it seems necessary to revise or complete the regulatory and institutional framework.

2.5.7 Legal framework and institutions

Fisheries policy in Senegal are currently governed by the strategy of sustainable development of fisheries and aquaculture 2001, document about Sector Policy 2007, the Action Plan of 2007 and the Act on the Code of sea fishing completed by Decree 2007 reorganizing the Ministry of maritime Economy.

This law focuses entirely the power to introduce management measures and development, including the granting of fishing rights (licenses and permits artisanal fisheries), in the hands of the Ministry of Fisheries.

This strategy refocuses sector development on the management of fisheries resources and the sector, including through measures to reduce capacity and fishing effort.

Continuous changes attitudes of stakeholders from the private sector, artisanal, industrial and responsible for processing have allowed the government to adopt a more aggressive approach to introduce a new system of fisheries management based on sector governance.

In artisanal maritime fisheries, the most represented are the National Federation of economic interest groups of fishermen (FENAGIE-FISHING), the National Federation of Economic Interest Groupings fishmongers of Senegal (FENAMS), the National Collective of artisanal fishermen of Senegal (CNPS), the National Union of GIE fishmongers of Senegal (UNAGIEMS) and the National Federation of women's transformative Senegal (FENATRAMS).

Recently, in order to unite their forces, the inter-professional national Council of artisanal fishermen in Senegal (CONIPAS) was created. In the area of inland fisheries, there is an organization of the fishery system and fishermen as fishing councils, cooperatives and economic interest groups.

Today, the need for a strong involvement of professionals in the management of fisheries resources has led the government to promote a

participatory process that includes the co-management through local councils' artisanal fishing (CLPA).

The main institutions are: Administration Fisheries and Aquaculture, Research institutions, Training institutions, financial institutions, Consultative bodies, and Cooperation institutions.

2.6 Fish stock

2.6.1 Marine resources

With its 200 miles of EEZ, the Senegalese waters are recognized to be among the highly productive in the world. Indeed, this productivity of Senegalese waters is mainly due to a seasonal phenomenon which goes from December to May. This phenomenon brings the minerals and nutrients of the cold deep to the species which live just below the surface such as Sardinella and Mackerel. However, despite its productivity, Senegalese fish stocks need to be conserved and managed well particularly straddling and high migratory stocks like tuna. It is in this same sense that the UN Fish Stocks Agreement seeks to ensure the long-term conservation and

sustainable use of straddling and highly migratory fish stocks by strengthening the legal regime for their conservation and management through global, regional and sub-regional fisheries management organization (RFMO) (Edson, W., Tsamenyi, M., Palma, M.A., McCrea, J, 2010).

In order to respect this UN Fish Stocks Agreement and to prevent the depletion of small pelagic stocks, a sub-regional task force of the FAO-CECAF (Central East Commission of Atlantic Fisheries) has been implemented to monitor theses stocks. The creation of this commission has allowed the fishermen to reduce the fishing of the main target species and also overfishing has been reported.

2.6.2 Coastal-demersal and deep demersal resources

Coastal-demersal resources include crustaceans, mollusks and fish bottom of the continental tray. They are respectively more than 25 and 50% of landings and revenue of fishery exports.

Biomass of the most popular species: bream (Pagellus bellottii), the thiof (Epinephelus aeneus), the snapper (Pagrus caeruleostictus), red mullet

(Pseudupeneus prayenis) and small masters (Galeoides decadactylus) are steadily declining about 75%, while fishing effort has more than doubled. Fishery potential is estimated at 125 000 and 130 000 tones (FAO, 2008).

Deep demersal resources are mainly hake (Merluccius polli and Merluccius senegalensis) and deep water shrimp (Parapenaeus longirostris). Total biomass is estimated at 34 000 tones with natural production of 3,757 and 2,560 tons respectively, for hake and deep water shrimp (FAO, 2008).

2.6.3 Coastal and offshore pelagic resources

Coastal pelagic resources are the sardines, horse mackerel, and mackerel. They inspire no major concern with the exception of the Small Coast where local overexploitation of sardines was observed. In this area, the sardines are under high pressure of fishing from canoes to purse seines, sardines fishermen and pelagic trawlers. The stock of sardines from the Senegal-Mauritanian zone display a strong abundance appears to be related to the high productivity of the estuarine zones induced by a good rainy season.

These resources are very sensitive to changes in the environment sailor. Potential varies between 173 000 and 248 000 tons per year.

Recent evaluations of the tropical three stocks offshore pelagic (Albacore, Big eye, Skipjack) show a trend of full exploitation or overexploitation at Atlantic scale.

Regarding small coastal tunas (Ravil, Bonito, Skipjack mackerel etc) mainly targeted by the Senegalese artisanal fisheries, they are underutilized and the potential is estimated at between 25 000 and 30 000 tons per year.

2.6.4 Continental resources

Local river systems such as the Casamance and Sine-Saloum run almost exclusively in Senegal. The rainfall deficit generates salinities of about 100% and 170%, respectively upstream of the Sine-Saloum and Casamance. Sub-regional systems include Senegal and Gambia Rivers. The Senegal River has its source in Guinea in a relatively well-watered area, so that the deficit rainfall in the Sahel during the last three decades has had a lesser effect salinity compared to what happened in the Sine-Saloum and

Casamance. Two major dams were built on the Senegal River (Diama anti-salt dam and Manatali dam).

2.6.5 Senegal, Casamance and Sine-Saloum Rivers

The exploitable fishing potential of Senegal River, including Lake Guiers is between 6500 and 9000 tons.

As for Casamance River, the exploitable potential varies between 9000 and 14 000 tons. For shrimp, catches vary between 700 and 1600 tons. The size of shrimp caught varies in the same meaning that catch. The rainfall deficit has been favorable for shrimp fishing in the estuary and it was not until 1984-1985 that the catch has fallen sharply with the over salinity.

Regarding to Sine-Saloum River, its area is similar to the productivity viewpoint to Casamance while Saloum has an area that is approximately two-thirds. It seems that the estuarine resources are fully exploited.

3. Fisheries management system in Senegal

3.1 Management goals

The goal of a responsible fishery management system is to improve compliance with fisheries management measures to prevent habitat destruction and overexploitation so as to improve ecosystem integrity, socioeconomic development among fishery communities through the adoption of an ecosystem approach to fisheries.

3.2 Management objectives

For a long time, fisheries sector play an important part in the economy of Senegal. However, this sector is confronted to serious problems of management which prevent it to maximize the benefits made from fisheries. In order to achieve its objectives, Senegalese fisheries sector need to:

- Enhance stakeholder's participation in the management of fisheries resources;
- Improve acquisition of scientific information on fisheries resources base for sustainable harvest;

- Strengthen human and institutional quality capacity in fishery industry;

- Ensure effective control, protection and management of fisheries resources and their environment;

- Address socio-economic concerns of all user groups including conflict associated with fisheries resources;

- Evaluate, enhance, and initiate studies to increase understanding of fish biology and population dynamics along Senegal coast waters;

- Promote fisheries resources marketing, quality and standards; and

- Enhance Regional and International cooperation on fisheries resources management.

3.3 Management issues

Like many developing countries, the issues of management are also frequent in Senegalese fisheries sector. To better apprehend these issues, this sector needs a management system which is focused on the following identified main issues:

3.3.1 Inadequate knowledge on fisheries resource base

This management system focuses on doing stock assessment of fish resource along the Senegal so as to understand the status of fishery resource which currently is not well known although there is indicator of resource decline? Some of the indicators which shows resource decline include reduction in size of some species caught with time; reduction of catch size of some species, decline or extinction of some species. Moreover, the biological behavior of species along the Senegalese coast is not well understood, hence there is a need to understand fish ecosystem so as to be able to manage fish resource based on scientific data and ensure sustainability of this fishery.

Lack of extensive stock assessment surveys and inadequate fisheries statistics plus in situ observation of the production trends and current occurrence of immature fishes; indicate the need to take immediate action and management interventions to sustain fisheries resources. Thus, necessitate having a management plan that will ensure that the Senegalese fishery resources are utilized in a sustainable manner.

3.3.2 Sustainable fish stocks and ecosystems

Fisheries resources and environmental protection involves conservation, management and sustainable aquatic resource utilization. Despite ongoing fisheries resources management efforts, there has been a decline in fish stocks and environmental degradation due to weak management, open access nature of fisheries resources, overexploitation of fisheries resources, use of illegal fishing gears and practices, illegal, unreported and unregulated fishing (IUU) as well as harvesting of endangered and rare aquatic species.

3.3.3 Fisheries resources utilization and marketing

Efficient fisheries resources utilization and marketing is constrained by inadequate infrastructure such as feeder roads, fish markets, landing sites, cold chain and storage facilities, laboratories, fish handling and processing facilities. Others include; lack of enough fishing harbour, inappropriate airport facilities as well as poor communication, transportation and fish preservation technologies.

3.3.4 Resource use conflict and alternative livelihoods

Fishery resources are found along the entire coast of Senegal together with other marine resources such as seaweeds, shrimps, crabs etc. However, other activities in the marine water of Senegal like, navigation, expansion of Senegal harbors, building of damns, heavy industries and hotels along the coast affect fishery in Senegalese coast. The presence of different users of marine resources and other socio-economic development may be a source of conflict between fishery resource users and other users.

In order to ensure that there is little pressure on fishery, promoting artisan fisher to generate alternative livelihoods is of great important. This is very important issue since most Senegalese fishers are poor, illiterate and some depend entirely on fishing activities despite a lot of opportunities available

3.3.5 Stakeholders and community participation

According to the Minister of Fisheries and Maritime Affair Aly Haidar, Senegalese government is still trying to make sure the community and all stakeholders participate fully in order to ensure sustainability and effective implementation of Fishery Management system.

3.3.6 Effective enforcement of laws governing the fisheries sector

The legal and regulatory framework of Senegalese fisheries sector requires transparency, predictability, minimum discretion and resource ownership. The effective implementation of the legal and regulatory framework requires adequate capacity to enforce and monitor compliance of the laws governing the sector.

3.4 Management measures

In Senegal artisanal fishery is as important as it provide food, income and employment to coastal communities and supports the majority of fishermen depend on it for their livelihood. More than half of fishers are artisanal and practices traditional fishing whereby fishing gears, vessels and technology is still poor. Therefore, this type of fishery becomes difficult to manage since fishermen are spread out all along the shores, and normally fishing tends to be their main source of income and employment in the coastal fishing communities. Thus, this management system reinforces the use of the following management measures;

3.4.1 Gear limitations, closed fishing areas and zoning

For Gear limitations, the most commonly used gear includes encircling gillnets, surface gillnet, shrimp nets, beach seine, purse seine, gillnets, saparrowhawk, hooks and lines, and hand lines (UNPE, 2004). All the other techniques are not allowed according to Senegalese fisheries regulation.

The existing fisheries laws and regulations on gear restrictions on fishery are enforced. According to the Ministry of Fisheries all stakeholders have approved these measures of gear limitations.

The introduction of closed fishing areas system will be promoted in Senegal marine waters. The closing of fishing is introduced in those areas where there is high rate of illegal fishing or reasonable reduction in catch. However OECD (1997) concluded that that time and area closures have not been effective in assuring resource conservation, though conservation might well have been poorer without them (Sinclair and Valdimarsson, 2005).

Zoning is a management strategy created to reduce overcrowding of fishing vessels or fishing efforts in the most productive areas especially if the fishing area is small. This strategy will be used in fishery management

meant to minimize effort or avoid potential conflict between artisanal fishers.

3.4.2 Licensing of vessels and fishermen

According to the Senegalese law, it is mandatory that fishing vessels be registered and licensed. Indeed, currently in Senegal the terms of issue of fishing license are as follow:

Legal and regulatory framework (Act No. 98-32 of 14 April 1998 Fisheries Code and its implementing Decree No. 98-498 of 10 June 1998) sets out the conditions for the exercise of fishing activity in waters under Senegalese jurisdiction: types of fishing allowed, fishing, mesh size nets and trawls, protected animals etc.

98-498°N decree of 10 June 1998 laying down detailed rules for the application of the law code of marine fisheries has created a Consultative Commission of Fishing Licenses Attribution (CCFLA), consisting of:

- Chairman: Director of Marine Fisheries;
- Secretary: Head of Division Industrial fishing;

Members:

- A representative of the Prime Minister;

- The Director of the Merchant Navy;

- The Director of the PRC;

- The director of the DPSP;

- A representative of the Ministry of Armed Forces;

- A representative of CRODT;

- The representative of the Ministry of Finance;

- Two representatives of ship-owners.

The administrative procedure is as follows:

A - When it comes to fishing vessels under foreign flags, access to the resource can be done in two cases:

i) In the context of fisheries agreement binding the Senegal and the flag State or the Organization that represents this state. In this case, the conditions for fishing activities are defined in the implementation of the agreement protocol.

ii) When chartered by persons of Senegalese nationality, under the conditions established by Decree No. 98-498 of 10 June 1998.

B - If the ship-owner intends to get his ship under the Senegalese flag, the process is as follows:

i) The ship-owner applies for a license to the Minister for Fisheries

- The Minister shall transmit the file to the Director of Marine Fisheries, President of the Commission.

- If the file is complete, it is submitted to the Commission which shall function in accordance with its rules;

- Each license application must be accompanied by information on the vessel's technical characteristics: date of construction, overall length, width, draft, gross tonnage and net tonnage, engine power conservation mode catches, etc.

- Join the act of nationality of the ship;

- The articles of association;

- The license application form to fill.

Types of licenses:

It established four (4) types of licenses, within which there are fishing options depending on target species and fishing gear:

(a) License inshore demersal fishing

- Option: shrimp trawlers.

- Option: fish and cephalopod trawlers

- Option: bottom long liners

(b) License for demersal species

- Option: shrimp trawlers

- Option: trawlers

- Option: bottom long liners

- Option: pink lobster traps

- Option: deep crab traps

(c) License coastal pelagic

- Option: purse

- Option: trawlers

(d) License offshore pelagic fishing

- Optional pole

- Option: purse

- Option: long line (tuna)

- Option: long line (swordfish)

The law also controls the allocation of fishing licenses, including those for foreign, flagged vessels. In fact, there are only two ways for foreign fishing vessels to obtain a license legally:

Under the term of a fishing agreement between Senegal and the country of registry or a representing organization (EU); or

Under a charter arrangement with a Senegalese national (Greenpeace, 2012);

According to this law, we realize that fishing license can be granted to foreign, flagged pelagic trawlers by Senegalese laws, if only there is a bilateral fishing agreement in place.

3.4.3 Catch and size restrictions

Currently there is catch restriction in Senegal fishery. Indeed, it is necessary to introduce catch restrictions such as total allowable catch (TAC) limits vessel catch limits and quotas system. This management system focuses on collecting more scientific information such as fish stock.

Size restriction on medium and large fish species is introduced so as to protect juvenile and fish production. This is done in participatory approach between government, fishers and all stakeholders.

3.4.4 Protected and targeted species and fishing technique

This system is focusing on conservation of protected species and target species through introducing bylaws to protect them. The bylaws are formulated by fishers themselves.

Many fishers combine different fishing methods in order to make the most of the increasingly scarce fishery resources.

The strict implementation of these management measures by the Senegalese government should ensure the protection of different species in the marine ecosystem. Indeed, according to the FAO Code of Conduct for Responsible Fisheries, the general principles of the Code suggest that fisheries management measures should ensure the protection not only of target species but also of non-target, associated or dependent species (Sinclair and Valdomarsson, 2005).

3.5 Sustainable fisheries management

Regarding the control and management of fishing capacity, the emphasis is on the following priority actions:

3.5.1 The capacity adjustment of sea fishing

There is already a broad consensus among stakeholders on the issue resulting in a program of rapid and drastic reduction of fishing effort. Other complementary activities are:

Best knowledge of canoe fleet of artisanal fishing through national computerized registration program;

Consolidation of the national register of fishing vessels;

The development of a national plan for capacity management fishing that will constitute the framework of the government to control the future of fishing capacity.

3.5.2 Control access to fishery resources

It focuses primarily on:

The spread and effectiveness of artisanal fishing license, and

The establishment of a system of grants access rights to fisheries resources.

The National Advisory Council on Fisheries (NACF) and Local Advisory on Artisanal Fishing (LAAF) are local institutions which support and involve fishing communities in fisheries management.

3.5.3 The establishment of fisheries management plan

They are the only way to ensure the sustainability of resources and fishing activity. Their implementation will be done gradually by starting with the most threatened stocks.

3.5.4 The promotion of a policy of resource conservation in the context of an integrated coastal zone management

Given the state of degradation of marine ecosystem, the government implements with development partners and professionals, rational management, integrated and sustainable development of marine and coastal environments based on the immersion of artificial reefs and establishment of marine protected areas. This conservation policy is based on ecosystem approaches.

3.5.5 Strengthening and adapting fisheries research

This option stems from the important place of research in fisheries management. Facing these constraints and weaknesses of fisheries research in Senegal, it is urgent to make an inventory mainly of CRODT and engage

in reflection on the contribution of the Research Institute for Development (RID) and the Cheikh Anta Diop University (UCAD).

3.5.6 Optimization means of monitoring, control and surveillance of fisheries

Investment in this area, which led to the establishment of a coastal radar system and VMS reflect the will of the State to better protect fisheries resources.

3.5.7 Satisfaction of domestic demand and reduction of post-harvest losses

It is a revival of inland fisheries by boosting research in inland fisheries, protection of reserves and spawning areas, the creation of a statistical database and access regulation.

In Aquaculture, the policy is mainly based on the implementation of the National Program for Aquaculture Development (NPAD). The Agency for the Promotion of Aquaculture (APA) will be the linchpin of the implementation of this program and priority will be given to the

establishment of the preconditions for the development of aquaculture in Senegal.

Satisfaction of domestic demand also requires minimizing post-harvest losses through the implementation of conservation infrastructures of fresh fish in coastal areas but also in towns inside the country. The cold program funded by the Spanish Cooperation is one of the tools for the implementation of this policy.

3.5.8 The valuation of fishery products

Today, the development of fisheries policy in Senegal cannot be focused on increasing catches, but a better used of the production and promotion of aquaculture products. It is a big priority issue in relation to the increasing demand of compliance with health standards in traditional export markets.

The priorities are:

-For artisanal fisheries

The creation of infrastructures enhancing production and allowing professionals to artisanal fisheries to operate in the best working conditions and health;

Improving the processing and marketing of fresh products;

Sanitation of trade processes and fish trade by the development and implementation of regulations defining the conditions for access to and exercise of these professions.

-Industrial fishing

Maintaining the gains of the upgrading of enterprises;

Reorganization and restructuring of the transformation and restructuring of industrial processing on the basis of actions identified by the sector strategy of accelerated growth industry sector;

Reviving tuna industry with the merger of the tuna platform;

The creation of mechanisms to mobilize donors to support the development of businesses;

3.5.9 Qualification of professionals and financing activities

Strengthening and improving the skill of professionals is an indispensable factor for the monitoring of the proposed reforms and the achievement of sustainable development sector.

It will be to provide professionals in the financial instruments to meet the investment and operating need in one hand compatible with the sustainable use of resource, on the other hand with financial sustainability of fishing activities.

3.5.12 Post capture utilization

Article 11 of the Code of conduct for responsible fisheries, which deals with post-harvest practices and trade focuses on the responsible use of fish. It is in this context that a division was created as competent administration Senegalese administration fisheries in control of fishery products to ensure the promotion of the concept HACCP (Hazard Analysis Critical Control Point) in fishing companies.

4. Foreign vessel management system

4.1 Current cooperation institutions

Senegal manages an extensive program of cooperation in fisheries at bilateral, sub regional, regional and international level. At the bilateral level, Senegal has signed cooperation agreements (fisheries) with Guinea Bissau, Gambia, Mauritania, Cape Verde and Japan. At the multilateral level, cooperation frameworks consist of the West African Economic and Monetary Union (UEMOA), the Economic Community of African States (ECOWAS), the Sub-Regional Fisheries Commission (SRFC), the European Union (EU), the World trade Organization (WTO) Ministerial Conference on Fisheries Cooperation among the riparian states of the Atlantic Ocean (COMAHFAT), the United nations Food and Agriculture Organization (FAO) Committee on Fisheries of the Eastern Central Atlantic (CFECA), the International Committee for the Conservation of Atlantic Tuna (ICCAT), the Committee for Inland Fisheries and Aquaculture (CIFA), the Inter- state Struggle against Drought in the Sahel (ISDS), the Organization for the Development of the Senegal

River (OMVS), the Organization for the development of the Gambia River (OMVG) Committee.

4.2 Current agreements

In the framework of fisheries cooperation, Senegal signed many agreements in order to develop its fisheries industry. These agreements are based on regional and international level. In the regional level it includes neighbouring countries such as Guinea Bissau, Gambia, Mauritania, etc. And in the international level we have France, Spain, South Korea, Japan, EU etc.

4.2.1 Agreement with neighboring countries

In this study the agreement with neighboring countries concerns Guinea Bissau, Gambia, and Mauritania. The choice on these countries is due to the maritime boundaries they share with Senegal.

- **Agreement with Guinea Bissau**

In 2013 a fisheries agreement was signed between the Republic of Senegal and the Republic of Guinea Bissau. This agreement between the two countries is based on some precise points. Among these points, the establishment of a partnership to develop joint research, the combination of their efforts for water monitoring, but also the support of the fisheries training and fishing licenses. Fishing licenses are subject to payment of a fee which depends on the requested rate at both artisanal and industrial fishing. This fee is a contribution to a fund set up in Guinea-Bissau and support for fishing.

- **Agreement with Gambia**

A fisheries agreement between Gambia and Senegal came into force in mid-January 2005 after two days of negotiation, when Gambian and Senegalese fisheries ministers signed a new protocol to their reciprocal fisheries agreement. This became effective from January 19th 2005 and is valid for a period of one year. The Gambia first signed this agreement with Senegal in 1982, and its protocol of implementation is reviewed annually.

The protocol includes fishing-vessel licensing, joint research exercises in the biological as well as social sciences, and aquaculture development. The protocol also includes provisions for facilitating cooperation in training between the two countries. For instance Senegal agreed to enroll Gambians in its schools for fisheries and maritime training.

In addition, the protocol allows the authorities responsible for surveillance and safety at sea in the two countries to organize combined operations relating to the coordination of monitoring, control and surveillance operations and the right of hot pursuit.

- **Agreement with Mauritania**

Broken since August 2012, fisheries agreements Mauritania-Senegal were signed after bitter and protracted negotiations, on 1 June 2013. Three hundred Senegalese pirogues are thus authorized to fish in Mauritania.[1] In the last agreement, that of March 26, 2008, the duration was four years, even if the volume was more important to land 15%.

[1] http://www.ndarinfo.com

Indeed, the agreement initialed by Senegalese former Minister of Fisheries and Maritime Affairs, Pape Diouf and his Mauritanian counterpart Aghdhefna Eyih Ould states that Senegalese fishermen will have a release issued by the Senegalese authorities to shift into input and output waters under Mauritanian jurisdiction located in the coast of Ndiago. Fishermen should also declare their catches at the end of each trip at the crossing point Ndiago and especially ensure the landing of 6% of their charge in Nouakchott.

A Joint Committee shall ensure the strict application of quota landed and protocol. Senegalese fishermen that are allowed to access the resource in Mauritania should also proceed to the identification of members of their crew for safety reasons. Violation of the terms could result in sanctions ranging from withdrawal of the license suspension of the offender in future agreements.

In this new Fisheries Protocol, the Mauritanian authorities grant a quota of 40,000 tons of fish annually, with a fee of 10 Euros per ton, or 400,000 Euros (160 million UM).

However, the novelty of the new agreements is the restriction of fishing time allowed, only three months, lower quota to land in Mauritania, 6%, but

also the introduction of a tithe of 10 Euros per ton caught, and the obligation of the crossing point, the identification of crew and vessel registration.

4.2.2 Agreement with other countries

As for agreements with other countries, it mainly concerns the EU due to its frequency in Senegalese waters but also mainly due to its disadvantage way of dealing agreements with Senegalese government.

- **Foreign fishing**

According to the Maritime Fisheries Directorate (MFD) report (2012), foreign fishing concerns on the one hand line tuna vessels based in Dakar, since the suspension of the fisheries agreement between Senegal and the European Union and other pelagic trawlers.

This report presents a total number of 8 tuna fishing vessels. Landings are estimated to 12.212 tons.

As for the pelagic trawl fishing, there are a total of 29 vessels. Their landings are estimated to 129.094 tons.

Nevertheless, despite these 8 tuna fishing vessels and 29 pelagic trawl fishing vessels, others foreign fishing vessels come to operate illegally in the Senegalese waters. This is the current case of the detention of a Russian trawler observed illegally catching fish in Senegalese waters. So, for a responsible fisheries development, the Senegalese government took serious measures to stop this illegal fishing as Michael B wrote: "Good for the Senegal government for taking this action against foreign fishing vessels that are stealing and destroying what isn't theirs. This illegal fishing needs to be stopped and this is an excellent start."[2] In this part, we notice the presence of a total of 37 fishing vessels in the Senegalese waters. Actually this number of fishing vessels is high above the norms for developing countries like Senegal which want to develop their fisheries industry, hence the Senegalese government found the necessity to reduce the number of foreign fishing vessels by cancealing some agreements.

[2] (http://amsterdamnews.com)

For the development of a responsible fishery, the Senegalese government established legal agreements and cooperation with foreign countries for the benefit of not only foreign vessels but also for its local population.

Table 4.1 Catch and landing of foreign tuna vessels (tons) 2012

Vessels	2012 Production
Aîta Fraxku	2067.65
Berriz San Francisco	2375.74
Corona Del Mar	1133.47
Gaztelugaitz	1001.19
Iribar Zuleika	2201.34
Kermantxo	1512.19
Nuevo San Luis	852.11
Pilar Torre	1068.48
Total	12212.17
2011 Production	12574.82

Source: MFD, Report 2012

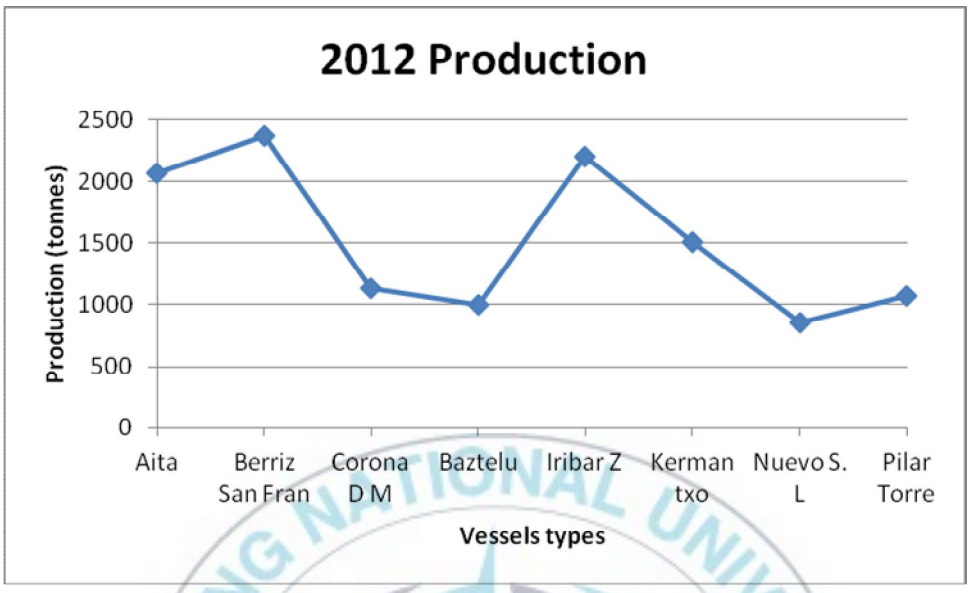


Figure 4.1 Catch and landing of foreign tuna vessels (tons) 2012

Table 4.2 Total production (tons) of foreign tuna vessels 2011-2012

Years	2011	2012
Productions	12574.82	12212.17

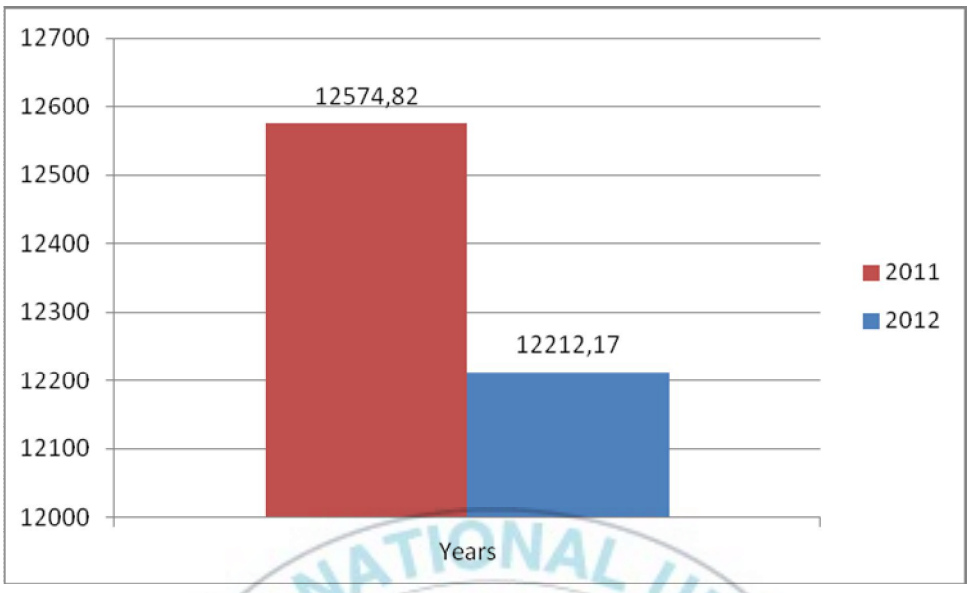


Figure 4.2 Total productions (tons) of foreign tuna vessels 2011-2012.

According to these results, we realize that the foreign tuna fishing has decreased from 12574.82 tons in 2011 to 12212.17 tons in 2012, a decrease of 362.65 tons which is equal to -0.03%. This situation can be explained on the one hand by the reduction of national and foreign vessels from 129 vessels in 2011 to 37 vessels in 2012. Indeed, in 2011, Senegal decided to cancel its fisheries agreement with many countries such as European Union, Russia, which resulted to the diminution of a great number of vessels. On

the other hand, this situation can be explained by the rarefaction of some value species such as tuna due to their overexploitation.

- **Agreement with European Union (EU)**

Senegal and European Union (EU) have signed a bilateral agreement protocol April 24, 2014. This agreement will allow the EU fishing vessels to have full right to fish in Senegalese waters for a period of 5 years. Indeed, during these 5 years, 38 fishing vessels will operate in Senegalese waters including mainly 28 tuna vessels, 8 pole vessels and 2 trawlers. This agreement is evaluated to a financial value of 9 billion FCFA.

In this new agreement some important points have been noticed and strongly recommended by the Senegalese government and adopted by the EU. Indeed, the Senegalese government recommends the EU vessels to recruit Senegalese marines as it is recommended in the chapter 4 of the agreement that "At least the crew should be composed of 20% of Senegalese marines during the tuna fishing season or from one of the ACP (Africa-Caraib-Pacific zone countries)."[3] Another point risen in this in this

[3] (www.sen24heures.com/spip.php)

agreement is the protection of the marine ecosystem in order to allow the development of juveniles and the protection of some value species. EU also engaged to ensure the control and surveillance against foreign vessels that have not right or license to operate in the Senegalese waters. However, Greenpeace strongly denounce this agreement. According to Greenpeace "This agreement contains some problems."[4] But the Minister of Fisheries and Maritime Affairs Ali Haidar sustains that this bilateral agreement is advantage for the country.

- **Regional cooperation**

The Republic of Senegal has a strong relationship with Western African countries in conservation and management of EEZ fishery. Senegal is member of Sub Regional Fisheries Commission (SRFC), Atlantic Regional Convention for Fisheries Cooperation (ATLAFCO), West African Economic and Monetary Union (WAEMU).

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[4] (www.sen24heures.com/spip.php?)

- **Sub regional fisheries commission (SRFC)**

The objective of the SRFC is to strengthen cooperation and coordination of member States' policies in particular through the following areas: harmonization of policies for the preservation, conservation and exploitation of fishery resources in the sub-region;

Adoption of common strategies in international fora;

Development of sub-regional cooperation in monitoring, control and surveillance;

Developing countries' capacity to undertake research in the fisheries sub-regional level;

SRFC derives its resources from member States' contributions and grants from technical and financial partners in the framework of the implementation of projects.

The sub regional fisheries commission (SRFC) has 3500km of coastline. The population is estimated at 37 M (70% living near the coast). The Per capita consumption of fish is 20 kg. The fisheries sector provides around 1 M job (direct and indirect). The number of boats is estimated at 36,000 and industrial vessels equal 1200 (750 foreign vessels). The total production is

equal to 1.7 MT/year for US$1.5 B. The value of exportation is estimated at US$412 M.[5]

- **Atlantic regional convention for fisheries cooperation (ATLAFCO)**

The main objectives of Atlantic regional convention for fisheries cooperation are as follows:

-The promotion and strengthening of regional cooperation on fisheries development; and

-The coordination and harmonization of efforts and capacities of stakeholders for the conservation and exploitation of fisheries resources.

The Atlantic regional convention for fisheries cooperation (ATLAFCO) is an inter-governmental organization created in 1989 and composed of 22 member States, from south of Namibia to north of Morocco.

The convention establishing The Ministerial Conference on Fisheries Cooperation among African States Bordering the Atlantic Ocean

[5] Htt://www.sustainabledevelopment.un.org

(COMHAFAT) adopted in 1991 sets the field and modalities of regional fisheries cooperation among the member of States.

Senegal has established cooperation with West African countries in order to prevent and eliminate IUU fishing activities through some tools such as the sub regional fisheries commission (SRFC), the Atlantic regional convention for fisheries cooperation (ATLAFCO) and West African Economic and Monetary Union (WAEMU) in implementing a common vision for a responsible fisheries development.

4.3. Cases studies

The choice of these cases studies on Taiwan and Namibia represents an important step in the implementation of an adequate management system in Senegal. Indeed, these countries have succeeded to implement a successful management system which allowed them to maximize their benefits and to develop their fishing industry. From these experiences, we are going to propose some recommendations so that Senegalese fisheries sector inspire and implement these experiences for the development of fisheries industries.

4.3.1 Taiwan

This case study deals with the management of tuna fishery in Taiwan. It demonstrates how Taiwan has succeeded to readjust policies in accordance with international management instruments and tuna compliance requirements. Despite it not being a member of United Nations, Taiwan succeeded to ensure the sustainability of marine resources.

This study aims to review the history and policy of Taiwan's distant water tuna fisheries. It also aims to analyze Taiwan's new policies derived from Recommendation n°-05-02 in ACCT. And finally it examines whether or not the readjusted policies conform to the international instruments derived from responsible fisheries management.

- **Taiwan's tuna fishery and its significance**

The management of Taiwan's tuna fishery was introduced from Japan in 1950s. Ten years later, the Taiwanese government started to encourage the private sector in order to help tuna fishery to develop. Then, the Ultra-law refrigerated technology was introduced. And the industry was characterized by long line and purse seine fisheries. In Taiwanese tuna fisheries, two types of tuna long lines were identified: the traditional long line and the associated

ultra-low refrigerated long line. Vessels catches are concentrated on skipjack tuna representing approximately 80% and yellow fin tuna.

Taiwan's annual tuna production is approximately 400,000 tons which represents 60% of the total production. While the annual export value is approximately US$ 1 billion dollars. Other related industries such as fish processing equipment manufacture and supply, vessel maintenance and the shipbuilding industry generate an additional US$ 433 million dollars per year and create 5,000 job opportunities supporting between 15,000-20,000 people.

- **Development of Taiwan's tuna fisheries policies**

Taiwan developed its tuna fisheries policy in four main phases: the development period (1950-1979), the transitional period (1980-1990), the management period (1991-2005) and the reinforce management period (2006-present).

During the developing period, Taiwan planned to develop its tuna fisheries by constructing Iron vessels over 350 t. the introduction of the Third Four-Year economic Development Plan initiating the import of second hand vessels, and the introduction of loans from the World Bank and the Asian

Development Bank for the construction of fishing vessels are new initiatives that have greatly encouraged the private sector to invest in the tuna fishery industry. In addition, the introduction of the ultra-low refrigerated tuna long line fishing helped Taiwan to become a major supplier of tuna sashimi to the Japanese market and becoming one of the most important tuna fishery states. Taiwan government also decided to invest in gear research in order to improve the catch efficiency.

The transitional period is marked by the Taiwanese government financial aid in infrastructure by the construction of large ports and ice-making equipment and also by supporting the development of more efficient catching methods. In addition, the government also made restrictions on the construction of vessels and the vessels elimination mechanism in response to the international fisheries management regime.

During the management period more conditions and rules were employed notably by readjusting the industry scale in its tuna fisheries policies. In order to achieve its main objective which is reducing fishing capacity, the Taiwanese government succeeded in working with every regional fisheries organization. The adoption of the catch documentation system (CDS), the

boarding inspection and vessel monitoring systems are also one of the measures adopted for the development of Taiwan tuna fishery.

The Taiwanese government reinforces the management of tuna by revising its fisheries management policies. Indeed, tuna fishery management was revised and the industry was restructured. In addition, the government also revised and drew up the law and regulations to solve the Taiwanese flags of convenience (FOC) and IUU fishing activities problems. Furthermore, the maritime patrol and boarding inspection mechanisms were developed.

- **The management measures for tuna fishery**

Taiwan's management principles and strategies are based on standards requested by RFMOs system. This system adopted by Taiwan considers the establishment and revision of regulations, the adjustment of fishing capacities and the implementation of various Monitoring, Control and Surveillance (MCS) measures.

The establishment and revision of regulations are marked by the amendment of regulations on Permission for the Export of Fishing Vessels. It is also marked by the establishment of Regulations on the Investment in the Operation of Foreign Flag Fishing Vessels by Taiwan Nationals.

Regulations for the issuing of building permits and fishery licenses are also part of the establishment and revision of regulations.

The reduction of fishing capacity is also one of the strategies the Taiwanese government used to develop the tuna fishery.

In order to fulfill its role in international tuna fisheries management, the Taiwanese government has adopted the implementation of MCS measures through vessel monitoring system (VMS) measurement, reinforcement of boarding inspection, the Observer Program, Port sampling and port state measures and catch document program. This management system also considered by-catch fisheries management.

However, Taiwan tuna fishery faces some current management issues such as the difficulty to become a member of several international fishery management organizations. The over capacity of the tuna fleet remain a great issue and also the authorities are enable to manage FOC. The limitation of current human resources in research and management fields fails to keep the industry abreast of new international regulation and implementation. In addition, the increase in demand for observers, management practices, and high turnover rate of observers and dispatch of

observers are essential issues in Taiwan's current management of tuna fisheries.

In the whole, this study has examined the readjusted management measures, law and regulations relating to the Taiwanese tuna industry. This study has also demonstrated their conformity in principle to that of the Compliance Agreement and the United Nation Fish Stocks Agreement. This study also illustrated the Taiwanese government's effort in executing some initiatives. It also demonstrated Taiwan's tuna fishery's success despite its unique position in the international community.

4.3.2 Namibia

Namibia is a southwestern African country which shares border with South Africa, Botswana, Zambian and Angola. It has 200 miles of EEZ and 12 small uninhabited islands. The economy is dominated by mining, fishing and tourism. GDP is around twice the average for African states.

Just after being an independent republic March 21th, 1990, Namibian government started working systematically to establish an appropriate system of governance for the fisheries sector. Namibian waters are highly

productive. More than 20 commercially important species are landed. Landing in 2003 totaled 631,119 tons taken by a total of 279 vessels licensed to fish in Namibian waters. For a better management of resources, Namibian government has divided the marine sector into nine main fisheries: demersal fisheries, mid-water fishery, purse-seine fishery, deep-sea red crap fishery, commercial line-fishing and cape for seals. In order to maximize catch utilization, Namibian fisheries policy has driven the development of a strong on-shore handling and processing sector. The government has strongly encouraged processing resulting in considerable expansion of employment.

According to our analysis, we realize that Namibia's fisheries management system success is mainly due to the implementation of the economic role of the fishing industry, its policy administration, its fisheries legislation, research, training, development assistance and international and regional law and relations.

- **Economic role of the fishing industry**

More than 13,500 people are directly employed. Among them 5,575 are employed on-board vessels and 7,925 works ashore. In terms of export

earnings, fisheries sector has been the second largest sector in the Namibian economy behind mining. The contribution of income from marine resources to GDP has shown an overall increase from N$ 288 million (4%) in 1991 to N$ 2526 million (7%) in 2003. We also noticed that the value of fisheries production has increased since 1991 mainly due to an increase in prices obtained in the export markets as well as value addition. The total value of landing has increased from N$ 644 million in 1991 to N$ 3668 million in 2003. The total value of exports has also increased from N$ 631 million in 1991 to N$ 3506 million in 2003.

Namibia's economic role of the fishing industry success is mainly due to the direct government revenues collected from the fisheries sector including quota fees; marine resources levy fund, a by-catch levy, licenses fees for vessels and processing facilities. These direct revenues totaled over N$ 100 million in 2003. The government also did not neglect the recreational fishing which is in excess of N$ 30 million per year. We also realized that Namibia's economic role of the fishing industry success is due to the support of Namibia's fishing companies providing finance and other forms of assistance for the construction of schools, clinics and other much needed

civic facilities. Indeed, for more than 13 years, the contribution is in excess of N$ 40 million.

- **Policy and administration**

In Namibia, the Ministry of Fisheries and Marine Resources (MFMR) is responsible for the management and development of fisheries. MFMR's mission is to strengthen Namibia's position as a leading fishing nation and to contribute toward the achievement of their economic, social and conservation goals for the benefit of all Namibians. Namibia current policy addresses IUU fishing including the development and implementation of national plans of action, the introduction of a national satellite for example based VMS providing for real time monitoring of vessel movement and activities and to assist in curbing IUU fishing activities within and outside the EEZ by Namibian flagged vessels. Namibian current policy also addresses to enforce port state responsibilities over all vessels by taking legal actions against vessels engaging in Illegal, Unreported and Unregulated fishing. This policy also enforces flag state responsibilities over all vessels with Namibian flag according to the national fisheries legislation.

- **Fisheries legislation**

Namibia's marine fisheries are governed by two primary legal instruments. The first one is the Territorial Sea and Exclusive Economic Zone of Namibia Act (n°. 3 of 1990). The second instrument is the Marine Resource Act (n°. 27 of 2000).

The Marine Resource Act focuses on the details of a right-based management system outlining fishing rights licenses, total allowable catches, individual quotas, fees and subsidies. This Act also focuses on giving effect to international fisheries agreements, management and conservation measures. It also insists on monitoring, control and surveillance, offences and penalties and finally integrated decision-making.

According to the Marine Resources Act no person shall harvest any marine resource for commercial purposes, except under a right. Indeed, the main purpose of Namibia's fishing right is to limit entry to the fisheries sector in order to protect the fisheries resources and maintain sustainable operations. Fishing rights are granted for a period of 7, 10, 15 or 20 years depending on various factors. Namibian government requires all fishing vessels to obtain a license in order to fish commercially within Namibia's 200 miles of EEZ.

TAC is set annually for 7 species such as pilchard, hake, horse mackerel, red crab and rock lobster, orange roughy and monk.

The main purpose of Namibia's quota allocation is to promote economic efficient knowledge about expected catch levels for the year for proper planning of their fishing activities.

Fees play an important role in two levels in the economy of Namibia. The first one is to earn revenue for the government and the second to create incentives that work towards the goals of the management system.

However, Namibia did not accept the subsidy policies because they believe that the subsidies cause over-capitalization, distort trade unfairly, lead to over-fishing and encourage illegal, unreported and unregulated (IUU) fishing practices. Indeed, the implementation of a rights based-system through the quota fees by Namibian government adopting a system of taxation , lead Namibia to have a healthier stocks, to improve compliance and an efficient industry that supports proper fisheries management and earns healthy profits. This also led to limit access to the resource and fishing mortality for each participant. It is apt to the Minister to make regulation in order to give effect to any agreement. After adopting any fisheries or

international agreements, text of all conservation and management measures adopted may be published in the national Gazette.

In order to manage well its fisheries resources, Namibia focused mainly on management and conservation measure such as TACs, effort limitations, fishing-gear specifications, protection of juvenile fish through measures such as minimum allowable mesh size, grid selectivity device, minimum fish size to be landed, restriction on by catch, temporal and spatial closures and measures for share stocks.

Namibia has succeeded to implement a very effective MCS system by supporting the sector in the financial, human and material plan. Indeed, Namibia's MCS system includes fisheries observer program, compliance and enforcement, sea, air and shore patrols, monitoring of landings, vessel reporting and vessel monitoring system.

Namibian government imposed to pay a fine of N$ 2 million for any unauthorized fishing. In addition, any person assaulting any officers authorized under Namibian law or international agreement pays N$ 1 million as fine.

Before taking any action to adjust any aspect of policy or management strategy, Namibia Ministry of Fisheries and Marine Resources habitually consults extensively with the stakeholders on matters.

- **Research**

Namibian government undertakes many marine research activities. Among the main activities we have stock survey and assessments to determine TACs, gear development, oceanography, environmental research and the impact of the environment on stock.

- **Training**

Namibian MFMR has developed four courses in order to train its fishery agents. Among them we have fisheries inspector and observer course for nine months, commercial sampling program for fisheries observers for six weeks, cadet program for patrol boat officers for four years, and scientific technical assistance course for six months. The Ministry also utilizes training or education opportunities for its staff both regionally and internationally.

- **Development Assistance**

Namibia has set development assistance into two levels: Bi-lateral assistance and Multi-lateral assistance. Bi-lateral assistance is provided by Norwegian Agency for Development Co-operation (NORAD), Australian International Development Assistance Bureau (AIDAB), and Danish International Development Agency (DANIDA) etc.

Multi-lateral assistance has been provided by Food and Agriculture Organization (FAO), United Nation Industrial development Organization (UNIDO), Commonwealth Fund for Technical Cooperation (CFTC), Global Environment Facility (GEF) and the European Union (EU).

- **International and regional law relations**

One of Namibia's success key of its management system is its involvement in treaties and agreements. Indeed, a number of international and regional instruments have been ratified. Its status of membership in Regional Fisheries Bodies allows Namibia's Ministry fisheries and Marine Resources to cooperate with regional and international fisheries organizations such as Southern African Development Community (SADC), INFOPECHE, South East Atlantic Fisheries Organization (SEAFO), and International

Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and Inter-governmental Oceanographic Commission (IOC).

Namibian government also grants a great importance in participation in regional programs through SADC Regional Fisheries MCS Program, Benguela Environment Fisheries Interaction and Training program (BENEFIT) and Benguela large marine Ecosystem Program (BCLME).

In the whole, we realize that Namibia's fisheries sector development is mainly due to its government to take the decision to implement a management system appropriate to Namibia through the implementation of a strong policy and administration. In addition, it also succeeded to put at the disposal of the sector a strong legislation through two instruments governing marine fisheries. The development of the sector is also due to the importance the government grants to research, training, development assistance and its implication in international and regional laws and regulations.

4.4. Agreements between coastal states and long distant fishing nations

Different types of agreements have been concluded with partner countries in the context of its external fisheries policy. The nature of the individual agreements is supposed to reflect the objectives and economic interest of the respective parties. Among these types of agreement are:

4.4.1 Types of agreements

Reciprocal agreements under which the community offers partners fishing opportunities in the waters of its member states in return for equivalent opportunities for community vessels in their waters. This is the case of Norway, the Faroe Islands, Iceland and Baltic Republics.

Agreements on access to surplus stocks are for community vessels to fish in the waters of a third country. For example this is the case of United States and Canada.

Access to resources and access to markets agreements are under license and joint venture arrangement in return for financial compensation and market access like Greenland for example.

Financial compensation agreements are agreements from where the community pays financial compensation in exchange for fishing rights. This is the case of most of West African coastal countries.

Joint enterprise agreements or "second generation" agreements where the community provides tariff concessions, funds for scientific and technical cooperation, and financial support to establish joint ventures, joint enterprises and local establishment of EU fishing enterprises for example, involving the transfer of EU vessels to a third country.

From these types of agreements, this study aims to examine some models of between coastal states and long distant fishing nations. In other words, it shows the way long distant fishing nation's access to coastal states waters and their fisheries resources.

In the implementation of their agreements with foreign fishing, coastal states consider a whole economics values. In some cases, these values are

perfectly clear where coastal states tend to get economic revenue from foreigners, or to develop national means supported by mix companies or fisheries training programs. In other cases, however, values are more difficult to define and they are not immediately measurable. This study aims to show the effects these agreements have on fisheries resources and industries as well as the economic profits which will derive from. Five different coastal countries agreements will be presented according to the types of agreements they have adopted.

4.4.2 Mauritania's agreement

Mauritania has taken disposition with foreign countries, which determine the use of freezer trawlers of which the effort bears essentially on cephalopods. This agreement aims primarily the economic revenues to derive from foreigners, which also seeking to develop the national fishing and its ability of processing. Mauritania obtains from foreign vessels an annual profit of 23 million of dollars in exchange to the right of access to Mauritanian fishing ground (FAO, 1979).

Under these agreements, foreign fishing vessels pay proportional price to their gross tonnage fee, which is added the obligation to employ Mauritanians in their crews and land a certain tonnage of fish for local processing.

The fee on fishing licenses provides the most direct and most important revenue source. It is about $ 150 per ton gross tonnage for the Spanish freezer trawlers and about $ 200 for Japanese vessels (FAO, 1979). Korean vessels pay the same fee like Japanese, but they do not land any catch in Mauritania. According to Mauritanian fisheries regulation, they must pay a supplement of $ 400 per ton gross tonnage. Mauritania also requires foreign vessels to that they employ Mauritanians in their crews. Apparently each vessel must employ five Mauritanians. But in the Spanish vessels, only two Mauritanians are required in the crews, the other three remaining Mauritanians receive scholarships from Spanish ship owners to improve in fisheries. Mauritanians also require the support of food and clothing including also the payment of salaries. According to the Ministry of fisheries, these costs represent a supplementary charge of $ 6 million. As for the Japanese, they are required to land their catches in Mauritania. For example the processing factory of Nouadhibou is a mix company between

the Mauritanian government and Japanese companies which benefit half of the profits according to the agreement. Finally, it should be noted that Mauritania perceives more fines on foreign vessels for violation of the regulations on mesh nets.

4.4.3 Morocco's agreement

Through its agreement with long distant fishing Nations, Morocco imposed a quota system for the sardine catches. For example, the agreement between Spain and Morocco imposed a quota of 80,000 tons of the Spanish sardine catches (FAO, 1979). In addition, according to the Ministry, it is expected that, after five years, half of the Spanish sardine become morocco property. Similarly, after this period, the crews must be made 80% of Moroccan nationals. Spanish boat owners do not pay direct economic returns to Morocco in the form of taxes or fees.

Although the Spanish owners might pay dearly during the next five years as we already mentioned it, the right to fish 80,000 tons of sardines per year, it is very difficult to estimate the cost. However, the quota or of this kind is adopted, each vessel has a tendency to fish with a more intensive effort to

increase its power outlet, so as to take as large a proportion as possible of the total quota before it is reached and close campaign declared. Also, even if the total capacity of the Spanish fleet is limited, it can be expected that ship owners multiply their investments in machinery and equipment to increase their power of decision. For example they increase the length of nets; they buy more powerful engines, electronics devices more precise location etc. But the vessels will have the chance to continue fishing likely benefit from net earnings. As for Morocco, it is even more difficult to assess the economic value of the benefits it derives. However, even if the Moroccan vessels able to transfer their fishing effort and increase their total catch, it does not likely result in increased catch per unit effort. In other words, Morocco should try either to reduce the overall amount of fishing effort or to ensure that this effort is properly divided between the two areas. When the net profits of Morocco are estimated, Morocco must also take into account expenses that represent for it the implementation of the agreement with Spain. The imposition of a quota catch requires them to be able to control the catches of Spanish vessels, at least monthly, and forbid them to continue fishing once the quota has been reached.

As regards the distribution of these benefits, the Moroccan system yields direct and indirect benefits to the fishing industry, but no direct revenue to the general treasury. They will contribute to the national economy if the industry is able to use the new opportunities offered to them effectively.

4.4.4 Senegal's agreement

As for Senegal, agreements with foreign fishing have in general primary objective to develop the country's ability to exploit and process the fish resources of the area. Senegal has established several joint ventures with foreign companies. For example, these are the cases with South Korea and Japan. Senegal has also concluded a number of agreements with foreign countries, generating different types of benefits to the national economy. These agreements in general, shall require foreign fishing vessels to pay a fixed fee and land part of their catches in Senegal for local processing. In addition, foreign nations must usually provide low interest loans or grants to help. Royalties on fishing licenses are set by law and applied to all vessels, they sail under Senegalese or foreign flags. These charges are moderate and do not affect the value of the privilege representing the right to fish in the

Senegalese waters. Moreover, as they are fixed once and for all for each vessel category, they do not provide access to a “market” for these privileges. Also, Senegal asked foreign countries to make an additional contribution in the form of law interest loans or donation helps. Loans are usually intended to cover the purchase of machinery and equipment specified donors. Such agreement is too complicated to allow rapid assessment of the cost paid by foreign vessels to access Senegalese waters. For example, the net burden for a foreign country for a loan will depend not only on the difference between interest rates and made commercial rates but also the benefit they will get from the sale of equipment and equipment made in consideration of the loan.

Similarly, it is also difficult to access in economic terms the benefits that Senegal withdrew from these agreements. Senegal’s fishing industry and processing has reached a good development, so that loans to purchase machinery and equipment, as well as aid donations, can probably be used effectively to enhance these industries. However, in so far as Senegal wish to authorize foreign fishing partially continue its operations, this approach may prevent to maximize the net benefits that the country could withdraw. The system tends, indeed, to restrict between a small number of countries

the market access rights of Senegalese waters as some governments, such as Korea and Japan, may be reluctant to grant soft loans or assistant grants, especially to provide the fishermen with their access right. Even assuming that the Korean and Japanese fishermen willing to pay more than others access to a particular stock, that they will not be easy to do directly, except in the form of joint ventures. In addition, if the loan conditions are required to purchase the gear and equipment from those countries of which they accepted joint ventures, Senegal may pay more elsewhere. However, Senegalese government should impose quota system to all foreign countries to balance its benefits. The agreement between the EU and Senegal, for example, involves no catch quotas whatsoever designed to maintain fish stock (Ilnyckyj, 2007). Such an approach neither aids the development of Senegalese society no maintains the sustainability of fisheries.

4.4.5 Ghana's agreement

For a responsible fisheries development, Ghana has focused its fisheries agreement on three main management elements with long distance States. The first element is license fees, royalties and others local currency. In this

case the Ghanaian government has restricted foreign participation in fishing to tuna fisheries. Fees for tuna vessels under joint venture registered in Ghana depend on gross register tonnage (GRT) of vessel, according to the Ghanaian system.

The second element is about the requirements concerning bilateral framework agreement, or joint venture participation. Indeed, Ghana has allowed foreign tuna companies to enter into partnership with Ghanaian companies. According to Ghanaian Ministry of Fisheries, at least 25% of shares in the joint venture for tuna fishing are owned by the government under the Ghanaian Companies Code 1963 (Act 179), by a citizen of Ghana, a public company, or by a limited liability company registered in Ghana.

The third element focuses on foreign fishing vessel license conditions. The Ghanaian government has prohibited fishing by foreign vessels except for tuna fishing. Licenses may be issue for tuna vessels where vessel is:

a) at least 25% locally owned; or
b) owned by company that is at least 25% share-owned by Ghanaian nationals; or
c) under charter agreement with local person or company that confers option to purchase within 3 years for which adequate provisions are

made for training, transfer of skills and expertise, as well as adequate arrangements for supply of ice that will not prejudice supply to local fleets.

- Except where permitted by regulations, all catch and fish loads of licensed tuna vessels must be landed in Ghana before any transshipment or export thereof.
- No black skipjack tuna and no fish other than tuna to be transshipped or exported.
- Permission to export required for all species of tuna from licensed vessels.
- At least 10% of designated species of tuna landed in Ghana to be offered for sale to local canneries, for example skip jack, yellow fin, and big albacore.
- Vessels to observe requirements concerning identification marking.

So these are the main agreement points on which the Ghanaian government has focused to develop its fisheries industries and at the same time to take into account the marine environment and fishermen living conditions.

4.4.6 Namibia's agreement

Namibia, which has opted not to have any of the "usual" foreign fishing States agreements types but instead have agreements of its own based on national requirements, has managed to increase the contribution the fisheries sector makes to the national economic and social development. It has been reported that in first five years of independence:

- 6,000 new jobs were created, doubling wage employment in the fisheries sector;
- Foreign exchange earnings were tripled;
- Tax revenue equivalent to 3 times the Fisheries Ministries budget was generated;
- The fisheries sector has been increasingly integrated into the wider Namibian economy.

All this is said to have been achieved against a background of:

- A major reduction in the total allowable catch (TAC) with a view to promoting stock recovery;
- Adverse environmental conditions in the fishery;

- A 30% reduction in fish landings.

The Namibian experience is been seen as example for other third countries in relation to the long distance fishing nations. It is worth stressing unlike other African countries Namibia has a well-established fishing industry which it able to control and regulate effectively such as revenue collection.

In sum, some of the agreements that coastal States have concluded with long distant fishing nations illustrates various approaches that reflect the different situation of resources and economies. Some of them such as Mauritania, favored the removal of economic returns on foreign vessels; while others such as Senegal, preferred reap the benefits directly to help the domestic fishing and processing industries of its products.

5. Conclusion

5.1 Issues in Senegal fisheries and management

According to our analysis of the different data, we realize that the Senegalese fisheries sector is still facing several problems which prevent it economic, social and ecological development. In fact, these problems are mainly related to overfishing, overexploitation, illegal fishing activities, failure in so-called authorization protocols and the post utilization of fisheries resources. In front of this embarrassing situation, some people like S.I Alioune and J. Catanzano (Eburon and Cunningham, 2005) think that it is urgent to warn people about the current critical status that characterizes Senegalese fisheries. According to Alioune and Catanzano, “Senegalese fisheries are currently characterized by the overexploitation of coastal demersal resources and the existence of excess fishing capacity. Catch per unit of effort is falling, with increasing numbers of fishing offences and increasing conflict at sea between fishers using different kinds of gears” (Eburon and Cunningham, 2005). According to our analysis, we clearly notice that the fishing effort has slightly increased due to the evolution of

the number of active fishermen, the evolution of the number of active pirogues, the increase of the quantity of fuel consumption and the yield of foreign fishing activities. Actually, the number of fishermen has increased from 58116 fishermen in 2011 to 58505 fishermen in 2012, an increase of 389 fishermen which represents 1% of evolution (MFD, Report 2012). This increase of the number of fishermen in artisanal fishing is mainly due to the lack of employment for young men who hardly find job in the other economical sector of the country on the one hand, and on the other by the quick profits they make in fishery's sector. The total number of pirogues has also increased from 10455 pirogues in 2011 to 10763 pirogues in 2012 with an increase of 308 pirogues representing an evolution of 3%. The total consumption of fuel in artisanal fishing is has increased from 33733 liters for a commercial value of 20872995 FCFA in 2011 to 34401 liters for a commercial value of 15283378 FCFA in 2012 equal to an increase of 668 liters representing 2% and 5589617 FCFA for a decrease of -27% (MFD, Report 2012). According to these results we clearly realize that the increase of the number of fishermen, the number of pirogues and the increase of the quantity of fuel consumption have encouraged the fishing effort in Senegalese fisheries. This is now the same situation which happens in most

of the main fishing States as it is clearly underlined in these following words "The investment to increase the fishing capacity (vessels, equipment, labor) have encouraged fishing effort to a level which is slightly great than the production capacity of the fishing area, in the main fishing states" (Fishery and Environment, 2005).

Another problem we noticed through this study is the use of banned fishing methods in both artisanal and industrial fishing. For example in artisanal fishing, the use of explosives, monofilaments and multi monofilaments are greatly responsible for the destruction of marine fauna and flora. In industrial fishing also, the use of trawl beef, gillnets right lobster, gillnet in tuna, trawler over 400 tons for shrimp fishing and sardine trawlers over 1500 tons cause so many damage and do not allow the sustainability of fisheries resources. Actually, they largely participate to overfishing and degradation of ecosystem environment.

According to the successful management system of the two case studies we presented in this study, we also realize that Senegalese fisheries is still facing some problems related to its management system such as the implementation of some new measures, but also the weakness of technology

for control and surveillance of big foreign vessels highly equipped with new fishing technology operating illegally in Senegalese waters.

Another issue is the way the Senegalese government deals with foreign vessels through fisheries agreements which are not most of the time benefit to the Senegalese fisheries sector. This situation causes much damage leading to the scarcity of some value species due to the overexploitation of their stocks and non respect of marine ecosystem foreign vessels are experiencing in Senegalese waters. Nowadays, the issue of overfishing is not a matter that one can find only in Senegalese fisheries, but all over the world. Even FAO recognizes that "overfishing of marine resources in the world is the main cause of the decrease of fishing productivity. 50% of all the fish resources are now entirely used, 25% are still potentially exploitable, and the remaining 25% are in serious damage of exhaustion and necessitate quick intervention in order to restore a sustainable yield" (UNPE, 2004). To this issue, we can also name the problem of illegal fishing activities which becomes more and more serious in Senegalese waters particularly with certain foreign vessels that the Senegalese fisheries authority hardly succeed sometimes to control them alone due to the weakness of the means of

control and surveillance. This is the case of one of the Russian vessels which was unfortunately caught illegally fishing in Senegalese waters.

The fact that some foreign vessels not landing and processing their captures in Senegal represent also a serious matter which does not encourage the development of fisheries sector in terms of employment and profits for Senegal.

And finally, another problem which is urgent is the lack of qualified fisheries agents who are able to manage well fisheries resources and bring at the same time real changes in Senegalese fisheries sector for a sustainable development of fisheries resources.

5.2 Recommendations and policy actions

After underlining some issues making serious trouble to Senegal's fisheries, we try to give some recommendations related to these issues from the success of the case studies we did before.

- **Making a strong controlling system**

I highly recommend the implementation of a new management system of fisheries resources in Senegal by making a strong controlling system in

order to solve problems in fisheries sector. This current system which is based on the free access of the resource, does not guarantee the sustainable management of this sector. Indeed, the implementation of this new system will allow the Senegalese government to solve the current problems of which the fisheries sector has been confronted. Thus, the Senegalese government should implement a new regulation of fisheries resource management based on the right of use particularly the right of access in all EEZ where it exercises its authority to define the regulation in terms of fisheries management. This new system is an answer to all the problems caused by the current system. This current system which is characterized by the open access of the resource has reached its boundaries and is no more able to satisfy fisheries actors. Actually, this current system has caused many problems in Senegalese fisheries such as overcapacity and overexploitation. Whereas the system based on the rights of access is a method which allows to regulate the access to fisheries resources and to fulfill the objectives in terms of sustainable management of fisheries resources.

However, the implementation of this new system should be followed by the adoption of some strict measures such as the implementation of a strong

controlling system, the definition of access rights based on local specificities, the choice of institution that must manage these use right and so on.

This new system will be an efficient tool not only in the fight against overexploitation of resources but also in the regulation of conflicts as we mentioned it before caused by the rush of fisheries resources opposing most of the time fishermen in high sea.

I also strongly recommend the Senegalese government to reinforce the fines and remain strict against fishing with explosives and poison in order to convince those doing illegal fishing activities to stop.

The government should also plan in the Code of environment appropriate penalties of disposition. But also to examine clauses of safeguarding of the United Nations Convention on the Right of sea in order to find out dispositions allowing to reinforce the punishment against the users. The current Code of fisheries should also be revised in order to ban the fishing of some small size of fish. This will allow at the same time to protect the ecosystem environment and to allow some species which reproduce quickly like sardinella to increase the productivity. The commercialization and the use of monofilaments and multi monofilaments should be banned by fishermen and imposed by the government.

Furthermore, the competent authorities of the State should contact other regional fisheries organizations so that these measures be generally applied and respected by all actors in fisheries sector.

Senegal's management principles and strategies should be based on standards requested by RMFOs system. For example, the system should consider the establishment and revision of regulations, the adjustment of fishing capacities and the implementation various MCS measures.

The reduction of fishing capacity is also one of the strategies the Senegalese government should use to develop its fisheries.

Senegal's current policy should also address to enforce port state responsibilities over all vessels by taking legal actions against vessels engaging in IUU fishing.

I also highly recommend the government to focus mainly on management and conservation measure such as TACs, effort limitations, fishing-gear specification, protection of juvenile fish through measures such as minimum allowable mesh size, grid selectivity device, minimum fish size to be landed, restriction on by catch, temporal and spatial closures and measures for share stocks.

The government should also undertake many marine research activities such as stock survey and assessment to determine TACs, gear development, oceanography, environmental research and the impact of the environment on stock.

The government should also be involved in treaties and agreements in order to cooperate with regional and international fisheries organizations.

- **Sharing the catch with foreign vessels**

I also highly recommend the Senegalese government to share the catch with foreign vessels of which the government has signed an agreement in order they can get free access to fisheries resources. In other words, when a foreign vessel comes to fish in Senegalese waters, all its operation should be achieved in Senegal, from the beginning to the end. That is to say, foreign vessels should land all their catches in Senegal where the fish will be processed. Then after this step, the two partners can proceed to share the final product before its commercialization. This new recommendation which allows to share the catch is actually better because it will allow Senegal to create fisheries industries, to create many jobs and as a consequence to make more profits. However, I strongly recommend the Senegalese

government for not signing agreement with foreign countries for fisheries resources just in exchange of money. Indeed, the government should be aware to the sustainability of fisheries resources for the next generations. In this case I significantly recommend the Senegalese government to adopt a new form of agreement or cooperation with its partners based on the sharing of the catches according to their agreements. However, these agreements must be improved to provide coastal States like Senegal greater net benefits than at present. National court must be more extensive fisheries for Senegal use its authority to get the maximum benefits.

It would be desirable to begin collecting economic data, or to improve the statistical process. Even in the case where Senegal does not wish to take abroad purely economic benefits, however, it should better understand the economic value of the resources in its area. This is for two main reasons. The first is that the knowledge of these values allows it to obtain wishing to have access to its national waters the most interesting foreign benefits. Secondly, with regard to stocks that are shared between two or more coastal states, knowledge of economic values of these resources will facilitate the distribution of profits.

- **Making or developing industries**

This step is of paramount importance to boost the development of the national economy. Thus, the Senegalese government should change its fisheries agreements policies with foreign vessels regarding the post capture utilization of fish particularly the processing. The government should sign agreements which will allow the foreign vessels to land all their catches in Senegal and to do the all processing in Senegal before they will send their part of processed products in their countries or targeted markets. Indeed, this new strategy will be more benefit because it will allow the creation of many processing companies and allowing the creation of thousands of jobs for young who don't have job. This current recommendation is fairer between the two partners. It will allow a rapid increase of the economy of the country by creating more jobs and making more profits. Furthermore, Senegal should inspire the case of Namibia by development a strong fisheries industry from its own means. It is also recommended to take as an example the case of Taiwan which develop its tuna fishery by the help of the Taiwanese government which has financially and materially help the tuna fishery to develop so that Taiwan has become one of the main tuna nations in the world.

As Namibia did, Senegal should also set development assistance into bi-lateral and multi-lateral levels in order to restart quickly the development of its fisheries industries.

In order to build a strong fisheries industries, Senegalese Ministry of Fisheries and Maritime Affairs (MFMA) should develop a number of training courses such as Fisheries Inspector and Observer course, Commercial Sampling program for fisheries observers, Cadet Program for patrol boat officers, and Scientific Technical Assistance course. The Ministry should also utilize training or education opportunities for its staff both regionally and internationally.

The Government should also grant a great importance to fees in order to earn revenues for the government on the one hand, and on the other to create incentives that work towards the goals of the management system.

Senegal's government should also not accept the subsidies policies because according to Namibia's success, it is believed that the subsidies cause over-capitalization, distort trade unfairly, lead to over-fishing and encourage IUU fishing practices. However, it is strongly recommend adopting a system of taxation, which allows having healthier stocks, to improve compliance and an efficient industry that supports proper fisheries management and earns

healthy profits. Furthermore, this also leads to limit access to the resource and fishing mortality for each participant.

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