Integrated Assessment of Trade Liberalization and Trade-Related Policies

A Country Study on the Fisheries Sector in Senegal

UNITED NATIONS
New York and Geneva, 2002

NOTE

The views and interpretation reflected in this document are those of the author(s) and do not necessarily reflect an expression of opinion on the part of the United Nations Environment Programme.

UNEP/ETB/2002/0010

UNITED NATIONS PUBLICATION

ISBN: 92-807-2220-2
ISSN: 1683-8157

EXECUTIVE SUMMARY

Fishing is an essential component of rural development in Senegal. It is a multipurpose activity strongly integrated with the rest of the Senegalese economy and society. Fishing plays a strategic role in ensuring the sustainable growth of the national economy. The fisheries sector covers an important proportion of the population's protein needs (75 per cent).

Fishing plays a dominant role in the Government's policy towards generating employment. It generates today about 100,000 direct jobs (i.e. fishermen) for nationals, of which more than 90 per cent are in small-scale fishing. Fishing also generates other related jobs, employing about 15 per cent of the Senegalese working population, which amounts to about 600,000 people; it thus contributes largely to employment.

Since 1986, the sector has ranked first for exports, ahead of combined groundnut and phosphate sectors, and accounts for about one third of the value of foreign sales. The fishing industry also contributes to Government revenue through different agreements.

Despite its economic and social importance, the sector is facing serious disequilibria both in resource exploitation and market supply: the coastal demersal (deep lying fish) stocks with high market value - mostly exported - are fully exploited and even over-exploited. A serious risk of local market supply shortages looms ahead, as fishing efforts shift from locally consumed species to export-oriented ones.

These pressures became clear as the sector turned towards meeting external demands. The move was instigated externally in a context of structural adjustment, and outside the play of market forces, including through:

- non-reciprocal advantages under the Lomé Agreements, authorizing Senegalese piscatorial products to enter the European market with the exemption of custom duties;
- export subsidy of 15 per cent, later raised to 25 per cent, first applied to canned tuna and later extended to all piscatorial products;
- 50 per cent devaluation of the CFA franc, which more than compensated for subsidy suspension (also linked to devaluation);
- fishing agreements concluded with a number of foreign fleets.

Despite its distorted effects, connecting the fisheries sector to external markets offered some advantages, both microeconomic through a contribution to the improved operating accounts of fisheries, and macroeconomic for its significant contribution to efforts to improve the balance of trade. However, external connection is threatened by multilateral trade liberalization. The new Lomé Agreement provides for

phasing out ACP (Africa, Caribbean and Pacific) countries' trade advantages. In the meantime, the process towards custom tariff reduction initiated under the aegis of the World Trade Organization (WTO) should speed up their erosion. Crisis factors are already known, and the question is whether growing trade liberalization will aggravate them, produce others, or on the contrary, facilitate finding solutions.

One of the risks implied by liberalization concerns Senegal's export of piscatorial products. Given that these exports are anchored to the European market and are hardly competitive with some rival products, the questioning of concessions granted to them by the European market might be consequential. In this case, environmental and food security pressures would add to the pressures on foreign exchange earnings and the costs and revenue of the sector.

Therefore, this study tries to pinpoint some disequilibria, to analyse them in the light of liberalization and to suggest a few *scenarios* that are likely to defuse them. The solutions envisaged take into consideration the multipurpose nature of fishing activities.

In section 2, the Lomé Agreement is analysed. Concluded in 1982, the Lomé Agreement instituted a customs duties exemption regime applicable to most products originating from ACP countries. Being covered by this regime, piscatorial products became clearly more competitive. The Senegalese piscatorial products also benefited from the customs duties exemption regime of the European market. Between 1982 and 1991, exported volumes of fish rose from 90,000 tonnes to about 120,000 tonnes. While the Lomé Agreement greatly contributed to the general expansion of Senegalese piscatorial exports, it also created a dependency on the European market. The system of trade preferences has reinforced the significance of the European market in the distribution of Senegalese piscatorial exports. Asian and North American markets remain marginal, while African market expansion is hindered by structural constraints. Europe remains by far the main destination for Senegalese piscatorial exports, receiving 79,000 tonnes out of the 125,000 tonnes exported in 1999 - that is about 60 per cent of the total.

Section 3 studies the direct and indirect export subsidies. From Independence to the late 1970s, the Government conducted a policy of active support to the fishing sector, as evidenced by the projects designed to develop small-scale fisheries into an intermediary stage as semi-industrial. This policy failed. In a second phase, which started in the early 1980s, Government support was first reduced under structural adjustment policies, and shifted from direct interventionism in the 'capture component' to export-stimulating mechanisms. The *free zone* and *free exporting enterprise* status, and an export subsidy, greatly contributed to an increasing anchoring of the sector to external markets.

In section 4, the impacts of structural adjustment policies and devaluation of the CFAF in the fishing sector are studied. The efficiency of the Structural Adjustment Programmes (SAPs) in the franc currency area was the subject of a debate which finally led to devaluation in 1994. In exchange, the IMF and the World Bank pledged to support countries of the franc currency area in their efforts to reactivate growth and to contain the perverse effects of devaluation. The trade policies related to the fisheries sector especially consisted of exogenous stimulants outside the play of market forces,

which threatened sustainable growth of activities. Even the devaluation of the CFAF encouraged quick profit seeking and equally favoured a 'rent culture' more than other government interventions. Devaluation therefore strongly contributed to an increased anchoring of the fisheries sector to the export sector.

The fishing agreements between Senegal and the EU are analysed in **Section 5**. The agreements signed with the EU attract most of the attention in view of the various factors at stake: the targeted species, the size of the fleets and the financial stakes. The conclusion of fishing agreements rests on the principle of complementarity between national and foreign fishing concerns. However, between practice and theory, a gap that has existed right from the beginning has not ceased to progressively widen. As regards coastal, demersal and pelagic resources, national fishing ships seem not only capable of exploiting almost all of the stocks but also exploiting them fully.

Section 6 analyses the economic and social impacts of export support mechanisms: fishing effort was noted to have shifted from the capture of domestic market oriented species to export oriented species. The partial redeployment of purse seines and surrounding gill nets (some pelagic small scale fishing units) effort towards these priority species, disturbs the domestic market supply, raising fears about an increasing protein deficit, which already exists in the countryside.

Section 7 studies the environmental impact of export support mechanisms on coastal demersals. Analysis of the trends in density indicators over the period under review (28 years) provides an indication of the sharp decline in global *catches per unit effort* of all species, thus confirming the results of assessment campaigns through trawling. However, some species appear to have been particularly affected. The latter belong both to the *Sciaenidae* and *Sparidae* communities and are particularly targeted for export.

Section 8 offers some recommendations for the sustainable management of Senegalese fisheries through resource preservation and product development.

- With regard to **quotas**, individual quotas appear to be more efficient than global quotas. However, many obstacles complicate the institution of quotas in multi-specific tropical fisheries, and even more so when these fisheries are, as in Senegal, dominated by the small-scale sub-sector.
- The issue of the price of access to resources, calls into question the **fishing agreements** concluded with foreign fleets, starting with those binding Senegal and the European Union. It may be possible to limit the agreements only to deep demersal and high seas pelagic resources. It would be also possible to increase considerably the prices of licences granted to boat owners so as to deter the least profitable enterprises.
- The subsidized motor fuel price might now be applied only to purse seines and surrounding gill nets.
- With regard to **infrastructure**, the programme on the construction of fishing wharves is likely to reduce post-capture losses. It should be complemented by a programme to create parking areas for fish and seafood wholesalers, and arrange security sites devoted to small-scale fish processing. Such measures would make it

possible to improve the working conditions of fish processing women, sanitation and product quality and increase profitability. It will at the same time contribute to the food security policy. The installation of storage infrastructures in the main small-scale processing centres aims for the same objectives. The improvement of existing roads and the construction of new ones at the national and sub-regional levels would also help to better develop piscatorial production.

- As for **support to some fisheries**, the revival of semi-industrial sardine fishing would provide more raw materials to high value added industrial processing (canned fish, freezing etc.), without competing with small-scale fishing (products of smaller size). It would extend the range of products exported to Africa.
- As the packaging and processing component is in a clear situation of excess capacity, **a freeze on new plants** is recommended.
- A **subsidy** for ice to cool fishing products would reduce the costs of fish trade considerably and contribute to improving product quality, notably for the rural populations.
- Market-based mechanisms and economic measures are also likely to increase the value of production. These include in particular, tax and customs incentives, measures facilitating the use of technologies adapted to industrial and small-scale processing, and systems designed to support market exploration.

ABBREVIATIONS AND ACRONYMS

ACP	Africa, Caribbean and Pacific countries
ADNP	Angling, dormant net and pot fishing
CAMP	Centre d'Assistance et de Motorisation de la Pêche artisanale
CAPAS	Centre d'Assistance de la Pêche au Sénégal
CFA franc	the basic monetary unit of UEMOA (West African Economic and Monetary Union)
CNCAS	Caisse Nationale de Crédit Agricole du Sénégal
CRODT	Centre de Recherche Océanographique de Dakar Thairoye– in charge of studying the stocks
DOPM	Direction de l'Océanographie et des Pêches Maritimes
EEZ	Exclusive Economic Zone
FOB	free on board
GIE	Groupement d'Intérêt Economique
GSP	Generalized System of Preferences
ICP	industrial and commercial profits
ICTSD	International Centre on Trade and Sustainable Development
IFZ	Dakar Industrial Free Zone
IRP	invested capital recovery period
IRR	internal rate of return of invested capital
LDC	least developed countries
MFI	Multilateral Financial Institutions
MFN	Most-favoured nation
OECD	Organization for Economic Cooperation and Development
SAP	Structural Adjustment Programme
WTO	World Trade Organization
OEPS	Economic Observatory of Senegalese Fisheries

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

A number of institutions and individuals have been involved in the implementation of this country study and contributed to its successful implementation. The ENDA Third World in Dakar has been the main national institution in Senegal responsible for undertaking the study. Special acknowledgement therefore goes to ENDA and to the technical team led by Karim Dahou. Thanks are also extended to the UNEP Technical Group which provided substantive guidance and input throughout the duration of the project.

It must also be recognized and acknowledged that this study has been made possible due to the commitment and supervision of the National Steering Committee, composed of the Senegalese Ministries of Fisheries and Trade and Environment, the Oceanographic Research Center in Dakar-Thiaroye, affiliated to the Senegalese Agricultural Research Institute (CRODT/ISRA), the *"Groupement des Armateurs et Industriels de Pêche du Sénégal" (GAIPES)*, the *"Collectif National des Pêcheurs du Sénégal" (CNPS),* the *"Fédération Nationale des GIE de Pêche du Sénégal" (FENAGIE),* non-governmental organizations (CREDETIP, ADPES and WWF), the Development Research Institute (DRI), the Food Technology Institute (ITA), the *"Fédération Nationale des Mareyeurs du Sénégal" (FENAMS)* and the *"Union Nationale des GIE de Mareyeurs du Sénégal" (UNAGIEMS)* . Thanks are also extended to our fellow researchers on the Senegalese team, Douguitigui Coulibaly, Papa Gora Ndiaye, Abdoulaye Sène and Djiby Thiam for their dedication and their precious knowledge which have contributed to the success of this study.

Special acknowledgment goes to Veena Jha who has provided extensive technical guidance and support to this project, as well as to Theodore Panayotou and Konrad von Moltke. Acknowledgements should also be extended to all resource persons who attended the expert meetings in Geneva and Berlin and the national workshops in Dakar.

It is important to thank all the institutions at the national and international level that have contributed and provided valuable information during the implementation phase of this project.

At UNEP, the project was initiated and led by Hussein and substantive comments were provided by Eugenia Nunez, Emeline Fellus and Anja Jänz. Desiree Leon was responsible for processing the country studies for publication, Andrea Smith edited the studies and Rahila Mughal provided administrative support.

United Nations Environment Programme

The United Nations Environment Programme (UNEP) is the overall coordinating environmental organization of the United Nations system. Its mission is to provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations. In accordance with its mandate, UNEP works to observe, monitor and assess the stat of the global environment, and improve our scientific understanding of how environmental change occurs, and in turn, how such changes can be managed by action-oriented national policies and international agreements. UNEP's capacity building work thus centers on helping countries strengthen environmental management in diverse areas including freshwater and land resource management, the conservation and sustainable use of biodiversity, marine and coastal ecosystem management, and cleaner industrial production and eco-efficiency, among many others.

UNEP, which is headquartered in Nairobi, marked its first 25 years of service in 1997. During this time, in partnership with a global array o collaborating organizations, UNEP has achieved major advances in the development of international environmental policy and law, environmental monitoring and assessment, and our understanding of the science of global change. This work has, and continues to support, successful development and implementation of the world's major environmental conventions. In parallel, UNEP administers several multilateral environmental agreements including the Vienna Convention's Montreal Protocol on Substances that Deplete the Ozone Layer, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (SBC), the Convention on Prior Informed Consent procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention, PIC) and most recently, the Cartagena Protocol on Biosafety to the Convention on Biological Diversity as well as the Stockholm Convention on Persistent Organic Pollutants (POPs).

Division of Technology, Industry and Economics

The mission of the Division of Technology, Industry and Economics (DTIE) is to encourage decision-makers in governments, industry, and business to develop and adopt policies, strategies and practices that are cleaner and safer, use natural resources more efficiently and reduce pollution risks to both human beings and the environment. The approach of DTIE is to raise awareness by fostering international consensus on policies, codes of practice, and economic instruments through capacity-building and information exchange and by means of pilot projects.

Economics and Trade Branch

The Economics and Trade Branch (ETB) is one of the Branches of the Division of Technology, Industry and Economics (DTIE). The work programme of the Branch consists of three main components: economics, trade and financial services. Its mission is to enhance the capacities of countries, particularly developing countries and countries with economies in transition, to integrate environmental considerations in development planning and macroeconomic policies, including trade policies. UNEP's mission in this field is also to address the linkages between environment and financial performance and the potential role of the financial services sector in promoting sustainable development. The trade component of the Programme focuses on improving countries' understanding of the linkages between trade and environment and enhancing their capacities in developing mutually supportive trade and environment policies, and providing technical input to the trade and environment debate through a transparent and a broad-based consultative process.

For information on UNEP's Programme on Economics and Trade, please contact:

Hussein Abaza
Chief, Economics and Trade Branch (ETB)
Division of Technology, Industry and Economics (DTIE)
United Nations Environment Programme (UNEP)
11–13, chemin des Anémones
CH-1219 Châtelaine/Geneva
Tel.: (41-22) 917 82 98
Fax : (41-22) 917 80 76
E-mail: *hussein.abaza@unep.ch*
Internet: http://www.unep.ch/etu

FOREWORD

The management of natural resources today poses a serious challenge for the future of our planet and especially for the Least Developed Countries (LDCs). While many countries tend, at times, to oppose rather too hastily the combining of development objectives with environmental protection, it is clear that complementing environmental and development policies is necessary for human survival. This is especially the case for the Senegalese piscatorial sector, which meets 75 per cent of the populations' animal protein needs. While its weight in the balance of trade as a foreign exchange earner (35 per cent), and its role in employment generation cannot be neglected (the sector employs about 600,000 people), the importance of piscatorial products in terms of contribution to food security in Senegal actually requires special attention. The multidimensional nature - social, economic and environmental - of the sustainable development concept is reflected in the multi-functionality of Senegalese fisheries. The purpose of this study is therefore to try to grasp the socio-economic and environmental consequences of trade policies on the piscatorial sector, bearing in mind the need to reconcile trade expansion with sustainable resource management and food security for the country.

After years of drought and crisis in the agricultural sector, fishing has become the leading sector of the Senegalese economy. Hence it is expected to underpin a sustainable growth policy by contributing to the reduction of the balance of payment deficit and unemployment, and to the populations' protein needs.

However, over the past twenty years, the piscatorial sector has become commercial and export-oriented. This has made demersal fishing clearly more profitable than the domestic market oriented pelagic fishing, and weakening the country's food security. Furthermore, exported species are threatened by biological extinction which is likely to jeopardize future export yields, and this is all the more likely as the erosion of tariff advantages also alters the competitiveness of Senegalese products in the European market.

The advantages offered with the various trade policies (the *free zone* and the *free exporting company* status, the Lomé Agreement, export subsidy, devaluation, fishing agreements etc.), have favoured a volume rather than value-based growth. The sector cannot cope with these difficulties unless a rational management based on resource conservation and product valorization is encouraged. This is the view of the authors and also of all those representing the various interests in the sector who have contributed to this research within the framework of a Steering Committee.

1. INTRODUCTION

1.1 The socio-economic importance of fishing: a multipurpose activity

The Senegalese economy has long relied heavily on phosphate and groundnut production. Since the drought years (1970's) and the crisis recorded in the agricultural sector, fishing has become the major sector of the economy. An essential component of rural development, fishing is a multipurpose activity strongly integrated with the rest of the Senegalese economy and society. Fishing plays a strategic role in ensuring the durable growth of the national economy, notably by contributing to the reduction of the balance of payments deficit, unemployment and the satisfaction of the population's protein needs.

Fish is a major source of protein for the Senegalese population. As a result of declining trends in agriculture and stockbreeding - the traditional sources of vegetal and animal proteins - fishing has become the mainstay of the Government's food security policy. The fisheries sector covers an important proportion of the population's protein needs at relatively low prices. In all regions of Senegal (except Tambacounda), the share of fish in animal protein consumption accounts for over 75 per cent.

Fishing plays a dominant role in the Government's policy towards generating employment. It generates today about 100,000 direct jobs (i.e. fishermen) for nationals, of which more than 90 per cent are in small-scale fishing. Fishing also generates allied jobs and employs about 15 per cent of the Senegalese working population, that is about 600,000 people; it therefore contributes largely to solving unemployment.

Furthermore, the Government is paying special attention to this sector in its effort to restore the trade balance. Since 1986, the sector ranks first for exports, ahead of combined groundnut and phosphate production, and accounts for about one-third of the value of foreign sales.

With a total turnover of about CFAF 278 billion in 1996, fishing generates a value added estimated at CFAF 80 billion, catches and processing accounting for 60 per cent and 40 per cent respectively, and 11 per cent of all primary gross domestic product (GDP) and 2.3 per cent of total GDP.

The fishing industry also contributes to the Government's revenue through different agreements. In addition to associated dues, fishing agreements imply a series of economic, trade and technical counterparts. Under the latest fishing agreement

concluded by Senegal and the European Union (1997 - 2001), direct financial compensation amounts to about CFAF 32 billion. To this amount must be added the dues collected from fishing licenses awarded to boats, fines imposed for violations of existing regulations and para-fiscal taxes.

1.2 Exports growth, social and environmental pressures

Despite its economic and social importance, the sector has to face serious disequilibria both in resource exploitation and market supply: the coastal demersal (deep lying fish) stocks with high market value - mostly exported - are fully and even over-exploited, with a serious risk of local market supply shortages looming ahead, as fishing efforts shift from locally consumed species to export-oriented ones.

These pressures became clear as the sector turned towards meeting external demands. The move was instigated externally in a context of structural adjustment, and outside the play of market forces, including:

- non-reciprocal advantages under the Lome Agreements, authorizing Senegalese piscatorial products to enter the European market with the exemption of custom duties;
- export subsidy of 15 per cent later raised to 25 per cent, first applied to canned tuna and later extended to all piscatorial products;
- 50 per cent devaluation of the CFA franc, which more than compensated for subsidy suspension (also linked to devaluation);
- fishing agreements concluded with a number of foreign fleets.

1.3 Liberalized trade of piscatorial products

Despite its distorted effects, anchoring the fisheries sector to external markets offered some advantages, both microeconomic through a contribution to the improved operating accounts of fisheries, and macroeconomic for its significant contribution to efforts to strike a trade balance. However, external anchoring is threatened by multilateral trade liberalization. The new Lome Agreement provides for phasing out ACP (Africa, Caribbean and Pacific) countries' trade advantages. In the meantime, the process towards custom tariff reduction initiated under the aegis of the World Trade Organization (WTO) should speed up their erosion. Crisis factors are already known, and the question is whether the advent of liberalization will aggravate them, produce others, or on the contrary, facilitate the search for solutions, if anticipated.

One of the risks implied by the expected liberalization has to do with the position of Senegal's export of piscatorial products. Given that these exports are anchored to the European market and are hardly competitive with some rival products, the questioning of concessions granted to them by the European market might be damaging. In which case, environmental and food security pressures are likely to add to the pressures on foreign exchange earnings and the costs and revenue of the sector's professionals.

1.4 Combining enhanced external competitiveness, sustainable resource management and food security in a liberalization context

The fisheries sector not only faces serious problems, but it must also solve them in a context complicated by the multipurpose nature of the activity. Favouring a strategic objective cannot be the solution, given the many purposes served by the sector. If nothing is done, chances are that international trade liberalization will jeopardize the export position of Senegalese piscatorial products, and force the country to shift again to pelagic (fish inhabiting upper layers of the coast and the high seas) fishing, which cannot reasonably be allowed to happen. Though food security might be achieved if this should happen, exports contribute so much to the sector's turnover and trade balance, that one cannot afford to sacrifice them. On the other hand, if exports were to be boosted by existing or new measures, this would probably lead to over fishing of demersal species. In this case, food security will equally be threatened, while irrecoverable losses in biodiversity are likely to occur. Again, failure to avoid misallocation of investment would compound industry competitiveness problems.

Therefore, this study tries to pinpoint crisis factors, to analyse their situation in the light of liberalization and to suggest a few *scenarios* that are likely to defuse them. The solutions envisaged take into consideration the multipurpose nature of fishing activities. They are based, in particular, on the assumption dictated by necessity, that there is some complementarity between trade, environmental and socio-economic objectives. They are also inspired by the sector's history and by the analysis of comparable experiences, and exclude, *a priori*, any management plan founded on a theoretical opposition between *interventionism* and *laissez-faire* policies.

In Chapters 2, 3, 4 and 5, the trade policies that favoured the anchoring of the sector to export markets are analysed. The Lome Agreement, subsidies, devaluation and fishing agreements encouraged external product trading, which explains some of the current dysfunctions. Chapter 6 describes the economic consequences of these measures on fishing companies. Analysis of their operating accounts clearly shows that export-oriented catches are now more profitable than fishing for the domestic market. This explains the shifts in fishing efforts, as indicated in Chapter 7, which translates into the depletion of coastal demersal stocks, the main exported species. Lastly, the recommendations explore avenues towards sustainable management, allowing both for resource preservation and product development.

2 THE LOME AGREEMENT

2.1 Contribution to export growth

The increasing externalization of the piscatorial sector is also largely linked to the trade mechanisms aimed at boosting exports in an adjustment context. Such is the case, for example, of the Lome Agreement binding Europe and ACP countries. Concluded in 1982, the Lome Agreement instituted a customs duties exemption regime applicable to most products originating from ACP countries. Being covered by this regime, piscatorial products became clearly more competitive.

Thus, while the ACP countries' share of sea products to total exports regularly decreased over the past twenty years from 5.3 per cent in 1975 to 4.5 per cent in 1985 and to 3.8 per cent in 1995, their exports to the European market increased rapidly. This situation translated into market share gains, as the ACP countries' share in the European market reached 13.2 per cent in 1996 compared to 6.1 per cent and 9.3 per cent in 1976 and 1986 respectively, to the extent of further increasing the dependency of ACP countries on the European market, which is already important for historical reasons linked to the relocation of processing units in Africa and to the presence of a European fleet to supply them. It is today estimated that the European market absorbs up to 80 per cent of African exports of sea products, and 66 per cent of Senegal's exports of piscatorial products.

The Senegalese piscatorial products also benefited from the customs duties exemption regime of the European market. Between 1982 and 1991, exported volumes of fish rose from 90,000 tons to about 120,000 tons (Table 1) and the European market absorbed most of that increase. Canned tuna and frozen products benefited most from the preferential regime.

Table 1 Trends in export volumes and values 1980 – 1990 (in tons and CFAF)

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Volume	84036	90204	91742	93344	94102	95449	93975	110808.6	111125.5	118326	124672.6
Value	32506359	37498726	47930780	52332207	61873032	74044942	89563789	98390104	94969956	91325566	110498253

Source : DOPM

While the Lome Agreement greatly contributed to the general expansion of Senegalese piscatorial exports, it also created a dependency on the European market (Section 2.2). This element appears to constitute a weakening factor as liberalization of international trade questions the maintenance of a system of trade preferences (Section 2.3), and subsequently threatens Senegalese exports, in particular those of processed products, which are already limited in volume (Section 2.4).

2.2 European market dependent exports

The system of trade preferences has reinforced the significance of the European market in the distribution of Senegalese piscatorial exports. Asian and North American markets remain marginal, while African market expansion is hindered by structural constraints.

The Asian market is also marginal, although the export of octopuses to Japan reached 13,000 tons in 1999. However, the position of Senegalese products in this market improved following devaluation. It seems that it could be further improved if more efforts were made. The American market has always remained very narrow, and it imported only 240 tons of Senegalese piscatorial products in 1999, barely 0.2 per cent of total exports. This market is notorious for being complex and difficult to access; however, Senegal's weak penetration of this market is not due to product quality problems, as several export units have been upgraded to standard. The high customs duties levied on processed products can certainly explain some of the difficulties to access canning factories. Yet non-processed products are virtually not liable to any tax payment. Then how can the access difficulties of Senegalese products be explained other than by their competitiveness, or insufficient knowledge of the market?

Since devaluation, African frozen exports have increased steadily, as the export prices of small pelagic fish were more attractive than those offered in the domestic market. However, exports to other African destinations could be much higher (supra) if a number of infrastructural and institutional constraints were overcome. In 1999, with a little less than 37,000 tons, exports to African destinations accounted for about 30 per cent of the total volume.

Europe remains by far the main destination for Senegalese piscatorial exports, receiving 79,000 tons out of the 125,000 tons exported in 1999 - that is about 60 per cent of the total. Every year, the European market absorbs about two-thirds of fish exports. From 1993 to 1999, exports of fresh products to Europe remained virtually stagnant (increasing from 9,415 to 9,938 tons), while the number of companies doubled; hence the factories' chronic deficits. Following devaluation, the exports of frozen products to Europe increased significantly from 21,000 in 1993 tons to 58,000 tons in 1999. This is further proof that devaluation tended to encourage export growth through higher volumes based on sustained demand, rather than on efforts to develop the product and to upgrade processing.

As is clear, exports to Europe represent the biggest share of overall exports. While the African market certainly holds an honourable position with almost one third of exports in volume, it has little weight in terms of value. From that

standpoint, Europe continues to hold a decisive position as it absorbs most of the high market-value exports. This is precisely the ground for fears concerning the effects of the expected liberalization of the piscatorial product market.

2.3 Liberalization and erosion of trade advantages

The products of ACP countries enter the European market with neither the tariff (customs duties) nor non-tariff (quotas) barriers imposed on other supplying countries. Yet WTO rules condemn this regime. The advantages conceded are not reciprocal, and violate the principle of non-discrimination between countries at an equal stage of development. The Generalized System of Preferences (GSP) provides that all developing countries must benefit from equal trade advantages.

The Lome Agreement therefore had to be revised. Europeans and ACP countries were left with the option of either having GSP extended to non-ACP countries (which would have made a mechanism hinged on trade much less attractive), or concluding a new free trade agreement. It is finally this latter option that has been chosen. At the end of a transitory period extending up to 2008, Europe should conclude free trade agreements with ACP countries.

However, it is uncertain that the WTO will authorize the maintenance of discrimination between countries at equal stage of development until 2008. Europe and ACP countries will throw all their political weight into obtaining a waiver under article XXV.5 of the WTO, which authorizes selective trade between developed countries and developing ones. But some of the WTO member countries have already denounced this request, and even if a waiver is obtained, the agreement may be attacked later on at any time. It would then be up to the WTO dispute resolution body to decide on the validity of the contention in relation to WTO rules. Regardless of whether or not reciprocal advantages are maintained until 2008, they would still continue to experience the effects of tariff erosion. This phenomenon has already materialized in the piscatorial sector since the *Uruguay Round*. The three main import markets substantially reduced their current tariffs under the Most-favoured nation (MFN) clause: USA applies 0.9 per cent, Japan 4.1 per cent and the European Union (EU) 10.7 per cent. Besides, the decision taken recently by the EU to extend tariff exemptions to all least developed countries (LDCs), also reduced the relative scope for ACP countries. Hence, trade concessions continue to be eroded thereby weakening the competitiveness of Senegalese exports.

2.4 Impact of questioning the privileges enjoyed by Senegalese exports

When the CFAF currency overvaluation eroded the competitiveness of Senegalese piscatorial products between 1991 and 1993, this automatically translated into a clear fall in exports to Europe. Out of an estimated overall fall of 35,000 tons, the share of exports of frozen products to Europe represented 22,000 tons. Given the

weight of the European market in terms of overall export volume, difficulties to access this market are likely to affect the situation of exports as a whole.

One way of assessing the impact that the questioning of the trade advantages provided for in the Lome Agreement might have, is to analyse the European markets of both processed and non-processed products (table 2). The ACP countries hold a smaller position in the market of non-processed products than the other developing countries, despite the fact that they have made some market gains. On the other hand, not only have they been making market gains for the past thirty years in the market of processed products, but they also hold a better position compared to the other developing countries. Asian countries remain best positioned, though ACP countries are about to catch up, and more importantly, they gained 12 per cent of market shares between 1976 and 1996. This can be explained by the 'tariff escalation' phenomenon. In fact, customs tariffs tend to increase as a function of the level of product processing, which penalizes exports of processed products from developing countries. However, this situation benefits the export of processed products from ACP countries. The comparative study of the European market for canned tuna and frozen shrimps clearly demonstrates this advantage. With regard to their exports of frozen shrimps, ACP countries have lost market shares to their rivals from developing countries. On the other hand they gained, in a market that they largely dominate, on the canned tuna market (Mongruel, 1998). The differential tariffs in force in these two markets can be explained by the much higher customs duties levied on canned tuna – a processed product – than on frozen shrimps – a non-processed product (Table 2).

Table 2 Customs duties on shrimps and canned tuna on entry into the European Union market

	Frozen shrimps	Canned tuna
Most-favoured nation	12 to 18%	24%
GSP	3 to 4.5%	18%

Source : GATT, 1997.

Therefore, any questioning of the Lome Agreement is likely to have very negative consequences on Senegalese exports of processed piscatorial products, starting with canned tuna. For different reasons[1], the difference in production costs between Thai canned tuna and its Senegalese counterpart varies between CFAF 70 and CFAF 90, to the advantage of the former. This difference represents almost exactly the amount of customs duties applicable to Thai canned tuna.

[1] Cost of raw material is cheaper in the Pacific Ocean; Thai industries took over the best performing companies on the market; relocation to countries offering tax advantages and cheap labour; devaluation brought about by Asia's financial crisis.

3. DIRECT AND INDIRECT EXPORT SUBSIDIES

3.1 Industrial modernization projects in support of small-scale fishing

The Senegalese Government has perceived small-scale fishing as a mere subsistence activity, which should develop into industrial forms deemed more suitable to the interests of the national economy. Thus, from Independence to the late 1970s, the Government conducted a policy of active support to the fishing sector, as evidenced by the (line and sardine) projects designed to develop small-scale fisheries into an intermediary stage as semi-industrial. The logic behind these projects was to substitute traditional pirogues for semi-industrial boats. This policy failed, mainly because small-scale fishing was dynamic, and despite relatively weak support from the Government, could remain competitive enough to hinder development of the industrial sub-sector. However, the policy could not be pursued, since public finance went into a financial crisis precipitated by indebtedness.

In a second phase, which more or less started in the early 1980s, government support was first reduced under structural adjustment policies, and shifted from direct interventionism in the 'capture component' to export-stimulating mechanisms. The *free point* and *free exporting enterprise* status, and an export subsidy, greatly contributed to an increasing anchoring of the sector to external markets. As it reduced and modified the nature of its interventions, the Government gave more consideration to developments in the sector, orienting its action in a direction more favourable to its development engine: small-scale fisheries. A number of mechanisms designed to support their modernization, and which were until then operated by the fishermen themselves, were then set up. Aid was made available for pirogue motorization and the incorporation of new fishing gear (*purse seines*[2]). These measures contributed to the expansion of small-scale fishing, the catches of which have recorded a spectacular increase over the past twenty years. From 130,000 tons in the early 1980s, they reached 170,000 tons in 1985, 250,000 tons in 1990 and almost 350,000 tons today.

The outcome of these policies in terms of fisheries durability is not clear. In fact, it appears from closer analysis, that the boom in small-scale fishing did not necessarily favour durable and responsible fisheries. These policies greatly contributed to the main problems created by growing piscatorial exports: the risks of a biological breakdown of exported species, and a shortage of animal protein supplies to the population. Many

[2] A fishing net which hangs vertically in the water with floats at the top and weights at the bottom.

fishermen indeed chose to fish for high market-value species, thus accounting for about 60 per cent of the raw material supply to export units.

3.2 Subsidies that directly or indirectly favour exports

Below is a summary of the Government's direct or indirect financial assistance to the fisheries sector in the past few years:

- reduced tax on fishing gear (motorization), subsidized fuel, and institution of fishing sector financing bodies;
- export subsidy and institution of free exporting enterprises for enhanced competitiveness and deeper penetration of external markets by Senegalese piscatorial exports.

3.2.1 The policy of reduced tax on pirogue motors and fishing gear

Initiated in the 1950s, the distribution of outboard motors in small-scale fishing took off permanently from 1965, with the sale by CAMP (Centre for small-scale fishing support and motorization) of duty-free motors and on credit. Motorization produced a considerable impact both technically and economically. It considerably expanded the fishing areas for small-scale fishing by allowing it to reach much more remote fishing zones. It simultaneously reduced travel time and extended fishing time. Additionally, the use of motors facilitated the migration of Senegalese artisan fishermen along the coasts of the West African Sub-Region. It was also the essential factor that encouraged fishermen to build bigger pirogues and to introduce new technologies such as purse seines.

The development of purse seines is the second major technological breakthrough in pirogue fishing since 1960, with enormous consequences:

- unprecedented increase in fish landings, subsequently boosting the trade of fresh products and the traditional braising industry (*kéthiakh*) especially on the *Petite Côte*;
- technological impacts induced by the building of bigger pirogues capable of carrying huge catches (up to 20 tons).

Today, the rate of motorization can be estimated at close to 90 per cent, and all pirogues that can be fitted with motors under satisfactory conditions of profitability have been motorized. This is evidenced by the fact that the tax reductions granted by the Government on the purchase of outboard motors amounts to CFAF 2.01 billion every year.

The Government introduced the policies of reduced taxes on motors and fishing gear when it became aware of the crucial role played by small-scale fishing in the development of the sector. Motorization was no doubt the decisive factor that contributed to the modernization of the small-scale fisheries sub-sector. However, it is

unclear whether motorization was a direct consequence of government tax reduction policies. While such policies certainly favoured it, clearly the amount of CFAF 2 billion in annual tax reductions are negligible compared to the CFAF 200 billion turnover of the sector, to the extent that ending tax reductions would not prevent most of the operators from self-financing. At worse, only the least profitable enterprises would be forced out of the sector. Yet those involved in this case are mainly fishing units specialized in the pelagic species, which are financially less attractive and therefore not as threatened by over-exploitation as the demersal species. Additionally, these fishing units are made up of boats meant to supply the domestic market, thereby playing an important role in the country's food security policy. Why these measures have been maintained for demersal fishing units, most of which are prosperous and the production of which is export-oriented (supra), remains a full and stunning question. The same units are now even targeting currently threatened stocks.

3.2.2 Fuel subsidy

The policy of fuel subsidy is one of the decisive factors that have contributed to equipment modernization. Subsidised fishing fuel has made it possible to use more powerful motors, to build bigger pirogues, to extend the length of sea trips and to exploit new fishing areas. It has considerably reduced the operating charges of fishing units, which in theory was expected to maintain the prices of fish landings by small-scale fishing units at a level compatible with the purchasing power of the Senegalese population. However, the fact that small-scale fishing units tend to export their catch, raises questions as to who finally benefits from the Government's financial assistance other than foreign industrialists and consumers. From less than CFAF 2 billion in 1986, the fuel subsidy in favour of small-scale fishing alone, rose to CFAF 6 billion in 1998. This measure also reinforces fishing capacities through its technological fallouts; it has encouraged boat owners to buy many more powerful and more fuel-consuming motors. The latter in turn enabled fishermen to fish in distant locations for a longer period of time, and to increase their catch. There is no doubt that subsidized fuel has had an important impact on the extension of sea trip duration for angling pirogues with an icebox, and encouraged intensified efforts for demersal fishing. So, maintaining the subsidy is questionable within a context characterized by the improved profitability of export-oriented fishing units, and suggests the need to discriminate between pelagic and demersal fisheries.

3.2.3 Free point and free exporting enterprise status

One of the main objectives of this policy is to expand Senegalese exports and subsequently increase its foreign exchange earnings and local value added to plug its balance of trade deficit. Other objectives include promoting salaried jobs and speeding up the country's industrialization process.

The free point and free exporting enterprise status grants significant advantages to export-oriented processing units. Established in 1974, the Dakar Industrial Free Zone (IFZ) offers enterprises located there a variety of tax, social and customs advantages. It was expected to provide an attractive framework for encouraging foreign investors to come and establish export-oriented and labour-intensive industries. The law of April 1991 establishing free point status extended these advantages to exporting

industries operating outside the IFZ. In 1995, this law was extended to cover agricultural enterprises (including fishing companies) exporting 80 per cent of their production. The advantages provided for under this regime are mainly:

- tax and customs stamp exemption on imports and exports of capital goods, materials and raw materials as well as semi-finished and finished products;
- tax exemption on value added, customs stamp, registration and stamp fees and patents;
- tax payment on industrial and commercial profits (ICP) at the reduced rate of 15 per cent (instead of 33 per cent under common law).

This status clearly improved the competitiveness of piscatorial exports and enabled them to maintain their presence in international markets. The customs exemptions reduced production costs while the 18 per cent reduction in company tax relieved companies' cash positions.

These advantages also attracted new piscatorial product packaging/processing enterprises into the zone. The latter sought to take advantage of increased world demand especially in developed countries. The presence of numerous enterprises thus exerts a strong pressure on demand for exportable products, and eventually represents a threat to stocks of demersals, crustaceans and cephalopods.

3.2.4 Export subsidy

The export subsidy policy is part of a national trade policy aimed at facilitating the penetration of external markets by local products. The subsidy thus granted adds to the value added already achieved by enterprises in order to pay for production factors. It allows an exporter to offer products at competitive prices that do not relay the factor-related surcharges recorded in the country. It is an option taken to protect some lines of activity, the socio-economic counterparts of which have been deemed at least equivalent to its cost to public finance. In short, the subsidy was expected to address the Government's concern about consolidating foreign exchange reserves in an adjustment context, aggravated by the exhaustion of groundnut economics.

Initially, the export subsidy was not meant for the fisheries sector. It was instituted in 1980 to boost exports of agricultural commodities, which have suffered from the sharp deterioration in the terms of trade in the international market. Initially set at 10 per cent of FOB value, it was raised to 15 per cent in 1983, and extended to tuna. Under its second reform in August 1986, it peaked at 25 per cent, and the subsidy was extended to all piscatorial products, i.e.:

- export subsidies to the trawling network in the 1991/1992 financial year amounted to CFAF 1.2 billion;
- the subsidy benefited in particular the three canning industries, the turnover of which increased from CFAF 13.4 billion in 1980 to CFAF 23.6 billion in 1986. Following the Government's failure to pay the subsidy in 1992, their turnover fell back to CFAF 13 billion.

Despite its impact on public finance, the donors were never critical of the mechanism because the Fisheries sector offered the dual advantage of reconciling food security and export requirements. However, time has demonstrated that those objectives could be antinomic. In fact, its institution coincided with the implementation of Structural Adjustment Programmes (SAPs) also aimed at increasing exports, including piscatorial products. This resulted in an ever-increasing pressure being brought on the main stocks of exported species of fish. It thus contributed to threatening the supply to the domestic market and the regeneration of coastal demersal species to equilibrium level.

With the devaluation of the CFAF currency by 50 per cent, and prospects for reviving the piscatorial industry looming ahead, export subsidy was finally ended by presidential decree in March 1994.

4. STRUCTURAL ADJUSTMENT AND DEVALUATION

At the time when structural adjustment policies touched Senegal and many other African countries, the piscatorial sector was in full bloom. The development of fishing activities was mainly underpinned by the small-scale fishing sub-sector, which had long been neglected by government regulation, to the extent that structural adjustment did not translate, as in the case of agriculture, into a substantial decline in production. Nonetheless, it would be wrong to conclude that it has had no impact on activity orientation. By emphasizing the need to balance external accounts, structural adjustment has encouraged the anchoring of the fisheries sector to export (which is already encouraged by other mechanisms). This was the consequence of the devaluation of the CFAF currency, the cornerstone of the mechanism.

4.1 Structural adjustment and liberalization of the domestic market

In the early 1980s, Senegal faced a serious crisis due to persistent difficulties in various sectors. These difficulties included strong demographic pressures, stagnant agricultural production and low industrial productivity. The balance of payments had deteriorated continuously over the previous decade due to declining export receipts and to increased prices of imported goods, raising the Government's indebtedness.

Given the size of its deficits, Senegal could not avoid adjusting to its external environment. It was the first sub-Saharan country to sign, in 1980, an Extended Fund Facility with the International Monetary Fund (IMF) and a Structural Adjustment Programme (SAP) with the World Bank. These two agreements were suspended and then cancelled shortly afterwards as the country failed to meet the performance criteria. Senegal soon resumed relations with the IMF through a first Stand-by Agreement signed in 1982, followed by three others. A three-year Structural Adjustment Facility Agreement was signed in 1986 and extended by a three-year Reinforced Structural Adjustment Facility Agreement in 1988. These agreements were implemented to the end of their duration, except for the 1982 Stand-by Agreement and the third year of the Structural Adjustment Facility of 1988. Negotiations with the World Bank on SAPs resumed seriously only in 1984 on the basis of a *Country Economic Memorandum*

submitted by the World Bank, and resulted in the signing of SAP II in 1986. This was followed by SAP III in 1987 and SAP IV in 1988

The SAP negotiated in 1981 provided for the traditional remedies of Multilateral Financial Institutions (MFI), that is, restoring equilibrium in the balance of paymentsby restricting domestic demand through reduced government spending, and by boosting the domestic supply targeted at export sectors. Devaluation was expected to bring the nominal exchange rate close to its real value. Devaluation finally took place only in 1994.

With SAPs, the Government gradually withdrew from the fisheries sector. It withdrew from input and fishing gear distribution in 1985, and was replaced by the private sector, although it maintained a reduced tax on motors, fishing gear and fuel (tax reduction and subsidy). By reducing investment costs, this policy made units able to become profitable as it was thus possible to maintain the prices of small-scale fish catches at a level compatible with the population's purchasing power, and to enhance the competitiveness of industrial fishing production.

The Government, with the support of international donors, replaced official funding with private funding. An institution governed by private law, the *Caisse Nationale de Crédit Agricole du Sénégal (CNCAS)* and other financing bodies with comparable characteristics (self-funding of 20 per cent, 11 per cent interest rates, fishing enterprises group collateral and life insurance) were put in place.

With regard to marketing, the profession of fish and seafood wholesaler was regulated, while the objective of the CAPAS project (*Centre d'Assistance de la Pêche au Sénégal)* was to market fish through fishermen's cooperative unions. This operation was cancelled in 1987 with the centres having to be retroceded after having been left to the joint management of fishermen. The Government is now in the process of evaluating assets for future disposal. Fish marketing has therefore been liberalized, as the profession of fish and seafood wholesaler is no longer governed by presidential decree, as of 1995.

4.2 Devaluation

The efficiency of the SAPs in the franc currency area was the subject of a debate which finally led to the adoption of devaluation in 1994. The IMF in particular observed partial inefficiency as from 1989, and suspended its lending, while France conditioned its backing of the mechanism on the conclusion of an agreement between countries of the franc currency area and the Bretton Woods institutions.[3] Devaluation, which was from the beginning part of the reforms recommended by donors, had long been strongly suggested to the different States. As part of their will to adjust the West African production structures to the international market, multilateral financial institutions estimated that the manipulation of the exchange rate was more consistent with 'real prices' than more direct incentive mechanisms (taxes and subsidies). As a result, the decision to devalue the CFA currency was taken on 11 January 1994.

[3] IMF and World Bank

The intention of the donors who recommended this change in currency parity, was to revive exports and restore the credibility of the franc currency area. Devaluation was expected to do away with the distortions affecting the exchange rate of the CFA currency, which is tantamount to an export tax and an import subsidy.

In exchange, the IMF and the World Bank pledged to support countries of the franc currency area in their efforts to reactivate growth and to contain the perverse effects of devaluation. In practical terms, this commitment translated into the adoption of accompanying policies. The various agreements concluded by Senegal with the Bretton Woods institutions, provided for a set of measures aimed at balancing public accounts, including the reduction of government spending and support to export receipt generating sectors. The increase in foreign exchange earnings resulting from improved foreign trade should help to relieve the debt service burden.

In the œux of this policy, donors accorded special attention to fishing, as it seemed to reconcile food security and export requirements. The devaluation of the CFA currency has had a significant impact on the fisheries sector. While exports dropped considerably in 1991 and 1993, especially exports of frozen products to Europe, devaluation immediately enhanced their competitiveness. It restored operating margins and allowed exports to grow rapidly.

Inferring from the foregoing that devaluation has had overall positive consequences on piscatorial activity, is something that cannot be empirically confirmed. Since the introduction of SAPs, production not only increased but was also increasingly traded on the international market. Such a situation, which can be more or less closely linked to adjustment, eventually gave rise to economic, social and environmental problems.

4.3 Devaluation and producers' 'rent'

The trade policies related to the fisheries sector especially consisted of exogenous stimulants outside the play of market forces, which favoured speculation at the expense of the durable development of activities. Such was also the case of devaluation, which encouraged quick profit seeking and equally favoured a 'rent culture' more than other government interventions. In the years that followed devaluation, exported volumes did not increase significantly (Table 3). The year 1999 should not create any illusion, in the sense that the sudden increase was largely attributable to the exceptional conditions of octopus exploitation. And such conditions are less likely to be regularly met.[4]

[4] Some biological characteristics of octopuses are likely to explain such explosions of its populations. First, while the life expectancy of an octopus is limited to a year, the average size of an individual varies a lot, with a significant difference in the weight of individuals of the same age. All the octopuses captured in the 1999 summer belonged presumably to the same age group and were born eighteen months earlier. They were therefore part of the same group of young individuals, which like all marine species, may vary from one year to another. This makes a significant difference with many fish species, which are fished at a different age. In this latter scenario, if the group of young individuals is limited in a given year, it will produce only a few individual adults, but the individual adults produced by groups of young individuals of the following or previous years will compensate

Statistics on exports of molluscs clearly indicate that it was the increase in their production that inflated exported volumes (Table 4). While their production level remained comparable to that of the previous years, the overall level of exports would have probably fallen to its all time low since 1994. In any case, it seems that the results achieved in 1990 were a record level that could be hardly renewed. This explains why the sudden increase in demand reflected more a price effect than a volume effect. Export prices thus increased (by up to 200 per cent). This 'price effect' may have concealed a fall in productivity and contributed in that way to an increased sector capitalization (30 per cent increase in trawl fishing effort between 1996 and 1997; redeployment of pirogue fishing effort towards export-oriented species). Enterprises that had been wound up reopened, while new investors entered the sector. Within a little more than a year, the number of processing enterprises in operation rose from about 40 to almost 80.

Table 3 Exports of Senegalese piscatorial products (in tons)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Volume	124672.6	118850.6	86110.65	83822.79	93674	103463	107080	112157	109448	124338

Source : DOPM.

Table 4 Trends in exports of molluscs (in tons)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Volume	1646.1	25917.8	86110.65	12774.85	14946.95	13271	12924	11327	14650	46626

Source : DOPM.

Devaluation therefore strongly contributed to an increased anchoring of the fisheries sector to the export sector. It benefited both the capture and industrial processing components (small-scale processing remaining local market-oriented and, of late, African markets-oriented). In so far as catches are concerned, both small-scale and industrial fishing units specialized in the capture of export species benefited from a constant increase in external demand (hence in prices). Industrial processing benefited from a 'secure income', which delayed its adjustments (upgrading to European

for that limitation. There is, therefore, an "average-effect" constraint with many fish, which does not exist in the case of the octopus.

On the other hand, female octopuses lay a considerable amount of eggs, about 200,000 almost all of which will hatch out as a result of the special way in which she takes care of them. The larvae then live at least for a month in the water column above the bottom. This is a critical phase because of the high mortality rate. However, it varies according to environmental conditions: available food, more or less important dispersion by waves and currents outside areas habitable by juveniles. Thus, if conditions are good enough, a single female's eggs will hatch into tens of octopuses the following year.

standards was costly, reflecting the importance of counterparts to commercial privileges; many processing units are now technically out of work; the share of production actually processed remains negligible…). Marketing channels also got adjusted, with local fish and seafood wholesalers selling an increasing share of small-scale production to export-oriented packaging and processing units. International distribution networks are beyond the control of national operators, which contributes to the depreciating production prices.

While all the operators anchored to the external market initially took advantage of devaluation, the economic and financial positions of different components of the industry gradually diverged. It is necessary in particular to make a distinction between the 'capture component' and the packaging and processing units. Although demersal, small-scale and industrial fishing units saw their operating accounts improve - more as a result of a price effect rather than a volume effect (supra) - industrial packaging and processing units on the contrary had to face severe financial difficulties. Presumably, this situation can be explained by the fact that the supply had reached saturation point (as evidenced by the relative stagnation of exported volumes), thereby complicating the supply of processing plants.

The increase in the number and capitalization of demersal fishing units did not prevent their operating accounts (supra) from improving despite resource scarcity, as evidenced by strong demand which exerted an upward pressure on the prices of raw materials. On the other hand, the export-oriented packaging/processing components felt the full force of the blow dealt by the monetary illusion that followed devaluation. Though higher demand sent sale prices upward, it failed, in view of limited stocks, to compensate for rare resources and to cover higher costs. This situation turned out to be favourable to fresh or frozen exports, which required lower investments hence lower charges than processed products. The exports of fresh products to Europe increased in the aftermath of devaluation from 21,000 tons in 1993 to 58,000 tons in 1999. The prospect of making quick profits led many operators to join the sector, notwithstanding the imbalance between resource scarcity and already existing strong production capacities. The resulting situation was over-capitalization and under-utilization of production capacities that weakened several enterprises. Investment misallocation within processing units is a major problem of Senegalese fisheries. It has frustrated companies that have made the biggest efforts to adjust to European technical standards, and reduced the performance of the sector as a whole.

While encouragement mechanisms favoured exports, operators failed to adjust their production tools and to create value added. The share of whole, fresh or frozen products in the export structure kept growing. Processing comes down to, in most cases, a simple packaging of the raw material into a frozen product. This situation is all the more detrimental in that value added on the production of processed products - including in a simple form requiring few investments (e.g. preparation of fillets and medallions, shrimp peeling etc.) - is much higher than on whole products. It also leads to favouring growth through volumes, which is well known to be no longer viable in the long term, rather than efforts at product development.

4.4 Pressure on food security

While government incentives stimulated exports, an increasing number of operators specialized in the capture of domestic market-oriented species, notably small pelagics, now turned to coastal demersal fishing. They were all the more encouraged to do so as devaluation increased capital charges without changing the domestic demand level. The resulting gap often required that production be adjusted or face bankruptcy. The conditions for the lower supply to the domestic market were thus met, triggering an increase in prices, which is dangerous for the country's food security. The Senegalese people are, indeed, great fish consumers (27 kg/annum per capita), and small coastal pelagics (covering 75 per cent of their needs) are the main source of animal proteins for the population.

Devaluation not only encouraged shifts in fishing effort to export-oriented species but also the export of species which were previously exclusively meant for the domestic market. The example of Cybium (*Yeet)* is quite indicative of this competition, and of the threat to supply to the domestic market. Until recently, *Yeet* was consumed almost exclusively in Senegal. An extra ingredient in the Senegalese cuisine, it is used as a choice condiment to 'flavour' most of the local dishes. Demand for it was therefore limited to strictly domestic outlets, and could be adequately supplied. Since this product started to be exported to Asian countries, it is becoming rare and absent from the Senegalese meals. Small-scale units now process for the domestic market very small quantities, essentially that which cannot be exported as fresh products.

Food security is also threatened by supply shortages of products processed locally. Some of the species processed by the women are more oriented towards the industrial sub-sector. For example tuna, ravile and listao used for *sali* become relatively less available to local small-scale processing. They are used in priority for canning industries and fillets which are export-oriented more elaborate products with higher value added.

4.5 Pressure on resources

The consequences of devaluation visibly influence the regeneration conditions of export species. A number of species are on the verge of biological breakdown (supra). Should exploitation be pursued at the current rate, the developments observed in the processing component are likely to be repeated at the capture level. The ratio of production to investment reflects lower productivity, which strong demand has so far concealed. This trend cannot be maintained without having some severe consequences on resources, and hence, on the financial equilibrium of fishing units. Under the most pessimistic scenario, investments would continue to grow within units specialized in the capture of demersals, crustaceans and cephalopods, thus speeding up stock depletion. Sustained demand will no longer be able to compensate for lower productivity, and the operating accounts of many fishing companies would deteriorate. This is not yet the case, but the conditions heralding the advent of such a scenario are already there, as evidenced by the evolution of the processing component in the sector.

5. EU / SENEGAL FISHING AGREEMENTS UNDER THE TEST OF TIME

Fishing ships flying foreign flags are authorized to fish in Senegalese waters either under fishing agreements concluded between Senegal and the State of the flown flag or the organization representing that State, or when chartered by Senegalese nationals.

Senegal signed different bilateral agreements with its neighbours (Cap Vert, The Gambia, Guinea Bissau and Mauritania), which are normally based on the reciprocity principle (Samb, 1999, Kebe and Deme, 1991). Actually, these agreements increase the fishing possibilities for its flotilla and attest to the declining stock of certain species - especially the coastal demersal species - at the national level. Senegal and Japan also concluded a fishing agreement authorizing Japanese professionals to fish in Senegalese waters under certain conditions. But it is the agreements signed with the EU that attracts most of the attention in view of the various factors at stake: the targeted species, the size of the flotillas and the financial stakes. The first agreement dates back to 1979. It had a duration of two years and has always been renewed, before being extended to a four year duration in 1997. The last agreement provides for a financial compensation of ecu[5] 48 million and introduced for the first time possibilities of pelagic trawl fishing up to 25,000 tons annually.

The first agreements were thus concluded about twenty years ago. In the meantime, the conditions that led to their conclusion have changed, suggesting that a reassessment of their content or even their existence is perhaps called for.

5.1 UN Convention on the Law of the Sea and fishing agreements

The problematic issue of fishing agreements was raised by the United Nations Convention on the Law of the Sea, which was adopted in 1982 and became effective in 1996. While a certain number of countries, including Senegal, extended, for a long time, their jurisdiction beyond their territorial waters (12 sea miles beyond their coasts), the Convention has legally consecrated this fact. The adoption of this Convention constitutes an extremely important questioning of the principle of free access to sea resources, since it creates an Exclusive Economic Zone (EEZ)

5 Former term for the euro, €.

of 200 marine miles (Art. 62), within which coastal states dispose of sovereign rights on sea resources (living or non-living). Yet 90 per cent of these resources are situated in the EEZs. Thus, coastal states can presently regulate their access, either by imposing shipping rights on distant waters fishing nations, or by limiting the usage of these resources through management and conservation measures. The Convention on the Law of the Sea even recommends that coastal states should authorize other states to catch resources that they do not have the means to exploit.

5.2 The complementarity principle

The conclusion of fishing agreements rests on the principle of complementarity between national and foreign fishing concerns. All the coastal states - beginning with developing countries - do not always have the possibility of exploiting the totality of their EEZ resources. Still, the application of this principle resides in the setting up of several conditions which, in practice, are not always easy to meet. The state applying this principle should notably have:

- assessed stock levels per targeted species;
- estimated precisely, on the basis of scientific studies, the level of the annual taking compatible for each stock;
- determined, by substraction, the balance that is likely to be attributed to foreign fishing boats in the form of licences or fishing rights on specified quantities of targeted species.

In theory, there should then not be any conflict between national and foreign fishing concerns, since the latter is limited, in principle, to what remains after satisfaction of the capacities of national fishing concerns. It will, however, be seen that the situation in reality is not so simple.

5.3 Overcapacity and fishing agreements

From the end of the 1970s, certain states have been confronted with problems of over capacity that led them to envisage the redeployment of their fleet to other waters. This favoured the conclusion of fishing agreements between coastal states and distant waters fishing nations. There are about one hundred agreements, excluding those with the EU, which has concluded about a dozen. Japan alone has about 40 agreements. Certain agreements provided for granting reciprocal fishing rights, but those concluded between powerful fishing nations and developing countries tend to focus on issuing licences or fishing rights in exchange for financial compensation. These powerful fishing nations are criticized for encouraging over fishing, slowing down development, and competing with small-scale fishing. They also tend ignore the state of stock and biomass distribution.

5.4 Weaknesses of the complementarity principle

As indicated earlier on, the principle of complementarity is one of the main theoretical justifications for the conclusion of fishing agreements. However, between practice and theory, a gap that has existed right from the beginning has not ceased to progressively widen.

Firstly, the development of Senegal / EU fishing agreements coincided with the development of small-scale fishing in the 1980s. As from this period, the landings of small-scale fishing sharply increased from about 150,000 tons in the early 1980s, to 250,000 tons in 1990 and reached 350,000 tons today. As regards coastal, demersal and pelagic resources, national fishing ships seem not only capable of exploiting almost all of the stocks but also exploiting them fully. While coastal pelagic resources are not fully exploited through small-scale fishing, this has nothing to do with productivity or capacity problems, but rather with higher capital costs and the attractiveness of export species - especially since devaluation. Therefore, complementarity only concerns, in principle, high seas resources. Again, a distinction should be made between deep lying demersal species - in the case of which supplementary exploitation seems acceptable, and the pelagic species - many of which seem to be over exploited (*listao*, *swordfish*, *albacore,* etc.).

Finally, it would be necessary, should the complementarity principle be fully operational, that agreements be actually based on available scientific estimates. Yet, this is clearly not the case, firstly because researchers' opinion has not always been taken into consideration and secondly, because the indices retained for the evaluation of sold quantities are not realistic and lastly, because agreements have been concluded notwithstanding intensive national pressure exerted on one stock or another.

On the whole, in the event that conditions for a theoretical complementarity between national and foreign fishing concerns exist, the principle would continue to face practical problems. If foreign fishing is normally allocated according to what remains beyond national fishing capacity, both of them will be competing in the same fishing zones. There are two sorts of competition: the first one opposes national and foreign industrial fishing over coastal demersals, crustaceans and cephalopods; the second one takes place between small-scale fishing and industrial fishing (national and foreign). In fact, there have been long standing conflicts between these two types of fishing, but they have tended to worsen since small-scale fishing has been in the position to compete off-sea with industrial fishing boats. This overlapping not only entails depletion of stocks, mainly of coastal demersals, but also destruction of fishing gear and sometimes collisions resulting in human casualties. However, foreign ships are only responsible for limited incursions into the reserved zone. Therefore, national industrial fishing ships are involved in most infractions. The fact is that the development of small-scale fishing has increased the risk of conflicts with industrial fishing concerns, whether national or foreign, and the possibility of extending the limits of the reserved zone may have to be considered.

The question of the relationship between agreements and conflicts between small-scale fishing and industrial fishing concerns, has become topical since the elaboration of an international legislation relative to the preservation of marine resources. Most of the instruments covered by this legislation (Convention on the Law

of the Sea, Agreement on Straddling and Migrant Stocks, Code of Conduct for Responsible Fisheries, etc.), insist on the necessity of protecting small-scale fishing, for at least three reasons:

- it plays a more important role in the supply of low-cost animal proteins than industrial fishing which is more concerned about commercial profits;
- its practices are also perceived as being more sustainable than those of industrial fishing (type of fishing gear and variety of catch, which are minimally disposed of in the local market, whereas industrial fishing is generally mono-specific and increases the risks of rejections);
- small-scale fishing is further integrated in the local economic fabric and provides employment and revenue to many people.

Yet the Senegalese small-scale fishing not only has these characteristics, but it also competes directly with industrial fishing because of its level of development. This problem has again been aggravated since the granting, in the last agreement with the EU, of quotas on coastal pelagics (although they have not been exploited so far).

Small-scale fishing also has the advantage of being disseminated on the whole littoral, while industrial fishing encourages concentration of fishing and processing units, hence rural migration. In any case, the importance of the sustainability concept in international regulations (even if the majority of them are not constraining) sheds a new and lasting light on agreements.

5.5 Risks of conflicts with the Agreement on Straddling and Migrant Stocks

Chapter V of the Convention on the Law of the Sea, contains provisions on migrant and straddling stocks, but does not clearly specify the rights and duties of distant waters fishing nations and of coastal states in relation to these species. This uncertainty entailed conflicts between these two categories of nations (ICTSD, 2000), leading to the adoption, in 1995, of the Agreement on Straddling and Migrant Stocks.

While the Convention on the Law of the Sea was criticized for not having responded efficiently to the problem of over fishing, the Agreement on Straddling and Migrant Stocks goes much further. Concerning the management of fishing operations, it regulates not only the conduct of coastal states, but also that of distant waters fishing nations. Additionally, it integrates the new principles on sustainable development and the environment, such as the precaution principle, biodiversity preservation, and the respect of small-scale fishermen's rights. It also recommends impact assessments, endorsing the idea that all the impacts of fishing activities (economic, social, environmental) must be examined. Article 6 stipulates that the absence of information should necessitate an increased vigilance in exploitation. This is a major change in the management of fisheries, where ignorance can no longer be alleged to justify bad practices: the administration of evidence has been inverted, since the issue now is not to demonstrate that exploitation threatens conservation but rather that it does not

threaten it. Moreover, the impact must not only be evaluated in relation to targeted species, but also in relation to associated or dependent species.

These stipulations are direct threats to fishing agreements. While some straddling and migrant stocks covered by Senegal / EU agreements are fully or overexploited (e.g., tuna), the impact of agreements on dependent species is also called into question. Hence, it would now be necessary to administrate evidence, in case of litigation, that the agreements do not threaten the species in question. Thus, the arguments of those opposed to fishing agreements will be fed with a new piece. The Agreement on Straddling and Migrant Stocks has not yet become effective, but it represents a notable evolution of international law, reinforced by the FAO's code of conduct for responsible fisheries.

5.6 Access to markets in exchange for access to resources

Unlike other OECD members, the EU proposed, during the Uruguay Round, a moderate drop in its customs tariffs on fish products. As an explanation, the EU recalled that its negotiation strategy is based on the principle of 'access to market in exchange for access to resources', meaning that it expressly subordinates tariff concessions to the conclusion of fishing agreements authorizing its ships access to the sea resources of its partners (Sury, 1994).

However, the options provided for by the new Cotonou Convention (ending non-reciprocity and tariff erosion) tend to question one of the pillars on which this policy rests. What will be the worth, from the perspective of growing tariff erosion, of the principle of market for resources swap? If access to markets no longer relies, as in the past, on significant commercial privileges, what about access to resources? The weakening of a fundamental clause of the contract suggests, at least, that its overall economy should be revised. Fishing agreements thus deserve to be reconsidered from this angle.

5.7 Unrealistic calculation modalities and the problem of secondary

In the framework of agreements, Europe acquires 'fishing capacities' in terms of tons of gross gauge. Yet this obsolete method of calculation contravenes international recommendations aimed at promoting sustainable fishing (Porter, 1997). This method presents the inconvenience of being based on catches made over the past 10 to 20 years by ships of the same tonnage fitted with less sophisticated detection gear and fishing materials. Electronic means of detection are, indeed, widely popularized and the capitalization race in the North Atlantic has revolutionized fishing techniques. By emphasizing estimates instead of real catches, the calculation in tons of gross gauge does not allow for measuring the actual drawings on stocks.

The granting of quotas in exchange for dues also tends to favour rejection of secondary catches. Secondary catches and rejections are inherent in a) the limits of fishing gear and techniques, which do not permit the perfect selection of species and sizes, b) the coexistence of several species in the same habitats. The rejections are a

loss of precious food products and have an impact on biodiversity and the environment. According to an FAO 1995 evaluation report, rejections represented 25 per cent of total maritime fish catches. There are many types of rejections: rejections of catches in excess of quotas, rejections of species of low market value (creaming) and 'discounted sales' (to maximize the value of his quota, the fisherman can decide to reject catches on his way back to the port if he feels that offered prices will be low).

Thus, the method of calculation in tons of gross gauge is inaccurate because it is not adapted to an ecosystem-managed fisheries, which appears to be the most suitable for a sustainable resource management (*a fortiori* in a tropical multi-specific fishery). This problem heightens risk of conflicts between fishing agreements and new legal instruments of resources conservation.

5.8 Compliance with WTO rules: trade agreements or 'disguised subsidies'?

The WTO rules limit the possibility of subsidizing production or exports as it could give undue comparative advantage to exporters or subsidized products. The Agreement on Subsidies and Retaliations authorizes members to apply taxes amounting to the sum of the subsidies and to notify it to the WTO dispute settlement organ. It also calls for transparency through their notification.

Subsidies encourage over capacity, which is one of the main causes of over fishing. Most discussions devoted to fishing at the WTO Trade and Environment Committee have dealt with the issue of subsidies. The WTO was to consider the issue in Seattle. It will probably be considered soon.

Senegal's Common Fishing Policy is threatened by the rules of international trade. Implemented by the Fisheries Department, this policy covers 4 areas, 1) the preservation and the management of sea resources, 2) relations and agreements with non-member countries and international organizations, 3) structural measures and 4) organization of the common market for sea products. If stocks preservation do not, *a priori,* pose any problem, structural measures are considered as subsidies to the sea sector, and fishing agreements tend to be considered as disguised subsidies that favour over fishing. The fact that the EU finances 80 to 90 per cent of access prices to resources (ship owners pay the balance by buying licences), leads to 'relativize' the commercial nature of fishing agreements (Porter, 1997; 1998). In any case, the interest shown by the WTO and environmentalists on the question of subsidies is therefore a threat to the agreements. In the future, the chances of seeing them challenged before the WTO dispute settlement organ should increase.

6. ECONOMIC AND SOCIAL IMPACTS OF EXPORT SUPPORT MECHANISMS: TRENDS IN THE OPERATING ACCOUNTS OF SMALL-SCALE FISHING UNITS

6.1 Fishing units

Coastal pelagics have long been exploited in Senegal on a limited scale through purse seines and gill nets.

Many small-scale fishing gear has targeted coastal demersals. Besides, due to the species scarcity problems, *blend-fishing* gear has replaced standard ones in each unit. This was possible because fishermen are polyvalent. Blend-fishing combines mainly three types of fishing : angling, dormant net and pot fishing (ADNP). Thus, the study uses the icebox angling (traditionally dominant) and ADNP blend to assess small-scale exploitation of coastal demersals.

6.1.1 Purse seines

The FAO introduced purse seines in Senegal in 1972 in an effort to put at the disposal of small-scale fishermen, more efficient fishing gear to tap small coastal pelagics.

The typical unit is usually made up of two pirogues due to the size of the net - one for the crew and the other for the expected catches. The smaller pirogue measures 16 to 18m and carries the net. The bigger one, which is 18 to 20m long with a capacity of 16 to 25 tons, is meant to carry the catch. Pirogues of a much smaller size operate on the north coast where a rough sea and docking problems deter the use of the very big pirogues as found on the *Petite Côte*. The pirogues are propelled by 40 horsepower outboard motors. The net is 300 to 400m in length and 40m in depth, and allows fish capture through an encircling method. Purse seines are mainly in operation in Mbour and Joal, the two main landing sites on the *Petite Côte*, in Hann (Dakar), Kayar and Saint-Louis (Grande Côte).

The target species of purse seines include flat sardinella, round sardinella, yellow scad, bonito mackerel (*Cybium tritor*), small tuna (*Euthynnus alleteratus* and the great scad (*Caranx carangus*).

6.1.2 Surrounding gill nets

Introduced in Senegal in 1965, the use of surrounding gill nets is the speciality of the *Nominka,* who are native *of Iles du Saloum.* This gear is in operation mainly in Joal. The typical fishing unit is made up of a 16m long pirogue with a 5 ton capacity, propelled by a 40 horsepower outboard motor fitted with a 300 to 500m long and 10 to 20m deep net. Two types of nets are used depending on the hunted species. Big stitch nets capture *ethmaloses* while the small stitch net is more adapted to fishing flat sardinella.

The ethmalose net is mainly used between June and October, a period when the hunted species is present in the fishing areas. The sardinella net is operated throughout the whole year because the flat sardinella is permanently present in the fishing areas.

6.1.3 Icebox pirogue

The unit icebox pirogue can carry along several types of fishing lines at each tide: scad (*Decapterus sp, trachurus sp*), wreck fish (*Epinephelus sp, Serranidae*) and sparidae (*Sparus caeruleostictus sp, Sparidae*) hand lines. The lines used are made of nylon fibre and measure 100 to 200m long depending on the depth of fishing area. They may carry up to five similar hooks, the size of which varies according to the hunted species. The lines are hand-held aboard motorized pirogues measuring 16 to 18m, fitted with an icebox and carrying a crew of seven on average. Sea trips generally last five days.

6.1.4 Lines

A traditional hand-held line or *palangrotte* is made of a nylon fibre with variable diameter and length. It is fitted with 1 to 5 casts carrying hooks. The line is weighted down by a piece of lead. There are different types of lines depending on the hunted demersal species:

- The ground lines used for demersals fished from a anchored pirogue. Sardinella is usually used as bait for these lines. Hook size depends on species size.
- Jig fishing consists of two parts: a set of hooks (4 to 8) crown-shaped, and a jig of variable colour. The whole outfit is 10 to 15cm long. Jig fishing is used mainly to capture cephalopods (cuttlefish and octopuses).

6.1.5 Dormant nets

Dormant nets are made of a set of several sheets the length, depth and stitch size of which varies according to the hunted species. These differences - especially of stitch - depend on the fishermen who, in most cases, make their nets by themselves. Therefore there are different types of nets:

- fish dormant nets, some of which are of surface type and target sardinella or grey mullet as well as other demersal species (soles, rays);
- dormant nets targeted at *Yeet (*Cymbium spp.);
- lobster dormant nets.

6.1.6 Pots

The most commonly used pots are steel-framed parallel piped, of about 1.20m long and 0.80cm wide. They have two round openings located each on either side of the trap. The pots are used to capture cuttlefish.

6.2 Investment components and related costs

Depending on the type of fishing, investment in small-scale fishing consists mainly of purchases of pirogues, motors, fishing gear and accessories.

Many factors influence the price of a pirogue: the size, the wood quality and the place of construction. Motors benefit from reduced taxes and are sold on credit to member fishermen of an economic grouping (GIE).

The price of fishing gear varies according to type. Nets are either made by the companies selling them (purse seines), or by the fishermen themselves (surrounding gill nets and dormant nets), and price varies according to the length and stitch. The fishermen on board individually own their lines. Some angling pirogues have built-in iceboxes - and are called icebox pirogues.

Accessories are mainly made up of water and fuel tanks, anchors, buoys, ropes, lamps, life jackets, knives, oilskins, buckets, 12-volt batteries and paddles.

The comparative analysis of Tables 5, 6 and 7 shows a clear upward trend in the different capital components of fishing units between 1993 and 1996: 169 per cent for outboard motors, 29 per cent for pirogues and 67 per cent for sheet nets, lines and accessories (Kébé and Dème 1996; Kébé 1997). This sharp increase is linked to the effects of devaluation, which occurred in 1994. The rate of increase was clearly lower between 1996 and 1999 and never exceeded 15 per cent. Incidentally, the prices of 40 horsepower outboard motors decreased by about 15 per cent and that of 25 horsepower outboards, by14 per cent (Dème 1999).

Table 5 Annual investment and operating costs of small-scale fishing units (1993)

	Purse seines		Surrounding gill nets		Icebox line		ADNP motor	
	CFAF	%	CFAF	%	CFAF	%	CFAF	%
Invested capital								
Pirogue (8 to 12m)	-	-	-	-	-	-	1 000 000	51.5
Pirogue (16 to 18m)	1 400 000	15.4	1 400 000	42.9	1 400 000	63.3	-	
Pirogue (18 to 21 m)	1 850 000	20.4	-				-	
Motors	1 320 400	14.6	660 200	20.3	660 200	29.9	390 000	20.1
Fishing gear	4 000 000	44.1	1 000 000	30.7	100 000	4.5	500 000	25.5
Accessories	500 000	5.5	200 000	6.1	50 000	2.3	50 000	2.6
TOTAL	**9 070 200**	**100**	**3 260 200**	**100**	**2 210 200**	**100**	**1 940 000**	**100**
Fixed costs								
- Depreciation								
. Motors	660 200	58.2	330 100	57.9	330 100	63.5	195 000	60.0
. Pirogues	325 000	28.6	140 000	24.6	140 000	26.9	100 000	30.8
- « Insurances »	150 000	13.2	100 000	17.5	50 000	9.6	30 000	9.2
TOTAL	**1 135 200**	**100**	**570 000**	**100**	**520 100**	**100**	**325 000**	**100**
Variable costs								
Fuel	6 880 000	70.6	4 129 000	81.9	2 500 000	58.3	500 000	47.7
Food	1 000 000	10.3	400 000	7.9	500 000	11.7	150 000	14.3
Minor upkeep	120 000	1.2	60 000	1.2	60 000	1.4	50 000	4.8
Ice	-	-	-	-	800 000	18.7	-	-
Bait	-	-	-	-	250 000	5.8	100 000	9.5
Repair	-	-	-	-	-	-	-	-
Fishing gear	1 000 000	10.3	250 000	5.0	25 000	0.6	125 000	11.9
Motors	251 000	2.6	125 500	2.5	125 500	2.9	74 100	7.1
Pirogues	495 000	5.1	75 000	1.5	75 000	1.8	50 000	4.8
TOTAL	**9 746 000**	**100**	**5 039 500**	**100**	**4 285 500**	**100**	**1 049 100**	**100**

Source: ENDA and CRODT

Table 6 Annual investment and operating costs of small-scale fishing units (1996)

		Purse seines	Surrounding gill nets	Icebox line	ADNP motor			
	CFAF	%	CFAF	%	CFAF	%	CFAF	%
Invested capital								
Pirogue (8 to 12 m)	-	-	-	-	-	-	1 300 000	35,6
Pirogue (16 to 18 m)	1 800 000	11.9	1 800 000	32.7	1 800 000	47.2	-	-
Pirogue (18 to 21 m)	2 400 000	15.9	-	-	-	-	-	-
Motors	3 560 000	23.6	1 780 000	32.3	1 780 000	46.7	1 454 000	39.8
Fishing gear	6 680 000	44.3	1 670 000	30.3	167 000	4.4	835 000	22.9
Accessories	650 000	4.3	260 000	4.7	65 000	1.7	65 000	1.8
TOTAL	**15 090 000**	**100**	**5 510 000**	**100**	**3 812 000**	**100**	**3 654 000**	**100**
Fixed costs								
- Depreciation								
. Motors	1 780 000	73.3	890 000	74.2	890 000	78.6	727 000	81.1
. Pirogues	420 000	17.5	180 000	15.0	180 000	15.9	130 000	14.5
- « Insurances »	195 000	8.1	130 000	10.8	65 000	5.5	39 000	4.4
TOTAL	**2 395 000**	**100**	**1 200 000**	**100**	**1 132 000**	**100**	**896 000**	**100**
Variable costs								
Fuel	10 600 000	70.5	6 361 540	81.4	3 851 745	60.8	770 350	45.2
Food	1 300 000	8.6	520 000	6.7	650 000	10.3	195 000	11.4
Minor upkeep	156 000	1.0	78 000	1.0	78 000	1.2	65 000	3.8
Ice	-		-		1 000 000	15.8	-	
Bait	-		-		275 000	4.3	125 000	7.3
Repair								
Fishing gear	1 670 000	11.1	417 500	5.3	41 750	0.7	208 750	12.2
Motors	676 400	4.5	338 200	4.3	338 200	5.3	276 260	16.2
. Pirogues	630 000	4.2	97 500	1.2	97 500	1.5	65 000	3.8
TOTAL	**15 032 400**	**100**	**7 812 740**	**100**	**6 332 195**	**100**	**1 705 360**	**100**

Source: ENDA and CRODT

Table 7 Annual investment and operating costs of small-scale fishing units (1999)

	Purse seines		Surrounding gill nets		Icebox line		ADNP motor	
	CFAF	%	CFAF	%	CFAF	%	CFAF	%
Invested capital								
Pirogue (8 to 12 m)	-		-		-		1 443 000	38.9
Pirogue (16 to 18 m)	1 944 000	12.4	1 944 000	34.5	1 944 000	51.9	-	-
(Pirogue 18 to 21 m)	2 592 000	16.5	-	-	-	-	-	-
(Motors)	3 100 000	19.7	1 550 000	27.5	1 550 000	41.3	1 275 000	34.3
Fishing gear	7 415 000	47.0	1 853 000	33.0	185 000	5.0	926 000	24.9
Accessories	702 000	4.4	281 000	5.0	70 000	1.8	70 000	1.9
TOTAL	**15 753 000**	**100**	**5 628 000**	**100**	**3 749 000**	**100**	**3 714 000**	**100**
Fixed costs								
- Depreciation								
Motors	1 550 000	69.6	775 000	69.2	775 000	74.2	637 500	77.1
Pirogues	453 600	20.3	194 400	17.4	194 400	18.6	144 300	17.5
« Insurances »	224 400	10.1	149 600	13.4	75 000	7.2	45 000	5.4
TOTAL	**2 228 000**	**100**	**1 119 000**	**100**	**1 044 400**	**100**	**826 800**	**100**
Variable costs								
Fuel	11 130 000	79.0	6 679 000	79.7	4 043 500	58,0	808 500	42,3
Food	1 326 000	9.4	530 400	6.4	663 000	9,5	199 000	10,4
Minor upkeep	176 000	1.3	90 000	1.1	89 000	1,3	73 000	3,8
Ice	-	-	-	-	1 230 000	17,6	-	-
Baits	-	-	-	-	313 000	4,5	141 000	7,4
Repair								
Fishing gear	178 500	1.3	463 300	5.6	46 300	0.7	231 500	12.1
Motors	589 300	4.2	294 600	3.6	294 600	4.2	242 400	12.7
. Pirogues	681 100	4.8	291 800	3.6	291 800	4.2	216 600	11.3
TOTAL	**14 080 900**	**100**	**8 379 100**	**100**	**6 971 200**	**100**	**1 912 000**	**100**

Source: ENDA and CRODT

6.3 Operating costs

Operating expenses consist of fixed and variable expenses.

6.3.1 Fixed expenses

These are expenses that remain constant irrespective of changes in the level of activities of fishing units. They include mainly equipment depreciation and 'insurances'.

Motors and pirogues are amortized over 2 to 10 years respectively. However, nets are not depreciated as they are continuously renewed, and nets are often completely renovated as whole sheets get renewed entirely. Repair and depreciation are thus mixed, which otherwise may result in dual accounting.

Insurance consists of all expenses incurred by fishermen who own fishing units, including traditional beliefs to ensure a favourable fishing campaign and to protect themselves against any accident out at sea. The annual cost of these expenses was estimated on the basis of the fishermen's indications.

6.3.2 Variable expenses

These are expenses that change according to the level of activities and production of fishing. They usually consist of five elements: fuel, food, bait, ice, upkeep and repair, as well as purchases of minor equipment (ropes, strings and hooks).

Fuel is by far the most important item of these expenses although it is subsidized up to 51 per cent.

Food, like fuel, is of average consumption borne by the fishing unit; it is not a salary component. It varies according to crew size and time spent at sea.

Motor upkeep is limited to periodic oil change and replacement of plugs, which are handled by the fishermen themselves. Annual motor upkeep and repair costs were estimated at 19 per cent of its purchase price. This rather high cost reflects the intensive use of the motor during its economic life.

Upkeep and repair of pirogues consist of replacing the broadside boards and spurs, painting them and having the waterproof redone. Nets are constantly repaired either by partly or entirely changing the sheets or by mending torn stitches. These expenses were estimated at one-quarter of the initial value of the net. The fishermen do the work themselves.

While the first three elements are common to all types of fishing, the use of bait is specific to dormant nets/lines/pots pirogues and icebox pirogues. Bait mainly consists of sardinella bought from purse seines fishermen or fish and seafood wholesalers.

Icebox pirogues carry on board 1.5 tons of ice for each sea trip. Fishermen either buy them through retailers who have a registered quota with ice manufacturers, or directly from the manufacturers.

The comparative analysis of the fishing units' operating costs in 1993, 1996 and 1999 reveals a very substantial increase between the first two years (fuel 55 per cent, food and minor upkeep 30 per cent, ice 25 per cent and bait 10 per cent) and a relatively low increase between 1996 and 1999 - between 5 per cent and 15 per cent (Tables 5, 6 and 7).

6.4 Generated income and remuneration of production factors

In small-scale fishing, crewmembers share the economic risks of going out to sea. Production factors are remunerated per share, sharing is done between the fishermen and the owners of fishing equipment, after deduction of common charges (fuel, bait, ice, food and minor upkeep) from gross income. The terms and conditions of gross operating result distribution between labour and capital/equipment vary according to the type of gear and the place of landing. However, the common practice among purse seines is to allocate 1/3 of net income to net and the remaining 2/3 to crew, to pirogues and to motors at the rate of one share per crewmember and one share for each piece of equipment. For the other fishing gear, net income is distributed as follows: one share per fisherman, one share for the motor, one share for the net and one share for the pirogue.

Income was calculated by recouping catch per unit effort and landing price files. Producer prices are especially characterized by their extreme variability. These sharp fluctuations depend on landed quantities, the place of landing, the season, additional landing forecasts and market absorption capacity.

The nature of the distribution channels has strongly influenced the price trends over the last few years. Between 1993 and 1996, small coastal pelagics meant for the domestic market increased slightly (from 26 per cent to 45 per cent on average) compared to export-oriented demersals (200 per cent on average) targeted at the export market (European or Asian), where substantial gains were achieved. Between 1996 and 1999, the prices of these species increased by 5 per cent and 15 per cent respectively, except for octopus, the price of which fell to its all time low since the record catches of 1999 (Dème 1999).

After the increase in factor costs that occurred in the wake of devaluation, purse seine units annual income dropped sharply by 25 per cent (from CFAF 9 to 7 million between 1993 and 1996). The internal rate of return of invested capital (IRR) fell from 83 per cent to 45 per cent. The capital amortization period - once lasting only about a year - took more than two years (Tables 8, 9 and 10).

In the case of surrounding gill nets units, devaluation almost nullified the boat owners' net income, which dropped from CFAF 448,000 to CFAF 47,000. On the other hand, icebox pirogues owners' net income soared from CFAF 67,000 in 1993 to CFAF 345,000 in 1996, an increase of 415 per cent. The profitability rate also clearly rose among dormant net and/or angling and/or pot fishing pirogues, from 4 per cent to 29

per cent. The boat owner saw his income rise from CFAF 78,000 to over a million CFAF, and the capital amortization period shortened from 25 to three and a half years.

Table 8 Operating costs of small-scale fishing units,1993

	Purse seines	Surrounding gill nets	Icebox line	ADNP motor
Turnover	31 400 000	10 100 000	8 300 000	2 300 000
Common expenses				
. Fuel	6 880 000	4 129 000	2 500 000	500 000
. Food	1 000 000	400 000	500 000	150 000
. Minor upkeep	120 000	60 000	60 000	50 000
. ice	-	-	800 000	-
. Baits	-	-	250 000	100 000
.TOTAL	**8 000 000**	**4 589 000**	**4 110 000**	**800 000**
Net Income	23 400 000	5 511 000	4 190 000	1 500 000
. Labour	13 000 000	4 006 497	3 427 420	848 000
. Capital	10 400 000	1 504 503	762 580	652 000
Repair				
. Fishing gear	1 000 000	250 000	-	125 000
. Motors	251 000	125 000	125 000	74 100
. Pirogues	495 000	75 000	50 000	50 000
TOTAL	**1 746 000**	**450 500**	**175 500**	**249 100**
Insurances	150 000	100 000	50 000	30 000
Gross result	8 504 000	954 003	537 080	372 900
Depreciation				
. Motors	660 200	330 100	330 100	195 000
. Pirogues	325 000	140 000	140 000	140 000
TOTAL	**985 200**	**470 100**	**470 100**	**295 000**
Boat's owner net esult	7 518 800	483 903	66 980	77 900
Invested capital	9 070 200	3 260 200	2 210 200	1 940 000
Rate of return (%)	82,8	14,8	3	4
Pay back period (year)	1,2	6,7	33,3	25

Source: ENDA and CRODT

Table 9 Operating accounts of small-scale fishing units, 1996

	Purse seines	Surrounding gill nets	Icebox line	ADNP motor
Turnover	39 564 000	14 645 000	16 600 000	6 900 000
Common expenses				
. Fuel	10 600 000	6 361 540	3 851 745	770 350
. Food	1 300 000	520 000	650 000	195 000
. Minor upkeep	156 000	78 000	78 000	65 000
. Ice	-	-	1 000 000	-
. Baits	-	-	275 000	125 000
.TOTAL	**12 056 000**	**6 959 540**	**5 854 745**	**1 155 350**
Net Income	27 508 000	7 685 460	10 745 255	5 744 650
. Labour	15 282 223	5 585 608	8 778 014	3 246 975
. Capital	12 225 777	2 099 852	1 957 241	2 497 675
Repair				
. Fishing gear	1 670 000	417 500	41 750	208 750
. Motors	676 400	338 200	338 200	276 260
. Pirogues	630 000	97 500	97 500	65 000
TOTAL	**2 976 400**	**853 200**	**477 450**	**550 010**
Insurances	195 000	130 000	65 000	39 000
Gross result	9 054 377	1 116 652	1 414 791	1 908 665
Depreciation				
. Motors	1 780 000	890 000	890 000	727 000
. Pirogues	420 000	180 000	180 000	130 000
TOTAL	**2 200 000**	**1 070 000**	**1 070 000**	**857 000**
Boat owner's net result	6 854 377	46 652	344 791	1 051 665
Invested Capital	15 090 000	5 510 000	3 812 000	3 654 000
Rate of return (%)	45	0,8	9,0	28,8
Pay back period (year)	2,2	118	11	3,5

Source :ENDA and CRODT:

Table 10 Operating accounts of small-scale fishing units, 1999

	Purse seines	Surrounding gill nets	Icebox line	ADNP motor
Turnover	31 425 000	13 500 000	23 250 000	9 450 000
Common expenses				
. Fuel	11 130 000	6 679 000	4 043 500	808 500
. Food	1 326 000	530 400	663 000	199 000
. Minor upkeep	176 000	90 000	89 000	73 000
. Glace	-	-	1 230 000	-
. Bait	-	-	313 000	141 000
.TOTAL	**12 632 000**	**7 299 400**	**6 338 500**	**1 221 500**
Net Income	18 793 000	6 200 600	16 911 500	8 228 500
. Labour	10 441 135	4 506 577	13 816 584	4 651 498
. Capital	8 351 865	1 694 023	3 094 916	3 577 002
Repair				
. Fishing gear	178 500	463 300	46 300	231 500
. Motors	589 300	294 600	294 600	242 400
. Pirogues	681 100	291 800	291 800	216 600
TOTAL	**1 448 900**	**1 049 700**	**632 700**	**690 500**
Insurances	244 400	149 600	75 000	45 000
Gross result	6 678 565	494 723	2 387 216	2 841 502
Depreciation				
. Motors	1 550 000	775 000	775 000	637 500
. Pirogues	453 600	194 400	194 400	144 300
TOTAL	**2 003 600**	**969 400**	**969 400**	**718 800**
Boat's owner net result	4 674 965	- 474 677	1 417 816	2 122 702
Invested capital	25 753 000	5 628 000	3 749 000	3 714 000
Rate of return (%)	18.1	-	37.8	57.1
Pay back period (year)	5.5	-	2.6	1.7

Source: ENDA and CRODT

Between 1996 and 1999, the operating results of purse seines and surrounding gill nets dropped further. The annual net result of purse seines owners fell by 46 per cent from CFAF 6,854,377 to 4,674,965, while surrounding gill nets owner suffered a CFAF 475,000 loss. Unlike the fishing units disposing of the bulk of their catches on the domestic market, the financial ratios of icebox pirogues and ADNP clearly improved. As for icebox pirogues, their owners' income rose from less than CFAF 350,000 to about CFAF 1.5 million. The same trend was observed in the case of ADNP with a 38 per cent increase. As a result, invested capital amortization periods clearly shortened, while the internal rate of return more than doubled in the case of ADNP, and quadrupled in the case of icebox pirogues.

The fishermen are the first to profit from this new fish landings price structure. In any case, they are better paid than the boat owners. Thus, while surrounding gill nets owners' income showed a deficit in 1999, each fisherman on board earned an annual

average salary of CFAF 643,796. Likewise, the purse seines owners' income fell by 25 per cent on average, while each fisherman on board this unit saw his gains increase by about 18 per cent in 1996. The same applies to the other types of fisheries as shown in Tables 11, 12 and 13. In this context, the question then is how to amortize invested capital and to renew fishing gear. This is why it was argued that fishing gear should be better remunerated, with a tendency to question the share systems operated in different landing centres.

Table 11 Net cash flow of production factors, 1993

Fishing units Production factors	Purse seines	Surrounding gill nets	Icebox pirogues	ADNP pirogues
Capital	7 518 800	483 903	66 980	77 900
Labour				
Total crewmembers	13 000 0000	4 006 497	3 427 420	848 000
Individual fisherman	650 000	572 367	380 824	212 000

Source: ENDA and CRODT

Table 12 Net cash flow of production factors, 1996

Fishing units Production factors	Purse seines	Surrounding gill nets	Icebox pirogues	ADNP pirogues
Capital	6 854 377	46 652	344 791	1 051 665
Labour				
Total crewmembers	15 282 223	5 585 608	8 778 014	3 246 975
Individual fisherman	764 111	797 944	976 446	811 745

Source: ENDA and CRODT

Table 13 Net cash flow of production factors, 1999

Fishing units Production factors	Purse seines	Surrounding gill nets	Icebox pirogues	ADNP pirogues
Capital	4 674 965	- 474 677	3 749 000	3 714 000
Labour				
Total crewmembers	10 441 135	4 506 577	13 816 574	8 228 500
Individual fisherman	522 056	643 796	1 535 174	2 057 125

Source :ENDA and CRODT

6.5 Impact of subsidized fuel on the profitability of fishing units

A sensitivity analysis shows how the financial profitability of fishing units would be affected if fuel subsidy were ended. In this connection, the impact of a 50 per cent reduction or ending of fuel subsidy was measured (Tables 14 and 15).

Based on a 50 per cent reduction of fuel subsidy, the net income of purse seines boat owners dropped by about 52 per cent from CFAF 4,674,965 to CFAF 2, 426, 205, and the profitability rate also decreased from 18 per cent to 9.4 per cent, with the invested capital recovery period (IRP) extending by 5 years. For surrounding gill net boat owners, such a reduction translated into a negative net income, meaning that the respective income is just not enough to renew fishing units and to cover investment risks. On the other hand, icebox angling and ADNP remain clearly profitable, with the internal profitability rate at 49 per cent and the invested capital recovery period not exceeding 2 years.

It appears therefore that a fuel subsidy is essential in the fishing of small coastal pelagics, and that the financial viability of domestic purse seines and surrounding gill nets, which are mostly domestic-market oriented and as such play an important role in the country's food security policy, largely depend on this incentive. So should a decision be taken to end this subsidy, it should be carried out gradually and targeted at demersal fishing units as they would maintain acceptable profitability rates if they benefited from market prices.

Why such measures have been maintained for export oriented fishing units, most of which are prosperous and the production of which does not benefit the Senegalese consumer remains to be answered. It should be recalled that the fuel subsidy was instituted to reduce the operating charges of small-scale fishing units, which was expected to make them offer products at prices compatible with the purchasing power of the local populations.

Table 14 Impact of reducing pirogue fuel subsidy by 50%

Fishing type Financial ratios	Purse seines	Surrounding gill nets	Icebox pirogues	ADNP pirogues
Boat owners' net income	2 426 205	- 1 237 536	1 122 823	1 971 972
Internal profitability rate (%)	9.42	-	29.9	53.0
Invested capital recovery period (year)	10.6	-	3.3	1.8

Source: ENDA and CRODT

Table 15 Impact of ending pirogue fuel subsidy

Fishing type Financial ratios	Purse seines	Surrounding gill nets	Icebox pirogues	ADNP pirogues
Boat owners' net income	- 46 957	- 2 497 500	752 829	1 816 241
Internal profitability rate (%)	-	-	20.0	48.9
Invested capital recovery period (year)	-	-	4.9	2.0

Source ENDA and CRODT

6.6 Social impact

Trends in the profitability rates of the different small-scale fishing units have encouraged small-scale fishermen to develop new strategies in the last few years. Fishing effort was noted to have shifted from the capture of domestic-market oriented species to export oriented species. Thus, it was noted that on the *Petite Côte,* the majority of small-scale pelagic and demersal fishing units hunted for cephalopods (cuttlefish and octopuses) in priority, to supply industries between June and September. Many pirogues that usually go angling used sole nets over the October to May period. In *Kayar*, the fishermen preferred to fish for red mullet. Cheap fish is becoming increasingly rare as fishing pressure shifts onto priority export species (soles, lobsters, shrimps, *pageots*, sea breams and wreck fish).

Coastal pelagics (whether fresh or processed) constitute the main source of animal protein for the low-income urban and rural populations. The partial redeployment of purse seines and surrounding gill nets fishing effort, towards these priority species disturbs the domestic market supply, raising fears about an increasing protein deficit, which is already the case in the countryside. Incidentally, the price of a kg of *kethiakh* (grilled fish) which was once about CFAF 75 in 1993, is now between CFAF 200 and 250 due to supply shortages.

The heavy pressures weighing on the fish trade prevent any significant increase in the landing price of small coastal pelagics. The costs of fish marketing across the country are relatively high. Their structure has also been deeply modified by devaluation, which raised fuel and ice prices substantially.

In 1993, the breakdown of the consumer price of sardinella into producers' and middlemen's income and gross margins revealed that on average: 27 per cent went to the fisherman, 35 per cent to the fish and seafood wholesaler and 38 per cent to the retailer. As far as this species is concerned, the share of the final price collected by the merchant has been reduced considerably due the increased costs borne. Hence, fish and

seafood wholesalers tend to turn to the industries and to the Central Fish Market, which are less risky and more profitable.

As it is difficult to acquire fishing equipment and to renew the existing ones due to the continuous fall in the internal rate of return of purse seines and surrounding gill nets, the fishing sector witnessed some social instability

Many fishermen of Saint-Louis, in particular, migrated to Mauritania during 1994. Others had their pirogues ferried far out at sea to fish for industrial boats. These practices jeopardize all the more the domestic market, as most of the purse seines belong to fishermen from Saint-Louis.

Instead of immobilizing their fishing units, fishermen reacted to the higher pirogue fuel price by adopting new strategies :

- purse seines pirogues fish in closer areas or go out to sea with a single pirogue instead of two. In *Kayar*, pirogues have limited their fishing trips to once a day;
- icebox pirogues clearly extended the fishing trip duration, which is likely to impact on the quality of products put on ice;
- surrounding gill nets opted for a reduced crew;
- some fishing units took exclusively to picking up *gastropods* and other fish captured by industrial fishing, thereby encouraging the latter to operate within the six-mile area reserved for pirogue fishing. This violation of existing regulations often translates into conflicts with small-scale fishing units resulting in equipment loss or at times, human casualties;
- fishermen have organized themselves such that they can make maximum gains from their capture despite the high costs of fishing equipment, by restricting supply of piscatorial products. Thus, a daily quota of *pageot* captures (3 crates of 13kg each per fishing unit) was imposed in *Kayar*, in the wake of devaluation.

All these strategies on fishing effort redeployment and the restricted supply of piscatorial products contribute to domestic market supply shortages.

7. ENVIRONMENTAL IMPACT OF EXPORT SUPPORT MECHANISMS: DENSITY INDICATOR PATHS OF COASTAL DEMERSALS

7.1 Retained species

The species retained for the present study are described in the following Table. These are mainly species characteristic of the continental shelf. However, a few species, often classified as deep demersal species, have been retained because of their massive presence along the edge of the continental shelf.

All of the species present in the database on assessment campaigns through trawling, have not been reflected in fishing statistics. In fact, commercial fishing uses names that can correspond either to a single and unique species or to group of species of the same gender or family.

Table 16 Retained species

Scientific name	Common name	Statistical data	Evaluation data
Mycteroperca rubra	*Badèche*	+	+
Brotula barbata	*Brotule*	+	+
Pseudotolithus senegalensis	*Captain*	+	+
Pseudotolitus typus	*Captain*	+	+
Arius heudeloti	*Machoiron*	+	+
Galeoides decadactylus	*Thièkem*	+	+
Epinephelus aenus	*Thiof*	+	+
Epinephelus guaza	Yellow Stone bass	+	
Epinephelus goreensis	Gorée Stone bass	+	
Dentex angolensis	*Dentex*	+	
Sparus caeruloestictus	Pink Sea bream	+	+
Diplodus bellotti	*Sar*	+	
Sparus auriga	Couch's sea bream	+	
Sparus pagrus africanus	Couch's sea bream	+	

Zenopsis conchifer	Silver St Pierre	+	
Pomadasys jubelini	*Sompatt*	+	+
Lutjanus spp	Red bass		+
Argyrosomus reguis	*Courbine*		+
Penaeus notialis	White shrimp		+
Plechtorhynchus mediterranneus	Grey sea bream		+
Merluccius spp	Hake		+
Pagellus bellotti	White sea bream		+
Pseudupenaeus prayensis	Red mullet		+
Sepia spp	Cuttlefish		+
Cynoglossus spp	Soles		+
Trichiurus lepturus	*Ceinture*		+
Octopus vulgaris	Octopus	+	+
Rhinobatos rhinobatos	Guitar ray	+	
Scorpaena normani	Scorpion fish	+	
Chlorophtalmus atlanticus	*Yeux verts*	+	
Pentanemus quinquarius	*Capitaine royal*	+	
Cymbium spp	*Yeet*	+	

7.2 Results

7.2.1 Relative densities as determined from assessment campaigns

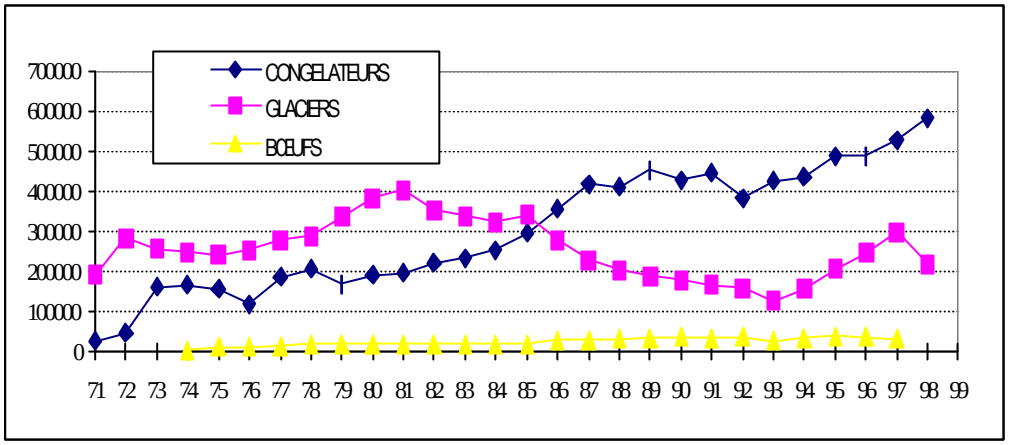
The relative density indicators obtained from the results of evaluation campaigns through trawling and their variance, can be estimated from a standard calculation of averages and variances based on regular distribution. In this case, the results are biased; in fact, for a given species, trawling reveals a very general asymmetric distribution of captures with many zero values and a few very large catches.

The delta distribution appeared to be best suited for minimizing biases in calculating the averages and variances of these trawling results (Pennington, 1983 and 1986, according to the works of Aitchison and Brown, 1957). The efficiency of delta distribution then depends on the number of trawlings, of zero proportion and variability amplitude of positive values (Smith, 1988).

The diagram on the evolution of instantaneous relative density indicators of 26 species is shown in Chart Series 1- 4 (Appendix 1).

The period covered by the campaigns is very important. In this connection, the following diagram, which shows the evolution of the Dakar-based demersal trawlers' fishing effort, reveals that all the campaigns took place after relatively significant fishing pressure had already tapped coastal demersal resources.

Figure 1 Evolution of fishing effort (sea hours) of the Dakar based demersal flotilla



Source ENDA and CRODT

The year 1986, in which the first campaign took place, coincided with the time when freezer trawlers' effort started exceeding that of icebox boats, which was noted to have been on the declining trend since the early 1980s. The observed decrease in icebox boats' effort since the early 1980s reveals, in the light of icebox boats' strategy, that the density of their main target species (captains, sea breams, stone basses and shrimps) seems to have declined. The ever-growing competition between freezer and deep lying trawlers also explains why icebox boats' effort has declined, because they have less autonomy than the freezer trawlers. Deep lying trawlers' effort also started to increase in 1986. The increase in global fishing effort has impacted significantly on the various species tapped. However, the fact that it was impossible, with the available data, to evaluate specific densities before 1986, constituted a major obstacle. This gap will be filled by analysing catches per effort unit on the basis of fishing statistics.

The fact that all flotillas increased their fishing efforts in 1994 was indicative of the strategic adjustment of fishermen with boat ownership, following devaluation. The increase in fishing pressure on export species is in fact a reaction to revived external demand entailed by monetary devaluation.

Trends in density indicators of species captured by deep-sea trawls during trawling campaigns, reflect for all species, a sharp decline between period start and end. Almost all fish species were affected by the fall. Catches of all species decreased from about 1,000 kg/hour in 1986 to 500 kg/hour in 1991 for the whole Senegalese continental shelf, corresponding to a 50 per cent decline.

The *serranidaes* group to which all stone basses belong (of the *Epinephelus* type) exhibited, at period start, a relatively low average density of about 30 kg/hour for all species. At period end, *catch per unit effort* was lower than 10 kg/hour for all species.

The same phenomenon applies both to the *sparidae* group, particularly to the species of the s*parus* type (couch's sea bream), the relative density of which decreased from over 40 kg/hour at period start to less than 10 kg/hour at period end, and to the guitar ray (60 kg/hour at period start and 5 kg/hour at period end). Lower abundance was caused by the strong fishing pressure exerted on these high market value species. Stone basses and couch's sea breams are exported in whole form while *selachians* i.e. (sharks and guitar rays) are in demand for their fins, which are exported, in dried form to Asia. Another major factor speeding up decline in densities is the fact that freezer trawlers reject back into the sea 'not-up-to-measurement' young and juvenile fish caught in the nets and keep only individuals of acceptable size.

Inversely, some species like octopus (*octopus vulgaris*) saw their relative density increase over the same period. In 1986, the relative density of octopuses was lower than 5 kg/hour, reached 10 kg/hour in 1995 and exceeded 15 kg/hour in 1994. Other secondary species found along the continental shelf and slopes, such as scorpion fish and hakes follow the same pattern.

The analysis of density indicators calculated from fishing statistics should provide complementary information for a better understanding of instantaneous densities reported by trawling campaigns.

7.2.2 Relative densities as determined from fishing statistics (main marketed species)

The statistics on captures and fishing effort are available in database form for the period spanning 1971 to 1998.

Table 17 shows the average values of *specific catches per unit effort* of main demersal species marketed while inter-annual trends in mono-specific catches per unit effort are described in Chart Series 5 to 9 (Appendix 2).

Table 17 Annual average relative density indicators (kg/sea hour) of retained species. Data from Dakar icebox trawlers

	71	72	73	74	75	76	77	78	79	80	81	82	83	84
Badèches	23,80	18,04	48,22	36,71	39,26	28,54	17,84	34,48	55,79	43,08	27,85	24,87	11,94	12,43
Brotules	2,40	0,32	5,66	344,04	226,74	277,47	886,65	238,00	584,51	307,09	448,97	663,35	159,07	439,36
Captains	102,27	333,15	869,14	592,10	501,84	973,55	1257,61	1937,08	2151,34	1974,32	1534,68	1185,82	814,04	692,39
Red bass	0,52	0,20	1,69	0,78	0,61	2,19	2,91	5,96	12,16	4,43	7,63	2,11	4,25	0,61
Courbine	0,19	4,94	5,83	2,06	3,98	8,48	6,65	13,85	25,97	20,03	32,97	32,61	15,11	27,18
White shrimp	900,73	722,34	717,66	705,29	752,60	656,71	418,90	438,47	474,44	405,22	262,63	273,69	244,55	329,81
Prof. shrimp	2,62	41,22	2,76	0,03	0,14	1,20	5,00	0,00	0,01	1,43	2,04	0,08	0,00	0,00
Grey sea bream	71,66	44,65	91,51	68,84	115,09	108,32	147,42	96,31	115,13	88,61	71,52	67,59	74,02	61,64
Pink sea bream	42,40	54,30	138,05	203,99	321,52	262,80	210,28	83,69	106,64	108,33	141,61	120,88	84,36	85,17
Machoirons	0,00	0,93	12,86	11,37	20,69	39,76	289,06	629,53	763,30	559,93	1151,67	1248,63	1273,75	967,17
Hake	8,13	3,95	16,88	9,10	19,23	12,96	13,27	12,58	7,72	5,24	4,91	6,23	4,40	1,99
White sea bream	154,36	90,70	192,67	176,89	177,80	169,59	1338,41	378,66	372,97	731,70	943,48	1250,00	1341,82	1480,18
Red mullet	142,41	163,56	111,14	193,13	252,73	209,77	169,43	174,20	113,41	85,70	97,03	98,42	123,06	136,18
Cuttlefish	2,28	27,91	9,85	29,11	11,48	30,82	41,08	62,77	38,10	44,24	35,47	54,78	51,77	58,49
Soles	678,18	837,29	788,20	913,42	709,56	1032,07	800,85	1149,67	959,34	796,01	700,15	675,88	763,45	552,32
Roc soles	32,65	14,15	15,11	19,40	40,82	20,43	71,48	52,81	72,73	80,92	32,36	46,86	18,16	22,04
Sompatt	16,19	49,38	224,33	120,66	91,59	215,52	280,11	228,81	315,98	416,25	588,04	520,36	538,76	627,70
Thiekèm	0,00	42,89	337,53	165,42	143,08	294,68	367,68	465,81	608,71	861,37	1041,79	899,79	849,59	854,87
Thiof	78,41	69,36	139,97	69,07	62,88	44,96	78,23	65,75	100,54	54,39	45,93	59,89	51,10	54,52
Ceinture	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Octopus	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

	85	86	87	88	89	90	91	92	93	94	95	96	97	98
Badèches	9,73	5,29	6,23	3,32	7,85	4,06	2,78	2,62	9,67	1,48	2,23	6,16	12,31	9,34
Brotules	1147,42	715,21	593,53	152,70	68,95	180,51	490,84	337,41	597,51	254,69	284,67	487,18	341,61	567,70
Captains	443,22	343,48	53,25	23,54	2,03	1,35	3,63	2,72	0,00	12,43	11,13	2,19	9,56	7,19
Red bass	4,83	6,63	0,37	0,60	1,14	0,84	0,32	0,88	8,80	0,38	0,50	0,22	9,40	4,96
Courbine	31,46	43,52	20,85	11,30	16,69	4,58	16,55	15,88	4,09	11,44	2,99	8,56	19,45	4,40
White shrimp	245,88	376,77	265,83	148,08	123,78	97,50	42,14	28,82	41,23	279,15	76,45	39,80	77,59	62,45
Prof. shrimp	0,00	0,00	0,00	0,03	0,00	0,01	0,00	0,22	0,04	30,12	0,00	0,33	1,66	4,29
Grey sea bream	56,15	32,55	28,63	24,91	18,62	48,25	18,41	18,69	19,65	73,66	7,93	14,29	49,94	10,78
Pink sea bream	113,69	108,45	47,51	44,32	46,38	76,84	75,73	85,68	67,81	178,29	68,08	74,95	132,78	46,05
Machoirons	935,07	528,30	433,43	329,00	235,97	168,54	89,84	300,04	203,74	341,01	127,89	210,70	1377,49	1172,76
Hake	2,29	1,89	3,91	3,45	0,58	0,93	0,79	0,26	0,43	0,31	0,70	0,58	9,38	23,64
White sea bream	1430,90	836,41	644,01	189,44	60,39	159,11	105,22	195,36	217,24	146,14	178,38	275,49	351,49	371,97
Red mullet	108,48	104,48	160,41	212,57	140,36	237,61	189,61	263,10	337,32	156,27	284,78	204,68	203,76	229,02
Cuttlefish	97,41	108,05	73,89	73,08	207,67	189,45	359,23	291,96	275,73	561,09	188,41	251,86	305,01	530,61
Soles	578,85	596,47	491,64	426,97	323,67	370,90	594,92	762,52	650,81	595,50	315,33	807,80	454,45	706,31
Roc soles	82,73	43,75	145,03	37,06	38,52	77,82	67,03	55,56	87,96	152,08	119,49	101,79	44,08	109,19
Sompatt	447,41	384,56	356,70	379,06	371,18	261,77	152,83	198,92	170,02	499,19	127,74	1206,15	1272,94	689,12
Thiekèm	922,58	770,81	554,61	557,43	468,98	441,77	282,31	460,93	192,61	246,41	136,81	291,00	389,07	396,42
Thiof	61,13	41,53	40,49	31,49	21,34	20,14	17,90	28,58	37,47	21,75	12,82	24,08	28,94	8,17
Ceinture	98,78	79,55	23,50	22,70	21,11	13,96	3,46	2,74	13,94	30,76	21,77	15,23	10,84	14,42
Octopus	45,12	687,36	26,66	69,32	443,54	272,57	776,26	206,99	247,90	508,76	121,52	77,77	73,76	363,47

Source: Data from Dakar icebox trawlers(CRODT and ENDA).

Analysis of the trends in density indicators over the period under review (28 years) provides an indication of the sharp decline in the global *catches per unit effort* of all species, thus confirming the results of assessment campaigns through trawling. However, some species appear to have been particularly affected. The latter belong both to the *Sciaenidae* and *Sparidae* communities and are particularly targeted for export.

- The relative density indicator of the badèche (*Mycteroperca rubra*) was lower than 10 kg/hour in 1998 whereas it exceeded 50 kg/hour during the 1970s.
- The *catch per unit effort* of captains (*Pseudotolithus spp*) of all species was lower than 10 kg/hour in 1998 whereas it was over 2 tons at the end of the 1970s.
- The abundance of pink sea breams, which exceeded 300 kg/hour in 1975, fell to 50 kg/hour in 1998. It is important to note, however, that many species of *Sparidae* are designated by this same commercial name. In fact, they include both coastal demersals of the continental shelf such as couch's sea breams (*Sparus caeruleostictus*) and those found on the edge of the continental shelf and slope and commonly known as deep dentex (*Dentex macrophtalmus, D. canariensis*). The actual decline in the density of a given species is masked by increasing the quantities preserved from another one. However, in the past few years, the deep dentex found along the edge of the continental shelf and slope were noted to have become gradually dominant.
- The white sea bream (*Pagellus bellotti*), the relative density of which was higher than 1000 kg/hour in the early 1980s, recorded a sharp decline over the second half of the same decade. Since 1990, its relative density has wavered between 200 and 400 kg/hour with a slight upward turn. This increase might be explained by the fact the species around the continental shelf and slope have been included in this commercial category.
- The relative density of machoirons (*Arius spp*) followed the same pattern as the white sea bream. It fell sharply during the second half of the 1980s from over 4000 kg/hour in 1981 to about 100 kg/hour in the early 1990s. The relative density of machoirons was noted to have increased significantly since 1996.
- The thiékhem (*Galeoides decadactylus*) saw its stock decline as from the early 1980s, from over 1000 kg/hour in 1981 to about 130 kg/hour in 1995, followed by a slight increase from that year up to 1998.
- The *catch per unit of effort* of grey sea bream (*Plectorhynchus mediterraneus*) once over 140 kg/hour in 1977 declined to below 20 kg/hour in 1998.
- The coastal white shrimp (*Penaeus notialis*) saw its relative density reduced to 60 kg/hour from over 800 kg/hour in the early 1970s.
- The same applies to the thiof (*Epinephelus aenus*), as its relative density was lower than 10 kg/hour in 1998 compared to 140 kg/hour in the early 1970s. This sharp decline in the density of thiof applies to almost all other species of stone bass.

However, the relative abundance of a few species tends to increase. These include, notably the cuttlefish, sole, octopuses, and to a lesser extent, *brotules*, *sompatts* and red mullets.

These mono-specific data show that available campaign information was gathered at a time when resource levels were already generally low. In fact, the decline in the densities of various species reported by evaluation campaign data is by far lower than the actual fall in density recorded over a longer period (about 30 years).

7.3 Justification of observed paths

7.3.1 Intensifying fishing efforts and increasing capture of secondary species

The observed paths of mono-specific relative densities reflect progress in trawl fishing dynamics in Senegal. In Senegal, trawl fishing for coastal demersal species of the continental shelf started around 1950. Up to 1965, this type of fishing exploited mainly noble species of the *Sparidae* community, made up mainly of pink, white, and grey sea breams and stone basses. Red mullets formed most of the landings, with very small quantities of sole. From 1965, the discovery and exploitation of shrimp beds in the north and later in the south of Senegal, radically changed fishing practices. In fact, fishermen anticipated more gains with shrimp catches. Between 1965 and 1970, most of the trawlers turned into shrimpers. The hard bottom species were then neglected for the 'grey fish' of the *Sciaenidae* community, which are characteristic of a muddy sea bottom like the soles, captains or thiékem *(polynemidae).*

From 1970, with shrimp stocks having been fully exploited, practices were reversed: flotillas were diversified with the emergence of new and specific activities. This is how fishing started to become specialized in red mullet, cephalopods, soles, etc. As far as shrimp fishing is concerned, the flotillas acquired more and more powerful units (300 to 800 horsepower). Initially, these were made up of icebox trawlers, but from 1975 the number of freezers increased and exceeded that of icebox boats in 1986. It is important to note that at the same time, the Government of Senegal pursued an intensive policy on establishing industrial fishing and shipyard infrastructures. As fishing strategy depends on boat type, a classification of trawlers according to tonnage and conservation mode was introduced.

From 1980, given the great number of demersal trawlers and capture quotas, the species targeted by the various units were greatly diversified. Secondary captures apparently increased while the percentage of rejections decreased. In other words, some species once rejected at the early stage of the exploitation saw their quantities increase in landings, as a result of the scarcity of the preferred target species. This explains why *Ceintures* (*Trichiurus lepturus*) started to be present in captures only from 1984.

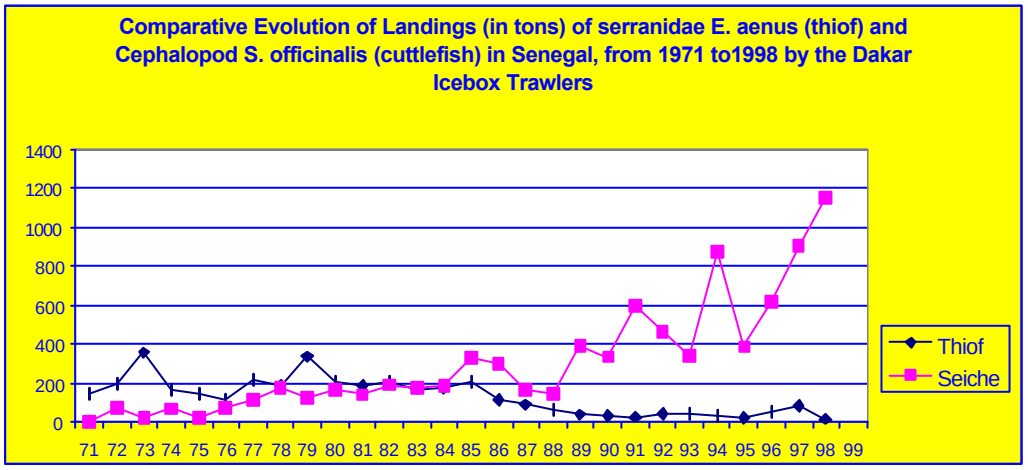
The multi-specificity of West African demersal fishing captures led to an increased exploitation of a great number of secondary species which, in the case of freezer trawlers, are often rejected back into the sea after capture sorting. Shrimpers, whether they are freezers or icebox boats in search of coastal shrimps on sandy or muddy bottoms, also capture captains, soles, *thiékem* and *machoirons* living in

similar biotopes as the targeted shrimp species. The specialization of flotillas tapping demersal resources therefore has an impact on non-targeted species.

7.3.2 Destroying habitats and 'replacing' *Sparidae* (wreck fish) by *Cephalopods*

Resource scarcity and the search for maximum gains from sea trips, gave rise to some negative practices, which have contributed to fast resource depletion. These include illicit practices tending to expand the capture capacities of fishing gear in an effort to compensate for lower abundance. Another practice with very negative impact on the so-called noble species (stone basses, red basses, *thiof*, in particular), living in rocky bottoms, is the use of big rolls (rolling steel *diabolos*) tied to trawlers belly cord. This type of authorization is held responsible for the gradual deterioration of vast rocky areas, destroying the natural rocky shields of secondary noble species and thus changing a whole biotope as well as contributing to the erosion of the entire biodiversity that goes with this type of habitat. The lower abundance of stone basses and other species of the *Sparidae* community favours occupation of their ecological niche by one or more rival species in the ocean trophic chain. This is known as the ecological replacement phenomenon of one species by another. In the case of West Africa, this replacement has materialized as an increased abundance of cephalopods (cuttlefish, octopuses, squid) and a simultaneous sharp decline in that of the species of the *Sparidae* community.

Figure 2 Comparative evolution of the landings (in tons) of serranidae E. aenus (thiof) and cephalod S. officinalis (cuttlefish) in Senegal, from 1971 - 1998 by the Dakar icebox trawlers



Source ENDA and CRODT

Similarly, the illegal incursions of demersal trawlers into some clearly coastal zones due to resource scarcity, causes habitat deterioration and biodiversity erosion in these coastal areas, in the short and even medium terms. This explains why, off the Saloum Central Delta, the major individuals of red mullets (*Mugil cephalus*) measuring 70 cm are very rarely captured nowadays. In fact, their preferred aquatic

plant habitats have been devastated and raked by boat trawls in search for sole and cuttlefish in areas reserved for small-scale fishing.

The greatest coastal infraction of stocks tapped offshore by industrial fishing is fished by small-scale fishing units. This infraction plays an essential role in feeding offshore fisheries. In fact, coastal zones constitute breeding grounds for almost all coastal demersal species. From birth to recruitment age, juveniles and young individuals of the high market value species are confined to coastal zones. Uncontrolled exploitation of these fragile resources by small-scale fishermen through non-selective fishing jeopardizes the regeneration of adult stocks tapped by industrial fisheries, and reduces the stocks of progenitors expected to supply coastal breeding grounds with juveniles. The decline in relative abundance is therefore not the consequence of industrial fishing units alone.

7.3.3 Harmful practices

The Senegalese small-scale fishing is now free of access and exploits intensively the coastal band, often through irresponsible fishing. It has been often observed that regulatory provisions are not applied to small-scale fishing operators, notably in terms of the mesh size of the fishing engines used. Resource scarcity is behind the conflicting competition between the two types of fishing. These conflicts range from sometimes dramatic incursions of industrial fishing units into areas reserved for small-scale fishing, to demand for the catches of small-scale fishing by exporting factory owners

In view of the fact that the overall level of effort is generally higher than the rate of exploitation that can possibly be sustained, and efforts to break even with the sea trips of fishing units by increasing fish captures, fishermen are compelled to develop compensatory adjustment reactions. Small-scale fishermen go fishing in increasingly distant zones, and associations with industrial fishing trawlers have surfaced. The noble species captured by small-scale fishing boats are then bought and preserved for export within the trawler, which then serves as a refuelling and security base for the pirogues, and in most cases, part of the secondary catches made by trawlers are sold to small-scale fishermen at the end of the sea trip. These common interests contribute to the depletion of coastal fishing zones through increased small-scale fishing effort and to the supply of poorer quality fish to the domestic market.

On the industrial fishing front, the most visible compensatory adjustable reaction is that of shrimpers. Due to the scarcity of hunted shrimp species, most shrimpers take advantage of their smaller mesh size (40 mm instead of 70 mm) to compete unfairly with fishing boats. Many of them exploit only fish and land very few shrimps on their return from sea trips. The use of shrimp trawlers for catching fish entails the rejection of great quantities back into the sea upon sorting, thus contributing to stock depletion. In 1998, the monitoring of the specific composition of nominal landings by shrimpers led the Fisheries Department to ‘downgrade’ many boats which had been issued a shrimp fishing license to fishing boats, because of the very limited quantities of shrimps landed over a period of several sea trips.

The ultimate measure taken by the authorities in charge of fisheries was to freeze the industrial fishing effort. While the measure is political, it is of little interest biologically. What was really called for was not a freeze but rather a reduction of the

fishing effort. And even then, the measure applied only to industrial fishing, while under-estimating the considerable fishing pressure exerted by small-scale fishing on the sea resources of the coastal zone. The following Table on the comparative evolution of small-scale and industrial fleets from 1980 to 1998 is clearly indicative of the progression in the degree of pressure exerted by industrial and small-scale fishing on sea resources respectively.

Table 18 Comparative analysis of the evolution of small-scale and industrial fishing boats

	INDUSTRIAL FISHING	SMALL-SCALE FISHING			
YEAR	National fleet	Foreign fleet	Total	Number of pirogues	Number of fishermen
1980	121	163	284	8 488	30 707
1985	154	85	239	5 100	41 770
1990	132	135	267	10 411	48 122
1994	137	102	239	9 632	52 498
1998	176	75	251	10 707	51 197

Source: MP/DOPM.

7.4 Average size monitoring

Table 19 shows how the evolution of the medium sizes of the main species is monitored. Some of the species described in the table have no matching medium sizes in the database either because no measurements were taken or because the number of measurements taken was not significant enough. In the year 2000, information was collected from fishing companies based in Dakar. The maximum size was indicated for each species together with the size at first sexual maturity. In order to better control the level of exploitation, the minimum size authorized for capture was indicated.

This table highlights the fact that authorized minimum sizes (in 1998) were in some cases inferior by far to the species' size at first sexual maturity. These provisions which threaten stock regeneration and sustainability of resource exploitation, are indicative of how intensively demersal resources are being exploited. In fact, it is noteworthy that the period covered by the table (1980 to 1998) corresponds, in the light of trends in density indicators since 1971, to the time when stocks of coastal demersal resources were already at a low level. These measures were reportedly an option taken to encourage increased landings and fewer rejections at the expense of resource regeneration for balancing purposes. This assumption is

confirmed by the increasing importance - though highly criticized - of the commercial category called **small fish for frying**, which are made up of juvenile and immature individuals of the demersal species, mainly captains.

Available data on average sizes, combined with that on authorized minimum sizes, tend to indicate that apart from the *thiékem,* the annual average sizes of which vary without being inferior to the size at first sexual maturity, all the species reported in the table are endangered. Actually, average sizes continue their regular decrease, which is encouraged by the authorization that individuals with minimum sizes inferior to size at first sexual maturity can be captured. This conclusion applies to species reported in the Table and for which data are not available on average sizes.

Corrective measures should be taken without delay on preservation, so as to avoid species extinction, which will be certainly followed by a *replacement phenomenon*, the consequences of which whether positive or negative on the fisheries, the predominant sector of the national economy, cannot be anticipated *à priori*.

Table 19 Evolution of average sizes (total length in cm) of landings of main export coastal demersal species at the Dakar port by icebox trawlers.

NAMES		Average Size	Size of First Sexual Maturity		Minimal Regulatory Size				
Scientific	Commercial	Maximum	1980	1985	1990	1995	2000		
Mycteroperca rubra	*Badèche*	100						***(>20)***	20
Pseudotolithus typus	*Captain*	120							
Pseudotolithus senegalensis	*Capitaine*	70	37,4	38,5	29	28,5	25,4	**33**	
Lutjanus spp.	Red Basses	40 à 90							
Argyrosomus regius	Courbine	150							
Penaeus notialis	White shrimp	23						**14**	
Plectorhyncus mediterraneus	Grey sea bream	60	31,8	29,1	27,5	26,8	26,1		
Sparus caeruleostictus	Pink sea bream	65	18,0	17,2	16,1	14,5	12,0	**23**	10
Epinephelus aenus	*Thiof*	115						***(>20)***	20
Pagellus bellotti	White sea bream	40	15,0	16,3	13,5	14,7	12,2	**14**	10
Cynoglossus canariensis	Sole	60						**34**	15
Pseudupenaeus prayensis	Red mullet	33						**13**	10
Galeoides decadactylus	*Thièkem*	45	22,3	14,8	16,3	15,1	14,8	**14**	

Source:CRODT and ENDA

7.5 Resource preservation constraints

About thirty years ago, West African sea resources were described as abundant; they are today partly over exploited. Such is the case of the coastal demersal community. This over tapping is followed by the deterioration of the marine environment and a sharp increase in demand as a result of population growth and supply for export markets.

Today, the pressure on resources has reached a critical level. This situation has been clearly confirmed by research findings on the one hand, and by the various diagnoses made by fishermen and the fishing industry on the other. Resource scarcity and competition have exacerbated conflicts both within small-scale fishing and between industrial fishing and small-scale fishing.

All those involved in the sector have acknowledged that the increase in global fishing effort and processing capacities unavoidably lead to over exploitation of sea resources. While solutions should be considered, it will be difficult to implement them due to various factors:

- insufficient measures for planning small-scale fishing that is turning in two-thirds of the catches and benefits from free access to the fisheries;
- difficult control of industrial fishing;
- shortage of financial means and human resources, notably for research and control;
- wrong perception of regulations by marine resource users;
- insufficient cooperation on matters relating to planned fisheries;
- the absence of clear objectives and responses in terms of sea resource planning.

In short, the absence of planning for sea resources, while fishing effort and processing capacities are expanding.

8. RECOMMENDATIONS

8.1 Sustainable management of Senegalese fisheries through resource preservation and product development

As it appears, the Senegalese fisheries sector stumbles over the internal contradictions of natural resource exporting industries. Those who favour increased capacity at the expense of higher productivity have to suffer tighter domestic and external competition and do not plead for balanced resource renewal. And yet, Senegalese fisheries appear to be capable of escaping this characteristic of 'rent culture'. Hinged on a dynamic small-scale sector and the expansion of the domestic market, the Senegalese fisheries sector has experienced endogenous development likely to protect them against possible external shocks. However, the 1980s marked a new stage in the history of the sector. In a structural adjustment context with poorly performing traditional exports, government interventions encouraged its growing connection to external markets. Historic legacy (presence of European fleets and export firms, distribution networks hinged on the European market etc.), favoured this development, but it is mainly attributable to the combination of two factors: the ability of small-scale fishing to adjust and the favourable signals sent out by both the market and official encouragement mechanisms.

The environment that favoured export growth also determined its structure. Because export growth was not the result of producers' spontaneous dynamics but rather that of external interventions, capacity expansion (of both fishing units and factories) prevailed over financial management and modernization of production tools. In order to meet a sustained demand, especially in the aftermath of devaluation, fishermen intensified their efforts on resources that were growing rare, notably as exporting industries processed little of their production and demanded huge volumes. In fact, the share of fresh or frozen whole products to total exports is rather higher than that involving more elaborate processing. Accordingly, exports should have grown quickly both in value and volume. But because certain stocks have been overexploited, export values increased more rapidly than quantities.

The various different signs of a crisis looming in the piscatorial sector gradually emerged. First, the limits inherent in renewable natural resource inelasticity caused raw material prices to soar. The sector of exporting industries, in a situation of over-capacity, could not resist it. Many enterprises, and perhaps the majority, are no longer profitable. While export-oriented fishing units benefited from high producer prices, lower productivity, however, raises fears that they might also experience operating deficits. Intensified fishing for export breeds raises fears of stock depletion and irreversible loss of biodiversity. Despite the dangers, the small-scale sub-sector continues to shun fishing for domestic-market breeds and go for export breeds instead.

Operating accounts of pelagic fishing units deteriorated as an immediate phenomenon, indeed while the critical phase of coastal demersal fishing has not yet occurred. In view of the importance of fish in meeting the population's protein needs, the threat of resource depletion is thus coupled with a threat to food security.

The liberalization of the international market for sea products is taking place against this background. Presumably, Senegal will loose some of the tariff advantages that it has enjoyed in the European market. This prospect seriously threatens the stability of its trade balance, which largely depends on exports of piscatorial products to Europe.

The deterioration of external competitiveness thus adds to the internal pressures of a non-sustainable production system. Under these circumstances, it is difficult to formulate policies that would guarantee operational sustainability while avoiding foreign exchange pressures. Room for such policies is all the more narrow as the two objectives are potentially divergent. At first sight, the sustainability of the fisheries sector calls for due care measures threatened by export objectives. In fact, perpetuation of non-discriminatory export support systems can no longer be considered in this context. However, given the commercial importance of Senegalese fisheries, there can be no *laissez-faire* option, which is likely to precipitate erosion of the sector's external competitiveness. **Between regulatory and market mechanisms, solutions to current constraints should be mindful of resource preservation and product development.**

While stocks are over-exploited, resource preservation must be treated in terms of environmental, social and economic objectives. Yet, whether it will alone restore in the medium term the financial position of enterprises facing more or less immediate difficulties is left to doubt. This observation applies both to exporting industries and pelagic fishing units or small-scale processing units. Hence, sustainable management of the sector - socially, ecologically and strictly economically - also calls for the institution of a series of measures aimed at reinforcing production development. As a result of the pressures exerted on resources, efforts should focus on increasing product value added without volume expansion, at for exports.

In the first analysis, resource preservation seems to justify a regulating power. With regard to 'commons'[6] like renewable natural resources, the simple play of competition may have environmentally and economically counter-productive effects. On the other hand, product development seems to require more market-based (or economic) instruments than support mechanisms. The latter were not compatible with maximum sustainable yield. A closer examination will reveal that government intervention may also have counter-productive effects on resources as evidenced by the history of export support mechanisms. Similarly, the creation of a flowing export market through the non-discriminatory granting of many advantages, did not necessarily translate into uniform economic performances. This fact is illustrated by the crisis in the processing component linked to the increase in the number of inputs. It is therefore necessary, for resource preservation and production development, to simultaneously set up market-based instruments and regulations, together with institutional measures to secure the participation of the people involved in the management of the sector.

[6] Resources which are not owned, either privately or by the state, are open for free use.

8.1.1 Resource preservation

Market-based or economic instruments

The market-based or economic instruments that are likely to facilitate resource preservation are also involved in access to the resources. Irrespective of the role played by external demand, it is also because access to resources was so free that export-oriented fishing units were able to exploit the stocks of coastal demersal resources beyond a maximum sustainable yield. Thus, notwithstanding the traditional regime of free access to natural resources, the question of their usage price should be raised with all the fishermen, starting with those responsible for demersal captures. **This question touches notably on the problems of quotas, fishing agreements and capture component support mechanisms.**

Quotas

With regard to **quotas**, individual quotas appear to be more efficient than global quotas. However, many obstacles complicate the institution of quotas in multi-specific tropical fisheries, and even more so when these fisheries are, as in Senegal, dominated by the small-scale sub-sector. Small-scale fishing is much less specialized than industrial fishing, which increases, with a quota perspective, the possibilities of rejections. To these technical obstacles must be added, in a developing country, the social inconveniences of such a policy. While developed countries can set up the accompanying mechanisms, what would become of small-scale fishermen who would not be allowed to benefit from transferable individual permits? For example, if it was agreed that out of the ten thousand or so pirogues that Senegal has, six or seven thousand permits would be issued, how would one choose who would be admitted into the system? In any case, such an arrangement could be efficient only if based on a schedule of landings according to the fishing seasons of targeted species and to handling facilities on the ground. On the other hand, going midway between free access and private ownership, one could also envisage a collective quota system put in place by the communities of fishermen. The Casamance and Saloum estuaries are the most suited sites for this type of arrangement, but some marine areas, like Kayar, could also be considered. Again, this possibility should be carefully studied and deeply debated at a time when there are growing conflicts between fishing communities.

Fishing agreements

The issue of the price of access to resources, calls into question the **fishing agreements** concluded with foreign fleets, starting with those binding Senegal and the European Union. European boat owners who first benefited from these agreements have a very reduced price of access to resources thanks to the financial counterpart granted by the European Commission. We have seen that these agreements were based especially on the principle of complementarity between national and foreign fisheries. And yet, if this principle continues to be justified for high seas pelagic fishing, it is no longer operational for coastal demersal fishing. In this case, various solutions can be considered for relieving the coastal demersal resources currently overexploited. First of all, one cannot ignore, given the level of resource exploitation, the possibility of not renewing these agreements. But it may also be possible to limit the agreements only to deep demersal and high seas pelagic resources. It would be also possible to increase

considerably the prices of licences granted to boat owners so as to deter the least profitable enterprises.

Capture component support mechanisms

In connection with the problem of the price of access to resources, a number of **capture component support mechanisms** need to be investigated. Many facilities for the acquisition of fishing units (reduced interest rates, reduced tax on motors, equipment and subsidized pirogue fuel price) were instituted. While pelagic fishing units should always benefit from these measures in view of their deteriorating operating accounts and their contribution to the country's food security policy, their maintenance for coastal demersal fishing units needs to be discussed. While these units are allowed to fish for endangered species under most favourable conditions, and their economic results improve, the possibility of reducing some of their advantages must be considered. Thus, the subsidized motor fuel price might now be applied only to purse seines and surrounding gill nets.

Regulating powers

In order for the authorities to exercise their regulating powers, there is a need to ensure the improved application of existing rules, and to enact new measures.

Enforcement of existing regulations

Before considering organizational measures based on quotas, the **existing regulations must be enforced,** especially those relating to stitch and marketed breed sizes. The use of small-stitch beach seines is still widespread, and especially in spawning areas (Bargny), in clear violation of existing laws. Similarly, incursions by industrial ships into the six-mile zone are still too frequent. All the professionals of the sector should be encouraged to reflect upon the reasons for such non-compliance with the laws, and consider ways and means for ending it.

New regulations

Concerning **new regulations**, the export of endangered species as whole products should be banned or surtaxed. A freeze on all fishing (small-scale and industrial) efforts on coastal demersals also would be desirable. Regarding industrial ships, the principle of a freeze on issuing licences must be respected, and dues must not be based on gauge tonnage but rather on the value of landed breeds. As far as small-scale fishing units are concerned, they might also be required to be licensed. Finally, in view of the growing conflicts between industrial and small-scale fishing, the limits of the area reserved for the latter might be extended beyond the six nautical miles.

Institutional measures

The measures necessary for the preservation of resources will have more chance to be effective if they are decided and applied with the involvement of all stakeholders – the professionals of the sector and all interested parties (fishermen, boat owners, fish processing women, researchers, NGOs, etc.).

Community consultation

Regarding, for example, the quota systems or community ownership rights, the latter not only implies internal **consultations within the communities** concerned, but also discussions with competing communities. In Senegal there are no longer any fishing areas remaining the prerogative of a single community. On the other hand, the authority of a community over a given fishing area could be recognized subject to being regulated and providing for mutual concessions. To that extent, some fisheries might be collectively organized.

Stakeholders

An effective stakeholder involvement also presupposes that those concerned should take on greater responsibilities. Thus, the **Licensing Committee might be consulted for a conform** and non-optional **advice**. As a rule, delegating management powers to this type of institution should increase the efficiency of organizational measures.

Structural cooperation

Lastly, the **structures charged with the preserving and marketing of resources should come closer** to each other. Thus, relations between Oceanographic Research Centre of Dakar Thiaroye (CRODT), who are in charge of studying the stocks, and the Economic Observatory of Senegalese Fisheries (OEPS) who are in charge of product competitiveness analysis might be institutionalized.

8.1.2 Product development

Government interventions

Government interventions, which are most likely to achieve piscatorial product development, should be in the form of constructing infrastructures, providing support to some fisheries and taking prohibition measures.

Constructing infrastructure

With regard to **infrastructure**, the programme on the construction of fishing wharves is likely to reduce post-capture losses. It should be complemented by a programme to create parking areas for fish and seafood wholesalers, and arrange security sites devoted to small-scale fish processing. Such measures would make it possible to improve the working conditions of fish processing women, sanitation and product quality and increase profitability. It will at the same time contribute to the food security policy. The installation of storage infrastructures in the main small-scale processing centres aims for the same objectives. The improvement of existing roads and the construction of new ones at the national and sub-regional levels would also help to better develop piscatorial production.

Fisheries support

As for **support to some fisheries**, the revival of semi-industrial sardine fishing would provide more raw materials to high value added industrial processing (canned fish, freezing etc.), without competing with small-scale fishing (products of smaller size). It would extend the range of products exported to Africa. Organizing a system for collecting the rejections from the industrial fishing units using pirogues assembled

in secondary coastal surveillance centres, would contribute to increasing the available quantities for the domestic markets and small-scale processing.

Prohibition measures

The packaging and processing components being in a clear situation of excess capacity, **a freeze on new plants** is recommended. Failing which, the arrival of newcomers attracted by falling rents might bring about the bankruptcy of all the owners. At the least, support measures should be applied only to the most performing companies in terms of value added.

Ice subsidy

An ice subsidy would reduce the costs of fish trade considerably and contribute to improving product quality, notably for the rural populations

Market-based mechanisms

Market-based mechanisms and economic measures are also likely to increase the value of production. These include in particular tax and customs incentives, measures facilitating the use of technologies adapted to industrial and small-scale processing, and systems designed to support market exploration.

Tax and customs harmonization policy

It is advisable **to grant the tax and customs advantages associated with free exporting company status in proportion with industrial product value added**. Such a measure offers the advantage of reconciling external competitiveness and the sustainable management of resources. On the other hand, the persistence of tax barriers hinders the circulation of sea products within regional customs unions despite lower customs duties. It is therefore necessary to **negotiate, at the sub-regional level, a customs and tax harmonization policy** that would profit all states.

Credit incentives

Financial incentives particularly in terms of credit, might facilitate the acquisition of **technologies adapted to industrial and small-scale processing**. As far as small-scale processing is concerned, its yields and quality and 'healthiness' might be improved through distribution of CHORKOR and PARPAING ovens, handling tools and storage infrastructures. Concerning industrial processing, the preparation of fillets, fish steaks or peeled shrimps requires relatively simple, cheap and labour-intensive technologies. Incentive mechanisms might facilitate their diffusion.

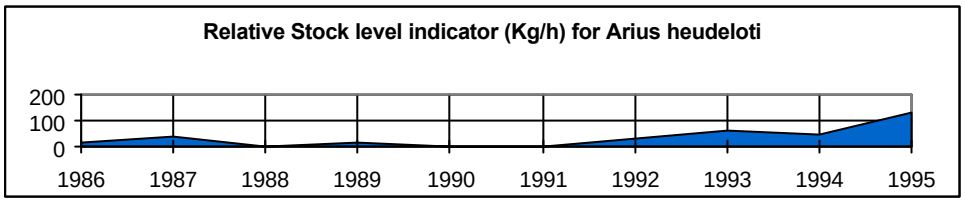
New market access

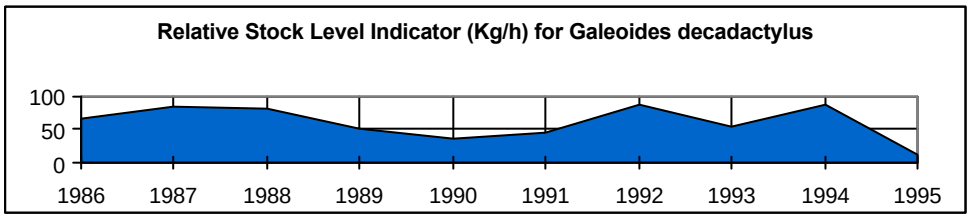
The penetration of **new markets** – African, Asian and American could be eventually favoured through the study of their specific features. Technical obstacles and those relating to the consumers' tastes might thus be surmounted by **research**.

APPENDIX 1

Chart Series on Relative Stock Levels Indicator of Scientific Evaluation of Resources Through Trawling (1986 to 1995)

Chart Series 1





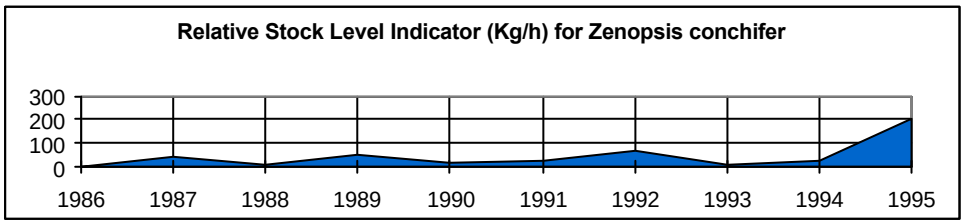
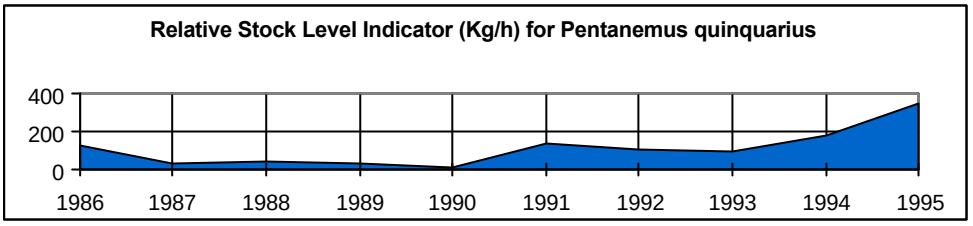
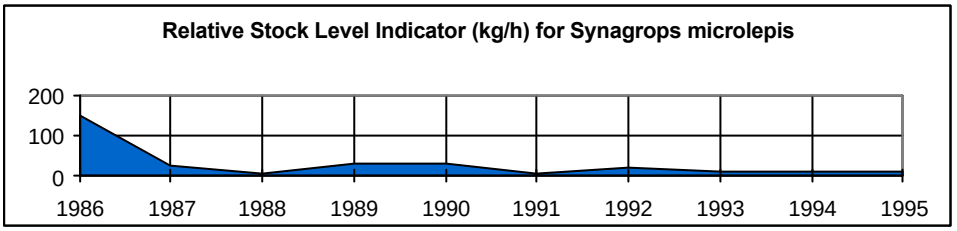
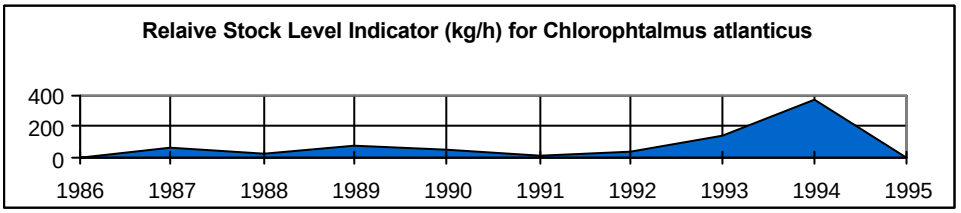


Chart Series 1 continued







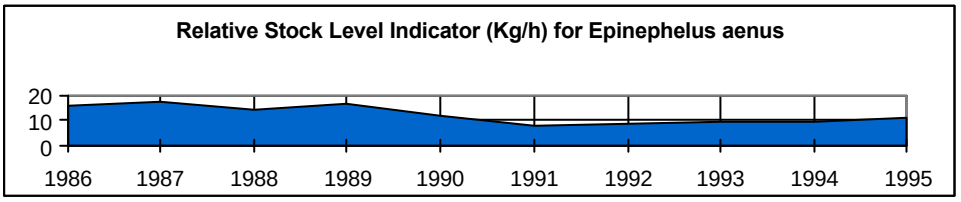
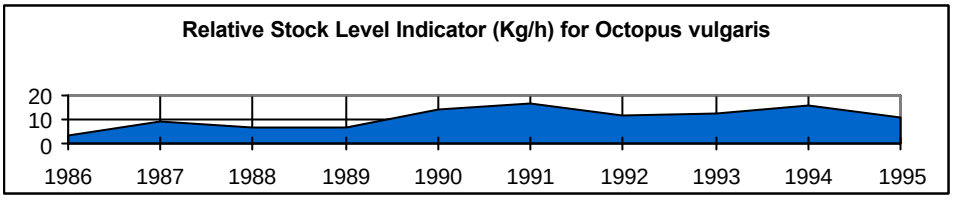
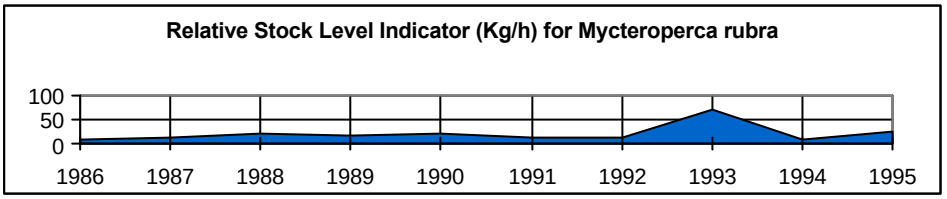
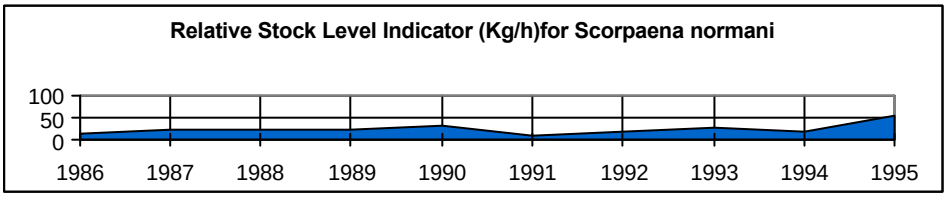
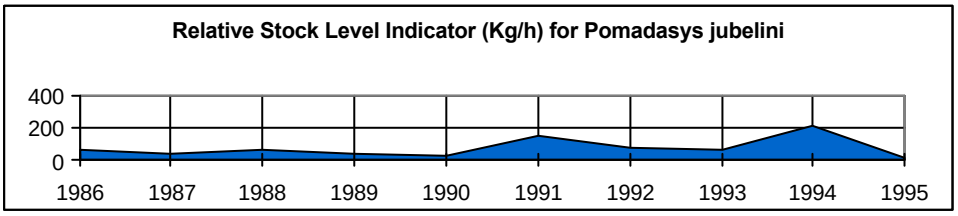


Chart Series 2









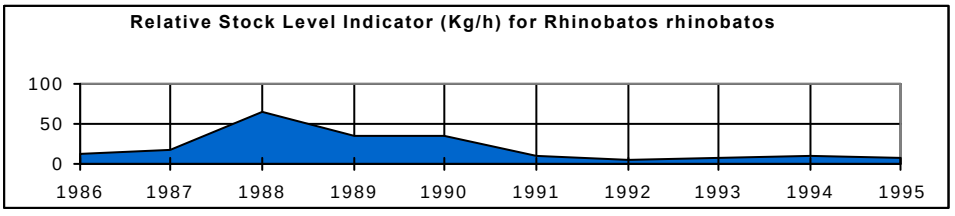
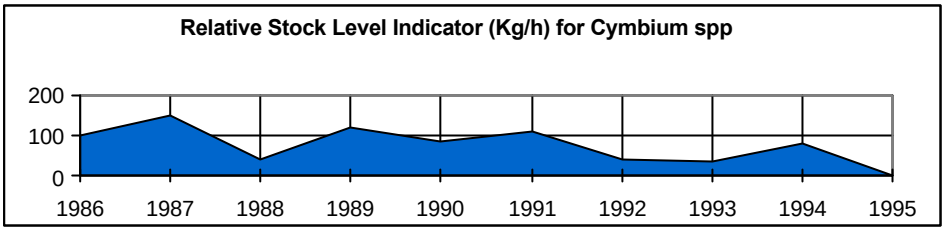


Chart Series 2 continued



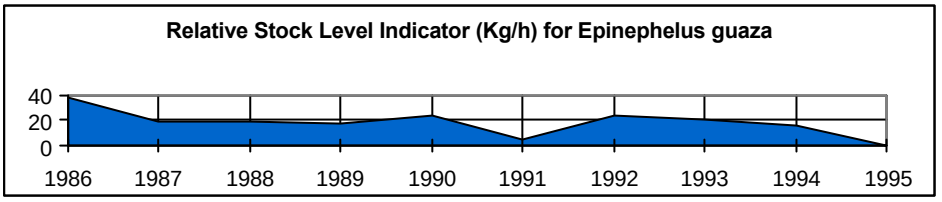
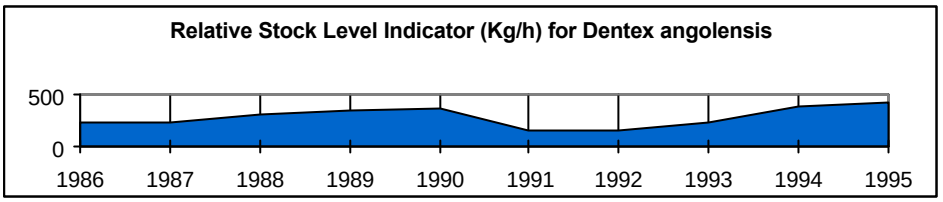
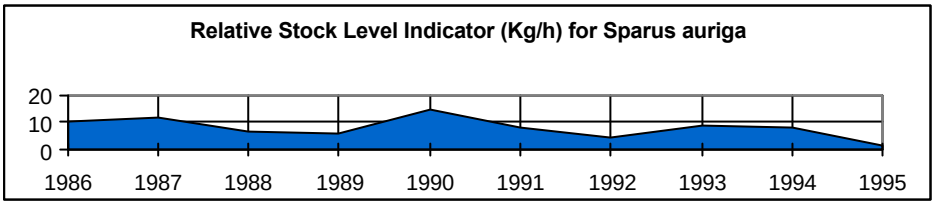
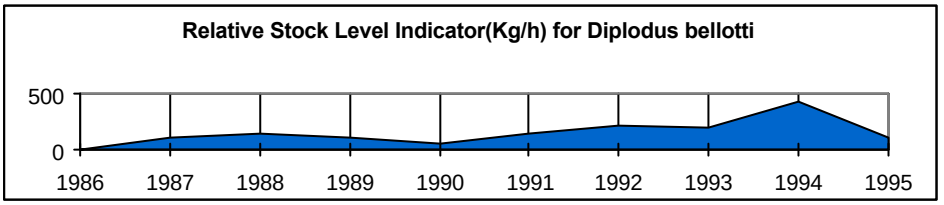


Chart Series 3







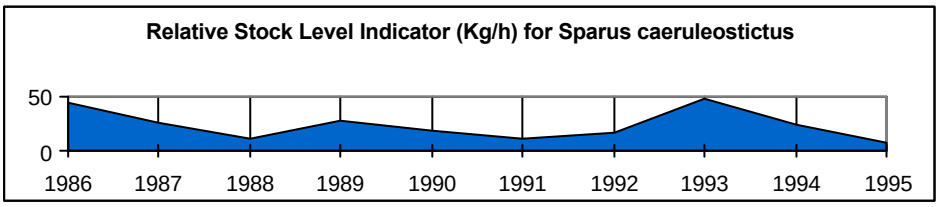
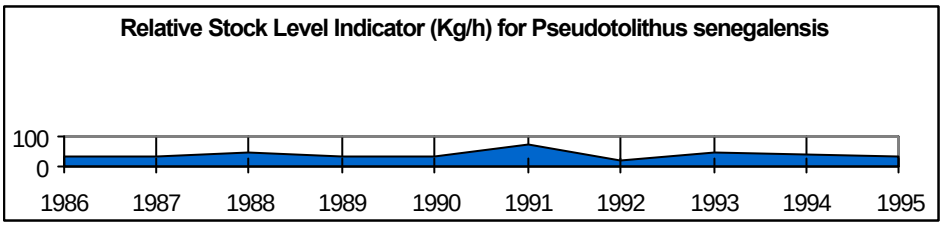
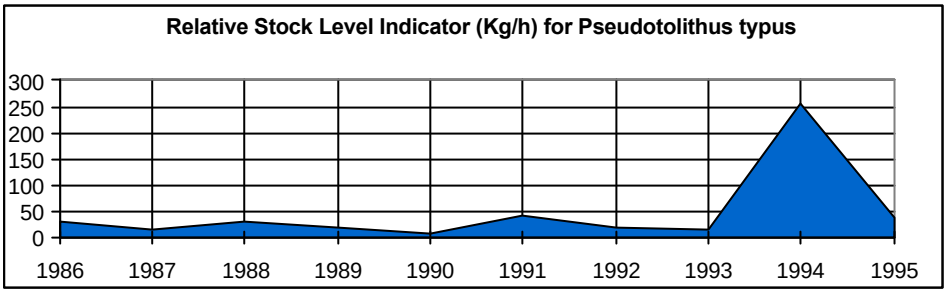
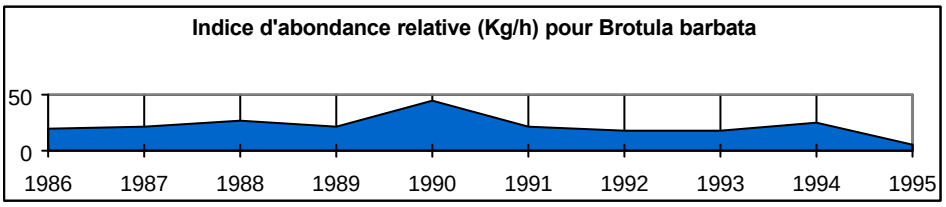
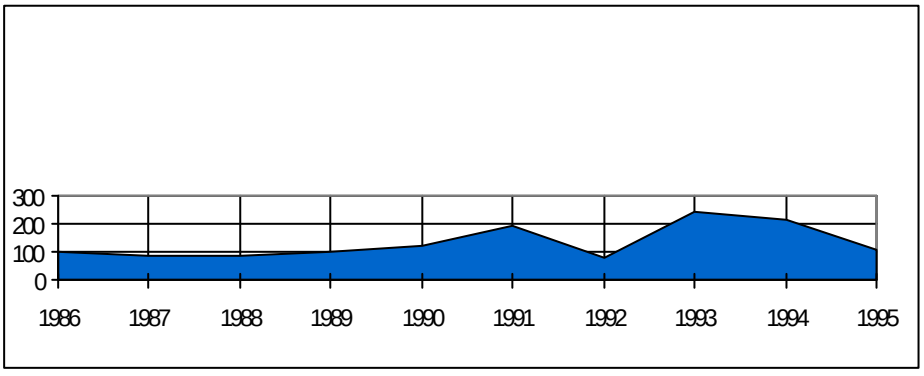


Chart Series 4





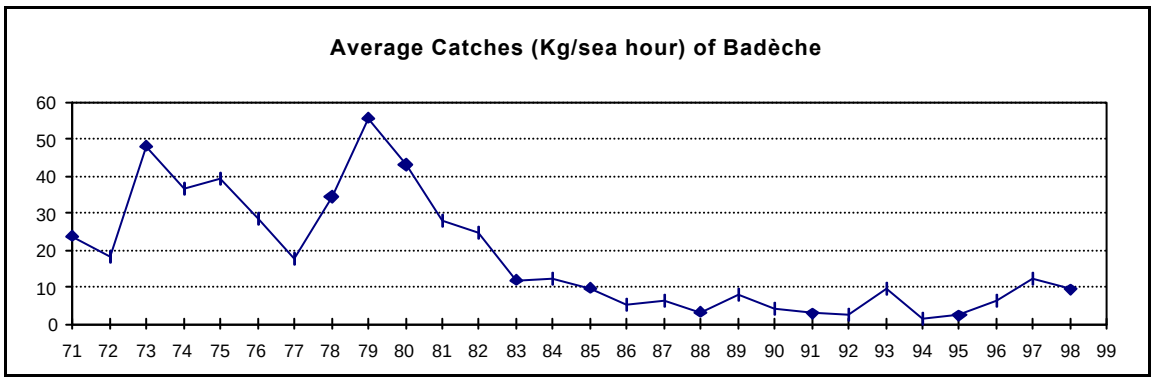




APPENDIX 2

Chart Series on Fishing Statistics for the Dakar-based Icebox Trawlers (from 1971 to 1998)

Chart Series 5



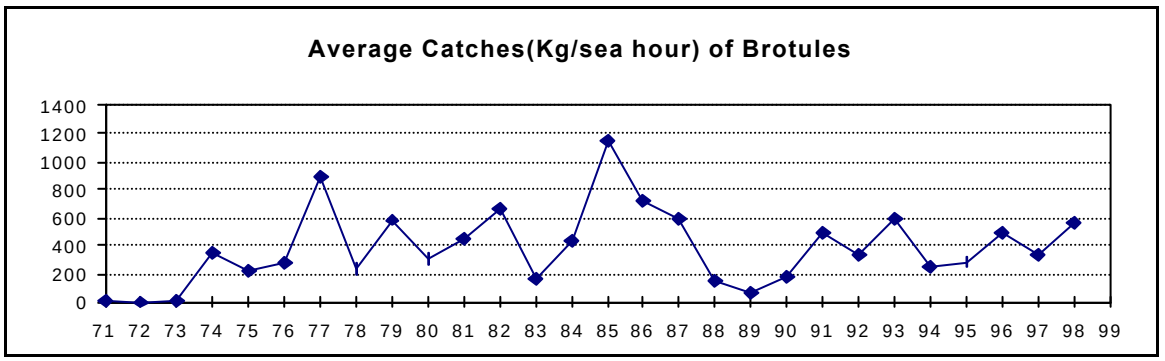
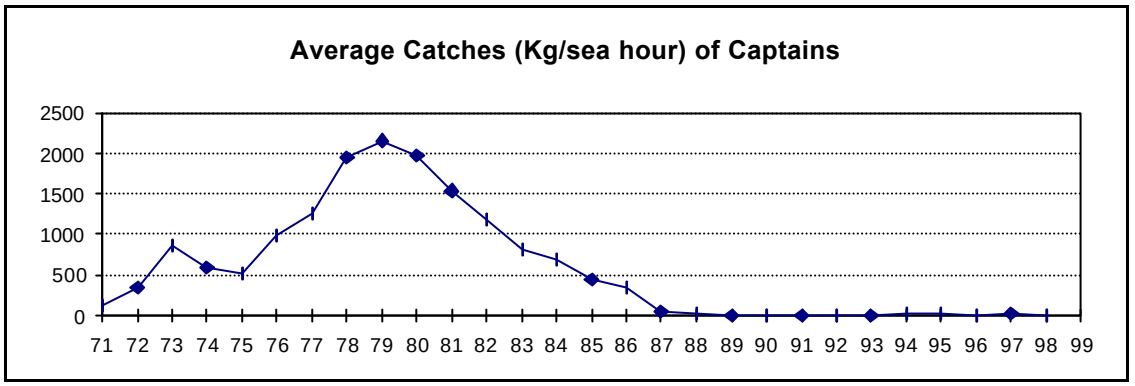


Chart Series 5 continued



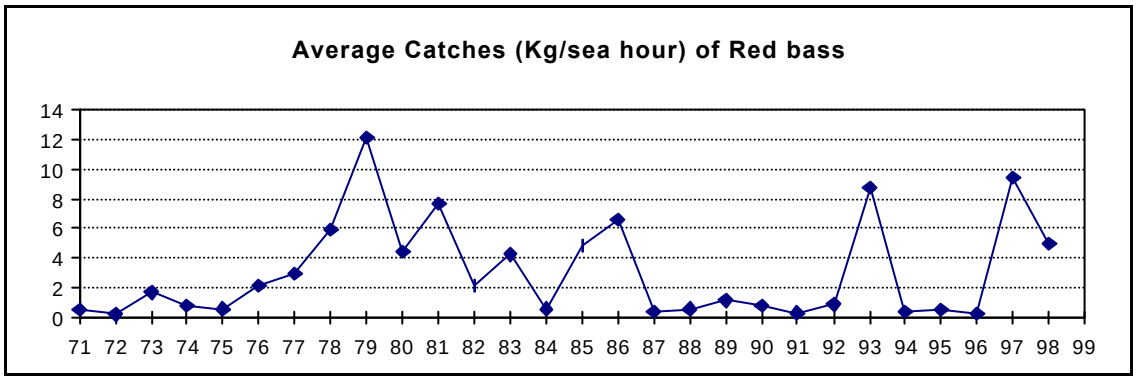
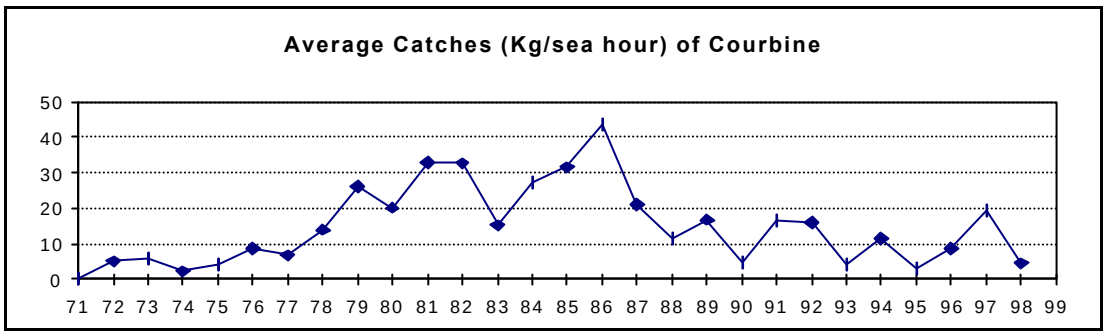
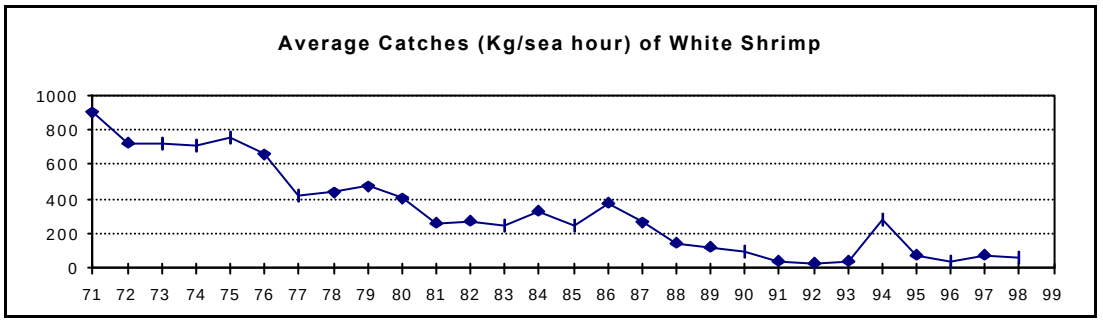
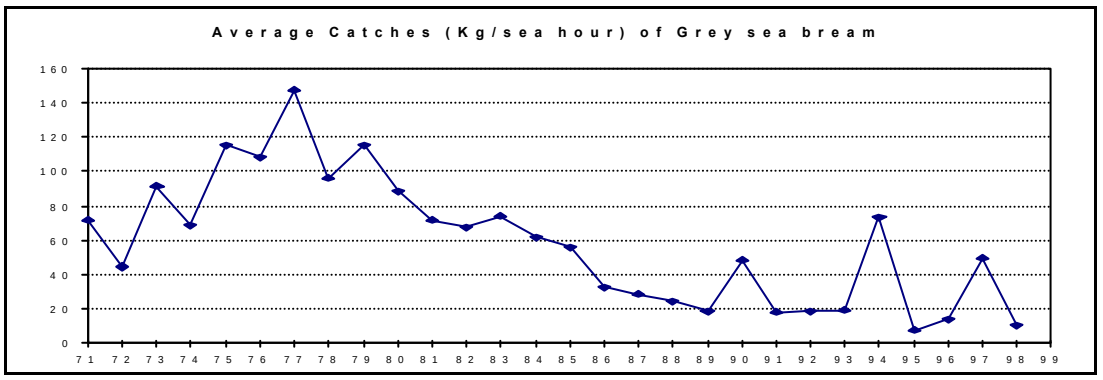


Chart Series 6







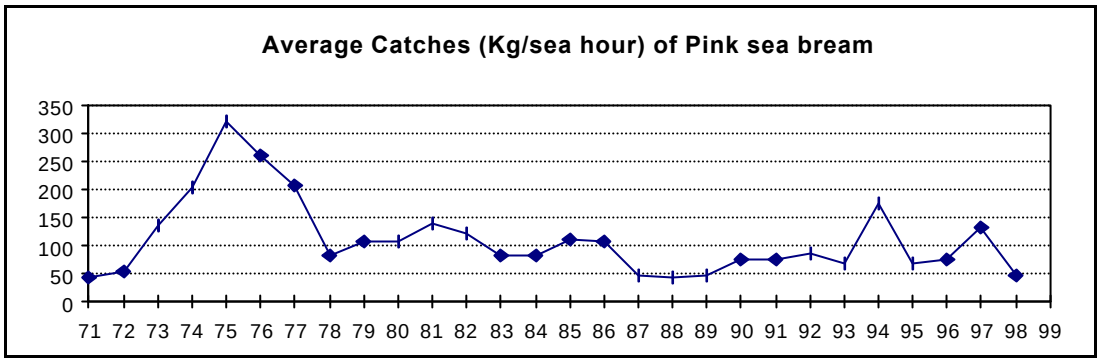
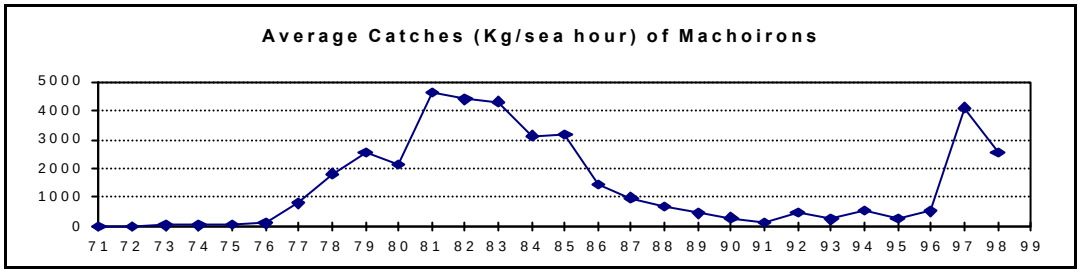
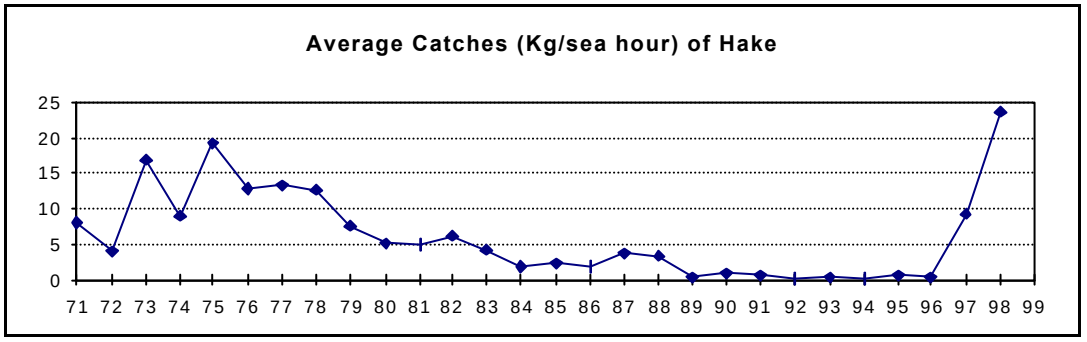
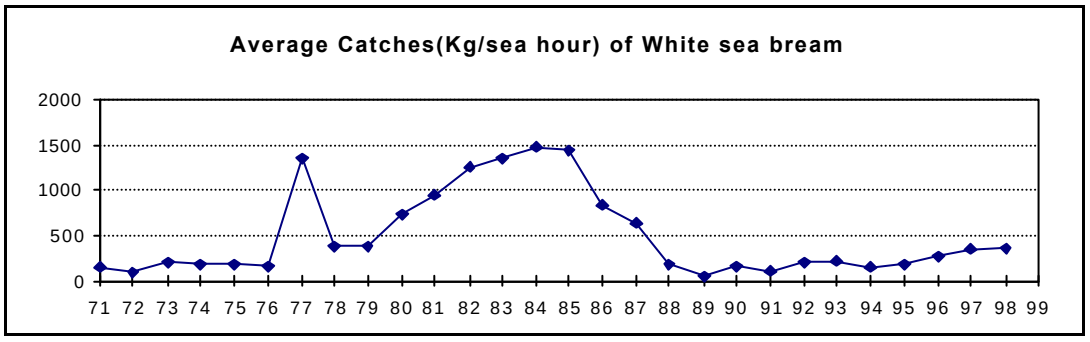

Average Catches (Kg/sea hour) of Pink sea bream
350
300
250
200
150
100
50
0
71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

Chart series 7







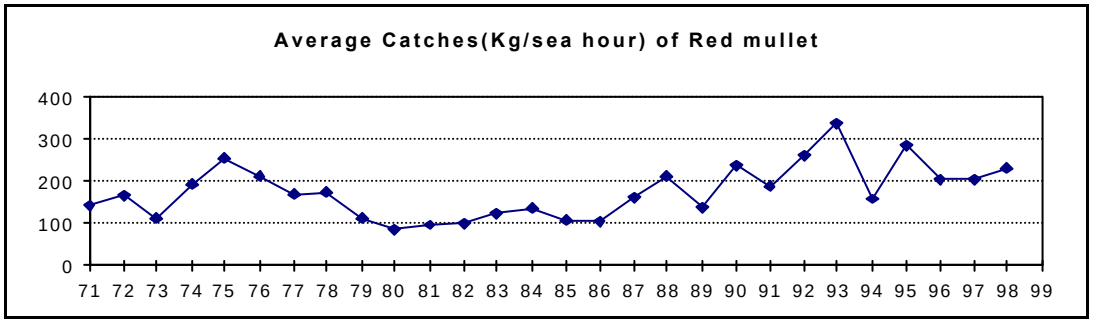
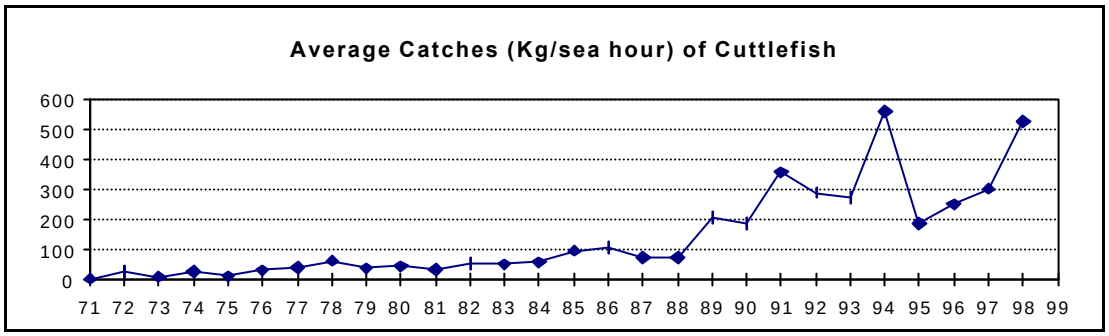
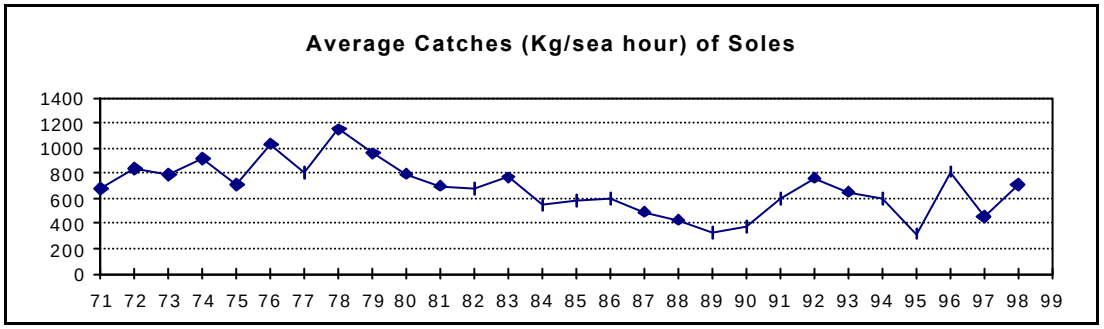
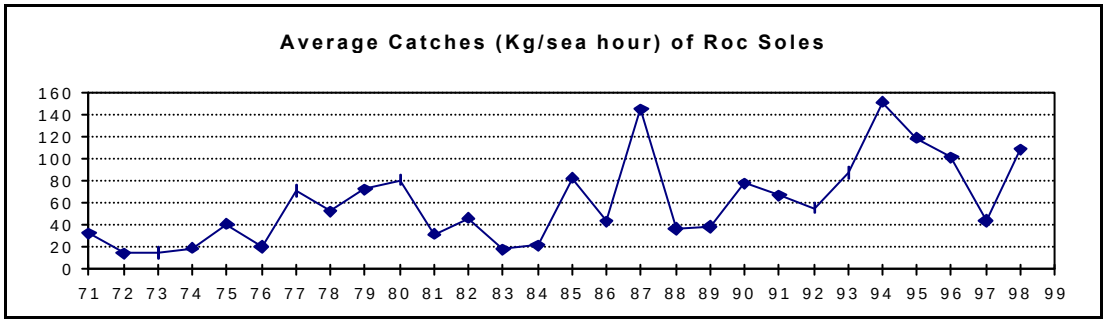


Chart Series 8







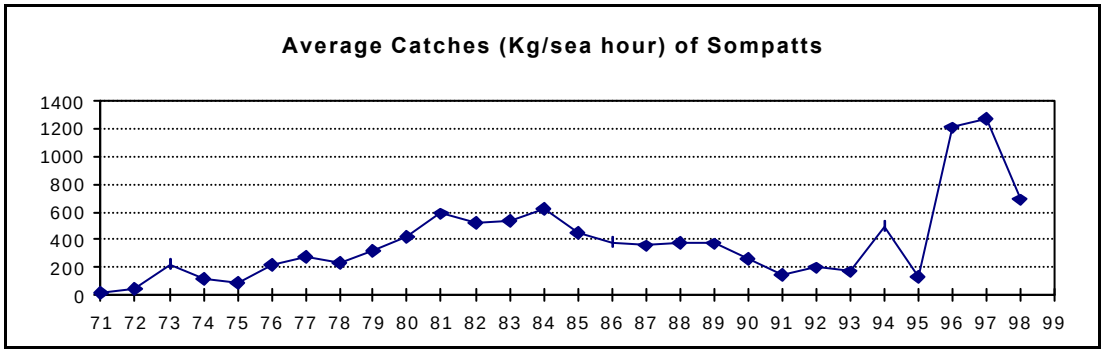
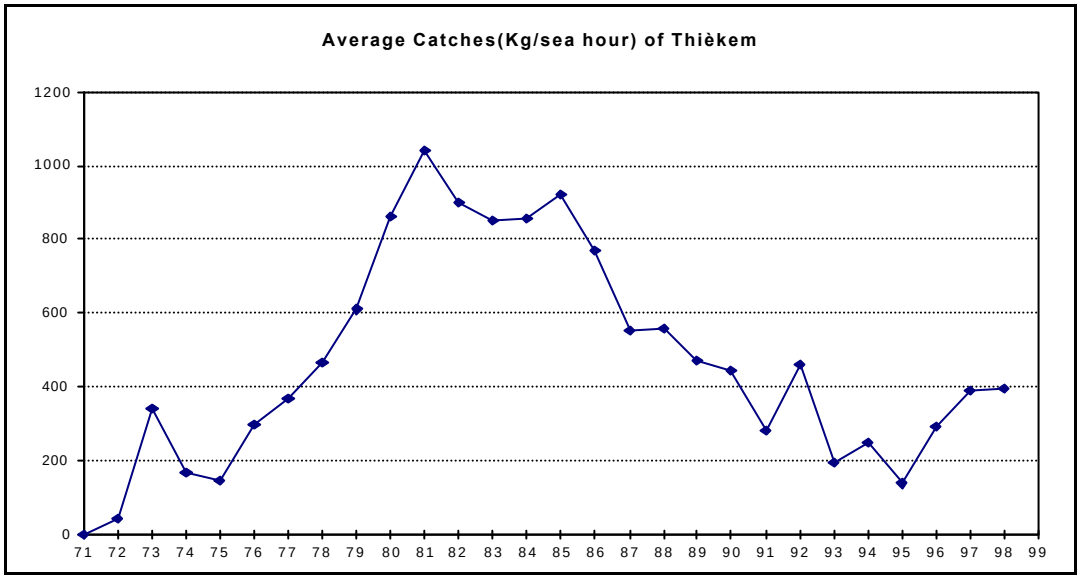
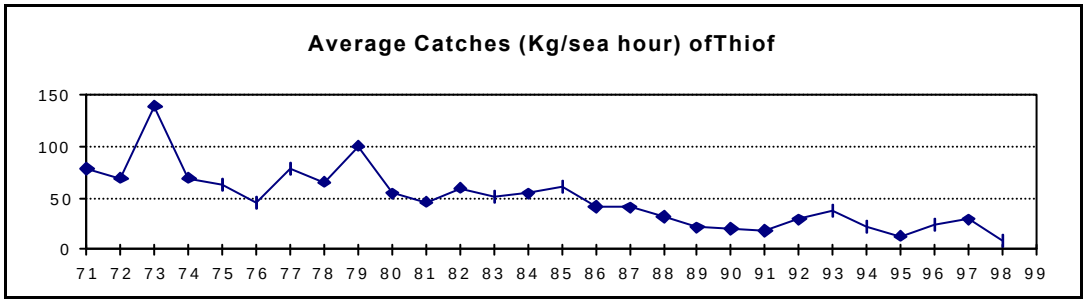


Chart Series 9





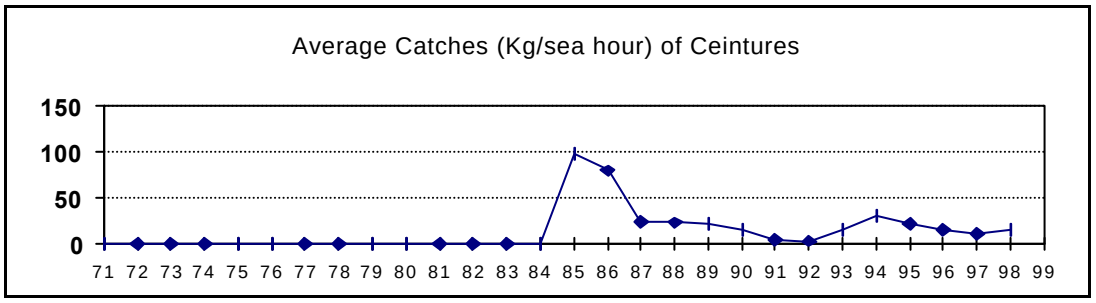
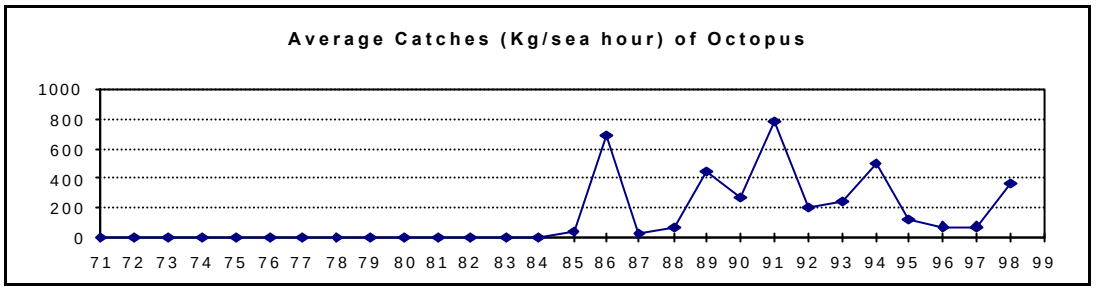


Chart Series 9 continued



APPENDIX 3

REFERENCES

AGC. 1998. Etude d'évaluation du projet de diésélisation du centre d'assistance, d'expérimentation et de vulgarisation pour la pêche artisanale (CAEP), Juillet, 38 pages.

Chaboud C. 1983. Le mareyage au Sénégal. Doc. sci. Cent. Rech. océanogr. Dakar-Thiaroye, 87, 112 pages, 52 tabl., 40 fig. + biblio.

Chaboud C. 1985. La commercialisation des débarquements de la pêche artisanale, commerce " traditionnel " et projets de développement, l'exemple sénégalais. Communication à l'atelier FAO/COPACE sur le développement et l'aménagement des pêches artisanales en Afrique de l'Ouest, Lomé, Togo, 20 au 29 Nov. 1985, 32 pages.

Chaboud C. and Kébé M. 1985. L'amélioration de la manutention et de la distribution du poisson à terre. Evaluation d'un essai de vulgarisation de containers isothermes. Communication à la consultation FAO des experts sur la technologie du poisson en Afrique, Luzaka (Zambie), 21 - 25 janvier 1985, 10 pages, 1 fig., tabl. + ann.

Chaboud C. and Kébé M. 1989. La distribution en frais de poisson de mer au Sénégal. Commerce traditionnel et interventions publiques, cahiers des sciences humaines 25 (1-2)

Chaboud C. and Kébé M. 1987. Les relations entre producteurs et commerçants ou les mareyeurs sont-ils des exploiteurs ? Le cas du Sénégal, Symposium ORSTOM-IFREMER, la recherche face à la pêche artisanale, ORSTOM 1991.

Chauveau J. P. 1984. La pêche piroguière sénégalaise. Les leçons de l'histoire, Revue de mer.

Chauveau J. P. 1984. Histoire de la pêche maritime et politiques de développement de la pêche au Sénégal, Anthropologie maritime.

Chauveau J. P. and Laloe F. and Samba A. 1987. Du schéma d'aménagement à ses résultats réels : "l'effet informel" dans l'aménagement des pêches artisanales

sénégalaises. Symposium ORSTOM-IFREMER la recherche face à la pêche artisanale.

Coly H. 2000. Valorisation des pertes après capture des pêches maritimes au Sénégal. Mémoire de fin d'études du CNFTPM, juillet 2000, 29 pages + annexes.

CRODT. 1994. Les pêcheries demersales côtières, artisanales et industrielles, au Sénégal : Analyses Comparatives des aspects biologiques et socio-économiques : Perspectives d'aménagement. Groupe ABC-SEPIA, 95 pages.

CRODT-DOPM-OEPS . 1997. Recensement national du parc piroguier et des infrastructures liées à la pêche. Vol. I : Résultats. Document de travail, 45 pages

Dème M. 1988. Etude économique et financière de la pêche sardinière sénégalaise. Document Scientifique du CRODT, 107, 66 pages.

Dème M. et Levenez J. 1989. L'exploitation des petits pélagiques au Sénégal : réponse de la recherche à la crise sardinière. In : La Recherche Face à la Pêche Artisanale, Symp.Int.ORSTOM-IFREMER, Montpellier France, 3-7 juillet 1989, J-R.Durand, J.Lemoalle et J.Weber (eds).Paris, ORSTOM, 1991, t.II : 657-669.

Dème M. and DIOH B. C. 1993. Aménagement, législations et développement des pêches artisanales au Sénégal. Bilan et analyse d'impact. Contribution au symposium sur la méhodologie d'évaluation des ressources exploitées par la pêche artisanale au Sénégal. CRODT. Dakar, Sénégal.

Dème M. 1999. Etude de la rentabilité économique et financière des pêcheries céphalopodières artisanales sénégalaises. Document préliminaire présenté au Collogue « Le poulpe commun Octopus vulgaris du Sénégal et des côtes nord-ouest africains », Dakar, Sénégal, 14-18 février 2000, 18 pages.

Dème M. 1991. Les politiques d'investissement et d'intervention de l'Etat Sénégalais dans le secteur des pêches : problématique générale et actions de recherches. Document Scientifique du CRODT, 128, 27 pages.

Dème M. 1996. Etude financière des activités de transformation artisanale et semi-industrielle du poisson au Sénégal - Groupe ABC, 20 pages.

Dème M. and Kébé M. 1996. Commercialisation du poisson frais au Sénégal : perspectives d'amélioration- INFOPECHE, 24 pages.

Dieng O. et al. 1998. Organisations informelles de contrôle de l'effort de pêche tout le long du littoral sénégalais. Rapport FUCID et CREDETIP, 52 pages + annexes.

DOPM. Résultats généraux de la pêche maritime sénégalaise, année 1980 à 1998.

Faye M. 1990. La transformation à Joal : organisation, principaux produits. Rapport interne, PRO-PECHE COMPOSANTE ATEPAS, 17 pages.

ICTSD 2000, *Fisheries, International Trade and Sustainable Development, Legal Framework,* Natural Ressources, Intenational Trade and Sustainable Development Series No 2

INFOPECHE 1990. Valorisation des captures de la pêche artisanale en Afrique de l'Ouest : commercialisation des produits de la pêche. Rapport technique INFOPECHE, septembre 1990, 116 pages.

IRD. Marchés, politiques publiques et dynamiques d'exploitation des petits pélagiques en Afrique de l'Ouest,, Rapport d'activités de l'UR 3 1998-199.

IRD. Changement technologique dans la pêche artisanale sénégalaise, rapport d'activité de l'UR 3 1998-1999.

ISRA. 1995. Planification stratégique de la recherche agricole : zone maritime, Document de travail du CRODT, 102 pages.

ITA. 1986. Etude et identification des caractéristiques techniques et socio-économiques de l'amélioration du secteur de traitement artisanal du poisson au Sénégal, Phase I du Projet ITA – ALTERSIAL de développement de la technologie au Sénégal.

KA S. 1991. Expérimentation sur les améliorations techniques dans la transformation artisanale du poisson au Sénégal, Document technique sur les pêches n° 10, PRO-PECHE COMPOSANTE ATEPAS, 43 pages.

Kébé M. 1982. L'approvisionnement en poisson de la région du Cap-Vert. Communication à la consultation FAO des experts sur la technologie du poisson, Casablanca, (Maroc), 7 - 12 juin 1982. In Doc. sci. Cent. Rech. océanogr. Dakar-Thiaroye, 84, 55 - 90.

Kébé M. and Chaboud C. 1985. Commercialisation du poisson frais dans les régions intérieures du Sénégal. Bilan provisoire, Arch. Cent. Rech. océanogr, Dakar-Thiaroye, 144, 22 pages.

Kébé M. 1987. Effets nos prévus des interventions pour le dévelopment, L'exemplement de la pêche cordière au Sénégal, Symposium ORSTM-IFREMER la recherche face à la pêche artisanale.

Kébé M. and Dème M. 1996. Filière pêche artisanale: rentabilité, exportations et consommation locale. Atelier de restitution « Impact de la dévaluation sur les revenus et la sécurité alimentaire au Sénégal », Novotel-Dakar, 23 février 1996, ISRA-PASE/ Institut du Sahel-PRISAS, Document Technique 96-02, 14 pages.

Kébé M. 1997. Coûts et revenus en pêche artisanale : résultats du suivi d'unités de pêche à Hann (Sénégal). Rapport DIPA, 23 pages.

Levesque P. 1992. Expérimentation de nouvelles techniques (four Chorkor) et améliorations de techniques existantes (pour Parpaing et au sol). DTP n° 8/ATEPAS, 57 pages + annexes.

Mbengue M. 1992. Synthèse des expériences d'introduction des fumoirs Chorkor et Parpaing réalisées au Sénégal. R.P./ATEPAS N° 22, 47 pages.

Mongruel R. 1998. Les pêcheries africaines face à la libéralisation du commerce international, *La pêche en Afrique*, Afrique Contemporaine.

Porter G. 1997. "The Euro-African Fishing Agreements : Subsidising Overfishing in African Waters", Background Paper for UNEP/WWF Workshop : *The Rôle of Trade Policies in the Fishing Sector*, Genève, UNEP.

Porter G. 1997. The Euro-african fishing agreements : subsidizing overfishing in African waters, UNEP.

Porter G. 1998. *Fisheries Subsidies, Overfishing and Trade*, Environment and Trade Series Paper, Switzerland, UNEP.

Schann M.A. 1994. Transformations artisanales des produits de la pêche: quel avenir dans les pays en voie de développement? Thèse de doctorat vétérinaire, Ecole Nationale Vétérinaire de Toulouse, 115 p.

Solignac Lecomte H.B. 1999, Lomé V et le commerce ACP-UE : quels enjeux pour les pays de la francophonie ? (Rapport 9) Maastricht, ECDPM.

Sene A. 1985. Les transformations sociales dans la pêche maritime piroguière: conditions de travail et modes de vie des pêcheurs de Guet-Ndar de Saint-Louis du Sénégal, thèse de doctorat de Sociologie, Université de Toulouse Le Mirail, 706 p.

Sene and Diouf F. B. 1987. Le tourisme international: étude géographique de impact sur la Petite Côte (Sénégal), IFAN, UCAD, 318 p.

UNEP 1999, Environmental Impact of Trade Liberalisation and Policies for the Sustainable Management of Natural Resources *A Case Study on Uganda's Fisheries Sector*, Geneva.

UNEP 1999, Environmental Impact of Trade Liberalisation and Policies for the Sustainable Management of Natural Resources *A case Study on Bengladesh's Shrimp Farming Industry*, Geneva.