

30 Years of shark fishing in west africa

MIKA DIOP
JUSTINE DOSSA





“To help my husband with the upkeep of the house and the education of our children, I very quickly dedicated my energies to the fish processing business.

In my desire to earn lots of money, I got involved in the drying and selling of Shark products. It has to be said that the demand for shark meat was very high. In parallel, I also had a sardine smoking activity. But that was really secondary until the day the exploitation of Shark products was forbidden. The situation became very difficult because there was a big difference to make up for. I no longer had the choice, so I devoted myself more to sardine smoking.

I have to say that at first the situation was not easy. I had to rent an oven for 3000 CFA francs a day to be able to smoke my products. Now that the project has provided us with ovens, I only have to rent one when those ovens are being used by other members of our group, and I have noticed a significant reduction in the costs required to smoke my products, as well as an improvement in their quality. My customers are pleased.”

*Mrs Gnima Sarr,
Fish processor
based in Joal (Senegal)*

A joint initiative by the



30 years of shark fishing in West Africa

Development of fisheries, catch trends,
and their conservation status in Sub-Regional
Fishing Commission member countries

Mika Diop
Justine Dossa



Preface



The Sub-Regional Fisheries Commission (SRFC) has included among its priorities the promotion and development of cooperation among its Member States for the preservation, conservation and sustainable exploitation of fisheries resources. To achieve its fundamental objectives, the SRFC focuses on concrete actions on the ground, the capacity of governments and civil society. It contributes to the debate on the future of fisheries for the benefit of present and future populations of the sub-region. Fishing in the SRFC area is characterized by overexploitation of stocks. The case of the Sharks characterized by slow growth, longevity and late reproduction, is instructive. Landings are plummeting because of the strong pressure on these species. This is reinforced by strong demand for fins on the world market. Hence the introduction of a Sub-Regional Plan Of Action for the Conservation and Management of Sharks (SRPOA-Sharks). Implemented by the SRFC with the financial and technical support of FIBA, the plan was broken

down into national action plans implemented in the Member States. Thus, management plans have been initiated, a study was conducted on alternative conversion specialized actors in the chain and concrete actions Sharks conversion determined in each country. The SRPOA-Sharks project has been instrumental in achieving the objectives of the Plan of Action Strategy 2002-2010 for the SRFC. The recorded results are eloquent enough to magnify the approach whose principles have been conducive to the implementation of political thought and consistent. It is now up to Member States of the SRFC to answer relevant and coordinated to sustain the gains.

KANE Ciré Amadou
Permanent Secretary of the SRFC



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Context



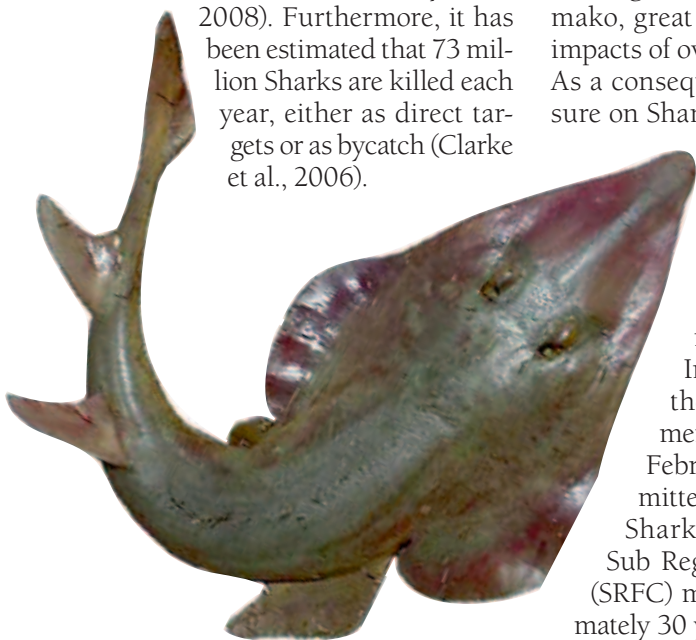
THE CLASS CHONDRICHTHYES (sharks, rays and chimaeras) includes some of the most charismatic species found in our oceans. However, this is not enough to save these remarkable fish from the widespread, intensive and short-sighted fishing practices implemented to satisfy the demand for shark fins by the Asian food market. Of the more than 1,100 currently known Chondrichthyes species, more than a quarter are threatened, mainly due to overfishing, but also because of coastal development, habitat loss and pollution. Currently, only one quarter of the species are considered to be “in good health” according to the IUCN Red List (IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. www.iucnredlist.org. Downloaded on 08 March 2011.).

Sharks¹ represent a significant marine resource for many cultures and communities throughout the world. Unfortunately, a great number of ray and shark species are intensively fished globally. Many authorities

1. In this report, the term ‘Sharks’ is used in *sensu lato* and refers to all the species in the class Chondrichthyes (sharks, skates, rays and chimaeras). This terminology corresponds to that used by the International Plan of Action for the Conservation and Management of Sharks, IPOA-Sharks, adopted by the FAO Committee on Fisheries in February 1999. In this document, we use Shark(s) with a capital ‘S’ to refer to all Chondrichthyes species, and sharks with a small ‘s’ to refer to sharks themselves.

are worried about the increasing catch of Sharks and the impact of this increase on certain species found in several ocean zones throughout the world (FAO, 2001). The European Union's Plan of Action for the Conservation and Sustainable Management of Sharks describes the current situation in the following terms: "The Chondrichthyes [...], commonly called "Sharks", have been subject to increasingly intensive fishing practices since the middle of 1980s, due to higher demand for Shark products (in particular shark fins, but also shark meat, skin, and cartilage), especially for the Asian markets. Between 1984 and 2004, worldwide shark catches increased from 600,000 tons to more than 810,000 tons (EU, 2009).

According to the U.S. Department of Commerce, Shark catches amounted to 800,000 tons per year, which represented about 0.6% of worldwide fishing in 2002 (IWMC, World Conservation Trust, 2002). In 2000, worldwide Shark catches were estimated to be nearly 900,000 tons in three years (2003). There was a decrease in the amount of sharks, rays, and chimaeras caught, which was estimated to be 750,000 tons in 2006, or 15% less than the maximum level (anonymous, 2008). Furthermore, it has been estimated that 73 million Sharks are killed each year, either as direct targets or as bycatch (Clarke et al., 2006).



The impact on sharks is particularly substantial for a number of reasons. Many shark and ray species are coastal, and are therefore directly impacted by coastal fishing activities, currently characterised by an increased fishing effort, a low degree of selectivity, and overcapacity in terms of the fishing fleet. In a global context in which many commercial fishing stocks are exhausted, Sharks represent a meat resource that is consumed in many countries. Furthermore, bycatch of sharks by deep-sea fisheries has been increasing over the past 15 years.

Sharks are also particularly vulnerable to overexploitation. Due to their life history characterized by low fecundity, slow growth and late sexual maturity, they have a low capacity to recover once their populations have been overexploited. These species, which play a very important role in maintaining balanced marine ecosystems, are also threatened by overfishing and illegal fishing. For example, according to the IUCN Red List (IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. www.iucnredlist.org. Downloaded on 08 March 2011.), a number of species are Critically Endangered, Endangered (e.g. basking shark) or Vulnerable (e.g. shortfin mako, great hammerhead) due mainly to impacts of overfishing and bycatch.

As a consequence of this increased pressure on Sharks, the countries represented by the FAO Committee on Fisheries created a working group for their conservation and management (1995). This group's recommendations led to the drawing up and adoption of an International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) in February 1999, by the FAO Committee on Fisheries, (FAO, 2001).

Sharks have been fished by the Sub Regional Fisheries Commission (SRFC) member countries for approximately 30 years. Prior to this the smoked

or salted and dried meat of the selachians (or *Elasmobranches*, a large subclass of cartilaginous fishes including the sharks, rays, dogfish, and skates) caught in this area (essentially sharks) was for the local market only. However, beginning in the 1970s, an export market opened up in response to the high demand for selachian fins in Asian countries, offering attractive prices that encouraged the development of Shark fishing throughout the world. In the sub-region, the Shark trade originated in Gambia, with a rapid and regular increase in the fishing effort (more boats with more efficient fishing gear). The activity then quickly developed in the rest of the SRFC zone, mainly in the form of artisanal fishing (SRFC, 2003). However, the trend towards lower yields and the decreasing profitability of these activities – despite the high added-value of shark fins – quickly demonstrated that the sustainable management of these selachians could not be guaranteed, which in turn forced certain groups of fishermen to migrate seasonally towards more remote fishing zones.

The SRFC member states, aware of the risks of the fast disappearance of Shark stocks, and its impact on the ecosystems, formalised their commitment to develop a strategy for Shark conservation and sustainable management in the sub-region with the Sub-Regional Plan of Action for the Conservation and Management of Sharks (SRPOA-Sharks). The SRFC adopted the plan in 2001, and it was launched the following year. The plan is divided into a number of sections, including research, field studies and surveys, development of management measures, methods for their applications, and the standardisation of actions and management rules at the sub-regional level. A four-year project (2004-2007) was set up to facilitate its implementation, with international funding, SRFC management guidance, and technical support from the FIBA. The project enabled the action plan to be implemented through the development of pilot activities and demonstrations to

mobilise partners and stakeholders in the field. During this time period, significant progress was made in terms of improving knowledge of Shark populations, monitoring fisheries, characterising specialised fishing sites, and describing the stakeholders directly involved in Shark fishing. In-depth studies on the development of Shark fisheries were conducted in all SRFC member states.

This document summarises the findings made during the first stage of implementation of the SRPOA-Sharks, which corresponds to Phase One of the Regional Marine and Coastal Conservation Programme for West Africa (PRCM). The second phase of the project was launched in 2008, and therefore some of the items assessed in this report include the period from 2004 to mid-2009, when required by the analysis.

Part One of this report presents the fishing context – particularly regarding Sharks – in West Africa, as well as the SRPOA-Sharks Project – its goals, activities, major achievements, and impacts.

Part Two contains an analysis of the studies carried out at the national and sub-regional levels: a description of the specialised Shark fishing sites, trends in the catch and the biological characteristics of the species caught using artisanal fishing methods, an assessment of the bycatch of Sharks by industrial fisheries, and a study of intra-regional migration by Shark fishermen.

Finally, Part Three describes the conservation status of Sharks and the initial conclusions drawn from these observations. The final section 'Conclusions and prospects' explores the challenges for the future in terms of managing Shark fisheries in the sub-region.

To make this document easier to read and understand, the strategic process put in place within the framework of the SRFC sub-regional plan of action is called the 'SRPOA-Sharks Process', whereas the project itself is called the 'SRPOA-Sharks Project'.

Part one.

The SRPOA-sharks project - inception, achievements and impacts



FISHING IN THE SRFC ZONE: A VITAL SECTOR

FISHING PLAYS A CRUCIAL ROLE in SRFC member states. The EEZ of the SRFC member countries is about 1,550,000 km², with an average annual fish catch estimated to be 1,500,000 tons, of which only 25% are demersal species² (SRFC, 2007). This catch represents 1.8% of the global fish catch, estimated to be 82 million tons in 2006 (FAO, 2008)³. The stocks of demersal and pelagic⁴ fish are, in many cases, being fished at full capacity, or are overfished.

In recent years, West Africa has experienced very heavy coastal human migration pressure. For the SRFC member countries, the population was estimated at 35 million people in 2007⁵. This population is predicted to reach nearly 76 million by 2050.

2. Species dwelling in the deep sea, like sea bream, white grouper, meagre, cephalopod mollusks and shellfish, and certain species of rays and sharks.

3. [ftp://ftp.fao.org/docrep/fao/011/i0250e/i0250e01.pdf](http://ftp.fao.org/docrep/fao/011/i0250e/i0250e01.pdf), consulted on 9 January, 2010.

4. Species dwelling near the surface, like tuna, sardines, sardinella, mackerel, chinchard horse mackerel, and certain species of sharks.

5. State of the World in 2007. Unleashing the Potential for Urban Growth, UNFPA, 2007. <http://www.unfpa.org/swp/2007/english/notes/indicators.html>, consulted on 13 September 2009.

Figure 1. Location of the SRFC member states



Based on World Resources Institute⁶ calculations, the percentage of the current population living within 100 kilometres of the coast in SRFC member countries is estimated to be 78.4%. This ‘coastalisation’ of the populations has resulted in a higher pressure on the coastal environments and a higher demand for marine resources.

Pressure from fishing activities is high (there were 30,000 dugboats/canoes and an industrial fleet of 1,000 boats in 2007, (Diop, personal communication). Many of the target species migrate along the coast, and are not generally confined to the waters of a single country (e.g. sardinella, tuna, and other pelagic fish). Therefore fishermen must also migrate, which makes cross-border resource management and the formulation and implementation of appropriate development policies very difficult.

6. World Resources Institute, Page, 2000. <http://earth-trends.wri.org/text/coastal-marine/variable-63.html>, consulted on 15 September 2009.

Artisanal fishing, supported by international cooperation programmes, plays an increasingly significant role in the impact on fish populations in the SRFC member countries. In the late 1990s, nearly 2/3 of the annual catch was from industrial fisheries, versus 1/3 from artisanal fishing. Today, these two sectors are nearly identical: approximately 700,000 tons come from artisanal fishing, and a little under 800,000 tons are taken from industrial fishing (see Table I).

It has not been possible to control the increase in artisanal fishing boats, especially in Senegal and Mauritania, where catches are increasing for international and sub-regional markets. As a result, there are now some 30,000 pirogues (16,000 motorised), 60% of which are in Senegal and 20% in Mauritania (see Table II).

As the numbers of artisanal boats have increased, the number of industrial boats has remained largely stable (except in

Table I. Average of fish caught by industrial fisheries and artisanal fishing in SRFC member countries, in tonnes

Catches (in tonnes)	Cape-Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone	Total
Total artisanal fishing	4 200	30 000	57 000	26 306	89 700	385 902	116 600	709 708
Total industrial fishing	3 800	10 000	42 000	44 720	807 300	42 000	15 800	965 620
Total catch	8 000	40 000	99 000	71 026	897 000	427 902	132 400	1 675 328

Sources: MAAP, 2005; GFD, 2005; CNSHB, 2005; IMROP, 2006; DPM, 2006; MFMW, 2005; COPACE, 2003 et 2005.

Senegal), and the problems in this sector (high levels of bycatch and discards, and impacts on threatened species) remain unresolved.

The combination of overcapacity, as described above, and increased performance (e.g. the use of GPS) resulted in decreasing yields in the 1990s (Josse and Garcia, 1986; FAO, 1988; Chavance *et al.*, 2004) and contributed significantly to the overfishing of demersal species. The rapid development of this sector had a negative impact on the status of fisheries resources in the countries in the sub-region, and is cause for concern. According to Chavance *et al.* (2004), 2/3 of the stocks of main demersal species exploited in the area are either close to their MSY (maximum sustainable yield), meaning that there is no room for further increase in the fisheries, or already overfished.

At the same time, the fisheries play an important role in State economies: it contributes to 43% of the export revenues and nearly 5% of the GDP in Mauritania, nearly 3% of the GDP in Gambia, and 21% of export revenues in Senegal (see table III). Fish products also play a very important role in terms of food security, as in Cape-Verde, where the average consumption per inhabitant is 25 kilograms per year. The fishing sector contributes significantly to the socio-economic development of the countries in the sub-region via job creation, food, and exports. It generates some 1,000,000 direct and indirect jobs – in particular more than 189,000 artisanal fishermen – 1.45% of jobs in these countries. On average, 4% of the active population in the SRFC zone are directly employed by fishing activities. In Sierra Leone, this figure is more than 5% despite the lack of modernisation in the artisanal

Table II. Industrial fishing fleets and artisanal fishing in the SRFC zone (2010)

Flottes	Cape-Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone	Total
Industrial fishing fleets	197	30	191	121	323	130	100	1 092
National or nationally-based boats	77	0	22	3	211	117	40	470
Foreign boat licenses *	120	30	169	118	112	13	60	622
Artisanal fishing fleet	1 267	1 700	3 636	1 000	4 800	13 420**	7 000	32 823
Percent motorised	73%	37%	29%	22%	97%	79%	3%	52%
Number of motorised pirogues	925	629	1 054	216	4 686	7 165	210	14 885

* More licenses are available. ** Seules 8 991 pirogues sont actives.

Sources: DGP, 2005; GFD, 2004; CNSHB, 2005; DGPA, 2006; IMROP, 2006; DPM, 2006; MFMW, 2006.

Table III. Importance of the fishing sector in the budgets of SRFC member states (2010)

Indicators	Cape-Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone	Total
Percent of GDP	1,52 %	2,68 %	0,43 %	5%	6%*	1,4%	N.D.	
Value of exports (M \$US)	0,55	0,31	33,30	0,20	169,03	313,49	18,10	534,94
Contribution to exports	0,99%	0,24 %	4,48 %	3,9%	43.45%	21.53%	0%	
Contribution to the State budget	N.D.	N.D.	2,5%	6,71%	6%**	1,7%	0,9%	

N.D.: not determined

* According to the 2005 FAO/PMEDP study, the contribution to GDP of the artisanal fishing sector alone was estimated to be 4.1%.

** Excluding the community fishing agreement. By including the fishing agreement with the European Union, this contribution amounted to 25% in 2003.

Sources: IMF, 2006; World Resources Institute, 2006; WB, 2006; FAO Country Profiles; national statistics institutes.

Table IV. Jobs in the fishing sector in the SRFC member countries(2010)

Indicators	Cape-Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone	Total
Jobs in the fishing sector	9 100	30 000	84 200	16 000	36 000	220 000	125 000	520 300
Number of artisanal fishermen	4 380	47 00	80 000	3 113	30 000	59 500	25 000	206 193
Percentage of jobs in the artisanal fishing sector	48 %	16%	95%	19%	84%	27%	20%	39%
Percentage of fishermen in the active population	4,6%	4,5%	2,5%	2,2%	3,1%	5%	5,2%	4%

Sources: IMF, 2006; World Resources Institute, 2006; WB, 2006; FAO Country Profiles; national statistics institutes.

fishing sector. On average, artisanal fishing accounts for 38% of the fishing sector jobs (see Table IV)⁷.

Analyses of data obtained within the framework of the SRPOA-Sharks Project show that Shark fishing is an important source of employment in the fishing sector. In 2008, some 13,000 jobs were estimated to be directly generated by Shark fisheries: nearly 7% of the jobs

generated by artisanal fishing. The value of Sharks landed was estimated to be 8,500,000 euros per year from 2005 to 2008: nearly 3.5% of the value of exports of fish products, which was reported to be slightly more than 250,000,000 Euros (350,000,000 US dollars) (see Table III). This percentage is significant if we keep in mind that the declared Shark catch by the small scale fisheries (24,000 tons in 2010) accounted for 1.6% of the average annual fish landed in the fishing sector, which was reported to be 1,473,900 tons per year (see table I).

7. <http://www.csrpsp.org/presentation/presentation.html>

Table V. Estimation of the direct and indirect jobs generated by Shark fishing in the SRFC countries (2008)

Indicators	Cape-Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone	Total
Fishermen	20	900	1 250	68	1 800	600	3 000	7 638
Processors		100	53		400	3 015	400	3 968
Fish smokers			77			32		109
Total jobs	20	1 000	1 385	68	2 200	3 647	3 400	12 720
Value of fish landed (in euros)		58 104	2 125 175		1 878 452	3 477 397	993 326	8 532 454

Source: Synthesis of the results of surveys on the development of Shark fisheries in SRFC member countries, SRPOA-Sharks Project, 2008.

CONTEXT AND JUSTIFICATION OF THE SRPOA-SHARKS PROCESS

According to the FAO, over three-quarters of global fish stocks and at least 90% of Shark stocks are overexploited (FAO, 2001). The contrast between these two estimates can be explained by the rapid and continued increase in fishing effort targeting these vulnerable species during the second half of the 20th century. It is also related to the increasing standard of living in South East Asia and globalised trade, which have resulted in a higher demand for shark fins; fisheries have developed throughout the world, attracted by this product's high commercial value (up to 100 US dollars per kilo).

The same pattern is evident on the West African coast. Shark fishing has increased rapidly in SRFC member countries. The sub-region's Shark fishing industry originated in Gambia in the 1970s. Centred initially in Gambia and the mouth of the Sine Saloum delta in Senegal, fishing activities soon developed in Mauritania to the north, and Casamance (Senegal) and Guinea Bissau to the south in the 1980s, then Guinea and Sierra Leone in the 1990s.

Sharks were not generally targeted by coastal fishermen in the sub-region prior to the 1970s. Sharks caught as incidental

bycatch were processed (salted, dried) and traded with the rural populations in the Sine Saloum region for various grain products. Sharks were only occasionally subject to targeted fishing, and were sometimes used for cultural and ceremonial purposes (on the Bijagos islands). Attempts were made at semi-industrial targeted shark fishing in the 1940s on the Petite Côte in Senegal, but it failed due to a sharp reduction in yield.

Specialised artisanal fishing only developed in the early 1970s within the Ghanaian community in Gambia. Originally carried out by about sixty fishermen, the fishery developed rapidly to also include fish-processing; the salted and dried meat was subsequently exported to Ghana. The Ghanaian processors bought the shark bycatch from nearby fisheries, such as those run by the Lebou and Niyominka peoples in Senegal. This first successful fishery triggered the subsequent interest in Sharks, which was immediately boosted by the growing numbers of shark fin buyers in the late 1970s. The fishing business boomed in the 1980s. However, faced with the almost immediate drop in yields, some fishermen were forced to migrate to distant fishing areas.

Another important driver of the increase in Shark fishing in the sub-region was the



Sharks caught aboard a boat in Cape Verde (I. Ndiaye)

devaluation of the CFA franc in 1994. This immediately meant that products produced in the CFA zone were highly competitive globally and greatly increased the commercial value of fishing products exported from the 'franc zone'. As fishing activities increased, fishing zones moved further south, with many fishermen from Saint-Louis in Senegal targeting Sharks as far south as Sierra Leone. In the sub-region today, with the exception of Cape Verde, resources seem to be fully exploited, if not overexploited, for almost all selachian species.

ORIGINS OF THE SRPOA-SHARKS PROCESS

Concerned by the global status of Sharks, the FAO Committee on Fisheries created in 1995 a working group to tackle

the problem. Recommendations from the group resulted in the creation and adoption of the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) by the Committee on Fisheries in February 1999. The goals of this strategic instrument were firstly to improve the statistical information available and the capacity to describe and monitor the status of Shark populations, and secondly to set up conservation and management measures when needed (see the text box on the IPOA-Sharks in Appendix 2).

In light of increasing awareness of the risks of rapid depletion of Shark stocks and the consequences of this depletion on biological diversity, the SRFC member states decided, in agreement with the recommendations made by the IPOA-Sharks, to create a Sub-regional Plan of Action for the Conservation and Management of Sharks (SRPOA-Sharks). This plan was adopted in 2001 by the Conference of Ministers

of the SRFC, and its effective implementation began in 2004 with the SRPOA-Sharks Project. This was in combination with other provisions, mechanisms, and programmes concerning access to fishing zones and the management of marine resource utilisation in the member states. The SRPOA-Sharks Process falls within the framework of the SRFC's 2002-2010 strategic plan of action (see text box on this Commission in the Appendix).

Between 2004 and 2007, within the framework of the PRCM, activities of the SRPOA-Sharks Project focused on the conservation, monitoring, and sustainable management of Shark populations, with funds from the MAVA Foundation and the Dutch Embassy in Dakar. In addition to the mechanisms set up to monitor trends in shark resources and the actions performed to regulate shark fishing, several studies were carried out on other issues relating to the shark industry in the sub-region.

To effectively contribute to the success of the SRPOA-Sharks Project, each country was required to create its National Plan of Action (NPOA-Sharks), inspired by the Sub-Regional Plan of Action. This began in 2003 with technical support from the FIBA for the drafting of NPOA-Sharks documents. The official NPOA-Sharks review process started in 2005. First, the NPOA-Sharks documents were distributed to the various concerned parties (administrators, researchers, fishermen, fish processors, and wholesale fish merchants), and then workshops were organised in each country. Currently, five out of seven NPOA-Sharks have been reviewed (Senegal, Guinea, Mauritania, Sierra Leone, and Guinea-Bissau); these documents have been approved by the governments involved (texts published in the official bulletins giving details of laws and official announcements), showing encouraging commitment on the part of the member states to shark conservation. In Cape-Verde, NPOA-Sharks goals have

been given official backing by integrating them into national development plans.

SUPPORT PROJECT FOR THE IMPLEMENTATION OF THE SRPOA-SHARKS PROCESS

1. Goals and organisation

In line with SRFC mandate and mission, the project supported the implementation of the SRPOA-Sharks. The intervention strategy focused on conservation issues and responsible management of Shark populations at the regional level. Additional support was made to Member States to assist with the implementation of national plans.

1.a. Goals of Phase 1

During Phase One of the project, special attention was paid to three main goals:

1. supporting the implementation of the SRPOA-Sharks Process and the production of tools for Shark population management;
2. developing a pilot programme to transition people out of Shark fishing industries to other activities;
3. Through outreach and communication actions, share the best conservation and sustainable management practices acquired through the project with the participants.

Many activities have been carried out to achieve these goals. Before describing these activities, we will briefly present the intervention strategy adopted to perform them.

Project architecture and intervention strategy

The SRFC administers the implementation of the SRPOA-Sharks Process for the Minister of Fishing through the National Plans

of Action for the Conservation and Management of Sharks (NPOA-Sharks). To better coordinate the SRPOA-Sharks Project activities, it was considered necessary for each country to have its own NPOA-Sharks programme, defining the actions to be carried out and the goals to be achieved. These National Plans of Action also define an intervention strategy and an implementation framework. Each NPOA-Sharks is coordinated by either the Fisheries Department or research institutes in the specific countries. These NPOA-Sharks programmes then feed into the SRPOA-Sharks Project to help achieve its goals.

Information gathered by the research institutes in Mauritania, Guinea, Guinea Bissau, and Cape Verde, and Fisheries Departments and Bureaus in the Gambia, Senegal, and Sierra Leone by interviewers, scientific observers, students, and consultants are analysed. This work provides the basis for creating management and development measures proposed to the fishery ministries at the national level, and to the SRFC for standardisation at the sub-regional level.

Partner institutions in the SRPOA-Sharks Project in the seven SRFC countries include:

- Guinea Bissau: CIPA (Centro de Investigação Pesqueira Aplicada / Centre of Applied Fishing Research).
- Gambia: FD (Fisheries Department).
- Cap Verde: INDP (Instituto Nacional de Desenvolvimento das Pescas / National Institute of Fishing Development); DGP (Fisheries Directorate).
- Mauritania: DARO (Direction de l'aménagement des ressources et de l'océanographie / Directorate of Resources Management and Oceanography) and IMROP (Institut mauritanien de recherches océanographiques et des pêches / Mauritanian Institute for Oceanographic and Fisheries Research);
- Guinea: CNSHB (Centre national des sciences halieutiques de Boussoira / Boussoira National Centre for Halieutic Sciences).
- Senegal: DPM (Direction des pêches maritimes / Directorate of Marine Fisheries).
- Sierra Leone: FD (Fisheries Department).

Integration in the PRCM and synergy with other SRFC projects

The SRPOA-Sharks Project is one of the flagship projects in the PRCM and SRFC programmes. It is also one of the SRFC's most visible projects, thanks to effective communication and the considerable efforts made to create management tools and to standardise shark conservation legislation.

Within the framework of the PRCM, the SRPOA-Sharks Project is part of the fishing component, which aims to "promote joint management frameworks that guarantee the sustainable exploitation of halieutic resources, respect ecosystem integrity and functioning, and participate in socio-economic development". The activities carried out in this component of the SRPOA-Sharks Project are exemplary in terms of the commitments made by the national institutions concerned (Fisheries Departments, research centres) and by those involved in the fishing industry. In synergy with the PRCM's other projects (creation of Marine Protected Areas, joint management of shared migratory stocks, for example), the project also contributes by identifying critical habitats and possible sanctuary zones, initiating dialogue on the development of fisheries, and supporting the SRFC in its implementation of coordination mechanisms, linking research activities and fishing regulations.

through these initiatives have contributed to attaining the PRCM fishing component's goals.

In addition, the different countries involved have agreed to make important efforts to create their own NPOA-Sharks, even if the implementation of these National Plans of Action differ.

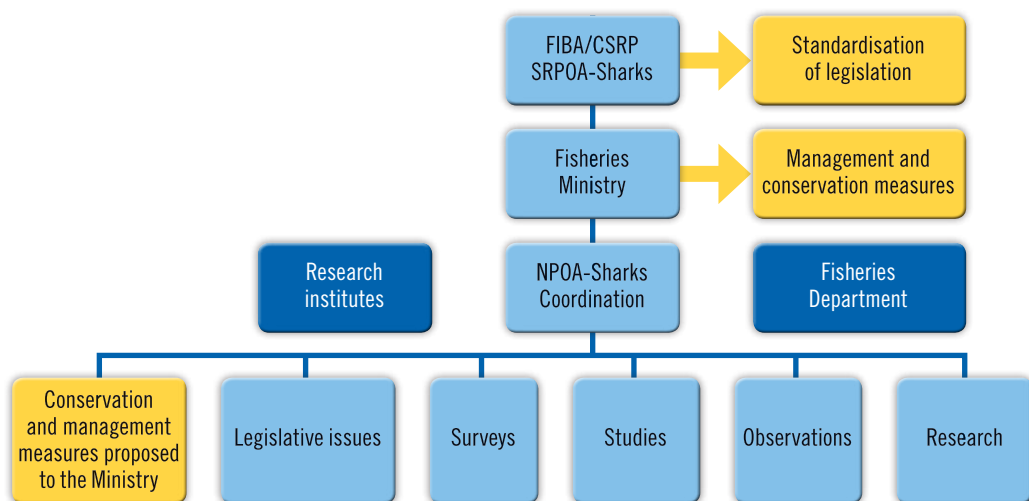
Furthermore, the numerous regional and national training sessions organised within the framework of the project have greatly contributed to the PRCM's and SRFC's capacity building goals.

1.b. Goals for Phase 2

Not all of the goals of Phase 1 were met by 2007; therefore, a second phase was considered necessary (2008-2011). This second phase included the following major actions:

- continue the NPOA-Sharks implementation process (production of shark population management tools and standardisation of legislation);
- the creation of a selachians observatory in West Africa (with the BIOMAC network);
- carry out pilot actions in terms of redevelopment and conservation;
- capitalise on and make wise use of the SRPOA-Sharks findings obtained during the first phase.

Figure 2. Cooperative links between the different SRPOA-Sharks Project stakeholders



Information on shark fisheries in the SRFC zone, gathered and analysed with support from the SRPOA-Sharks Project, has enabled positive measures to be formulated to manage Shark stocks: creating specific licenses, establishing protected zones, limiting access to the resources, banning fishing on threatened species, establishing minimum landing sizes for species, and recommending how to set up specific fiscal regimes (for example, taxation on the export of Shark products, particularly shark fins). The results achieved



2. Data acquisition strategy

Data for these projects has come from various sources: historical information has been used, as well as data collected within the framework of the project. In terms of historical data, the project team used information from the TrawlBase (experimental fishing trip) and StatBase (fishing statistics) databases in the Fisheries Information and Analysis System (FIAS), which was set up by the SRFC between 2000 and 2002, with funding from the European Union. These regional databases provided information on species caught in the SRFC zone (identification of the different species of rays and sharks, when catches occur, and trends in landings and fishing efforts) in the past 50 years. From these sources the best time series of shark catch by industrial and artisanal fisheries over the past twenty years (1984-2004) were pieced together.

Furthermore, through surveys at landing areas since 2005 (complete surveys or representative samplings of the boats catch according to the zone and country), the project has included the monitoring of Shark landings and the collection of biological data on fishing effort, the price of shark by-products and jobs generated by Shark fishing.

It should be emphasised here that the regular monitoring of fishing activities and the collection of biological data were made possible by a network

of field surveyors trained in shark landing monitoring techniques, which was set up in each of the SRFC member countries. Indeed, within the framework of the SRPOA-Sharks Project, annual training sessions have been organised for technicians and scientific observers since 2004, to include Shark identification, biology, data collection of landings, etc. A species identification guide was created within this framework (see Text Box 1). They are intended for research institutes, fisheries departments, field surveyors and at-sea observers, students, fishermen and fish processors. Before the project was implemented, this information was organised only by groups of species (rays and sharks), but since 2005 the data have been gathered and recorded at the species level, which has significantly improved data quality (for Mauritania, data had been collected according to species since 1998 by the IMROP field surveyors working at the principal landing sites).

PROJECT ACHIEVEMENTS AND IMPACT

1. Major project achievements

The information gathered by field surveyors, scientific observers, students, and consultants working at research institutes (in Mauritania, Guinea, Guinea-Bissau, and Cape-Verde) and Fisheries Departments (in Gambia, Senegal, and Sierra Leone) were consolidated, analysed and compared. The principal project achievements were written up in technical reports and in the framework of the sub-regional capitalisation workshop organised in 2008. They can be summarised as follows:

- Used information from databases created in previous projects (notably the FIAS project) within the framework of the SRPOA-Sharks Project.

- Trained fisheries technicians and scientific observers in Shark biology, biological data collection, and management of Shark fishery (regional and national training since 2004).
- Produced a scientific publication on halting shark fishing in the Banc d'Arguin National Park (Mauritania), Shark biology and fishing, and the cultural importance of sawfish in West Africa.

- Created databases on Shark catch and Shark fishing activities in the SRFC zone.
- Produced a film on the biological characteristics of Sharks and the use of Shark resources in West Africa.
- Supervised several theses (see text box 2) on selachian biology, ecology, and fishing in Mauritania, Senegal, Guinea, Sierra Leone, and Cape-Verde.

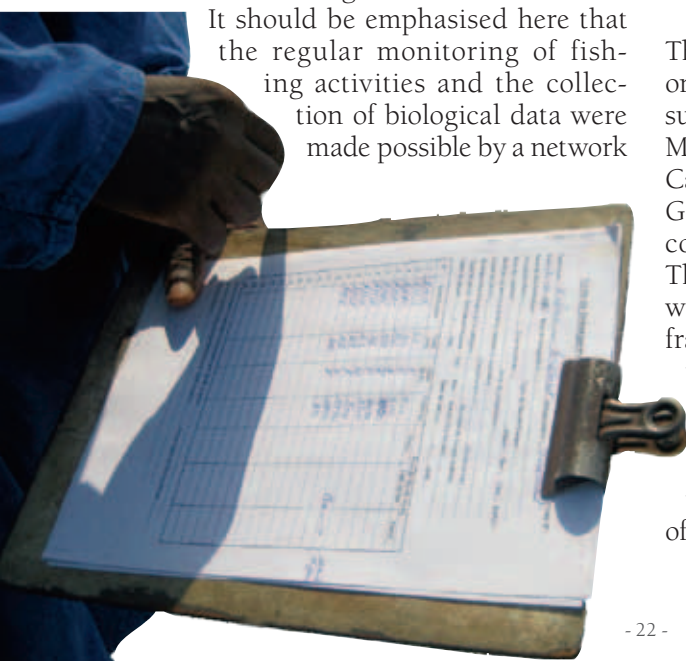
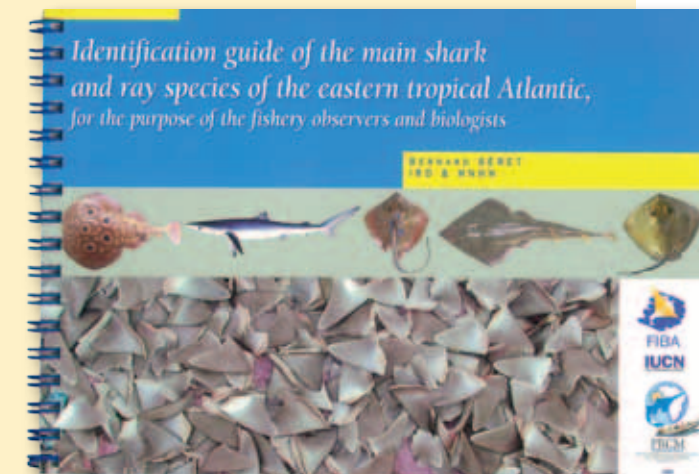
Text Box 1. Field guide for the principal Shark species found in the sub-region

Completed within the framework of the SRPOA-Sharks Project, this guide is intended to facilitate the rapid and effortless identification of the principal shark species commonly found at landing sites in the SRFC zone and, more generally, in West Africa. It was published with support from the FIBA and IUCN.

Data collection on Sharks is a priority of the SRPOA-Sharks Project. This guide has made it possible to improve shark monitoring capacity, and consequently, the accuracy of the scientific information that is available for their sustainable management. This work is mainly intended for the networks of field surveyors and biologists, participating in the SRPOA-Sharks Project in the seven SRFC member countries, who gather information on Shark catches and the biology of shark species. However, it is also used by fishermen, who record daily catch in their fishing logbooks.

Each species is described by a master identification page, featuring a central picture, sometimes with extra pictures that describe a species-specific morphological characteristic (e.g. details on teeth morphology). The species' main morphological characteristics are listed to draw the user's attention to the distinguishing features used to identify the species. Several other details such as the fishing equipment used to catch the species, bathymetric distribution, and habitat are also provided. The guide is an extremely valuable tool for improving the quality of data gathered on coastal shark catches. The guide was originally written in French, but English and Portuguese translations were created, covering therefore the three main languages spoken in the Sub-Regional member countries.

This guide can be downloaded at: http://www.lafiba.org/index.php/fr/documentation/boite_a_ouils/guides_methodologiques/



Text Box 2. A student supported by the SRPOA-Sharks Project

“In 2007, I received financial support from the FIBA, via the SRPOA-Sharks Project, to carry out the research needed to write my final report. At that time, I was a student at the Fishing and Aquaculture Institute (IUPA) in Dakar. I chose to work on the topic of conservation of Shark populations in Senegal. This study fit into the POA-Sharks implementation framework and the IUPA’s research goals.

The SRPOA-Sharks Project team supported and guided me, and, thanks to their assistance, I was able to successfully complete my field surveys, process the data I had collected, and produce a document on the demographic composition of the landings and a structural and biological analysis of the five species caught by the elasmobranch fisheries on the Senegalese coast.

I was given high marks for my dissertation (defended in May 2008) by the jury that included professors from IUPA’s science and technology faculties, CRODT and SRFC researchers, and the SRPOA-Sharks Project Coordinator. My dissertation allowed me to graduate with honours.”

Ndaté (Mingué) MAR, completed a Master’s Degree in fishing and aquaculture from the University of Cheikh-Anta-Diop (Dakar, Senegal)



Field exercise for identification of species and practice of biological data collection during a regional training seminar. (M. Diop & J. Dossa)

- Published an identification guide for West African rays and sharks (see text box 1).
- Organised meetings and workshops to consult with Shark trade stakeholders in Gambia, Guinea, Guinea Bissau, Mauritania, Sierra Leone, and Senegal.
- Completed studies on the possibility of reassigning specialised Shark trade stakeholders and setting up pilot initiatives for reassigning these individuals.
- Updated the IUCN Red List of rays and sharks for West Africa and assisted with the listing of sawfish under CITES appendix I and II.
- Set up databases on catch from artisanal fishing and industrial fishing for

each country. These databases are a reliable source of information, because they include data not only from research institutes and fisheries departments, since 2003, but also information from the FIAS databases prior to 2002.

- Completed several studies on Shark migration and how fisheries in the sub-region have consequently developed.

The results obtained during the first phase of this project were presented and analysed in the framework of two assessment workshops organised in Dakar in 2008. The first workshop discussed the overall capitalisation achieved by the project, and the second looked at the impact of

training technicians, observers, and students to achieve their thesis on Sharks. All of the stakeholders concerned participated in these workshops, including fisheries administrations, various professionals, research institutes, social science researchers, representatives of nature conservation NGOs, and local partners.

The project’s impact was assessed in terms of three main criteria:

1. capacity building and improving knowledge on how the shark industry is developing;
2. the status of Shark fisheries;
3. the conservation status of Sharks at the national, sub-regional, and international levels.

Capacity building

The SRPOA-Sharks Project has enabled an annual regional training course to be organised for NPOA-Sharks managers, technicians, and on-board observers. The project has also provided financial support for national training courses for the field surveyors in charge of data collection for Shark fisheries.

Major advances have been made in terms of improving capacity and skills through these training courses and the supervision of student dissertations. The initiative has been supported by the production of a shark species identification guide and tools for raising awareness among policy makers and the general public on the

Text Box 3. Impact of national and regional training courses in the SRFC member countries

Senegal

- Improved species information (47 species listed in the database).
- Monitored changes in landings by species and species group.
- Identified fishing zones, especially in the south.
- Identified the main fishing techniques (and local differences).
- Studied the distribution channels of sharks using the database created by field surveys
- Heightened awareness of how fragile this resource is by those involved in the Shark fishing industry

Gambia

Acquisition of far more accurate data (before the implementation of the SRPOA-Sharks Project, the identification of the species caught was problematic).

Mauritania

- Acquisition of far more accurate data, which are used to form relevant scientific opinions.
- Increased interest in Sharks and improved knowledge about their biology, role in the ecosystems, • etc.
- More effective data gathering by technicians.
- Diversified the parameters for monitoring fisheries.
- Better-informed technical opinions for taking management decisions.

- Contributed to the project for revising a number of regulatory measures.
- Improved the perceived image of sharks by the local community
- Reorganised the Sharks database
- Improved regulations through improved knowledge of Sharks

Sierra Leone

Improved data quality collected on Sharks

Guinea

- Improved the data collection and processing skills of Technicians
- Strengthened the CNSHB's capacity via the recruitment of two students who have written their Master's dissertation on Sharks.
- Published studies on ray and shark fishing in the CNSHB's scientific journals.

Guinea-Bissau

- Improved data collection on sharks.
- Trained fishermen to identify species using the Sharks identification guide.

Cape-Verde

Setup a national system for collecting landing data and identifying species.

Source: Workshop to assess the impact of Shark training in the countries in the SRFC zone, FIBA/SRFC, September 2008.

issues involved in managing Shark populations (a film, brochures, flyers, and posters).

During the first phase of the project, approximately one hundred observers, technicians, and NPOA-Sharks managers completed training on Shark identifi-

cation, biology, statistical data gathering, and the development of Shark fisheries. Furthermore, nine theses were completed on Shark populations in Senegal (2), Guinea (4), Cape-Verde (1), and Sierra Leone (2). The impact of this training was assessed for each country (see Text Box 3).



Field surveyors and fisheries technicians attending the fifth regional training for Sharks identification. (M. Diop & J. Dossa)

2. State recognition

2.a. Official adoption of the NPOA-Sharks in the SRFC member countries

In conjunction with its effort to improve training and provide support for data collection on the Shark fishing industry, the SRPOA-Sharks Project has undertaken considerable activities to improve the awareness of fishery administrations, so that the States concerned will make an official commitment to the conservation and sustainable management of Sharks. The SRPOA-Sharks Project established a process for the official adoption of National Plans of Action for the Conservation and Management of Sharks (NPOA-Sharks) in each SRFC country. This process consisted of three steps:

Review of NPOA-Sharks documents within national institutions in charge of the plan;
 Organisation of national review workshops for all stakeholders involved;
 Official adoption of the NPOA-Sharks by States.
 The ministries of fishing administer the NPOA-Sharks, a responsibility they entrust to one of their technical services, which is designated as the national focal point for the SRPOA-Sharks Project. All of the countries involved adopted a NPOA-Sharks, which was reviewed by all of the stakeholders concerned. Six NPOA-Sharks have been officially adopted in Senegal, Guinea, Guinea-Bissau, Mauritania, Sierra Leone, and Cape-Verde. In Cape-Verde, the NPOA-Sharks objectives were incorporated into the country's plan for

Table VI. Shark management legislation in the SRFC zone

Country	Regulations
Mauritania	Minimum landing size of 60 centimetres for houndsharks (<i>Mustelus mustelus</i> and <i>Leptocharias smithi</i>). Ban on Shark fishing in the Banc d'Arguin National Park (PNBA) in 2003 (except houndsharks: <i>Mustelus mustelus</i> and <i>Leptocharias smithi</i>). As part of the IRM-EU agreement, ban on tuna seiners and longline surface boats fishing for: basking shark (<i>Cetorhinus maximus</i>); great white shark (<i>Carcharodon carcharias</i>); sand tiger shark (<i>Carcharias taurus</i>), and tope shark (<i>Galeorhinus galeus</i>). Official adoption of NPOA-Sharks in 2007.
Cape-Verde	Ban on finning in all territorial waters since 2005. Development and management measures published in the official legal journal. Integration of NPOA-Sharks objectives in the fisheries management plan since 2006.
Guinea	Introduction of a shark fishing licence: increase from 1,000,000 GNF to 5,000,000 GNF (around 7,000 euros today compared to 1,000 euros in 2005). Ban on finning in all territorial waters since 2009. Ban on fishing the seven species of rays and sharks critically threatened with extinction. Official adoption of its NPOA-Sharks in 2006.
Gambia	Ban on finning in all territorial waters since 2004. Measures adopted making it mandatory to land sharks caught in Gambian waters on Gambian soil. Management measures drafted for the 2008 fishing regulation law and the decree specifying how the law should be enforced. NPOA-Sharks not yet officially adopted.
Guinea-Bissau	Ban on Shark fishing in the Marine Protected Areas. General fisheries law protecting Sharks. Official adoption of NPOA-Sharks in 2008.
Sierra Leone	Introduction of special Shark licences. Introduction of a Shark fishing licence. Ban on finning. Ban on taking children on fishing boats. Creation of an export tax for Shark products. Increased size of mesh in Shark fishing nets (300 millimetres stretched mesh) Official adoption of NPOA-Sharks in 2008.
Senegal	Three species of sawfish placed on the list of protected species. Proposal to set a size limit for the scalloped hammerhead shark (<i>Sphyrna lewini</i>): male 140 cm and female 165 cm, and for the blackchin guitarfish (<i>Rhinobatos cemiculus</i>): male 106 cm and female 100 cm Official adoption of NPOA-Sharks in 2006.

Source: report on the achievements of the SRPOA-Sharks Project in terms of the different countries' legislation up to 2009.

managing fisheries resources, which is a form of official adoption. In addition, Mauritania, Guinea, Guinea Bissau, and Sierra Leone adopted various management measures: (1) halting Shark fishing in a Marine Protected Area in Mauritania (PNBA) (2) introduction of a Shark fishing licence in Guinea and Sierra Leone, and (3) dismantling all Shark

fishing camps in the Bijagós Archipelago, and banning of shark fishing in Guinea Bissau's Marine Protected Areas. Gambia and Cape-Verde have also banned finning (removing shark fins and discarding the carcass). It is worth noting that these focal points maintained close partnerships with the SRPOA-Sharks Project team and benefited



Dialogue with fishermen in the course of a monitoring visit to Cape Verde. (M. Diop & J. Dossa)

from technical and financial support for drawing up and implementing the NPOA-Sharks. Depending on the national circumstances, research institutions, nature conservation bodies and occasionally universities were brought in to contribute to the process.

As well as helping to achieve the adoption of the National Plans of Action, the SRPOA-Sharks Project contributed to changes in legislation on shark fishing in the SRFC zone (see Table VI).

However, it is important to note that specific sustainable management rules adopted at the state level still suffer from a lack of standardisation and coherence at the regional level, and do not therefore benefit from mutual support between states. For example, Shark fishing licences are much cheaper in Sierra Leone than Guinea, which leads Shark fishermen working in Guinea to go and

fish for Sharks in Sierra Leone at a lower cost. In addition, Shark fishery management plans are often at an early stage of implementation and do not translate yet into strengthened management measures. Regulations for shark fisheries are not very strict, whereas the situation calls for firmer measures. Finally, only limited technical and financial resources are allocated to monitoring and managing shark fisheries.

2.b. Promotion of a multi-disciplinary and participative approach

In implementing the regional sharks action plan, the project used a multi-disciplinary and participative approach by linking various stakeholders (administrators, researchers, students and professionals), specifically the professional at the ground level and the decision makers. The



Dialogue with women processing Shark meat in Guinea, for identification of alternative activities. (J. Dossa)

NPOA-Sharks review process provided an opportunity for sustained consultation because each stakeholder contributed to the discussions and implementation of NPOA-Sharks. Applied research institutions (technicians and researchers in all fields) and universities (students) were involved in the tasks of collecting and analysing biological and ecological data. Fishing professionals (fishermen, ship owners, wholesale fish merchants, and processors) also assisted the scientists by agreeing, in most cases, to supply relevant information (landing surveys, socio-economic surveys, empirical knowledge, and historical data). The results obtained from analysing the vast array of data collected were used to convince the administration of the need to make NPOA-Sharks official, representing a major political commitment. This close collaboration served not only to characterise the fisheries, but also to document the development of shark fisheries within both the country and the SRFC sub region.

2.c. Raising public awareness and reassigning stakeholders

This project featured an in-depth consultation process in the sub-region with those involved at grassroot levels, about the need to reassign fishermen and women fish processors to other forms of employment. Several consultation meetings were held in Gambia, Guinea, Guinea Bissau, Mauritania, Sierra Leone, Cape-Verde and Senegal. The SRPOA-Sharks committee and NPOA-Sharks administrators organised exercises to consult with and raise awareness among directly-concerned individuals: fishermen in Senegal, Guinea, Gambia and Sierra Leone, and processors and wholesale fish merchants in Mauritania, Guinea Bissau and Cap Verde. These exercises addressed the need to replace shark fishing with alternative activities, and reassign those involved to other sectors (fishing, eco-tourism, trade, etc.). The film produced by the SRPOA-Sharks Project (“What future

lies ahead for Sharks?”) was shown during these consultations. As a result, many of those involved are now aware of the need to avoid overfishing, and are asking for reassignment support. With their help, an estimate of their reassignment cost has been calculated, and a programme for implementing and monitoring their reassignment has been prepared.

It is in this framework that some funds, albeit limited, were mobilised in 2008 and 2009 for the reassignment of women shark processors in the Senegalese villages of M'bour and Joal. A workshop was organised to expose the participants to new processing technologies (braised smoked fishes).

2.d. Improving knowledge and more effective awareness raising

The vast amount of work completed throughout this program has provided us with a better understanding of the problem and more precise knowledge of developments, markets, stakeholders, and their mindsets and strategies, together with the state of the fisheries and status of the various species encountered.

Furthermore, the status of Shark populations and the efforts made within the framework of this project have been cited at international colloquia (in Canada, Australia, England, France and Spain) and at various events (PRCM Forums, Conferences of the SRFC Ministers, etc.) organised in the sub-region.

2.e. Contribution to international Shark conservation

Two outcomes of the SRPOA-Sharks Project represent a real contribution to international Shark conservation activities.

The updating of the IUCN Red List for West Africa in 2006.

As mentioned above, knowledge of the status of 17 species has improved, partly,

because of the results achieved by the SRPOA-Sharks Project.

To accomplish this work, in 2006 the SRPOA-Sharks Project and the IUCN organised a workgroup to update the IUCN Red List for West Africa. This group analysed:

- information contained in the relevant FIAS databases (Vernet, 2007);

- results of surveys at the landing points made within the framework of the SRPOA-Sharks Project;

- results of surveys concerning empirical knowledge on sawfish (see the reports by Robillard and Candice, 2005, and Balouard, 2007);

- empirical knowledge on Shark fishermen.

The listing of sawfish species under CITES Appendices I and II.

Few species found in the SRFC zone were listed under the CITES appendices before the implementation of the SRPOA-Sharks Project. Only the following species have been listed in Appendix II of the CITES since 2003: the basking shark (*Cetorhinus maximus*), the whale shark (*Rhincodon typus*) and the great white shark (*Carcharodon carcharias*).

In 2005, FIBA, the NGO Noé-Conservation, and the SRFC carried out surveys on the empirical knowledge of sawfish in six SRFC countries, where this species had been seen in recent years. These surveys were performed in 2006 in Sierra Leone and Guinea-Bissau, the countries in which the probability of finding sawfish was the highest. This campaign demonstrated that these species were not available throughout the sub-region, with Guinea-Bissau representing the only location where individuals have been confirmed in a few isolated cases (Candice et al., 2005 and Balouard, 2006).

Drawing on these findings and the results of the workgroup to update the IUCN's Red List, the SRFC prepared a report for the Presidency of the SRFC, asking for it to intercede with CITES in the name of all SRFC countries and support the proposal to list sawfish in the CITES appendices.

Thus, in 2007, thanks in part to the studies carried out in the SRFC zone in collaboration with Noé Conservation, CITES listed the sawfish species *Pristis pectinata*, *Pristis pristis* under Appendix I, and *Pristis microdon* under Appendix II.



Training of women Shark meat processors to hygiene and smoking techniques for small pelagic fish. (M.Diop)

Part Two.

Synthesis and preliminary analysis of the studies carried out in the framework of the SRPOA-sharks project



DEVELOPMENT OF SHARK FISHERIES IN THE SUB-REGION

1. Participants of the shark fishing industry in the sub-region

STUDIES OF THE SHARK FISHING INDUSTRY, completed within the framework of the SRPOA-Sharks Project, showed that Sharks are caught, processed and sold by relatively specialised economic agents. In the SRFC zone, except in some rare cases, this means fishing boat owners, fishermen, fish processors, middlemen who assemble the products (particularly shark fins), and the exporter-brokers of finished products.

In the sub-region, Sharks are targeted by artisanal fishermen. Shark fishing is practiced by several communities of fishermen (Guet-Ndariens, Lébous and Nyominkas in Senegal, the Imragens in Mauritania, and Ghanaians in other countries) using more than twenty fishing techniques and strategies that vary according to the seasons and biological and socio-economic factors. It is the Ghanaian community that greatly contributed to the development of selachian fisheries in the SRFC countries, first for the consumption of Shark meat in West Africa, then for the consumption of shark fins in Asia.

Each country has its own specialised players in the different parts of this food industry.

In **Sierra Leone**, the fishing activities are dominated by local fishermen and the finished products are sold by various communities (Ghanaians, Senegalese, and Gambians).

In **Mauritania**, artisanal shark fishing is the work of Mauritians and Senegalese, but various communities are involved in processing and sales activities. The Malians living in Nouadhibou and the Ghanaians in Nouakchott buy the fish from fishermen and process them before selling them to Ghanaian wholesale fish merchants, who export the finished products to their country. The Imraguen community has become significantly involved in the shark fishing industry by processing a large amount of their catch. Their shark fishing activities began with the recruitment by Nouadhibou-Nouakchott fishing boat owners of Senegalese captains and fishermen, who were more accustomed to this type of fishing. After a few years, Mauritanian fishermen became skilled in this type of fishing, and a progressive 'Mauritanisation' of selachian fishing was observed. In response to the intensification of the shark fishing activities, the wholesale fish trading business developed very rapidly along the Mauritanian coast, and many retailers in different Imraguen villages invested massively in the selachian business. Likewise, to target Sharks and have exclusive rights to purchase shark fins, they financed the fishermen's acquisition of fishing equipment, the construction of their housing, and provided them with food and water. The unprecedented rush towards this profitable activity is at the origin of the operators' commitment to this fishery, which has generated significant profits. Numerous wholesale fish merchants scour the coast looking for Sharks, in Nouadhibou, Nouakchott, and especially the Banc d'Arguin.

In **Senegal**, fishing is mainly carried out by the Senegalese themselves, whereas

the fish processing is also done by Ghanaians. The Senegalese Shark fishing business started in the 1940s. Senegalese fishermen, particularly the Guet-Ndariens (originating from Saint-Louis), put a great deal of effort into developing Shark fishing (with specific boating equipment) and became 'brokers' in their own right, developing direct relations with Asia. The fishing boats are organised into two groups: some are based in Saint-Louis and have operations all the way to Sierra Leone; the others are based between Casamance and Guinea Bissau and tend to make permanent settlements. In the current situation, in which Sharks are becoming rarer, the Guet-Ndarian fishermen would like to be able to move their fishing efforts to Cape-Verde.

In **Guinea**, the fishermen are mainly Senegalese and Ghanaian. The fish is salted and dried by Ghanaians, and smoked by Guinean professionals.

In **Gambia**, the fishing activities are mainly performed by the Senegalese and Ghanaians. The fish is salted and dried by Ghanaians, and sold by Ghanaians, Senegalese, Guineans, and Gambians.

In **Cape-Verde** and **Guinea-Bissau** this business has not yet developed.

In some countries, Ghanaians dominate every stage in the process; this is particularly true in Senegal and Gambia.

In terms of fleets, Mauritania has 500 fishing boats targeting selachians that employ 1800 people, whereas in Guinea there are 120 boats and 1250 fishermen. In Gambia, 60 pirogues were identified in the village of Brufut, employing between 600 and 900 Ghanaian fishermen. Approximately 100 fishing boats are involved in the ray and shark fisheries in Senegal, employing more than 600 fishermen. In Guinea-Bissau, Sharks are mainly fished by foreigners (Senegalese and Ghanaians,) who have set up an unknown number of camps in the Bijagos islands. Finally, 500 boats have been identified in Sierra Leone, employing 3000 fishermen.

In all, there are nearly 1300 artisanal fishing boats specialising in Shark fishing in the SRFC zone. If all of the other artisanal fishing boats that occasionally land Sharks are taken into account, the fishing effort for selachians represents some 2500 vessels.

In terms of processing, the number of people involved is much higher. In Mauritania, 400 fish processors have been identified. In Guinea, nearly 100 people are linked to the artisanal processing of fish products: the Ghanaians specialise in salting and drying, whereas the Guineans are the only community that smoke the fish. More than 3,000 people are employed in the various fish processing jobs in Senegal. In Sierra Leone, more than 200 people are involved in shark processing, sales and pirogue building.

In some countries, the number of people involved in the Shark fishing business is quite limited. In Cape-Verde, for instance, Shark fishing only began in 1978 and its coastal activities are not very developed. Diop (2005) estimated that there were 18 jobs linked to this activity: from which 14 Cape Verdians (6 fishermen, 3 processors, 3 retailers, and 2 maintenance men) whose boat is operated by a Senegalese boat owner.

It is also worth mentioning that the Ghanaians are present in large numbers in every sector of the Shark fishing business in all countries (from fishing to sales and also the collecting and processing of shark products).

In some countries, those involved in the Shark industry are well organised. For instance, in Senegal they are organised into economic interest groupings, or EIGs (as defined by law 85-84, dated 29 July 1985). These organisations have helped gain access to bank loans and an inflow of capital, enabling a significant increase in the production capacity of

those involved. Some EIGs have taken on the task of getting the finished products to market, which has increased their negotiating power. This is the case in particular of the EIG 'Seutou Ndiaré de Yoff', which manages an important semi-industrial Shark salting and drying processing unit. In Mauritania, the Ghanaians working in Nouadhibou have joined forces for Shark processing, negotiating, and setting the price of the salting and drying, while the Nigerians have worked together for the export of their products, which has significantly reduced the transport costs. These examples demonstrate that there is a form of 'national solidarity' in the Shark fishing business.

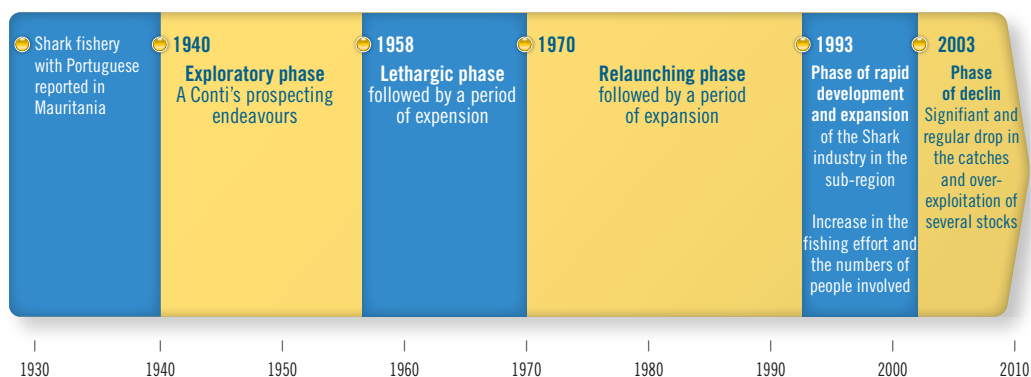
In the other countries, the organisation forms are in their early stages of development and have not yet had any impact on the industry's general orientation.

2. Developmental phases in Shark fisheries

Shark fisheries in West Africa have a long history. They first appeared on the Mauritanian and Senegalese coasts. In Mauritania, a shark fishery operated by Spanish,



Development of Sharks fisheries in the SRFC AREA



Portuguese, British, Dutch and French trawlermen is known to have existed at the beginning of the 20th century. However, in both Mauritania and Senegal, significant Shark fishing only really began in the 1940s. There have been five phases in the development of Shark fishing in the sub-region.

- **Exploratory phase: 1940 to 1958**

Certain Shark species were targeted on the West African coast as of the 1940s, with a few experiments carried out on the Petite Côte in Senegal by European industries looking for a source of vitamin A. These experiments did not succeed. The first period of shark fishing, subsequent to the prospecting carried out by the oceanographer Anita Conti (see text box 4), occurred between the 1940s and 1950s.

Following the decline of European companies, people of different nationalities started to work in this industry (Ghanaians, Burkinabés, and Fulanis from Guinea) and they began to explore new methods (salting and smoking). The Ghanaians helped bring about the development of selachian fisheries in the other coastal countries in the sub-region.

- **An idle phase: 1958 to 1970, followed by a period of expansion**

The production of shark liver oil on the West African coast decreased because of

low yields, competition from the Ivory Coast where stocks were more abundant, and the production of synthetic Vitamin A. Nonetheless, during the 1960s and 1970s, new Shark fisheries developed in Gambia, with the arrival of a Ghanaian group of fishermen. Aware that there was a demand for salted and dried selachian meat in their country and that the resource was not being exploited in the sub-region, these fishermen developed targeted fishing and established a network for purchasing the Sharks accidentally caught by the other fishermen, in particular the Nyominkas (Sine Saloum).

- **A growth phase: 1970 to 1993, followed by a period in which the shark fin market developed, then a consequential drop in yields**

Exploitation of sharks developed rapidly in the sub-region from the 1970s, and most of the Sharks were targeted by artisanal fisheries (Ducrocq *et al.*, 2005), not only for their liver oil, but also for their meat (especially their fins), which became the main reason for their exploitation. There was also an increase in landings made by artisanal fishermen, and a rapid and regular increase in the fishing effort (more boats, with more efficient fishing equipment). It should also be pointed out that the development of specialised artisanal fishing

Text box 4. Prospecting by Anita Conti and the first Shark fishing activities

In her book *Géants des mers chaudes (Giants of the warm seas)*, the oceanographer Anita Conti describes the experimental fishing activities that took place in the 1940s to evaluate the fish resources of the West African coast. The aim of these scientific missions was to study the extent to which fishing activities could be developed in order to feed the populations living on the coast. Anita Conti's work focused on Sharks, which were very abundant at that time. She describes scenes in which sawfish weighing more than 1 tonne were caught, and big hammerhead sharks 6 metres long, unlikely to be found today. She draws attention to a significant biomass of Sharks, which represented a resource that could be exploited to provide meat to the local markets.

On the basis of Conti's recommendations, Shark fisheries developed. For instance, six fisheries were created on the Petite Côte in Senegal at the beginning of the 1940s, producing shark meat and liver oil. Despite the initial high biomass levels, the Shark stocks dwindled because of this targeted fishing. The average annual catch during that period was estimated to be 2,500 tons (Blanc, 1958).

In 1952, only one of these fisheries was still operating, using motorised pirogues and exploiting the most remote fishing zones. All the other fisheries had disappeared, due to the fact that the yields had plummeted in less than ten years.

Overexploitation and the need to establish management rules were already important issues (the closing of Lévrier Bay, in Mauritania, for example, to limit the decreasing yields in meagre); however, in general the biology of the species was not taken into account as a means for measuring the possible levels of exploitation.

Géants des mers chaudes, by Anita Conti, Hoëbeke, Paris, 1993.

was accompanied by industrial fishing increased capacity, which was responsible for a significant amount of Shark bycatch. Driven by the Ghanaians living in Gambia, Shark exploitation became a sub-regional affair. The Ghanaian fisheries in Gambia became a regional centre in which shark by-products were traded.

Originally numbering about sixty fishermen, the community rapidly expanded to develop into an organised industry, which exported the salted and dried meat to Ghana, where shark meat is traditionally consumed.

Taking part in the fishing activities, with techniques developed in the homelands, the Ghanaians managed to become involved in all sectors of this industry, working on shark processing, purchasing

fresh products, and selling the salted and dried meat to the Ghanaian market.

The Ghanaians also started buying Sharks caught by Senegalese fishermen, who were targeting mainly barracuda and operating in the Saloum delta and along the Gambian coast. The purchasing of ray and shark carcasses from common fisheries also developed throughout the sub-region: Ghanaian purchasers could be found from Mauritania to Guinea. Some Ghanaian merchants even provided informal loans to entice the networks of fish wholesalers and fisheries to target selachians.

The 1980s and 1990s correspond to a period of development for the worldwide shark fin market in response to the demand from South East Asia. This

development had significant repercussions in West Africa. The price of shark fins reached up to 50,000 CFA francs per kilo (approximately 100 US dollars) and sale prices on the Asian market as high as 500 dollars per kilo (WWF, 1996). This made the existing fisheries more profitable, enabling them to increase even more their fishing effort and attract new participants. New fisheries were created, for example in the PNBA in Mauritania.

• **Phase of rapid development and expansion of the Shark industry in the sub-region: 1994 to 2002**

During this period, Shark catch reached its maximum levels, with a continued increase in fishing activities and the number of people involved.

The devaluation of the CFA franc in 1994 led numerous Senegalese fishermen to take an interest in Sharks, since shark fins were exported outside of the franc zone (Niamadio, 2000). As a consequence of the increased fishing effort, yields decreased

dramatically and rapidly throughout the sub-region forcing the fishermen to take on more debt to further increase their fishing effort and to move their activities to more distant zones (Ducrocq, 2000). For instance, the Ghanaians in Gambia started carrying out six-month fishing trips to Guinea, and the Senegalese pirogues started scouring Sierra Leonean waters (Ducrocq & Diallo, 2000). This rapid advance was also linked to the devaluation of the CFA franc in 1994, which immediately meant that the products coming from the CFA zone became more competitive in the international markets. This resulted in fish product from the sub region being cheaper for foreign buyers and consequently an upward pressure on fish production. The subsequent increase in fishing effort forced Shark fishermen to move further south; for instance, many fishermen from Saint-Louis in Senegal travelled to Sierra Leone. The Shark fishermen then began to set up a system of trips involving the utilisation of large

fishing canoes and seasonal fishing camps in Gambia and Casamance (southern part of Senegal). Djogué, in Casamance, was the largest selachian fishing camp until the end of the 1990s. However, in 1997, because of the war that took place in Casamance, fishermen, processors, wholesalers and retailers resettled to Elinkine, another place in Casamance where the Senegalese army was building a military base. From there fishermen started venturing further out to Guinea Bissau, specifically in the waters of the Bijagos archipelago, and sold the salted meat from their Shark catch to Ghanaians.

• **Phase of decline: 2003 to the present**

This period has been characterised by a significant and ongoing drop in the number of Shark landings. Further details are included in this chapter on catch trends in the sub-region.

3. Development of new tools and techniques

To meet the needs of increasing and more broad-based demand, new fishing techniques were developed, which revitalised the expansion of the Shark industry on the West African coasts. Line fishing, which had been the main technique until the beginning of the 1970s, was progressively replaced by the use of specially designed nets to catch Sharks. These technological innovations, introduced by Ghanaian fishermen, quickly spread throughout the SRFC zone, especially among Senegalese⁸ fishermen. For example, in Mauritania, they used *Rhinobatos* (guitarfish) nets and the houndshark net⁹ and lines (see Text

Box 5), equivalents of which can be found throughout the sub-region.

The 1980s and 1990s were pivotal periods in the introduction and expansion of new technologies, through the utilisation of larger fishing canoes (18 - 23 metres), with more powerful engines (40 - 55 HP). On the Mauritanian coast, 10-ton Spanish capacity canoes were introduced between Mamghar (Banc d'Arguin) and Nouadhibou (port city and economic capital), together with fibreglass boats provided by Japanese cooperation. This cooperation supported the development of small-scale fisheries.

The mechanisms put in place by the institutional sponsors and within the framework of bi- or multi-lateral cooperation to encourage the boat owners to buy new boats and fishing equipment contributed greatly to the development of Shark exploitation. These innovations drastically modified how the fisheries were organised, which now had the production capacity to run several activities at once and employ a considerable workforce. A well-structured industry emerged around fishing activities, fish processing, various services, and the sale of Shark products.

The 'Shark race' intensified, with extensive travel to more distant fishing zones, a longer fishing season, and increased professionalization in terms of financing and contracts (product purchase contracts between the fishermen and wholesale fish merchants, for example). The fishermen were now using boats called *pirogues de marée*, going out on 2 - 3 week trips, and were beginning to process the Sharks on board.

The 'mercenary' mindset underlying the hunt for shark fins has encouraged those involved to behave irresponsibly, to maximise profit. The pirogue's cargo hold is first filled with shark fins; the carcass, regardless of size, is discarded during the first part of the outing, once its fins have been removed. The rest of the meat is only kept during the final days of the trip, in

Landing of sharks on landing stage of Missirah in Delta de Saloum, Senegal. (J. Dossa)



8. In particular, the Guet-Ndariens and Nyominkas, whose social and technological capital were enriched thanks to their collaboration with Ghanaian fishermen.

9. Particularly used along the Mauritanian coast to catch small Sharks.

Text box 5. Principal shark fishing equipment used in Mauritania

Merluza, smooth hound or barbled houndshark nets

These nets are used with the fixed gill net technique, and catch several species. Although only their mesh differs, the name of these nets changes from one village to another in Mauritania.

In Blawakh and Nouadhihou, they are called smooth hound nets; in Mamghar and Tasset, merluza nets; in R'guibba and Teichitt, barbled houndshark or smooth hound nets. According to fishermen from Mamghar, the merluza nets were originally designed and sized to target houndsharks (*Mustelus mustelus*). However, since this species is not very common in near Mamghar, they were called merluza nets because with a bigger mesh than the original nets, they made it possible to catch merluza.

The smooth hound, barbled houndshark, and merluza nets are the same length (50 to 150 metres) and their chute drop is between 25 and 35 meshes. The size of the stretched mesh differentiates the smooth hound and barbled houndshark nets (140 to 160 millimetres) from the merluza nets (up to 180 or even 200 millimetres).

Ray nets or tchoker nets

Rays and sharks were historically fished with lines cast from the beach along the Mauritanian coast. Recently, a group of Senegalese fishermen working in the southern zone introduced nets called 'tchoker nets'. They feature large mesh, up to 500 millimetres long. Their vertical drop is shallow: only 5 to 6 meshes. The length and number of nets per series varied.

Guitarfish lines

On the beaches between PK 45 and N'diogo in Mauritania, another type of hand line is used for fishing common rays (*Rhinobatos rhinobatos*). These lines, locally called 'tchenrkid', are used at night by the fishermen, who place posts on the beaches to be able to locate them. The guitarfish lines are composed of a main line that is 200 metres long and 1.6 millimetres in diameter. There is only one hook (n°1 or 2), attached with a leader that is 28 centimetres long and 1.8 millimetres in diameter. A small ancre sinker / anchor is attached to the end of the main line, with a monofilament line that is 47 centimetres long.

order to minimise the waste at port. Discarding carcasses after shark fins have been cut off is also practiced in industrial fishing, and in much more significant proportions.

New smoking techniques have also been introduced to avoid the constraints characterising artisanal methods and to meet the high demand for traditionally processed fish products. These include the Chorkor ovens (1984) and 'parpaing' ovens (1986) in Senegal, and prefabricated warehouses in which modern ovens are installed in Kamsar, Guinea. To modernise the artisanal fish processing indus-

try in Senegal (particularly products from the Sharks sector), the national government in 1983, with help from the French cooperation agency, built an experimental solar fish drier, 100 square meters in size with a drying capacity of 1 ton every forty eight hours. During that same period in Senegal, the ITA's¹⁰ 'Solar tents' project pursued the same development goals for the sector. Each of the processing centres has two solar drying units (the tents), two braising and smoking ovens, four fer-

10. Institut de technologie alimentaire (Institute of Food Technology)

mentation-salting-washing vats, a warehouse in which fresh fish is prepared, and a storage warehouse. In 1990, the CPM¹¹, began operations in Senegal with the goal of developing the fishing sector in the Saloum estuary. The 'artisanal fish processing' activities were significant (fish drying racks and smoking ovens were made available). Today, the fish processors have more space, better equipped workshops, and functional, cemented processing areas.

4. Economic factors and analysis of demand

Today, the increasing market for shark fins is the main driving force behind the increasing pressure to target Sharks.

However, as explained in previous sections, Shark carcasses have become economically viable through a new social and work organisation, which have conferred value upon some parts of Sharks that used to be thrown discarded. Shark meat is now processed in different ways making it possible to create various marketable by-products.

These products include: salted and dried fish, *métora* or smoked fish (*saly*), a specialty of Senegal and Guinea; fermented and dried fish (*guedj*); Shark liver oil, manufactured in Senegal in small quantities for local use; frozen products (frozen whole Sharks are mainly produced by Mauritanian industrial fleets); products used in other industries (perfume, leatherworks, jewellery).

4.a. Funding and profitability of Shark fishing activities

Generally speaking, there is an informal system for funding the artisanal fishing sector, characterised by prohibitive inter-

11. Centre de pêche de Missirah (Missirah Fishing Centre)

est rates and very limited investment capacities. To combat these high interest rates, certain NGOs created savings and loan associations (S&Ls) at the beginning of the 1990s, particularly in the major fishing centres in Senegal. Offering funding ranging from 2 to 5 million CFA francs, these S&Ls greatly decreased the dependency of the Shark processors on foreign merchants.

The profitability of selachian processing activities varies according to fishing zone and country. In Guinea, Shark processing is not particularly profitable. For instance, average total annual net revenues from salting and drying operations are approximately 3.7 million Guinean francs (about 8,000 euros), and from smoking 2.3 million Guinean francs (about 5,000 euros). The internal profitability rate (IPR) for these two types of processing are 9.5% and 6.2%, and the return time for the capital invested in these activities exceeds ten years.

A case study in Senegal (Dème *et al.*, 2006) determined the investment costs, operating expenses and net revenues generated for the different types of fishing (see Table VII).

In Guinea-Bissau, given the price of fuel and cost of the crew, a minimum catch of 7 to 8 kilograms of shark fins or 400 kilograms of fresh Shark products is required for a fishing expedition to be profitable.

In Cape-Verde in 2005, a Senegalese boat owner living in Praia, who managed a coastal fishing boat, was interviewed. He declared that his activity was profitable, to the extent that he could pay for chartering the boat and make substantial earnings from operating it.

Recent research into the Shark fishing business (Diop *et al.*, in press) describes the networks through which various Shark products are sold.

Sales networks

There are two principal networks: 1) linked to the regional market for Shark

meat (salted and dried or smoked – for information on Guinea, see Figure 3); for shark fins, Figure 2): the South East Asia export market.

It is important to remember that Shark fishing first developed on the West African

coasts to meet local demand. In Ghana, Sharks were caught, often accidentally as by-catch, by fishermen targeting small pelagic fish, and their meat was then transformed into salted and dried products that were exchanged with the inland rural populations for grain products (Diop

Figure 3. Sales network for Shark products in Guinea (CNSHB, 2007)

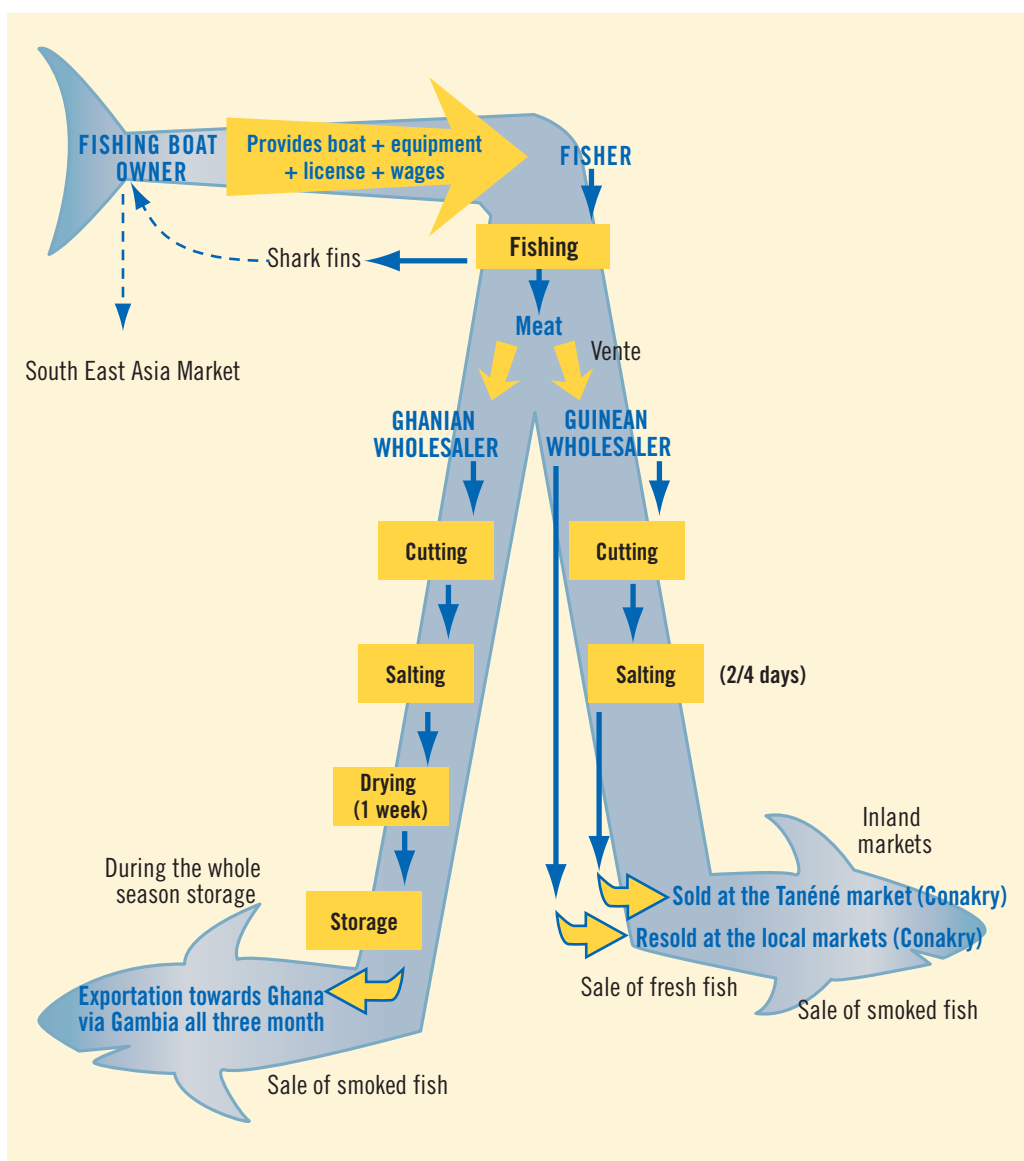


Table VII. Analysis of the profitability of the means of production in the Sharks industry in Senegal (FCFA)

En francs CFA	Rhinobatos (guitarfish) trap nets	Bottom set nets day fishing (one-day trip)	Bottom set nets longer trip
Investment costs	3 950 000	3 775 000	6 740 000
Operating costs	5 060 000	4 060 000	7 643 000
Net revenues generated	1 400 000	1 503 000	1 619 000

Source: Dème et al., (2006).

et al., 2007)¹². These Shark products were appreciated for their nutritional value, but also because they keep well, and could be preserved to last longer than bush meat. The market opportunities were very limited, with greater local demand for the small pelagic fish that were abundant at the time. The lack of economic profitability characterising Shark fishing at that time naturally limited Shark exploitation activities, which explains why few people specialised in the Shark fishing business. Furthermore, in some societies eating Sharks, which were considered to be dangerous, was taboo.

In Mauritania, for example, at the beginning of the 1970s, Shark fishing was almost nonexistent. In the Banc d'Arguin zone, the Imraguens' relationship with Sharks was based on extreme fear of them. Antunaioz (1967) wrote: "The Atlantic coast is infested with sharks, and the fishermen are exposed to their attacks, often bitten, and sometimes even have a limb amputated." Fishermen on the West African coast expressed a strong fear of these 'dangerous' animals. The most implicated species in these attacks was the shark with two dorsal fins, known as the lemon shark (*Negaprion brevirostris*).

Few species were exploited in the sub-region: in Mauritania, mainly smooth hounds, whereas in Senegal and Gambia, where some twenty species had been identified, the landings were especially tiger sharks, hammerhead sharks, and various species of guitarfish.

12. This practice was observed in the Sine Saloum region, in Senegal.

The shark products market in the sub region.

This market was supplied mostly by Senegal and Gambia, then Mauritania. Furthermore, in the zone between Joal and Mbour (Senegal) and Gambia, the meat's economic value is better promoted, because of the size of the Ghanaian market, which is not able to produce enough to meet its own demands. Wholesalers from countries in the Gulf of Guinea, where there is a profitable market for salted and dried Sharks products, occasionally buy supplies in this zone. The experienced merchants in this geographic area are knowledgeable about the road networks connecting the weekly wholesale markets for processed Shark products (Diaobé, in Senegal, and N'Zérékoré, in Guinea, the Tuesday Market, in Ghana, etc.).

In Mauritania, before 1978, the sharks caught were discarded. Then the first Senegalese pirogues targeting Sharks arrived. In 1979, there were five pirogues being used for selachian fishing. In 1980, there were already twice as many. Between eight and nine fishermen went out on these boats, which could bring in revenues of 80 to 100,000 UM (after deducting overhead costs), which means 300 euros per fisherman for a six-day outing. During this period, the rays and sharks caught in Mauritanian waters were either brought directly to Senegal (then exported to Gambia, Nigeria, the Congo, Ghana, and South East Asia, depending on the product), or brought to Nouakchott, where the Sharks were transformed into salted and dried products, and sold to foreign wholesale



Salted and dried meat of shark on fishing zone of Kamsar in Guinea . (J. Dossa)

fish merchants (particularly, Senegalese), who paid to have them exported to Senegal. There were few wholesale fish merchants, and sometimes the fishermen exported the products to Senegal themselves.

The highly sought after shark fins only represented on average about 5% of the total weight of the Sharks (Ocean, 2010) and the carcasses were transformed into smoked, salted and dried, or fermented and dried meat for the local market. The dried meat was sold in Ghana, whereas the smoked product was consumed in many of the countries in the coastal area.

Locally, the wives of fishermen have always played a very important role in the salting and drying or fermenting and drying (*guedj*) of the fish purchased or received from their husbands. Still today, the wives of Senegalese fishermen perform this activity on 'fishermen's beach' in Nouakchott, Mauritania.

The European market

In Mauritania, at the beginning of the 1900s, fishermen using overnight nets to catch smooth hounds (*Mustelus mustelus*), the best known and most abundant sharks in the northern Mauritanian waters, for the Canary Islands market. In 1905, the catches by schooners from the Canaries were estimated to be between 7,000 and 9,500 tons of various species, including meagre (Tous *et al.*, 2002).

In Senegal, during World War II, the extraction of liver oil from the deep-sea gulper shark (*Centrophorus granulosus*) justified the implementation of targeted fishing. The traders involved in this activity were French, and they exported their products to Europe. The discovery of synthetic vitamin A led them to abandon this activity only a few years later.

In Senegal and Mauritania, the presence of specific processing factories for Shark meat using salting and drying techniques was



Shark fins on board of a vessel that had practiced finning in Cape Verde. (I. Ndiaye)

another factor that encouraged the targeting of these species to be exported to Europe, where the demand was high on the Spanish market. On the Mauritanian and Senegalese coasts, the Shark catch increased at the end of the 1960s. Given how abundant Sharks were in Mauritania, the fishing, especially for blue sharks and oceanic whitetip sharks, was carried out from the beach using lines, and was adequate to satisfy the factories' requirements. These factories belonged to Europeans, who exported the products (fresh and salted and dried) to Spain, France, and Japan.

Still in Mauritania, starting at the end of the 1980s, some Portuguese traders made contact with Imraguen fishermen in the PNBA, thanks to wholesale fish merchants in the zone, to buy fresh products to be exported to the European market. At the same time, a high demand was made for fresh Shark by the factories set up in Senegal to export to Spain, Holland, and Italy.

At this time, purse seiners also started targeting Sharks.

Asian and international shark fin markets

The Asian shark fin market has been the driving force behind the Shark fishing business in the past twenty years. According to Mika Diop (Personal comment) Hong Kong, Taiwan and, to a lesser extent, Singapore and Japan are the final destinations of virtually all the worldwide production of Shark fins (95%).

The price of shark fins on the international market rose from 1 US dollar/lb in the mid 1980s to 30 US dollars/lb in 1990 (Camhi, 1998). In Taiwan, the price for one kilogramme of top grade shark fins was more than 500 US dollars (WWF, 1996). This explosion in demand is correlated to the economic boom in the countries of South East Asia, where shark fin soup is considered to be an indicator of wealth at a

Chinese wedding, but also as an aphrodisiac (Mika Diop, Personal comment). The wider dissemination of Asian culinary specialities throughout the world, via restaurants and supermarkets selling shark and shark fin products, has also contributed to the increased demand.

Locally, the price paid to fishermen for shark fins may be as high as 100 US dollars per kilogram (Ducrocq, 1997), which represents a significant amount of money for an artisanal fisherman in a developing country. In this context, it is easy to understand the attraction to artisanal fishermen of this activity, which is also considered to be adventurous and prestigious. Small scale and semi-industrial fishermen are targeting sharks because of their very high market price. This problem is compounded by some crew members of industrial fishing vessels also practicing *finning* that is, removing the shark fins before

throwing the carcasses back in the sea (Niamadio and Ducrocq, 2002).

It is also worth mentioning that shark fins are often directly bartered for Asian manufactured goods (appliances, clothes, etc.), which are then sold on the African markets. However, in a situation where there is free access to resources and low export taxes applied to artisanal fishing, the national governments earn very little for the exploitation of these resources.

MIGRATORY MOVEMENTS AND SOCIAL TRANSFORMATIONS

Due to the scarcity of Sharks in the countries where they were initially exploited, such as Gambia, and Senegal, fishermen have developed a fishing strategy that includes long migratory movements.

These large migratory movements have been occurring since the late 1980s. The Asian shark fin market developed at that time, leading to the arrival of new participants in this sector. New centres of interest started emerging (Guinea, Sierra Leone), to the detriment of former fishing centres, which no longer provided good yields (Gambia, Senegal) or where targeted fishing was forbidden (Parc National du Banc d'Arguin, in Mauritania).

1. Origins and strategies of the fishermen involved in migratory flows

Although fishermen from several countries have been involved in the migratory flows linked to the Shark fishing business, most of them are from Ghana or Senegal. Having depleted the Shark resources in Gambian and then Senegalese waters, these communities started making longer outings (sometimes up to one month long, compared to three to five days before), to Mauritania in the north, and Casamance (Senegal) and Guinea-Bissau in the south, where the yields were better. They then explored the fishing zone further south, first in Guinea, then in Sierra Leone and Liberia.

The different communities adopted various migratory strategies.

Ghanaians are among the biggest migrants in the sub-region. Those who practiced Shark fishing settled in Gambia, Casamance (Senegal), and Guinea-Bissau, with a preference for Gambia (for linguistic reasons) where in the 1970s they established the village of Brufut, nicknamed 'Ghana Town'. At the end of the 1960s, successive waves of Ghanaian migrants from the south of Senegal arrived in the Shark-rich fishing zones. The *félé félé*, a type of driftnet, progressively replaced purse seining. As in Gambia, the Ghanaian migrants settled in Guinea and established a fishing village in Kassa (Loos islands), across from Conakry. From this site, they are still

engaged in fishing expeditions along the entire Guinean coast. Due to the scarcity of the resource and the introduction of fishing licences, considered to be exorbitantly priced, the fishing trips have shifted to Sierra Leone and Liberia, where access to resources is more affordable.

With the increased arrival of Ghanaian migrants in Guinea, Shark fishing, which was a seasonal activity open from October to May from 1990 to 2003, became a year-long activity as of 2003.

The **Senegalese** (essentially GuetNdariens, Lebous, Nyominkas, and Walos-Walos) are the other big community of Shark fishermen.

Having worked in Gambia and Mauritania, they migrated southwards to Sierra Leone. They started in the south of Senegal, where they settled in camps in Casamance (Kafountine, Elinkine, Diogué), where they fished the waters of Guinea-Bissau. Progressively, their scope of action broadened southwards to include Guinea-Bissau, Guinea-Conakry, and Sierra Leone. In Guinea, they settled in the village of Kassa, alongside the Ghanaian community, and worked in the Kamsar port for artisanal fishermen, and to a lesser extent, in certain artisanal fishing ports in Conakry (Boulbinet, Taminataye, and Bonfi). They were sometimes taken on board, during their first migrations, by shark fin traders who also processed Shark meat for the forest regions. These Shark fishing specialists are divided in two groups: the first group does not migrate along the coastline while a second group is composed of migrants that operate in the Guineans waters for two to three weeks before sailing to their home ports in Senegal.

2. Impact of migratory movements

It is likely that the mobility of fishermen has greatly contributed to the rapid development of Shark fishing, especially artisanal fishing, and to the overexploitation



Figure 4. Migrations of Shark fishermen in the SRFC zone (studies completed within the framework of the SRPOA-Sharks Project, Sall, 2006)



of Sharks in the SRFC zone. It has been observed that Shark fishing also involves countries with no coastline, such as Mali (see figure 4). Driven by industrial fishing, the migratory cycles have become intercontinental due to the demand from European boat owners, in particular the Spanish. These migrations have gone beyond the scope of artisanal fishing. The reckless hunt for shark fins has indeed pushed artisanal fishermen from SRFC member countries to play a role as shark fin gatherers for freezer boats, which fish Sharks as far away as waters under Australian jurisdiction. The migrations of artisanal fishermen looking for Sharks on the coasts of the SRFC zone have brought about many social transformations. They create a sociocultural melting pot in which the various communities of fishermen mix, but also lead to the discovery and dissemination of new ways of creating economic value from the fish resources. The Shark trade emerged and expanded via these processes, which were marked by the arrival of certain local populations who took part in the industry's activities, according to the

opportunities offered in terms of investment and new revenues. For example, the migrations represented a key moment of 'capitalisation' for the Guet-Ndarians who worked in Mauritania, where they accumulated capital to purchase one or more fishing boats, and learned new fishing techniques. The fibreglass pirogues, which had not had much success among the Senegalese fishermen, became more widely by the Guet-Ndarians. The introduction of driftnets in Mauritania, which was funded by private business, contributed greatly to the practice and to the development of new fishing techniques in Mauritanian waters and beyond. These migratory movements sometimes lead to conflicts, as the resources become scarce and the demand for shark fins increases. Conflicts between the host communities (especially the women involved in Shark processing and sales operations) and migrants have been observed. For example, the women from Burkina Faso based in Joal, who prepare *métora* (braised shark), are accused by Senegalese women Shark processors of depriving them of the

raw material they need. Sall (1999) has reported on this type of conflict between local populations in Joal and the people from Burkina Faso. The same is true of the Ghanaians based in Casamance, who are blamed by the women at the Diogué, Elinkine, Kafountine, Diana, and Cap Skirring sites of refusing to sell them their Shark carcasses, which they return to the women in their own community. In terms of social transformations, it must also be pointed out that the fishermen, who are led to explore new zones when they embark on longer trips (twenty to thirty days at sea), or even seasonal movements (three to six months), sometimes settle there permanently. The repercussions of this re-settling process on the social structure of their place of origin can be significant.

In addition, the fact that the fishermen exploit stocks that are deeper and deeper in the sea has a significant impact on the investments in terms of equipment (particularly for the conservation of fresh products) and fuel. More and more operating accounts that show a deficit are being seen in the zones in which the resource is becoming scarce. To avoid this, some crews are starting to act recklessly: they fish in marine protected areas or use forbidden fishing techniques, despite the fines they may incur. Several conflicts linked to this search for profitability have been reported¹³.

Another negative impact of these migratory movements is the degradation of coastal habitats, due to the use of mangrove wood for fires. Since the arrival of the migrants, processing activities have developed that produce smoked fish, but they consume a great deal of mangrove wood. A striking example is the quantity of mangrove that has disappeared in only a few years near the port of Kamsar, in Guinea.

13. For instance, conflicts between Guet-Ndarian fishermen and Mauritanian authorities, and conflicts between Guet-Ndarians and Kayarois.

We must remember that the exploitation of sharks is facilitated by considerable financial support from external stakeholders to purchase shark fins. This investment is as much for the fishermen as for the fish processors. The major losses recorded by certain fishermen tend to make them more dependent on these 'hidden' financial actors, called 'wholesale fish merchants,' because they finance the fishing expeditions. This situation enables the wholesale fish merchants (who are also the 'lenders') to strengthen their monopolistic positions, by means of top-down strategies for controlling the Shark exploitation activities, which consist in signing purchase contracts with the fishermen to buy most of what they catch, and in being involved in the processing and selling of the products.

FISHING ZONES AND TRENDS IN CATCHES IN THE SUB-REGION

1. Fishing sites set aside for Shark fishing activities

Studies carried out and surveys made at landing areas within the framework of the SRPOA-Sharks Project and the NPOA-Sharks have identified the landing areas and selachian fishing zones in the exclusive economic zones (EEZ) in the seven SRFC member countries (see Figure 5).

Specialised artisanal fisheries can be found in Gambia, Senegal (the Grande Côte, the Saloum delta, and Casamance), in the Bijagos islands and on the coast in Guinea-Bissau, Guinea, and Sierra Leone, as well as, temporarily, in the seasonal camps found in Mauritania. There was also a specialised fishery in Mauritania in the PNBA, which was forbidden in 2003, after consultation with the Imraguen fishermen, the PNBA administration, and the fisheries ministry, on the basis of research findings, which showed that such a fishery was not sustainable.

Figure 5. Landing areas and selachian fishing zones in the exclusive economic zones (EEZ) in the 7 SRFC member countries



Figure 5a: Mauritania

In **Mauritania**, the principal landing sites are located in Nouadhibou (Boutiya) and Nouakchott. Temporary camps have been identified between the PNBA and Nouakchott. A specialised Shark fishery had been developed in the PNBA until 2003. Its activities were officially stopped in 2004, at least for guitarfish and the large shark species.

In **Gambia**, the principal fishing zones are Gunjur, Tanji, Bakau, Burufut, Kartung, Sanyang, and Banjul (in decreasing order of importance). They can be mixed up with those in Senegal, due to their proximity and the fact they are operated by the same communities.



Figure 5b: the Gambia



Figure 5c: Senegal

In **Senegal**, Sharks are caught at all coastal fishing centres, either as target species, or accidentally as by-catch. However, most Shark landings take place

on the Grande Côte (Saint-Louis), the Petite Côte (M'bour and Joal), and in the south (Kafountine and Elinkine, in Casamance).

In **Guinea**, the coastal zones, particularly around the Loos islands, off Koba, and the zone near Boké (îles de Katckeck the Katcheck islands, Alkatraz, and the port at Kamsar) and Kassa are renowned selachian fishing sites. This resource is exploited by Senegalese and Ghanaian fishermen, who stay there on a temporary or permanent basis.

In **Guinea-Bissau**, the Bijagos archipelagos and Melo Island, in the south of the country, are important Shark fishing zones.



Figure 5d: Guinea



Figure 5e: Guinea-Bissau

In **Cape-Verde**, due to the almost total absence of a continental shelf, the regions of Sao Vicente and Santa Lucia seem to be the only zones in which there is a significant number of incidental Shark by-catch. In **Sierra Leone**, shark fishing is concentrated in Bonthe, Shenge, and Moyamba Island.

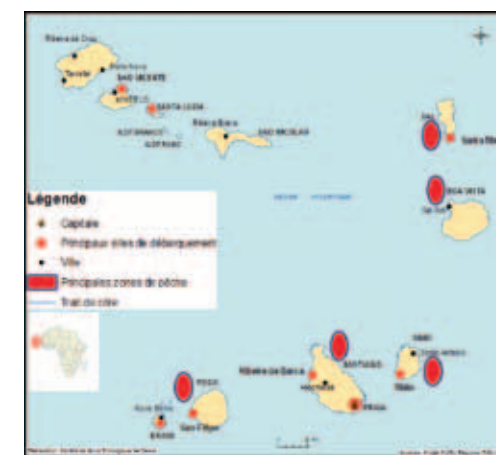


Figure 5f: Cap-verde



Figure 5g: Sierra-Leone



Drying of guitar rays on a processing site in Mauritania.

2. Trends in Shark landings in the SRFC zone

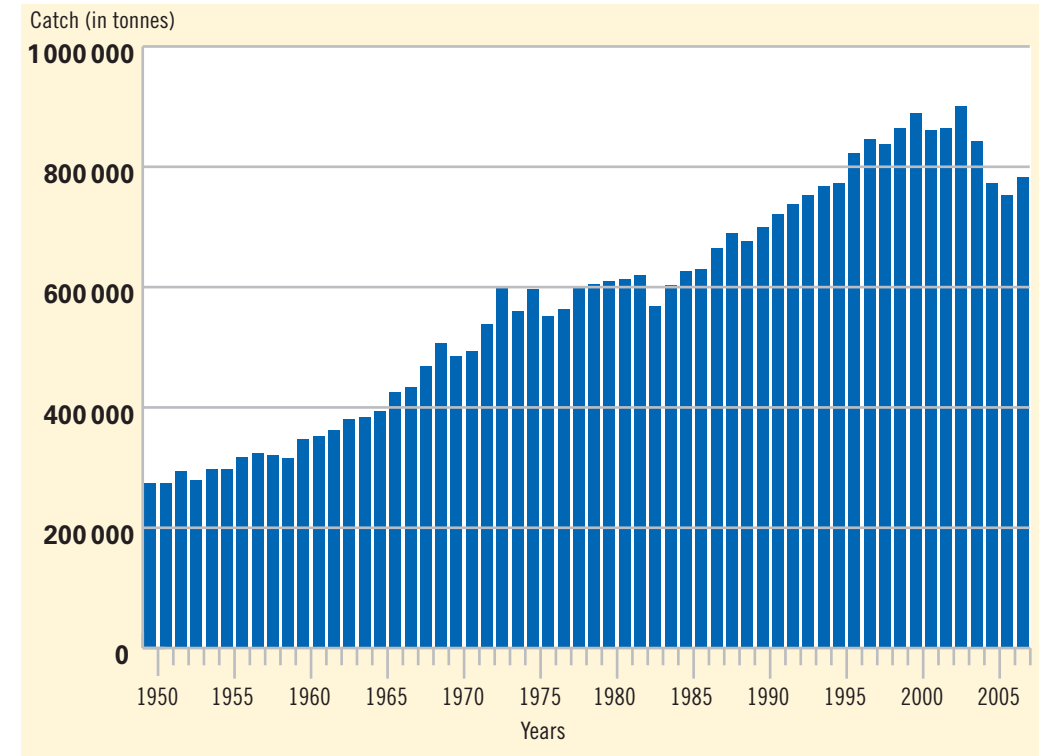
As we stated in the introduction, chondrichthyes have been increasingly intensively exploited since the middle of the 1980s, due to an increased demand for shark products (particularly, shark fins, but also meat, skin, cartilage, etc.) from South East Asia.

At the worldwide level, between 1984 and 2004, Shark catch increased from 600,000 tons to more than 810,000 (Bonfil, 2002; EU POA-Sharks, 2009). Worldwide catch tripled between 1950 and 2000 (see Figure 6).

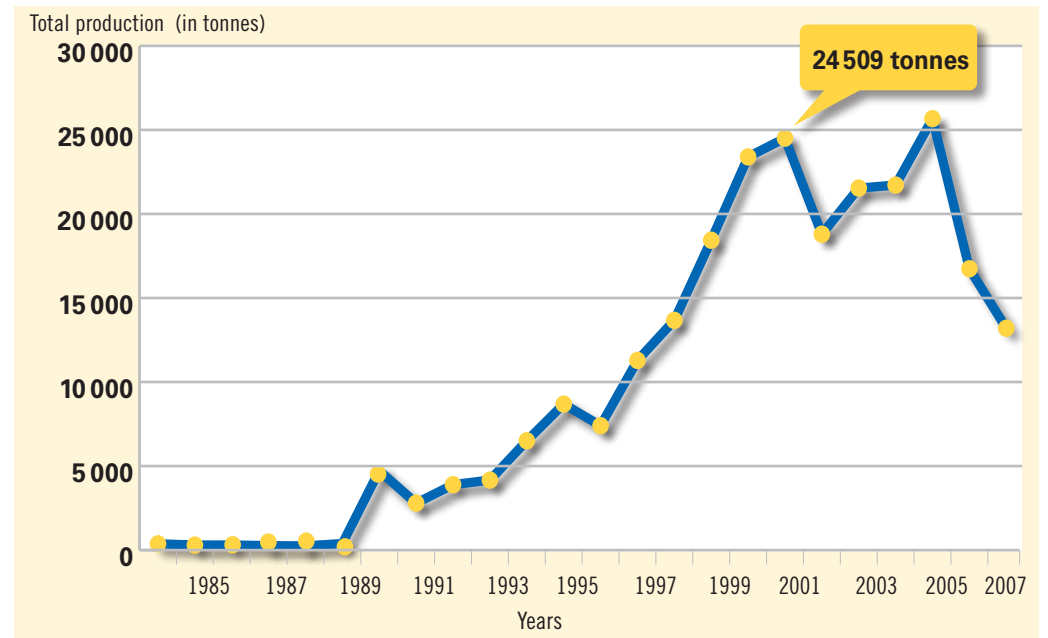
Pile of Sharks salted and dried meat on a site of Saint Louis, Senegal. (J. Dossa)



Figure 6. Trends in worldwide Shark catches (FAO Data, 2010)



Trends in Sharks caught in the SRFC zone from 1984 to 2008 (SRPOA-Sharks data)





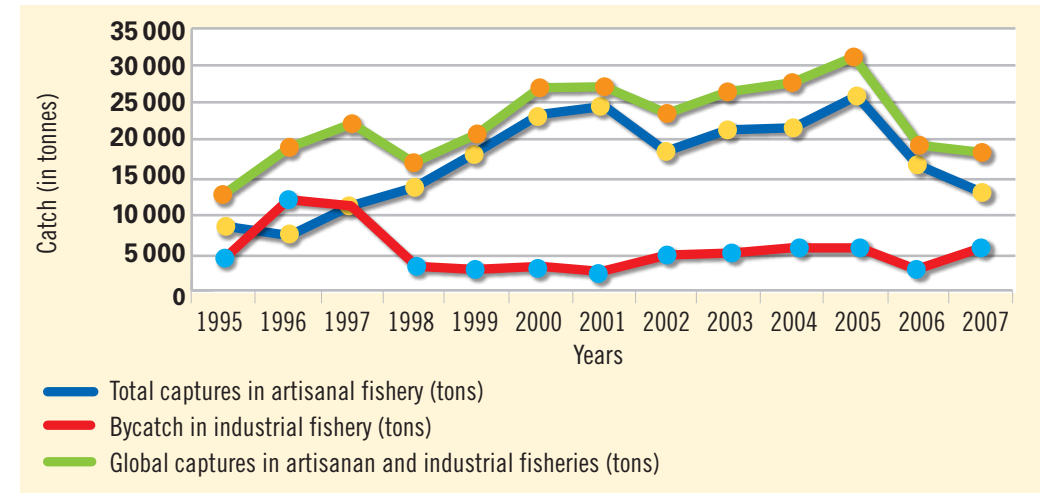
Landing of sharks in Mauritania. (A. Araujo)

In 2000, worldwide Shark catches were estimated to be nearly 900,000 tons in 2003. There was a decrease in the amount of sharks, rays, and chimaeras caught, which was estimated to be 750,000 tons in 2006, or 15% less than the maximum level (anonymous, 2008). This upward trend in harvest could be explained by the fact that Sharks were at the center of attention by international institutions, regional fisheries management organisations, and the public. This general awareness contributed to the improvement in catch declaration. In the SRFC zone, the Shark catch declared by artisanal fishermen was less than 4,000 tons before 1989 (see figure 7). In 1990, catch increased sharply, rising from 5,000 tons to more than 26,000 tons in 2005. The trend has been reversed since 2005: the declared landings amounted to 12,000 tons in 2008, i.e., a drop of more than 50% in three years.

The information collected by on board observers and from fishermen, as well as the analyses of databases from different countries, show that industrial fishing is responsible for a significant level of bycatch – which are not always reported. This bycatch is from industrial trawlers, tuna boats and longliners. Analyses show that even though the declared incidental catch was showing irregular patterns, there has been an overall downward trend since 1998 (see Figure 8). After a sharp peak in 1996 and 1997, with declared volumes of nearly 12,000 tons, a significant decrease occurred to less than 4,000 tons in 1998. Bycatch started to rise again in 2001, with values close to 6,000 tons in 2004, followed by a drop to approximately 5,000 tons.

A comparison between targeted catches and bycatch was carried out (Figure 8). Bycatch declared by the industrial fishing

Figure 8. Overall trends in Shark bycatch by the industrial fisheries in the SRFC zone from 1995 to 2007



sector was estimated at nearly 12,000 tons in 1996 and 1997. This bycatch exceeded the landings of the artisanal fishing sector during the same period (estimated at 8000 tons). The overall impact of fishing on Sharks would therefore be about 20,000 tons. After 1997, the overall Shark catch was around 30,000 tons in the sub-region with a reversal in the trend; more landings from the artisanal fisheries.

Given the volume of bycatch it must be considered by any management measures implemented. In addition, we must point out that most of the data on bycatch is derived from declarations made at the landing areas. This information does not take into account any Sharks that were discarded at sea. Therefore, this may lead to an under-estimation of the number of Sharks caught by domestic industrial fishing boats, but especially by foreign vessels, which are forced to respect the operating norms stipulated in their fishing licences. Further investigations of Shark discards would help to refine these conclusions. The overall decrease in catch in the West African sub-region is an indication that this resource

has decreased: there is an almost complete disappearance of some species (e.g. sawfish) and a scarcity of others, such as guitarfish and large hammerhead sharks.

3. Variety of Shark species encountered on the coast in the SRFC zone

Research by Niamadio and Ducrocq (2002), and the studies carried out within the framework of the SRPOA-Sharks Project (mainly surveys made at the landing sites), have made it possible to draw up a complete list of the Shark species found in the coastal waters in the SRFC zone (see appendix 3). These findings confirm that Shark resources in the sub-region are diverse. The number of species recorded in the landings per country varied from 20 in Sierra Leone, to 70 in Senegal (see figure 9).

An important number of species are widely distributed. Among them are flagship species such as the sawfish (*Pristis pectinata*), the whale shark (*Rhincodon typus*), the giant manta ray (*Manta birostris*), and the African wedgefish (*Rhynchobatus luebberti*).

The most common species in the SRFC countries are *Rhinobatos rhinobatos* (guitarfish), *Mustelus mustelus* (smooth hound), *Raja miraletus* (twineye skate), and *Paragaleus pectoralis* (Atlantic weasel shark).

Figure 10 shows that 50% of the species identified in the SRFC zone can only be found in one country. Slightly less than half of the species inventoried can be found in two, three, four, or five countries. Very few species (4%) are found in six countries. No single ray or shark spe-

cies can be found in all of the countries. Although sharks are migratory species, the presence of a species in the landings shows that it can be found in the country's EEZ, and that there is an ecosystem favourable to its survival. The fact that most of the species can only be found in one country is important, because high fishing pressure in that zone could lead to their disappearance in the sub-region.

Among the species very rarely found, five are 'critically endangered', according to the IUCN Red List, which was updated

Figure 9. Number of Shark species identified in each SRFC country

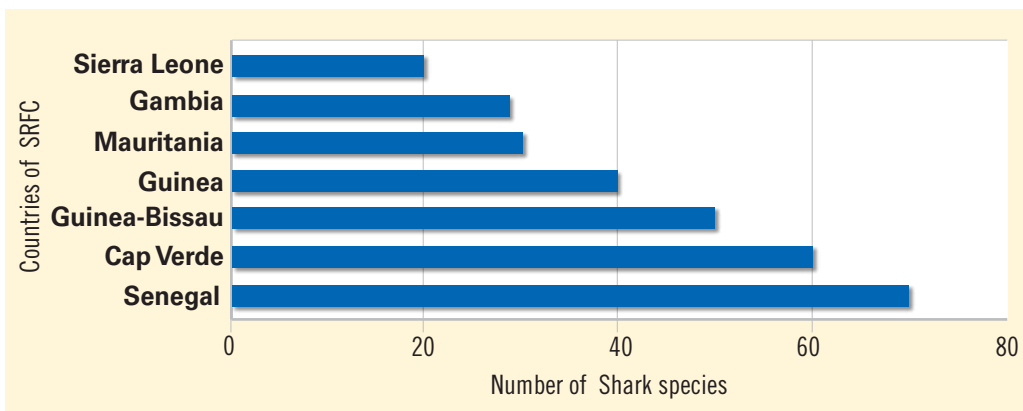
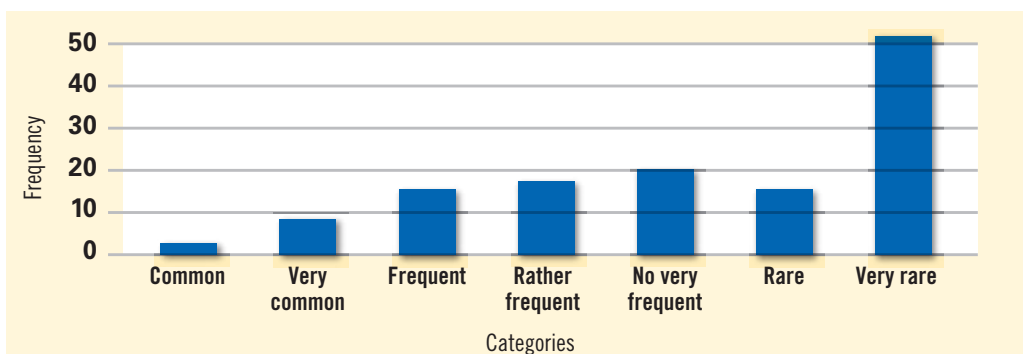


Figure 10. Frequency of observation of Shark species in SRFC countries



Common species: species found in the seven countries
Very frequent species: species found in six countries
Frequent species: species found in five countries
Rather frequent species: species found in four countries

Infrequent species: species found in three countries
Rare species: species found in two countries
Very rare species: species found in only one country.

Text box 6. Ray and shark species found in SRFC countries

In **Senegal**, 40 species of sharks and 30 species of rays have been identified in the landings (CADENAT, 1950, SRPOA-Sharks Project reports). Fisheries mainly target guitarfish (Rhinobatidae) and coastal sharks, particularly Carcharhinidae. A significant level of ray bycatch has been observed.

In **Mauritania**, 30 coastal species (16 sharks and 14 rays) have been identified. Three species targeted by artisanal fishing, *Mustelus mustelus*, *Rhizoprionodon acutus*, and *Rhinobatos cemiculus*, are taken in great numbers. Only one Squalidae (*Squalus fernandinus*) is taken by the industrial fisheries.

In **Guinea**, 40 species (20 sharks and 20 rays) were found. The most important landings were *Carcharhinus limbatus* (a species considered to be Near Threatened on the IUCN red list), *C. leucas*, *Rhinobatos cemiculus*, *Rhinoptera bonasus*, *Dasyatis margarita* and, in general, *Dasyatidae* in the estuary and coastal zone and *Carcharhinidae* on the high seas.

In **Cape-Verde**, 60 species have been recorded since the end of the 1950s. The landings are comprised of deep-dwelling species and certain pelagic species, the most important of which are *Centrophorus granulosus*, *C. uyato*, *Sphyrna zygaena*, *Carcharodon carcharias*, *Galeocerdo cuvieri*, *Prionace glauca*, and *Mustelus mustelus*. Other coastal species are also found, notably *Galeocerdo cuvieri*, and deep sea *Centrophorus spp.*

In **Guinea-Bissau**, 29 species of sharks and 21 species of rays were identified during experimental fishing trips conducted in 1989 by IPIMAR (The Portuguese Government

marine research institute). The species taken in the highest numbers were *Rhizoprionodon acutus*, *Carcharhinus limbatus*, *C. brevipinna*, *C. leucas*, *Sphyrna lewini*, *Rhinobatos cemiculus*, *Rhinoptera marginata*, *Dasyatis margarita*, and *Pteromylaeus bovinus*.

In **Sierra Leone**, 20 elasmobranch species (14 sharks and 6 rays) are exploited. The most abundant sharks in the catches, in terms of weight, are *Sphyrna spp* (27%) and *Carcharhinus spp* (52%). However, in terms of numbers, the species *Ginglymostoma cirratum* is the most frequent in the landings (31%). *Rhinobatos spp* and *Dasyatis spp* are found in the highest numbers, both in terms of weight and number.

In **Gambia**, 29 species (14 sharks and 15 rays) have been identified. This includes *Dasyatis margarita*, *D. pastinaca*, *Gymnura micrura*, *Rhinoptera marginata*, *Carcharhinus brevipinna*, *Rhizoprionodon acutus*, and *Sphyrna lewini*.

N.B.: the situation described in text box 6 can change over time, according to market demand and the status of the stocks exploited.



in 2007 for West Africa: *Rhynchobatus luebberti*, *Sphyrna mokarran*, *Squatina aculeata*, *Squatina oculata*, and *Squatina squatina*

We must remember that given their biological characteristics (late sexual maturity, low fertility rate, and slow growth),

Sharks are highly vulnerable to fishing pressure (see Text Box 7). Therefore, the combined effects of targeted artisanal fishing and significant incidental by-catch by industrial fisheries could mark the end of the once abundant selachian populations in the region.

Text box 7. The biological specificity of Sharks: a factor in their vulnerability to exploitation

Cartilaginous fish are top predators. Except in some rare cases, they have no natural predators, unless they meet a bigger shark. Therefore, they regulate the balance among in marine ecosystems.

Although there are over 1,000 species of Sharks, there are some common characteristics shared by almost all Shark species.

Most species reach sexual maturity very late (more than 10 years), their gestation is very long (often more than nine months), with the use of organs similar to the placenta found in mammals. Their reproductive cycles are annual or biennial.

*In addition, their fertility rate is very low, and most species produce no more than eight pups per litter. Only a few species or groups of species have litters with dozens of pups, such as the hammerhead shark *Sphyrna* spp and the tiger shark *Galeocerdo cuvieri*, or even several hundred for the whale shark *Rhincodon typus*.*

These figures are the maximums observed, and we should point out that on average a pregnant shark has fewer foetuses, and also that these maximum litters come from the most highly reproductive sharks, and younger ones have a much lower fertility rate.

*For example, in Mauritania it has been shown that female *Rhizoprionodon acutus* carry one or two fetuses during their first reproductive cycle. The maximum number of six pups per litter is only seen on a regular basis in very large females (105 to 115 centimetres, the maximum size observed). The youngest age groups contribute rela-*

tively little to the reproductive output, and it is of course the individuals in the oldest age groups that disappear the most quickly from a population when targeted by fishing. In an overfished population, in which the large breeding Sharks have been removed, the reproductive effort of female adults is lower than in a healthy population. Therefore, continuing to exploit an overfished population further accelerates its collapse.

*Other aspects of Shark behaviour must be considered, for example segregation by size and by sex. In some species, schools of sharks are composed of a high majority (or only) individuals of the same sex and/or in the same age group. More than 60% of the *Rhinoptera marginata* caught at the Banc d'Arguin (Mauritania) from March to June are females. Catches of *Sphyrna lewini* (small hammerhead sharks) usually occur in schools of juvenile sharks, with a many individuals of about the same size. For *Rhizoprionodon acutus* (milk sharks), 70 to 85% of the individuals caught from April to June at the PNBA are females, more than half of them are carrying fully developed foetuses, and they are concentrated in a well-defined fishing zone, in relatively shallow water.*

These biological characteristics explain the great vulnerability of sharks to exploitation. In addition, fishermen are familiar with their migrations and or groupings linked to their biological cycles, which results in targeted and intensified fishing practices. For this reason, artisanal fishing can have extremely destructive effects on these populations.



Part three.

Status of shark stocks in the SRFC zone and initial Conclusions



CONSERVATION STATUS OF SHARKS IN WEST AFRICA

THE INTENSIVE EXPLOITATION OF SHARKS over the past thirty years has completely decimated the most vulnerable populations of Sharks.

Some species are extinct locally, for example, *Pristidae* (sawfish) in Mauritania, Senegal, Gambia, Guinea, and Sierra Leone. The only remaining population is in the Bijagos islands in Guinea-Bissau. *Rhynchobatidae* (guitarfish) have also almost completely disappeared in the sub-region, except at the Banc d'Arguin, in Mauritania. Other species, like the great hammerhead shark (*Sphyrna mokarran*) and the lemon shark (*Negaprion brevirostris*), are threatened. Furthermore, the proportion of large breeding sharks has decreased in all large shark species. Finally, degradation in the status of all species has been observed.

The IUCN Red List is an important source of information on the issues described above. It was recently updated for West Africa (2007), partly thanks to the results from the SRPOA-Sharks Project. This update shows that several species are Endangered, or even Critically Endangered. The following species are of particular concern:

—*Pristis microdon*, *Pristis pectinata*, *Pristis pristis*, *Squatina aculeata*, *Squatina oculata*



Rostrum transformed into a weapon by a Diola - Gunjur, Gambia. (Robillard & Yvon)

and *Squatina squatina* (6 Critically Endangered species);
 –, *Rhynchobatus luebberti*, *Sphyrna mokarran*, *Rhinobatos cemiculus*, *Rhinobatos rhinobatos*, *Sphyrna lewini* (5 Endangered species);
 –*Gymnura altavela*, *Rhinobatos irvinei*, *Sphyrna zygaena*, and *Rhincodon typus* (4 Vulnerable species).

The SRPOA-Sharks Project made a substantial contribution to the listing of *Pristiidae* (sawfish) under CITES. Unfortunately, CITES only regulates trading at an international level, and this listing has not been translated to all of the national regulations, nor systematically backed up by protective measures. In fact, only Guinea and Senegal have followed the CITES

Text box 8. The PNBA's participative management experience

The PNBA has been using a participative management approach for more than ten years, which gets the local communities involved in the decision-making processes. The village chiefs and traditional authorities were consulted to 1) prepare the legislation relating to the PNBA, 2) design the maritime surveillance system, and 3) prepare the opening of the Park to ecotourism. In addition, each village has representation on the 'lanche committee' which monitors the fleet of lanche boats and oversees the registrations of these traditional sailboats.

Similarly, no solution could be found to the overexploitation of selachians without the involvement of the community of Imraguen fishermen. As a result, annual workshops were set up to discuss issues relating to selachian fishing.

Since 1998, these workshops have attempted to communicate the results of the scientific monitoring of selachian fishing to all concerned in a simplified manner. The following table presents the developments of conservation measures for rays and sharks from 1998 to 2001, the implementation process of which is described in Text Box 9.

Périodes	Mesures de conservation
1998	Prefectoral decree setting the opening and closing dates for the selachian fishing season (from 1 February to 15 September)
October 1998	1 st joint workshop: conservation measures put in place for rays and sharks: limitations on the fishing season and the number of nets per lanche
October 1999	2 nd joint workshop: reinforcement of selachian fishing measures
January 2001	3 rd joint workshop: reinforcement of measures limiting selachian fishing
December 2001	4 th joint workshop: reinforcement of measures limiting selachian fishing
2002	5 th joint workshop: halt large shark fishing
2003	6 th joint workshop: halt targeted ray and shark fishing

recommendations by officially forbidding the fishing and sale of sawfish.

In the PNBA (see text boxes 8 and 9), the ban on shark fishing and the destruction of fishing gear in 2003 has impacted guitarfish and large sharks – the *Carcharhinidae* (bouledogue bull, bordé blacktip, and lemon sharks), and the great hammerhead shark *Sphyrna mokarran*. However,

it has not been possible to achieve all goals particularly for the small species of sharks and the juvenile hammerhead sharks. This was an extremely valuable experience in terms of proposing a new approach and participative management. However, it should not be repeated on other sites without a preliminary analysis of local conditions.

Text box 9. Process leading to the end of targeted fishing of rays and large sharks in the PNBA

In October 1998, the first of six annual joint workshops on the future of fishing in the PNBA took place in Mamghar. These two- to three-day meetings take place every year in a different village.

The traditional chief, a representative of the fishermen and of the women fish processors were invited from each village to this first gathering, and during the following workshops a representative from the village cooperative office also participated in the debates. Representatives from territorial administrations, the Mauritanian Ministry of Fisheries, the PNBA, fish researchers, Fisheries Surveillance, and from institutions such as the Ministry of Economic Affaires and Development, the Commission for Combating Poverty, and the Secretariat for Women's Conditions attended these meetings, as well as some technical and financial partners, such as the FIBA, and, more occasionally, the bi- and multi-lateral cooperation agencies and diplomatic representatives.

A common vision emerged from these discussions: scientists and fishermen agreed on the fragile state of Shark resources, which could not be exploited sustainably, and the significant risk that some species would become extremely scarce or simply disappear. Joint reflections focusing on the scientific database made it possible to identify consensually, as of 1998, a series of conservation measures, which were conceived so that the fishermen could continue fishing

all year long, but that enabled protection for Sharks, according to the specificity of the fishing gear used, during the periods in which they were the most highly concentrated for reproduction.

Year after year, the impacts or inadequacy of the measures limiting shark fishing were presented to the representatives of fishermen and administrations. The joint workshops in 1999, 2000, 2001, 2002, and 2003 reinforced the conservation measures, which resulted in the definitive closure of the fishery in 2003. These measures concerned the periods of fishing according to the different types of gear used, the size and number of nets, and the species fished.

However, these efforts were plagued by pernicious effects. For instance, the shorter fishing season led to a higher number of outings during that period of time: each lanche increased the number of outings made during the open season, to make up for production losses. Therefore, a different strategy was needed to actually decrease the overall fishing activities. This observation led to the retraining of fishermen so they could fish for different species.

Large shark nets was the first gear abandoned, followed by the guitarfish nets in 2003. The small shark nets are still used; however, in theory only for fishing alternative species, such as sea bream and sole. These nets, and the meagre nets, were the two main elements used to demonstrate that it was possible to abandon Shark fishing.

SIGNS OF THE OVEREXPLOITATION OF RESOURCES IN THE SRFC ZONE

On a global scale, when the other ecological and natural factors remain stable, the overexploitation of species results in a lower catch despite an increased fishing effort.

Declared shark landings in all countries in the sub-region have decreased for five years, whereas the fishing effort has strongly increased. However, we are unable to show by a catch per unit of effort

approach that Sharks are being overexploited, because fishing effort for the entire sub-region is difficult to assess.

We are going to consider other tangible signs that give evidence of the declining Shark stocks observed in the SRFC zone.

1. Decrease in the average size of certain species: the guitarfish in Mauritania

Monitoring the changes in the average size of the principal species landed has shown

that Shark catch are comprised of more juveniles, even for the species that are still relatively abundant. For example, in the PNBA in Mauritania, 95% of the guitarfish (*Rhinobatos cemiculus*) caught are smaller than their size-at-maturity (Lt50, size at which 50% of the individuals are mature) (CNROP, 2001). The analysis of the changes in the average size of this species from 1998 to 2007 (the samples taken in 2002 and 2003 were not representative) highlights a significant decrease of more than 10 centimetres (see figure 11). These changes affect the species' reproductive capacity.

In addition, fishing now takes place year round, even during periods of reproduction. This affects both juvenile and breeding populations. For instance, among the adult milk sharks (*Rhizoprionodon acutus*) caught in the PNBA, in Mauritania, and the *Carcharhinus* spp in Guinea, a high

percentage of pregnant females have been observed (Camara, 2000).

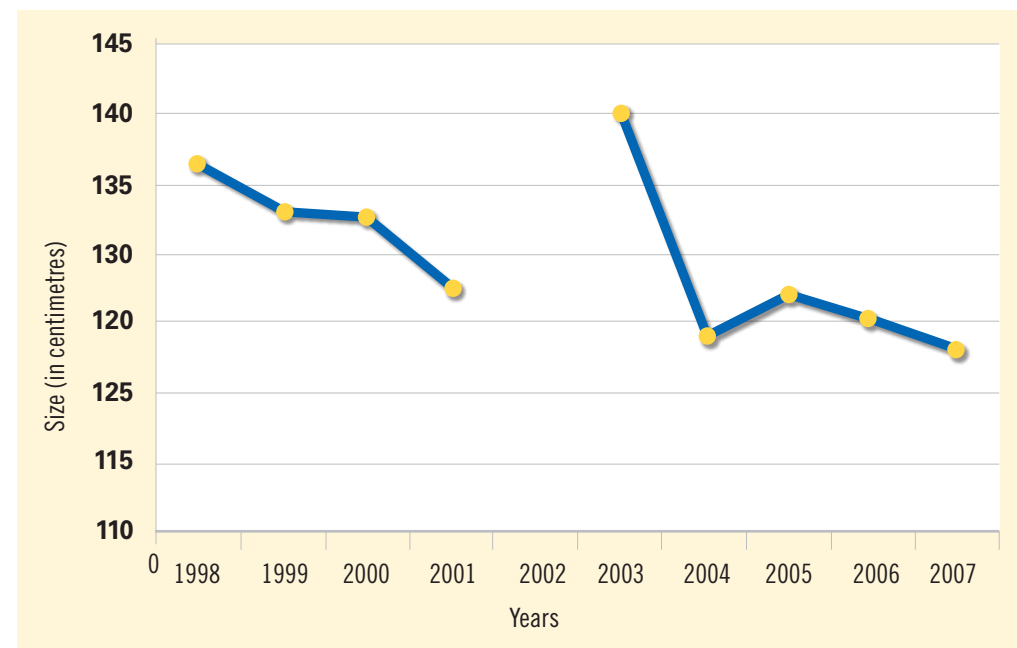
Surveys made at landing areas reveal that the business logic in the sector now means that even the shark fins of fetuses taken from pregnant females are included on the balance sheet. It is therefore easy to understand how Shark reproductive cycles are affected and why the renewal of the species is being undermined. In this context, a decline in the conservation status of the stocks in the sub-region has been observed, as highlighted by the IUCN Red List for West African sharks.

2. Longer outings and/or periods of migration of the fishermen looking for Sharks

The fishing zones in Senegal and Gambia have suffered the most in the region, especially with respect to the increased fishing



Figure 11. Changes in the average size of guitarfish in the PNBA from 1998 to 2007



effort, particularly by industrial fisheries. Along the West African coast, communities complain that the no-fishing zones are not being respected by trawlers. They tell of the disgraceful nightly show that has been going on for decades with rows and rows of lights of the boats that are trawling the coastal area. The best proof of the dwindling local stocks is that the specialised fleets have abandoned the traditional fishing zones in Mauritania, Senegal, and Gambia, and that major fishing expeditions towards the south (Guinea-Bissau, Guinea, Sierra Leone, and Liberia) have become the norm, since targeted shark fishing has been forbidden in the PNBA since 2003.

3.The local disappearance of species

Scientists and fishermen agree that shark populations have declined since 2000

Aerial view of the processing zone of the artisanal fishing port of Nouakchott. (en Haut ! M. Broquère - S. Nancy)



(Ducrocq, 2000) throughout the sub-region. Time series data on Shark harvests in the sub-region prior to 2005 was poor. Those data were gathered through fishermen interviews without rigorous scientific validation. Consequently no objective comparison could be made on the evolution of catch per unit of fishing effort (Ducrocq 1997, 1999, 2000). Since 2005, frame surveys were made at landing sites using the SRPOA-Sharks Project approach. These surveys show that several species have disappeared, such as the sawfish *Pristis* spp (see text box 10) throughout the sub-region (except in Guinea-Bissau) and the African wedgefish (*Rhynchobatus lueberti*) throughout the sub-region (except for in the PNBA). Great hammerhead sharks (*Sphyrna mokarran*), tiger sharks (*Galeocerdo cuvieri*), and lemon sharks (*Negaprion brevirostris*), the flagship species in the group, are only caught occasionally.

Large Carcharhinidae, such as *Carcharhinus altimus*, *C. obscurus* and *C. falciformis*, and the rough-tail stingray (*Dasyatis centroura*) are also among the species less frequently caught.

The bull shark (*Carcharhinus leucas*), which used to be frequent in the waters in the sub-region, is no longer caught regularly except in the waters of the two Guineas. The Bijagos archipelago may be the refuge of residual populations, because young bull sharks, close to the size of newborn pups, have been observed there since the 1990s, and catches there have remained relatively stable, whereas elsewhere they have plummeted. The archipelago could serve as a base for this species to recolonise the sub-regional waters, if given the opportunity.

Meanwhile, some species have fluctuated astonishingly, like the smooth hound, which was very abundant in Mauritania in 1998 and 1999, but since 2000 has only rarely appeared in the catches made by the Imraguen fleet.

The Lusitanian cownose ray (*Rhinoptera marginata*) is caught incidentally in large numbers using new artisanal fishing gear, such as purse seine nets and driftnets. It is likely that the sub-regional population of this still abundant ray species will show signs of decline in the upcoming years.

The Bijagos archipelago and the coastal zone of Guinea-Bissau in general, except for some particular zones (mouths of the Rio Buba and Rio Cacheu, and of the big streams in the South, and of the archipelago's biggest channels, such as the Canhabaque canal and the Orango canal) are better protected against industrial exploitation because of the very extensive shallow waters. The relative abundance of Sharks attract many pirogues from Casamance and Gambia, which carry out long fishing trips. However, sports fishermen and local residents say that populations have dropped significantly: some species of large Carcharhinidae and the great hammerhead shark (*Sphyrna mokarran*) have

particularly suffered from targeted exploitation by artisanal fisheries. Fishing activities in this region targeting Sharks have declined since 2000: an indication of a sharp drop in yields.

Lemon sharks seem to be threatened in Mauritania and Guinea-Bissau, where the catches are becoming rare. Elsewhere in the sub-region, they are almost never caught. The extinction of these species throughout the sub-region is feared.

Lower catches and yields offer proof that Shark populations have dwindled in the waters of the Republic of Guinea, which in the 2000s were home to enough Sharks to enable fishermen to obtain higher yields than in the other countries of the sub-region. This degradation is undoubtedly linked to the massive arrival, since 1995, of specialised pirogues crewed by Ghanaians from Gambia or Senegalese.

Only the population of *Rhizoprionodon acutus* may be showing signs of increasing in numbers, at least locally. Sports fishing guides from the Bijagos archipelago have in fact mentioned higher catches of this species. This small coastal shark's reproductive cycle (sexual maturity at 2 or 3 years) is much faster than the other species found in similar areas, and the decreased predation pressure from other Sharks may have allowed it to progressively develop in an ecological niche left vacant.

Finally, it should be pointed out that Sharks share ecological niches with some species targeted by common fisheries (*Serranidae*, meagre), and this makes them more likely to be caught incidentally. The increasing scarcity of these competing resources and the relative abundance of sharks, until recently, have forced fishermen to target Sharks. This practice has developed in response to the progressively higher commercial value of Shark products. The impacts of this strategy on the marine ecosystem and food chains, which have not been sufficiently analysed, are probably considerable.

Text Box 10. The local disappearance of sawfish: a sign of the degradation of Shark stocks in the SRFC sub-region

Sawfish (family Pristidae) have progressively disappeared throughout the sub-region in the past ten years, except in Guinea-Bissau and Sierra Leone, as highlighted by the surveys carried out in the sub-region in 2005 and 2006, in the framework of the SRPOA-Sharks Project, by the SRFC/FIBA and the French NGO, Noé Conservation. According to these surveys, some 'pockets of resistance' seem to remain in the Bijagos archipelago, in Guinea-Bissau, and in the sea coastal zones of Sierra Leone.

The surveys carried out in collaboration with Noé Conservation (Ballouard et al., 2006) show that up until the 1970s, according to the fishermen interviewed in the six countries investigated (Cape-Verde was not included in the surveys, because the configuration of its continental shelf does not provide a favourable habitat for such species), Pristidae sp. was commonly found. Although sawfish had never been specifically targeted, up to ten individuals could be caught in one outing. However, most of the landings were comprised of one or two specimens. The landings seem to be relatively regular in some zones (once a week) and more spaced out in others (a few landings per year). In Guinea-Bissau in particular, the species was even fished using traditional techniques, such as the harpoon and trap nets.

There were probably zones in which sawfish were concentrated. In Mauritania, sawfish seemed to be particularly abundant near Tidra (Banc d'Arguin). On the rest of the West African coast, they were especially numerous in the region between Casamance, in Senegal, and Kamsar, in Guinea-Conakry, as well as further to the

south, around Sierra Leone. This phenomenon can be explained by the fact that in this part of the sub-region there are numerous estuaries, which would appear to be the preferred habitat of sawfish. The surveys also drew attention to the disappearance, in only thirty years, of Pristis in nearly all of West Africa.

The disappearance of sawfish probably began in the 1970s, when the migrant fishermen started to arrive, and new fishing techniques were developed including monofilament fishing lines. According to the migrant fishermen interviewed, the disappearance of sawfish began in northern Senegalese waters, from where the wave of extinction moved south.

In Mauritania, the last sawfish seen was in 1995. In Senegal, the last catch dates vary. Sightings range for the 1970s in the north to the most recent date of 1992 at Cap Skiring. In Gambia, the last date mentioned is 1995. In Guinea, some interviews mention landings that took place in 2005 in Dar es Salam and Dobiré; however, this information could not be verified. The most credible declarations of landings refer to catches in 1999, in northern Guinean waters, at the border of Guinea-Bissau. Sierra Leonean waters are likely to shelter a vestigial population of sawfish: there are accounts of catches in 2003 and 2006 in the northern estuary of the Grandes and Petites Scarcies Rivers, then in Sawfish are most likely to be found today in Guinea-Bissau. During the surveys made in 2005 and 2006, the most recent catch in the sub-region took place in Guinea-Bissau, in 2004. With this in mind we can predict that sawfish are still present in the Bijagos archipelago.

CONCLUSIONS AND PROSPECTS

The emergence and development of a Shark fishing industry in the SRFC zone is linked to multiple factors, which have brought about significant changes in the organisation and management of fisheries. The commercial value of shark fins in the

Asian market and the increasing value of certain by-products (salted and dried, and smoked meat) on the sub-regional market were the basis of a headlong 'Shark rush'. This almost uncontrollable exploitation led to Shark stocks becoming exhausted, and many species are now seriously threatened with extinction. The negative effects of this exploitation were soon felt in



both socio-economic and environmental terms. They led policy makers, researchers, and other partners to reflect upon the future of this industry and to consider the management and conservation measures that had to be implemented.

The aim of the SRPOA-Sharks Process, initiated by the SRFC, is to assist in the creation of conditions for the exploitation and processing of sharks that respects the need to maintain the equilibrium of species living in the marine ecosystems of West Africa. After four years of effective implementation of the project, major steps have been taken, but there is a long way to go. Serious commitment and a real understanding of the issues by all stakeholders involved are indispensable for progress to be made.

1. Lessons learned and Shark resource governance

The different studies conducted at the national and sub-regional levels have shed light on Shark fishing. This activity represents a real threat to the future of fish resources and the maintenance of balanced marine ecosystems on the West African coasts. Due to their particular biological characteristics, Shark populations cannot survive when faced with intensive fishing operations, which leads to their rapid decline. Further, the disappearance of these top predators has disastrous consequences on the whole ecosystem, given their role as top of the food webs regulators.

Yet today we see that the shark fin trade, the principal lucrative activity in the Shark fishing industry, has intensified the lust to fish for Sharks, which are now pursued into their most remote refuges. This situation reflects the current trend toward decreased Shark stocks, in which they are the victims of an increased fishing effort. Indeed, conscious that there is a very profitable shark fin market, those involved in the Shark fishing industry have developed

strategies to continue to profit from this resource in a state of advanced decline. The traders who export shark fins to South East Asia, import manufactured goods in return. They give loans to the fishermen so that they can continue to fish for shark fins, despite the increasing production costs. The size of the fishing boats continues to increase, as do their engines, which enables them to go out on longer and more distant outings. New fishing zones are explored in the quest for areas of abundance. The fishermen get into debt and it is not easy for them to abandon their activity. They are trapped in a vicious cycle. This situation is the result of the worldwide overexploitation of this resource. As we indicated above, some species are threatened with extinction, and others are already locally extinct.

There are clear signs of the overexploitation of this resource: lower catch rates, a drop in the number of Sharks taken per unit of effort, and the smaller average size of the fish landed. The analysis of the biological data of the Sharks landed on the Senegalese coast, carried out within the framework of the NPOA-Sharks project, reveals, even if it is still too early to give a firm opinion on how (over)exploited the species is, that most of the individuals caught have not reached reproductive maturity (Mar, 2008).

To reverse this situation, efforts must be made to sustainably manage both ray and shark populations. Monitoring of Sharks caught must continue for groups of species, and ideally for each species, as well as for both small-scale and industrial fisheries. In addition, the critical seasons and habitats must be identified for each species, the risks in terms of stock depletion must be defined and estimated, and conservation measures must be defined and enforced. These measures may seem secondary compared to the urgent need to set up other large commercial fisheries or to increase the global fishing capacity. However, if we cannot evaluate with certainty

the medium- and long-term impacts on the ecosystem of collapsing top predator populations, and if we consider that this collapse has already partly occurred, the conservation and sustainable management of Shark populations appears to be more urgent and indispensable than ever before.

2. Future options

Given the dwindling Shark resources and the threats of extinction weighing on some species, it is of the utmost importance to define and implement conservation and management measures aimed at all parties concerned, including fishermen, policy makers, and technical and financial partners. The efforts already made via the SRPOA-Sharks Project must be continued and increased, given the scope and com-

plexity of the challenges faced by creating non-fishing zones, setting up a dissuasive policy, retraining many of those specialising in Shark fishing activities so they can work in other areas and to decrease the overall pressure on Sharks.

The visibility given to such issues by this project is a significant added value that should facilitate the coordination and standardisation of conservation strategies and the sustainable utilisation of Sharks in the sub-region.

A new system of organisation for the exploitation of Sharks must be put in place, which prioritises the conservation and sustainable management of these species. Our analysis of what has been achieved and the challenges to meet in the second phase of the SRPOA-Sharks Project recommends that the following strategic options be implemented.



1. By the different countries involved

- attempt to standardise the methods and rates for collecting, storing, and analysing scientific information on the biological and socio-economic aspects of shark fishing, and transfer the information produced to a regional database;
- finalise and adopt National Plans of Action in the countries that do not have one yet, attempting to standardise the goals, rules, and methods therein with

neighbouring countries as much as possible;

- implement National Plans of Action and express them in concrete management and conservation measures that are applied and monitored, with an estimation of the impact of these measures on the ray and shark populations;
- utilise economic measures, such as licences and specific taxes, to 1) create revenues from Shark fishing, 2) encourage

people to look for alternative activities to reduce the pressure on Sharks, and 3) limit the number of new people getting involved in the Shark fishing business;

- get the institutions in charge of managing trade issues (Ministries of Commerce, Customs, etc.) involved in Shark fisheries management, and create export taxes to limit the profitability of this business for the hidden participants (intermediaries).

2. By the SRFC and its partners

- put more effort into training technicians and students, as well as into creating awareness raising activities and communication tools for policy makers and the general public;

– make a regional database accessible that groups together scientific information and facilitates access to the global and sub-regional networks of experts, while at the same time making intelligent use of the knowledge and skills available in the region (researchers, technicians, and students);

- provide support for the implementation of Plans of Action while seeking to create links with other regional initiatives, such as the fishing capacity reduction project;

– strengthen relationships with conventions such as the CITES and the CMS and attempt to facilitate the integration of their recommendations in domestic regulations;

– work on relationships with Marine Protected Areas, which are conservation tools, identify the Shark reproduction sites, sanctuaries, nurseries, etc., and encourage the protection of these areas;

- strengthen relationships with the different networks and initiatives in the sub-region.

In any case, nothing can have a lasting effect if there is not a joint effort worldwide to decrease the demand coming from international markets. Then, and only then, can the tools put in place at the sub-regional level lead to concrete results in terms of improving the status of Sharks.

This effort must also and especially be made internationally, by means of lobbying and raising consumer awareness. Partnerships could be developed with organisations such as WWF and Greenpeace to carry out effective consumer awareness-raising campaigns.





Mauritania
(en Haut! kite aerial photo)

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See also the following sites:

- www.lafiba.org
- www.fao.org
- www.csrp.org

Abbreviations and Acronyms

CIPA: Centro de Investigaçao Pesqueira Aplicada (Centre of Applied Fishing Research)

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora

CMS: Convention on Migratory Species

CNCAS: Caisse nationale du Crédit Agricole du Sénégal (National Office of Crédit Agricole Bank in Senegal)

CNSHB: Centre national des sciences halieutiques de Boussoura (Boussoura National Centre for Halieutic Science, Guinea)

COFI: FAO Committee on Fisheries

CPM: Centre de pêche de Missirah, (Missirah Fishing Centre, Senegal)

CRODT: Centre de recherches océanographiques de Dakar-Thiaroye (Centre for Oceanographic Research, Senegal)

DARO (Direction de l'aménagement des ressources et de l'océanographie / Directo-

rate of Resources Management and Oceanography)

DEMERSAL SPECIES: Species dwelling in the deep sea, like sea bream, white grouper, meagre, cephalopod mollusks and shellfish, and certain species of rays and sharks

DOPM: Direction de l'océanographie et des pêches maritimes (Directorate of Oceanography and Marine Fisheries, Senegal)

DPM: Direction des pêches maritimes (Directorate of Marine Fisheries, Senegal)

EEZ: Exclusive Economic Zone

FAO: United Nations Food and Agriculture Organization

FD: Fisheries Department

FIAS: Fisheries Information and Analysis System

FIBA: Fondation Internationale du Banc d'Arguin

GIE: groupement d'intérêt économique (Economic Interest Group)

IMAPEC: Mauritanian Fishing Industry

IMROP: Institut mauritanien de recherches océanographiques et des pêches (Mauritanian Institute for Oceanographic and Fisheries Research)

INDP: Instituto Nacional de Desenvolvimento das Pescas (National Institute for Fishing Development)

IPIMAR: Instituto de Investigaçao das Pescas et do Mar (Portuguese Institute for Fishing and Sea Research)

IPOA-SHARKS: International Plan of Action for the conservation and Management of Sharks

IRD: Institut de recherche pour le développement (Research Institute for Development)

ISRA: Institut sénégalais de recherche agricole (Senegalese Agricultural Research Institute)

ISTAM: Improve Scientific and Technical advices for fisheries Management

IUCN: International Union for the Conservation of Nature

NPOA-SHARKS: National Action Plan for the Conservation and Management of Sharks

PNBA: Parc National du Banc d'Arguin (Banc d'Arguin National Park)

PRCM: Programme régional de conservation de la zone côtière et marine (Regional Programme for Coastal and Marine Conservation in West Africa)

SIGP: Société industrielle de la grande pêche (International Deep-Sea Fishing Company)

SRPOA-Sharks: Sub-Regional Plan of Action for the Conservation and Management of Sharks

WI: Wetlands International

WWF: World Wide Fund for Nature

Glossary

Batoids: this superorder, the rays and skates, includes the guitarfish, sawfish and torpedo fish (electric rays). With their dorsal-ventrally flattened bodies, these fish are generally adapted to living on the sea-floor. Their pectoral fins are highly developed and attached to their torso like wings. They have either five or six pairs of ventral gill slits. Some 600 species have been identified worldwide.

Chimaeras: a group of Chondrichthyes (cartilaginous fish), distinguished from the elasmobranchs (sharks and rays), containing about 35 species, all marine. Chimaeras, or ghost sharks, have a large head, smooth scaleless skin and often a very long caudal filament. The leading edge of the first dorsal fin possesses a powerful sting.

Demersal (species): species living on or close to the seabed and not far from the coast, which feed from the seabed or just above it. The hake is an example of a demersal fish.

Fishery: all the boat and fishing equipment used to target a species, for example a tuna fishery, sardine fishery or cod fishery.

Fishing capacity: all the fishing resources available during a given period within a defined zone.

Fishing effort: all the means implemented by fishing boats to catch fish resources during a given period within a defined zone (number and size of boats, nets and motors, fishing times and electronic equipment used to locate the fish).

Incidental catch, bycatch: used to denote the catching of a given species through fishing activities targeting a different species or group of species. The results of this unintentional capture are usually discarded at sea.

Longline: a nylon fishing line of variable length fitted with a large number of hooks baited to attract and catch fish. Some longlines can reach lengths of several hundred kilometres and be fitted with tens of thousands of hooks.

Minimum size limit: size limit concerning a species or group of species below which storage on board, transshipment, transportation, landing and commercialisation are forbidden. These regulations are adopted in order to enable juvenile fish to become adults.

Pelagic (species): species living in the surface layer of the sea. Many species of phytoplankton and zooplankton, and numerous fish (sardines, anchovies, sprats, etc.) are pelagic species.

Rays: fish with cartilaginous skeletons related to sharks. Rays belong to the order rajiforms and the suborder elasmobranchs. The order includes sawfish (pristidae), guitarfish (rhinobatidae), stingrays, torpedoes or electric rays, manta rays and true rays. Rays are found in all oceans of the world; some also frequent tropical and subtropical estuaries

Selection (selective fishing): fishing technique that uses appropriate equipment in order only to take target species.

Sharks: true sharks are generally torpedo-shaped, although a few species resemble rays in shape, and possess between five and seven pairs of gill slits. Approximately 400 species have been identified worldwide.

Sustainable (fishing): fishing practices that enable the long-term exploitation of species, without negative effects on population dynamics.

Target, targeted species: species on which the fisher has decided to concentrate and for which he had adapted his equipment.

Targeted fishing: fishing activity intended to catch a target species.

Trawl net: dragnet in the form of a funnel, its horizontal spread increased by wing-like trawl doors, pulled by either one or two boats (trawlers). Trawling is used to catch many species living on or just above the ocean floor.

Appendix 1. The IPOA, its objectives and main aspects (FAO, 2001)

The IPOA-Sharks is a non-restrictive plan intended, mainly by means of inter-State cooperation, to improve the statistical information and monitoring of shark populations in order to set up conservation and management measures. At global level, the only tool for conservation and the regulation of international trade is the Convention on International Trade in Endangered Species (CITES). Apart from the basking shark, *Cetorhinus maximus*, and whale shark, *Rhincodon typus*, listed since 2002, there are no sharks listed in the appendices of the CITES, even though international trade is the cause of the over-exploitation and local extinction of many species.

In 1994, the 9th CITES Conference adopted a resolution inciting the FAO and other international fishing management organisations to establish programmes for collecting biological and commercial data concerning shark species. The FAO was charged with gathering together the required information in order to draw up

and propose directives intended to result in an action plan. It was in this framework that the IPOA was drawn up by the technical workgroup on the conservation and management of sharks, which met in Tokyo from 23 to 27 April 1998, together with the Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries, held in Rome from 26 to 30 October 1998. Since the launching of the procedure of drawing up the IPOA-Sharks, some regional bodies have started to encourage their member states to collect information on sharks.

The Sharks IPOA consists of 31 paragraphs and 2 appendices, which were adopted by the COFI member states at the meeting held from 26 to 30 October 1998. The COFI then endorsed the IPOA-Sharks at its 23rd session, held in Rome from 15 to 19 February 1999.

The aim of the IPOA-Sharks is to ensure the conservation, management and sustainable exploitation of sharks. Achieving

this objective is based on three guiding principles:

- **participation.** Any States whose fishing activities contribute to the mortality of a species or stock should participate in their management;
- **maintenance of stocks.** Management and conservation strategies should aim to maintain the mortality rates linked to fishing at a level that does not threaten the viability of each stock, applying precautionary principle;
- **consideration of nutritional and socio-economic issues.** Management and conservation objectives and strategies need to take into account the fact that, in some low-income countries and/or regions with a food-producing deficiency, shark catches are a traditional and substantial source of food, employment and/or revenue. These fisheries should be managed sustainably in order to continue to provide food, employment and revenue to local populations.

When drawing up the IPOA-Sharks, the FAO asked the Member States, regional

fishery planning organisations and other bodies involved in fishing management to set up appropriate political, legal and institutional frameworks, and adopt measures to favour the conservation and long-term exploitation of shark halieutic resources. The FAO provided support to member states in the application of the IPOA-Sharks. It helped the member states to draw up and implement their shark action plans, by means of technical assistance projects specifically designed for each country, financed by the credits normally provided for in the programme, together with extra-budgetary funds made available to the Organisation for that purpose. The FAO, through its Fisheries Committee, produces a report every two years concerning the progress made in the implementation of the IPOA-Sharks.

References: FAO (2001); <http://www.fao.org/DOCREP/006/X3170E/X3170E00.HTM>

Appendix 2. Distribution of shark species in the SRFC member states

Family	Scientific name	Countries where the species is found						
		Cap Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone
Alopiidae	<i>Alopias vulpinus</i>							
Odontaspidae	<i>Carcharias taurus (EN)</i>	✓					✓	
Carcharhinidae	<i>Carcharhinus altimus</i>	✓		✓	✓			
Carcharhinidae	<i>Carcharhinus amboinensis</i>							✓
Carcharhinidae	<i>Carcharhinus brevipinna</i>	✓		✓			✓	✓
Carcharhinidae	<i>Carcharhinus falciformis</i>	✓		✓	✓			✓
Carcharhinidae	<i>Carcharhinus leucas</i>	✓		✓	✓			✓
Carcharhinidae	<i>Carcharhinus limbatus</i>	✓		✓			✓	✓
Carcharhinidae	<i>Carcharhinus longimanus</i>	✓						
Carcharhinidae	<i>Carcharhinus obscurus</i>							✓
Carcharhinidae	<i>Carcharhinus plumbeus</i>	✓		✓	✓			✓
Carcharhinidae	<i>Carcharhinus signatus</i>			✓	✓		✓	
Carcharhinidae	<i>Carcharhinus tiastoni</i>		✓				✓	
Lamnidae	<i>Carcharodon carcharias</i>	✓		✓				
Centrophoridae	<i>Centrophorus lusitanicus</i>	✓					✓	
Centrophoridae	<i>Centrophorus uyato</i>	✓						
Somniosidae	<i>Centroscyminus coelestis</i>	✓						
Centrophoridae	<i>Centrophorus granulosus</i>	✓		✓				
Dalatiidae	<i>Dalatis licha</i>	✓						
Dasyatiidae	<i>Dasyatis marmorata</i>	✓		✓				
Dasyatiidae	<i>Dasyatis margarita</i>	✓		✓				

Dasyatiidae	<i>Dasyatis margaritella</i>			✓								
Dasyatiidae	<i>Dasyatis centroura</i>			✓								
Dasyatiidae	<i>Dasyatis hastata</i>			✓								
Dasyatiidae	<i>Dasyatis pastinaca</i>	✓										✓
Centrophoridae	<i>Deania profundorum</i>	✓										
Echinorhinidae	<i>Echinorhinus brucus</i>										✓	
Etmopteridae	<i>Etmopterus princeps</i>	✓										
Etmopteridae	<i>Etmopterus pusillus</i>	✓										
Etmopteridae	<i>Etmopterus spinax</i>	✓		✓								
Carcharhinidae	<i>Galeocerdo cuvier</i>	✓		✓							✓	
Triakidae	<i>Galeorhinus galeus</i>						✓					
Scyliorhinidae	<i>Galeus melastomus</i>						✓	✓				
Scyliorhinidae	<i>Galeus polli</i>			✓				✓				
Ginglymostomatidae	<i>Ginglymostoma cirratum</i>	✓		✓								✓
Gymnuridae	<i>Gymnura micrura</i>			✓								
Scyliorhinidae	<i>Haploblepharus pictus</i>						✓					
Hexanchidae	<i>Heptranchias perlo</i>	✓		✓								
Hexanchidae	<i>Hexanchus griseus</i>	✓										
Lamnidae	<i>Isurus oxyrinchus</i>	✓										✓
Lamnidae	<i>Isurus paucus</i>	✓										
Lamnidae	<i>Lamna nasus</i>	✓										
Triakidae	<i>Leptocharias smithii</i>			✓							✓	
Mobulidae	<i>Manta birostris</i>			✓								
Mobulidae	<i>Mobula rochebrunei</i>			✓								
Triakidae	<i>Mustelus asterias</i>										✓	
Triakidae	<i>Mustelus canis</i>										✓	
Triakidae	<i>Mustelus mustelus</i>	✓		✓							✓	
Carcharhinidae	<i>Negaprion brevirostris</i>			✓								✓
Odontaspidae	<i>Odontaspis ferox</i>	✓										

Family	Scientific name	Countries where the species is found										
		Cap Verde	Gambia	Guinea	Guinea-Bissau	Mauritania	Senegal	Sierra Leone				
Hemigaleidae	<i>Paragaleus pectoralis</i>	✓	✓	✓	✓	✓	✓					
Carcharhinidae	<i>Prionace glauca</i>	✓										
Pristidae	<i>Pristis microdon</i>				✓							
Pristidae	<i>Pristis pectinata</i>		✓	✓	✓							
Pseudotriakidae	<i>Pseudotriakis microdon</i>	✓										
Myliobatidae	<i>Pteromylaeus bovinus</i>			✓								
Rajidae	<i>Raja ackleyi</i>									✓		
Rajidae	<i>Raja alba</i>											✓
Rajidae	<i>Raja circularis</i>					✓						
Rajidae	<i>Raja clavata</i>					✓						
Rajidae	<i>Raja confundens</i>		✓			✓				✓		
Rajidae	<i>Raja herwigi</i>	✓										
Rajidae	<i>Raja leucosticta</i>		✓							✓		
Rajidae	<i>Raja maderensis</i>					✓				✓		
Rajidae	<i>Raja miraletus</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rajidae	<i>Raja montagui</i>					✓						
Rajidae	<i>Raja naevus</i>					✓						
Rajidae	<i>Raja straeleni</i>		✓	✓						✓		
Rajidae	<i>Raja undulata</i>					✓						
Rhinobatidae	<i>Rhinobatos albomaculatus</i>			✓								
Rhinobatidae	<i>Rhinobatos cemiculus</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rhinobatidae	<i>Rhinobatos irvinei</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Rhincodontidae	<i>Rhincodon typus</i>			✓								
Rhinopteridae	<i>Rhinoptera marginata</i>			✓								✓
Rhinobatidae	<i>Rhinobatos rhinobatos</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Carcharhinidae	<i>Rhizoprionodon acutus</i>	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Rhynchobatidae	<i>Rhynchobatus luebberti (CR)</i>			✓								✓

Scyliorhinidae	<i>Scyliorhinus canicula</i>									✓		
Scyliorhinidae	<i>Scyliorhinus cervigoni</i>			✓								
Scyliorhinidae	<i>Scyliorhinus stellaris</i>			✓	✓							
Somniosidae	<i>Scymnodon obscurus</i>	✓										
Sphyrnidae	<i>Sphyrna cowardi</i>			✓	✓					✓		
Sphyrnidae	<i>Sphyrna lewini</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sphyrnidae	<i>Sphyrna mokarran</i>			✓						✓		✓
Sphyrnidae	<i>Sphyrna zygaena</i>	✓			✓					✓		✓
Squalidae	<i>Squalus acanthias</i>	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Squalidae	<i>Squalus blainvilliei</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Squalidae	<i>Squalus megalops</i>			✓								
Squalidae	<i>Squatina aculeata</i>		✓	✓						✓		
Squalidae	<i>Squatina oculata</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Squalidae	<i>Squatina squatina (CR)</i>									✓		
Dasyatidae	<i>Taeniura grabata</i>	✓										
Torpedinidae	<i>Torpedo bauchotae</i>		✓							✓		
Torpedinidae	<i>Torpedo marmorata</i>		✓	✓						✓		
Torpedinidae	<i>Torpedo nobiliana</i>		✓	✓						✓		
Torpedinidae	<i>Torpedo torpedo</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dasyatidae	<i>Urogymnus asperinus</i>			✓								
Zanobatidae	<i>Zanobatus schoenleinii</i>		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: SIAP Project and Results of the PSRA-Sharks Project

Key

Categories	Common	Very frequent	Frequent	Quite frequent	Uncommon	Rare	Very rare

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The Sub-Regional Fishing Commission (SRFC) is an intergovernmental organisation created 29 March 1985 by means of a convention. The Commission groups together seven States (Cape-Verde, Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal and Sierra Leone), which have committed to the setting up of appropriate instruments for the conservation and sustainable management of their halieutic resources. The Commission's headquarters are in the Republic of Senegal.

The SRFC is responsible for the coordination and harmonisation of fishing policies at West African subregional level. By means of its Strategic Action Plan, the SRFC provides its partners with a coherent framework for designing and implementing projects and development programmes in the fishing sector.

The Permanent Secretariat is the executive organ of the SRFC, charged with implementing the decisions taken by the Conference of Ministers. It is directed by a Permanent Secretary, under the direct authority of the President of the Conference of Ministers. The Coordination Committee is the technical and consultative organ of the SRFC, charged with monitoring the execution of the various decisions taken by the Conference of Ministers.

The Conference of Ministers, for its part, is the supreme decision-making body of the SRFC. It is made up of the ministers responsible for fishing in the various Member States.

The main objectives assigned to the Commission are as follows:

- to harmonise policies concerning the management, exploitation and conservation of halieutic resources in the subregion;
- to develop the capacity of countries to undertake research in the fishing sector at subregional level;
- to develop subregional cooperation concerning the surveillance of fishing;
- to encourage the creation of joint ventures and the signing of fishing agreements between the countries of the subregion;
- to adopt common strategies in international bodies.

30 years of shark fishing in West Africa

The price of shark fins on the Asian and European markets, along with the gradual increase in value of certain processed products (salt-dried and smoked meat) on the sub-regional market, led to an excessive surge in demand for Shark meat. This dynamic of virtually uncontrolled exploitation put the Shark fishing industry in a situation of gradual exhaustion of stocks, exposing numerous species to the threat of extinction.

The goal of the "SRPOA-Sharks" project, initiated by the SRFC, is to contribute to creating appropriate conditions for the exploitation and wise-use of Sharks that respect the need to maintain the balance between the species living in the marine ecosystems of West Africa. Major steps have been taken during the first four years of implementation, but there is still a long way to go. Real commitment and appropriation of the issues by all the stakeholders concerned are indispensable for sustaining these achievements, and thus ensuring the conservation and rational management of Shark populations in the subregion.

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