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REPUBLIC OF SEYCHELLES

SEYCHELLES NATIONAL PLAN OF ACTION FOR THE CONSERVATION AND MANAGEMENT OF SHARKS

2007

SEYCHELLES FISHING AUTHORITY

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CONTENTS

ACRONYMS / ABBREVIATIONS

CBD	Convention on Biological Diversity
CITES	Convention on the International Trade in Endangered Species
CMS	Convention on Migratory Species
COFI	FAO Committee on Fisheries
COP	Conference of the Parties
CS	Conservation Section (MENR)
DMC	Destination Management Companies
EEZ	Exclusive Economic Zone
FADIO	Fish Aggregating Devices as Instrumented Observatories Of Pelagic System
FAO	Food and Agriculture Organisation
FBOA	Fishing Boat Owners Association.
Forex	Foreign Exchange
FPU	Fisheries Policy Unit (MENR)
GOS	Government of Seychelles
IA	Interested Agencies
IOTC	Indian Ocean Tuna Commission
IPOA-sharks	International Plan of Action for the Conservation and Management of Sharks
IRD	French Research Institute for Development
IUCN	World Conservation Union
MCA	Marine Charter Association
MCSS	Marine Conservation Society, Seychelles
ME	Ministry of Education
MENR	Ministry of Environment and Natural Resources
MEP	Ministry of Economic Planning
MOF	Ministry of Finance
MPA	Marine Parks Authority
MTT	Ministry of Tourism and Transport
NGO	Non Governmental Organisation
NPOA	National Plan of Action
RA	Research Agencies
RFMO	Regional Fisheries Management Organisations
SBS	Seychelles Bureau of Standards
SC	Steering Committee
SCCI	Seychelles Chamber of Commerce and Industry
SCMRT	Seychelles Centre for Marine Research and Technology
SFA	Seychelles Fishing Authority
SLA	Seychelles Licensing Authority
SPDF	Seychelles People's Defense Force
SSA	UN Agreement on Straddling and Highly Migratory Fish Stocks
STB	Seychelles Tourism Board
Sub-C	Sub-Committee
SWIOFC	South West Indian Ocean Fishery Commission
SWIOFP	South West Indian Ocean Fisheries Project
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
WP	Work Programme
WSSD	World Summit on Sustainable Development

PART I Background

1. Introduction

Sharks[1] comprise some 1000 species worldwide [1]. Estimates on the global annual harvest of shark vary considerably from between 700,000 to 1.5 million tonnes and the only real consensus is that data on the fishery are chronically lacking [2,3]. The Food and Agricultural Organisation (FAO) statistics in 2003 stated that chondrichthyans accounted for 0.65% of total world catches and 0.85% of total world captures, translating to a catch of 789,900 tonnes [4]. Catches have grown considerably from 271,800 tonnes in 1950, fuelled by the expansion of long-line fisheries, the escalating commodity value of shark fin and through overall increases in global fish production.

Sharks are prone to over-exploitation and population collapse due to their life history characteristics [5]. Previous examples of shark stock collapse, due to targeted fisheries [6,7], have recently been supplemented by studies showing rapid decline in shark populations across large oceanic regions as a result of by-catch in multi-species fisheries [8-12].

2. Shark populations: cause for concern

Sharks, typified as they are, by slow growth, late maturation, low fecundity and long reproductive cycles, are amongst the least resilient of fish species to intense exploitation [1,5,13]. There are various published examples of collapse in shark fisheries including extirpation and potential extinction [6,7,14].

[1] For the purposes of this document the term “shark” is taken to include all species of sharks, skates, rays and chimaeras (class Chondrichthyes). It should be noted however, that the focus of this document falls primarily on “true sharks” as this is deemed to be the main issue of concern in the national context due to the economic pressure applied by the market price for fin -in this context the Giant Guitarfish (*Rhyncobatus djiddensis*) is also included as it is targeted for its fin and meat.

The vulnerability of sharks to over exploitation is heightened by the difficulties in effectively managing fisheries which:

- are often data deficient particularly with regard to discarded by-catch from multi-species fisheries [2,6], and
- often involve wide-ranging, transboundary or migratory species [15,16].

Sharks have been increasingly exploited in recent decades, both as by-catch in pelagic longline fisheries, from the 1960s onward, and in targeted fisheries that expanded rapidly in the 1980s [11]. Only in the past half century, as fishing fleets expanded rapidly in the open ocean have large marine predators been subject to intense exploitation [11]. Pelagic longlines are the most widespread fishing gear used in the open ocean [8]. Pelagic longline fisheries primarily catch oceanic shark species, but also catch coastal shark species when operating in close proximity to land [12].

Longlines in effect constitute long baited transects and catch a wide range of species [8]. It is such multi-species fisheries that pose the greatest threat to sharks as the fishery continues to be viable and active long after the shark species would have become "economically extinct" to activities of a targeted fishery [17]. Furthermore, the value of shark fin has seen the finning of by-catch increase dramatically as opposed to its previous release [6]. It has been estimated that some 50% of all shark harvest is from by-catch and that it is subject to finning, discard and non-declaration to fishing authorities [3].

3. Population declines

There is growing evidence that shark populations have undergone dramatic declines since the 1950s. Recent studies show that shark populations experience very rapid declines in the early years of their exploitation [11,12]. These declines occur typically before management and related monitoring regimes are put in place and as such the virgin stock abundance is not reliably known for stock assessment and population modelling.

The most comprehensive published data on shark populations pertains to the waters and stocks around North America, where rapid and large declines (between 50 and 90%, depending on species) have been shown in large coastal and oceanic populations in the northwest Atlantic and the Gulf of Mexico [1,11,12].

Furthermore, Baum *et al.,* (2003) [11] estimate that all recorded shark species in the northwest Atlantic, with exception of makos (*Isurus spp*.), have declined by more than 50% in the past 8 to 15 years. This is of particular note as it shows that declines continue well past those accrued during the initial (1960s) exploitation phase of these stocks.

Perceptions of marine populations and their vulnerability to extinction have altered and there is a growing realisation that extinctions can occur [17]. In addition to known cases of extirpation and instances of fishery driven population collapse [3,6,7,14,18], shark populations may also be prone to depensation, or the "Allee effect", where populations demonstrate negative population growth once they reach a critical level regardless as to whether the fishing pressure is removed or not [17].

4. Ecosystem impacts

Predators play an important role in the maintenance of the structure and function of marine systems [19]. It is widely accepted that large-scale declines in predators may seriously affect marine ecosystems [8,12,19,20]. More serious concerns relate to ecosystem phase shift or even collapse and have spurred United Nations resolutions on restoring fisheries [10,21,22].

5. International initiatives in shark management

The last fifteen years have seen major advances in the international pursuit of conservation and sustainable use of marine resources. The 1982 United Nations Convention on the Law of the Sea (UNCLOS) laid the foundation for these activities. UNCLOS provides a basis for the improved management of marine resources, by extending rights and setting out obligations with regard to Exclusive Economic Zones (EEZ), establishing a framework for the exploitation of high seas fisheries and the further development of the Convention [23].

In 1992, the United Nations Conference on Environment and Development (UNCED) saw the world take its first steps towards a holistic approach to environmental management. Chapter 17 of Agenda 21 addresses the protection of the marine environment and in particular Sections 17 c and d set out a basis for action with objectives and activities for the conservation and sustainable use of marine living resources of the high seas and jurisdictional waters respectively [24]. The year 1992 also saw the coming into force of the international moratorium[2] on the use of driftnets on the high seas.

In 1995, under the UNCLOS framework, the United Nations Agreement on Straddling and Highly Migratory Fish Stocks (SSA) was adopted by the U.N. General Assembly, and the FAO Code of Conduct for Responsible Fisheries was finalised [25]. These two mechanisms, prepared in parallel, are intended to be complementary and refer to each other extensively. The SSA was a major advance in enabling international cooperation and addresses issues of key importance to shark population management, many of which are straddling and migratory in nature.

[2] United Nations General Assembly: Resolution 46/215 1991.

The SSA embodies concepts of conservation, sustainable and equitable use of fish stocks, the precautionary and ecosystem[3] approaches [26,27], and provides for their implementation through regional management arrangements. It also provides State Parties with ground-breaking enforcement powers. The SSA came into force in December 2001 after its 30th ratification.

The Code of Conduct is non-binding but provides guidance for the correct implementation of UNCLOS and the SSA. Furthermore, it takes on board concerns of biodiversity conservation and sustainable use consistent with the provisions of the Convention on Biological Diversity (CBD). The Code also requires elaboration of other aspects to enable the development and implementation of responsible fisheries and it was through such a process that the IPOA-Sharks [28] was developed.

In September 2002, world leaders, environmental agencies and experts came together in Johannesburg for the World Summit on Sustainable Development (WSSD). The summit and its numerous preparatory meetings served to review and build upon the process initiated by UNCED in 1992. The resulting Plan of Implementation, in paragraphs 29 – 30:

- encourages the application of the ecosystem approach [27] to fisheries by 2010;
- is revolutionary in its call for a restoration of depleted fishing stocks "on an urgent basis and where possible not later than 2015";
- calls on States to ratify and effectively implement UNCLOS and the SSA;
- urges States to establish marine protected areas consistent with international law and based on scientific information, including representative networks by 2012, and
- calls upon States to urgently develop and implement NPOAs to put into effect the FAO IPOAs – *inter alia* IPOA-Sharks.

The issue of shark conservation and management has also been addressed by two global biodiversity-related Conventions, namely, the Convention on the International Trade in Endangered Species (CITES) and the Convention on Migratory Species (CMS). These initiatives are summarised in Annex 1 & 2, respectively. Seychelles is a party to both conventions and has implemented national legislation with respect to the whale shark (see section 6).

[3] The ecosystem approach is particularly relevant to sharks in this context as it relates to associated (in this case non-target) species and hence the crucial issue of shark by-catch.

In terms of regional initiatives and frameworks relevant to shark conservation and management, most relate to IOTC and the management of tuna and tuna-like species in the Indian Ocean. Sharks (mainly pelagic species) are taken as by-catch in the industrial purse seine and longline fisheries. IOTC Resolution 0505 concerning the conservation of sharks caught in association with fisheries managed by IOTC deals with issues of utilisation, stock assessment, gear selectivity, and research needs.

The emergence of other regional fisheries management bodies (Southwest Indian Ocean Fisheries Commission, Southern Indian Ocean Fisheries Agreement) may influence regional and national activities related to the conservation and management of sharks, including coastal and high seas shark populations, as their work programmes develop.

6. International plan of action for the conservation and management of sharks (IPOA Sharks)

The IPOA-Sharks is, to date, the only international initiative of global scope specifically dedicated to the management of shark populations, and as such it represents the "cutting-edge" in this domain. The process was initiated by the 1994 CITES Resolution 9.17 [29], which called upon:

- FAO and other relevant agencies to establish programmes to collect the necessary biological and trade data on shark species;
- All nations utilising and trading in shark species to assist FAO in this endeavour, and
- FAO to fully inform CITES on the progress of collection, elaboration and analyses of said data.

There followed successive interactions between CITES and the FAO Committee on Fisheries (COFI), and the formation and meeting of the Technical Working Group on the Conservation and Management of Sharks (Tokyo, April 1998) [30].

Subsequent consultations in Rome culminated in the adoption of the IPOA-Sharks in 1999 by the 23rd session of COFI[4]. IPOA-Sharks is a voluntary mechanism and was elaborated in the context of article 2d of the Code of Conduct for Responsible Fisheries.

The objective of the IPOA is

"…to ensure the conservation and management of sharks and their long-term sustainable use."

[4] COFI further noted the implementation of the plan should be pursued as a matter of high priority [31].

The IPOA functions on the principle that States that contribute to fishing mortality of a species or stock of shark, through targeted or non-targeted catches, should participate in their management. States should implement the IPOA by the establishment of a National Plan of Action (NPOA) and/or a regional equivalent as appropriate. The IPOA contains guidance as to the contents of an NPOA and also that of a shark assessment report (SAR)[5]. Technical guidelines have also been published [31].

The IPOA-Sharks represents a comprehensive approach to shark management. It incorporates aims that are logically derived from its objective and which place appropriate emphasis upon:

- sustainability of catches (targeted and by-catch);
- assessment of threats to populations and key habitats to enable adaptive management and prioritisation of actions;
- contribution to the protection of biodiversity and ecosystem structure and function;
- encouraging full use of sharks (i.e. ban the practice of finning);
- collection and distribution of data pertaining to shark catches and landings, species specific biology and trade, and
- capacity building and assistance to developing countries and international cooperation in general for the integrated and harmonised implementation.

States should report on the development, implementation and assessment of their shark-plans biennially. Key elements of the IPOA are summarised in Annex 3.

7. Seychelles national plan of action for the conservation and management of sharks

The Republic of Seychelles is an archipelago in the western Indian Ocean consisting of 115 islands and spread across an Exclusive Economic Zone (EEZ) of some 1.4 million square kilometres. The national economy is largely based on tourism and fisheries.

Shark fishing has a long history in Seychelles and has significant historical socio-economic importance, whilst diving represents a significant component of the tourism industry. The mass coral bleaching event of 1997/98 heightened the importance of macro-fauna, such as sharks and turtles, to the dive industry. The shark stocks of Seychelles therefore represent an important resource that fulfils diverse economic, social and environmental roles.

[5] The SAR is a preparatory phase in the development of, and a precursor to, an NPOA.

The shark stocks of Seychelles, like many around the world, have been the subject of increasing conjecture in recent years with concerns as to the sustainability of current exploitation and in particular the practice of "finning" in some fisheries. The Ministry of Environment and Natural Resources (MENR) and the Seychelles Fishing Authority (SFA) initiated the process to develop a National Plan of Action for the Conservation and Management of Sharks (NPOA-sharks) to address these concerns. The NPOA has been developed as per the FAO guidelines under its IPOA-sharks.

The NPOA was developed through a highly consultative, stakeholder-driven process, including interviews of stakeholders, two national workshops and iterative stages of consultation.

The following sections set out the context of the Seychelles contemporary shark fishery, the status and trends of stocks through time, and elaborate a prioritised action plan as developed by the stakeholders in a user-friendly format.

The NPOA sets out a four-year action plan with 11 work programmes that seek to address the 10 goals of the IPOA-Sharks (Annex 3 para 22) as they relate to local circumstances. The NPOA contains a mission statement for attainment within its first four year-phase and sets as its ultimate vision:

"That Shark Stocks In The Seychelles EEZ Are Effectively Conserved And Managed So As To Enable Their Optimal Long-Term Sustainable Use."

7.1. Description of the Seychelles shark fishery

7.1.1. Fishery baseline

The short human presence in Seychelles[6] means that fisheries have a distinct and readily defined history. This imbues particular value to early historical references pertaining to shark stocks. Early accounts are descriptive and detailed and indicate very large populations of aggressive sharks (Table 1).

[6] Seychelles had no indigenous people and was first colonised in 1770.

Table 1: References to shark populations from the late 18th and early 19th centuries

DATE	REFERENCE
1768	"*the turtle populations of the islands are heavily predated by the sharks that populate the waters in prodigious numbers*" Mr Duchemin [32]
1770	*"Silhouette island is surrounded by prodigious numbers of sharks and crocodiles. The former are so aggressive as to impede the work of the oarsmen by their repeated biting of the oars"* Du Roslan [33].
1800	The Corsair Hodoul described how, while his ship lay at anchor close to the island of St Anne, one of his boats putting off to go ashore was overturned by a school of sharks leaving the crew on the ship to watch helplessly as their shipmates were torn apart. [34]
1805	*"But no [other] part [of the world] I have visited is so infested with sharks – the blue, the white, the tiger, the hammer-headed and indeed most of the varieties of that voracious tribe."* Captain Philip Beaver, [35]

Shark populations remained high and the occurrence of large specimens inshore was common through the 19th and first half of the 20th century [36-38]. In 1926, an eminent fisheries scientist, Mr James Hornell, strongly recommended the development of the shark fishery be facilitated;

"…seeing how sharks swarm in the sea surrounding the island[s]" [36].

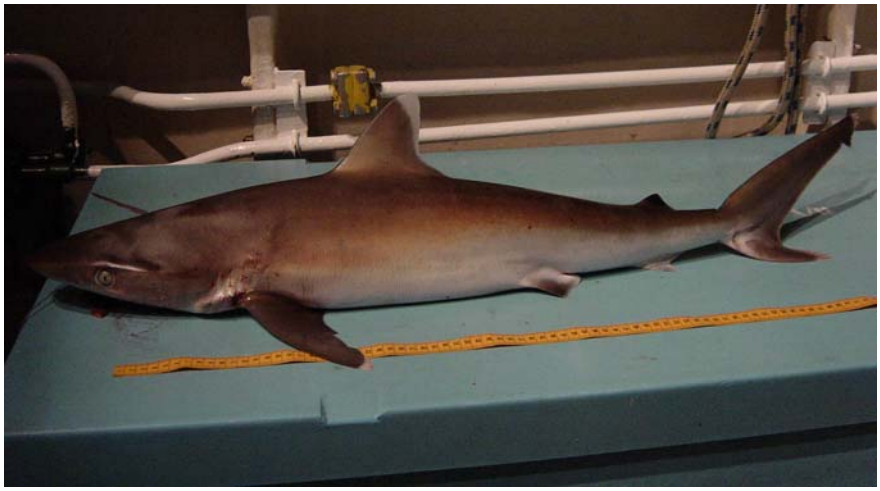
In 1945, fisheries scientist J. Wheeler stated "that sharks abound on the banks", and in his 1948/49 fisheries survey he concluded that the standing biomass of shark on the Seychelles banks exceeded that of demersal fish. Fortune Bank in particular was found to have very dense shark populations yielding a catch ratio of shark: fish of 16:1 [38] (Table 2).

Table 2: Estimate of the standing biomass of shark and fish on the Seychelles banks [38,39]

	Standing Biomass (metric tonnes)		Shark : Fish biomass ratio
	Shark	Fish	
Mahe Plateau	56,100	46,500	1.2 : 1
Fortune Bank	10,622	655	16 : 1
Constant Bank	8,300	1,760	4.7 : 1
Amirantes Plateau	15,168	17,024	1 : 1.1
Total	90,190	65,939	1.4 : 1

In the 1940s, large specimens of the most feared species were still common inshore along the coasts of the inner granite islands. Great white sharks (*Carcharodon carcharias*) were sighted around Port Victoria, and sightings of large hammerheads (*Sphyrna* spp) and tiger sharks (*Galeocerdo cuvier*) were common inshore along the bays, beaches and reefs [37,39]. However, by the late 1950s, populations were noted as being in decline and the sighting of large specimens around the central islands and latterly on the banks was becoming rare [39,40]. This trend continued such that sharks around the main island of Mahe were cited as very rare by the end of the 1960s [41], though smaller sharks[7] were still considered common on the more distant banks [40,42].

These initial accounts of decline have been corroborated by contemporary interviews of former shark fishermen involved in the fishery during the 1950s [39].



Shark research by SFA © R. Aumeeruddy

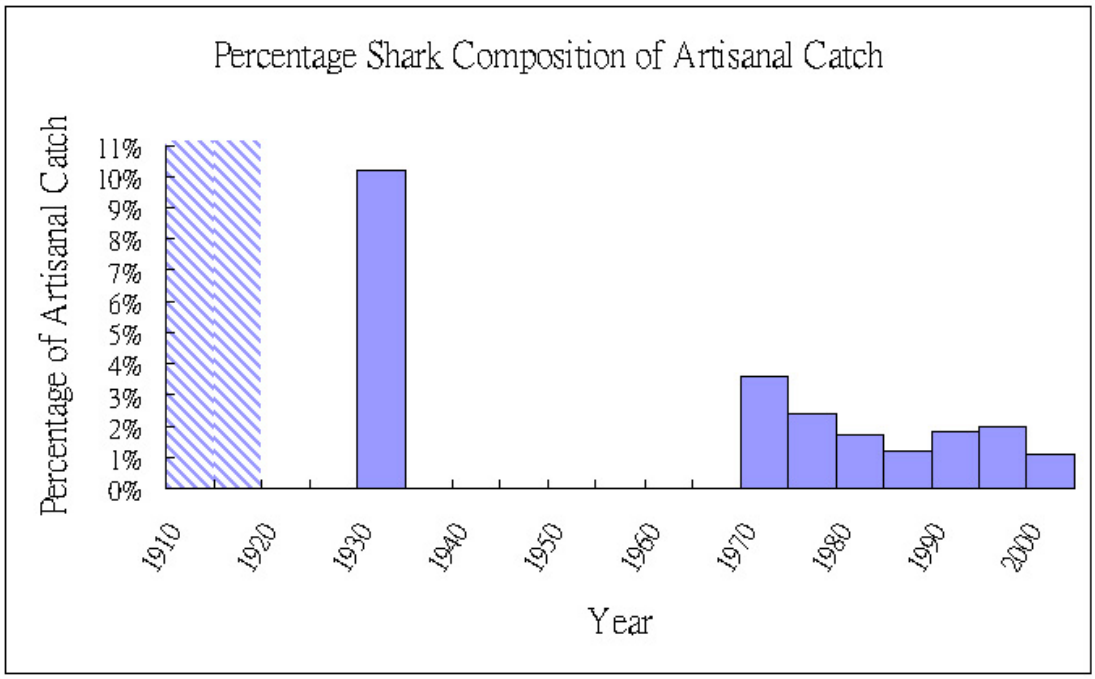
The importance of sharks to the total artisanal fisheries catch has declined substantially since the early 20th century (Fig 1). Despite a lack of data over much of the period, a clear trend of declining importance is only temporarily broken by the increasing price of fin, and related increase in catch and effort, in the 1990s.

These figures indicate an order of magnitude decline in importance in the last 70 years. This can be considered a conservative estimate because of the markedly greater effort, targeting shark from the 1980s onward and, unlike the 1930s, the data from the 1970s onwards is composed of shark and ray landings combined.

When viewed in the context of history of the fishery baseline and related recent research, and the history of shark fishery development (section 2 below), the weight of evidence indicates a significant decline in shark stocks during the second half of the 20th century.

[7] The terminology used referred to “pack shark” [40] – this likely refers predominantly *to C. amblyrhynchos, C. albimarginatus* and *C. plumbeus* [43].

Figure 1: Percentage shark composition (5-year means) of artisanal catches. [39]



7.1.2. History of shark fishery development

First colonised in 1770, the Seychelles has a long history of shark fishing. As early as the 1780s sharks were being utilised to generate medicinal products and the potential to produce fish oil from cartilaginous fish had also been noted [43]. By the 1840s shark skin and fins constituted a major export from the island group [43].

The year 1903 saw the first attempt at a targeted fishery but this failed due to the inadequacies of local equipment and navigational capacity [38]. By the 1920s, however, a schooner-based fishery[8] was successfully developed and continued to grow through the decade. This was facilitated by the British Colonial Government, which introduced ordinance setting out favourable terms and conditions to encourage the development of the shark fishery. The measures were effective in expanding the industry through local operations and also attracted interest from international investors [39,43]. The fishery ceased, however, with the collapse of world markets during the Great Depression [39].

Shark utilisation continued on a by-catch basis until the emergence, at the end of the Second World War, of an indigenous middle class in East Africa that imbued a traditional market for dried shark meat with new economic strength [40]. Seychellois entrepreneurs responded rapidly to this new opportunity and a local targeted fishery developed with more than 20 dedicated schooners. These boats differed from their predecessors, being powered by inboard diesel engines and utilising enhanced navigational and fishing capacity [43].

[8] Schooners, at that time, were wooden craft typically some 30 feet in length and predominantly, if not all, sail-powered [43].

Consequently, fishing effort was applied across the entire Mahe plateau and its surrounds, the banks beyond and the Amirantes[9]. During this period stock declines started to be reported; initially with the demise of the large specimens in near shore waters, then with the decline of the smaller species throughout the banks, and finally the abundance of sharks caught at the "bordage" or "drop off" at the edge of the Mahe plateau[10]. The trade continued despite declining catches until 1964 when the fall of Zanzibar, the regional hub for the meat trade, saw the collapse of the market [39].

The fall of Zanzibar signified a fundamental turning point in the economic dynamic of the Seychelles shark fishery, as from that point onwards, fin replaced meat as the primary commodity [39].

Fresh shark fins at a landing site in Seychelles © R. Aumeeruddy

The emergence of the Southeast Asian "tiger economies" in the 1980s and the Chinese economy in the 1990s served to increase the market demand for shark fin, and exports increased due to increased targeting by the artisanal fishery. Figure 2 illustrates a hundred-year dataset[11] for shark fin export and unit value[12].

A local semi-industrial long-line fishery was initiated in the mid-nineties to target swordfish and tuna; this resulted in increased shark by-catch. In the late 1990 it was noted that some of the long-line vessels were increasingly targeting and finning shark in order to export this high-value commodity [45]. The targeting of sharks increased dramatically when the Seychelles Government banned the export of swordfish (2003 –2005) to the EU until issues regarding the cadmium content of the fish exceeding EU recommended levels were resolved in 2005.

[9] Travis [40] gives a very detailed and evocative account of this fishery.

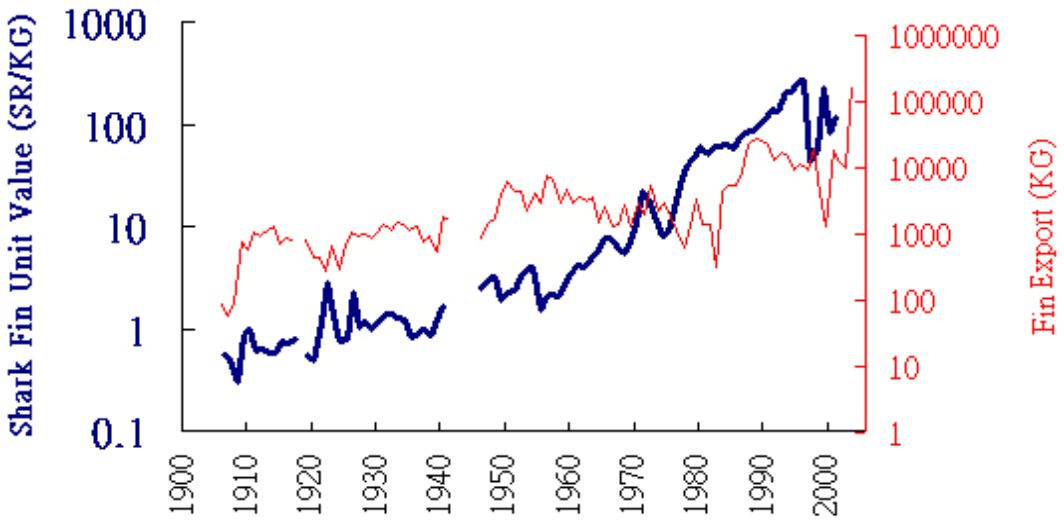
[10] It should be noted that Korean and Japanese industrial fleets commenced fishing for tuna in what is today the Seychelles EEZ during this period [39,43].

[11] The gaps in 1918 and in the 1940s reflect wartime cessation of trade.

[12] The drop in exports and values in the late 1990s reflects false declaration of exports by dealers to avoid duties and foreign exchange control measures [44].

This resulted in most of the long-line fleet (at that time 11 vessels) switching to shark fishing for fin in order to meet their financial obligations. Fin export for 2003 was an order of magnitude higher than any previous year on record [39].

Figure 2: Shark unit value (SCR) and fin export (kg) [39]



7.2. Status of current stocks

The best current information available regarding the species composition of contemporary stocks is restricted to an interview-based stakeholder survey undertaken in 2005 [39]. Figure 3 illustrates the species most commonly caught by both artisanal and semi-industrial shark fishermen whilst figure 4 illustrates a weighted index of species most commonly seen by divers.

Fig 3: Shark species most frequently caught [39]

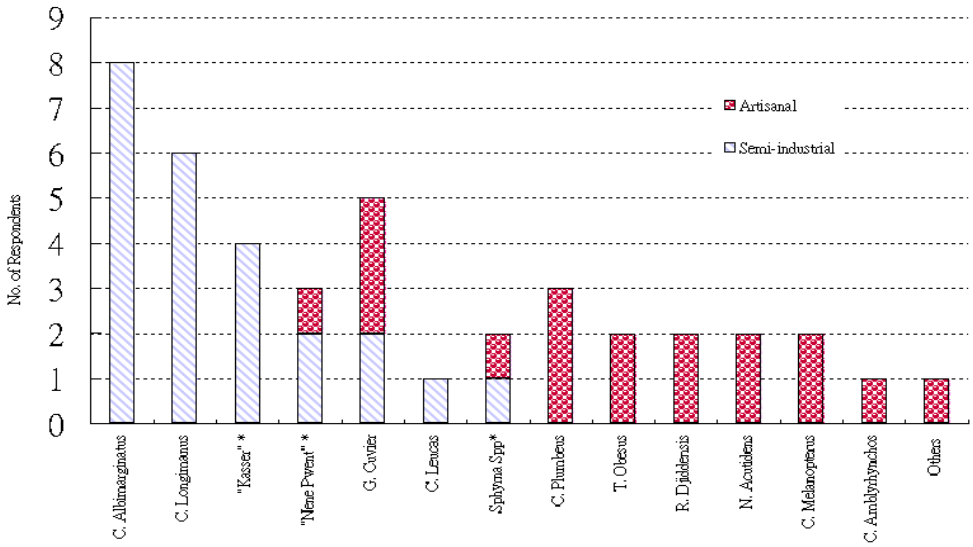


Fig 4: Shark species most frequently seen by divers [39]

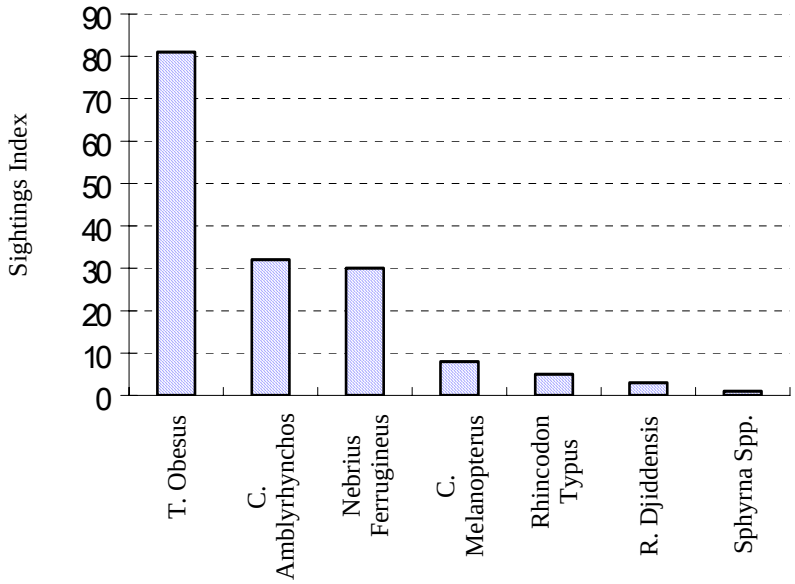


Figure 3 shows that a diversity of shark species are still commonly caught (fishers were asked to name the three species they caught most frequently) and also highlights that the artisanal and semi-industrial fisheries are in general targeting different species components of the overall shark stock, reflecting their different areas, depths and methods of activity. Figure 4, however, suggests that there is a reduced diversity of sharks in near shore waters with only 3 species being seen much and one (*T. obesus*) dominating sightings.

Species based information on stock status is chronically lacking. The historical data available (fin export and catch data) pertains to biomass caught predominantly on the Mahe plateau and surrounding drop-off, though there is significant anecdotal information that the Amirantes shark stock has been severely depleted [39].

Decline in shark abundance cannot be directly inferred from the decline of the importance of shark in the artisanal fishery (Figure 1). However, when coupled with the large increase in effort in the fishery, the historical accounts of abundance and decline (including the extirpation of resident near shore populations of great white, hammerhead and tiger sharks [32-41]), and contemporary interviews of former fishermen [39], substantial evidence points to a significant decline in shark stocks.

It is thus reasonable to consider cognisant of the precautionary approach and based on current available information that, for management purposes, the fishery as a whole be characterised as overexploited or depleted. Consequently two priorities for the NPOA should be;

- the enhanced gathering and management of data on the current status and species composition of the stock, and
- the application of a precautionary approach to the management of effort in the fishery.

These survey results also demonstrate, however, that, despite the apparent heavy decline in shark biomass on the Mahe plateau in the last 70 years, there remains a reasonable diversity of species that utilise the plateau for at least part of their lifecycle. This offers considerable scope for conservation management and rehabilitation. The shark species known to occur in Seychelles waters are listed in Annex 6.

7.3. Stakeholder analysis

The Seychelles shark fishery has the following primary stakeholders[13]:

- Artisanal shark fishermen: it is estimated that there are some 10 – 12 artisanal operators who specifically target shark in the Seychelles.

- Semi-industrial longline operators[14]: 4-5 semi-industrial long liners are currently targeting shark in finning operations, 2-3 others are believed to switch to shark targeted activities in the months of July and August when swordfish are seasonally scarce. Shark is also a significant by-catch from the semi-industrial Longline fishery targeting either swordfish or tuna.

- Shark fin exporters: There are currently three agencies operating in this domain.

- Dive operations: there are currently 20 licensed dive operators in Seychelles. Sharks are a major attraction for the dive industry. This is particularly true since the mass coral bleaching event of 1997/98, which caused the emphasis of dives to shift from coral reefs to granite reefs, wrecks and “mega fauna” (sharks, turtles).

[13] The full stakeholder analysis is summarised in Annex 4

[14] The semi-industrial longline fishery (and corresponding sub-sector) is entirely Seychellois owned and operated, whereas the industrial longline fleet (as part of the industrial fisheries sub-sector) is foreign owned and operated. In the context of the NPOA, the longline fishery refers to the local semi-industrial fishery.

Some dive centres operate whale shark ecotourism trips from the months of August - October in partnership with the Marine Conservation Society, Seychelles.

Mako shark caught by semi-industrial longliner © M. Velly

- Seychelles fishing authority (SFA): is a parastatal organisation under the governmental portfolio of the Ministry of Environment and Natural Resources (MENR). SFA was formed in 1984 to "develop the fishing industry to its fullest potential and to safeguard the resource base for sustainable development". It administers the fisheries and implements legislation such as the Fisheries Act etc.

- Fisheries policy unit (FPU): the FPU was established within MENR, in 2005, to advise the Minister on the development and implementation of fisheries policy.

- Conservation section (CS): the CS, within MENR, functions primarily in the domain of biodiversity conservation, management and policy, in particular the conservation of threatened species and addressing the causes of biodiversity loss. The CS also oversees the Wild Animals and Birds Protection Act (1961), which protects the whale shark (*Rhincodon typus*) under the Whale Shark Protection Regulations, 2003.

- The Marine conservation society, Seychelles (MCSS) is the only NGO solely dedicated to the conservation and sustainable use of marine biodiversity in Seychelles. It has, amongst other projects, been running a research programme on the whale shark (*Rhincodon typus*) since 1997. It raises revenue for this project, in part, through targeted ecotourism activities relating to the species.

7.4. Current fishing activities

7.4.1. Targeted shark-fishing activities

- Artisanal shark fishermen. There are believed to be some 10-12 artisanal shark fishermen operating from the three main islands (Mahe, Praslin and La Digue). The gear used is anchored and buoyed longlines (known locally as “drag”), which typically range from 150-400 metres in length and are set with 50-150 baited hooks [43]. The fishermen utilise their local knowledge of the plateau and set their lines in the evening to drift over prime areas with the prevailing current, lines are gathered at first light. The method is largely non-selective though variations of depth of hook and habitat fished can be utilised to target certain species. Whilst there are seasonal peaks for certain species (July-August and Jan-February), the fishery is otherwise a year-round activity. The fishermen utilise open vessels with outboard engines and their range is in general restricted to within 10 miles of their home anchorage. The fishery is typified by the diverse and full use of shark products for the local market.

- Semi-industrial long liner fishermen. 4 or 5 full-time long line boats are believed to be still targeting shark fulltime, while other boats are known to switch to shark during the low season for swordfish (July-August). Buoyed monofilament long lines with metal trace are utilised. An average of 350-400 baited hooks is set over some 12-15 miles of line. Fishing grounds include the entire fringe (“drop off” or “bordage”) of the Mahe plateau and adjacent banks, the Amirantes plateau as well as deeper areas of the Mahe plateau itself. The boats are equipped variously with charts, GPS, echo sounders and some have access to satellite data. The gear, though sophisticated, is largely non-selective with regard to shark species caught. Catch varies by depth and area of fishing activity. At sea sharks are typically finned and carcasses discarded.

7.4.2. Incidental shark catch

- Artisanal fisheries: sharks are taken as by-catch in several artisanal fisheries, particularly juvenile sharks that are readily caught by hook and line and in mackerel nets. It is important to note, however, that all demersal fishermen carry a shark line and hook on board for cases when they encounter a “run” of shark or, more often, when a shark becomes problematic on the fishing grounds by repeatedly taking fish from their lines. Due to lack of suitable storage facilities these boats will generally fin the shark catch.

- Semi-industrial longline fisheries: the fleet utilises metal trace in the swordfish and tuna fisheries and shark forms a significant proportion of by-catch [45]. The shark catch is generally finned.

- Industrial fisheries: industrial fishing for tuna commenced in the waters that today constitute the Seychelles EEZ in the mid-1950s and expanded with the development of Port Victoria in the early 1980s. The industrial purse seine and long-line fleet, licensed to fish in Seychelles waters, are characterised by state-of-the-art technology (bird radars, sonars, echo sounders, instrumented FADs and satellite charts). Shark forms a significant component of the by-catch of these fisheries and was in the past typically finned, with additional revenue generated going as a perk to crewmembers. EU vessels have been banned from finning shark by European commission legislation since 2003[15] and the Seychelles Government banned finning by foreign vessels in its waters in 2006[16] – the viability and effectiveness of these bans has yet to be determined.

Table 3: Industrial vessels licensed to operate in Seychelles EEZ. [46]

GEAR	YEAR				
	2001	2002	2003	2004	2005
Purse Seine	53	51	50	51	52
Long line	175	137	265	252	256
Total	228	188	315	303	308

The industrial vessels are foreign-owned and widely perceived by local fishermen to be responsible for the decline in shark stocks. Foreign vessels are required to operate 3km beyond the 200m isobar.

Sharks aggregating at open water FAD © FADIO/IRD/Ifremer/M.Taquet

[15] Council Regulation (EC) No. 1185/2003. [adoption CNS (2002) 0198],entry on to force 02/09/2003.
[16] Fisheries (Shark Finning) Regs 2006.

7.4.3. Illegal, Unregulated and Unreported fishing (IUU)

- IUU is by its very nature hard to quantify. However there is substantial anecdotal evidence of such activities and the authorities periodically seize boats. To what extent any such activities may be targeting shark (e.g. by industrial long liners) is unknown. There is a severe lack of national capacity to properly police the EEZ but this broader issue goes beyond the scope of the NPOA shark and should be addressed under the FAO International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (IPOA-IUU).

7.5. Legislation [47]

The legislation that pertains directly to sharks, shark-related fisheries and their management is summarised below.

a) **The Fisheries Act (1987),** sets out the framework for fishery management measures for local and foreign vessels. The primary regulations pertaining to the shark fishery fall under this Act.

- Zones where fishing by foreign vessels is prohibited (Reg. 5a, Schedule 1): covers all islands and related banks prohibiting fishing activity within 3km of the 200m isobath. This in effect reserves the fishing of banks and inshore areas to local operators.

- Prohibition of net fishing of sharks (Reg. 16c): forbids the fishing of shark using nets from the 1st August 1998. This regulation was brought in due to concerns about by-catch of turtles, marine mammals and non-target whale shark in gillnets. Subsequent to this, SFA developed and distributed the local "drag" (anchored longlines) system of fishing to former net fishermen. The switch to this equipment is believed to have increased shark catch [48].

- Fisheries (Shark Finning) Regulations 2006: forbids the practice of finning by foreign vessels licensed to operate in Seychelles EEZ by requiring vessels to land fin to the quantity of no more than 5% of the mass of dressed shark carcass. The feasibility/effectiveness of the enforcement of this regulation has yet to be assessed.

b) **The wild animals and birds protection Act (1961),** establishes the legal framework for the protection of species of wild animals and birds:

- Wild Animals (Whale Shark) Protection Regulations, 2003: declares the whale shark (*Rhincodon typus*) protected throughout Seychelles at all times. The whale shark was not previously fished in Seychelles waters, the legislation was rather introduced in order to facilitate the pursuit of an international conservation agreement for the species.

c) **The National Parks and Nature Conservancy Act (1969),** establishes the framework for the declaration of different categories of protected area. There are 3 Marine Special Reserves and 6 marine National Parks declared to date under this Act, where fishing is prohibited.

- The special reserve of Aldabra is significant in that it effectively protects the shark stocks and nursery of the bank and lagoon of a world heritage site and the world's largest raised atoll.

Shark and fish aggregations at open water FAD © FADIO/IRD/Ifremer/M.Taquet

- The origin of four of the Marine National Parks relates primarily to their locations being ideally suited to tourism operations, whilst the others, Silhouette and Ile Cocos/Ile Fouches/Iles Plattes, were declared primarily for the protection of a nesting marine turtle population and coral gardens, respectively [49]. The motivation for the main parks was not therefore, originally as a measure for fisheries conservation. Ste Anne Marine Park does, however, harbour a portion of an important shark pupping ground and nursery.

8. Developing the Seychelles national plan of action

The NPOA was prepared in line with the FAO guidelines as set out in the International Plan of Action for the Conservation and Management of Sharks (IPOA – Sharks). Research was undertaken to establish a baseline for shark stocks in Seychelles and the history and development of the shark fishery. Current knowledge on the fishery, its status, stakeholders, scale of operation and legislative and administrative framework was gathered to enable a situation analysis.

The Action Plan itself was developed through a highly consultative, iterative and stakeholder-driven process.

- A stakeholder analysis was undertaken to determine the scope of consultations (Annex 4);
- Primary stakeholders were interviewed to ascertain the measure of their interest and their principal concerns/aspirations with regard to the development of the NPOA;
- The findings of these interviews were cross-referenced with the 10 goals of the IPOA-sharks[17] [18] to provide a preliminary "NPOA Goals/Situation Analysis" matrix that formed the basis for discussion at the first stakeholder workshop;
- Stakeholder Workshops: two stakeholder workshops were held to which all primary and secondary stakeholders were invited;
    - 1st Workshop: stakeholders were given a presentation of and invited to comment on the baseline and historical data gathered in the research phase. The meeting then divided into working groups to discuss and modify the matrix document and determine options for work programmes to address the concerns identified;
    - 2nd Workshop: stakeholders elaborated and refined the work programmes of the Action Plan;
    - After each workshop, updated documents were circulated to stakeholders for comments;
- The draft action plan was presented to stakeholders at a final meeting. Stakeholders made certain refinements after the presentation and a final updated document was circulated for stakeholder input on content, and
- The final draft was subsequently submitted to SFA for endorsement.

[17] See Annex 3 paragraph 22.
[18] These Goals were latterly adopted verbatim as the Strategic Objectives of the NPOA.

PART II Seychelles Shark Plan

9. Seychelles action plan for the conservation and management of sharks[19]

9.1. Vision

"That Shark Stocks In The Seychelles EEZ Are Effectively Conserved And Managed So As To Enable Their Optimal Long-Term Sustainable Use."

9.2. Mission

The Mission of the first 4-year phase of this National Plan of Action is twofold:

- *to establish the necessary capacity, systems and databases to enable the informed adaptive management of shark stocks in Seychelles, and*
- *to implement an active and progressive precautionary approach to the management of targeted and non-targeted shark fishing effort that takes into account the transitional needs of stakeholders.*

[19] For the purposes of this document the term "shark" is taken to include all species of sharks, skates, rays and chimaeras (class Chondrichthyes). It should be noted, however, that the focus of this document falls primarily on "true sharks" as this is deemed to be the main issue of concern in the national context due to the economic pressure applied by the market price for fin -in this context the Giant Guitarfish (*Rhyncobatus djiddensis*) is also included as it is targeted for its fin and meat.
It is recognised, however, that information on the ray fishery in Seychelles is severely lacking and prohibitive to adaptive management measures. Work Programmes 3,4,5 & 9 should be considered, as appropriate, for implementation in the context of all Chondrichthyes.

9.3. Strategic objectives

1). Ensure that shark catches from directed and non-directed fisheries are sustainable.

2). Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use.

3). Identify and provide special attention, in particular, to vulnerable or threatened shark stocks.

4). Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States.

5). Minimize unutilized incidental catches of sharks.

6). Contribute to the protection of biodiversity and ecosystem structure and function.

7). Minimize waste and discards from shark catches in accordance with article 7.2.2.(g) of the Code of Conduct for Responsible Fisheries.

8). Encourage full use of dead sharks.

9). Facilitate improved species-specific catch and landings data and monitoring of shark catches.

10). Facilitate the identification and reporting of species-specific biological and trade data.

9.4. Working principles

The Interdependence of Humans and Biodiversity

Intrinsic Value

The Precautionary Principle

Ecologically Sustainable Development

9.5. Plan duration and review

The Plan is intended to have an initial 4-year duration (2007- 2010) with an independent review during year four, which will provide the basis for a consultative revision of the NPOA so as to enable an adaptive management approach and the optimal attainment of its strategic objectives.

9.6. Work programmes

Stakeholders identified eleven work programmes which when combined, seek to address the mission of the plan and its strategic objectives[20]. These work programmes are listed below and are elaborated in the following pages.

1. Co-management of the NPOA
2. Immediate stakeholder issues
3. Data gathering and management
4. Research
5. Managing effort in line with a precautionary approach
6. Develop/access markets for shark products
7. Optimising use of shark catch.
8. Non-consumptive sustainable use.
9. Review and improve administrative, management and conservation measures
10. International cooperation
11. Education and awareness

9.7. Priority framework

In the eleven following work programmes stakeholders allocated varying levels of priority to the specified actions. These priorities are encoded A to G in the work programme tables. The interpretation of each priority level is explained below.

A: Action initiated immediately and completed within 6 months.

B: Action initiated immediately and completed within 12 months.

C: Action initiated immediately with open-ended implementation.

D: Action initiated within 12 months and completed in shortest possible timeframe.

E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.

F: Action initiated and completed within 4 years.

G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

[20] The matrix in Annex 5 sets out how each work programme contributes to the attainment of the strategic objectives.

Work Programme 1: Co-management of the NPOA

Situation Analysis: The management of the shark fishery and shark populations is a complex issue with broad environmental, economic and social ramifications. The geographic extent of operations and the diversity of stakeholders exceed the capacity of the authorities to directly police the fishery. It is therefore essential that the plan and its oversight have broad stakeholder support and participation. Integral to such an approach is the establishment of a multi-stakeholder Steering Committee (SC) to guide the implementation of the NPOA. This committee should:

- be balanced and representative in membership;
- be equitable and transparent in function;
- have a clear executive role in the management of the plan (an advisory role would not meet the requirements for broad stakeholder participation).
- function as, or make provision for, a dispute resolution mechanism,
- form sub-committees as necessary to address issues of management, research, education and effective broader stakeholder communication and consultation.

The committee will be chaired by the appropriate government agency (SFA/MENR). The chair shall have power of veto over committee decisions but the use of veto will require substantive justification in order to maintain transparency and accountability of function.

Actions	Priority[21]	Agencies
i) Identify SC membership.	A	All primary stakeholders
ii) Formalise SC terms of reference, mandate[1] and *modus operandi.*	A	All primary stakeholders
iii) Launch and commence operation of SC.	A	SC
iv) Seek to effectively harness the full complement of national capacity towards the implementation of the NPOA, through the forming of partnerships and cooperative agreements.	C	SC Interested Agencies (IA)
v) Means to be found to subsidise the attendance of artisanal fishermen to the Steering Committee.	C	SFA, MENR

Notes:
1) The development of the mandate of the Steering Committee will require a review of pertinent legislation (namely the Fisheries Act) to ensure that the executive role of the SC as defined is not subject to other discretionary powers aside from the prescribed veto.

[21] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 2: Immediate stakeholder issues

Situation Analysis: The successful implementation of the NPOA will depend upon effective stakeholder involvement and collaboration. Initial interviews and stakeholder discussions highlighted issues that require immediate attention in order to lay the necessary foundation for future collaboration. In particular, this related to a conflict of interest pertaining to near shore locations with shark populations utilised both as an attraction by dive operations and as fishing grounds by artisanal shark fishermen. This issue was addressed in the workshops and stakeholders approved, in principle, the process as set out in the actions below.

Actions	Priority[22]	Agencies
i) Determine membership, mandate (Terms of Reference) and initiate works of sub-committee (Sub-C)[1]	A	All primary stakeholders
ii) Identify and agree on number, location and size of dive areas where artisanal fishermen agree not to place anchored long lines ("drag").	A	Sub-C
iii) Develop and agree on format and nature of monitoring that dive centres will undertake at specified sites.	A	Sub-C
iv) Negotiate and determine distance from the islands of Mahe, Praslin and La Digue within which boats involved in setting longlines agree to not set their lines[2].	A	Sub-C
v) Legislate if and as appropriate[3].	B	SFA/MENR

Notes:
1). The Sub-C is formed from representative stakeholders by the SC, upon establishment, to meet as required to address the actions of this issue-based work programme.
2). Consideration needs to be given to the possible over night drift of long lines towards land when determining the distance.
3). Legislation may not be necessary, or may be only required for the duration of the NPOA.

[22] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 3: Data gathering and management

Situation Analysis: The lack of information as to the species-specific nature of the shark catch has been identified as a critical impediment to the adaptive management of shark stocks in Seychelles. The primary problem relates to the correct and consistent identification of shark species, particularly when animals are processed (e.g. gutted, headed and finned) at sea.

There are, furthermore, clear shortcomings in the collection and recording of trade data in recent years, which serve to impede effective administration of the fishery.

Actions	Priority[23]	Agencies
i) Develop user-friendly identification keys with standardised terminology and nomenclature (incorporating Creole names).	A	SFA, Fishermen IA (e.g. NGOs), Dive Ctrs
ii) Develop criteria for sharks to be landed in form that facilitates species identification[1].	D	SFA, Fishers, RA
iii) Develop standardised data gathering methods and user-friendly data charts that incorporate necessary information[2,3&4].	B	SFA Fishermen IA (e.g. NGOs)
iv) Develop an effective, secure database with a protocol that facilitates data gathering and management, summarisation, efficient data extraction and exchange between partners whilst securing information rights.	D	SFA IA (e.g. NGOs)
v) Determine if listed species are caught[5].	C	SFA/MENR
vi) Establish where possible appropriate and effective mechanisms for the validation of biological, catch[6] and trade data[7].	F	SFA
vii) Assess the nature and extent of the sports and recreational fishery and determine whether it should be incorporated into the standardised monitoring system.	D	SFA, MCA MTT, IA.

[23] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Notes:

1) e.g. gutted and headed but landed with fins, skin, claspers.

2) Methods should be standardised across fisheries and consider information requirements such as species, number caught, size classification, sex, number of young carried, location, depth and method of fishing etc…

3) Prior to requirements to land the whole shark, guides should be prepared to enable species identification from whole animals, carcasses and, possibly fins, skins, vertebrae and heads.

4) Consideration should also be given to the collection of data necessary for the formulation of species risk assessments.

5) i.e. species that may be classified as endangered or threatened under IUCN criteria or protected by national law or international agreement.

6) e.g. using observers, monitoring schemes, fishery-independent research programs.

7) X-ref with WP 9 iv.

Work Programme 4: Research

Situation Analysis: Information on the current species-specific status and distribution of shark stocks, their biology and role in the ecosystem is fundamentally lacking. This represents a major limiting factor to the effective adaptive management of shark stocks and the shark fishery.

Actions	Priority[24]	Agencies
i) Identify and prioritise key research requirements to enable efficient and cost-effective implementation of the NPOA[1].	A	SC, Research agencies (RA)
ii) Develop and implement/facilitate prioritised research programme.	E	SC, SFA, SBS, RA, IA.
iii) Generate science-based recommendations for the conservation, management and sustainable use of Seychelles shark stocks.	F	SFA, RA, IA.
iv) Develop and pilot risk assessment criteria to identify priority shark species[2].	G	SFA, RA, IA.
v) Initiate management and research actions to minimise impact and rehabilitate populations of species identified as being at high risk.	C	SFA, RA, IA.
vi) Monitor and assess efficacy of conservation measures.	C	SC, SFA, RA, IA. Dive Ctrs.

Notes:

1) Priority research requirements include:
- Status of shark stocks, their distribution (temporal and spatial), biology and ecology.
- Identification of critical habitats (aggregation areas, breeding/pupping grounds),
- Identification of migration routes, and barriers to migration.
- Socioeconomic study of Seychelles shark fishery (economic requirements for landing whole shark, scope for production of value-added shark products, scope for expansion of local products market, identification of international shark product markets).
- Investigation and valuation of potential dive tourism. (X-ref with WP 8v & 9vi).
- Survey and assess local knowledge of shark stocks and shark fishing (seasonality, species location, methods).

2) May include threatened/listed species, targeted or key catch species or rare species.

[24] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 5: Managing effort in line with a precautionary approach

Situation Analysis: Whilst species-specific information as to current stock status is limiting; there is strong evidence (scientific, historical and anecdotal) to suggest a significant decline in shark abundance on the Mahe Plateau over the last 70 years. This decline, plus anecdotal evidence of significant declines in other island groups and banks (notably the Amirantes), is sufficient to warrant an active and progressive application of a precautionary approach to the management of effort in both targeted and incidental shark fisheries.

It is particularly important that an effective implementation of WP 6 not result in an increase of effort in the shark fishery, hence existing fishers/operators should be licensed and effort level capped or closed to new entrant.

Actions	Priority[25]	Agencies
i) Survey and identify current artisanal shark fishermen, the number of boats and number of "drag" under use.	A	SFA, IA Fishers assoc.
ii) Legislate to license the fishery and give licenses only to current operators[1].	B	SFA/MENR
iii) Investigate and facilitate viable alternatives to shark fishing for the semi-industrial fleet[2&3].	F	SFA, FBOA, RA, Fishers. MoF
iv) Move to progressively limit and ultimately prohibit[4], the use of metal trace in the non-shark licensed fishery, by the conclusion of the first four years of this plan[5].	F	SFA/MENR
v) Investigate scope for gear modifications or introductions to limit by-catch[6,7&8].	G	SFA, Fishers, IOTC, RA.

[25] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Notes:

1) No new/additional licenses to be issued prior to review of plan in 4 years.
2) e.g. identification of and incentives for other fishery options during the low season for swordfish (typically July/August), eliminate double retention of foreign exchange from sale of fish to exporter and then export, and increase percentage of foreign exchange retained by the fishers.
3) Establish effective mechanism to ensure market prices are reflected in local purchasing price of swordfish/tuna – e.g. through market research and the formation of a price regulatory body.
4) Actions iv and v of this Work Programme are intrinsically linked. The stakeholder agreed letter and spirit of this action is that existing long liner stakeholders will be allowed to continue to use metal trace until a viable alternative is found. It is however fundamental to the overall balance of the NPOA that effort (directed or otherwise) in the shark fishery is decreased in general, in line with the precautionary approach espoused in the NPOA's Mission, its working principles and this work programme. As such new operators entering into the long line fishery will not be allowed to utilise metal trace.
5) Excluding artisanal and drop line fisheries.
6) A review of species viable for retention may also highlight necessary gear modifications.
7) Incidental catches would also need to be addressed if local purse seine vessels were introduced.
8) There may be funding opportunities under SWIOPF and SWIOFC.

Work Programme 6: Develop/access markets for shark products

Situation Analysis: The development of and access to markets for shark products is fundamentally linked to the optimal use of shark catch (WP 7). It is also essential that provisions (ensuring that effort in the fishery is limited, as a maximum, to current operators) in WP 5 are successfully in place before this programme is initiated, as the intention of developing/accessing new markets is to enable the landing of the whole shark and must not result in increased effort. In the expansion of markets and the facilitation/stimulation of production of shark products, measures need to be taken to protect the market share and interest of artisanal fishermen.[1]

Actions	Priority[26]	Agencies
i) Assess international markets for shark and shark products and where viable seek to secure access for local produce.	D	SFA, MEP, SCCI, Private sector.
ii) Review needs for the local processing of sharks[2].	D	SFA, SCCI, Private sector.
iii) Develop mechanism to ensure primary access to local market for artisanal fishermen.	D	SFA/GoS
iv) Establish Processing facilities, market and test local products (within 4-year NPOA).	E	Private sector, SCCI,SFA,GoS.
v) Review local market and propose measures to expand and develop it.	E	SFA, RA.
vi) Liberalise fin export to allow local fisherman to export their own fin[3].	A	SFA/MENR, SLA.

Notes:

1) All these actions must be devised and developed in the context of the long-term ecologically sustainable harvest of shark species and the current information deficit. This requires the application of a precautionary approach through the prior reduction of effort – as set out in WP 5..

2) Due to high local costs processing may be viable only in part. Research is needed to promote the local processing and value-adding for shark products in terms of incentives and facilitation of establishment of processing facilities (X-ref WP 4i) – e.g. availability of land. Consideration should also be given to the feasibility of requiring the international fleet to sell shark by-catch to local processors.

3) Only a limited number of licenses for export are permitted at present. Liberalization will enable operators landing whole shark, in line with WP7 (ii), to export fins directly, thus contributing to cost effectiveness.

[26] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 7: Optimising use of shark catch

Situation Analysis: Work programmes 5,6 and 7 are fundamentally linked with a common goal of enhancing commercial scope for shark products (in the context of an effectively managed fishery effort) in order to make it viable to land the whole shark, therefore actually reducing the impact to stocks. Additional factors that need to be considered, however, include the viability of landing whole specimens of certain species which may not have commercial value for the whole carcass – for example, because of poor quality of meat – and the logistical and capacity requirements imposed by storing by-catch shark meat on different models of vessel.

Actions	Priority[27]	Agencies
i) Enable the viability of landing the whole shark (within time span of plan - 4 years)[1].	E	SFA/GoS, SCCI Private sector.
ii) Develop timeline and criteria for legislation regarding landing of whole shark[2&3].	E	SFA/MENR

Notes:
1) This is a combined goal requiring input from WPs 5,6 & 7.
2) The timeline is dependent on economic viability of landing whole shark or the implementation of subsidies/incentives that make it viable. (incl: greater retention of forex for vessels landing whole shark, and in the longer term a possible ecotourism related incentive for shark fishers to comply with management measures).
3) Develop criteria for what vessels should land whole shark and what species should be landed whole. A review of vessel requirements across artisanal and semi-industrial fleets was proposed to assess needs for modifications to enable landing of whole shark.

[27] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 8: Non-consumptive sustainable use

Situation Analysis: The non-consumptive use of sharks through ecotourism activities offers considerable potential for the furtherance of the conservation, management and sustainable use of sharks, by imbuing value to the living animal. These aspects of use need to be enabled and developed so as to find a balance between consumptive and non-consumptive use and the ecology of the marine ecosystem.

Actions	Priority[28]	Agencies
i) Identify and declare no shark fishing areas[1,2&3].	A	Sub-C
ii) Enforce no shark fishing areas[1&2].	D	Sub-C, appropriate agencies.
iii) Monitor designated areas to assess impact on shark populations and make recommendations.	E	SFA, Dive centres.
iv) Initiate ecotourism activities if and when shark populations are noted to improve and reach a viable density and diversity.	E	Dive centres, STB, SFA.
v) Investigate options for various ecotourism activities and make recommendations[4].	E	Dive centres, STB, DMCs, RA.
vi) Publish whale shark encounter policy and establish licensing and enforcement regulations.	A	MENR/MTT
vii) Assess the socioeconomic value of the living shark in Seychelles[5].	E	STB, DMCs, RA, SFA.

Notes:
1) X-ref with WP 2ii (Immediate Stakeholder Issues)
2) Including gear controls to prevent shark by-catch.
3) Consideration needs to be given to number, size and location of sites such that they can realise a positive effect on local shark populations.
4) X-ref with WP 9 vi.
5) X-ref with WP 4 i.

[28] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 9: Review and Improve Administrative, Management and Conservation Measures

Situation Analysis: The current fishery administration and management measures, and broader marine conservation framework, require review in light of the development of the NPOA in order to:

- streamline measures and avoid duplications;
- realise synergies;
- identify systemic, institutional, legislative and human resource capacity needs; and
- ensure that measures are enforceable and in line with the goal of ecologically sustainable use.

Actions	Priority[29]	Agencies
i) Assess feasibility and capacity requirements for enforcement of the Fisheries (Shark Finning) Regulations 2006, and develop and implement effective and transparent measures to enable their implementation[1].	D	SFA, IA International Agencies.
iia) Undertake a national capacity assessment to optimise use of existing capacity and identify capacity needs for effective implementation of NPOA.	D	SFA, RA. IA (Govt Manpower Dept)
iib) Develop capacity building plan to address needs[2].	D	SFA, RA. (Govt Manpower Dept)
iiia) Assess current management arrangements for sharks against the objectives and actions of this Shark-plan and whether they are enforceable and consistent with the ecologically sustainable use of sharks[3].	A	SFA, RA
iiib) Develop and implement action plan to address any deficiencies.	E	SFA, RA
iv) Review, streamline and improve current trade management measures[4] and related collection and management of data.	D	SFA, MEP,RA, MoF Fishers, Exporters,

[29] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

v) Improve and plan monitoring and enforcement of local fisheries and regulations, respectively	C	SFA, SPDF, Police, Fishers, customs.
vi) Implement recommendations identified in WP 4 iii, 8 iii & 8 v.	C	SFA
vii) Investigate scope for funds to be sourced from fishery tax revenues, and other sources, and re-directed/placed in a fund for implementation of the NPOA.	A	SFA, SC, MoF.
viii) Review incentives (e.g. Fisheries Incentive Act)[5].	B	SFA/MENR MoF,

Notes:
1) It is central to the success of the NPOA that management measures pertaining to shark catch for the international fleet fishing in Seychelles' EEZ are enforced and that they are seen to be enforced.
2) States are expected, under the IPOA-sharks, to be able to assess the state of the stocks under their jurisdictions, including the impacts of ecosystem changes resulting from the effects of fishing, pollution and habitat change; as well as the effects of climate change on shark stocks.
3) Particular attention should be given to threatened/listed shark species.
4) X-ref socioeconomic surveys under WP 4i and address the existing issue of double forex retention in sale of catch from fisher to exporter and overseas, and seek to increase forex retention of fishers.
5) X-ref with WP 4 i.

Work Programme 10: International cooperation

Situation Analysis: International cooperation is essential for the implementation of the IPOA-sharks. Existing bi- and multilateral agreements and RFMOs (in this case the Indian Ocean Tuna Commission) should be utilised to include or give higher priority to shark fisheries and particularly transboundary and straddling stocks.

Actions	Priority[30]	Agencies
i) Seek means through international agreements[1] to actively promote the IPOA-Sharks, establish cooperative research, stock assessments, conservation and management initiatives for transboundary, straddling, highly migratory and high seas shark stocks.	C	SFA, GoS, IA.
ii) Analyse data promptly and publish results in a timely manner and understandable format and make available for peer review.	C	SFA, RA.
iii) Seek international assistance and resources to enhance national capacity to implement the NPOA[2].	C	SFA/GoS, IA.
iv) Disseminate the NPOA (and related assessments and implementation reports) internationally and fulfil reporting requirements to FAO[3].	C	SFA.

Notes:
1) Relevant bilateral, multilateral and regional fisheries management agreements and international conventions such as CITES and the Convention on Migratory Species (Seychelles is already working on an international agreement under the CMS for migratory sharks – i.e. *Rhincodon typus* and *Carcharodon carcharias*).
2) X-ref with WP (9iia) on capacity needs assessment
3) Biennial reports.

[30] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Work Programme 11: Education and awareness

Situation Analysis: Education and awareness of all stakeholders (see Annex 4) is central to the effective implementation of the NPOA. This programme should be implemented in a cross-cutting manner throughout the work programmes. The different stakeholder groups will require targeted and actively disseminated information to enable them to fulfil their respective roles in the implementation of the NPOA.

Actions	Priority[31]	Agencies
i) Develop and implement a public education and awareness strategy aimed at the general public and stakeholders that: a) Educates the public about the myths and realities of shark behaviour, conservation and management; b) Emphasises the vulnerability of sharks to fishing pressure and their role in the marine ecosystem; c) Addresses by-catch issues and encourages the successful return of living sharks to the sea; d) Highlights the status, role and progressive implementation of the NPOA; e) Educates stakeholders on the need for shark catch data and species identification; f) Disseminates identification keys and trains stakeholders in their use[1]; g) Trains stakeholders in the correct implementation of data gathering protocols[2]; h) Develops stakeholder awareness of the pertinent legislation and management measures, reporting requirements and penalties[3].	C	SFA/MENR/ ME SC, IA.
ii) Monitor effectiveness of the strategy and adaptively manage[4].	F	SC, SFA

Notes:
1) X-ref with WP 3 i.
2) X-ref with WP 3 iii.
3) e.g. gear regulations, no take areas and the whale shark encounter policy etc...
4) In particular monitor the efficacy of the identification guides and the subsequent veracity of catch data submitted.

[31] **Priority framework**

A: Action initiated immediately and completed within 6 months.
B: Action initiated immediately and completed within 12 months.
C: Action initiated immediately with open-ended implementation.
D: Action initiated within 12 months and completed in shortest possible timeframe.
E: Action initiated within 12 months of completion of prerequisite work and completed in shortest possible timeframe.
F: Action initiated and completed within 4 years.
G: Action initiated within 4 years, if not sooner, and completed in shortest possible timeframe.

Annex 1: CITES shark conservation and management initiatives

CITES monitors and regulates the international trade in endangered species and their products so as to protect species from unsustainable exploitation. Trade is controlled by the utilisation of import and export certificates provided by the respective national authorities. It is important to note that CITES does not apply to Parties' internal markets.

CITES utilises appendices to classify endangered species with regard to international trade [50] this includes so called "look-alike species" i.e. species of which the specimens in trade look like those of species listed for conservation reasons [51]. There are three appendices under CITES:

- Appendix I includes species threatened with extinction. Trade in such species is permitted only under exceptional circumstances e.g. scientific research or conservation programmes [51].
- Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilisation incompatible with their survival [50].
- Appendix III contains species that are protected in at least one country which has asked other CITES Parties for assistance in controlling its trade.

CITES first substantively addressed the issue of shark populations in resolution 9.17 (*CITES 1994*) which initiated the process that ultimately led to the development of the FAO IPOA –Shark. At the 12th Conference of the Parties (COP) in Chile 2002 the Whale shark and Basking shark were added to appendix II [52] whilst in COP 13 in Thailand 2004 Parties agreed to regulate international trade in the Great White shark by also listing it in Appendix II [53].

In addition CITES played a central role in the development of the FAO IPOA-Sharks and continues to be active in the monitoring of its implementation.

Annex 2: CMS shark conservation and management initiatives

The CMS addresses the particular concerns and needs of migratory species. The CMS has two appendices that classify migratory species as per degree of conservation concern [54].

Appendix I – Endangered migratory species [55]:

- Contains species that have been categorised as being in danger of extinction throughout all or a significant proportion of their range
- State parties to the CMS that are range states for Appendix I species are to strive toward protecting these animals, conserving or restoring habitats in which they live, mitigating obstacles to migration and controlling other factors that might endanger them.

Appendix II - Migratory species conserved through Agreements [55]:

- Contains migratory species that are deemed to have an unfavourable conservation status or would benefit significantly from international cooperation organised by specific Agreements.
- Under the Convention range states are encouraged to develop memorandums of Understanding (MoUs) or Agreements (agreements are more substantive and legally binding in nature).

The CMS is classified as a Framework Convention because it enables and uses Agreements[32] and MoUs[33] as its primary means to implement its overall objectives. To facilitate this States do not have to be party to the CMS in order to accede to its Agreements.

In 1999, the Whale shark was listed in CMS Appendix II in recognition of the threats posed by directed takes for fins and meat. Since then negotiations regarding the development of an Agreement for this species have been ongoing. At COP 7 in September 2002, the Great White shark was listed in both Appendices in response to a worldwide decline that was attributed to both incidental and targeted catches.

A workshop is scheduled for January 2007 in Seychelles to initiate the development of an Agreement on three species of migratory shark: the great white shark, the whale shark and the basking shark.

[32] E.g. The African-Eurasian Water Bird Agreement.
[33] E.g. Memorandum of Understanding on the Conservation and Management of Marine turtles and their Habitats of the Indian Ocean and South East Asia.

Annex 3: summary of the IPOA-sharks

Introduction

1. For centuries artisanal fishermen have conducted fishing for sharks sustainably in coastal waters, and some still do. However, during recent decades modern technology in combination with access to distant markets have caused an increase in effort and yield of shark catches, as well as an expansion of the areas fished.

2. There is concern over the increase of shark catches and the consequences which this has for the populations of some shark species in several areas of the world's oceans. This is because sharks often have a close stock recruitment relationship, long recovery times in response to over-fishing (low biological productivity because of late sexual maturity; few off-spring, albeit with low natural mortality) and complex spatial structures (size/sex segregation and seasonal migration).

3. The current state of knowledge of sharks and the practices employed in shark fisheries cause problems in the conservation and management of sharks due to lack of available catch, effort, landings and trade data, as well as limited information on the biological parameters of many species and their identification. In order to improve knowledge on the state of shark stocks and facilitate the collection of the necessary information, adequate funds are required for research and management.

4. The prevailing view is that it is necessary to better manage directed shark catches and certain multi-species fisheries in which sharks constitute a significant by-catch. In some cases the need for management may be urgent.

5. A few countries have specific management plans for their shark catches and their plans include control of access, technical measures including strategies for reduction of shark by-catches and support for full use of sharks. However, given the wide-ranging distribution of sharks, including on the high seas, and the long migration of many species, it is increasingly important to have international cooperation and coordination of shark management plans. At the present time there are few international management mechanisms effectively addressing the capture of sharks.

6. The Inter-American Tropical Tuna Commission, the International Council for the Exploration of the Sea, the International Commission for the Conservation of Atlantic Tunas, the Northwest Atlantic Fisheries Organization, the Sub-regional Fisheries Commission of West African States, the Latin American Organization for Fishery Development, the Indian Ocean Tuna Commission, the Commission for the Conservation of Southern Bluefin Tuna and the Oceanic Fisheries Programme of the Pacific Community have initiated efforts encouraging member countries to collect information about sharks, and in some cases developed regional databases for the purpose of stock assessment.

7. Noting the increased concern about the expanding catches of sharks and their potential negative impacts on shark populations, a proposal was made at the Twenty-second Session of the FAO Committee on Fisheries (COFI) in March 1997 that FAO organize an expert consultation, using extra-budgetary funds, to develop Guidelines leading to a Plan of Action to be submitted at the next Session of the Committee aimed at improved conservation and management of sharks.

8. This International Plan of Action for Conservation and Management of Sharks (IPOA-SHARKS) has been developed through the meeting of the Technical Working Group on the Conservation and Management of Sharks in Tokyo from 23 to 27 April 1998 and the Consultation on Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries held in Rome from

26 to 30 October 1998 and its preparatory meeting held in Rome from 22 to 24 July 1998.

9. The IPOA-SHARKS consists of the nature and scope, principles, objective and procedures for implementation specified in this annex.

Nature and Scope

10. The IPOA-SHARKS is voluntary. It has been elaborated within the framework of the Code of Conduct for Responsible Fisheries as envisaged by Article 2 (d). The provisions of Article 3 of the Code of Conduct apply to the interpretation and application of this document and its relationship with other international instruments. All concerned States are encouraged to implement it.

11. For the purposes of this document, the term "shark" is taken to include all species of sharks, skates, rays and chimaeras (Class *Chondrichtyes*), and the term "shark catch" is taken to include directed, by-catch, commercial, recreational and other forms of taking sharks.

12. The IPOA-SHARKS encompasses both target and non-target catches. See: "Report of the FAO Technical Working Group on the Conservation and Management of Sharks". Tokyo, Japan, 23-27 April 1998. FAO Fisheries Report No. 583. See "Report of the Preparatory Meeting for the Consultation on the Management of Fishing Capacity, Shark Fisheries and Incidental Catch of Seabirds in Longline Fisheries." Rome, Italy, 22-24 July,1998. FAO Fisheries Report No. 584. In this document, the term "State" includes Members and non-members of FAO and applies *mutatis mutandis* also to "fishing entities" other than States.

Guiding principles

13. *Participation*. States that contribute to fishing mortality on a species or stock should participate in its management.

14. *Sustaining stocks*. Management and conservation strategies should aim to keep total fishing mortality for each stock within sustainable levels by applying the precautionary approach.

15. *Nutritional and socio-economic considerations*. Management and conservation objectives and strategies should recognize that in some low-income food-deficit regions and/or countries, shark catches are a traditional and important source of food, employment and/or income. Such catches should be managed on a sustainable basis to provide a continued source of food, employment and income to local communities.

Objective

16. The objective of the IPOA-SHARKS is to ensure the conservation and management of sharks and their long-term sustainable use.

Implementation

17. The IPOA-SHARKS applies to States in the waters of which sharks are caught by their own or foreign vessels and to States the vessels of which catch sharks on the high seas.

18. States should adopt a national plan of action for conservation and management of shark stocks (*Shark-plan*) if their vessels conduct directed fisheries for sharks or if their vessels regularly catch sharks in non-directed fisheries. When developing a *Shark-plan*, experience of sub-regional and regional fisheries management organizations should be taken into account, as appropriate.

19. Each State is responsible for developing, implementing and monitoring its *Shark-plan*.

20. States should strive to have a *Shark-plan* by the COFI Session in 2001.

21. States should carry out a regular assessment of the status of shark stocks subject to fishing so as to determine if there is a need for development of a shark plan. This assessment should be guided by article 6.13 of the Code of Conduct for Responsible Fisheries. The assessment should be reported as a part of each relevant State's *Shark-plan*. The assessment would necessitate consistent collection of data, including *inter alia* commercial data and data leading to improved species identification and, ultimately, the establishment of abundance indices. Data collected by States should, where appropriate, be made available to, and discussed within the framework of, relevant sub-regional and regional fisheries organizations and FAO. International collaboration on data collection and data sharing systems for stock assessments is particularly important in relation to transboundary, straddling, highly migratory and high seas shark stocks.

22. The *Shark-plan* should aim to:

- Ensure that shark catches from directed and non-directed fisheries are sustainable;
- Assess threats to shark populations determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use;
- Identify and provide special attention, in particular to vulnerable or threatened shark stocks;
- Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;
- Minimize unutilized incidental catches of sharks;
- Contribute to the protection of biodiversity and ecosystem structure and function;
- Minimize waste and discards from shark catches in accordance with article 7.2.2.(g) of the Code o Conduct for Responsible Fisheries (for example, requiring the retention of sharks from which fins are removed);
- Encourage full use of dead sharks;
- Facilitate improved species-specific catch and landings data and monitoring of shark catches;
- Facilitate the identification and reporting of species-specific biological and trade data.

23. States which implement the *Shark-plan* should regularly, at least every four years, assess its implementation for the purpose of identifying cost-effective strategies for increasing its effectiveness.

24. States which determine that a *Shark-plan* is not necessary should review that decision on a regular basis taking into account changes in their fisheries, but as a minimum, data on catches, landings and trade should be collected.

25. States, within the framework of their respective competencies and consistent with international law, should strive to cooperate through regional and subregional fisheries organizations or arrangements, and other forms of cooperation, with a view to ensuring the sustainability of shark stocks, including, where appropriate, the development of subregional or regional shark plans.

26. Where transboundary, straddling, highly migratory and high seas stocks of sharks are exploited by two or more States, the States concerned should strive to ensure effective conservation and management of the stocks.

27. States should strive to collaborate through FAO and through international arrangements in research, training and the production of information and educational material.

28. States should report on the progress of the assessment, development and implementation of their *Shark-plans* as part of their biennial reporting to FAO on the Code of Conduct for Responsible Fisheries.

Annex 4: NPOA stakeholder analysis

Primary Stakeholders:

Those that will be directly involved in or affected by the development and implementation of the NPOA. These stakeholders should be as much as possible involved in interviews and consultations.

- Artisanal shark fishermen
- Semi-industrial Longline operators
- Dive operations
- Seychelles Fishing Authority (SFA).
- MENR: (Conservation Section & Fisheries Policy Unit).
- MCSS.

Secondary Stakeholders:

Stakeholders that will be affected indirectly by the development and implementation of the NPOA. They should be included in the invitation list to presentations and workshops but not required in the one-to-one interview and consultation activities.

- Fisherman's Association.
- Fishing Boat Owners Association (FBOA).
- Sports Fisherman.
- Marine Charter Association.
- Professional Divers Association.
- Seychelles Centre for Marine Research and Technology/Marine Parks Authority (SCMRT/MPA).
- Fin exporters/processors.
- Environmental NGOs (Nature Seychelles and Island Conservation Society).
- Fish buyers/exporters (Sea Harvest & Oceana Fisheries).
- Indian Ocean Tuna Commission (IOTC).
- Seychelles Tourism Board (STB).
- Ministry of Tourism and Transport (MTT).

Tertiary Stakeholders:

These stakeholders should be informed of developments through appropriate information dissemination/media coverage etc.

- General population through Constitutional commitment to sound and healthy environment.

Preliminary Stakeholder Analysis		
Primary Stakeholders:	Stakeholders that will be directly involved in or affected by the development and implementation of the NPOA. These stakeholders should be as much as possible involved in interviews and consultations as per activities x – x of the work programme.	
Stakeholder	**Description**	**Notes**
Fishermen	Artisanal shark fishermen i.e. those that actively target shark in their operations.	Previous survey suggested there were 10-12 such operations but there is no definitive listing. Assistance will be required from SFA to identify and incorporate such individuals into the process. It would also serve to assist in future data collection if the fisherman could be identified and listed.
	Semi-industrial long liner operators.	Shark is a major by-catch and seasonal target for their operations. 3 or 4 boats still target shark full-time.
Shark Fin Exporters	3 exporters are currently licensed to export fin	
Dive Operations	Sharks can be a major attraction for dive operations and offer scope for non-consumptive use of the resource.	There are 18 licensed dive operations in central Seychelles and 2 more in the outer islands.
Seychelles Fishing Authority (SFA).	Responsible for Fishery Research and management.	
Ministry of Environment and Natural Resources (MENR).	Government portfolio responsible for natural resource management and environmental protection. In particular: Fisheries Policy Unit Conservation Section (responsible for protected – e.g. *Rhincodon typus* - and rare/endangered species).	
Marine Conservation Society Seychelles (MCSS)	Has specific shark initiatives and research projects Only NGO in Seychelles dedicated solely to marine conservation, management and research.	

Secondary Stakeholders:	Stakeholders affected indirectly by the development and implementation of the NPOA. They should be included in invitation list to presentations and workshops but not required in the one-to-one interview and consultation activities.	
Stakeholder	**Description**	**Notes**
Fishermen's Associations	To represent the broader fishing community (e.g. Apostalat de la Mer, Fishing Boat Owners Association).	
Marine Charter Association	Overarching association that represents interests of sports fishing activities amongst other hire boat activities.	
Sports Fisherman.	Various sports fishing operations may be actively targeting shark.	A survey/ further analysis is required of these operators to determine who should be included
SCMRT/MPA	Coordinates marine research and manages Marine National Parks.	
Environmental NGOs	Nature Seychelles: primary focus remains on bird and their habitats, but increasingly broadening scope to island management initiatives etc… manages Cousin Island Special Reserve and associated MPA	As NGOs with mandates that cover the broader management of Seychelles' biodiversity they have a legitimate stake in the development of the NPOA.
	Nature Protection Trust Seychelles: based on and focusing its activities primarily on Silhouette Island, known for work on tortoises, terrapins, *Impatiens gordonii* etc…	
	Island Conservation Society: Focus primarily on biodiversity management in the context of island ecosystems. Manages Aride Island Special Reserve and associated MPA.	
Indian Ocean Tuna	Purchases, processes and exports tuna.	
Fish Buyers/Exporters	E.g. Sea Harvest and Oceana fisheries.	
Indian Ocean Tuna Commission	Officed on Mahe has a legitimate interest in fisheries management and implementation of the FAO Code of Conduct for Responsible Fisheries (Resolution 05/05)	
Seychelles Tourism Board	Responsible for the marketing of Seychelles as a tourism product	
Ministry of Tourism and Transport	Government portfolio for tourism policy and management.	
Professional Divers Association	Represents the broader professional diving community in Seychelles.	

Annex 5: strategic objectives / work programmes matrix

Strategic Objective	Work Programmes										
	1	2	3	4	5	6	7	8	9	10	11
1). Ensure that shark catches from directed and non-directed fisheries are sustainable.			x	x	X	X	X		*X*	x	x
2). Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use.			x	X					x	x	x
3). Identify and provide special attention, in particular to vulnerable or threatened shark stocks.			x	X				X	x	X	x
4). Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States.	X	X							x	X	x
5). Minimize unutilized incidental catches of sharks.				x	X	X			x	x	x
6). Contribute to the protection of biodiversity and ecosystem structure and function.		X		X	X			X	X	x	x
7). Minimize waste and discards from shark catches in accordance with article 7.2.2.(g) of the Code of Conduct for Responsible Fisheries.				x		X	X		x	x	x
8). Encourage full use of dead sharks.				x		X	X		x	x	x
9). Facilitate improved species-specific catch and landings data and monitoring of shark catches.			X	x					X	x	x
10). Facilitate the identification and reporting of species-specific biological and trade data.			X	x					X	x	x
Key: X: Primary Interaction x: Secondary Interaction **Note:** whilst most of the work programmes contribute in some form or another to all the objectives the primary and secondary contributions of the work programmes to the NPOA strategic objectives are highlighted in this matrix.											

Annex 6: species of sharks found in Seychelles waters adapted from Serret 2002 [13]

Family	Species	Common Name
Hexanchidae	*Heptranchias perlo*	Sharpnose sevengill shark
	Hexanchus griseus	Bluntnose sixgill shark
	Hexanchus nakamurai	Bigeye sixgill shark
Somniosidae	*Centroscymnus coelolepis*	Portuguese dogfish
	Centroscymnus crepidater	Longnose velvet dogfish
	Centroscymnus owstoni	Roughskin dogfish
	Zameus squamulosus	Velvet dogfish
Centrophoridae	*Centrophorus granulosus*	Gulper shark
	Centrophorus moluccensis	Smallfin gulper shark
	Centrophorus sp.	
	Centrophorus sp. 1	
	Centrophorus sp. 2 (lallanus)	
	Centrophorus spp.	
	Centrophorus squamosus	Leafscale gulper shark
Squalidae	*Squalus asper*	Roughskin spurdog
	Squalus megalops	Shortnose spurdog
	Squalus mitsukurii	Shortspine spurdog
	Squalus sp.	
	Squalus sp. 1	
	Squalus sp. 2	
	Squalus sp. 3	
	Squalus sp. 4	
	Squalus sp. 5	
	Squalus spp.	
Squatinidae	*Squatina sp. (africana?)*	(African angelshark)
Stegostomatidae	*Stegostoma fasciatum*	Zebra shark
Ginglymostomatidae	*Ginglymostoma brevicaudatum*	Short-tail nurse shark
	Nebrius ferrugineus	Tawny nurse shark
Rhincodontidae	*Rhincodon typus*	Whale shark
Odontaspididae	*Carcharias taurus*	Sand tiger shark
	Carcharias tricuspidatus	Indian sand tiger
	Odontaspis ferox	Smalltooth sand tiger
	Odontaspis noronhai	Bigeye sand tiger
Pseudocarchariidae	*Pseudocarcharias kamoharai*	Crocodile shark
Alopiidae	*Alopias pelagicus*	Pelagic thresher
	Alopias superciliosus	Bigeye thresher
	Alopias vulpinus	Thintail thresher
Lamnidae	*Carcharodon carcharias*	Great white shark
	Isurus oxyrhinchus	Shortfin mako
	Isurus paucus	Longfin mako
Pseudotriakidae	*Pseudotriakis microdon*	False catshark
Triakidae	*Mustelus manazo*	Starspotted smooth-hound
Hemigaleidae	*Hemipristis elongatus*	Snaggletooth shark
Carcharhinidae	*Carcharhinus albimarginatus*	Silvertip shark
	Carcharhinus amblyrhynchos	Grey reef shark
	Carcharhinus brachyurus	Copper shark
	Carcharhinus brevipinna	Spinner shark
	Carcharhinus dussumieri	Whitecheek shark
	Carcharhinus falciformis	Silky shark
	Carcharhinus galapagensis	Galapagos shark
	Carcharhinus leucas	Bull shark
	Carcharhinus limbatus	Blacktip shark
	Carcharhinus longimanus	Oceanic whitetip shark

	Carcharhinus melanopterus	Blacktip reef shark
	Carcharhinus plumbeus	Sandbar shark
	Carcharhinus sealei	Blackspot shark
	Carcharhinus sorrah	Spottail shark
	Galeocerdo cuvieri	Tiger shark
	Loxodon macrorhinus	Sliteye shark
	Negaprion acutidiens	Sicklefin lemon shark
	Prionace glauca	Blue shark
	Rhizoprionodon acutus	Milk shark
	Rhizoprionodon sp.	
	Triaenodon obesus	Whitetip reef shark
Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead
	Sphyrna mokarran	Great hammerhead
	Sphyrna zygaena	Smooth hammerhead

Ray Species Recorded To Date In Seychelles Waters.		
Family	**Species**	**Common Name**
Pristidae	**Pristis microdon**	Largetooth sawfish
Rhinidae	*Rhina ancylostoma*	Bowmouth guitarfish
Rhyncobatidae	*Rhyncobatus djiddensis*	Giant guitarfish
Rhinobatidae	*Rhinobatus annulatus*	Lesser sandshark
	Rhinobatus blochi	Bluntnose guitarfish
	Rhinobatus obtusus	Widenose guitarfish
	Rhinobatus schlegeli	Yellow guitarfish
Topedinidae	*Torpedo fuscomaculata*	Black-spotted torpedo
	Torpedo sinuspersici	Marbled electric ray
Plesiobatidae	*Plesiobatis daviesi*	Deepwater stingray
Dasyatidae	*Dasyatis kuhlii*	Bluespotted stingray
	Dasyatis sp. 1	
	Himantura uarnak	Honeycomb stingray
	Himantura granulata	Mangrove whipray
	Pastinachus sephen	Cowtail stingray
	Pteroplatytrygon violacea	Pelagic stingray
	Taeniura lymma	Bluespotted ribbontail ray
	Taeniura meyeni	Blotched fantail ray
	Urogymnus asperrimus	Porcupine ray
Myliobatidae	*Aetobatus narinari*	Spotted eagle ray
Rhinopteridae	*Manta birostris*	Giant manta
Mobulidae	*Mobula eregoodootenkee*	Pygmy devilray

Glossary[1]

Abundance: degree of plentifulness. The total number of fish in a population or on a fishing ground. Can be measured in absolute or relative terms.

Adaptive management: Regulation or control of resource use that adapts in response to the results of management actions.

Artisanal fisheries: Traditional fisheries typically involving fishing households (as opposed to commercial companies), using relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption.

Baseline: A set of reference data sets or analyses used for comparative purposes; it can be based on a reference year or a reference set of (standard) conditions.

Biodiversity: see **Biological diversity**

Biological diversity: the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. [Convention on Biological Diversity].

Biomass: or standing stock. The total weight of a group or stock of living organism, or of some defined fraction of it, in an area at a particular time.

By-catch: Part of a catch of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed. Some or all of it may be returned to the sea as discards, usually dead or dying.

Catch: The total number (or weight) of fish caught by fishing operations. Catch should include all fish killed by the act of fishing, not just those landed.

Collapse: Reduction of a stock abundance by fishing and / or other causes to levels at which the production is negligible compared to historical levels.

Conservation: Of natural resources. The protection, improvement, and use of natural resources according to principles that will assure their highest economic or social benefits for man and his environment now and into the future.

Critical habitat: habitat vital to the successful completion of the species lifecycle (e.g. pupping grounds, nurseries etc…) and/or areas where the species is particularly vulnerable (e.g. aggregation areas, migration corridors etc…)[Nevill JEG 2006].

Demersal: Living in close relation with the bottom and depending on it. Example: Cods, Groupers and lobsters are demersal resources. The term “demersal fish” usually refers to the living mode of the adult.

Directed Fishery: Fishing that is directed at a certain species or group of species. This applies to both sport fishing and commercial fishing.

Discard: To release or return fish to the sea, dead or alive, whether or not such fish are brought fully on board a fishing vessel .

Dressed weight: The weight of fish after the gills, guts, head and fins have been removed.

Ecological sustainable development: Using, conserving and enhancing the community’s resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased [National Strategy for Ecologically Sustainable Development, Council of Australia Governments, 1992. http://www.fisheries-esd.com/c/glossary/index.cfm (20/09/06)].

Ecotourism: Travel undertaken to witness the unique natural or ecological quality of particular sites or regions, including the provision of services to facilitate such travel.

Finning: The practice of removing fins and discarding the carcass, usually pertaining to sharks.

Fishing effort: The amount of fishing gear of a specific type used on the fishing grounds over a given unit of time e.g. hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day.

[1] All terms derived from FAO fisheries glossary [http://www.fao.org/fi/glossary/default.asp (20/09/06)] unless otherwise stated.

Habitat: means any area in the range of a migratory species, which contains suitable living conditions for that species (Convention on Migratory Species).

Highly migratory species or stocks: Marine species whose life cycle includes lengthy migrations, usually through the EEZ of two or more countries as well as into international waters.

Longline: A fishing gear in which short lines carrying hooks are attached to a longer main line at regular intervals. Longlines are laid on the bottom or suspended horizontally at a predetermined depth with the help of surface floats. The main lines can be as long as 150 km and have several thousand hooks (e.g. in tuna fisheries).

Longliner: A fishing vessel employing longlines. Longlines can be operated from vessels of any size adapted to the length of longline to be set. Several automatic or semi-automatic systems are used on larger boats to bait the hooks and to shoot and haul the lines.

Management: The art of taking measures affecting a resource and its exploitation with a view to achieving certain objectives, such as the maximization of the production of that resource. Management includes, for example, fishery regulations such as catch quotas or closed seasons.

Migration: Systematic (as opposed to random) movement of individuals of a stock from one place to another, often related to season. A knowledge of the migration patterns helps in targeting high concentrations of fish and managing shared stocks.

Migratory Species: Species that move over national boundaries, and hence require international cooperation to enable their comprehensive management (Convention on Migratory Species)

Non-consumptive use: Refers to cases where one person's enjoyment does not prevent others from enjoying the same resource. For example, the viewing of marine mammals or other wildlife does not prevent another from enjoying the same resources.

Non-Governmental Organisation: Any organisation that is not a part of national, local or parastatal government. In the Seychelles context, this means organisations registered under the Registration of Associations Act.

Non-target species: Species for which the gear is not specifically set, although they may have immediate commercial value and be a desirable component of the catch.

Recreational fishery: Harvesting fish for personal use, fun, and challenge (e.g. as opposed to profit or research).

Selective gear: A gear allowing fishers to capture few (if any) species other than the target species.

Shark catch: includes directed, by-catch, commercial, recreational and other forms of taking sharks. (from IPOA sharks).

Stakeholder: An actor having a stake or interest in a physical resource, ecosystem service, institution, or social system, or someone who is or may be affected by a public policy.

Stock: The part of a fish population which is under consideration from the point of view of actual or potential utilization.

Sustainable development: Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

Sustainable use: The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations. [Convention on Biological Diversity]

Virgin stock: A stock in its natural condition before anyone has fished it.

Vulnerability: A term equivalent to "catchability" but usually applied to separate parts of a stock, for example those of a particular size, or those living in a particular part of the range.

References

[1] Musick, J.A., Burgess, G., Vailliet, G., Camhi, M. & Fordham, S. (2000) Management of Sharks and Their Relatives (Elasmobranchii). *Fisheries* 25(3): 9 - 13.

[2] Frisk, G.F., Miller, T.J. & Fogarty, M.J. (2001): Estimation and analysis of biological parameters in elasmobranch fishes: a comparative life history study. *Canadian Journal of Fisheries and Aquatic Science*, 58: 969 – 981.

[3] Stevens, J.D., Bonfil, R., Dulvy, N.K. & Walker, P.A. (2000): The effects of fishing on sharks, rays, chimaeras (chondrichthyans), and the implications for marine ecosystems. *ICES Journal of Marine Science*, 57: 476 – 494.

[4] FAO FIDI (1999): Catch by Species. FAO website: http://www.fao.org/fi/struct/fidi.asp#TOP (22/11/04).

[5] King, J.R. & Mcfarlane, G.A. (2003): Marine fish life history strategies: applications to fishery management. *Fisheries Management and Ecology*, 10: 249-264.

[6] Castro, J.I., Woodley, C.M. & Brudek, R.L. (1999): A preliminary evaluation of the status of shark species. *FAO Fisheries Technical paper 380*. Food and Agriculture Organisation of the United Nations. Rome. ISBN 92-5-104299-3.

[7] Casey, J.M. & Myers, R.A. (1998): Near Extinction of a Large, Widely Distributed Fish. *Science*, 281(5377): 690 – 692.

[8] Myers, R.A. & Worm, B. (2003): Rapid worldwide depletion of predatory fish communities. *Nature*, 423: 280-283.

[9] Christensen, V., Guenette, S., Heymans, J.J., Walters, C.J., Watson, R., Zeller, D. & Pauly, D. (2003): Hundred-year decline of North Atlantic predatory fishes. *Fish and Fisheries* 4: 1-24.

[10] Steele, J.H. & Schumacher, M. (2000): Ecosystem structure before fishing. *Fisheries Research* 44: 201-205.

[11] Baum, J.K., Myers, R.A., Kehler, D.G., Worm, B., Harley, S.J. & Doherty, P.A. (2003): Collapse and Conservation of Shark Populations in the Northwest Atlantic. *Science* 299: 389 – 392.

[12] Baum, J.K. & Myers, R.A. (2004): Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. *Ecology Letters*, 7: 135 – 145.

[13] Jennings, S., Greenstreet, S.P.R. & Reynolds, J.D. (1999): Structural change in an exploited fish community: a consequence of differential fishing effects on species with contrasting life histories. *Journal of Animal Ecology*, 68: 617 – 627.

[14] Brander, K. (1981): Disappearance of Common Skate *Raia Batis* from Irish Sea. *Nature*, 290(5801): 48 – 49.

[15] Kohler, N.E. & Turner, P.A. (2001): Shark tagging: a review of conventional methods and studies. *Environmental Biology of Fishes* 60:191-223.

[16] Casey, J.G. & Kohler, N.E. (1990): Long Distance Movements of Atlantic Sharks from the NMFS Cooperative Shark Tagging Program. *In:* Discovering Sharks. 1990. S.H. Gruber ed. American Littoral Society, Highlands, N.J. pp.87-90.

[17] Dulvy, N.K., Sadovy, Y. & Reynolds J.D. (2003): Extinction vulnerability in marine populations. *Fish and Fisheries* 4: 25 -64.

[18] Walker, T.I. (1998): Can shark resources be harvested sustainably? A question revisited with a review of shark fisheries. *Journal of Marine and Freshwater Research*, 49: 553 – 572.

[19] Worm, B., Lotze, H.K., Hillebrand, H. & Sommer, H. (2002): Consumer versus resource control of species diversity and ecosystem functioning. *Nature*, 417: 848-851.

[20] Jackson, J.B.C. (2001): What was natural in coastal oceans? *PNAS* 98 (10) 5411-5418.

[21] Jackson, J.B.C., Kirby, M.X., Berger, W.H., Bjorndal, K.A., Botsford, L. W., Bourque, B.J., Bradbury, R.H., Cooke, R., Erlandson, J., Estes, J.A., Hughes, T.P., Kidwell, S., Lange, C.B.. Lenihan, H.S., Pandolfi, J.M., Peterson, C.H., Steneck, R.S., Tegner, M.J. & Warner, R.R. (2001): Historical Overfishing and the Recent Collapse of Coastal Ecosystems. *Science*, 293 (5530): 629 – 638.

[22] WSSD (2002): World Summit on Sustainable Development: Plan of Implementation. Johannesburg, South Africa 2002. http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm

[23] DOALOS (1982): The United Nations Convention on the Law of the Sea. DOALOS website:http://www.un.org/depts/los/convention_agreements/convention_overview_convention.htm. (22/11/04)

[24] UNCED (1992): Agenda 21. http://www.oceanlaw.net/texts/summaries/unced.htm (15/11/04).

[25] UNCSHMFS (1995): United Nations Agreement on Straddling and Highly Migratory Fish Stocks United Nations Conference On Straddling Fish Stocks And Highly Migratory Fish Stocks. Sixth session New York, 24 July-4 August 1995 A/CONF.164/37 8 September 1995

[26] UNCED (1992b): Rio Declaration of Principles. UNEP website: http://www.unep.org/Documents/Default.asp?DocumentID=78&ArticleID=1163 (22/11/04)

[27] CBD (2000): Decision V/6. CBD COP V. CBD website: www.biodiv.org

[28] FAO (1998): The International Plan of Action for Conservation and management of Sharks. Consultation on management of Fishing Capacity, Shark Fisheries and Incidental catch of seabirds in Longline Fisheries. Rome. 26-30 October 1998. (Food and Agriculture Organisation of the United Nations: Rome).

[29] CITES (1994): Resolution of the Conference of the Parties 9.17. Status of International Trade in Shark Species. http://www.traffic.org/factfile/sharks-cites.html (19/11/04).

[30] FAO (1999): Report of the FAO Technical Working Group on the Conservation and Management of Sharks. Tokyo, Japan, 23-27 April 1998. *FAO Fisheries Report*. No. 583. Rome, FAO. 1999.

[31] FAO (2000): FAO Technical Guidelines for Responsible Fisheries – Fisheries Management – 4 Suppl. 1-1. Conservation and Management of Sharks. Food and Agricultural Organisation of the United Nations. Rome, 2000. ISBN 92-5-104514-3.

[32] Lionnet G. Observations d'histoire naturelle fait aux Seychelles en 1768 au cours de l'expedition Marion Dufresne 1984 (unpublished).

[33] Fauvel AA. Unpublished documents on the history of the Seychelles islands anterior to 1810. Government Printing Office, Mahe, Seychelles. 1909.

[34] Webb AWT. The Story of Seychelles. 2nd Edition, 1965.

[35] Smyth WH. The Life and Services of Captain Philip Beaver. John Murray, Albemarle Street London. 1829.

[36] Hornell J. Report on the fisheries and fish of the Seychelles islands. HMSO 1927.

[37] Ommaney FD. A Draught of Fishes. Longmans, Green and Co. Ltd. London. 1965.

[38] Wheeler JFG. The Potential Fish Production of the Seychelles Area and notes on the fisheries there. Government Printing Office, Victoria, Seychelles. 1946.

[39] Nevill JEG. Establishing a Baseline for Shark fishery Management in the Seychelles. MSc University of Newcastle upon Tyne, 2005.

[40] Travis W. Shark for sale. George Allen and Unwin Ltd. London. 1961

[41] Smith JLB and Smith MM. The fishes of Seychelles. The JLB Smith Institute of Icthyology. Rhodes University, Grahamstown, South Africa. 1969.

[42] Cole RC. Commercial Fisheries in Seychelles. Tropical Products Institute report No.R13. Ministry of Overseas Development. 1966.

[43] Nevill JEG & Pollunin NVC in prep.

[44] Seret B. Shark fisheries and conservation in the Seychelles. Consultancy Report for the Seychelles Fishing Authority. December 2002.

[45] Bargain RM. Trends in the Seychelles Semi-Industrial Longline Fishery. IOTC proc. No. 4 page 110 –119. 2001.

[46] Seychelles Fishing Authority: Annual Reports 2001-2005.

[47] Laws of Seychelles 1991 edition (updated).

[48] Nageon de Lestang J. Management of Shark Fisheries in Seychelles. In: Shotton, R. (ed.) Case studies of the management of elasmobranch fisheries. FAO Fisheries Technical Paper. No. 378, part 2. Rome, FAO. 1999. pp. 480–920.

[49] Engelhardt U. Integrated Marine Protected Area Systems Plan For Seychelles (IMPASP). 2004.

[50] CITES (2004a): CITES website: How does CITES work. http://www.cites.org/eng/disc/how.shtml (20/11/04)

[51] CITES (2004b): CITES website: Appendices. http://www.cites.org/eng/append/index.shtml (20/11/04)

[52] CITES (2002): COP 12 Amendments to Appendices: http://www.cites.org/eng/cop/12/Adopted_Amendments.pdf (19/11/04)

[53] CITES (2004c): CITES website. COP 13 updates. http://www.cites.org/eng/cop/index.shtml (19/11/04)

[54] CMS (2004a): Convention on Migratory Species website http://www.cms.int/about/intro.htm (20/11/04).

[55] CMS (2004b): Convention on Migratory Species website, Convention appendices. http://www.cms.int/documents/appendix/cms_app1_2.htm (20/11/04).