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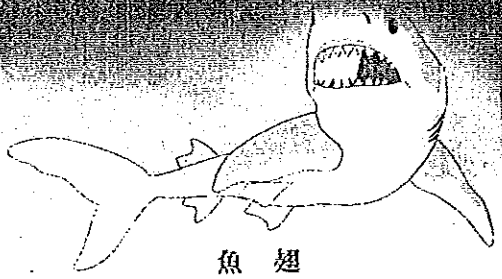
TRADE REVIEW

THE TRADE IN SHARKS AND SHARK PRODUCTS IN THE WESTERN INDIAN AND SOUTHEAST ATLANTIC OCEANS

Edited by

Nina T. Marshall and Rob Barnett



魚翅

魚翅乃鯊魚之翅，可食用部份包括尾部、背部及兩傍划水部份。魚翅稱尾部爲勾或尾，背部之魚翅，稱爲脊；划水之部份，則稱爲翼或片，每一部份必須加工製作始可食用。

未經加工前之魚翅是黑色，稱爲生貨，須經過刮沙、起骨、晒乾後，稱爲乾貨。常用魚翅有三種做法：散翅、排翅及乾翅。

生翅乃最通行之食法，如雞絲生翅、清湯翅及鴻圖翅等。排翅亦爲烹製魚翅方法之一，上菜時排成一列，故稱排翅，可紅扒或作燴湯用途。乾翅翅針軟滑翅肚，排成扇形，多用以製作紅燒大乾翅或清湯乾翅月。

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Great White Shark *Carcharodon Carcharias*
J. Stafford-Deitsch

Menu from Hong Kong restaurant serving shark fin soup

Shark fin for sale in Hong Kong
Rob Parry-Jones – TRAFFIC

Shark fins and jaws drying before sale
Alex Forbes – IUCN

Shark trunk drying on the Somali coast
Alex Forbes – IUCN

Sharks for sale
A.L.Gaski – TRAFFIC

Shark fishing
Liz Hayes – TRAFFIC

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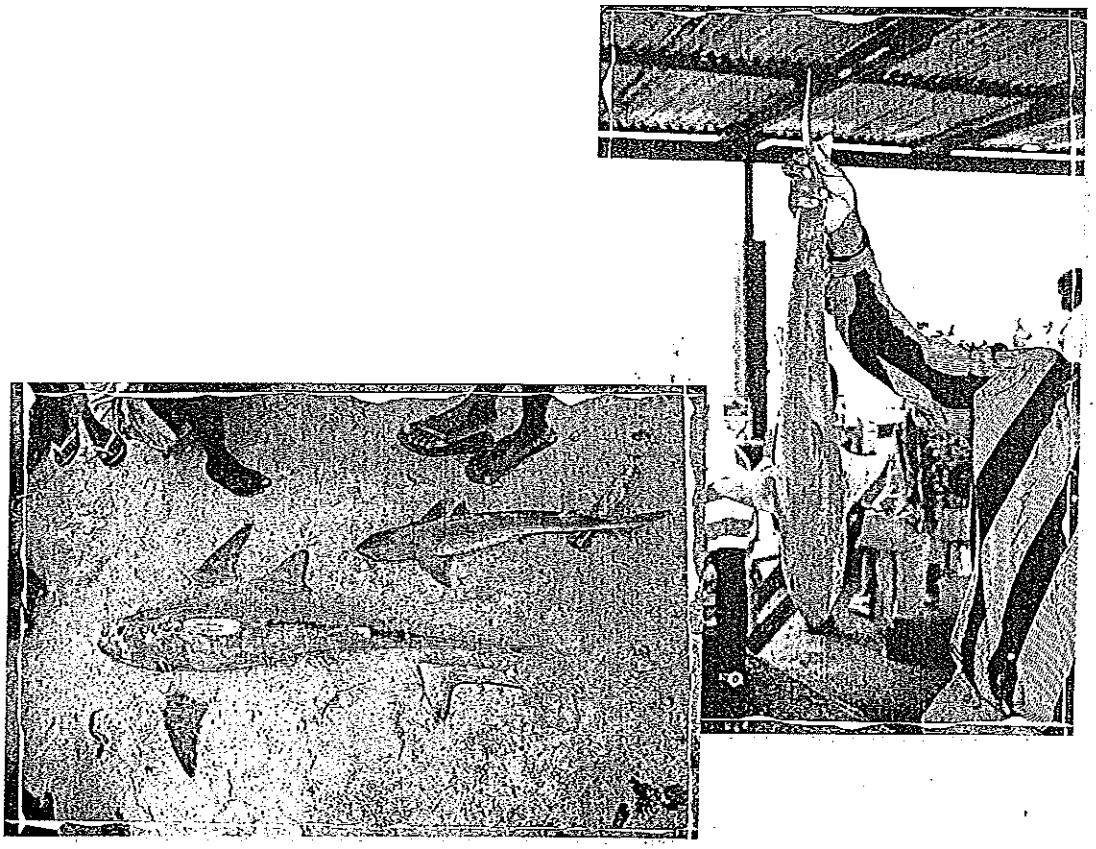
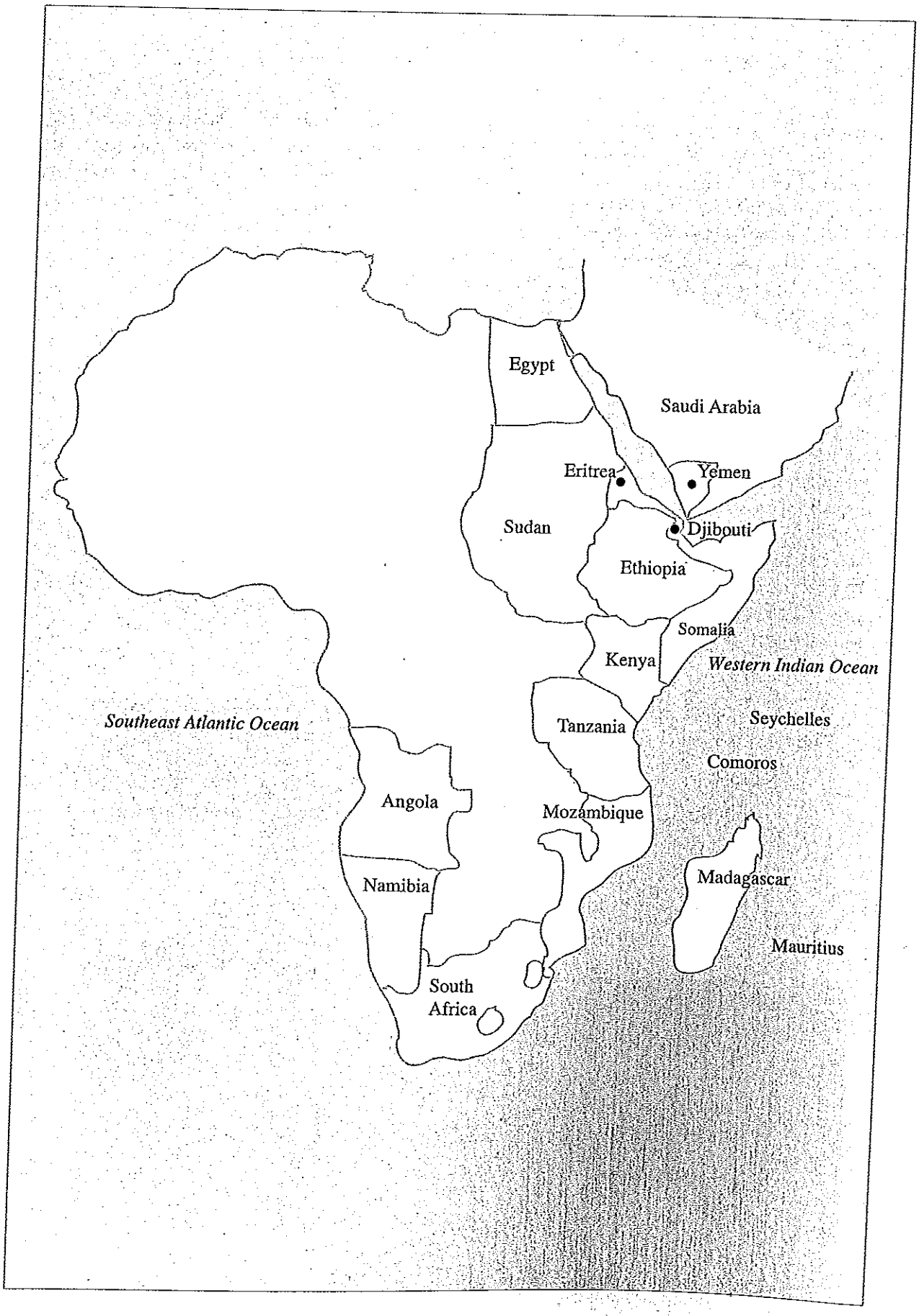


In the region all sizes of sharks are utilised for their meat and fins
Rob Barnett-TRAFFIC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Sudan
Djibouti
Ethiopia
Somalia
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Western Indian Ocean
Southeast Atlantic Ocean
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Seychelles
Comoros
Angola
Mozambique
Madagascar
Namibia
Mauritius
South Africa

SHARK FISHERIES AND TRADE IN EAST AND SOUTHERN AFRICA

Rob Barnett

INTRODUCTION

In early 1994, the TRAFFIC Network embarked upon a worldwide project to assemble a wide range of information for a global assessment of the trade in shark products. As part of that study, TRAFFIC East/Southern Africa undertook the co-ordination of national studies in eastern and southern Africa and adjacent Indian Ocean islands. This effort has been directed at Eritrea, Somalia, Kenya, Tanzania, Seychelles, Madagascar, Mozambique, and South Africa. Due to limited resources and ongoing civil strife in some countries, it has not been possible to assess the situation in Angola, the Comoros, Djibouti, Mauritius, Namibia and Sudan. Therefore, the role these countries play in shark fisheries and local, regional and international trade in shark products remains to be assessed in any detail.

METHODOLOGY

The objectives of the study were to identify and obtain available quantitative data on shark catches/landings and trade in shark products in the nine targeted countries in order to assess overall volumes and values of the trade, key harvest areas, individual shark species affected and their conservation status and other trade variables, including local uses and consumption, exports of shark products and illegal trade dynamics. The results of the study were intended to put into perspective the status of shark fisheries in the Western Indian and the Southeastern Atlantic Oceans.

TRAFFIC East/Southern Africa initiated the study by undertaking a comprehensive literature review and identification of relevant published material on shark fisheries and trade. In a preliminary effort to add new baseline information to existing information on the target countries, detailed questionnaires were prepared for the recreational and commercial fishery industries, government officials, non-governmental organisations, associations and individuals involved with, or knowledgeable on the utilisation of sharks. These questionnaires were delivered to the target countries five months prior to the commencement of field work, in the hope that information received, and contacts initiated would maximise the efficiency of consultants' time in the field. Questionnaires were also hand-delivered by consultants to key individuals as they were identified, and used as guidelines for interviews conducted.

Short term field based consultancies were conducted for the countries of Kenya, Tanzania, Madagascar and South Africa. These consultancies focused on the following main activities:

- Compilation of relevant trade data and information on shark catches/landings and trade in sharks or shark products from local, provincial or national sources and authorities;
- Consultation with relevant experts including academics, fisheries biologists, government officials, law enforcement agents, artisanal fisherman and suppliers as well as industry sources such as shark product traders and exporters;
- Field visits to appropriate locations to collect data and information;
- Preparation of a report on the findings of the study for use in the larger TRAFFIC trade study.

The country reports of Eritrea, Somalia, Mozambique and Seychelles were compiled from desk studies using information and data collated from literature search, returned questionnaires, and out of country electronic communication with government officials and non-governmental organisations involved with shark trade issues.

BACKGROUND

As categorised by FAO (Anon., 1993a; Anon., 1993b), the Western Indian Ocean (Area 30: 198 000 km^2) includes the countries under study of Eritrea, Somalia, Kenya, Tanzania, Seychelles, Madagascar, Mozambique and the eastern fisheries of South Africa. The Southeast Atlantic Ocean (Area 18: 594 000 km^2) includes the western fisheries of South Africa and Namibia.

The total Western Indian Ocean production of marine and diadromous fish, crustaceans and molluscs has experienced a rising linear trend from 1 592 900 mt in 1970 to 3 394 959 mt in 1990. Based on 1990 catch and landing figures, sharks and rays represented 96 978 mt, constituting 2.39% of the total marine production. This catch has remained relatively constant over the past three decades. Taking total catch figures from 1970, 1980 and 1990, the proportion of shark catch in 1990 coming from declining catches represented 23.9%, from stable catches 74.9% and from rising catches 1.3% (Anon., 1993a).

The total Southeast Atlantic Ocean production of marine and diadromous fish, crustaceans and molluscs has experienced a decreasing linear trend from 2 459 974 mt in 1970 to 1 534 952 mt in 1990. The total annual catch of sharks and rays in 1990 represented 7 054 mt, which constituted 0.27% of the total marine production. Taking total catch figures from 1970, 1980 and 1990, the proportion of shark catch in 1990 coming from declining catches represented 56.7%, from stable catches 0.0%, and from rising catches 43.3% (Anon., 1993b). However, FAO's catch statistics do not accurately assess shark catches, because bycatch is often under-reported. At the same time, harvest of sharks has generally been on the increase since the 1940s, due to an expanding market for fins and meat which has resulted in directed shark fisheries in certain areas (Anon., 1994a).

HISTORICAL OVERVIEW

Historically, trade in shark products has been occurring throughout eastern Africa and some Indian Ocean islands for centuries, with shark meat and liver oil forming the main products commercially traded and locally consumed. In Eritrea, Somalia, Kenya, Tanzania and Seychelles, artisanal fishing involved sharks mainly in the production of dried/salted shark meat, and the local use of liver oil for maintenance of traditional vessels. Being nutritious and inexpensive, shark meat has served as a staple food for human consumption, and in countries such as Tanzania, the market has been reported as expanding to include non-coastal peoples (Anon., 1984). In the southern African countries of Madagascar, Mozambique and South Africa, shark meat has not traditionally been a staple diet for local consumption, but commercial fisheries were formed in recent history to meet export demands. In Madagascar, during the early 1980s, shark meat was exported to the Comoros; in Seychelles, commercial shark fishing expanded after 1950 to meet demand from the African mainland and Asia; and in South Africa, shark meat was exported to other African countries and to the Mediterranean and Australia during the 1950s (Marchand, 1956; Marchand, 1957). In South Africa, vitamin A-rich shark liver oil was also exported in large quantities during the 1940s (von Bonde, 1949; von Bonde, 1956), with demand falling after 1952 (Marchand, 1952; von Bonde, 1952).

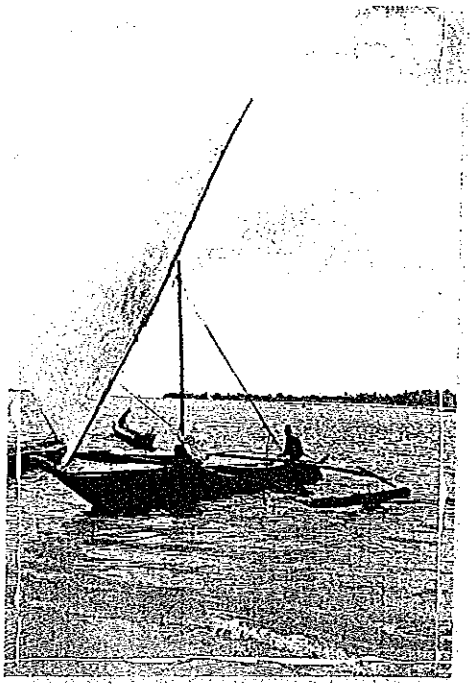
The market for other shark products such as skin, cartilage, and fins became established to differing degrees over the past three decades. The predominant export during this time has been shark fin, which, over the past five years has experienced a sudden increase in production in countries such as Madagascar and Tanzania. Due to their high value, shark fins are taken by both artisanal and commercial fishermen from directed and bycatch fisheries.

CURRENT FISHERIES

This section summarises information from the country reports that appear in this report, and detailed descriptions can be found in the chapters that follow. The current fisheries in the national shark trade studies are categorised under artisanal, commercial and recreational, with separate headings for each on directed and bycatch fisheries. The most recent available official shark and ray landing figures for the countries studied were 125 mt in 1994 for Seychelles, 152 mt in 1993 for Kenya, 2 236 mt in 1993 for Mozambique, 3 050 mt in 1993 for South Africa, and 1 810 mt in 1994 for Tanzania. From available official statistics, Madagascar and Kenya have experienced a small downward trend in shark and ray catch in recent years. South Africa, Seychelles and Tanzania show a gradual rising trend in shark and ray catch over the past five years, with the Tanzanian island region of Zanzibar experiencing a sudden increase in catch during the last two years. However, with the exception possibly of South Africa, these data need to be viewed with some caution as the management frameworks in place for many of the countries are insufficient to enable the compilation of complete data sets on shark and ray annual catch. For example, annual shark and ray catch

for Zanzibar is under-reported due to inadequate numbers of government fish landing beach recorders at fish landing sites.

Tanzania and South Africa represent both ends of the spectrum in regard to their current national fisheries. The artisanal fishery in Tanzania represents the current fisheries sector that contributes the greatest shark fishing pressure. In contrast, the commercial fishery in South Africa represents the current fisheries sector that results in the most substantial fishing pressures on sharks and rays. Even in the case of Tanzania, and to a lesser extent South Africa, the proportions contributed to the annual total shark and ray landing figures by the artisanal and commercial fisheries cannot be accurately determined due to the lack of specific data in most cases. Furthermore, the majority of governments in the countries under study lack the economic and human resources necessary for effective regulation and monitoring of offshore foreign fishing vessels.



Artisanal fishermen off the Tanzanian Coast
Rob Barnett-TRAFFIC

In Tanzania, more than 96% of the total marine production is contributed by small scale artisanal fishermen, who predominantly fish in coastal waters due to the nature of the small traditional vessels used (Rumisha, 1995). A substantial directed shark fishery occurs using drift gillnets, demersal gillnets and long lines that is estimated to result in an artisanal shark catch of 1 103 mt per annum. At present, the commercial fishery in Tanzania is restricted to a small commercial prawn fishery operating 13 vessels in 1993, which results in an annual shark bycatch of approximately 24 mt. This bycatch forms an added income for the trawler fisherman who consume the shark meat and sell the fins when in port.

Kenya is similar to Tanzania in that 80% of the total marine production of Kenya is attributed to 6 500 artisanal fishermen using traditional vessels in coastal waters (Anon., 1995). The fishing gears used are predominantly handlines with castnets, gillnets, and beach seines being used to a lesser extent (Ardill and Sanders, 1991). Existing figures do not exist to ascertain which of Kenya's fisheries lands what percentage of the total shark and ray catch. However, the coastal inshore fishery is regarded as being at maximum sustainable yield and the offshore fishery is thought to be under-exploited (Anon., 1995). Kenya's local commercial fishery consists of trawlers targeting prawn, yellowfin, tuna and marlin. This commercial fishing fleet does not specifically target sharks, although sharks are caught as bycatch. Spanish tuna vessels report shark bycatch of 2-3 mt every two weeks, and 14 local prawn trawlers operating in 1989 resulted in 561 mt of bycatch, in which shark and ray would have formed a significant utilised proportion (Ardill and Sanders, 1991).

The Eritrean artisanal fishery in 1992 consisted of 2 615 fisherman and 636 vessels (Bellemans and Reynolds, 1992b). An artisanal directed shark fishery exists that uses gillnets and longlines and yields a shark catch which is utilised for domestic and export markets (Bellemans and Reynolds, 1992a; Bellemans and Reynolds, 1992b). There is a pelagic offshore fishery in Eritrea that targets snapper, grouper and Spanish mackerel using gillnets and trawls. Sharks are caught as bycatch and in general discarded at sea after fins have been removed.

In 1984, it was estimated that 90 000-100 000 people were indirectly or directly involved in Somalia's artisanal fishing (Bihi, 1984). Sharks and rays represent an important part of the artisanal fish landings, and it is estimated that sharks comprise 40% of the artisanal landings in the southeastern coastal area (Stromme, 1987). In the Bosaso region on the horn of Africa, sharks are the main target species largely because of a lack in market for other species due to inadequate facilities to produce fresh and frozen fish products (R. Remmerswaal, *in litt.*, 1995). The directed artisanal fishery utilises vessels measuring 6-8.5 m, and fishing gears include baited longlines, driftnets and gillnets. The reported total artisanal catch of sharks in 1976 was estimated at 1 500 mt (Bihi, 1984). However, in 1996 the yearly

shark catch was roughly estimated to be 6 700 mt, an increase of over quadruple the shark catch in the last two decades. The offshore commercial fishery in Somalia consists of approximately 15 illegal foreign vessels trawling for pelagic and demersal species. Incidental catch of sharks occurs, and is estimated to be 5% of total catch, which equates to 2 mt per vessel per year (R. Remmerswaal., *in litt.* 1995).

Approximately 80 000 people generated earnings from Mozambique's artisanal fishery in 1993, using handlines, beach seines, drift gillnets and bottom gillnets. In 1993 it was estimated that the number of boats in the artisanal sector was 10 700 units, of which 380 were engine-powered vessels (Anon., 1994b). Sharks are landed as bycatch by the artisanal fishery, and in 1993 the estimated catch was 2 186 mt. Mozambique has a semi-industrial fishery consisting of 69 vessels mainly involved in prawn fishing, but also in line fishing. An industrial fishery, also concentrated on the prawn fishery, in 1993 comprised 118 industrial fishing vessels (Anon., 1994b). A small directed semi-industrial shark fishery exists off Inhaca Island (Cockcroft, pers. comm., 1996), and directed shark fishing also occurs at the entrances of Maputo and Inhambane Bays using gillnets (Hatton, 1995). The most recent estimate of total shark catch was 2 236 mt for 1993, and the level of exploitation was thought to be low (Anon., 1994b).

The Seychelles artisanal fishery operates on the Mahé plateau and offshore banks, and targets groupers (Serranidae), snappers (Lutjanidae), emperors (Lethrinidae), rabbitfish (Siganidae) and to a lesser extent sharks. The vessels used by the artisanal fishermen numbered approximately 600 in 1995, and consisted of small wooden boats with small outboards, fibreglass boats with small outboards and larger whalers, schooners and longline vessels with larger outboard engines. Sharks are not specifically targeted by the artisanal fleet largely because they do not command a high price in comparison to other species. However, fins from sharks caught as bycatch are valued and commercially traded. In 1994, landings of sharks and rays by artisanal vessels represented 116.5 mt. The Seychelles commercial fishery is geared towards tuna and swordfish, and operates throughout the EEZ (E. Grandcourt, *in litt.*, 1995). A total of 52 purse seiners, most of which were EEC vessels, were licensed in Seychelles in 1992, which resulted in transshipment of over 160 000 mt, of which 32 000 mt were harvested within the Seychelles EEZ (Seychelles Fishing Authority, in Shah 1994). Bycatch represents 6% of the total catch, of which 12% is estimated to comprise shark (Shah, 1994). Foreign tuna longline vessels also capture sharks as bycatch, and often land these sharks in Seychelles. In 1994, landings of sharks from these vessels amounted to 8.3 mt (E. Grandcourt, *in litt.*, 1995).

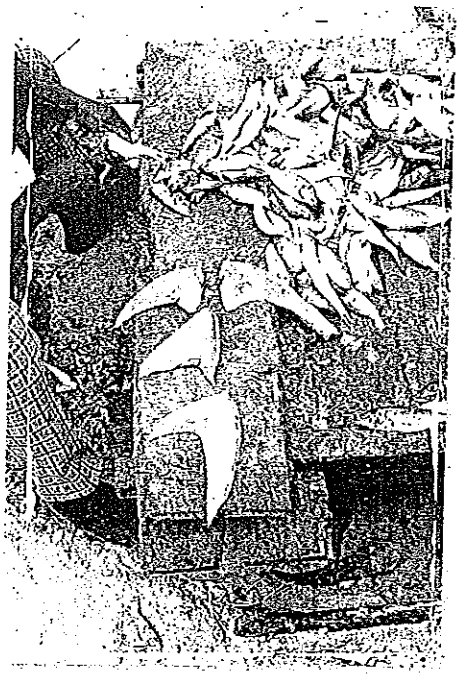
In Madagascar, the artisanal fishery uses small, sail-powered traditional vessels and wooden or GRP launches with outboard or inboard engines. Fishing gears predominantly used by smaller vessels are handlines, large mesh gillnets (*jarifa*), small mesh gillnets, and the larger vessels use longlines and drift gillnets. Madagascar has a substantial coastal prawn fishery which comprises 84 vessels. The estimated bycatch for this fishing fleet is tens of thousands of sharks per year. In addition, Madagascar has a pelagic tuna fishery consisting of a licensed European fleet of 60 purse seine vessels and a long line tuna fishery comprising 40 licensed, but possibly 300-500 mostly unlicensed foreign vessels from Taiwan, Korea and China. It is likely that the tuna fishery takes a significant number of sharks as bycatch from Malagasy and Seychelles waters (Cooke, 1996).

Although indigenous people in South Africa used sea products to a limited extent as a subsistence activity, it was after the arrival of European settlers that larger commercial fishing developed (von Bonde, 1956). To this day the indigenous artisanal fishery remains limited with no major impacts on chondrichthyan (cartilaginous fishes such as sharks, rays, skates and chimaeras) catches, but South Africa maintains the largest offshore commercial fishery. Due to the limited nature of the artisanal fishery in that country, the proportions contributed to total annual shark and ray catch can be more accurately estimated.

The bottom trawl hake and sole fisheries of South Africa, which comprise 90 offshore and inshore vessels, recorded shark landings of 164 mt in 1993 (Japp *et al.*, 1994; Roel, 1987). This figure does not take into account the discarded component of the catch, which is reported to be substantial. In the KwaZulu-Natal demersal prawn trawl fishery chondrichthyans are not retained by the fishery but many are returned to the sea dead, and therefore are not included in landings data. The purse seine fisheries and midwater trawls off the Cape south and west coasts take small quantities of chondrichthyans, although catch data is unavailable. The commercial line fishery in South Africa uses motorised vessels of up to 12 m, and fishing gears consist mainly of handlines. Sharks are not primarily targeted,

although declining catches of teleosts since the 1960s has meant that sharks are being increasingly targeted (Penney *et al.*, 1989). The annual reported catch of chondrichthyans for this fishery in 1994 was 518 mt. As longlining in South Africa is generally illegal, numbers of this fishery type are restricted. However, shark-targeted longlining by vessels normally fishing for tuna was permitted in 1990 due to a decline in availability of tuna, and 31 vessels are presently licensed (Kroese *et al.*, 1995). Currently, there are 120 foreign vessels licensed in South Africa for pelagic longlining targeted at tunas. Bycatch includes sharks, and finning is carried out. The total longline shark catch in 1994 was 233 mt, although Kroese *et al.* (1995) suggest that the real annual catch is much higher. The beach seine fisheries usually return chondrichthyans, although beach seiners have expressed an interest in marketing components of the chondrichthyan catch. Seine and gillnet recorded shark landings in South Africa amounted to 346 mt in 1993.

The extent of recreational current fisheries in the countries studied is directly related to demand from domestic and foreign tourism. Substantial recreational fishery industries were identified in Kenya and South Africa and may be growing in Mozambique. In general, chondrichthyans are not normally targeted by recreational anglers because teleosts are considered to be more challenging and better eating. Bycatch is reported to be minimal, as recreational fisherman use fishing gears that are generally species-specific. Directed shark fishing occurs in South Africa, Kenya and at least one location in Mozambique where anglers are competing in fishing championships with the aim of maximising landing weight. Total chondrichthyan landings in South Africa from recreational fishing amounted to 73 mt in 1994. Limited recreational fishing takes place in the other countries studied.



Wet shark fins on sale in Dar-es-Salaam market
Rob Barnett-TRAFFIC

TRADE

Of the countries studied in the eastern and southern African region and adjacent Indian Ocean Islands, a domestic, regional and international trade in shark meat, cartilage, skin and liver oil occurs, with a substantial international trade in shark fin. The majority of dried/salted shark meat produced in Somalia, Madagascar, Seychelles and South Africa is exported within the region due to supply exceeding demand. Kenya and Tanzania maintain a high domestic demand for shark meat, which in Kenya, results in imports from Somalia, Zanzibar (Tanzania) and Yemen. Dried/salted shark meat in Eritrea is almost exclusively exported to Saudi Arabia and to East Africa via Yemen, as domestic demand is negligible (S. Etoh, *in litt.*, 1995). The long shelf life and transportable nature of dried/salted shark meat has contributed to its substantial domestic and regional trade in Africa. This is mainly due to the inadequate storage facilities and transport infrastructure found in most countries that result in a low shelf life for other fresh marine produce. Shark meat's high tolerance to spoilage through curing has enabled its efficient utilisation by artisanal fisheries in the region.

Presently, shark liver oil is domestically traded within Eritrea, Somalia, Kenya, Tanzania and Madagascar for use in maintenance of traditional fishing vessels. International exports to Japan of liver oil derived from large oceanic species were identified in Madagascar, amounting to 16.4 mt in 1994. The trade in shark skin is minimal with a small international trade identified in Zanzibar to Hong Kong, which amounted to only 300 kg in 1995. The curio trade in shark jaws and teeth is apparent throughout the countries studied, but is minimal and dependant on tourism. Trade in shark cartilage has raised interest among shark product traders, but to date, only in South Africa has a small domestic trade in imported cartilage occurred.

Total official annual exports of shark fin for the countries studied is 4.3 mt in 1995 for Kenya, 1.6 mt in 1994 for Tanzania, 17.97 mt in 1993 for South Africa, 6.5 mt in 1995 from Madagascar, and 12.68 mt in 1994 for Seychelles.

All of the countries with available official data show constant or declining shark fin exports over the past five years. Kenya, Tanzania, Seychelles and South Africa have had relatively constant annual shark fin exports over the past five years, with Madagascar showing a general downward trend. In most cases, the official export statistics for international trade in shark fin need to be taken with some caution, as a number of the national studies indicate that complete data is not available, and/or loopholes exist in export procedures. For example, in Madagascar at least 50% of shark fin trade cannot be attributed to any particular fishing region in which official statistics are compiled, and in Tanzania, shark fin is likely to be classified as fish offal when exported, and therefore not included in official statistics. In South Africa, official export figures are low when compared to total annual shark production, and the limited domestic market. In South Africa and Kenya, figures reported by importing countries conflict with reported export figures. In addition, many of the countries studied in eastern Africa experience illegal cross border trade in shark fin which is not monitored. The quantity of shark fin exports from the majority of countries studied was found to be much higher than that reflected in official export statistics.

The countries of Kenya, Tanzania, Madagascar and South Africa export shark fin directly out of their own countries, with Kenya and South Africa also importing shark fin from neighbouring countries for subsequent re-export to the Far East. Somalia exports most of its shark fin through Dubai (United Arab Emirates), sometimes via Djibouti, and shark fin from Eritrea is predominantly traded through Yemen to the Far East (S. Etoh, *in litt.*, 1995). Limited domestic or regional consumption exists for shark fin. The destination of shark fin exports is predominantly Hong Kong, Singapore and Japan. Data available for imports of shark fin into Singapore for January-October, 1990 were 26 mt from Kenya, 3 mt from Madagascar, 2 mt from Mozambique, 7 mt from Seychelles, 3 mt from Somalia (Singapore Trade Statistics, 1990). Reported imports into Hong Kong for 1988 were 3 mt from Somalia, 1.6 mt from Mozambique, 5.2 mt from Madagascar, 115.7 mt from South Africa, 1.6 mt from Kenya and 1.2 mt from Tanzania (Hong Kong Trade Statistics, 1988).

The competitive nature of shark fin trade is most apparent in Kenya, Tanzania, Madagascar and South Africa. Madagascar has reportedly experienced a significant increase in real terms of shark fin exports since 1988. During the past two-three years, West African buyers have increased the competitive nature of the trade in shark fin by buying directly from fisherman. Traditional middlemen are by-passed when West African traders deliver fins in person to the Far East market (Cooke, 1996). During the past five years in Tanzania, the price of shark fin has increased by 70% due to increased competition between traders. This increased demand and competition for fin has increased the bargaining power of shark fin suppliers, with the result that artisanal fisherman in Tanzania are receiving higher prices for their product, whilst primary collector and exporter profit margins have been reduced.

CONSERVATION IMPLICATIONS

At least 25 species of shark, predominantly comprising the carcharhinid species, are affected by artisanal and commercial fisheries in the countries under study. The inshore species of shark are under the largest fishing pressure in countries with substantial artisanal fisheries. The fishing pressure resulting from offshore fisheries is hard to estimate due to lack of data on size of foreign fleets and their annual catch figures. For example, EEC purse seine vessels registered in Seychelles are reported to trawl in Kenya's and Tanzania's EEZ, and in Madagascar the offshore longline tuna vessels operating in the Malagasy EEZ could consist of up to 300-500 unlicensed vessels. In addition, the conservation implications of the national directed and bycatch fisheries on sharks is hard to evaluate due to minimal information on marine resources for the majority of target countries. However, resource surveys undertaken in Seychelles during 1981 revealed substantial stocks of sharks with an estimated shark biomass on the Mahé Plateau of 50-56 000 mt, and 34 000 mt on other Seychelles banks (Shah, 1994). Surveys undertaken in the 1970s and 1980s in the Tanzanian and Zanzibar territorial waters revealed substantial potential elasmobranch yields that increased with depth of water. In Somalia, the Ministry of Fisheries reported in 1983 an expected annual fisheries yield, and forecasted for sharks and rays a yield of 30 000 mt. In Madagascar, Eritrea, Somalia, Tanzania and Mozambique the marine resources are believed to be under-utilized and governments are actively encouraging the expansion of their fisheries sectors. In Somalia, for example, the Government has encouraged the expansion of the artisanal fishery

through such mechanisms as fixed price purchasing and promoting resettlement of nomadic peoples to the coast regions (Stromme, 1987).

The resource information available implies the occurrence of greater stocks of offshore chondrichthyans in comparison to inshore waters. Data identified in Tanzania and Madagascar suggest that a significant proportion of inshore sharks caught for their fins are immature. In Tanzania, it was found that 25.4% of shark fin exports are likely to consist of immature sharks with fin sizes of less than five inches in length, which could point to the over-utilisation of inshore species by the predominantly artisanal shark fishery. However, any excessive shark fishing pressure is alleviated for part of the year, as many of the shark fisheries in the countries studied are seasonal, such as in Kenya where the season lasts for nine months and in Zanzibar where it lasts for only four months.

REGULATORY/MANAGEMENT FRAMEWORKS

With the exception of South Africa, none of the countries under study have quotas, restrictions or any regulatory controls on the import or export of shark products. Eritrea and Somalia do not have in place most of the fisheries regulatory measures that would be expected. Eritrea is rebuilding after a 30-year war, and Somalia has no functional government in place to administer existing legislation. In the countries under study, fisheries legislation is concerned almost exclusively with commercial species, and in the case of fish, is focused on teleosts. Legislation affecting utilisation of sharks is not specific, but of a general nature, protecting, regulating and conserving the marine habitat. In general, national fisheries legislation makes provision for the regulation and licensing of local and foreign fishing vessels, importing and exporting of fish and fish products, and may specify license, permit and registration requirements for exploitation of national marine resources. In addition, the majority of countries under study are parties to international law, such as the United Nations Law of the Sea Convention, which could have a limited effect on shark utilisation.

South Africa maintains the only shark fisheries legislation out of the countries studied by TRAFFIC East/Southern Africa. In 1991, fisheries legislation was passed making it illegal to catch, kill or attempt to kill the Great White Shark *Carcharodon carcharias*, or to trade in any of its products. Other regulations concerning sharks allow fishing boats to decapitate, gut or cut off the tail of a shark before it is landed, so long as the shark products are retained in refrigeration facilities until it is landed. The only legislation pertaining to the size or quota of catch is under section 47 (11) of Gazette No 14353 of 1993, which allows recreational fishermen a maximum total of 10 fish to be caught per day. The exploitable list referred to includes elasmobranchs (subclass Elasmobranchi).

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THE SEYCHELLES SHARK FISHERY

Nina T. Marshall

INTRODUCTION

The Seychelles comprises about 115 islands, of which 74 are low elevation coral islands, and 41 are granitic formations that are hilly and often quite rugged (Shah, 1994). The three largest islands are Mahé, Praslin and La Digue, and these harbour most of the human population and are the centres of much of the country's economic activities (Faure, 1984). The combined area of coastline is 600 km. The Seychelles are surrounded by a shelf estimated to be about 50 000 km^2 in size, and the EEZ is over 1 370 000 km^2 (Boullé, 1991).

HISTORICAL OVERVIEW

Shark fishing has been undertaken in the Seychelles for several centuries, mainly to produce dried salted shark meat which is rich in protein, inexpensive and easily transported. This meat has had a ready market among the inland peoples of East Africa and the Far East, despite the fact that the product is often of low quality, having rotted during transport (Travis, 1990).

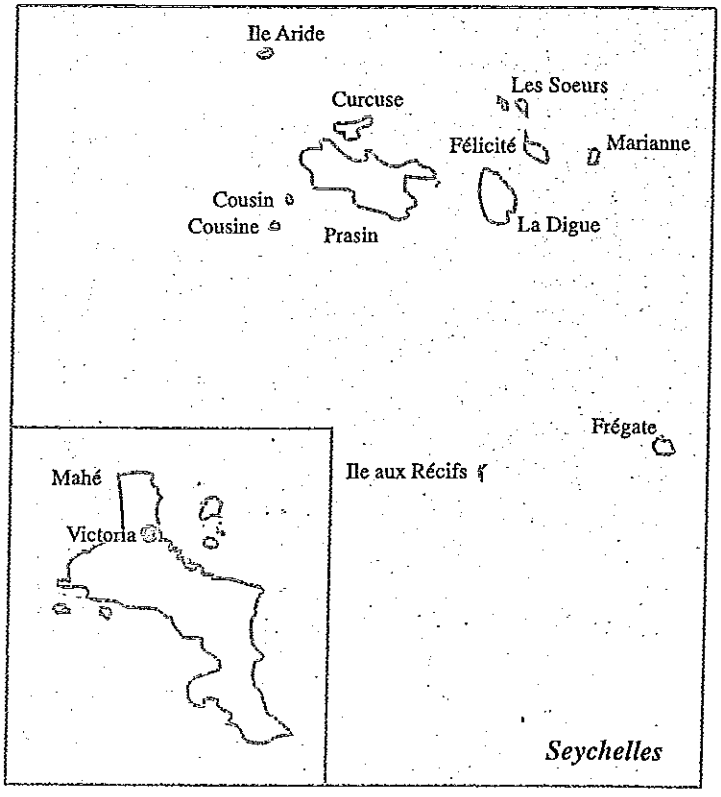
In the 1950s, there arose a demand for a higher quality grade of dried and salted shark meat, and people in many locations throughout the world and especially in Asia, moved to improve their methods of preparing and packaging shark meat. A number of operators in the Seychelles recognized this new demand, and were successful at developing a superior product. As many vessels use the Seychelles as a calling point when travelling across the Indian Ocean to Africa and Asia, the Seychellois had no difficulty in marketing their improved product (Travis, 1990). In addition, shark backbones made into walking sticks were marketed to tourists in the 1950s. Increased demand led to a larger harvest, and Travis (1990) noted that by the end of the 1950s shark stocks had become depleted due to over-exploitation.

Sharks continue to be a valued catch in the Seychelles, and sharks are harvested by the artisanal fleet as well as commercial interests (E. Grandcourt, *in litt.*, 1995). Expansion of the utilisation of shark products is also being considered, especially with regard to processing of shark skins for leather (Boullé, 1991).

CURRENT FISHERIES

1. *Artisanal*

The Seychelles artisanal fishery operates on the Mahé plateau and offshore banks, and targets groupers (Serranidae), snappers (Lutjanidae), emperors (Lethrinidae), rabbitfish (Siganidae), and to a lesser extent sharks. The number of vessels involved in shark fishing in 1995 was approximately 600, and this figure includes pirogues (small wooden boats with < 15 Hp), outboards (fibreglass boats with outboard motors > 2 Hp), whalers (uncovered wooden boats of 16 Hp), schooners (covered wooden vessels > 16 Hp), and longline vessels. Gear used includes baited longlines, gillnets, beach seines and handlines. All vessels must be licensed (E. Grandcourt, *in litt.*, 1995).

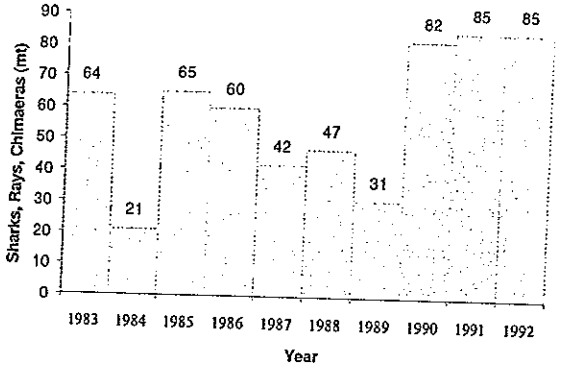


The small boat fishery accounts for 35% of the total artisanal catch, and the remaining 65% is caught by the whalers and schooners (Shah, 1994). An average of about 5 000 mt of fish are landed per year by the artisanal fishing fleet (Seychelles Fishing Authority, 1991 in Shah, 1994). Figures for nominal catches (landings converted into live weight) for the period 1983 to 1992 for fish, crustaceans, and molluscs, and for sharks, rays and chimaeras, for the commercial and artisanal fisheries, are presented below.

Table 1

Nominal catches by the Seychelles, 1983-1992 (mt)

Year	Fish, Crustaceans, Molluscs	Sharks, Rays, Chimaeras
1983	3 853	64
1984	3 831	21
1985	4 090	65
1986	4 542	60
1987	3 908	42
1988	4 341	47
1989	4 402	31
1990	5 382	82
1991	7 990	85
1992	6 632 (estimate)	85 (estimate)



Source: Anon., 1994.

i. Directed

Sharks are not specifically targeted by artisanal fishermen in the Seychelles, largely because shark meat does not command a high price, and fishermen prefer not to combine sharks in their holds with the more valuable fish. Sharks are however caught for their fins (ENVI.R.O., 1994).

ii. Bycatch

Sharks and rays are caught as bycatch by the artisanal fishing fleet. Due to the low value of shark meat, sharks are usually retained only for their fins, although some meat is consumed locally and is also exported. A complete list of the sharks commonly occurring in the Seychelles is provided below (E. Grandcourt, *in litt.*, 1995).

Scientific Name	Common Name
Carcharhinus albimarginatus	Silvertip Shark
Carcharhinus amblyrhynchos	Grey Reef Shark
Carcharhinus brachyurus	Copper Shark
Carcharhinus brevipinna	Spinner Shark
Carcharhinus melanopterus	Blacktip Reef Shark
Carcharhinus milberti	Requin Blanc
Carcharhinus tjutjot	Requin Nene Pointe
Carcharhinus longimanus	Oceanic Whitetip Shark
Galeocerdo cuvier	Tiger Shark
Loxodon macrorhinus	Sliteye Shark
Triaenodon obesus	Whitetip Reef Shark
Ondontaspis tricuspidatus	Sand Tiger Shark
Sphyrna mokarran	Great Hammerhead
Sphyrna zygaena	Smooth Hammerhead
Ginglymostoma brevicaudatum	Shorttail Nurse Shark
Ginglymostoma ferrugineum	Tawny Nurse Shark
Rhynchobatus djiddensis	Violin Shark
Rhinobatos blochi	Sand Shark

Data on landings of sharks and rays by the artisanal fleet are available for the period 1985 to 1994 and are presented below. When these figures are compared to those in Table 1 which pertain to total catch, one can see that the artisanal fleet brings in almost all of the sharks and rays landed in the Seychelles.

Sharks are processed for meat, and are usually salted either on board or on shore, and then dried. Shark fins are sun-dried. In addition, teeth and jaws are sometimes prepared for sale to tourists, as are backbones which are made into ornamental walking sticks.

Table 2
Landings of sharks/rays in the Seychelles by artisanal vessels, 1985-1994 (mt)

Year	Quantity (mt)
1985	37.4
1986	60.0
1987	41.9
1988	46.9
1989	31.0
1990	81.8
1991	84.6
1992	93.0
1993	82.2
1994	116.5

Source: E. Grandcourt, *in litt.*, 1995.

2. Industrial Fishery

The commercial fishery is geared towards tuna and swordfish, and operates throughout the EEZ, with the exception of the plateau areas. This fishery is primarily comprised of foreign owned vessels (E. Grandcourt, *in litt.*, 1995).

Numerous countries and territories have signed bilateral and multilateral agreements with the Seychelles to fish for tuna, and these include but are not limited to France, Japan, South Korea, Mauritius, Spain, Taiwan, and USSR (Boullé, 1991). Approximately 52 purse seiners, most of which were EEC vessels, were licensed to operate in 1992. Purse seiner transshipment for 1992 was over 160 000 mt, of which approximately 32 000 mt was harvested within the Seychelles' EEZ (Seychelles Fishing Authority, 1992 in Shah, 1994). These figures mainly comprise tuna and swordfish.

i. Directed

A directed fishery for sharks no longer exists.

ii. Bycatch

Observers from the Seychelles Fishing Authority have collected information on bycatch caught by the purse seiner fleet in Port Victoria. According to ENVI.R.O (1994), analysis of bycatch commenced in 1987. Bycatch was found to comprise 6% of the total catch. The percentage of bycatch that was sharks stood at 12%, behind tuna discarded because of lack of hold space (37%) and damaged or undersized tuna (22%). The bycatch from the purse seiner fleet is generally discarded at sea. The shark species most commonly caught as bycatch is the Oceanic Whitetip Shark (ENVI.R.O., 1994).

Table 3
Landings of shark in the Seychelles by foreign longline vessels, 1989-1994 (mt)

Year	Quantity (mt)
1989	6.8
1990	3.1
1991	1.3
1992	2.2
1993	2.3
1994	8.3

Source: E. Grandcourt, *in litt.*, 1995.

Foreign tuna longline vessels also capture sharks as bycatch, and often land these sharks in the Seychelles. Figures for landings from 1989 to 1994 are presented below. However, if one combines the landings figures for artisanal vessels with those of foreign longline vessels, these figures are higher then those reported by FAO in Table 1, indicating that a portion of these landings are not recorded in official Seychelles landings statistics.

3. Recreational

No information is available on recreational fishing in the Seychelles.

TRADE

Shark products are traded both domestically and internationally from the Seychelles. Meat and fins are the most frequently traded products, although markets also exist for jaws, teeth, backbones, and liver oil.

Curios: Shark jaws and teeth are sold to tourists. In addition, the backbone of the shark can be made into an ornamental walking stick and sold to tourists (E. Grandcourt, *in litt.*, 1995).

Fins: Shark fins are dried and exported from the Seychelles. The total weight of dried shark fins exported during the last ten years is 134.66 mt, which equates to 9 351.36 mt wet weight of shark (see Table 4). These figures are interesting in that they indicate that the many sharks are utilised only for their fins, and are never landed in the Seychelles. For example, the combined landings of artisanal and longline landings in 1994 as reported by Grandcourt (*in litt.*, 1995) were 124.8 mt (artisanal landings were 116.5 mt). 1994 dried fin exports converted to wet weight are 880.56 mt, a figure that indicates that the quantity of sharks caught is about seven times higher than what is recorded as landed.

Meat: Shark meat is dried and salted, but is also landed frozen by longliners. Much of the dried shark meat is consumed locally. However, some of the meat is exported; figures are provided below.

From Table 5 it is clear that much of the shark meat produced in the Seychelles is consumed locally. While a trend in increased landings of shark is evident, this does not result into increased exports. Data for 1994 indicate a further significant increase for trade in sharks, but without data for 1995 it is difficult to assess whether this was an unusual year.

CONSERVATION IMPLICATIONS

A number of resource studies have been carried out in the Seychelles, although the most recent study was undertaken in 1981. The results reveal that there are substantial stocks of sharks in the Seychelles. On the Mahé Plateau shark biomass has been estimated at 50 000-56 000 mt, equating to about 21 mt of shark per square mile. On other Seychelles banks the shark biomass is estimated at 34 000 mt, with approximately 35 mt per square mile

Table 4

The quantity (mt) and value of dried shark fin exports from the Seychelles, 1985-1994

Year	Value (US $)	Value (Scr)	Weight (mt)	Wet Weight Equivalent
1985	64 400	322 000	2.15	149.30
1986	127 000	635 000	4.23	293.75
1987	363 200	1 816 000	12.11	840.97
1988	469 400	2 347 000	15.65	1 086.80
1989	638 000	3 190 000	21.27	1 477.08
1990	513 400	2 567 000	17.11	1 188.19
1991	418 400	2 092 000	13.95	968.75
1992	453 000	2 265 000	15.10	1 048.61
1993	612 400	3 062 000	20.41	1 417.36
1994	380 400	1 902 000	12.68	880.55

Note: Figures for wet weight equivalent calculated for dried fins being 1.44% of the wet (live) weight of a shark. These figures have been added to the table by TRAFFIC. Average exchange rate: US $1.00 = 5.00 Seychelles Rupees. *Source*: E. Grandcourt, *in litt.*, 1996.

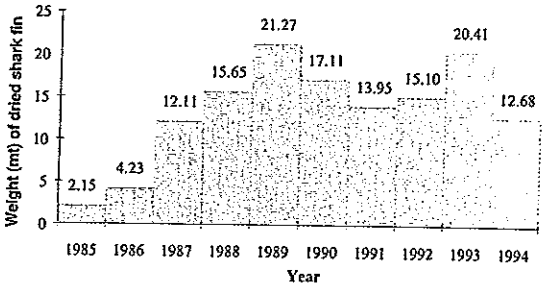


Table 5

Exports of shark from the Seychelles, 1985-1994, as compared to artisanal landings of sharks/rays, and longline landings of shark (mt, and excluding fins)

Year	Shark Exports	Artisanal Landings	Longline Landings
1985	0.0	37.4	0.0
1986	0.0	60.0	0.0
1987	0.0	41.9	0.0
1988	3.5	46.9	0.0
1989	4.5	31.0	6.8
1990	0.9	81.8	3.1
1991	1.6	84.6	1.3
1992	0.8	93.0	2.2
1993	0.7	82.2	2.3
1994	9.7	116.5	8.4

Source: E. Grandcourt, *in litt.*, 1995.
Note: Exports include sharks caught by both artisanal and longline vessels, and are comprised of frozen shark meat.

(ENVI.R.O., 1994). Grandcourt (*in litt.*, 1995) states that shark fishing in the Seychelles is not cause for concern. At the same time, it appears that the quantity of sharks caught for their fins and then discarded far exceeds that which is landed. While this catch may not at present be a threat to shark populations in the Seychelles, it certainly points to the need for improved monitoring of the shark catch.

REGULATORY/MANAGEMENT FRAMEWORKS

1. Domestic

Fisheries in the Seychelles are regulated by the Fisheries Act (5 of 1986), the Licenses (Fisheries) Regulations (SI 21 of 1987) and the Harbour (Fishing Port) Regulations (SI 58 of 1988) (Shah, 1994). Most matters relating to fisheries are governed by the Seychelles Fishing Authority.

The Seychelles Marketing Board Fish Division is the only agency licensed to import and export food-related fisheries products, and they also purchase the catch of the artisanal fishing fleet (Boullé, 1991).

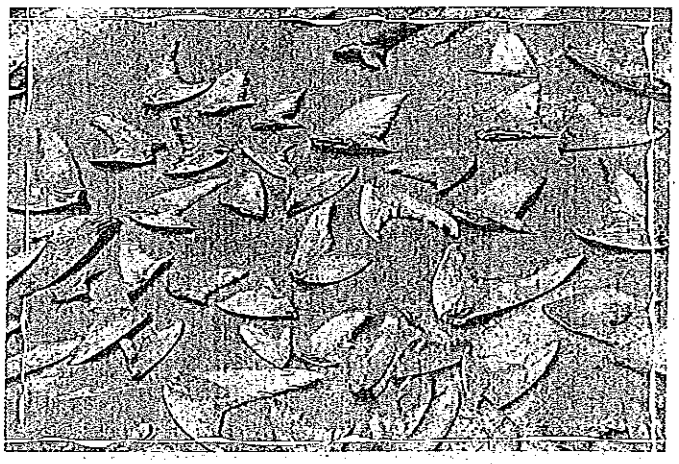
The Seychelles Fishing Authority monitors catch returns from shark fishing, but aside from this, there is no other regulatory mechanism applied to the fishery. There are no quotas or restrictions, and there are no controls on the import or export of shark products (Grandcourt, *in litt.*, 1995).

2. Regional/International

The Seychelles is a signatory to the United Nations Convention on the Law of the Sea (Shah, 1994), and also participates in regional tuna development and management initiatives. No shark related regional or international measures have been identified.

CONCLUSIONS AND RECOMMENDATIONS

Fishing in the Seychelles is geared towards high value demersal and pelagic fish, and generally sharks are only harvested as bycatch. Figures for artisanal and longliner landings, as well as for purse seiner bycatch, appear to be within sustainable limits defined by resource surveys carried out in the past. Analysis of trade data for shark fins, however, indicates that the overall shark catch may be almost seven times greater than the amount recorded as landed. Therefore, in order to accurately gauge the total shark harvest, it may be appropriate to examine in more detail the figures for shark fin exports. It may also be necessary to re-evaluate the status of the stocks, as no resource surveys have been undertaken recently.



Shark fins drying at exporter's warehouse
Rob Barnett-TRAFFIC

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TRADE IN SHARKS AND SHARK PRODUCTS IN ERITREA

Nina T. Marshall

INTRODUCTION

Newly independent Eritrea borders the southern portion of the Red Sea, with a total coastline of about 1 720 km in length, comprised of 1 155 km on the continental shore, and 565 km surrounding its many islands. Fishing has been a part of life on the Eritrean coast for millennia. The area fished by Eritrea's artisanal fishermen measures approximately 55 000 km^2.

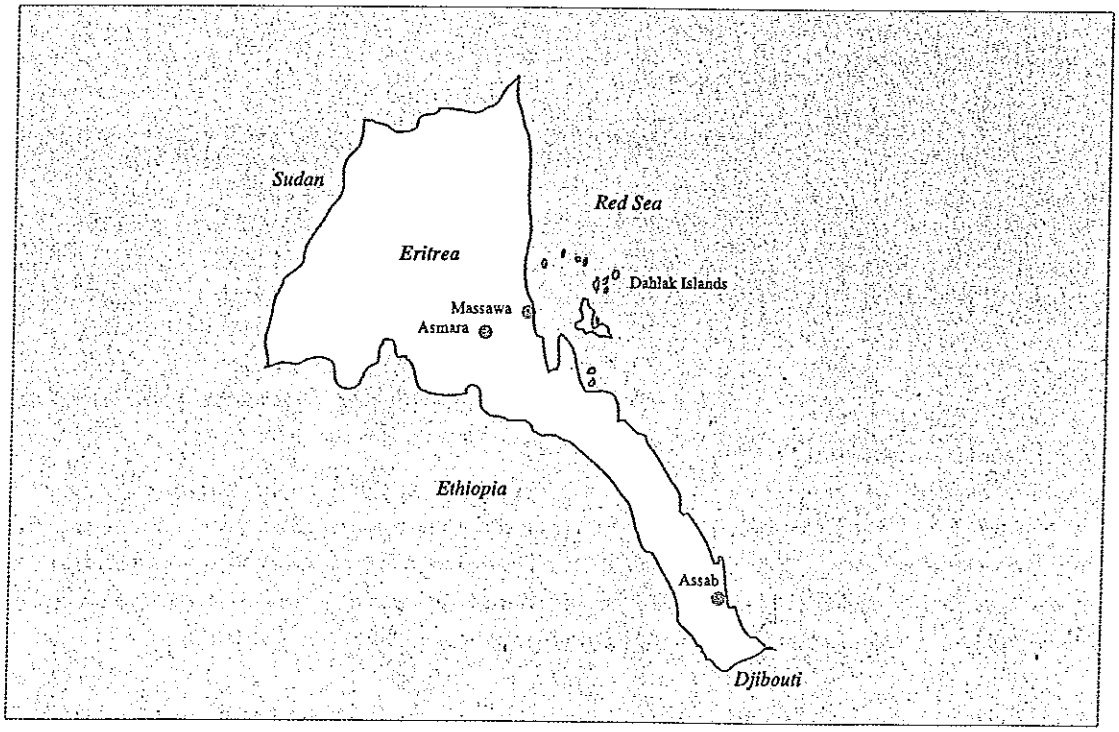
HISTORICAL OVERVIEW

Eritrea's fishing industry has been in operation for several thousand years. During the 1950s and 1960s Eritrea actively exported small coastal pelagics, such as sardines and anchovies (Bellemans and Reynolds, 1992a). Total landings in 1954 were over 25 000 mt, and were exported fresh and frozen to many countries. Since that time, Eritrea has endured continued war, and as a result, the total catch has declined steadily; in 1987 landings were a mere 250 mt (Abebe, 1993).

In the 1960s, the artisanal fishing industry became increasingly motorized. Whereas most of the fishermen previously operated canoes, by 1970, the artisanal fleet consisted of approximately 500 *houris* (6-15 m open long boats, 70 of which had outboard motors), and 300 *dhows* (8-17 m, 80 of which had inboard engines). This fleet decreased to 130 vessels by 1981 and only half were operational. At the same time, the number of fishermen decreased from 23 000 in the 1950s to about 3 500 in 1981 (Bellemans and Reynolds, 1992a).

The industrial fishing fleet in the 1960s was comprised of four inshore trawlers, three handliners, and nine offshore trawlers. Facilities were present in the port cities of Massawa and Assab to process the catch (Bellemans and Reynolds, 1992a). These facilities collapsed completely during the war, but a number of efforts are underway or proposed to rehabilitate and revitalize the fisheries sector (RDA International, 1993).

Sharks formed part of the catch during the 1950s and 1960s, and meat was dried and salted, and exported to Yemen. Shark fins were also dried and exported to Asia (Abebe, 1993). Figures for production of shark in Eritrea are available for the years 1965/1966 to 1976/1977.



CURRENT FISHERIES

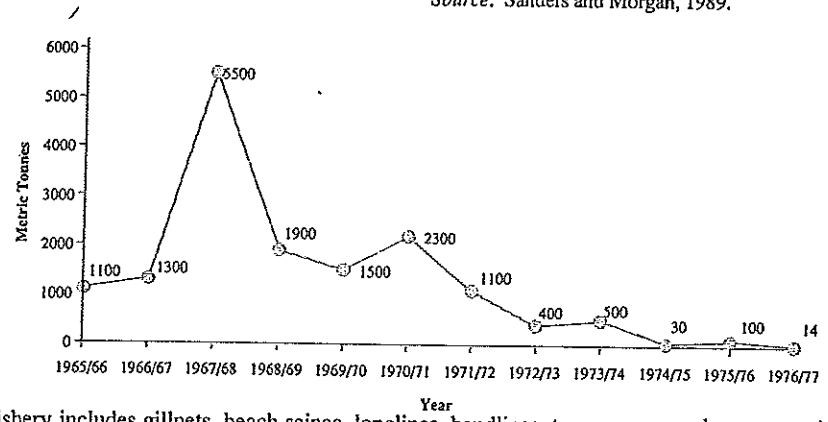
Fisheries in Eritrea consist of an artisanal fishery operating along the coast which targets snapper (Lutjanidae), grouper (Serranidae), Spanish mackerel and shark, a modern shore-based fishery concentrating in the Massawa environs geared toward catching snapper, grouper and Spanish mackerel, and an offshore fishery operating in the Red Sea which targets snapper, grouper and grunter (Centropomidae). The key fishing areas include the region between Massawa and the border with Djibouti, with a concentration in the Dahlak islands (S. Etoh, *in litt.*, 1995).

Fishing vessels must be registered with the government. At present there are numerous unregistered boats operating illegally in Eritrean waters, and figures on the number of such illegal boats are impossible to determine (S. Etoh, *in litt.*, 1995). Nevertheless, it is estimated that there are over 150 vessels illegally involved in shark fishing in Eritrean waters.

Table 1
Estimated production of shark in Ethiopia (now Eritrea),1965/1966 to 1976/1977

Year	Metric Tonnes
1965/1966	1 100
1966/1967	1 300
1967/1968	5 500
1968/1969	1 900
1969/1970	1 500
1970/1971	2 300
1971/1972	1 100
1972/1973	400
1973/1974	500
1974/1975	30
1975/1976	100
1976/1977	14

Source: Sanders and Morgan, 1989.



Gear used by the Eritrean fishery includes gillnets, beach seines, longlines, handlines, traps, spears and castnets, with the most common gear being the gillnet (Bellemans and Reynolds, 1992b). Etoh (*in litt.*, 1995) also reports the use of trawls and driftnets.

1. Artisanal/Shorebased

In 1992 a survey of the Eritrean marine fisheries sector was carried out by FAO. This survey revealed that a total of 2 615 people were involved in fishing along the Eritrean coast at that time (Bellemans and Reynolds, 1992b). These fishermen were either "foot-fishers", artisanal or subsistence fishermen who operate in shallow waters primarily using handlines, but also nets, traps and spears, or fishermen operating vessels of various types and sizes. The fleet was found to number 636 craft, although at least one-third of the craft were not operational. Types of boats identified in the survey were canoes (6-10 m, non motorized), *houris* (6-30 m with outboard engines), and *sambuks* (6-30 m with inboard diesel engines) (Bellemans and Reynolds, 1992b). Vessels involved in shark fishing are generally 10-25 m *houris* or *sambuks* (S. Etoh, *in litt.*, 1995).

Table 2
Shark species caught off Eritrea

Species	Common Name	IUCN Category	Type of Fishery
Carcharhinus limbatus	Blacktip Shark	Common	Incidental
C. albimarginatus	Silvertip Shark	Common	Incidental
C. amblyrhynchos	Grey Reef Shark	Common	Incidental
C. melanopterus	Blacktip Reef Shark	Common	Incidental
Galeocerdo cuvier	Tiger Shark	Rare	Incidental
Triaenodon obesus	Whitetip Reef Shark	Common	Incidental
Sphyrna spp.	Hammerhead Shark	Common	Incidental

Source: S. Etoh, *in litt.*, 1995.

Fishing is undertaken throughout the year, although shark fishing is generally carried out from October to May. Fishermen make approximately 15-20 trips per season, and each trip lasts five to seven days (S. Etoh, *in litt.*, 1995).

i. Directed

A directed fishery for sharks exists in Eritrea, but in some areas landings are only consumed locally, because of the lack of market access (S. Etoh, *in litt.*, 1995). Sharks are caught with gillnets (200-400mm mesh size), as well as longlines (Bellemans and Reynolds, 1992a; Bellemans and Reynolds, 1992b). The smaller sharks are valued as a source of meat; they are dried and exported to Saudi Arabia and Yemen. The larger sharks are utilised only for their fins, which are exported to Singapore either directly, or via Yemen (S. Etoh, *in litt.*, 1995). The trading channels for dried shark meat are well-established (Bellemans and Reynolds, 1992b).

Figures do not exist for the current shark catch. Ethiopia, of which Eritrea was part until 1994 is listed in the FAO Yearbook of Fishery Statistics, and although landings are recorded for fish, crustaceans and molluscs, there are no data recorded for sharks (Anon., 1995).

Bellemans and Reynolds (1992a) have noted that skates and rays are occasionally caught on a subsistence basis.

ii. Bycatch

Sharks are sometimes caught incidentally when fishing for snapper, grouper and Spanish mackerel (S. Etoh, *in litt.*, 1995). In addition, skates, manta rays, and eagle rays are caught as bycatch.

2. Commercial Fishery

The pelagic commercial fishery is comprised of Eritrean vessels, South Korean trawlers, and illegal Yemeni vessels. Egyptian, Israeli and Saudi Arabian vessels have also been observed fishing in Eritrean waters. The main methods of capture are gillnets and trawls, and the target species are snapper, grouper and Spanish mackerel.

i. Directed

There is no directed commercial fishery for sharks in Eritrean waters.

ii. Bycatch

Sharks are caught as bycatch, and are in general discarded at sea after the fins have been removed. Efforts are underway to reduce the size of the bycatch by improving utilization of the sharks that are caught, in particular for human or animal food consumption.

Both shark jaws and fins are dried before sale
Alex Forbes-IUCN

TRADE

There is little information on the quantities of shark products traded within and from Eritrea.

Meat: Dried shark meat is produced from small sharks, and is consumed along the coast. Most of the dried shark meat is however exported to Saudi Arabia and to eastern African countries via Yemen (S. Etoh, *in litt.*, 1995).

Fins: Large sharks are not generally utilised for their meat, but they are valued for their fins. Dried fins are exported either directly to Singapore, or to Singapore via Yemen (S. Etoh, *in litt.*, 1995). Recently, shark landings are believed to have increased, largely because the price offered for shark fins in Yemen has also increased.

Curios: Shark teeth are sometimes offered for sale to tourists (S. Etoh, *in litt.*, 1995). Jaws are also offered to tourists on occasion.

Liver Oil: Shark liver oil is used locally in Eritrea as a preservative and sealant for wooden boats.

Whole shark: Small sharks are traded.

CONSERVATION IMPLICATIONS

No quantitative resource surveys have been carried out in Eritrean waters, although minor surveys have been undertaken from time to time (Sanders and Morgan, 1989). These surveys have allowed for estimates to be made of maximum sustainable yield for numerous marine species, but these estimates vary considerably. For sharks the estimates vary from 2 000-5 000 mt/yr for offtake in Eritrean marine waters (Bellemans and Reynolds, 1992a). There is an urgent need to carry out fishery stock assessments and develop an appropriate management system to sustainably utilise these resources. Eritrea's Ministry of Marine Resources is well aware of this need and has not licensed foreign trawlers to operate in its waters (RDA International, 1993).

Pollution has emerged as a problem related to shark utilization, as numerous sharks are discarded at sea either as bycatch, or because the sharks are large and only the fins are harvested. There have been reports of dead sharks washing up on the Dahlak islands, although Etoh (*in litt.*, 1995) notes that no "large quantities" of dead sharks have been found.

REGULATORY/MANAGEMENT FRAMEWORKS

Eritrea is in the process of rebuilding after 30 years of war. As such, many of the expected regulatory measures are not yet in place, although efforts are underway to develop appropriate and effective legislation, especially with regard to coastal and marine issues. Eritrea has adopted certain legislation from the former regime, in particular the Ethiopian Maritime Proclamation, and has specified in the Eritrean Proclamation No. 7/1991 that "...Fishing of all sorts, including pearl fishing, within the said territorial waters shall be reserved exclusively to nationals of Eritrea..." (Cullinan, 1994).

In addition, vessels in Eritrea must be registered if they are involved in fishing, although artisanal craft solely involved in shark fishing do not necessarily have to be registered. At present there are no restrictions on shark fishing, and the government does not keep records on the level of shark landings. Furthermore, there are no restrictions on the import or export of shark products (S. Etoh, *in litt.*, 1995).

CONCLUSIONS AND RECOMMENDATIONS

Shark fishing at present in Eritrea does not appear to represent a threat to sharks although illegal fishing may be taking place. Furthermore, the Ministry of Marine Resources is intent upon re-establishing a sustainable fishery sector in Eritrea, and plans to carry out stock assessments, which will be used to develop appropriate management systems for the nation's marine resources.

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THE SOMALI SHARK FISHERY IN THE GULF OF ADEN AND THE WESTERN INDIAN OCEAN

Nina T. Marshall

INTRODUCTION

Somalia's coastline extends some 3 200 km, with 1 200 km bordering the southern coast of the Gulf of Aden, and 2 000 km facing the Indian Ocean (Bihi, 1984). Somalia has the longest coastline in Africa, and its marine resources are rich and varied. Most trade is carried out by sea through the four major ports, Mogadishu, Berbera, Kismayu, and Bosaso.

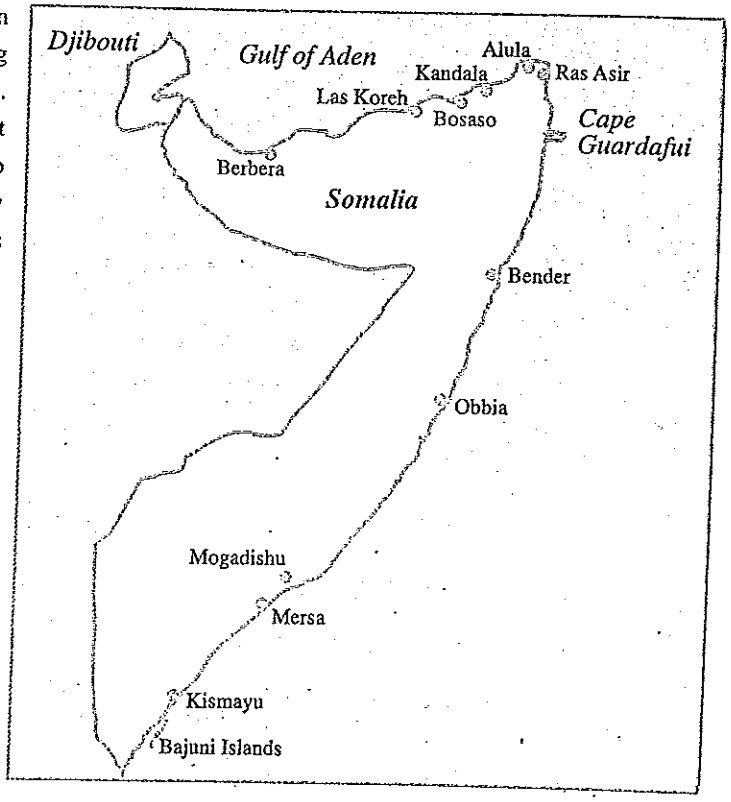
The north coast is typified by sandy beaches punctuated by rocky outcrops, and an absence of coral reefs due to seasonal influxes of cold water currents. The eastern part of this area experiences seasonal migrations of pelagic fish, while the western portion is rather uniform throughout the year. The east coast of Somalia is most notable for the northern area between Ras Asir and Ras Mabber, which at times is subjected to exceptional primary productivity; this area is regarded as having some of the highest fish densities in the world. The central east coast experiences occasional high fish densities, but these are not constant throughout the year. Further south, the area between Obbia and Chiamboni harbours coral reefs and is characterised by mild seasonal variations. The Somali shelf consists of 24 500 km^2 off the east coast and 3 200 km^2 off the north coast (Stromme, 1987).

Southern Somalia also has numerous small islands situated north of the Kenyan border. The Bajuni islands, and the mainland southern coast, are home to the only two ethnic groups (the Bajuni and the Rermanyo) who have a tradition of fishing in Somalia (Lovatelli, 1996).

HISTORICAL OVERVIEW

Utilisation of sharks in Somalia occurred in the past and continues today. Artisanal fishing has involved sharks mainly in the form of production of dried shark meat and fins, and local use of shark liver oil for maintenance of *dhows*. Commercial fishing activities in the past focused primarily on crustaceans and fish and did not target shark species (Stromme, 1987).

Artisanal fishing has been practised in Somalia for centuries by the many fishing communities that occur along the coast. During the 1970s the Somali Government worked with these communities to establish fishing cooperatives, whereby the catch was purchased at fixed prices and traded by cooperative trade agencies. The Government also promoted resettlement of nomadic peoples to the coast during the 1973-1974 drought, and provided fishing equipment (including boats) as well as training in fishing methods (Stromme, 1987). In 1984, it was estimated that approximately one million people lived on the Somali coast, and that 90 000-100 000 people were involved directly or indirectly in artisanal fishing (Bihi, 1984).



At present it appears that large scale commercial fishing operations (such as trawling) still do not include a directed fishery for sharks, but that shark bycatch results in the trade in shark fins and meat. Artisanal fishing operations now target sharks, and can be considered commercial (R. Remmerswaal, pers. comm., 1996). Figures for total landings are presented in Table 1.

Remmerswaal (pers. comm., 1996) notes that the figures listed above for 1990, 1991, and 1992, are most likely overestimates, and a more accurate figure for each of these three years is probably closer to 5 000 mt. The reduced catch is primarily related to the unstable political situation.

Table 1
Nominal catch of fish, crustaceans and molluscs, 1983-1992 (mt)

Year	Quantity (mt)
1983	11 195
1984	19 639
1985	18 467
1986	16 500 (estimate)
1987	17 000 (estimate)
1988	17 727 (estimate)
1989	17 696 (estimate)
1990	17 095 (estimate)
1991	15 800 (estimate)
1992	15 000 (estimate)

Source: Anon. 1994.

CURRENT FISHERIES

1. Artisanal

Data on annual landings of the artisanal fish catch are incomplete, however Stromme (1987) provides some data produced by the Ministry of Fisheries. He also states that in the 1970s the total annual catch was about 5 000 mt, but it increased to 8 000 mt in 1975 due the introduction of 500 mechanized boats. By the end of the 1970s, most of the boats were no longer in operation, and annual landings returned to their previous level. Figures for annual artisanal fish landings for the period 1980-1985 are listed in Table 2.

During the 1980s there existed three fisheries development projects, which were run as agencies under the Ministry of Fisheries. Of particular note is Somali Marine Products, an operation which purchased fish from fisheries co-operatives and from independent fishermen. In 1985, 28.2 mt of sharks were processed, representing approximately 5% of the total production (Stromme, 1987). This figure cannot however be interpreted as a large-scale decrease in the overall shark harvest; data for total landings for the same year are unavailable and the proportion of direct consumption unknown.

Table 2
Annual production of the artisanal fishery, 1980-1985 (mt)

Year	Quantity (mt)
1980	4 000
1981	4 255
1982	4 390
1983	5 280
1984	7 724
1985	4 067

Source: Ministry of Fisheries, in Stromme, 1987.

The artisanal fish catch consists primarily of tuna, mackerel and sharks (Bihi, 1984). Bihi (1984) reported that in 1976, total artisanal landings were 7 050 mt, of which 1 500 mt were "sharks for drying". It is likely that the artisanal annual production increased in the late 1980's, as a result of a number of fisheries development projects focusing on the co-operatives. For example, a World Bank project targeting the Bosaso-Alula area aimed at increasing a mid-1980s production figure of 100-200 mt to 4 000 mt within seven years (Stromme, 1987). Political unrest undoubtedly had a negative effect on this goal. By the late 1980s however, government support to fishing co-operatives ceased. At present the fishermen operate as independent groups, or as business associations supported by an individual who supplies boats and gear, and usually markets the fish landings (Lovatelli, 1996). Figures for the present annual production of the artisanal fishing fleet are unavailable.

i. Directed

Sharks and rays represent an important part of the artisanal fishery. Regions that are significant include the north coast, and the southern portion of the east coast. It has been estimated that sharks comprise 40% of the artisanal landings in the southeastern coastal area. The main shark species landed include Hammerhead *Sphyrna* spp., and Mako *Isurus* spp. (Stromme, 1987).

In 1995, information on the shark fishery was provided by a local NGO located in Bosaso, Ocean Training and Promotion, which is working to improve the utilisation of sharks and to support the development of the fishing

industry. Sharks are the main target species in the Bosaso region, largely because of the lack of a local market for other species, and the lack of facilities to produce fresh and frozen fish products (R. Remmerswaal, *in litt.*, 1995).

The artisanal fishery targets shark, spiny lobster, and to a lesser extent tuna and grouper. Approximately 200 motorized and wooden boats operate in the northeast region of Somalia; these boats measure 6-9 m in length, hold up to ten fishermen, and fish with 10-15 nets each. Fishing takes place all year except for the hot season which occurs in June, July and August, therefore boats fish for approximately 150-200 days per year. Gear used includes baited longlines, driftnets, and gillnets (R. Remmerswaal, *in litt.*, 1995). Lovatelli (1996) reports that gillnets of 200 mm mesh size are used most frequently for catching sharks. This fishery has been in operation for about 20 years, or ever since good boats and nets have been available, and there has been a healthy market for shark fins. It should be noted that because of the last four years of war in Somalia, at least 140 boats are non-operational and therefore the number of boats involved in the industry in the northeast region has decreased. At the same time, fishermen report that more fishermen are actively fishing (with less effective operation), and therefore the trend indicated is a decrease in the overall catch per unit of effort (R. Remmerswaal, *in litt.*, 1995).

Records of landings are compiled by Ocean Training and Promotion. The number of sharks caught in 1995 is estimated at ±45,000; this figure is calculated from 150 boats x 150 days x 10 nets x 0.2 shark caught per net night. Data on total number of boats in Somalia is impossible to obtain, however, estimates are available from Lovatelli (1996), and stand at approximately 269 motorized GRP vessels, and 806 traditional wooden boats. With these figures it is possible to estimate the total artisanal shark catch to be ±130,000 sharks per year (R. Remmerswaal, pers. comm., 1996). The size of sharks varies, with 50% being less than 1.5m. Shark species that are caught are listed below. Remmerswaal (pers. comm., 1996) reports that 90% of the catch consists of four species, the Blacktip Reef Shark *Carcharhinus melanopterus*, the Thresher Shark *Alopias vulpinus*, the Hammerhead Shark, and the Mako Shark.

Table 3
Shark species caught off Somalia

Species	Common Name	Occurrence	Type of Fishery
Carcharhinus melanopterus	Blacktip Reef Shark	Common	Directed
Alopias vulpinus	Thresher Shark	Common	Directed
Sphyrna spp.	Hammerhead Shark	Common	Directed
Isurus spp.	Mako Shark	Common	Directed
Negaprion acutidens	Lemon Shark	Common	Directed
	Sand Shark	Common	Directed
Carcharhinus brevipenna	Spinner Shark	Occasional	Directed
Galeocerdo cuvier	Tiger Shark	Rare	Directed
Prionace glauca	Blue Shark	Rare	Directed
Rhiniodon typus	Whale Shark	Rare	Incidental
	Saw Shark	Rare	Directed
Scoliodon laticaudus	Spadenosed Shark	Rare	Directed

Source: R. Remmerswaal, *in litt.*, 1995.

Sharks are processed both on board boats and on shore (on the beach). Shark meat is salted and dried (once the head, fins and tail have been removed), and fins are dried. Ocean Training and Promotion is also processing on a trial basis cartilage (dried), skins, liver (boiled), and jaws (as curios). In addition, baby sharks are made into meat dough. This processing operation involves only the sharks caught locally, and is small-scale (R. Remmerswaal, *in litt.*, 1995).

ii. Bycatch

Manta rays (Mobulidae) and stingrays (Dasyatidae) form part of the incidental catch in the northeast region, and are either dried for meat or used as bait for longlines. In addition, the Whale Shark is occasionally caught incidentally (R. Remmerswaal, *in litt.*, 1995).

2. Commercial Fishery

Commercial fishing has been undertaken in Somalia for decades. As early as 1936, Italy built two tuna canneries, in Habo and Kandala, and later a third was built by Russians in Las Koreh (R. Remmerswaal, pers. comm., 1996). According to Lovatelli (1996) one of the first operations was a Soviet joint venture (Somalfish) that involved ten freezer trawlers; this operation was active from 1973 to 1977. Stromme (1987) reports that deep sea trawling was carried out by various joint ventures in the 1970s, and that Italian, Greek, Egyptian and Japanese companies were given fishing concessions. Targeted resources were primarily crustaceans (the deep sea spiny lobster, *Puerulus* spp.) and demersal fish. During the 1980s, additional countries entered into fishing agreements with Somalia including Iraq and Yugoslavia (Singh, 1984). At present Russian, South Korean, Taiwanese, and Italian vessels, among others, are carrying out trawling activities off Somalia specifically for pelagic and demersal fish. These boats are operating from Cape Guardafui to Bender Beila. There are approximately 15 of these vessels, and their fishing activities are illegal (R. Remmerswaal, *in litt.*, 1995).

i. Directed

Sharks are not part of a commercial directed fishery in Somalia.

ii. Bycatch

Incidental catch of sharks occurs on foreign fishing trawlers, and is estimated to be 5% of the total weight of the catch. Sharks are either dead when landed, or are killed on board, and the fins are always removed and the body discarded (R. Remmerswaal, *in litt.*, 1995).

Determination of overall figures of shark bycatch is difficult. Nevertheless, estimates are available for one Somali fishing trawler operating in 1995. This trawler is one of five owned by a Somali company fishing primarily for lobster, squid, and fish, destined to be frozen and exported to Europe (especially Italy). This trawler operates in the Hafun region, approximately 11 months out of the year. About two to three sharks are caught as bycatch per day, and each shark is approximately 3m in length. Fins are removed from the shark and the carcass is thrown overboard. The crew regards shark fin as an extra bonus and usually harvests and dries the fins, and sells them when they go ashore. Approximately 400-600 kg of fins are produced each three months, which would extrapolate to about two mt of fins produced per year by one trawler.

3. Recreational

It is unlikely that any recreational fishing is now taking place in Somalia due to civil unrest.

TRADE

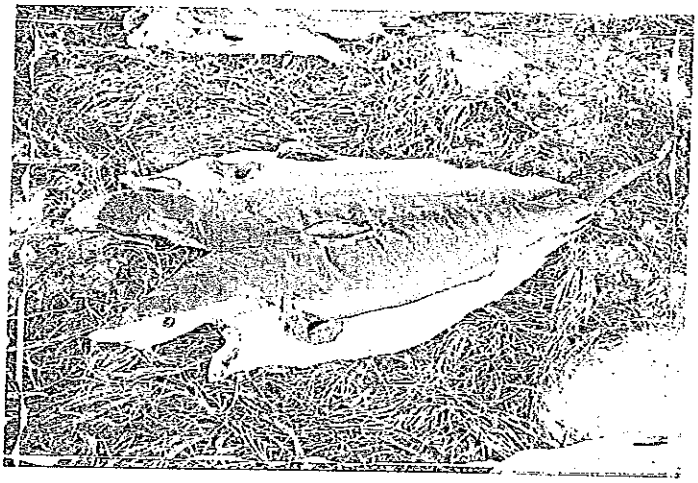
Trade in shark products in Somalia is dominated by the trade in fins and dried/salted shark meat. Fins are exported primarily to Dubai, sometimes via Djibouti, and then re-exported to Asia to be consumed as soup. Dried meat is consumed locally or exported to Kenya and Yemen. Shark liver oil is used locally for boat maintenance, and is also being produced experimentally in the northeast region by the NGO Ocean Training and Promotion. This NGO is also producing skins and cartilage on a trial basis.

Fins: Shark fins are harvested by both artisanal and commercial fishermen, and are dried prior to sale. Artisanal fishermen have in the past sold their shark fins to local middlemen, who in turn transport the shark fins to Bosaso and Berbera, where they are purchased and exported to Dubai directly or through Djibouti. Fishermen generally receive about US $12-20/kg for a straight cut (with meat) and US $30-50/kg for a half moon cut. Exports to Dubai are usually transported by boat, but occasionally shipments are flown out. From Dubai the shark fins are re-exported mainly to Singapore and Hong Kong (A. Lovatelli, pers. comm., 1995; R. Remmerswaal, *in litt.*, 1995).

While export figures for shark fins are largely unavailable, it has been reported that 10 530 kg of fins were exported from the port of Bosaso between January and July 1996 (Anon., 1996).

Crew from commercial fishing vessels often sell shark fins when their vessels come ashore for refueling. Fins originating in Somali waters are reportedly sold in Tanzania (Zanzibar), Yemen (Aden), and Kenya (Mombasa). Crew are generally able to sell shark fins for about US $20/kg, although they know that they could get a higher price if their sales activities weren't subject to time constraints.

Meat: Shark meat in Somalia is dried and salted and then exported. Prices vary and range from about US $0.20/kg in Bosaso, to US $0.70/kg in Mogadishu (Lovatelli, 1996; R. Remmerswaal, *in litt.*, 1995). Exports of shipments containing dried and salted sharks and rays to Kenya are estimated to be approximately 300-660 mt/year. Shipments are comprised of about 75% sharks and 25% rays; therefore dried shark meat imports into Kenya are about 225-495 mt per year. Dried/salted shark meat is also exported from Somalia to Yemen (R. Remmerswaal, *in litt.*, 1995). Lovatelli (1996) reports that in Kenya dried and salted shark meat is sold in units of 16 kg and by grades (1-6). Grades are determined by quality, as well as species, with Grade 1 being comprised of species such as the Bull Shark *Carcharhinus leucas*, and the Hammerhead Shark. Grade 1 sells for approximately US $11.00-18.00 per 16 kg; grade 2 goes for US $4.50-9.00 per 16 kg. It has also been reported that shark meat in Somalia is used as bait for lobster traps.



Shark trunk drying on the Somali coas
Alex Forbes-IUCN

Liver oil: Shark liver oil is used for maintenance of boats within Somalia and is not exported. In 1995 liver oil was priced at US $0.50/litre (R. Remmerswaal, *in litt.*, 1995).

CONSERVATION IMPLICATIONS

A number of fisheries resource surveys have been carried out in Somalia since the 1960s by both research vessels and commercial trawlers carrying out exploratory surveys. The data are limited however by numerous factors, for example, commercial exploratory surveys were often carried out in areas where the fish density was high. In 1986, the Ministry of Fisheries reported on expected annual yield, and forecast for sharks and rays a yield of 30 000 mt. According to Stromme (1987), this level of annual production would require a standing stock of 120 000-150 000 mt, a figure regarded to be quite high. Stromme (1987) further indicated that there is little information available on the status of sharks, and that for rational harvest levels to be set, additional research would be required.

Remmerswaal (*in litt.*, 1995) notes that there is concern regarding overfishing of sharks in the northeast region of Somalia. Illegal commercial trawling operations are harvesting sharks as shark bycatch. The artisanal fishery regards sharks as one of the few sources of cash income in the region and directly targets sharks. Furthermore, it has been reported that the shark stock is declining in the Gulf of Aden, off the coast of South Yemen (Lindley, 1994). Given the significant offtake and poor knowledge of shark resources, there is a great need to promote fisheries management in the area.

REGULATORY/MANAGEMENT FRAMEWORKS

At present there is no functional government in existence in Somalia. In the past, fisheries were regulated by the Department of Fisheries under the Ministry of Marine Transport and Ports, which was established by Law No. 12 of 3 February 1977 (Sainlos, 1987). The principal fisheries legislation was the Maritime Code of 1959 and its various amendments (Salah, 1984). Whatever legislation and regulatory authority existed is now largely ineffectual. In essence, Somalia currently has no ability to regulate or manage its fisheries.

1. Domestic Measures

These measures are discussed because they existed before the war, and may be applied at some point in the future. At present however, no domestic measures are being implemented.

The Maritime Code, Decree Law No. 1 of 21 February 1959 has several articles that pertain to fisheries rights. In particular, Article 67 states that major fishing activities on the territorial sea are permitted only by persons holding a concession for this purpose issued upon decree of the Minister of Fisheries, and that minor fishing activities are permitted only with a license issued by the maritime authority. The article further states that licenses are not required for those fishing with conventional fishing means (Singh, 1984).

Law No. 37 of 10 September 1972 states that unauthorized vessels fishing in the territorial sea shall be punished with a fine, and if the offense is repeated, the fine shall be doubled, the vessel may be confiscated, and the captain shall be liable to punishment as prescribed under the Somali penal laws (Singh, 1984).

As the Maritime Code of 1959 was regarded as not being entirely adequate, additional fisheries legislation, Law No. 13 of 30 November 1985, was enacted. This law covers fisheries licensing and enforcement, as well as administration and planning (Sainlos, 1987).

2. Regional/International Measures

No regional or international measures related specifically to sharks have been identified. However, Somalia is a party to the United Nations Convention on the Law of the Sea. The Maritime Code of 1959, as amended by Law No. 37 of 10 September 1972, states that "the Somali territorial sea includes the portion of the sea to the extent of 200 nautical miles within the continental and insular coasts". Somalia has also signed the convention of the Red Sea and Gulf of Aden Environment Programme (Singh, 1984).

CONCLUSIONS AND RECOMMENDATIONS

From these data, one can make a very rough estimate of the shark harvest in Somalia, however one should bear in mind that the figure is an extrapolation and may not be accurate. The artisanal landing figure of approximately 130 000 sharks of small to medium size (estimate of 40 kg each) equates to 5 200 mt of fresh shark landed per year. Commercial fishing trawlers are estimated to number at least 20, and if one assumes that two to three sharks are caught per day for 330 days per year, and each shark is about 3m in length weighing an average of 100 kg, then the total wet weight of the shark catch would be $\pm$1 500 mt per year.

The rough estimate of the yearly shark catch is therefore 6 700 mt (wet weight), although the actual harvest is probably larger as information on the number of deep sea vessels operating in Somali waters is incomplete.

Dried/salted shark meat is exported to Kenya and to Yemen. The only available figures are for imports into Kenya, which range from 225-495 mt/year. Dried meat is calculated at 38% of fresh weight (Kreuzer and Ahmed, 1978), and therefore total artisanal landings in the northeast region of 1 800 mt would equate to 684 mt of dried meat. The figures for Kenyan imports are therefore well within the bounds of reason, and probably should be considered to be minimum figures as meat is likely to be exported from the central and southern regions as well.

This level of harvest, even if it is an underestimate, is not thought to be a significant threat to shark populations in Somali waters (A. Lovatelli, pers. comm., 1995). However, as noted earlier, Remmerswaal (*in litt.*, 1995) and Lindley (1994) remarked upon overfishing of sharks in the northeast region, and the need for fisheries management measures. Sharks are an extremely important resource for Somalia, and given the lack of any management whatsoever in Somali waters, it would appear prudent to promote appropriate management measures for the shark fishery.

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TRADE IN SHARKS AND SHARK PRODUCTS IN KENYAN WATERS

Nina T. Marshall

INTRODUCTION

Kenya lies between Somalia to the north and Tanzania to the south, with a coastline measuring 880 km. The continental shelf extends approximately 18 km from shore, and there is an offshore bank (the North Kenya Bank) stretching from the Somali border to about 35 km southeast of Lamu. The Kenyan coast is punctuated by a number of river systems, the largest of which are the Sabaki River and the Tana River (Ardill and Sanders, 1991). Coral reefs occur along much of the coastline.

HISTORICAL OVERVIEW

Shark fishing has taken place along the East African coast for centuries, as dried/salted shark meat is nutritious and inexpensive. Shark fins have also been traded for centuries, with the value of shark fins in the Far East well-known to East African traders.

CURRENT FISHERIES

The marine fisheries of Kenya consist of both an artisanal and an offshore fishery. The artisanal sector is the most significant. There are approximately 6 500 fishermen operating along the Kenyan coast, using canoes and outrigger boats (Anon., 1995a). The offshore fishery is comprised of Kenyan and foreign vessels, and Kenya also serves as a transshipment point for foreign fishing vessels. In 1993, the number of fishermen and vessels involved in the marine sector was 7 330 and 2 347 respectively (Anon., 1994a). In addition, Kenya has an active sport fishing industry. FAO figures on the nominal catch of fish, crustaceans and molluscs are presented below.

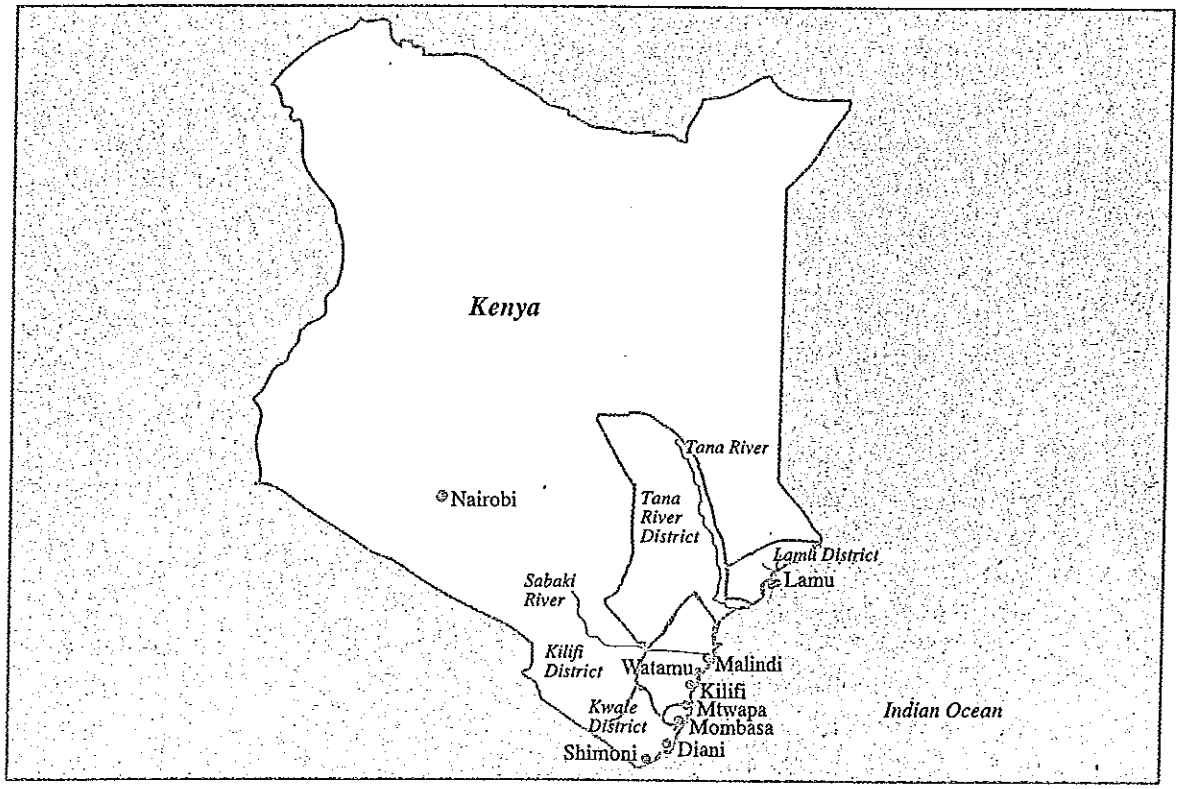
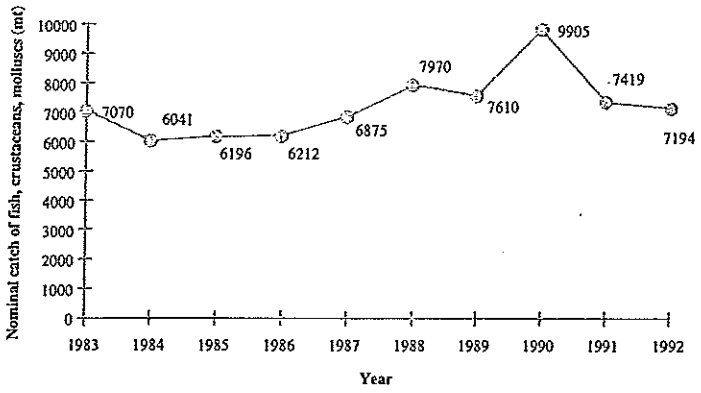


Table 1
Nominal catch of fish, crustaceans, and molluscs by Kenya, 1983-1992 (mt)

Year	Quantity (mt)
1983	7 070
1984	6 041
1985	6 196
1986	6 212
1987	6 875
1988	7 970
1989	7 610
1990	9 905
1991	7 419
1992	7 194



Source: Anon., 1994b.

Approximately 80% of Kenya's fish catch is brought in from shallow coastal waters and from reefs, and the remainder is caught by offshore vessels. The coastal/inshore fishery is regarded as being at maximum sustainable yield (Anon., 1995a) and there is concern about its over-exploitation (Anon., 1989b). The offshore fishery is thought to be under-exploited (Anon., 1995a).

There are insufficient data to ascertain which of Kenya's fisheries lands what percentage of the total elasmobranch catch, nevertheless, combined catch data are presented below showing total landings by district.

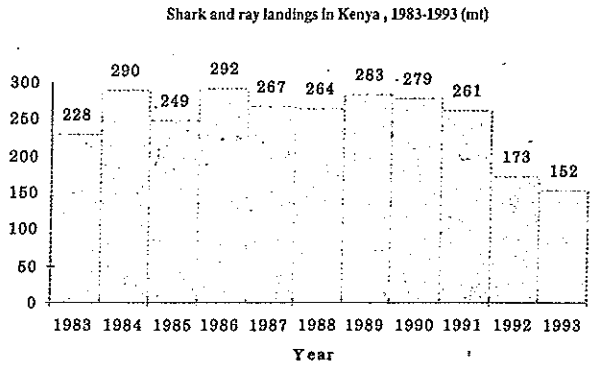
Table 2
Shark and ray landings in Kenya by district, 1983-1993 (mt)

Year	Lamu	Tana River	Kilifi	Mombasa	Kwale	TOTAL
1983	11	3	89	100	25	228
1984	33	15	118	105	19	290
1985	25	3	86	109	26	249
1986	30	1	112	128	21	292
1987	28	6	72	138	23	267
1988	13	4	81	139	27	264
1989	37	19	57	139	31	283
1990	n/a	n/a	n/a	n/a	n/a	279
1991	n/a	n/a	n/a	n/a	n/a	261
1992	34	2	66	22	49	173
1993	24	4	66	18	40	152
TOTAL	235	57	747	898	261	2738

Source: Anon., 1984, 1985, 1986, 1987, 1989a, 1990, 1993, 1994a, 1995b.

1. Artisanal Fishery

The artisanal fishery operates along the length of the Kenyan coastline, in the area between the shore and the outer edge of the reef. In 1985, the total number of boats involved in the fishery was 1 828, with 558 in Kwale District, 508 in Lamu District, 401 in Mombasa District, and 361 in Malindi District (Cararra and Coppola, 1985 in Ardill and Sanders, 1991). The type of gear used by the artisanal fishery includes castnets, gillnets, beach seines, handlines,



and various other gear. Handlines are the most frequently used type of gear (Ardill and Sanders, 1991).

Landings from the artisanal fishery are varied, and include demersal fish, pelagic fish, sardines, sharks and rays, lobster, prawns and crab (Ardill and Sanders, 1991). Sharks are valued as a source of meat, which is usually salted and dried, and consumed locally. Shark fins have been traded from East Africa to Asia for many years; and the trade in shark fins from Kenya remains healthy.

2. Commercial Fishery

Kenya's commercial fishery consists of both Kenyan trawlers and foreign-owned vessels mainly targeting prawns, yellowfin tuna and marlin. Kenya's coastline has an abundance of coral reefs, deep fissures and rock outcrops, which restrict the area in which these trawlers can operate. Prawn trawlers operate in the vicinity of Ungwana Bay and Malindi Bay (Wamukoya et al., 1995). Vessels operating in or just outside Kenyan waters include Japanese, South Korean, Taiwanese, Spanish and French vessels. Gear used includes driftnets and longlines, and some vessels use satellites to locate fish (D. Darnborough, in litt., 1995; P. Hemphill in litt., 1995; Moorings in litt., 1995). Trawling is not permitted within ten miles of the high water mark, yet trawlers have been observed frequently fishing in this zone illegally (Schoorl and Visser, 1991).

i. Directed

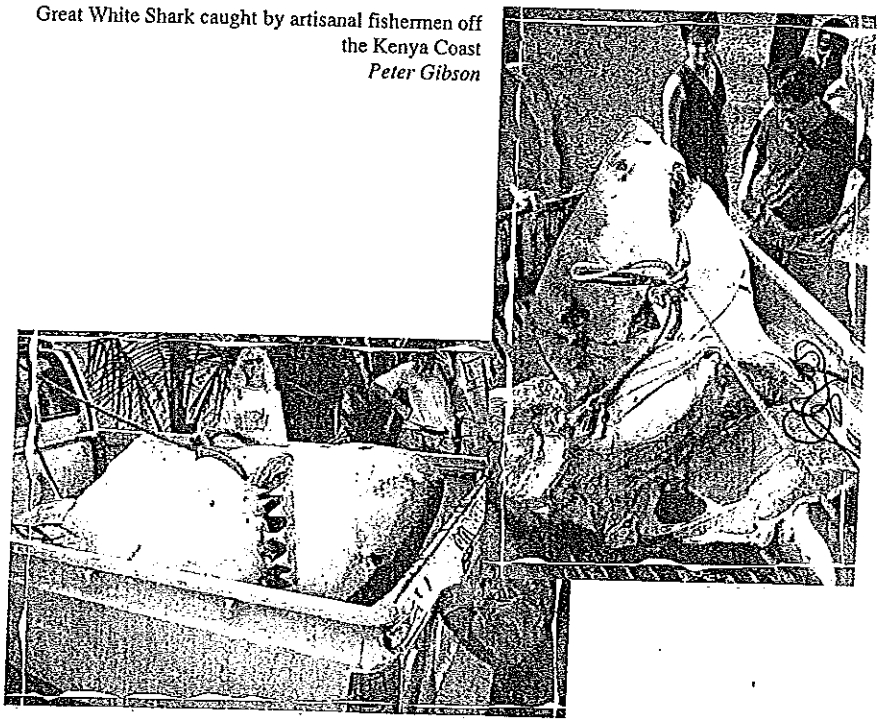
Kenya's commercial fishery does not specifically target sharks although sharks are caught as bycatch.

ii. Bycatch

Figures for shark bycatch from the Kenyan fleet and from those foreign vessels that transship in Kenya are largely unavailable. However, Spanish tuna vessels reportedly land 200 mt of tuna every two weeks, with an estimated 2-3 mt of bycatch. This bycatch is brought to Mombasa and sold locally. The sharks are sold for meat after the fins have been removed by the transhipment firm for eventual export to Hong Kong.

In 1995, there were an estimated 15 prawn trawlers operating in Kenyan waters (Wamukoya et al., 1995). In 1989, 14 prawn trawlers caught 335 mt of prawn and 561 mt of fish bycatch. This fish bycatch is landed and is included in Kenyan fisheries statistics (Ardill and Sanders, 1991). The proportion of shark bycatch is unknown.

Great White Shark caught by artisanal fishermen off the Kenya Coast
Peter Gibson



3. Recreational

Sport fishing takes place at all the major ports along the Kenyan coast, in particular in Malindi, Watamu, Kilifi, Mtwapa, Mombasa, Diani and Shimoni. The main target species are black marlin, blue marlin, kingfish, wahoo, broadbill swordfish, sailfish, and yellowfin tuna (D. Damborough, in litt., 1995). Sharks are occasionally caught incidentally, and are rarely targeted by fishermen although there are instances when a client requests to catch shark (D. Slater, in litt., 1995). Sharks landed by sport fishermen are generally sold as meat to dealers, although occasionally the jaws are kept (D. Damborough in litt., 1995; D. Slater in litt., 1995). Sport fishing vessels generally operate within 20-30 miles of shore (Moorings, in litt., 1995). There are approximately 60 sport fishing vessels, most of which are 5.2-12.2 m boats; these vessels are required to be registered with the Kenya Government (Moorings, in litt., 1995). The fishery has been operating since around 1960, and in the last 10-15 years the number of boats has increased markedly (D. Slater, in litt., 1995). The number of trips made by sport fishing vessels varies according to season and client availability, but appears to be in the range of 60-200 trips per year. All sport fishermen interviewed during this survey expressed concern over the decrease in numbers and sizes of sharks that they have observed over the last five years.

Most sport fishing clubs in Kenya keep records of the weight of catches. Some clubs also record the number of boat fishing days per season. This information is useful in providing insight into the size of shark species caught along the Kenya coast, but its value is limited as the potential size of the catch would vary depending on the weight of the line used. Nevertheless, sport fishermen have expressed an interest in refining data collection so that in the future it might yield results that would be more useful for examining trends in shark size and density. The table below presents an example of the type of information that is already being collected by sport fishing clubs.

Table 3
Shark catches reported for Shimoni, 1989/90-1993/94 (number of sharks and total weight)

	Shimoni Fishing Club									
	1989/90		1990/91		1991/92		1992/93		1993/94	
Species	#	Kg	#	Kg	#	Kg	#	Kg	#	Kg
Hammerhead *Sphyrna* spp.	-	-	-	-	1	173	1	160	2	192
Mako *Isurus* spp.	8	670	7	499	8	1 048	6	431	11	960
Tiger *Galeocerdo cuvier*	1	163	3	474	9	1 904	7	1 243	3	391
Other	4	89	5	261	5	123	9	226	4	129

Source: Anon., 1995c.

TRADE

The Kenyan trade in shark products consists primarily of fins and meat. Jaws and teeth are sold infrequently to tourists, and the market for cartilage is largely unknown. Liver oil is traded locally. In Mombasa, there are seven dealers licensed to export shark fin, and there are two dealers who specialise in trade in dried fish (L. Thairo, pers. comm., 1995).

Cartilage: There is a growing interest in the marketing of cartilage by Kenyan shark dealers. This interest is relatively new, with only one dealer currently exporting cartilage. Many others are interested in getting into the shark cartilage trade, however, and several have received import requests from American companies. No information is available on the volume of trade in shark cartilage.

Fins: Sharks fins are both imported to and exported from Kenya. Official statistics on shark fin trade are as follows:

These data greatly under-reflect the trade in shark fin. Figures reported by importing countries for the period 1986 to 1990 show that Kenya exported a total of at least 138.9 mt of shark fin, which equates to an average of 28 mt per year (Dockerty, 1992). The reported imports of shark fin for Singapore alone, during 1992-1994 totalled 55 mt (Singapore Customs Statistics, 1995). Some Kenyan traders estimate the volume of shark fin exports to be in the area of three to four mt per month in the peak season, and 1-1.5 mt in the off season (May to September), or a total of 26-36 mt per year.

Imports are likewise under-reported and there is also a steady trade in shark fins from Zanzibar to Mombasa. The largest proportion of shark fins appearing in the Kenyan trade originate in Somalia. The Somali source is diminishing however, as Somalia is increasingly exporting their shark fins directly to the Middle East or to Asia (H. Jiwa, pers. comm., 1995). Only about 25% of the shark fins traded in Kenya actually are landed in Kenyan waters (N. Majeed, pers. comm., 1995). Therefore, it should be noted that a significant quantity of the shark fin exports are actually re-exports.

Table 4
Imports and exports of shark fin (mt), 1987-1993

Year	Exports	Value (000 KSh)	Imports	Value (000 KSh)
1987	1.0	187.00	-	-
1988	n/a	n/a	n/a	n/a
1989	-	-	20.0	90.00
1990	10.0	2 740.00	-	-
1991	19.0	2 531.00	-	-
1992	7.0	5 773.00	-	-
1993	7.5	n/a	-	-
1994	7.2	n/a	-	-
1995	4.3	n/a	-	-

Source: Anon., 1988, 1990, 1991, 1992, 1993, 1994a; L. Thairo, *in litt.*, 1995.

The number of export shipments reported for each year is few, as can be noted from the table below which lists shark fin exports by shipment for 1993 to 1995.

Table 5
Shark fin exports for the period 1993-1995

1993	Kg	1994	Kg	1995	Kg
21/12/93	600	02/11/94	1 000	21/09/95	100
24/11/93	1 000	27/07/94	400	28/07/95	300
21/11/93	200	27/07/94	300	11/07/95	200
22/10/93	500	06/06/94	500	21/06/95	943
20/07/93	1 920	07/03/94	1 480	15/06/95	500
22/02/93	2 520	08/03/94	3 000	07/04/95	300
22/01/93	838	10/01/94	600	22/02/95	900
				21/02/95	250
				08/02/95	600
				31/01/95	200
				09/01/95	75
TOTAL KG	7 578		7 280		4 368

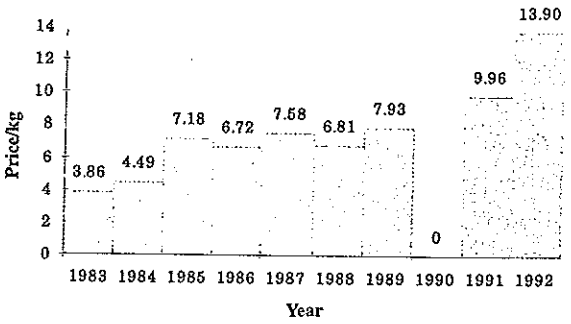
Source: L. Thairo, *in litt.*, 1995.

Prices for shark fin vary depending on the grade of fin. The lowest grade is valued at about US $10/kg, and the highest is US $60-70/kg. Most shipments contain a higher number of low grade fins, hence the average price reported per kg of shark fin is $45 (H. Jiwa, pers. comm., 1995).

Meat: Dried shark meat has been an important source of protein in East Africa for thousands of years. Kenya imports dried, salted shark meat from Somalia and Yemen and also occasionally from Djibouti (L. Thairo, pers. comm., 1995). Although Kenya records imports of "Smoked/dried fish", it does not appear that imports of shark meat appear in Customs statistics. In 1993, Kenya reported imports of 30 mt of smoked/dried fish. However, importers of dried, salted shark/ray meat reportedly import as much as 10-20 mt of meat per month from Somalia alone. This figure can increase to approximately 20-50 mt per month during the months of November, December and January. Meat shipments are reported to be comprised of about 75% shark meat and 25% ray meat. All shark meat produced in Kenya is consumed locally, and is popular along the coast and inland approximately 100 km. Prices offered to fishermen for fresh shark meat are as follows:

Table 6
Prices for shark/ray meat in Kenya, 1983-1992

Year	Price/kg
1983	Ksh 3.86
1984	Ksh 4.49
1985	Ksh 7.18
1986	Ksh 6.72
1987	Ksh 7.58
1988	Ksh 6.81
1989	Ksh 7.93
1990	n/a
1991	Ksh 9.96
1992	Ksh 13.90



Note: Exchange rates for Kenya are unavailable.
Source: Anon., 1984, 1985, 1986, 1987, 1988, 1989a, 1990, 1992, 1993.

Curios: Shark jaws are the most frequently marketed shark curio product. In surveys of kiosks and curio shops in Mombasa, however, shark jaws are offered only occasionally. The price for a large jaw is approximately Ksh 2 000 (US $35.00). Shark teeth appear to be sold very infrequently in Mombasa tourist kiosks, although it is possible that they are sold in tourist gift shops in hotels along the coast; these shops were not surveyed during this study.

Liver oil: Shark liver oil is produced for maintenance of *dhows*. All shark liver oil is consumed locally.

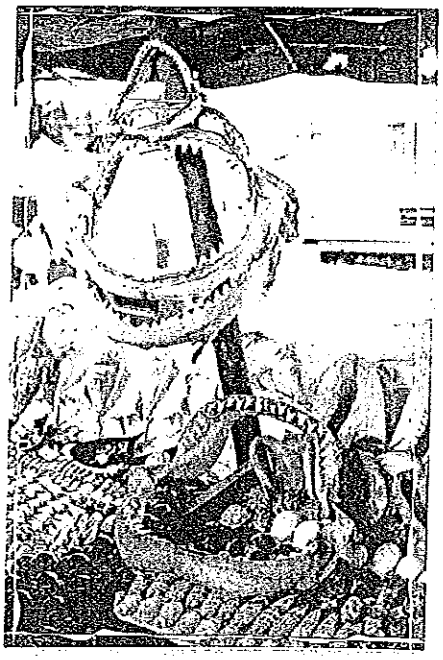
CONSERVATION IMPLICATIONS

Minimal information could be found on the status of Kenya's marine resources. However, Ardill and Sanders (1991) report that the inshore waters are believed to be at full exploitation levels. The situation is similar for the prawn trawl fishery, and in 1991 it was noted that there was an excess of trawlers (Ardill and Sanders, 1991). At the same time, sport fishermen have reported declines in shark catches, not only in numbers, but also in sizes. It should also be noted that the reported catch has declined in recent years (Table 2).

REGULATORY/MANAGEMENT FRAMEWORKS

Kenya has no legislation that specifically pertains to sharks. However, The Fisheries Act, Cap. 378, revised in 1991, in particular provides regulations for licensing of local and foreign fishing vessels, methods of fishing including use of fishing gear, importing and exporting fish and fish products, and specifies license, permit, and registration requirements for exploitation and trade in Kenya's varied marine resources. The export fee for fish is set at 0.5% of the market price, as specified in the 2nd Schedule of the Fisheries (General) Regulations.

In addition, the Fisheries (Foreign Fishing Craft) Regulations state that fishing plans be submitted to the Director of Fisheries by the diplomatic representative of the country that has been apportioned an allowable catch. These plans must include information on where within the EEZ the craft will be fishing, the number of craft that will be fishing, their movements within the EEZ, their schedule for calling at port, and also a proposal for taking the country's apportionment from Kenyan waters. The Director of Fisheries has the power to approve, revise or suspend the fishing plan as well as the power to cancel the approval.



Shark jaws are often bought by tourists
Rob Barnett - TRAFFIC

CONCLUSIONS AND RECOMMENDATIONS

Kenya's shark fishery has a long history of exploitation. The trade in shark products in Kenya, imports, exports and re-exports, is closely linked with Kenya's neighbours, in particular Somalia, Tanzania and Yemen. While the Government of Kenya collects data on landings, imports and exports, it is evident that official statistics underestimate the actual trade levels. In addition, it is widely known that many foreign vessels retain shark bycatch, especially for shark fin.

Although the volume of trade in sharks and shark products is well below that recorded for some countries, this resource is an important one for Kenya. Dried and salted shark meat is an important source of protein for the local population. Furthermore, the export of shark products provides both income to traders and duty to the Government.

Given the importance of the fishery, more effort be put into collection of statistics, as well as plans to manage the resource. Such management should include enforcement of fishing regulations in the offshore areas where illegal fishing has been observed. In addition, it would seem prudent at this stage to conduct a resource assessment of the elasmobranch resource, as this resource is valued not only locally as a source of food, but also as a source of foreign exchange.

Dried shark fin being graded for size and quality before auction
Rob Barnett - TRAFFIC

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THE SHARK TRADE IN MAINLAND TANZANIA AND ZANZIBAR

Rob Barnett

INTRODUCTION

Tanzania has an area of some 945 087 km^2 and a human population of more than 23 million, of which 2.5 million are estimated to be either directly or indirectly involved in fishing related activities (Beare *et al.*, 1991).

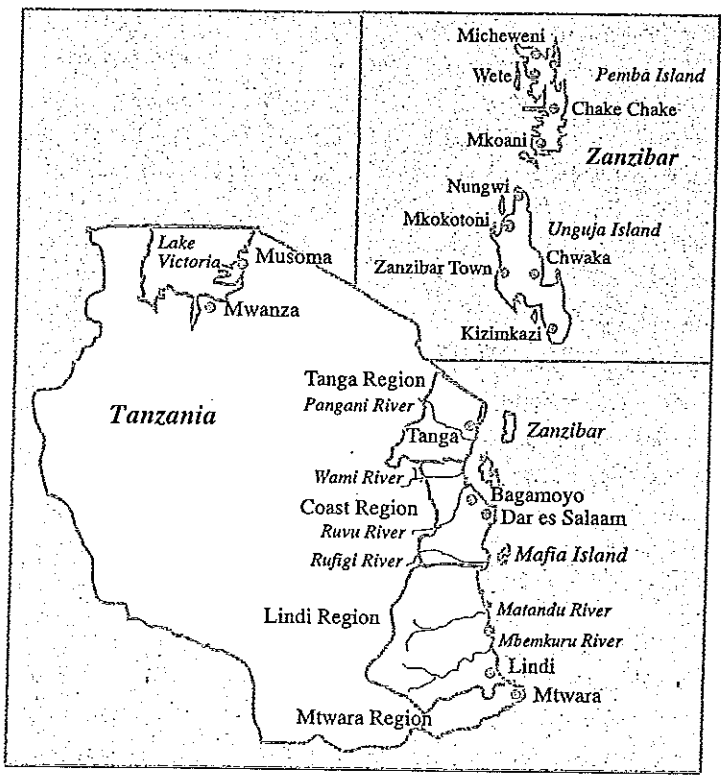
The coastline of mainland Tanzania extends for some 800 km of which about two-thirds has fringing reefs, often close to the shoreline, broken by river outlets such as the Rufigi delta (Lundin, 1992). The continental shelf is narrow, varying from approximately 3.2 nm wide to a maximum of 34.5 nm in areas around Mafia, Unguja and Pemba Islands, and is estimated to cover an area of 19 000 km^2. Beyond the coastal zone the continental shelf drops rapidly to depths of over 300 m (Anon., 1989a). Grounds suitable for trawling are found adjacent to the mouths of the five main rivers (Pangani, Wami, Ruvu, Rufiji and Ruvuma) and within the Zanzibar Channel (Nhwani, 1987). The territorial sea is estimated to be 64 000 km^2, while the EEZ is estimated at 223 000 km^2 (Rumisha, 1995).

Zanzibar, comprising the islands of Unguja and Pemba, was united with Tanzania in 1964, but still retains its own parliament and government. The total land area of the islands is 2 450 km^2 and the population was 640 578 in 1990. The islands are separated from the mainland by a wide channel of about 22 miles (Omar *et al.*, 1995).

Mainland Tanzania and Zanzibar are affected climatically by two monsoons which have an impact on the seasonal aspects of fisheries. The south east monsoon (April-October) season consists typically of strong southerly winds, cool air temperatures and rough seas. In contrast, the northern monsoon season (November-March) is characterised by higher air temperatures, low wind speeds, and consequently calmer seas. The inter monsoon seasons are associated with heavy rains in March but less rain in October (Horrill and Ngoile, 1992).

HISTORICAL OVERVIEW

In the past, sharks were exploited for their liver oil used in the maintenance of fishing vessels, and for their meat, which has been eaten locally by artisanal fisherman in fresh and dried form for centuries. Past records show that traditionally, only people from coastal areas consumed marine fish, and that in the northern central plains of mainland Tanzania nomads were traditionally meat eaters. Surveys conducted in Dar-es-Salaam show that habits are changing and that people from "up country" are now consuming marine fish including shark (Kamulaka, 1984).



The commercial trade in shark fin is reported to have begun in Tanzania in the 1960s, when the market was monopolised for two decades by four Far Eastern businessmen in Dar-es-Salaam, and three in Zanzibar. During the past five years, the shark fin industry in Tanzania has experienced a large increase in the numbers of fin traders operating. The increased competition for fin amongst traders has

resulted in a corresponding increase in the local price of shark fin. At present, local prices for fin are approximately 70% higher than they were five years ago (M. Salum, B. Young, J. Kiza, pers. comm., 1996).

Due to the strong cultural and trading links between Zanzibar and Kenya, much of Zanzibar's export trade in shark fin and meat has traditionally passed through Kenya's port city of Mombasa. In the past, most of the shark fin being traded in Zanzibar originated from the many Arab state fishing trawlers that used to call at Zanzibar port. With no trading mechanisms in place in their own countries fishing trawlers used Zanzibar as the principal market for their shark fin (K. Wong, pers. comm., 1995).

CURRENT FISHERIES

FAO fishery statistics for Tanzania's total shark, ray and skate catch in 1992 totalled 18 532 mt (Anon., 1992a).

1. Artisanal

In Tanzania marine fisheries are still mainly artisanal (Anon., 1989a). Marine fish output contributes about 15% of the total fish production in the country with the rest coming from inland fisheries. In mainland Tanzania, marine fish catches have been fluctuating between 36 000-56 000 mt annually over the past five years of which more than 96% is contributed by small-scale fisheries (Rumisha, 1995). The number of artisanal fishermen in mainland Tanzania in 1993 was estimated to be 15 027 and the number of fishing vessels 3 232 (Tanzania Mainland Fisheries Division, *in litt.*, 1996).

Table 1
Tanzania Mainland and Zanzibar annual marine production in mt by region, 1989-1994

Region	1989	1990	1991	1992	1993	1994
Mainland Tanzania						
Tanga Region	5 440	5 544	4 187	4 187	4 855	n/a
Coast Region	10 998	16 499	12 631	10 659	8 609	n/a
Dar Region	15 256	14 557	15 451	16 502	14 867	n/a
Lindi Region	8 042	9 886	12 071	6 378	3 270	n/a
Mtwara Region	7 407	8 039	8 039	4 455	2 623	n/a
Industrial Production	2 437	2 015	1 510	1 119	1 222	n/a
Other Marine Production	659	237	451	584	1 235	n/a
TOTAL Marine Production	**50 239**	**56 777**	**54 340**	**43 884**	**36 681**	**n/a**
Zanzibar						
Unguja South	n/a	1 245	1 196	1 236	1 390	3 257
Unguja North	n/a	1 588	2 189	3 948	2 059	1 653
Unguja Urban	n/a	3 988	2 713	3 904	3 824	4 093
Pemba North	n/a	1 169	1 041	1 215	1 212	1 358
Pemba South	n/a	898	860	1 478	924	740
TOTAL Marine Production	**n/a**	**8 888**	**7 999**	**11 781**	**9 409**	**11 101**

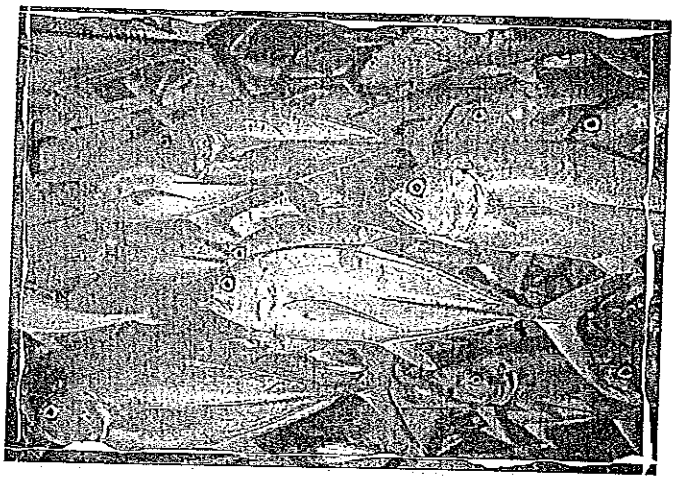
Source: Anon., 1989c; Anon., 1990; Anon., 1991; Anon., 1992b; Anon., 1993; Omar *et al.*, 1995.

The ocean is an important source of income to Zanzibar, with about 30 000 people depending on fisheries related activities as their main source of protein and income (Omar *et al.*, 1995). In 1989, the number of artisanal fishermen in Zanzibar was estimated to be 15 500 with at least another 2 000-2 500 distributors and sellers of fish (Anon., 1989b). Fishing vessel numbers were estimated at 4 272 in 1989 (Hoekstra, 1990). In mainland Tanzania and Zanzibar the fishing effort has not changed significantly over the past five years with the exception in Zanzibar of the purse seine and scoop net small pelagic fishery switching from sail powered vessels to motorized boats in Zanzibar town (Omar *et al.*, 1995).

Artisanal fishermen use traditional craft (mostly non-motorised) and simple fishing gears (Sanders, 1990). Almost all fishing vessels in mainland Tanzania and Zanzibar are locally made and range in size from 4-10 m. The most common fishing vessels are dugout canoes. Dugout canoes with outriggers are known locally as "*ngalawa*", and those

without are known as "*mtumbwi*". The most common means of propulsion is by oar, pole or sail. The larger "*dhow*" and "*mashua*" are usually wooden planked and sometimes motorised. The most common vessel used in Tanzania is the *ngalawa* because it is cheaper than the *mashua* and relatively more efficient than the *dhow* or *mtumbwi*. The fishing gears commonly used are lines (troll line, handline and longline), traps (fixed and moveable), nets (purse seine, scoop, drift gillnets, demersal gillnets with small and large mesh, shark nets and surrounding gill nets), spear gun and iron harpoons (Jiddawi *et al.*, 1992).

The main groups of fish caught by artisanal fisherman in Tanzania are the demersal fish (bream, parrotfish, snappers, mullet, emperors, groupers, etc.), which are caught with lines, traps and nets, and the small pelagic fish (sardines, mackerel, anchovies, etc.) caught with purse seine nets, surrounding nets, scoop nets, and the large pelagic fish (tuna, kingfish, sailfish, marlin, shark and ray, etc.) caught by lines, drift gillnets, demersal gillnets and shark nets.. Other species caught include octopus, squid, prawn and lobster (Omar *et al.*, 1995).



School of Jacks
David Obura

With the exception of Dar-es-Salaam, the fishing communities exist in many small villages scattered along the entire Tanzanian mainland coastline. Fishing takes place almost entirely within the near shore waters to depths of 40 m, although sometimes there is handlining to 60 m depth on the upper edge of the continental shelf (Nhwani, 1987). The area along the mainland coast available to the artisanal fishery was estimated at over 12 000 km^2 by Wijkstrom (1987), regionally divided into Tanga (2 200 km^2), Coast including Dar-es-Salaam (8 100 km^2), Lindi (1 550 km^2) and Mtwara (310 km^2).

In Zanzibar, artisanal fishing is undertaken along the entire coastline of both islands within 2 km of the shore, where the areas are protected by coral reef barriers, and the water depths are not more than 20 m. Some fishing occurs in depths of 100 m and more in the case of drift gillnetting and large pelagic fishing, although this is on a smaller scale and is undertaken by the larger boats such as *dhows* (Sanders, 1990). As the main propulsion for the fishing boats is wind, the fishing areas protected by the coral reef barriers are the only places where it is possible to fish all the year round, but with the limitation of the tides, the fishermen can only operate for 12 hrs per day (Omar *et al.*, 1995). The total area available to artisanal fishermen is estimated at 4 001 km^2, divided into 1 279 km^2 for Unguja and 2,722 km^2 for Pemba islands (Anon., 1989b).

i. Directed Shark Fishery

A directed shark fishery has been present in Tanzania for centuries. However, this fishery is limited by the small size of fishing vessels. In both mainland Tanzania and Zanzibar, the fishing fleet consists predominantly of *mtumbwi* and *ngalawas*, which numbered 3 556 out of a total of 4 233 vessels in 1989 (Hoekstra, 1990). National economic constraints have led to an acute shortage of foreign currency in Tanzania that has limited not only the quantity but also the quality of available fishing gear and engines, with the result that traditional fishing gear is still in large-scale use (Jiddawi *et al.*, 1992).

In addition, the directed shark fishery in Tanzania is seasonal. Shark fin exporters and artisanal fishermen report that in mainland Tanzania significant quantities of shark are only caught for nine months of the year when wind strengths are sufficient for the traditional sail-powered vessels (A. Kunya, B. Young, J. Kiza, pers. comm., 1996). In Zanzibar, shark fishing in both Unguja and Pemba Islands is even more seasonal in that substantial quantities of sharks are only caught from February through May. For the rest of the year only small quantities of shark products find their way to

the markets (C. Karibhai, H. Boss, pers. comm., 1996). This seasonal aspect of shark fishing reflects heavily on the artisanal directed shark fishery in that for a proportion of the year sharks are not solely targeted for fishing, but form a welcome benefit if caught during off season periods.

Fishing gears used in the artisanal directed shark fishery consist mainly of large mesh (usually over 13 cm) entanglement/gillnets ("*jarife*") referred to as shark nets, and longlines ("*cocho*") (Darwall, 1995). In addition, drift gillnets and demersal gillnets ("*nyavu*"), which generally have mesh sizes of 2-11 cm are reported to catch significant numbers of shark, although this type of fishing gear is not generally used in the directed shark fishery. Bwathondi *et al.* (1988) report that smaller mesh drift gillnets and demersal gillnets yield smaller catches than the larger mesh shark nets because they are generally used in shallow waters where fish stocks have been over-exploited. Shark nets are usually set in deeper waters and target larger fish such as sharks.

In Zanzibar, the large mesh shark net ("*jarife*") with mesh sizes of up to 40 cm have traditionally been used to catch rays, sharks and turtles. Smaller mesh nylon gillnets with mesh sizes of 13-15 cm ("*nyavu*") were introduced in the late 1960s and have greatly increased in popularity since then (Tarbit, 1984).

In general, shark nets consist of 45 m and 120 m long sections made from 36 ply twine with a mesh size of 13-30 cm. A typical length for a shark net is 240 m, but nets have been known to be as long as 1 km. *Mashuas* are the main vessel type that are used with this form of fishing, which takes place at neap tides in waters ranging in depth from 10-30 m. If fishing in waters of greater than 30 m depth, the net becomes too heavy to pull back into the boat. The nets are strung with a hanging ratio of 45-50% and are laid perpendicular to the main current. The depth of net is usually 5 m. Once set, the net forms a vertical wall for trapping and entangling sharks.

Longlines consist of lengths of rope measuring 80-100 m with 8-12 half metre lengths of chain attached at approximately 10 m intervals. The half metre lengths of chain are hooked and baited. The hooks measure 5 cm perpendicular distance from shaft to tip and moray eel are favoured as bait, although turtle and dolphin have also been known to be used. Longlines are set much the same as shark nets with the lines being placed perpendicular to the main current (Darwall, 1995).

The high demand for fresh and dried shark meat in Tanzania together with high prices and export markets for shark fin has resulted in a substantial artisanal directed shark fishery. The main species of sharks being caught regularly are as follows:

Silky Shark (*Carcharhinus falciformis*): found over continental shelf areas;

Silvertip Shark (*Carcharhinus albimarginatus*): usually found near offshore banks but also comes into shallow inshore waters and has been taken over deep water near offshore banks and islands;

Hardnose Shark (*Carcharhinus macloti*): occurs in shallow water;

Blacktip Reef Shark (*Carcharhinus melanopterus*): a roving scavenger of coral reef areas, often occurring in less than 1m;

Sandbar Shark (*Carcharhinus plumbeus*): shallow coastal waters;

Blackspot Shark (*Carcharhinus sealei*): often found in less than 40m of water;

Blacktail Reef Shark (*Carcharhinus wheeleri*): juveniles in shallow inshore waters, adults usually in deeper waters of 80m;

Milk Shark (*Rhizoprionodon acutus*): Up to 50m inshore;

Whitetip Reef Shark (*Triaenodon obesus*): inhabitant of coral reef areas;

Scalloped Hammerhead (*Sphyrna diplana*): in/offshore;

Great Hammerhead (*Sphyrna mokarran*): confined to coastal and offshore continental and insular waters, from the intertidal and surface, down to at least 275m. None are benthic, deepwater or oceanic in habitat;

Giant Guitar Fish (*Rhynchobatus djiddensis*): inshore.

Source: Smith and Heemstra, 1986; Bianchi, 1987.

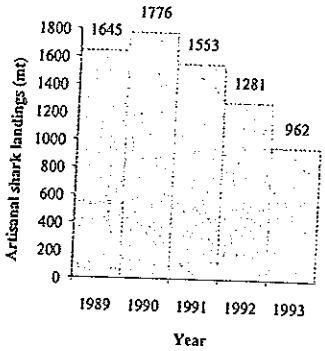
a. Tanzania Mainland

The numbers of shark nets, longlines and drift gillnets together with annual shark landing figures for each region of mainland Tanzania from 1989 to 1993 are shown in Tables 2 and 3.

Table 2

Tanzania Mainland annual artisanal shark landings in mt, 1989-1993

Artisanal Shark Landings	Tanga Region	Coast Region	Dar-es-Salaam	Lindi Region	Mtwara Region	TOTAL
1989	272	335	75	540	423	1 645
1990	206	296	92	578	604	1 776
1991	218	326	194	291	504	1 533
1992	218	472	225	83	283	1 281
1993	n/a	n/a	n/a	n/a	n/a	962



Source: Anon., 1989c; Anon., 1990; Anon., 1991; Anon., 1992b; Anon., 1993.

Table 3

Tanzania Mainland numbers of gillnets, shark nets, longlines and vessels by region, 1992

Fishing Gears in 1992	Tanga Region	Coast Region	Dar-es-Salaam	Lindi Region	Mtwara Region	TOTAL
No. Gillnets	777	839	438	679	655	3 388
No. Shark Nets	584	739	923	267	914	3 427
No. Longlines	59	128	2	-	4	193
TOTAL	1 420	1 706	1 363	946	1 573	
Vessel Nos. in 1992						
Dhow	126	56	n/a	61	94	342
Mashua	117	104	n/a	31	423	675
Ngalawa	459	382	n/a	229	7	1 077
Mtumbwi	245	390	n/a	266	316	1 217
TOTAL	947	932	577	592	840	3 311

Source: Anon., 1992b.

Bwathondi *et al.* (1988) reported that there is a direct correlation between the numbers of shark nets, longlines and gillnets with the overall fish landings in a region. The above data suggests that this is also the case with shark landings. Using 1992 data from Table 2 for annual shark landings and from Table 3 for number of shark fishing gears per region, it can be seen that the Mtwara and the Coast regions yield the highest annual shark landings, which corresponds to those regions having greater numbers of shark fishing gear.

Surveys undertaken in Mafia Island Marine Park by Frontier Tanzania in 1995 revealed the presence of a large directed artisanal shark fishery. Within the Marine Park (approximately 300 km^2), it was found that 70% of all *mashua* vessels and 44% of all *dhow* vessels were actively involved in shark fishing, using shark nets and longlines to target sharks. Shark nets alone were traditionally used for directed shark fishing until the recent introduction of longlines to Mafia. Darwall (1995) reports that this new fishing method was introduced to Mafia by visiting Zanzibar traders in return for exclusive purchase rights.

As determined from catch sampling of shark nets and longlines in 1992 and 1993, sharks as a proportion of the total catch ranged from 8-26% for shark nets, and from 75-93% for longlines. Longlines were found to be much more selective for shark than the shark nets. In addition, the mean catch weights of shark per fishing trip for longlines was significantly higher than that for shark nets due to the greater weight of sharks taken by the longlines. Sharks caught by net ranged from a maximum length of 250 cm to a minimum of 58 cm, with an average weight of 9 kg, whereas sharks caught by longline ranged from a maximum length of 410 cm to a minimum of 70 cm, with an average weight of 72 kg (Darwall, 1995).

In general, fishing vessels will fish for ten days each month for nine months of the year during the shark season thus yielding 90 fishing days per annum. There were 3 427 shark nets and 193 longlines used in Tanzania in 1993 (refer to Table 3). By multiplying the mean shark catch weight (1994) per fishing trip, by the total number of longlines and shark nets by 90 fishing days fished for each fishing gear, a speculative estimate of national shark catch per annum can be reached. Annual artisanal national shark catch from shark nets is estimated at 278 mt and 274 mt for the longline fishery. These estimates do not take into consideration the 3 388 gillnets and other fishing gears in which sharks

Table 4
Mafia Island Marine Park mean catch weights of shark per fishing trip for longlines and shark nets with total annual shark catch

	1991	1992	1993	1994
Shark Net Mean Catch per Fishing Trip (kg)	1.5 kg	3.1 kg	1.8 kg	0.9 kg
Annual Sub Total	4 860 kg	10 044 kg	5 832 kg	2 916 kg
Longline Mean Catch per Fishing Trip (kg)	n/a	n/a	49.8 kg	15.8 kg
Annual Sub Total	n/a	n/a	26 892 kg	8 532 kg
ANNUAL GRAND TOTAL	4 860 kg	10 044 kg	32 724 kg	11 448 kg

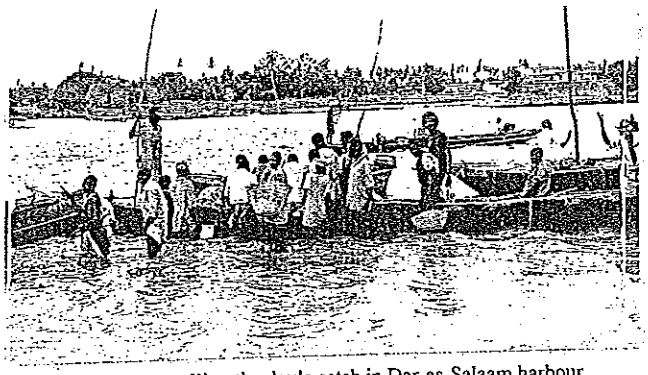
Note: Annual subtotals for each gear type calculated using 90 fishing days per year. *Source*: Darwall, 1995.

would form a percentage of catch. These fishing gears account for a significant portion of the overall catch as can be seen in Table 2 where the total annual artisanal national shark catch for the years 1989-1993 has consecutively been over 1 000 mt for most years.

b. Zanzibar

During the shark fishing season in Zanzibar, it is reported that artisanal fisherman target sharks using longlines and shark nets, and that sharks also form one of the major target species when drift gillnetting (Ho Ko Kung, pers. comm., 1996).

The annual landing statistics of sharks and rays for the islands of Pemba and Unguja are shown in Table 5 for the years 1990-1994. The data produced by the Fisheries Statistics Department can only provide a superficial idea of the real artisanal landings, due to a number of major constraints with regard to data collection. The statistics are compiled from data collected by beach recorders employed by the Sub-Commission for Fisheries. However, these staff are few in number at each landing site in relation to the activity around them and some landings are frequently missed (pers. obs., 1996).



Artisanal fishermen selling the day's catch in Dar-es-Salaam harbour
Rob Barnett-TRAFFIC

In addition, a great deal of shark products are transported to the Tanzanian mainland and to Kenya without being recorded. With the many vessels trading between Zanzibar and the Tanzanian mainland and the traditionally strong trading and cultural links with Mombasa, the government is unable to regulate effectively the passage of goods due to a shortage of economic resources and manpower. The official landings data should be regarded as a minimum figure with the likelihood that the true figure is much higher.

The annual landings of sharks and rays have increased significantly since 1990, although the long term trend cannot be ascertained due to the lack of data prior to 1990. The exceptional increase seen for 1994 of nearly 940 mt was apparently due to a catch of 656 mt in North A Region. The

reasons for this increase are hard to substantiate without further information or data for the following year.

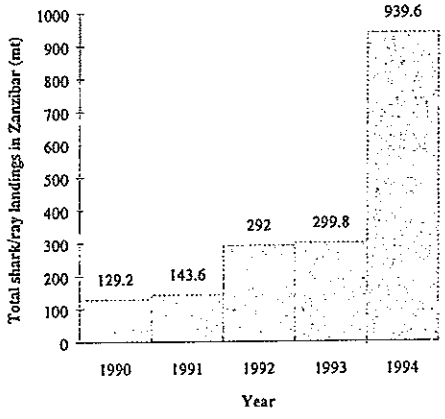
The proportion of shark versus ray attributed to Zanzibar official landings statistics cannot accurately be determined. During 1974-1976, the East African Marine Fisheries Organisation (EAMFRO) collected data from three major landing sites where the fishing effort concentrated on the shallow waters of the Zanzibar Channel, the northern entrance of the Zanzibar Channel (Mkokotoni); and the shallow mangrove-lined bays of the east coast of Zanzibar (Chwaka). These three environments were representative of much of the available inshore fishing area in Zanzibar (Tarbit, 1984). Significant catches of shark and ray occurred only in the Mkokotoni area of the Zanzibar Channel. It was found that rays represented 13% and sharks 6.9% of the species landed at Mkokotoni (Tarbit, 1976). From these rather dated findings it can be seen that rays could represent the majority of the annual landings in the Zanzibar Official Fisheries Statistics which categorises sharks and rays together.

Taking the average reported annual shark/ray landings during 1990-1994, it can be seen that Unguja Island produces on average 321 mt per annum in comparison to Pemba Island which produces 52 mt per annum. The North A and Urban (Zanzibar Town) regions of Unguja produce significantly higher average quantities in shark landings than other regions on Unguja and Pemba Islands. Vessel and fishing gear type and numbers by region for Unguja and Pemba Islands are detailed in Tables 6 and 7. The data show a correlation between the regions with high shark/ray annual landings and the numbers and type of vessels and fishing gear used in the region.

Table 5
Zanzibar (Unguja and Pemba Islands) annual shark/ray landings per region in mt for the years 1990-1994

	UNGUJA ISLAND						PEMBA ISLAND				
Shark/Ray Landings	South	West	Central	Urban	North A	North B	Wete	Micheweni	Chake	Mkoani	TOTAL mt
1990	10.6	0.8	18.6	31.4	25.6	6.2	4	17.8	7.3	6.5	129.2
1991	3.3	1.9	2.1	45.9	38.7	5.1	10	16.9	11.7	7.6	143.6
1992	20.9	9	36.4	88.3	135.3	1.7	n/a	n/a	n/a	n/a	292
1993	7.3	15	40	95.7	83.4	4.4	12.8	29.3	n/a	11.6	299.8
1994	18.9	15.9	33.4	151	656.1	1.3	19.6	32.6	8.5	1.9	939.6
Average	12.2	8.5	26.1	82.5	187.8	3.7	11.6	24.1	9.2	6.9	

Source: Omar *et al.*, 1995; Jiddawi, 1990; Hoekstra *et al.*, 1990.



The North A Region of Unguja Island contains by far the highest number of *dhows*, demersal large mesh gillnets and longlines in comparison with the other regions of Unguja and Pemba Islands. These types of fishing gear are used for directed shark fishing and would suggest that they are the reason for the North A region producing the highest yields in shark/ray landings. The Urban (Zanzibar town) region has the second largest annual shark/ray landings, and corresponding to this has the second highest number of larger vessels, specifically *mashuas* with outboard motors (Jiddawi, 1990). Drift gillnets comprise the main fishery gear type used by the *mashuas* (83.3%) in the Urban region (Hoekstra, 1990). The target species are reported to be skipjack, kingfish, yellowfin tuna and sharks.

In areas such as North A Region and Urban Region (Zanzibar Town) on Unguja Island, fishermen invest by default in shark fishing gear such as large mesh demersal gillnets, drift gillnets and longlines, as the fishing grounds they use in the Pemba Channel and the types of boats they operate (*dhows*) accommodate the use of these fishing gears for other main target species such as mackerel, skate, tuna and large pelagics. For most of the year these deep water species from the Pemba Channel generate income which pays for the operation of the larger vessels. However, during the

four months of shark season these vessels and fishing gears can be used for specifically targeting sharks with resulting high economic returns.

Table 6
Zanzibar (Unguja and Pemba Islands) number of fishing units by main shark fishery gear type for each region in 1989

UNGUJA ISLAND							PEMBA ISLAND				
Region	South	West	Central	Urban	North A	North B	Wete	Micheweni	Chake	Mkoani	TOTAL
Fishing Gear No's. 1989											
Troll Line	14	4	3	23	10	51	7	4	11	72	199
Longline	280	163	85	19	216	242	125	178	213	290	1 811
Drift Gillnet	11	11	28	39	78	2	6	2	3	5	185
Small mesh Dem/Gillnet	65	11	33	5	52	7	44	120	13	49	399
Large mesh Dem/Gillnet	13	6	12	0	47	1	24	13	9	27	152
TOTAL	383	195	161	86	403	303	206	317	249	443	2 746

Source: Omar *et al.*, 1995; Jiddawi, 1990; Hoekstra *et al.*, 1990.

Table 7
Zanzibar (Unguja and Pemba Islands) number of vessels by type for each region in 1989

UNGUJA ISLAND							PEMBA ISLAND				
Region	South	West	Central	Urban	North A	North B	Wete	Micheweni	Chake	Mkoani	TOTAL
Vessel No's. 1989											
Dhow	0	26	1	5	309	8	17	3	1	6	376
Mashua	22	25	31	86	31	12	29	5	5	34	280
Ngalawa	350	252	203	9	236	255	103	182	219	299	2 108
Mtumbwi	67	27	46	12	123	55	318	370	116	335	1 469
TOTAL	439	330	281	112	699	330	467	560	341	674	4 233

Source: Omar *et al.*, 1995; Jiddawi, 1990; Hoekstra *et al.*, 1990.

Out of a total of 4 233 fishing vessels in 1989, 2 191 were found on Unguja and 2 042 were found on Pemba (Hoekstra, 1990). However, Pemba Island has very few *dhows*, with the main type of vessels being the smaller *ngalawas* and *mutumbwis* with numbers being relatively constant throughout the regions (Jiddawi, 1990). The Micheweni region of Pemba Island contains the highest number of demersal small mesh gillnets, but average numbers of troll lines, longlines and demersal large mesh gillnets in comparison with the other regions of Pemba Island (Hoekstra, 1990). Small mesh demersal gillnets have not been known to be used for directed shark fishing, and so it is likely that this region reports the largest annual shark/ray landings for Pemba partly as a result of bycatch from using non-directed shark fishing gears.

With shark fishing being extremely seasonal, it is unlikely that fishermen would invest in shark fishing gear that could only be used for four months of the year. Most artisanal fishermen could not target the larger pelagic species in the deeper offshore waters for the eight months out of shark season that are associated with directed shark fishing gear, due to the small size of boats being used such as *ngalawas* and *mutumbwis*. It is more than likely that artisanal fishermen using smaller vessels would own fishing gears that could be used for the entire year, such as small mesh demersal gillnets which predominantly target species such as rabbitfish, emperor, parrotfish, silver biddy and goatfish, with the possibility of catching sharks during the season.

The available data for type of vessel and fishing gear suggest that high annual shark landings occur in regions where there are high numbers of larger vessels able to venture further offshore and target the larger pelagics which offer

higher economic returns (i.e North A and Urban). The fishing gears used, such as large mesh demersal gillnets, drift gillnets and longlines by their very nature target sharks when in season. Where large pelagics are not as abundant or are inaccessible to local vessels such as in Pemba, fishermen rely on targeting fish species that are available to them throughout the year so that a steady income can be earned. In areas such as Micheweni with a high natural occurrence of shark, these fishermen gain extra income through non-directed shark catch when in season (Sheha Mohammed, pers. comm., 1996).

Data gathered during 1994 on daily fish landings by the Shukrani and Fikirini fishing vessels owned by a fishing cooperative from Kigomani village in the North A region of Unguja Island give a general idea on the quantities of shark caught by the larger vessels that use large mesh demersal/drift gillnets, as is common in the North A and Urban (Zanzibar Town) regions of Unguja Island. Following the donation of a traditional fishing vessel (small *dhow/mashua*), each with an outboard engine and drift gillnets of 13-28 cm mesh by the Netherlands Embassy small project scheme, the activities of the two cooperatives were monitored by the Institute of Marine Sciences, University of Dar-es-Salaam (Richmond and Mganwa, 1994). As a condition of the donation the cooperatives were asked to record data on their daily fish landings, which included:

number of fish caught

method of fishing (net, hook/line, trap)

catch destination (sold, consumed, salted)

Unfortunately, length measurements and catch weight were deliberately not recorded so as not to overburden the fishermen at an early stage in the project.

Fishing was conducted at night, mostly during darker phases of the moon. Between 300-550 m of 13-28 cm gillnets were used to catch large pelagic species in deep waters off the reef, specifically in the southern end of the Pemba Channel. Marlin, sailfish, several species of caranx, rainbow runner, assorted tuna, sharks and rays formed the majority of directed fish catch. Table 8 shows the shark landings for both the Shukrani and Fikirini co-operative fishing vessels for March 1994 to April 1995.

Table 8
Shukrani and Fikirini Co-operative fishing vessel's shark landings for March 1994-April 1995

Month	No. of Sharks	Type of Fishing Gear	Catch Destination
SHUKRANI (130 Fishing Days)			
5/94	3	Nets	-
7/94	1	Nets	Sold
12/94	2	Nets	Sold
2/95	5	Nets	3 Eaten/2 Sold
3/95	7	n/a	Eaten
4/95	3	Nets	Eaten
TOTAL	21		
FIKIRINI (156 Fishing Days)			
5/94	2	Nets	-
8/94	1	Nets	-
10/94	2	Nets	-
11/94	5	Nets	Sold
12/94	5	Nets	Sold
2/95	3.	Nets	-
3/95	3	Nets	Sold
4/95	1	Nets	Cured
TOTAL	22		

Source: Richmond and Mganwa, 1994.

The data available from the Shukrani and Fikirini fishing boats show that an average of 145 days of fishing effort per year from small *dhow* or *mashua* type boats with large mesh gillnet fishing gear produce an average of 21 sharks. Taking an average estimate weight for a shark of 40 kg, the total estimated weight of shark caught per vessel is 0.84 mt. Table 7 shows that in 1989, 340 *mashuas* and *dhows* where operating in the North A region where the Shukrani and Fikirini vessels operated. Using the above figures this number of vessels could produce annual shark landings of 285.6 mt which is substantially higher than the 1990 annual shark landings of 25.6 mt reported for North A Region by the Zanzibar Fisheries Statistics Department. Most fishing vessels in Zanzibar are not motorised (there

were only 116 outboards/inboards in Zanzibar in 1989) as compared with the motorised cooperative vessels, and so the daily shark landings may be less. Even though the actual task of drift gillnetting does not utilise an engine, the time taken to get to the fishing grounds would be a factor in the final fish catch (Richmond and Mganwa, 1994).

In 1989, there were 656 boats of the *mashua* and *dhow* type in Zanzibar, which, based on the above figures, could potentially produce shark landings of 551 mt per annum. This estimate does not take into account the 3 556 smaller fishing boats which, although restricted to shallow coastal waters, do catch significant numbers of sharks using non-directed and directed fishing gear. Taking this into consideration, it is likely that total shark landings are significantly higher than the estimate of 551 mt per annum. Out of the 43 sharks caught, 18 sharks were sold, 13 sharks were eaten and one was cured. The fate of the fins was unfortunately not recorded. Due to the high price for fins of all sizes it can be assumed that the fins were sold to primary collectors.

ii. Bycatch in Zanzibar and Tanzanian Mainland

During the three months in mainland Tanzania and the eight months in Zanzibar where the occurrence of sharks is low, artisanal fisherman direct their effort to catching demersal and pelagic fish, in which shark bycatch forms a small but welcomed proportion of overall catch.

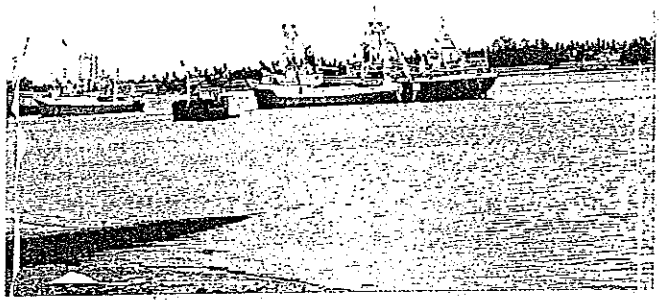
2. Commercial Fishery in Mainland Tanzania and Zanzibar

The commercial fishery of Tanzania consists primarily of the semi-industrial prawn trawl fishery.

There have been several attempts by the Government of Tanzania and the Tanzanian Fishing Corporation (TAFICO), established in 1974, to introduce a semi-industrial trawling fishery, but without much success to date (Kamulaka, 1984). In 1986, there were five trawlers engaged exclusively in the capture of fin fish. These included four owned by TAFICO and the "M/V Mafunzo" owned by the Mbegani Fisheries Development Centre. The combined catch from these trawlers was 414 mt of fin fish in 1986 (Nhwani, 1987).

As with the other TAFICO vessels, the M/V Mafunzo was equipped with a calypso trawl net having an effective horizontal "width" estimated at 25 m (van Nierope, 1987a). The catch from the M/V Mafunzo during 1986 alone was reported as 262 mt (van Nierope, 1987b). The percentage by weight of sharks and rays that contributed to the annual catch was reported to be 6.6% of the total catch. This represents an annual shark/ray catch of 17.3 mt for 1986. The fishing grounds exploited by the M/V Mafunzo covered 237 km^2 west of Mafia Island, and 172 km^2 and 305 km^2 respectively of southern and northern parts of the Zanzibar Channel (van Nierope, 1987a & b).

Fisheries Division data shows that all semi-industrial fin fish trawling vessels were out of commission by 1991, which led to a decrease in the commercial fishery total catch in the following years. After 1991, prawns were the target species for the entire remaining commercial fishery, with any accidental catch of fin fish being regarded as bycatch. From Table 10 it can be seen that no directed fin fish trawlers were operational during 1993, and that all trawlers targeted prawns. The Fisheries Division reports that this was also the case in 1994 and 1995, although commercial fish catch statistics for these years are yet to be compiled. TAFICO have temporarily directed their fishing effort to operating two prawn trawlers. However, the Government of Tanzania and TAFICO's mandate remains to encourage the semi-industrial fin fish industry, and their future success could result in added pressures on shark populations.



Prawn trawlers in Dar-es-Salaam harbour
Rob Barnett-TRAFFIC

There are no commercial fishing trawlers registered in Zanzibar and foreign fishing vessels have not used Zanzibar port for over five years. The last reported visit of foreign fishing vessels was in 1989 when three Somali-registered fishing trawlers used the Zanzibar port for a number of months (G. Jumbe, pers. comm., 1996).

The Zanzibar Fisheries Corporation (ZAFICO) is a parastatal body which was established in 1964 to develop the commercial fishery in the country. To achieve this objective ZAFICO has been empowered to enter into national and international commercial ventures for the purpose of rejuvenating the fishing industry; to develop the crustacean fishery and market with the objective of selling to foreign countries; to enhance the fish distribution system; to provide cold stores for fish preservation; and to develop fishing activities by supplying modernised fishing gear at affordable prices (Omar *et al.*, 1995).

During 1986, ZAFICO commenced sample fishing by semi-industrial vessels for large pelagics, with purse seine nets set adjacent to Zanzibar town and drift gillnets set off the west coast of Pemba Island. During the first three months of 1987 the purse seine provided 72 mt of small tuna. Off Pemba Island a fishing effort of about 350 boat days during 1986/87 resulted in landings of 10.1 mt of skipjack tuna, 13.8 mt of sharks, 6.7 mt of sailfish and 1.4 mt of other species (Jiddawi, 1987). To date, ZAFICO has only targeted the small pelagics and small tuna in coastal waters with the purse seine fishery, and has not developed any infrastructure for utilising the offshore waters in the EEZ. However the data obtained from the pilot fishing off Pemba west coast does show that a significant quantity of sharks can be caught by a semi-industrial fishery in Zanzibar.

i. Directed

No directed commercial shark fishery operates off mainland Tanzania or Zanzibar's territorial waters and the EEZ.

ii. Bycatch

Sharks form a percentage of the bycatch incurred by the semi-industrial prawn fishery operating out of Dar-es-Salaam (J. Coccinis, E. Mtoni, P. Kefalas, pers. comm., 1996). The numbers of operational prawn trawlers registered in Tanzania from 1989 to 1993, and annual total landings of prawns and fin fish bycatch are shown in Table 9.

Table 9
Number of prawn trawlers registered in Tanzania and total annual landings for the years 1989-1993

Year	No. Vessels	Total Landings
1989	21 vessels	2 437 mt
1990	16 vessels	2 015 mt
1991	19 vessels	1 510 mt
1992	15 vessels	1 119 mt
1993	13 vessels	1 222 mt

Note: Total landings consist of prawn and fin fish bycatch landings; 1993 data for four vessels unavailable.
Source: Anon., 1989c; Anon., 1990; Anon., 1991; Anon., 1992b; Anon., 1993.

Prawn trawlers operating in Tanzania during 1993 numbered 13 vessels with a total annual landings weight for prawns and bycatch of 1 222 mt. The large majority of these vessels are foreign owned but many fly Tanzanian flags (J. Coccinis, pers. comm., 1996). Fisheries Division and prawn trawler captains reported that numbers of vessels operating in 1995 had increased to 18 with the arrival of more foreign owned vessels from countries such as Australia (P. Kefalas, pers. comm., 1996). In early 1996, four large Canadian trawlers (25-50 m length) arrived at Dar-es-Salaam port with the intention of securing prawn and tuna licenses for fishing in Tanzanian waters (J. Coccinis, pers. comm., 1996). However, the Dar-es-Salaam Harbour Master reports that the occurrence of this happening is rare (G. Jumbe, pers. comm., 1996).

Prawn trawler captains report the annual bycatch of sharks as comprising approximately 2% of their total annual landings; this bycatch although landed is not recorded in any official statistics (J. Coccinis, E. Mtoni, P. Kefalas, pers. comm., 1996). For 1993, this represented 24.4 mt of shark bycatch. In terms of numbers of sharks caught, vessel captains report catching on average 15 sharks per month (135 per prawn fishing season) of which over 40% are estimated to consist of Giant Guitar Fish *Rhynchobatus djiddensis* (T. Economou, pers. comm., 1996).

The prawn fishing season lasts for nine months from March to the end of November, and trawling is permitted from 6:00 am to 6:00 pm every day. Prawn trawlers maximise their yields during this season by spending as short a time in

port as possible (usually two days) offloading fish landings, restocking and repairing vessels. The prawn trawling grounds are divided into three zones as follows: Zone 1 - Bagomoyo and North; Zone 2 - Shunga Bay to Ras Twana; Zone 3 - Boydu Island and South. Due to rivers such as the Rufigi, Zone 2 produces the highest prawn yields for the trawlers. The Fisheries Division allocates Zones to trawlers on a rotational basis to alleviate over-exploitation of Zone 2 (J. Coccinis, Limu, pers. comm., 1996).

Zones 1 and 3 are reported to produce the highest bycatch in sharks due to the deeper nature of the waters. The water depths that the trawlers operate in range from 2-8 m, which results in smaller size sharks being caught as bycatch. The fishing gear used by the trawlers consists of specialised prawn trawling nets with an average length of 38 m per trawler. The nets have a 5 cm mesh and are trawled with a 1 m ground clearance.

Commercial prawn trawlers registered in mainland Tanzania are seen regularly in the territorial waters of Zanzibar, specifically the Zanzibar and Pemba Channels (Haji, pers. comm., 1996). It is unlikely that they are fishing, but rather travelling to prawn fishing grounds on the Tanzanian coastline.

Table 10
Summary of Tanzania Mainland industrial fish production for 1993

Vessel Name	Wt of Bycatch for Fishmeal	Wt of Prawns (kg)	Total Annual Landings (kg)
Kirki	71 290	125 174	196 464
Odyseas	22 158	92 493	114 651
Spyridon	78 224	82 808	161 032
Seashore 1	101 384	78 850	180 234
Seashore 2	n/a	n/a	n/a
Mama Otan	30 709	116 285	146 994
Al-Wally	7 540	24 110	31 650
Aimilia	32 920	98 989	131 909
Arusha	n/a	n/a	n/a
Banuso 2	58 710	89 894	148 604
Banuso 3	34 640	76 566	111 206
Mama Tafico	n/a	n/a	n/a
Sadani	n/a	n/a	n/a
13 Trawlers	437 575	785 169	1 222 744

Source: Anon., 1993.

There have been reports that EEC-registered fishing trawlers are fishing in the offshore waters of Zanzibar. These boats fish for tuna and large pelagics and belong to a fleet of 54 EEC registered vessels that operate out of Mahé, Victoria in the Seychelles and fish in the Western Indian Ocean (Shah, 1994). Since 1989, Zanzibar has maintained a 200 mile EEZ, which has only been commercially utilised by foreign registered vessels such as the EEC tuna vessels operating out of Seychelles. The numbers of vessels operating in the Zanzibar EEZ cannot be ascertained as no effective government regulatory activities take place in these areas.

3. Recreational

The sport fishing industry in Tanzania is limited. The majority of vessels involved in the sport are owned by private leisure fishermen who do not operate on a commercial basis (Jensen, pers. comm., 1996). In 1995, a total of 21 vessels were registered and licensed with the Dar-es-Salaam District Office for recreational sport fishing. The majority of these vessels where based at the Dar-es-Salaam Yacht Club and belonged to non-residents. The Dar-es-Salaam Yacht Club maintains a policy of not allowing the vessels of their membership to operate commercially.

One commercial sport fisherman operates out of the Slipway, Msasani (Goodall), one operates in the Mafia Region (Ocean Safaris Ltd), one in Tanga (Kingfisher Lodge) and one in Pangani (Mashoda Game Fishing Lodge Ltd). Sport fishermen in Tanga and Pangani report a low incidence of shark catch (Mashoda, pers. comm., 1996). In the Dar-es-Salaam area, sharks are caught on a more regular basis, with fishing grounds around the Latham Island reported to have high numbers of sharks, specifically White Tip Reef Shark *Triaenodon obesus* (Jensen, pers. comm., 1996).

There is a small sport fishing community in Zanzibar that caters to the minor demand from tourists that visit the islands. Table 11 shows the sports fishing vessels that are registered in Zanzibar. There are nine sport fishing vessels registered in Zanzibar of which four are based in Kenya. These registered boats do not represent all sports fishing

boats utilising the territorial waters of Zanzibar, as many from Kenya visit the Zanzibar fishing grounds regularly without registering.

i. Directed

As determined from interviews with Tanzanian and Zanzibar sport fishermen, sharks are not targeted on a regular basis (Kingfisher, pers. comm., 1996). If a client is especially keen to catch shark, then appropriate fishing gear will be used to target sharks, but this happens very infrequently as the preferred species to be caught are the large pelagics and demersal fish species, such as black marlin, blue marlin, kingfish, wahoo, broadbill swordfish and sailfish.

Table 11
Sport fishing vessels registered in Zanzibar

Vessel Register No.	Home Port
Reg. 1106	Mombasa, Kenya
Reg. 671	Shimoni, Kenya
Reg. 0721	Mombasa, Kenya
Reg. WK 50437	Kizimkazi, Mkunguni,Unguja
Reg. WK 50438	Kizimkazi, Mkunguni, Unguja
n/a	Uroa Bay, Unguja
Reg. WMJU 720	Mizingani
Reg. KWL/SH/670	Shimoni, Kenya
Reg. WMJU 595	Malindi, Unguja

Source: Zanzibar Sub-Commission for Fisheries, *in litt.*, 1996.

ii. Bycatch

Sport fishermen reported small quantities of shark bycatch (Jensen, pers. comm., 1996). The sport fishermen interviewed maintained that sharks are rarely caught due to the use of correct fishing gear for the species that they target. They were of the opinion that only inexperienced sport fishermen regularly catch sharks accidentally.

TRADE IN MAINLAND TANZANIA AND ZANZIBAR

A domestic and regional trade in shark meat, liver oil, shark curios, and a regional and international trade in shark fins exists in mainland Tanzania and Zanzibar. The Tanzania mainland imports a small quantity of cured fish, but exports large quantities of fisheries products including crustaceans, dried sardines (dagaa), fresh fish (Nile perch), sea shells, beche-de-mer, shark fins, shark jaws, sea weed and molluscs (Mlay and Mutsekwa, 1995). The export of marine products in Zanzibar consists mainly of lobsters, beche-de-mer, shells, dried shark meat, shark fins, shark skin and sea weed (Omar et al., 1995). The demand for these products outside Zanzibar is high, but the export figures are comparatively low due to illegal unmonitored exporting, poor transport facilities and a shortage of handling facilities (Jiddawi et al., 1992).

The extent of domestic, regional and international trade in shark products is difficult to accurately estimate due to overburdened regulatory and management frameworks that have resulted from a shortage of economic and human resources within the government ministries of mainland Tanzania and Zanzibar.

1a. Shark Fin Trade in Mainland Tanzania

The commercial export of shark products from mainland Tanzania consists almost entirely of shark fins. No domestic market for shark fin could be identified during this study. Shark fin exporters are required to undertake the following procedure as prescribed by the Government of Tanzania. Firstly, an export license is required for the export of fish and fish products from Tanzania. In some cases the license classifies the specific product for export, such as shark fin, although in reality little importance is attached to having specific product licenses as long as the exporter is generally licensed for fish/produce export (Limu, pers. comm., 1996). This license is renewed every 12 months. Four forms are necessary for the export of shark fin:

Commercial Invoice - Indicates quantity, number of items and total value in foreign exchange.

CD3 Form - Indicates the value of products in foreign exchange, local currency and the bank in which payment transfer will take place. This form is a confirmation that the importer will be able to pay the exporter the contracted amount.

Customs Data Entry Form - This form contains all the information that is used in the compilation of export statistics: commodity, importer and exporter, foreign exchange price per kg, total foreign exchange value, local currency (Tsh) total value, local currency (Tsh) royalty received, tariff category, and mode of transport (i.e ship, road, air) are included on this form.

Certificate of Health - All fish/produce for export are inspected by fisheries officers at the regional level to check for quality and hygienic condition of the goods, with the aim of ensuring that all fish/produce shipments from Tanzania reach their destinations in good quality.

An export duty of 5% of the Freight on Board (FOB) value is paid at the Regional Fisheries Departments. Tanzania does not encourage the export of sea fish other than that which does not have a ready market in Tanzania, such as shark fin and beche-de-mer, as the local market more than adequately utilises the fin fish resources available. Luxury sea products such as prawns and lobster tail, which have a limited local market, are exported to earn much needed foreign currency. The Fisheries Division calculates the export duty to be paid by using the foreign exchange and local currency value shown on the CD3 form and Commercial Invoice. To ensure that foreign exchange prices given by exporters are "realistic", the Fisheries Division maintains a "Tanzania minimum prices" list for fish/produce exported from Tanzania. The official minimum prices for shark fins are given in Table 12.

The "minimum prices" presently used by the Fisheries Division are outdated, as they have not been reviewed since March 1993. However the Fisheries Division reports that they are being reviewed at present (Limu, pers. comm., 1996).

Exporters from different regions take the Commercial Invoice, Customs Data Entry Form and Certificate of Health to their Regional Customs Office for declaration and to show that they have paid the export duty to the Fisheries Division. Every month export documents for each transaction from Coast, Lindi, Mtwara, Tanga, Mwanza, Musoma, and Zanzibar regions are compiled into a monthly register at Customs Division Headquarters based in Dar-es-Salaam (Saidi, pers. comm., 1996).

Table 12
Tanzania Mainland official minimum prices (US $) for shark fins in March 1993

Products	Size	Price
Shark Fins	5-13cm	US $13 per kg
Shark Fins	13-46cm	US $23 per kg
Shark Fins	>46cm	US $27 per kg

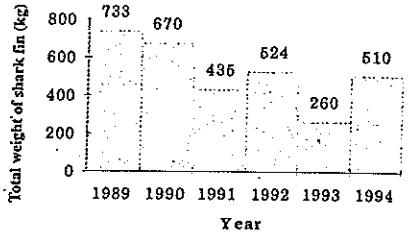
Source: Tanzania Mainland Fisheries Division, *in litt.*, 1993.

Customs have a detailed classification system for export goods which indicate tariffs. This classification system makes specific provision for shark fin under Tariff Heading 03.05., where "unskinned shark fins, and parts of shark fins which have been immersed in hot water, skinned or shredded before drying" are classified (Harmonised Customs, 1990).

Fisheries Division statistics on the export of shark fins for the years 1989-1994 are shown in Table 13.

Table 13
Tanzania Mainland official statistics for the export of shark fin, 1989-1994

Years	Products	Total Weight (kg)	Average Price Value/kg (US $)
1989	Shark Fin	733	US $6
1990	Shark Fin	670	US $6
1991	Shark Fin	435	US $11
1992	Shark Fin	524	US $11
1993	Shark Fin	260	US $6
1994	Shark Fin	510	US $10



Source: Tanzania Mainland Customs Division Headquarters, *in litt.*, 1996.

The primary destinations for the above shark fin exports were Hong Kong, Singapore and Thailand. During 1994, there were only three separate shipments of shark fin, one to Hong Kong and two to Thailand. One shipment to Hong Kong consisted of 90 kg of shark fin valued at US $27 per kg resulting in a total FOB value of Tsh 1 225 327 (or US

$2 430 at prevailing exchange rates), in which Tsh 61 266 (or US $122) was paid in duty. It can be seen that when shipments are classified correctly as shark fins, exporters are paying 5% on the correct official minimum prices as in the example above where the exporter paid duty on the top official minimum price per kg of shark fin. Table 13 shows that in general exporters paid duty on an average minimum price of US $10 per kg of shark fin in 1994, which is less than the official minimum price of US $13 as indicated in Table 12. Shark fin exporters are able to obtain a lower minimum price per kg of shark fin than is officially authorized even when they follow correct export procedures.

However, shark fin traders report that the correct exporting procedure is rarely adhered to, and that loopholes existing in the system are easily exploited to the economic benefit of exporters and importers. Shark fin dealers specify that almost all exports of shark fin are classified as "fish offal" so that an export duty of 5% is paid on a shipment that is valued at only $2 per kg (as per official Fisheries Division "minimum prices"), instead of the correct $13-27 per kg. The Customs data for the export of shark fins and fish offal during six months July 1994-January 1995 is shown in Table 14.

Through the analysis of Tanzania Mainland Customs Data Entry (CDE) forms for all shipments of shark fin and fish offal during the period January 1994-January 1995, and through enquiries made to industry sources, 11 shark fin exporters were identified. Through interviews and informal discussions held with "fish offal" exporters identified from Customs Data Entry Forms, it was determined that the majority traded in only two products - *beche-de-mer* and shark fin. *Beche-de-mer* is classified as "beche de mer" when exported, and in many cases is included on the same Customs Data Entry (CDE) form as "fish offal" consignments, indicating that *beche-de-mer* and fish offal exporters are one and the same (refer Table 11, where bold indicates *beche-de-mer* classified consignment is included with fish offal classified consignment on the same CDE form). Exporters of *beche-de-mer* value their shipments at US $1.50 per kg and therefore are paying less duty than if they were classifying their *beche-de-mer* as fish offal with a minimum price of US $2 per kg. The logical conclusion is that exports classified as "fish offal" from these traders are likely to represent shark fin.

Out of the nine "fish offal" exporters interviewed, two traded in fishmaws (swim bladders of Nile perch) in addition to *beche-de-mer* and shark fin, although the quantities of fishmaws exported could not be determined. Fishmaws originate from Lake Victoria and the lesser freshwaters of Tanzania, and are processed for export in the Musoma and Mwanza regions. The Fisheries Division maintains that all fishmaws are exported through Kenya rather than Dar-es-Salaam due to better and faster road connections, and this is reflected in the Customs Monthly Export Registers for Musoma and Mwanza. Even so, it was determined that some fishmaws are exported from Dar-es-Salaam and could be classified as fish offal, as the official Fisheries Division minimum prices for fishmaws are US $5 per kg, compared to US $2 per kg for fish offal. No other fish produce traded by fish offal exporters, other than fishmaws, *beche-de-mer* and shark fin were identified that could be classified as "fish offal" when exported.

Table 14 shows that tariff headings used for export of fish offal were 03049000 - "other fish meat, unaffected by presence of minor bones"; 03079900 - "Other"; 05119990 - "Other animal products unfit for human consumption". Common sense dictates that shark fin could be classified as fish offal, and it is not general knowledge within Tanzania that shark fins are a high value consumable delicacy, which may explain the ease in which exporters are able to classify their fins as non-edible/edible offal with fisheries and customs officers approval.

It is likely that the export in fish offal consists of shark fin and fishmaws, but relative proportions of the trade cannot be accurately estimated. However, it is probable that the majority of exports in shark fin are classified as fish offal which would explain the low quantities of shark fin export recorded in the official statistics presented in Table 13.

The cost savings made by exporters by classifying shark fin as offal are high. For example, the export of 2 mt of top grade shark fin with an official minimum price of US $27 per kg would result in payment of US $2 700 in export duty. This in itself is a substantial saving in comparison to the real local market values of approx US $60 per kg of top grade shark fin, in which a consignment of 2 mt would result in payment of US $6 000 in export duty. However,

Table 14

Tanzania Mainland Customs data for export of fish offal for six months, July 1994-January 1995

Month (C/D/E No.)	Commodity	Tariff Heading	Weight (kg)	Declared Value (US $/kg)	FOB Value (US$)	Export Duty (US$)	Destination
1/95 No.045	Fish Offal	03079900	1 200	$2/kg	1 243 200	62 160	Hong Kong
No.256	Fish Prod.		5 035	$2/kg	4 486 316	229 093	Hong Kong
No.428	Fish Offal	05119190	3 000	$2/kg	3 143 036	157 152	Hong Kong
No.605	Fish Offal	03032900	4 400	$2/kg	4 654 459	232 720	Thailand
12/94 No.192	Fish Offal		2 130	$2/kg	2 212 427	110 621	Hong Kong
No.65	**Fish Offal**	05119190	1 400	$2/kg	1 460 439	730 022	Hong Kong
No.259	**Fish Offal**		2 920	$2/kg	4 053 272	202 663	Thailand
No.417	**Fish Offal**	05119190	1 800	$2/kg	1 861 196	93 059	Hong Kong
No.401	Fish Offal	05119900	2 300	$2/kg	2 376 617	118 830	Hong Kong
No.603	**Fish Offal**	05119900	5 940	$2/kg	6 137 873	306 893	Hong Kong
No.616	**Fish Offal**	05119900	1 600	$2/kg	1 653 299	82 664	Singapore
No.659	**Fish Offal**	05119190	2 655	$2/kg	2 753 174	137 658	Hong Kong
No.629	**Fish Offal**	03032900	4 000	$2/kg	4 147 909	207 395	Thailand
No.732	**Fish Offal**		4 100	$2/kg	2 177 652	108 882	Hong Kong
No.734	Fish Offal		4 200	$2/kg	2 177 652	108 882	Hong Kong
11/94 **No.214**	**Fish Offal**		1 500	$2/kg	1 560 000	127 560	Hong Kong
No.215	**Fish Offal**		2 000	$2/kg	2 080 000	104 000	Hong Kong
No.292	**Fish Offal**		2 000	$2/kg	2 081 440	104 072	Hong Kong
No.315	**Fish Offal**		4 140	$2/kg	4 305 600	215 280	Thailand
No.345	**Fish Offal**	03079900	1 530	$2/kg	1 623 850	81 193	Hong Kong
No.636	**Fish Offal**	05119990	2 140	$2/kg	2 232 386	111 619	Hong Kong
10/94 No.027	Sea Prod.		3 330	$2/kg	2 210 250	110 513	Singapore
No.094	Fish Offal	05119190	1 780	$2/kg	1 833 400	91 670	Hong Kong
No.108	Fish Offal	05119990	2 100	$2/kg	2 207 100	110 355	Hong Kong
No.298	Fish Offal	05119190	2 100	$2/kg	2 179 010	110 602	Hong Kong
No.330	Fish Offal		3 200	$2/kg	3 320 397	166 019	Singapore
No.345	Fish Offal	05119190	2 300	$2/kg	2 386 535	119 326	Hong Kong
No.359	Fish Offal	05119190	1 620	$2/kg	1 680 951	84 047	Hong Kong
No.581	**Fish Offal**		1 600	$2/kg	1 680 000	84 000	Hong Kong
No.582	Fish Offal		2 100	$2/kg	2 230 /06	111 545	Hong Kong
8/94 **No.36**	**Fish Offal**	05119990	2 200	$2/kg	2 270 400	113 520	Hong Kong
No.264	**Fish Offal**		5 095	$2/kg	5 222 375	261 118	Hong Kong
No.271	**Fish Offal**		3 600	$2/kg	3 690 000	184 500	Singapore
No.304	**Fish Offal**		1 400	$2/kg	1 416 800	70 840	Hong Kong
No.305	Fish Offal		2 220	$2/kg	2 248 469	112 423	Thailand
7/94 No.13	Fish Offal	03049000	1 725	$2/kg	1 782 191	89 110	Hong Kong
No.80	**Fish Offal**		2 550	$2/kg	2 652 000	132 600	Hong Kong
No.377	**Fish Offal**		1 800	$2/kg	1 818 000	90 900	Hong Kong
No.381	**Fish Offal**		2 100	$2/kg	2 152 500	107 625	Singapore
No.394	**Fish Offal**		4 935	$2/kg	5 058 375	252 918	Hong Kong

(Exchange Rates: 1994 - Tsh 504:US $1. 1995 - Tsh 600:US $1) *Note*: Bold indicates *beche-de-mer* (a marine invertebrate, also known as sea cucumber, belonging to the phylum Echinodermata) classified consignment is included with fish offal classified consignment on the same CDE form). *Source*: Tanzania Mainland Customs Division Headquarters, *in litt.*, 1996.

by classifying shark fin as offal, exporters would pay an export duty of only US $200 for a 2 mt shipment of goods valued at US $2 per kg. This represents a tiny proportion of the correct export duty payment.

The fin dealers interviewed, which represented only a proportion of total numbers, reported exports totalling approximately 5 mt per month. This equates to 45 mt annually in comparison to official statistics of approximately 0.5 mt per annum. In comparison, fish offal exports for 1994 were 177 mt (Tanzania Mainland Fisheries Division, *in litt.*, 1996).

When traded, shark fins are categorised as "black" or "white", depending on which species they derive from. Black fins are derived mainly from the *Carcharhinus* species and one set comprises four pieces, two pectoral, one dorsal and a caudal fin. White fin derives solely from the Giant Guitar Fish, and one set comprises of only three fins, two dorsal and a caudal fin. The batoid pectoral fins of this species are not used due to the absence of any cartilaginous strands.

A fairly well organised structure exists for the trade in shark fins that stretches to all coastal regions of mainland Tanzania. Dar-es-Salaam acts as the centre for shark fin trade in mainland Tanzania and receives fins from Tanga, Coast, Dar-es-Salaam, Lindi and Mtwara regions.

Wet shark fins are brought in by the fishermen to fish markets or landing sites on a regular basis, depending on the season, and are usually sold at auction where primary collectors bid for the black and white wet shark fin. As with all auctions, the price varies due to supply and demand interactions and with the shark fishing seasons, but from one sample auction the following quantities and prices of fins were being purchased:

Table 15
Sample auction of quantities and prices of wet shark fins purchased

Black Shark Fin (20-41 cm)	Wet 14 kgs - Tshs 200 000 (US $25.50 per kg)
White Shark Fin (20-41 cm)	Wet 8 kgs - Tshs 150 000 (US $33.50 per kg)

(Exchange Rate: February 1996 - Tsh 560:US $1).
Source: Dar-es-Salaam Banda Beach fish market shark auction, pers. obs., February 1996.

Primary collectors dry the fins and when sufficient quantities are at hand, they travel to Dar-es-Salaam to sell them to exporters. The primary collectors do not remove excess meat with a moon cut (local term commonly used for moon cut in Tanzania is a monk cut) in the hope that extra weight can be sold to fin exporters, which results in a continuous argument between primary collectors and exporters. Currently shark fin exporters categorise and purchase fins according to size (see Table 16).

Table 16
Category and purchase prices (US $) per kg of dried shark fin offered by Tanzania Mainland exporters

Category	Size	Price (US $/kg) Black fin	Price (US $/kg) White fin
A	41 cm >	US $53.60 - 62.50	US $80.40 - 89.30
B	33-38 cm	US $35.70 - 53.60	US $62.50 - 80.40
C	25-30 cm	US $26.80 - 35.70	US $44.60 - 62.50
D	20-23 cm	US $17.90 - 26.80	US $26.80 - 44.60
E	15-18 cm	US $14.30 - 17.90	US $17.90 - 26.80
F	8-13 cm	US $8.90 - 14.30	US $14.30 - 17.90
Mix	< 8 cm	US $8.90	US $14.30

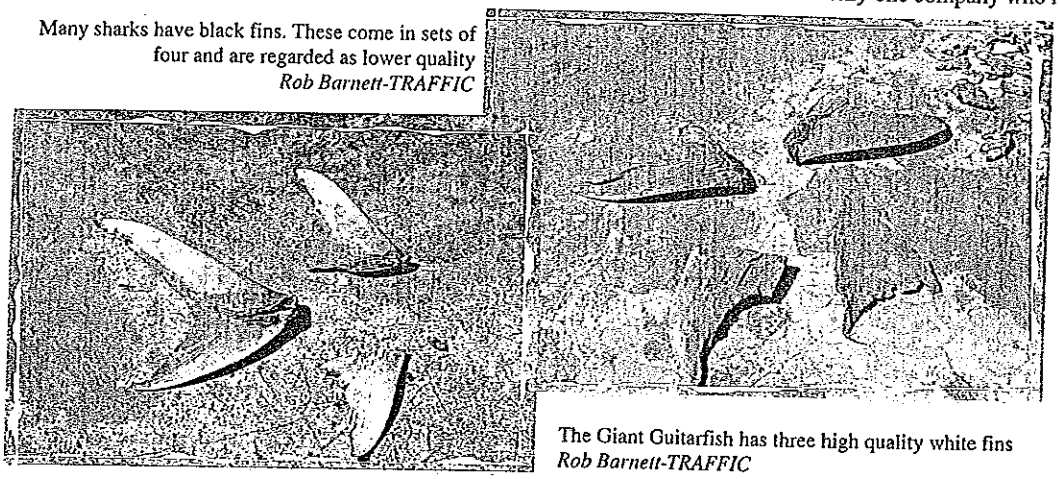
(Exchange Rate: February 1996 - Tshs 560:US $1). *Source*: J. Kiza, pers. comm., February 1996.

Exporters report that most good sized white shark fin is received from the south coast (Mafia, Mtwara, Lindi). The Dar-es-Salaam coastal area produces less large fins especially of the white variety and accounts for most of the small (less than 8 cm fins), which may be a sign of over utilisation, different species composition of catch or of an unsuitable oceanic topography for successful shark fishing. The Tanga region supplies small quantities of fin, but what is supplied consists of large black fin (J. Kiza, pers. comm., 1996).

The cross-border trade in shark products was reported to be substantial, although accurate quantities could not be identified as the majority of trade is undertaken illegally and is not reflected in official statistics (Saidi, pers. comm., 1996). The unmonitored cross-border movement of shark fin from Mozambique into Tanzania is often cited and shark

fin dealers report buying fins that have originated in Mozambique. Most shark fin originating in Tanga Region finds its way to Mombasa via unmonitored routes due to the higher prices being offered there. Shark fin dealers in Tanga Region estimated a total of 0.5 mt dried shark fin per month being sold in Mombasa (Rashid Moheni, Haji Nunda, Mussa, pers. comm., 1996).

The large majority of traders export shark fin by sea in 6 m containers, as there is now only one company who handles



Many sharks have black fins. These come in sets of four and are regarded as lower quality
Rob Barnett-TRAFFIC

The Giant Guitarfish has three high quality white fins
Rob Barnett-TRAFFIC

small consignments of "loose" cargo (B. Young, pers. comm., 1996). Exporters usually do not wait until they have enough shark fin to fill the entire container but rather prefer to ship what they have every month even if only half the container is filled. The cost of shipping a 6 m container to Singapore is approximately US $1 700. This would seem to show that the profits gained by shark fin exporters are high as they do not have to maximise the cost efficiency of their shipping. There are vessels which leave for the Far East at least every two weeks. Many of the smaller traders use shipping or forwarding agents to facilitate export of their shark fins. During the past year, traders have begun to use improved flight connections to the Far East to transport at a reported cost of approximately US $6 per kg. As air cargo, it takes a maximum of five days for the product to reach the Far East market (B. Young, pers. comm., 1996).

Table 17 gives the current cost and freight prices (C and F, all charges prepaid at origin) being offered to Tanzanian exporters for shark fins by wholesalers in Hong Kong.

Table 17
Cost and freight prices (US $) per kg of dried shark fin being offered to Tanzanian exporters by wholesalers in Hong Kong

Dry White Fin Moon Cut	Grades A and B, 1 kg - US $110
	Grades C and D, 1 kg - US $77
	Grades E and F, 1 kg - US $46
Dry Black Fin Moon Cut	Grades A and B, 1 kg - US $85
	Grades C and D, 1 kg - US $56
	Grades E and F, 1 kg - US $37

Source: B. Young, pers. comm., 1996.

Before export, fins are properly cleaned, all excess meat is removed using a moon cut and are properly dried. The caudal fin derived from Giant Guitar Fish is kept whole, with the vertical cut at the base of the tail remaining with no excess meat removed. The fins are not kept in the original sets received from primary collectors and fishermen, but are organised into size and colour categories and put loosely into sacks (50-60 kg each), which is contrary to other reports that importers prefer and indeed demand the fins in sets.

Shark fins less than 8 cm in size are also included, although Darwall (pers. comm., 1996) reports that very small sharks are thrown back alive by shark fishermen in the Mafia Island Marine Park. Extremely large shark fins which exceed 53 cm are not accepted because the cartilaginous strands are not favoured by fin clients. The species of shark from which these fins are derived could not be accurately identified.

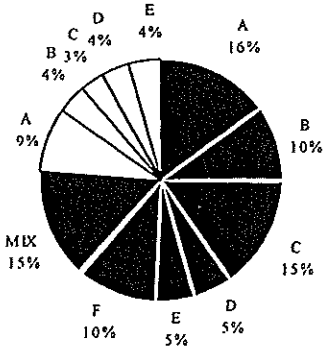
Out of a sample of 589 kg purchased by an exporter from one primary collector in Mtwara, the quantities of different black and white fin size categories that constituted the consignment were identified. Numbers of dried black/white fins per kg according to size categories A to F and mix are given in Table 18.

The data below provide insight into the number of sharks and size of sharks that are represented in shark fin exports. White fin derived solely from Giant Guitar Fish represented 24% of the sample consignment and consisted of fin sizes above 15 cm, suggesting that mature sharks are being caught regularly. The reverse is true for black fin in that a significant percentage (25.4%) of the fins are under 13 cm, indicating a higher occurrence of immature or small sharks in the catch. However, it is not known whether these immature or small sharks are caught through directed fishing, or as bycatch in non-directed shark fishing.

Table 18

Numbers of dried black/white fins per kg according to size categories A to F and mix represented in one sample export consignment of 589 kg

Category	Size	Category Quantities for 589 kg Consignment				
		No. of Fin per kg	Black Fin		White Fin	
			WT	%	WT	%
A	> 41 cm	1 3/4	90 kg	15.2	52 kg	9
B	33-38 cm	3	60 kg	10.2	23 kg	4
C	25-30 cm	6	90 kg	15.2	19 kg	3
D	20-23 cm	13	30 kg	5.0	23 kg	4
E	15-18 cm	27	30 kg	5.0	22 kg	4
F	8-13 cm	53	60 kg	10.2		
Mix	< 8 cm	88	90 kg	15.2		
TOTAL			450 kg		139 kg	



Source: Company Packing List, *in litt.*, February 1996.

Taking the numbers of dried fin per kg and the weight percentage for each size category of the sample consignment (see Table 18), it can be extrapolated that 1 mt of dried shark fin equates to 7 116 fins (see Table 19). This presents 1 519 sharks of the black fin *Carcharhinus* species (4 fins per shark), and 345 sharks of the white fin Giant Guitar Fish (3 fins per shark). Of the total 1 864 sharks represented, 1 173 were of sharks with fins of less than 13 cm in length.

Table 19

Number of shark fins extrapolated from 1 mt of dried shark fin

Category	Size	No. of Shark Fins Represented in 1 mt of Dried Shark Fin	
		Black Fin	White Fin
A	> 41 cm	106	141
B	33-38 cm	106	142
C	25-30 cm	273	364
D	20-23 cm	292	390
E	15-18 cm	607	
F	8-13 cm	1 351	
Mix	< 8 cm	3 344	
TOTAL		6 079	1 037

1b. Shark Fin Trade in Zanzibar

All shark fin exporters must be registered by the Ministry of Trade. Each shipment must be inspected by an officer from the Ministry of Health to confirm that the shipment will reach the port of destination in a hygienic condition, with a Certificate of Health being issued to confirm this. The exporters pay a 5% export royalty on the value of their shipment to the Sub-Commission of Fisheries, and in addition to this a 2% duty to the Ministry of Trade. Once the royalties have been paid, the Sub-Commission of Fisheries writes a letter to the Ministry of Trade stating that the exporter has paid his duty and has obtained the necessary Certificate of Health (A.H. Kombo, pers. comm., 1996).

Total annual exports broken down as individual consignments of shark fins from Zanzibar during 1993-1995 are shown in Table 20.

The data in Table 20 show that on average 10.9 mt of shark fin are reported as being exported each year. As reflected in individual exports, the Zanzibar Sub-Commission for Fisheries reports that there are only two traders licensed for the export of shark fin (Haji Pandu, pers. comm., 1996).

The destination for the legal export of shark fins is without exception Hong Kong. In discussions held with the two licensed exporters, it was apparent that the official statistics as shown in Table 20 are a true reflection of the quantities exported by these traders, and that they did not export additional quantities to other destinations, such as Kenya, through unmonitored channels. These traders would in fact like to obtain greater quantities of fins, and to this end have increased their buying rates in order to attract fins from Mtwara and Mafia.

Table 20

Export of dried shark fins from Zanzibar (Unguja Island only, no shark fin exports recorded for Pemba Island), 1993-1995

Date	Produce	Weight (Kg)	Export Value (Tsh/per kg)	Total Value (Tsh)	Royalty (Tsh)	Destination
1993						
18/1	Shark Fins	100	1 962	196 200	5 886	Hong Kong
17/2	Shark Fins	100	2 020	202 000	8 080	Hong Kong
24/5	Shark Fins	240	3 780	907 200	27 216	Hong Kong
4/6	Shark Fins	300	1 440	432 000	12 960	Hong Kong
8/10	Shark Fins	300	3 192	957 600	28 728	Hong Kong
TOTAL		**1 040**	**2 695 000**	**82 870**		
1994						
28/3	Shark Fins	540	4 563	2 464 020	123 201	Hong Kong
13/5	Shark Fins	200	3 000	600 000	30 000	Hong Kong
17/8	Shark Fins	40	3 000	120 000	6 000	Hong Kong
31/10	Shark Fins	420	4 842	2 033 640	101 682	Hong Kong
TOTAL		**1 200**	**5 217 660**	**260 883**		
1995						
13/5	Shark Fins	450	2 480	1 116 000	112 500	Hong Kong
23/5	Shark Fins	600	5 580	3 348 000	167 400	Hong Kong
TOTAL		**1 050**	**3 259 Average (1993-5)**	**4 464 000**	**279 900**	

(Exchange Rates: 1993-Tsh 515:US $1, 1994-Tsh 504:US $1, 1995-Tsh 600:US $1).
Source: Zanzibar Sub-Commission for Fisheries, Statistics Department *in litt.*, 1996.

The Sub-Commission for Fisheries maintains a minimum Zanzibar price for the export of shark fins of between Tsh 4 000-10 000 (US $7.10-US $17.80) per kg. As can be seen from Table 20, the dealers exporting to the Far East are on average paying royalty of 5% on minimum prices of Tsh 3,259 (US $5.40 per kg at 1995 Exchange Rate). The local market value of fins is approx Tsh 20 000 (US $35.70) per kg; therefore exporters are presently making large savings on export duty payments.

Exports from licensed traders have decreased in the last five to ten years. One trader whose family has been dealing in shark products for over 20 years reported that they used to buy large quantities of shark fins from Somali vessels who used to call into Zanzibar regularly. The shark fin traders average monthly export of fins then was on the order of 3 mt. The Arab fishing trawlers no longer call into Zanzibar and it is thought that they now export their fins through Dubai, UAE (Ho Ko Kung pers. comm., 1996).

The licensed traders operating in Zanzibar represent only a small percentage of the total number of dealers who are involved in the trade of shark fin. Preliminary enquiries into the trade in shark fin in Unguja Island revealed many unregistered local traders who exported their shark fin without going through correct government procedures. Through informal discussions held with eight unlicensed shark fin traders operating on Unguja Island, it was discovered that all of their export of shark fin goes to Mombasa on board the frequent vessels travelling that route. These traders can be considered to be the most frequent exporters of shark fin and indeed many of them are employed directly by Mombasa fin dealers on a permanent basis to collect fins from Zanzibar. The export of fins in Unguja

Island is undertaken by three types of traders: international traders that export to the Far East directly from Zanzibar; Swahili middlemen who supply Mombasa shark fin exporters; and artisanal fishermen/primary collectors who are also part-time shark fin traders. This latter category of trader generally sells to other exporters in Zanzibar town, but occasionally arranges for sea transport to Mombasa or Dar-es-Salaam so that a higher price may be obtained for their fins. In Unguja Island, there are four to six primary fin collectors who buy from fishermen in the Nungwi area, two to three who collect in Mkokotoni and one who collects in Bwejuu. The primary fin collectors in the Kizimkazi area sell their fins in Dar-es-Salaam as it is closer logistically (C. Karibhai, pers. comm., 1996).

The eight traders interviewed were a sample of the exporters operating out of Unguja, and do not represent all shark fin traders in Zanzibar (Unguja and Pemba Islands). These traders generally export to Kenya and reported a total shark fin export to Mombasa of 6 350 kg per annum. This figure equates to 440.9 mt of shark landings for Unguja Island alone (wet fins are 4.5% of the wet weight of a shark, and after being dried and trimmed, fins are approximately 1.44%) (ENVI.R.O., 1994).

The prices in the Zanzibar coastal regions at which the primary collectors sell are Tsh 20 000-25 000 (US $35.70-US $44.60) per kg for large black fin, Tsh 35 000 - 40 000 (US $62.50-US $71.40) for large white fin. The full-time shark fin traders in Zanzibar town buy fins for the following prices:

The cost of fins in the Zanzibar coastal regions was found to be less than in Zanzibar town due to savings made in transport costs.

Since the end of 1995, dealers have been able to buy fins from Comoros freight vessels calling at Zanzibar Port. The quantity at present is small, but it is thought that in the future these vessels might replace that which was previously supplied by Somali vessels (K. Makame, pers. comm., 1996).

Table 21
Prices per kg of dried shark fins in Zanzibar Town

Grade A, 30-41 cm	**Black Fin**	**White Fin**
Price per kg	Tsh 30 000 - 32 000	Tsh 42 000 - 45 000
	(US $53.60 - US $57.10)	(US $75 - US $80.40)
Grade B, 5-30 cm	**Black Fin**	**White Fin**
Price per kg	Tsh 20 000 - 22 000	Tsh 22 000 - 25 000
	(US $35.70 - US $39.30)	(US $39.30 - US $44.60)
Grade C, 5-10 cm	**Black Fin**	**White Fin**
Price per kg	Tsh 10 000	Tsh 16 000
	(US $17.90)	(US $28.60)

Source: C. Karibhai, pers. comm., 1996.

There are reported to be four fin dealers on Pemba Island who export their produce to Mombasa (Sheha Mohammed, pers. comm., 1996). Data on the quantities exported could not be ascertained as none of the fin dealers in Pemba reportedly use official exporting channels. This fact is reflected in Zanzibar official statistics for shark fin exports presented in Table 20, where no shark fin exports for Pemba Island are recorded.

2. Shark Meat/Skin/Liver Oil Trade in Mainland Tanzania and Zanzibar

Prices of fish are determined by market forces in relation to the fish catch landed. The human population increase experienced in recent years in Tanzania has contributed to a general increase in fish prices. Small pelagics such as sardines, mackerel, anchovies, rays and sharks are the main types of cheap fish consumed by artisanal fisherman, with the high value catch like marlin, kingfish, snappers and lobsters being sold (Omar *et al.*, 1995).

Table 22 indicates the average market price per kg for the most common fish caught in early 1996, which includes prices for sharks and rays. Fish prices were obtained in Zanzibar from the Malindi, Darajani, K/Tumbo, Mikunguni, Magomeni and Jang'ombe fish markets and in mainland Tanzania from the Tanga, Coastal, Dar-es-Salaam, Lindi and Mtwara regions.

This data indicates that in Zanzibar, sharks and rays fetch a good price of Tsh 534.83 (US $0.95) per kg (1996 prices) in the local markets, and is only slightly lower than the average price for 1 kg of fresh fish at Tsh 570 (US $1.01) (Quarterly Price Survey, Department of Statistics, 1996), and is substantially higher than the prices gained for the small pelagics such as sardines and mackerel which are the main fish species eaten by artisanal fishermen. Similarly,

the 1993 price for shark meat in mainland Tanzania of Tsh 215 (US $0.41) per kg is only slightly lower than the average 1993 price for fresh fish of Tsh 229 (US $0.44) per kg (Anon., 1993).

Shark meat is widely consumed in mainland Tanzania and Zanzibar by artisanal fishermen, and any shark catch excess is sold mainly in dried and salted form due to inadequate handling facilities and poor transport services. One major factor contributing to the presence of a large artisanal directed shark fishery is the sharks' high tolerance to spoilage. Table 23 shows the tolerance to spoilage for the main fish groups caught in Zanzibar Islands.

Sharks are the most tolerant to spoilage because they can be easily cured by drying and salting. Anecdotal reports suggest that the process of drying and salting diminishes the taste derived from the high urea content of the larger sharks. Curing of shark meat is a common practice in mainland Tanzania and Zanzibar and dried shark meat can be readily found at any fish market. Methods of curing include salting, hot drying, smoking or a combination of these. The sun drying of fish is commonly undertaken directly on the beaches, with the result that the final product is heavily impregnated with sand particles. Sometimes the problem is so bad that sand accounts for an appreciable proportion of the marketed product. The method of salting has limited application in Tanzania because of the high cost of salt (Tsh 100/kg in 1991) and restricted domestic demand (Mlay and Mutsekwa, 1995). The preferred method of curing shark meat is by simple drying. Curing of fish is prompted either as a means to salvage an already deteriorating shark or as preservation (Jiddawi *et al.*, 1992). Shark meat is preferably eaten fresh but when there is an excess catch, especially in remote areas, the fishermen cure the meat so that it will reach market in a saleable form. The value of dried shark meat is generally half that of fresh shark meat.

As a result, shark meat is efficiently utilised in Tanzania with no or little wastage. Due to its long shelf life the transportable nature of the cured shark meat has resulted in the majority of the produce of Zanzibar being exported to mainland Tanzania. The Zanzibar Sub-Commission for Fisheries believes that 75% of all cured shark meat produced in Zanzibar is shipped to

Table 22

Average market price per kg for common species of fish caught in Tanzania Mainland (1993 prices) and Zanzibar (1996 prices)

Fish Species	Average Price/kg (Tsh/kg)	
	1993 Prices Tanzania Mainland	1996 Prices Zanzibar
Kingfish	358.00	861.50
Albacore	273.00	747.00
Barracuda	-	538.00
Yellow Snapper	-	668.16
Lethrinus	-	747.83
Caranx	-	691.66
Sharks/Rays	215.00	534.83
SailFish	245.00	690.33
Grouper	-	563.50
Octopus/Squid	175.00	756.33
Mackerel	242.00	337.50
Sardines	146.00	331.66
Parrots	180.00	497.50
Siganus	-	547.66
Goat Fish	-	406.50
Herring	-	216.50
Average Tshs price per 1 kg fresh fish	229.00	570.00

(Exchange Rate: 1993 - Tsh 515:US $1, 1996 - Tsh 560:US $1).
Source: Anon., 1993; Zanzibar Sub-Commission for Fisheries, Statistics Department, *in litt.*, 1996.

Table 23

Tolerance to spoilage of the major fish groups caught in Zanzibar Islands (ranking: 1 most tolerant; 3 least tolerant)

Fish Group	Ranking
Lethrinids	1
Lutjanids	1
Serranids	2
Carangids	2
Scombrids	3
Mullids	1
Sardines	3
Sharks	1
Skates	1
Parrot/wrasses	3
Sphyraenids	2

Source: Jiddawi *et al.*, 1992.

mainland Tanzania (Makame Nassor, pers. comm., 1996). In February 1996, there were 10 mt of cured shark meat in Nungwi ready for shipment to the Tanzanian mainland (A.H. Kombo, pers. comm., 1996). However, due to the traditionally strong cultural and economic trading links with mainland Tanzania and Kenya and the resulting high numbers of vessels moving between the countries, the majority of dried shark meat transported to these destinations goes unmonitored. The total official exports of dried shark meat for 1993-1995 from Zanzibar was only 118 kg, with the destination of export being mainland Tanzania.

Trade in shark skin was found to exist on a small scale in Zanzibar as shown in Table 24. No trade in shark skin could be identified in mainland Tanzania.

Table 24
Zanzibar exports of shark hide, 1994-1995

Date	Product	Weight (kg)	Export Unit Value per kg	Total Unit Value	Royalty (Unit)	Destination
23/3/94	Shark Skin	100	Tsh 20 (US $0.039)	Tsh 2 000 (US $3.90)	Tsh 100 (US $0.19)	Hong Kong
28/3/95	Shark Skin	300	Tsh 4 320 (US $7.20)	Tsh 1 296 000 (US $2 160)	Tsh 112 500 (US $187.50)	Hong Kong

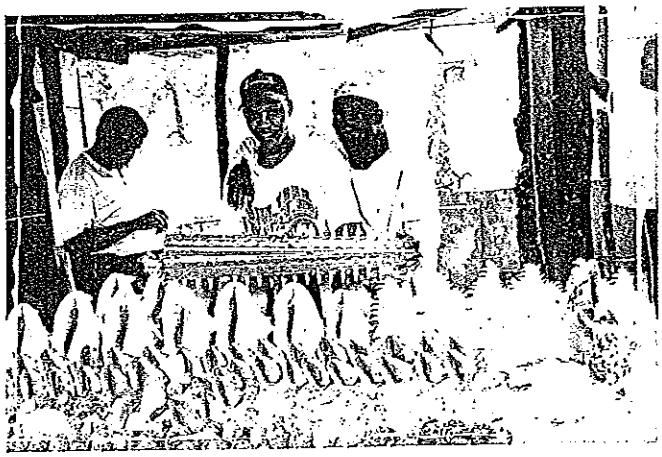
(Exchange Rate: 1994 - Tsh 504:US $1, 1995 - Tsh 600:US $1).
Source: Zanzibar Sub-Commission for Fisheries, Statistics Department, pers. comm., 1996.

The one exporter responsible for all exports of shark skin reported that Hammerhead Sharks *Sphyrna mokarran*, *Sphyrna diplana* were targeted for their leather. The exporter undertook the skinning and fleshing of the sharks himself due to the unavailability of skilled labour in this task, and salted the skins using high grade mineral salt. The reasons given for low quantities exported were the amount of time required for skinning, fleshing and salting, and that only small amounts of suitably large sharks were brought into the Malindi landing site in Zanzibar town, where the exporter was located. Suitable sharks from other regions of Zanzibar could not be utilised because the sharks needed to be skinned when still fresh (Chung, pers. comm., 1996).

Liver oil is used predominantly within Tanzania for maintenance of traditional wooden fishing vessels and no international trade could be identified. The price for 1 litre of shark liver oil was approximately Tsh 2 500 (US $4.50) in February 1996.

3. Curio Trade in Mainland Tanzania and Zanzibar

In mainland Tanzania, shark jaws are readily available from the stalls selling seashells and tourist curios. For example, four stalls out of the nine in the Banda Beach market in Dar-es-Salaam had an average of two shark jaws on display and large quantities of shark teeth in early 1996. The smallest shark jaw measured 16 cm horizontally and the largest measured 34 cm horizontally. The smaller shark jaws are sold for Tsh 3 500 (US $6.25) with the larger shark jaws being sold at Tsh 6 000 (US $10.70). There is a high demand for the larger shark jaws from western tourists, however, the regional and international trade in shark curios is small.



Blade-like snout of a sawfish on sale at the Banda Beach curio market, Dar-es-Salaam
Rob Barnett-TRAFFIC

In Zanzibar, shark jaws are widely available in Unguja Island for sale to tourists and prices range from Tsh 2 000 (US $3.60) for small jaws up to Tsh 5 000 (US $8.90) for the larger jaws. Shark teeth are also sold individually or as necklaces. The long, flat bladelike snouts of the sawfish (Pristidae) are

frequently available in many of the curio stalls in mainland Tanzania and Zanzibar. Prices range from Tsh 8 000 (US $14.30) up to Tsh 20 000 (US $35.70) depending on the condition and size of the dried snout (most specimens are below 38 cm).

TANZANIA MAINLAND AND ZANZIBAR CONSERVATION IMPLICATIONS

Information on resource assessments of sharks and rays in mainland Tanzania and Zanzibar fishing grounds is limited, although stocks of the smaller pelagic species such as sardines and Indian mackerel have been more thoroughly investigated in Zanzibar (e.g Clelland, 1973; Mwebaza-Ndawula, 1990).

During 1982-1983, three surveys were carried out in Tanzanian waters by the R/V "Dr. Fridtjof Nansen". The fish resources in water depths ranging from 10 m to about 500 m were investigated. The estimated fish biomass in the investigated area varied between 100 000 and 175 000 mt during the three surveys, although these estimates did not include the areas within the reef. The main part of the biomass was observed in waters shallower than 200 m, and particularly in waters shallower than 50 m. In contrast, it was found that the catch rates for sharks and rays increased with increasing depth within the investigated area (Tarbit, 1984). The biomass of elasmobranchs estimated from the surveys of the R/V "Dr. Fridtjof Nansen" were approximately 5 000 mt for the first two surveys and 10 000 mt for the last survey. The relatively larger biomass estimated for the last survey was mainly due to a big catch of devil rays east of Mbegani (Iverson *et al.*, 1984). The most common species caught were stingrays *Dasyatis* spp., Milk Shark *Rhizoprionodon acutus*, and Smallfin Gulper Shark *Centrophorus moluccensis*.

East African Marine Fisheries Organisation (EAMFRO) conducted exploratory and experimental fishing exercises with handlines, droplines and longlines during the period 1969-1976, mostly on the deep reefs at the entrances of the Mafia and Zanzibar Channels. In waters of depth 45-120 m sharks represented 17.3% of the catch, and in waters of 120-250 m, sharks represented 29.8% of the catch. These findings support those of the R/V "Dr. Fridtjof Nansen" surveys in which it was found that shark catch increases with deeper water depth. In addition, results of bottom trawl surveys for demersal fish in Zanzibar Channel undertaken by M/V "Mafunzo" during 1986-1987 showed that sharks represented 0.3% of the catch in water depths of under 20 m, 1.7% in 20-40 m water depths, and 5.5% in water depths of over 100 m (Msumi, 1987).

The results of the above surveys and experimental fishing exercises indicate considerable conservation implications with regard to Tanzania's directed and bycatch shark fishery and its impact on shark population numbers. As described in earlier sections of this report, Tanzania's main fishing pressure is directed at coastal waters by artisanal fisherman due to the use of small traditional fishing vessels, and subsequently do not target the deeper offshore waters where sharks occur in greater numbers. In addition, Tanzania does not maintain a domestic semi or industrial fin fish industry, which would target these offshore waters. Apart from reported fishing of foreign registered longline vessels, Tanzania's deep water EEZ is not utilised by domestic fishing vessels and consequently shark populations in these areas are left largely untouched by Tanzanians. However the extent of foreign longline vessel activity in these areas cannot be accurately determined.

REGULATORY/MANAGEMENT FRAMEWORKS

1. Tanzania Mainland

i. Domestic

Environmental conservation is considered an important element in Tanzania for sustainable exploitation of the fish resources. The Tanzania Fisheries Act No. 6 of 1970 (which replaced the Fisheries and Trout Ordinance of 1948), provides for the protection, conservation, development, regulation and control of fish, fish products, aquatic flora, fauna and products thereof (Rumisha, 1995). The Tanzania Fisheries Act is essentially an enabling law that delegates broad regulatory power to the Minister, including the powers to require licences and specify their application, conditions and fees; to restrict fishing areas and methods; to prescribe penalties and prohibit, regulate or control

activities of foreign fishing vessels within jurisdictional waters (Christy, 1981). No specific legislation concerning shark utilisation in Tanzania was identified.

The Fisheries Principal Regulations of 1989 and the Fisheries Inland Water Regulation of 1982 are subsidiary regulations that regulate fisheries development and management, and provide for protection of fish breeding grounds especially in river mouths and set back lines from the river channel/banks (Rumisha, 1995). The Fisheries (General) Regulations require all fishing vessels to be both "registered" and "licensed" (Reg. 3 and 11). Licenses are also required for the export of fish and fish products (Christy, 1981). However, in reality the regulatory legislation in place is rarely efficiently enforced due to lack of financial and human resources within the relevant government ministries.

At the national level, fisheries are administered by the Fisheries Division within the Ministry of Tourism, Natural Resources and Environment. Its main functions are: to advise the government on fisheries matters; to compile and analyse the national fisheries statistics; to develop fisheries legislation; to advise Regional and District Fisheries administrations; to manage the registration of commercial trawlers; licensing and registering of fish produce exporters; and collection of export duty. The Regional Fisheries administrations are within the Office of the Prime Minister. They prepare regional fisheries plans, coordinate implementation (usually by the District Administrations) and provide technical advice at the regional level.

The Ministry of Local Government and Co-operative Development appoints the District Authorities, who in turn employ the District Fisheries Officers. The District Fisheries Officers are primarily concerned with the implementation of fisheries plans and they are also responsible for checking the hygienic conditions of fish product exports at the regional level. They receive guidance on policy, co-ordination and technical matters from the regional and headquarters staff (Sanders, 1990). It is this multi-employer characteristic of fisheries administration which, along with inadequate provision of support equipment and funds, contributes to a low level of management effectiveness.

ii. Regional/International Measures

No regional or international measures related specifically to sharks could be identified, although Tanzania does belong to a number of agreements that could affect shark utilisation.

In line with the provisions of the United Nations Convention on the Law of the Sea (1982), the Government of the United Republic of Tanzania makes a distinction between the territorial waters (12 nm limit) and the EEZ (200 nm limit) (Rumisha, 1995). Also, Tanzania is a party to the African Convention on the Conservation of Nature and Natural Resources. Through this Convention, States are obliged to "manage aquatic environments", to prohibit fishing with poisons or explosives, and to protect many species including dugongs and marine turtles. Sharks are not specifically mentioned. Tanzania became a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973) in 1980, although no national legislation is modelled on the Convention. Tanzania is also a member of the Indian Ocean Fishery Commission, which was established by FAO council. Its terms of reference include promotion of national fisheries programmes and promotion of internationally assisted research and development programmes with particular reference to offshore resources.

An agreement between Tanzania and Kenya has delimited the marine territory between the two countries, and the two neighbours have agreed to grant reciprocally tolerant treatment to each others' traditional vessels operating in these territorial waters. However this has led to abuse with regard to cross-border smuggling, with the concern being especially acute in Zanzibar (Christy, 1981).

2. Zanzibar

Marine resources within the territorial waters of the Zanzibar islands fall under the jurisdiction of the Zanzibar House of Representatives (Act No 8 of 1988). The act stipulates conservation measures which prohibit the use of certain gears, including explosives, poison, small size mesh nets and spear guns. The act also prohibits the catching of fish including sharks below a certain size limit. There is no legislation in place that regulates or prohibits the import or export of shark products.

Existing legislation applies only to that part of the ocean which Zanzibar regards as its territorial waters. This arrangement has worked as far as "local fishing is concerned", for example Zanzibar has its own fisheries regulations such as declaration of closed fishing seasons. However, according to the constitution, Zanzibar cannot regulate or control foreign fishing vessels in waters under its jurisdiction; foreign fishing involves external affairs which is the domain of the Government of Tanzania.

The Ministry of Agriculture, Livestock and Natural Resources is responsible for management of fishery resources and for enforcing the fisheries laws. This is achieved through the Sub-Commission of Fisheries. However, even with assistance from the Zanzibar Navy, in reality little effective enforcement or regulation occurs due to shortages in economic resources and manpower (Omar *et al.*, 1995). The commission is headed by the Assistant Commissioner for Fisheries whose mandate includes improving the efficient utilisation of Zanzibar's fishery resources for the benefit of traditional fishermen.

CONCLUSION

Artisanal fishermen are responsible for the majority of Tanzania's annual shark landings, with the commercial and recreational fisheries contributing a small percentage to the overall shark landings.

According to official statistics, the total shark landings for mainland Tanzania and Zanzibar in 1993 was 1 261 mt and the export of dried fins was 1.3 mt, which equates to approximately 90 mt of sharks (wet fins are approximately 4.5% of the wet weight of a shark, and after being dried and trimmed, fins are approximately 1.44%) (ENVI.R.O., 1994). This compares with shark fin traders' reported exports of dried shark fin of 56 mt per annum, which equates to 3 888 mt of shark, a figure more than double the amount officially recorded. Estimates obtained from linking the quantity of shark fishing gear and vessels with shark landings data from sample surveys, such as those made for Mafia Island Marine Park and Shukrani/Fikirini cooperative vessels in Zanzibar, are useful in assessing possible shark yields from directed shark fishing gears and vessel type. These estimates are less useful in determining overall national shark catches, as they do not account for the significant shark landings from other fishing gears. Taking this into consideration, estimates of total catches for mainland Tanzania and Zanzibar came to 1 103 mt.

The large demand for shark products, especially shark fin, and subsequent high prices have resulted in a substantial artisanal directed shark fishery. This directed fishery is restricted by the seasonal aspect of shark fishing in Tanzania, and national socio-economic factors which have limited the introduction of larger fishing vessels and more modernised fishing gear. As a result, the majority of artisanal fishermen use small traditional fishing vessels and fishing gear which limits their fishing areas to inshore waters. The species of sharks which predominantly inhabit coastal waters are therefore likely to be under the highest artisanal fishing pressure. In addition, the commercial prawn fishery would also be likely to increase this pressure due to the nature of shallow water trawling that the vessels undertake. There are eight species of sharks regularly caught in Tanzania which primarily inhabit inshore coastal waters. Of particular concern is Giant Guitar Fish, which is the only species targeted for the higher value white fins. The price per fin derived from this species is Tsh 15 000 (US $26.80) compared to Tsh 8 750 (US $15.60) per fin for other shark species, making this shallow water inhabitant especially sought after by the artisanal fishery. Data from the sample export consignment of dried shark fins could also suggest that coastal shark species are under considerable fishing pressure due to the high percentage (25.4%) of small sharks being caught.

Resource assessments of the R/V "Dr. Fridtjof Nansen" and sample experimental fishing as undertaken by EAMFRO, ZAFICO and the M/V Mafunzo indicate that substantial yields of shark can be expected when fishing in deeper offshore waters using semi-industrial vessels and fishing gear. At present the shark species inhabiting offshore waters are largely untouched by any domestic fishery activity, but should the Government of Tanzania successfully carry out its goal of increasing semi-industrial fin fisheries in its EEZ, the fishing pressure on sharks will significantly increase because of the potential for shark bycatch.

Due to the recent increase in competition between shark fin traders and the subsequent drop in profits, there is a possibility, as reported by one exporter, of shark fin traders capitalising on the shark rich offshore waters of Tanzania

by initiating a semi-industrialised shark fishery. Should this take place the government regulatory and management mechanisms presently in place would be largely inadequate to control this fishery.

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THE SHARK TRADE IN MOZAMBIQUE

Maria Imelda Sousa, Nina T. Marshall and Malcolm J. Smale

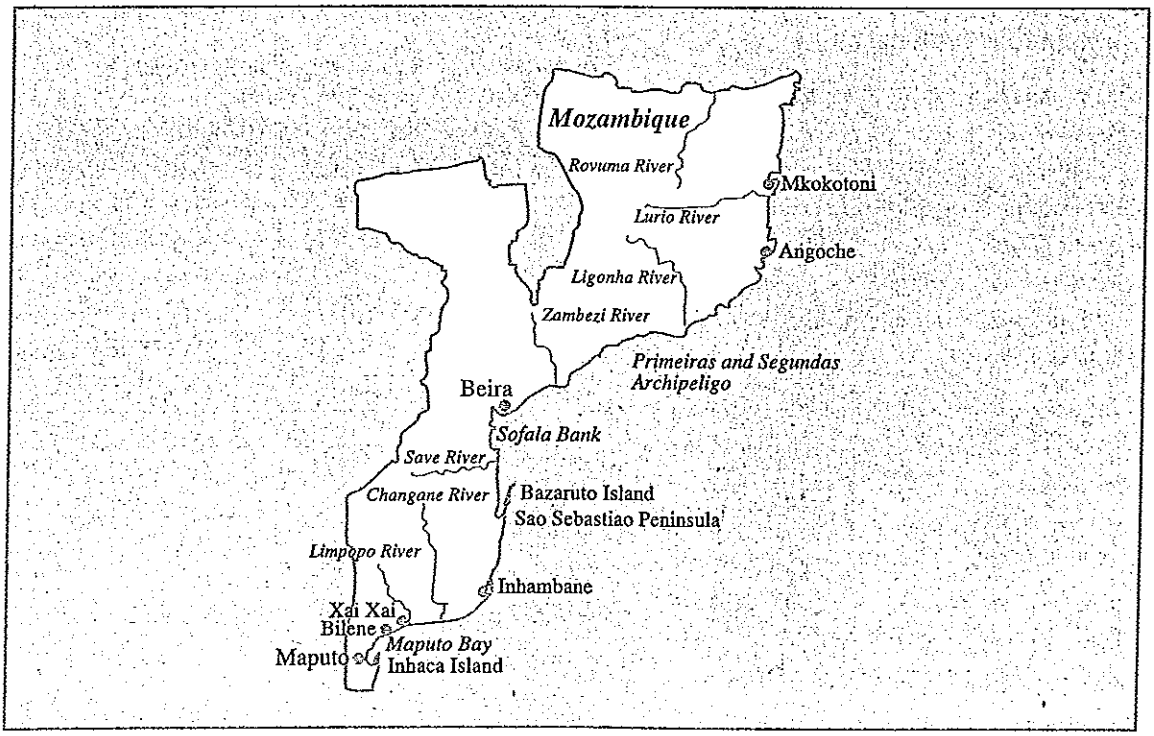
INTRODUCTION

Mozambique lies on the southeastern seaboard of Africa from the Rovuma River mouth (10° 20'S) to the South African border (26° 50'S), with an extension of 2 780 km of coastline characterised by a wide diversity of habitats including sandy beaches, coral reefs, estuarine systems, bays, mangroves and seagrass beds (Tinley, 1971).

In general, the continental shelf is narrow, averaging 15-25 km in width. However, it can be as narrow as 100 m off Pemba on the north of Mozambique to nearly 145 km on Sofala Bank, in the central part of the country. Three main natural regions are defined: (1) the Northern Coast, from the Rovuma River to Moçambo Bay, faulted, embayed coast with fringing coral and coral rock cliffs which also occur offshore at intervals southwards forming submarine platforms comprising Primeiras and Segundas Archipelago and probably other islands of the Northern Coast; swamp and arcuate sand beach coasts occur at intervals near river mouths, e.g. Lurio and Messalo; (2) Central Coast, from Moçambo Bay south to the Save River, mangrove swamps and estuary barrier coast with simple or arcuate beaches; black beaches occur between Pebane and the Zambezi River mouth and (3) Southern Coast, from Save River to Ponta do Ouro, parabolic dune coast with dune rock at intervals forming north-trending capes, large barrier lakes.

Types (1) and (3) with crystal clear waters occur in conjunction with the narrow continental shelf zones with extremely steep slopes. The deltaic, estuarine, swamp and arcuate shorelines occur where the continental shelf is broad. Turbid waters occur mainly in the bight and off the mouths of rivers carrying muddy waters (Tinley, 1971).

The country lies due west of Madagascar from which it is separated by the Moçambique Channel, which is 400 km wide at its narrowest point. The warm southward flowing branch of the South Equatorial Current, known as the Moçambique Current has a strong influence on the Mozambican coast except in the extreme south (south of latitude 25°S) in the confluence of the Alguhas current. Large counter currents occur in the Bights of Sofala and Maputo forming, in the latter case, the characteristically northward trending peninsulas most notably Machangulo, Inhambane and São Sebastiao (Bazaruto) Peninsulas (Tinley, 1971).



The major part of the Mozambican coast has a tropical humid to sub-humid climate. Typically the coast receives rain in all months of the year with the maximum in the summer months (October to March). The highest recorded annual average rainfall has been in the central part of the coast and the lowest one in the southern sector. The mean surface sea temperature off the Mozambique coast shows a gradient from north to south from 25.5° C at Mocimboa da Praia to 21.4° C off Maputo. Tides are semi-diurnal to mixed with maximum ranges about 3 m. The coast is subject to the effect of high velocity storm winds which cause major shoreline changes over relatively short periods (Hughes and Hughes, 1992).

A number of rivers discharge in the Indian Ocean. The Zambezi River in the central region is the largest and discharges 15 000 - 20 000 m^3/s of freshwater into the sea in the rainy season (January to March). Other important rivers are the Rovuma and Lurio in the north, several which enter the Sofala Bank in the middle of the coast (Punguè, Búzi, Gorongosa and Save), and the Limpopo, Incomati and Maputo which discharge into Maputo Bay (Hatton, 1995). Aside from the influence of freshwater, heavy sediment loads have created muddy areas and sediment banks offshore, causing expansion of deltas and, in several cases, of mangrove and swampy areas. Mangrove forests cover 500 000 ha (Tinley, 1971).

The country's resource base is favourable for agricultural production and fisheries. Growing at 2.8% per annum, the mid-1990 population was estimated at 15.7 million. Per capita GNP (1991) was estimated at US $70, with a slight increase in subsequent years to US $130 in 1995. Fisheries are extremely important to the national economy, with the increase in contribution to the GNP estimated to rise from 0.95% in 1985 to 3% in 1989 (Anon., 1991). The importance of fisheries is due not only to the extensive coastline of about 2 800 km, of which more than half is occupied by mangroves, but also to the fact that fisheries were less affected by insecurity during the war than were other economic activities such as agriculture.

The fishing sector plays a key role in the generation of net foreign exchange earnings. However, the revenues resulting from export of fishing products (almost exclusively prawns) represent more than 40% of total export of the country. The contribution of the fishing sector to fish food for internal consumption is also significant, estimating a national annual production for internal consumption of 50-60 000 mt, or 3.5-4 kg per capita in 1989 (Anon., 1991). The national per capita consumption of fish (produced in Mozambique) was estimated at 5.1 kg/yr in 1991. The sector employs about 85 000 fishermen for an annual catch of some 100 000 mt of fish in 1991 (Anon., 1994a).

HISTORICAL OVERVIEW

During the 1960s and 1970s the fishery sector in Mozambique was comprised of artisanal, semi-industrial, and industrial sectors, with the national industrial fishery geared primarily toward prawns. Table 1 provides figures for crustacean and total landings for the period 1965 to 1975, according to official statistics (Sætre and Silva, 1979).

The national recorded catch included prawn (*Penaeus indicus*, *P. monodon*, and *Metapenaeus monoceros*), spiny lobster (*Palinurus delagoae*), magumba or kelee shad (*Hilsa keele*) and a variety of pelagic and demersal fish (Anon., 1979). Figures for landings for the period 1983-1992 are presented in Table 2.

Table 1
Total and crustacean landings of the industrial and semi-industrial fisheries, 1965-1975 (mt)

Year	Total Landings	Crustacean Landings	Total Landings in Main Ports
1965	4 181	599	
1966	5 347	1 019	
1967	5 047	1 037	
1968	5 707	1 070	
1969	7 028	1 125	
1970	7 634	1 128	
1971	10 423	2 554	5 513
1972	10 413	2 689	6 332
1973	13 338	3 442	9 329
1974	15 855	6 072	12 628
1975	11 466	4 339	8 289
1976		4 822	
TOTAL	96 439	29 896	42 091

Source: Sætre and Silva, 1979.

Sætre and Silva (1979) observed that the first attempt to estimate the fish resources of Mozambique was carried out by Shomura (Gulland 1970), who arrived at a potential annual yield of demersal fish in the order of 300 000 mt/yr. Since then several other surveys have been conducted in Mozambican waters, with special reference to the Soviet trawler "Aelita" that worked in 1976 (Budnitchenko, 1977), "Dr. Fridtjof Nansen" that conducted surveys in 1977 and 1978 (Sætre and Silva, 1979), in 1980 (Brinca *et al.*, 1981), and in 1982 (Brinca *et al.*, 1983b). A number of surveys were carried out by both Soviet and German trawlers primarily to estimate the fish and deep-water prawn resources of Mozambique (Brinca *et al.*, 1983a; Sousa, 1983a; Sousa, 1983b; Sousa, 1988a; Sousa, 1988b; Sousa 1989a; Sousa, 1989b; Sousa, 1989c; Sousa, 1989d; Sousa 1990a; Sousa, 1990b; Sousa, 1990c; Torstensen, 1991). All these surveys recorded data on sharks. Smith (1972) and Fischer *et al.* (1990) were used to identify the fish species encountered in the surveys.

Table 2
Nominal catches of fish, crustaceans and molluscs from the Indian Ocean, 1983-1992 (mt)

Year	Quantity (mt)
1983	37 516
1984	31 847
1985	33 306
1986	31 154
1987	35 850
1988	33 300
1989	33 075 (estimate)
1990	35 520 (estimate)
1991	35 370 (estimate)
1992	33 500 (estimate)

Source: Anon., 1994b.

Table 3
Some of the shark species identified during surveys

Scientific Name	Common Name	Scientific Name	Common Name
Carcharhinus amboinensis	Pigeye Shark/Java Shark	*Rhina ancylostoma*	Bowmouth Guitarfish
C. brachyurus	Copper Shark/Bronze Whaler	*Sphyrna lewini*	Scalloped Hammerhead
C. brevipinna	Spinner Shark	*S. mokarran*	Great Hammerhead
C. dussumieri	Whitecheeked Shark	*S. zygaena*	Smooth Hammerhead
C. falciformis	Silky Shark	*Squalus blainvillei*	Longnose Spurdog
C. limbatus	Blacktip Shark	*Rhizoprionodon acutus*	Milk Shark
C. longimanus	Oceanic Whitetip Shark		
C. macloti	Hardnose Shark		
C. melanopterus	Blacktip Reef Shark		
C. obscurus	Dusky Shark		
C. plumbeus (=C. milberti)	Sandbar Shark		
C. sealei (=C. tjutjot)	Blackspot Shark		
Etmopterus granulosus	Southern Lantern Shark		
Eulamia limbata (=C. limbatus)	Blacktip Shark		
Galeocerdo cuvier	Tiger Shark		
Galeorhinus galeus	Tope Shark		
Halaelurus boesmani	Speckled Catshark		
Mobula diabolus	Devilray		
Mustelus manazo	Star-spotted Smoothhound		
M. mustelus	Smoothhound		
Pliotrema warreni	Sixgill Sawshark		
Prionace acutus	Blue Shark		

Source: Sætre and Silva, 1979.

Exporters often trade in both shark fin and beche de mer.
Rob Barnett-TRAFFIC

The most commonly seen species were the Silky Shark, the Dusky Shark, the Star-spotted Smoothhound, and the Smooth Hammerhead.

In addition, shark species caught by the vessel "Aelita" from 29 longline stations were recorded in August and November 1976, and in June and July 1977. Sharks comprised 23% of the catch; species and percentages are listed in Table 4 (Sætre and Silva, 1979).

Table 4
Shark species caught by the vessel "Aelita" on two trips in 1976 and 1977

Species	% Composition of the catch
Prionace glauca	8.5
Carcharhinus limbatus	5.9
Alopias vulpinus	2.8
Carcharhinus longimanus	2.1
Carcharhinus melanopterus	1.4
Carcharhinus albimarginatus	1.3
Carcharhinus leucas	0.6
Carcharhinus brevipinna	0.4

Source: Sætre and Silva, 1979.

Based on available information of the commercial catch and from surveys, the State Secretariat of Fisheries (SEP) prepared the Master Plan for the Fishery Sector. Information on the potential of the fishery resources and status of exploitation is presented below (Anon., 1994a).

Table 5
Fishery resources, catch and level of exploitation in Mozambique

Resource	Potential (mt)	Estimated Catch (mt, 1994)	Level of Exploitation
Crustaceans			
Shallow-water prawns	19 100	11 522	Intensive on Sofala Bank and Maputo Bay. Moderate in zones only accessible to artisanal fishery
Mundle prawns	4 100	3 154	Intensive
Deep-water prawns	3 500	1 830	Moderate
Deep-water lobster	400	292	Intensive
Crayfish	500	450	Moderate
Deep-water crab	800	309	Moderate
Rock lobster	150	20	Low
Mangrove crab	13 300	2 000	Low
Marine Fish			
Large Demersals	29 500	7 338	Unexploited on St. Lazarus Bank, moderate in rest of the country
Large pelagics	37 000	4 212	Very low
Sharks	10 500	2 236	Low
Small demersals	116 500	15 875	Low
Small pelagics	131 300	35 894	Low
Deep-water fish	500	250	Low
Molluscs and other marine resources			
Holothurians	750	700	Intensive
Cephalopods	2 000	240	Low
Algae	500	0	Low
Clams and bivalves	2 200	200	Low
Inland Waters Fish			
Kapenta (C. Bassa)	15 000	460	Low
Demersals (C. Bassa)	5 000	4 500	Intensive
Utaka (L. Niassa)	22 000	4 000	Low
TOTAL	**414 600**	**95 482**	

Source: Anon., 1994a.

The fishery resources of major economic impact are the crustaceans, namely the shallow-water prawns, and the deep-water prawns and lobster. With the exception of deep-water prawns, these resources are at a stage of extensive exploitation. The bycatch of deep-water prawns is composed of other species of crustacea, fish and cephalopods of high commercial value, such as crayfish and deep-water crab.

The most abundant fish resources belong to the category of small pelagic fish. Most of these resources are accessible to small-scale fisheries (semi-industrial and artisanal). The littoral resources - mangrove crabs, sea cucumber, molluscs and bivalves - are accessible in greater or lesser abundance to artisanal fisheries in almost all regions in the country. In the northern part of the country (Cabo Delgado and north of Nampula province), demersal species of high commercial value, as well as seasonally concentrated small and large pelagics, are accessible to artisanal fishermen.

In the central part of the country, along the Sofala Bank, the shallow-water prawns and respective bycatch, demersal species and the seasonally occurring small pelagics are accessible resources harvested by artisanal fishermen. In the south, there are areas where the demersal resources of high commercial value are easily accessed by the artisanal fishermen. In addition, small pelagics are relatively abundant on a seasonal basis, mostly in the Bays of Maputo and Inhambane, as well as in estuaries and other sheltered locations.

It should be noted that although the data compiled by SEP (Anon., 1994a) is regarded as the most comprehensive assessment of the current situation, other assessments were carried out prior to 1994 that conflict with these figures. For example, in 1990 a review of the fisheries sector was carried out, and the following data was recorded with regard to sharks and rays.

Table 6
Recorded, estimated and potential shark/ray catch - 1990 (mt)

Total Recorded	**3 000**
Estimated Total	3 300
Estimated Industrial Catch	1 000
Estimated Semi-industrial Catch	500
Estimated Artisanal Catch	1 800
Potential Catch	3 300

Source: Adapted from Tembe, 1991.

It is possible that the above assessment as well as others were made without the full benefit of survey data that was collected, compiled and published in the late 1980s and early 1990s. At the same time, it is worthwhile to point out that there are differences of opinion concerning the status of the fishery resources of Mozambique.

Sharks are caught as bycatch in all types of Mozambican fisheries, industrial, semi-industrial and by all types of boats using all types of gears, in the full range of depth intervals, from the coastline to about 1 200 m in depth (Slotsvik and Volstad, 1993).

Some projects geared towards development of the shark fishery were carried out with external support. From 1980 to 1984, FAO was involved in a project aimed at assisting the fisheries sector in the industrialisation of shark fishing (Mihara, 1984). The project focused on the artisanal and coastal fisheries, and provided training in fishing methods, in particular longline fishing for sharks. Larger sharks were targeted with longlines, and smaller sharks were targeted in Maputo Bay with gillnets. The project tested various fishing methods, and found that a 10% catch rate was possible with longlines. The project was hindered by a lack of new and efficient vessels, but regardless the catch rates for shark longliners are presented below.

This project continued into 1985, and its shark-related aspects included providing shark fishing demonstrations to local fishermen, and designing practical guidelines for shark utilisation (Mihara and Donato, 1986). Utilisation of sharks included demonstration and training in processing of shark skins, processing of shark and ray meat by drying and salting, preparation of shark fins for export, processing of liver for oil, preparation of jaws and teeth for sale to tourists, processing of shark cartilage, and processing of head, cartilage and viscera for domestic animal feed. It was noted that shark fins were the main product supporting the shark fishing industry in Mozambique (Mihara and Donato, 1986).

Table 7

Operations and catches of shark longliners (16-19 m, 230 HP type)

Year	No. of boats	Average Operating Days	Average Catch	Total Tons
1980	2	70 days	300 kg/day	42.0
1981	3	30 days	500 kg/day	45.0
1982	3	67 days	300 kg/day	60.3

Source: Adapted from Mihara, 1984.

During the period of project implementation, numerous problems abounded with respect to availability of materials required for shark processing, such as fuel oil, salt and tools. In addition, transportation was irregular, making ready access to markets difficult. As a result, project executants focused on the small-scale shark fishery, and on improving utilisation of shark by promoting processing of a variety of products (Mihara and Donato, 1986). To support project objectives, Donato (1985) prepared some notes on shark capture and processing. Mihara and Donato (1986) presented guidelines for catch and artisanal processing of sharks.

CURRENT FISHERIES

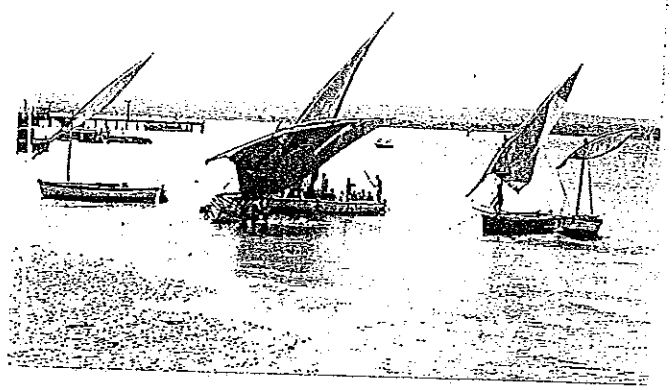
Marine fisheries in Mozambique fisheries are classified into three categories, which include industrial, operating with 20-30 m motor boats, semi-industrial, with 10-20 m motor boats, and artisanal, operating on foot or with 3-10 m canoes and boats, powered by sail and paddle. Fishing takes place along the length of Mozambique's coastline, although most activity occurs in three zones. The Sofala and Boa-Paz Banks are fished with mechanized and industrial trawl, and the continental shelf with mechanized trawling nets and pots. The littoral zone, bays and estuaries are fished by the artisanal and semi-industrial fleets and the gear includes gillnets, beach seines, pots, traps, lines, and beach trawls (Tembe, 1991). The potential and estimated recorded catch for sharks for 1993 are presented in Table 5.

1. Artisanal

In 1989, it was estimated that approximately 55 000 people generated earnings from artisanal fishing (Anon., 1993). In 1993, the number of fishermen increased to 80 000, 35% of which are subsistence fishermen. This increase since 1989 is mainly due to displacement of population from inland to the coastal areas as a result of the war. The estimated number of boats in 1993 was 10 700, using sails or oars as the means of propulsion and about 360 motorized vessels. However, based on information from three censuses conducted in three main provinces, the actual number of boats is likely to be between 11 000 and 19 000 units. The methods and gear used by the artisanal fishery are virtually the same throughout all the regions in the country, with slight differences from region to region. Commonly found throughout the country are handlines, "gamboas", beach seines, drift gillnets and bottom gillnets. Locally made artisanal pots have widespread use in the north, as well as spears. Fishing without boats is carried out along the entire coast for littoral species (mangrove crabs, sea cucumbers, molluscs and bivalves). In this fishery with boats, targeted species include prawns and several species of small pelagic and demersal fish (Anon., 1994a).

i. Directed

Presently no direct artisanal shark fishing is practised in the country.



Artisanal fishermen in Inhambane, Mozambique
Simon Anstey

ii. Bycatch

The most recent estimate of shark bycatch, made in 1993 (Anon., 1994a); gave a total shark catch of 2 186 mt, which may be an underestimated value. Sharks are caught mainly as bycatch from the handline and drift and bottom gillnet fisheries.

2. Semi-industrial

Semi-industrial fishing activity is carried out with vessels of medium size concentrating mainly on prawn trawling in zones close to the coast or in bays and on line fishing of demersal fish. Production from semi-industrial catch is targeted at the urban domestic market and export (Anon., 1994a).

Table 8
Distribution of the semi-industrial fleet, 1993

Resource/Method	Total fleet
Prawn (trawl)	40
Fish (gillnet, purse seine, line)	29
TOTAL	69

Source: Anon., 1994a.

In 1993 a total number of 69 vessels were registered to carry out semi-industrial fishing activities. All vessels were privately owned, including some Mozambican nationals. Most vessels were wooden (57), with an average length of between 12-18 m (32). Most engines ranged from between 120-200 HP (23), and ice was used as a means to preserve the catch (Anon., 1994a). The technology and resources for which the semi-industrial fleet is currently licensed are prawn trawling - in which most are involved - shark, large demersals and large pelagic fisheries with gillnets, purse seines and line fishing.

i. Directed

At least two fishermen on Inhaca Island, 20 km east of Maputo, fish semi-commercially for sharks. The gear used is predominantly 100 to 300 m x 10 m multi-filament set net of 20 cm mesh (two to three per fisherman), although mono-filament nets (100 x 10 m x 15 cm mesh - five to six per fisherman) are also used. The multi-filament nets are set mid-water and soak time is more than one day, while the mono-filament nets seem to be ground set. On one occasion in October 1994, a 500 x 10 m and 20 cm mesh multi-filament net was found about 5 km west of Inhaca. The net was covered in growth and was tangled, it appeared to have been lost. No animals were found enmeshed in the net. Catches include swordfish, the Zambezi Shark Carcharhinus leucas, the Tiger Shark and several other unknown species of sharks (V. Cockcroft, pers. comm., 1996).

ii. Bycatch

The semi-industrial fishery sector is mostly geared toward prawn trawling. The fishery is predominantly based in two main centres, Beira and Maputo. In 1987 a total number of 54 trawlers were registered in both centres. They fish with prawn trawl nets of 37 mm mesh in the cod-end. Total recorded catch in 1986 was 666 mt in those centres (Silva and Sousa, 1988). Sharks occur in small quantities as bycatch of the prawn fishery. Sousa (1990b) estimated that 0.5% of the total prawn bycatch was comprised of sharks and rays in Maputo Bay.

A semi-industrial kelee shad fishery operated in Maputo Bay (682 km^2) until 1989. The fleet was composed of 4 four motorized boats of 6.5 to 8.5 m long, making daily trips to the fishing harbour and the fish was preserved in ice. Gear used was nylon mono-filament netting (Silva and Sousa, 1988).

A semi-industrial line fishery for hard-bottom demersal fish has developed since 1990 in Mozambique. This fishery primarily occurs in the southern region, from Ponta Zavora to Maputo. In 1993, 23 line fishing vessels were based in Maputo and Inhambane, with refrigeration on board, 8-18 m long, powered with 12-180 HP motors. The crew consisted of 10-15 fishermen, making 5-10 day trips (Dengo and Torstensen, in press). In 1993, the total recorded catch for six line fishing vessels operating from Maputo was 216 mt. Sharks were not usually caught in this fishery (Anon., 1994a).

3. Industrial

Industrial fisheries have concentrated on prawn fishing in Sofala Bank, with minimal attention paid to other resources that could increase the current value of exports and also contribute to the supply of fish for the domestic market. The production from the industrial catch is primarily for export.

In 1993, there were 118 industrial fishing vessels registered for shallow-water prawn, deep-water prawn, and other fish resources, distributed as follows in Table 9.

Table 9
Industrial fleet distribution according to resource and fishing methods used, 1993

Resource/Method	Total Fleet
Prawn (trawl)	54
Deep-water Prawn	26
Fish (trawl)	13
Fish (line)	4
Fish (purse seine)	14
Lobster (trap)	1
Lobster (pots)	2
Associated	4
TOTAL	118

Source: Anon., 1994a.

i. Directed

A set gillnet fishery for sharks operated north of Maputo until the mid 1980s. Although this fishery apparently ceased (R. van der Elst, pers. comm., 1990), an industrial fishery for sharks was recently established within Maputo Bay and environs. In addition, there is a commercial shark fishery in Inhambane Bay. The commercial fishery uses six motorised boats ranging in size from 10-20 m, and multi-filament 300 x 10 m x 20 cm mesh nets. Each boat sets two to three nets daily. These are set mid-water and overnight. Furthermore, there is a shark net fishery in the region of Vilankulos (central Mozambique), which sets at least two (100 m x 10 m) nets daily (V. Cockcroft, pers. comm., 1996).

ii. Bycatch

The prawn fishery is estimated to provide about 42% of Mozambique's export revenue (Anon., 1993). Schultz and Baltazar (in press) estimated the total prawn bycatch caught by the industrial prawn trawlers in Sofala Bank, for 1991 and 1992. Based on the prawn catch and on the ratio of prawn:prawn bycatch, estimated as 68.8% in 1991 and 68.2% in 1992, these authors estimated 15 363 mt of prawn bycatch in 1991 and 13 327 mt in 1992. The species composition of different groups of prawn bycatch was as follows in Table 10.

Table 10
Species composition (%) of prawn bycatch in Sofala Bank

Year	Fish	Other Crustaceans	Cephalopods	Others
1991	75.5	15.7	4.5	4.0
1992	78.8	12.8	2.5	5.9

Source: Schultz and Baltazar, in press.

Sharks were probably included in the group of fish, which was split into three grades, as follows in Table 11.

Table 11
Species composition (%) of fish by commercial grades

Year	1st Grade	2nd Grade	3rd Grade
1991	0.2	16.9	82.9
1992	0.9	21.8	77.3

Source: Schultz and Baltazar, in press.

Besides sharks, several other fish belong to Grade 3 fish. Schultz (1989) estimated that about 1% of total fish would be composed of species belonging to Chondrichthyes (sharks and rays). The following families were identified: Alopiidae, Carcharhinidae, Dasyatidae, Odontaspididae, Mobulidae, Rajiidae, Rhinobatidae, Sphyrnidae, Squalidae, Stegostomidae, Torpedinidae and Triakidae.

The bycatch of the deep-water prawn fishery was analysed by Dengo and Torstensen (in press). About 85% of total deep-water prawn catch is bycatch, of which 73% is fish and the remaining 12% are cephalopods and other deep-water crustaceans. In the group of fish the families Acropomatidae, Chlorophthalmidae, Gempylidae, Macrouridae, Nomeidae and Synodontidae are the best represented in the bycatch. Sharks belong to a less representative group (Torstensen, 1991).

4. Recreational

Since 1992, sport fishing has increased in Mozambique. The sport fishermen are primarily of South African origin, and the areas most frequented are the Ponto do Ouro-Machangulo Peninsula, the Bilene-Xai Xai coastline and Bazaruto Island (Hatton, 1995; L. Erasmus, *in litt.*, 1996). Targeted species include bonito, tuna, mackerel, bonefish and various billfishes. In the past, the total estimated recreational billfish catch was a mere 250 fish (Dutton and Zolho, 1989/1990). Van der Elst *et al.* (1996) refers to increasing numbers of tourist anglers arriving in Mozambique through the Ponta do Ouro border in the south. These tourists participate in skiboat angling, shore angling, and spear fishing. Data from catch cards introduced at Ponta Malongane and Ponta do Ouro in 1994 were analysed to determine the catch and effort expended by tourist anglers. The catch of skiboats consists largely of tuna, king mackerel, kingfish, jobfish and reef-dwelling fishes. The catch of shore anglers is dominated by wave garrick and stumpnose whilst spearfishers catch a variety of kingfish species, king mackerel, barracuda and reef-dwelling species.

Cartilaginous fishes were recorded on catch cards by tourist anglers, as follows:

Carcharhinidae	*Carcharhinus leucas*
	C. limbatus
Dasyatidae	*Himantura uarak*
Odontaspididae	*Carcharias taurus*
Rhinobatidae	*Rhyncobatus djiddensis*
Sphrynidae	*Sphyrna* spp.

With the conclusion of Mozambique's civil war and the development of tourist facilities, Bazaruto Island has become a popular sport fishing destination. Currently, four 6 m catamarans from the Bazaruto Lodge are involved in year round sport fishing operations, making some 200 trips annually at approximately US $200 per day; other lodges on Bazaruto also offer sport fishing (L. Erasmus, *in litt.*, 1996). Sharks are targeted about every tenth trip, and the number reportedly taken has increased since 1988, but the size of individual specimens has remained constant (L. Erasmus, *in litt.*, 1996). Along with sharks, various rays and skates are also occasionally caught, and all specimens are released live if possible (L. Erasmus, *in litt.*, 1996). The Mozambique government requires all sport fishing boats to be registered. Table 11 indicates the species composition and frequency of shark catches off of Bazaruto.

Table 12
Bazaruto Lodge shark catches off Bazaruto Island, Mozambique

Common Name	Scientific Name	Frequency of Catch
Great Hammerhead	*Sphyrna mokarran*	Occasional
Great White	*Carcharodon carcharias*	Rare
Sandbar	*Carcharhinus plumbeus*	Occasional
Snaggletooth	*Hemipristis elongatus*	Common
Spinner	*Carcharhinus brevipinna*	Common

Source: L. Erasmus, *in litt.*, 1996.

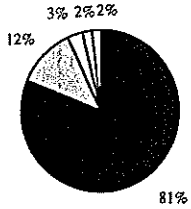
TRADE

According to available information, exports of fish products were valued at US$ 73 million in 1993, distributed among the following markets: Spain (50%); Japan (30%; South Africa (13%); Portugal (4%); and other countries (3%) (Anon., 1994a). Shallow and deep-water prawn exports represented the following proportions per market:

Shallow Water Prawns	Spain	93%
	Japan	90%
	South Africa	31%
	Portugal	65%
Deep Water Prawns	South Africa	41%
	Portugal	22%

The importance of the different marine products in the exports from the sector was as follows:

Shallow water prawns	81%
Deep water prawns	12%
Lobster	3%
Deep water crayfish	2%
Fish, crab, others	2%



A total of 84 exporters of seafood products were registered in 1992. However, most have limited expertise in international marketing of seafoods.

Although considerable effort was made in the 1980s to increase the shark fishery and to improve shark utilisation (Mihara and Donato, 1986), information on the level of trade in shark products is not available. However, figures on imports of some products into Taiwan and Japan are presented below.

Table 13
Imports of shark products as reported by Taiwan and Japan, 1989-1995 (mt)

Imports of Dried Shark fin to Taiwan 1989-1995 (mt)								
Year	1989	1990	1991	1992	1993	1994	1995	Total
Quantity	0.0	0.0	0.01	0.38	0.25	0.0	0.11	0.75
Imports of Frozen Shark (excluding fillets and other fish meat) to Japan, 1989-1995 (mt)[1]								
Year	1989	1990	1991	1992	1993	1994	1995	Total
Quantity	24.4	81.9	97.4	33.6	36.3	39.0	5.1[2]	317.7

1. Dogfish and other sharks, frozen excluding fish fillets and other fish meat of heading No. 03.04 excluding liver and roes (Japanese Customs Statistics).
2. The quantity reported for 1995 is for January to June only.

Source: M. Phipps, *in litt.*, 1996.

CONSERVATION IMPLICATIONS

Sharks were reported in 1979 as being a significant resource in Mozambican waters, especially near the mouth of the Zambezi River, and in general were considered to be "lightly exploited" (Sætre and Silva, 1979). Since that time however, considerable effort has been made to increase shark exploitation in Mozambique. The most recent available information indicates that the level of shark exploitation remains low, if one compares the potential catch with the current (1993) recorded catch (see Table 5). However, the estimated catch may be considered as an underestimation as in many cases shark catches are not recorded. This is especially the case in the shallow water prawn fishery where the crew consume sharks as food while at sea.

REGULATORY/MANAGEMENT FRAMEWORKS

Mozambique has a Fisheries Law and various management measures, and the sector is managed by the Secretariat of the State for Fisheries (Tembe, 1991). No regulatory measures specific to sharks have been identified during this study.

CONCLUSIONS AND RECOMMENDATIONS

The official statistics pertaining to sharks presented in this report indicate that the shark fishery in Mozambique is experiencing a low level of exploitation, relative to the potential catch. On the other hand, it should be noted that a number of reviews of the fishery sector have been carried out, resulting in far more conservative estimates of the status of the resource and the potential catch. Research has also been undertaken to determine the most suitable boats and fishing gears to exploit fishery resources, in particular sharks. Yet, there still exists a need to collect, compile and analyse additional information on shark stocks and exploitation. Data are lacking on certain aspects of the catch, as

well as the trade in shark products. The recorded catch is likely to be underestimated, given the incomplete recording of actual shark landings. Furthermore, sharks occur and are caught at all depth intervals in Mozambican waters, and it is probable that fishing success using different fishing gears for targeted shark species and fishing boats is quite high.

In addition, Mozambique does not record any exports of shark fins, yet data from importing countries indicate that a trade is occurring. It would seem appropriate that increased effort be devoted to monitoring the export trade in products such as meat and shark fins, in order to obtain an accurate quantification of the trade.

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TRADE IN SHARKS AND SHARK PRODUCTS IN SOUTH AFRICA

Malcolm J. Smale

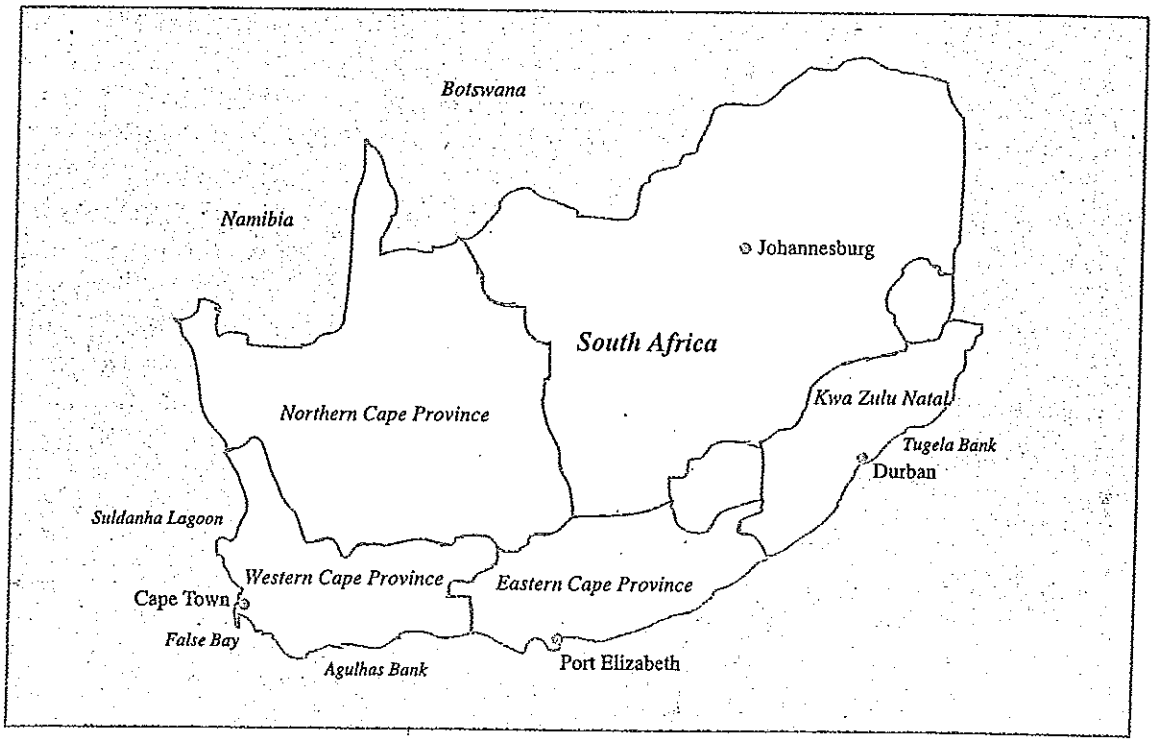
INTRODUCTION

South Africa has 3 000 km of coastline and is bounded by two oceans, the Indian Ocean on the east and south coasts and the Atlantic along the west coast. Because of oceanographic influences, there are different zoogeographic components to the fauna found in South African waters. Off the KwaZulu-Natal coast, the fauna is subtropical, giving way to warm temperate species off the south coast of Eastern and Western Cape Provinces. The cool temperate south eastern Atlantic waters are part of the Benguela ecosystem which extend along the west coasts of Western and Northern Cape Provinces up into Namibia. This Atlantic region has a less diverse chondrichthyan fauna, while that of the subequatorial African region is diverse with 48 families and roughly 260 species (Compagno *et al.*, 1989; Compagno *et al.*, 1994). Sharks make up 51%, batoids 45% and chimaeroids 4% of the total (Compagno *et al.*, 1994). Approximately 79 species are "area endemics" found only in the subequatorial region of the Atlantic, Indian and Antarctic oceans (Compagno *et al.*, 1994).

HISTORICAL OVERVIEW

Indigenous people in South Africa used sea products to a limited extent as a subsistence activity. Although they caught fish using devices such as traps, it was only after the arrival of European settlers that larger commercial fisheries developed in the form of trawling, purse seining and line fisheries. These were based largely on the European fishing techniques, but modified for local conditions. Development was greatest after the 1900s and substantial growth was recorded in the 1940s and 1950s (von Bonde, 1956).

Interest in shark fishing started in the 1930s and it was noted that virtually the entire carcass could be used for various products such as meat, fins, shagreen (skin), fertilizer and oils (von Bonde, 1934; Kroese *et al.*, 1995). Shark fishing has, however, always been a fishery of last resort and more lucrative fish groups, particularly a number of teleost species, have been the principal targets of both line and trawl fisheries. Nevertheless, sharks or shark products may be landed, particularly when market conditions are favorable.



Market forces have varied with time. In the 1940s, for example, the demand for vitamin A from shark livers made this the main focus of the shark fishery (von Bonde, 1949; von Bonde, 1956). Towards the end of World War II, South Africa was producing six million international units of vitamin A oil, valued at 300 000 pounds sterling (Lees, 1969). From 1952, there was a marked reduction in the demand for vitamin A oil on the international market, and this reduced the targeted shark fishery to soupfin sharks (Marchand, 1952; von Bonde, 1952). Export of the meat to other African countries was important in the 1950s and liver oil was less important, although it continued to be exported (Marchand, 1956; Marchand, 1957). Shark trunks were exported to the Mediterranean and Australia until 1968 when the so-called "mercury scare" put a stop to this trade. Exports to the rest of Africa declined sharply and by 1972 were minimal. Shark fins, however, were exported to the Far East at least from the 1950s and currently this product is becoming an increasingly important component of South Africa's shark fisheries.

CURRENT FISHERIES

Sharks are caught in a lot of fisheries because of the multi-species catches made by the fishing gears. Because of this often large impact on bycatch species (those not primarily targeted by a particular fishery), the various fisheries are considered according to gear type, and their impacts on chondrichthyans are highlighted when these are known. Principal target species for each fishery are indicated for each. It is important to note that much of the impacts on sharks and other chondrichthyans is as bycatch and this considerably complicates management policies, as will be discussed later.

1. Artisanal

In South Africa, artisanal fisheries are found mainly in estuaries of the north east coast, off KwaZulu-Natal, in the form of fish traps and nets. These catch teleosts mainly and probably have little impact on chondrichthyans. Other line fishing is considered below but these are not artisanal in the strict sense, in that the catch is usually marketed, rather than used exclusively for the local community food needs.

2. Offshore Fishery

1. The bottom trawl hake and sole-directed fisheries in South Africa are centred largely in the western Cape coast and on the Agulhas Bank on South Africa's south coast. They target Hake *Merluccius* spp., Kingklip *Genypterus capensis*, Sole *Austroglossus* spp., and several other teleosts. In 1995, some 30 inshore trawlers were operating inshore of about 120 m, mainly in the Agulhas Bank and they initially targeted sole, but several other species, particularly hake were also important (Japp *et al.*, 1994). Only about 20% of the Agulhas Bank is considered safe to standard trawl gear. The rest is hard ground that may be trawled using bobbins (circular rubber or steel wheel-like attachments to demersal nets that allow boats to fish over rough ground), but these are not generally employed. Inshore bays that are closed to trawling make up 5% of the total inshore area and 20% of the safe area for standard bottom trawling gear (Japp *et al.*, 1994).

In 1995, there were approximately 60 offshore trawlers operating in waters 110 m deep down to at least 500 m, targeting hake species mainly, but also taking a variety of bycatch species, the composition of which depends on the fishing area and depth (Roel, 1987). Most of the offshore trawling occurs on the west coast, although limited areas of the Agulhas Bank are suitable (Japp *et al.*, 1994).

More than 45 species of chondrichthyans are caught in trawl nets on the Agulhas Bank (Smale *et al.*, 1993), and 55 have been recorded from the southern African west coast during research trawls that regularly sampled the shelf and slope fauna for research purposes (Compagno *et al.*, 1991). Nevertheless, chondrichthyans are a minor component of the landings of the trawl fleet (Table 1), and these records of landings certainly underestimate the catches. The bulk of bycatches are returned to the sea dead because they do not survive the trawling and hauling process. At present, there are no records of the discarded component of the catch but studies currently underway are aimed at obtaining this data. One of the most dominant chondrichthyan species on the Agulhas bank is the Shortnose Spiny Dogfish *Squalus megalops*. It is thought to be the fifth most dominant fish with an index of biomass of about 102 000 mt (Japp *et al.*,

1994), but because it is not marketed, no records exist of catches, although it is occasionally caught in large numbers. A preliminary estimate of 22 000 mt catch of chondrichthyans by South African trawlers was made by Compagno *et al.* (1994).

A research project investigating the bycatch of trawlers was initiated in South Africa in 1994, but results are not yet available. Nevertheless, it is clear that trawling on grounds with a diverse fauna will have multispecies impacts, and affect nurseries of both teleosts and chondrichthyans adversely (Buxton *et al.*, 1984; Smale, 1991; Smale & Compagno, unpublished data).

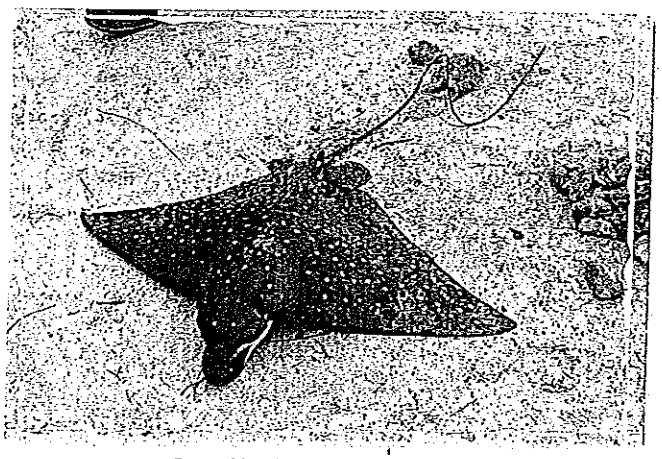
Species retained by the trawl fleet include unspecified sharks although the dominant shark species is the Soupfin Shark *Galeorhinus galeus*. Other species that may be retained are Smoothhounds *Mustelus mustelus* and Grey Sharks *Carcharhinus* spp.. At least part of the catch of St Joseph *Callorhinchus capensis* and unspecified skates, which are mainly Biscuit Skate *Raja clavata*, are also retained. It should be noted, however, that there are some unresolved systematic problems with the biscuit skate off Southern Africa (Compagno *et al.*, 1991). Apparently only shark trunks and skate wings are landed by trawlers and few, if any, market either livers, fins or cartilage at present.

2. The KwaZulu-Natal demersal prawn trawl fishery on Tugela Banks targets crustaceans, but bycatches include bony fish and chondrichthyans (Fennessy, 1994a; Fennessy, 1994b; Table 2). Although the chondrichthyans are not retained by the fishery, many are returned to the sea dead; and no landing records are kept. Nevertheless, the crustacean fishery has a negative impact on a relatively small area of the Natal coast and impacts on chondrichthyan nursery areas. The trawls are carried out with a prawn net which is fairly small and slow-moving, hence small sharks are susceptible to capture.

3. Purse seine fisheries for clupeids off the Cape south and west coasts target clupeiform fishes, namely Pilchards *Sardinops sagax* and Anchovy *Engraulis japonicus*. They occasionally catch large Grey Sharks *Carcharhinus* spp. feeding on aggregated shoals, but these appear to be infrequent occurrences. These sharks may be dressed (guts and fins removed) and sold to marketing companies, but no records exist on quantities caught, although they may be included as part of aggregate export data.

4. The midwater trawl fishery targeting Horse Mackerel *Trachurus trachurus* off the Cape south and west coasts probably has minimal impact on chondrichthyans although there are no recorded data. However, species such as Shortnose Spiny Dogfish and pelagic sharks and rays are probably taken occasionally. Indeed, experimental pelagic trawling by the research vessel "Africana" has collected large numbers of neonate Shortnose Spiny Dogfish near or even at the surface, so there is a possibility that commercial pelagic trawling occasionally impinges upon the recruitment of this abundant demersal dogfish through bycatch of young (L. Compagno, *in litt.*, 1996).

5. Commercial line fisheries use either large deck boats or skiboats (dinghies with either two out-board motors of up to 120 hp each or an inboard motor), 80% of which are smaller than 10 m, although some are 12 m or larger (Kroese *et al.*, 1995). Fishing gear used includes handlines or rods and reels with monofilament line, lead sinkers and 3-15 baited hooks, although two to six is more common. Line fishing occurs around the entire coast but is most developed along the southwestern, south and eastern Cape coasts and KwaZulu-Natal (Penney *et al.*, 1989). The line fishery is driven by market forces and fish availability. Teleosts are prime targets but sharks are targeted by some boats, particularly in the south western Cape and at a few localities on the KwaZulu-Natal south coast if a factory or processor can find a market for the products. Because the price for shark is currently one-third or less per kg compared of that for teleosts, they are taken opportunistically either when teleost prices fall or when they are not catchable. Because of declining line catches of teleosts since the 1960s, despite improved technology



Spotted EagleRay on sale in Dar-es-Salaam, Tanzania
Rob Barnett-TRAFFIC

(Penney *et al.*, 1989), species of lower market value, including sharks, are increasingly being targeted.

Table 1

Recorded annual landings of trawlers in Eastern and Western Cape waters, nominal weight (mt)

Gear and common name	Scientific name	mt				
		1989	1990	1991	1992	1993
Offshore trawl						
Hake	*Merluccius capensis, M. paradoxus*	122 395	122 645	125 913	124 631	132 089
Kingklip	*Genypterus capensis*	1 467	1 156	1 772	2 014	2 490
Monk	*Lophius vomerinus*	4 750	5 419	5 819	4 724	4 176
Jacopever	*Helicolenus dactylopterus*	1 044	1 005	1 015	1 211	1 478
St Joseph	*Callorhinchus capensis*	75	12	10	18	344
Unidentified sharks		68	89	34	45	14
Skates		24	129	91	18	27
Total chondrichthyan landings		167	230	135	143	385
Chondrichthyans as % total landings		0.09	0.1	0.07	0.08	0.2
Inshore trawl						
Hake	*Merluccius capensis, M. paradoxus*	10 038	10 012	8 206	9 252	8 870
Horse mackerel	*Trachurus trachurus capensis*	1 475	2 314	5 442	4 939	2 202
East coast sole	*Austroglossus pectoralis*	912	807	717	698	764
Panga	*Pterogymnus laniarius*	139	328	395	448	597
St Joseph	*Callorhinchus capensis*	184	373	248	345	330
Unidentified sharks		143	132	158	149	150
Skates		1 173	1 270	1 177	1 255	1 057
Total chondrichthyan landings		1 500	1 775	1 583	1 749	1 537
Chondrichthyans as % total landings		9.7	10.9	8.9	9.5	10.1
Inshore and Offshore trawl						
Total St Joseph landings		259	385	258	363	674
Total shark landings		211	221	192	194	164
Total skate landings		1 197	1 399	1 268	1 273	1 084
Total Chondrichthyan landings		**1 667**	**2 005**	**1 718**	**1 830**	**1 922**

Source: Data modified from Stuttaford, 1993, 1994, 1995, Sea Fisheries Research Institute unpublished data, and Kroese *et al.* 1995.

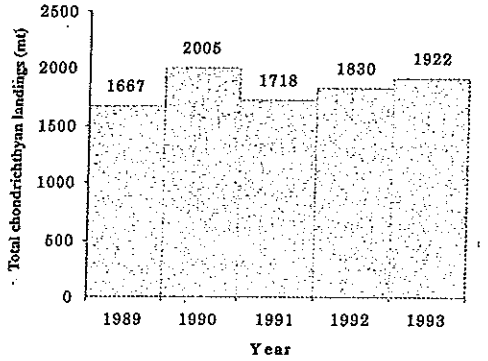


Table 2

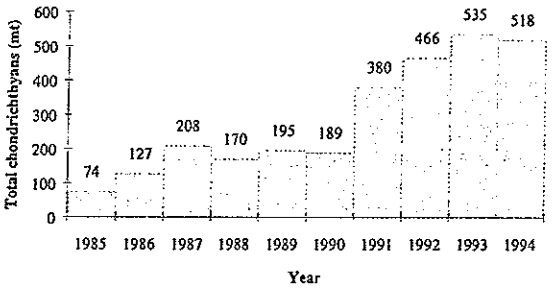
Elasmobranchs recorded from the Tugela Bank prawn trawls

Taxon	Common name	Recorded size			% mortality	Derived estimate of catch	
		Min.	Max.	No.	in 100 trawls	1989	1992
		m	m		in 1990-1992	Tot. fleet hrs. 12 457	Tot. fleet hrs. 6601
DASYATIDAE					36.50	5 235	2 774
Gymnura natalensis	Butterfly ray	0.3	1.7	110	46.40	1 876	994
Himantura gerrardii	Sharpnose stingray	0.2	0.8	64	42.60	1 441	764
Dasyatis chrysonota	Blue stingray	0.2	0.7	73	17.70	1 280	678
Himantura uarnak	Honeycomb stingray	0.3	0.8	21	25.00	422	224
Dasyatis thetidis	Thorntail stingray	0.8	1.5	11	70.00	164	87
SPHYRNIDAE							
Sphyrna lewini	Scalloped hammerhead	0.4	1.5	174	97.60	3 288	1 742
CARCHARHINIDAE					35.60	3 745	1 984
Mustelus mosis	Hardnosed smoothhound	0.3	1.2	77	28.60	1 371	727
Rhizoprionodon acutus	Milkshark	0.3	1	33	29.20	723	383
Carcharhinus brevipinna	Spinner shark	0.6	1.6	29	56.00	630	334
Unidentified carcharhinids	Grey sharks						
Carcharhinus obscurus	Dusky shark	0.7	1.3	10	12.50	320	169
Carcharhinus plumbeus	Sandbar shark	1	1.4	7	33.30	126	67
Carcharhinus sealei	Blackspot shark	1	1.2	3		190	101
Carcharhinus amboinensis	Java shark	1.3	1.3	1	0.00	14	7
Scylliogaleus queketti	Flapnosed shark	1.1	1.1	1		80	42
SCYLIORHINIDAE							
Halaelurus lineatus	Banded catshark	0.2	0.6	91	19.20	2 021	1 071
RHINOBATIDAE					32.50	807	428
Rhinobatos leucospilus	Greyspot guitarfish	0.2	0.5	23	52.60	385	204
Rhyncobatus djiddensis	Giant guitarfish	0.5	2	14	18.20	231	123
Rhinobatos annulatus	Lesser guitarfish	0.3	0.6	9	11.10	154	82
Rhina ancylostoma	Bowfin guitarfish	0.7	1.2	2	0.00	23	12
RAJIDAE							
Raja miraletus	Twineye skate	0.1	0.3	33	0.00	196	104
MYLIOBATIDAE					27.30	276	146
Pteromylaeus bovinus	Bullray	0.4	1.2	6	25.00	150	79
Myliobatis aquila	Eagleray	0.2	0.8	4	50.00	71	38
Aetobatus narinari	Spotted eagleray	0.4	0.8	4	0.00	64	34
SQUATINIDAE							
Squatina africana	African angelshark	0.2	0.5	14	60.00	172	91
TORPEDINIDAE							
Torpedo sinuspersici	Marbled electric ray	0.1	0.4	10	40.00	156	82
ORECTOLOBIDAE							
Stegostoma fasciatum	Zebra shark	1.3	1.3	1	0.00	17	9

Note: Size is total length, except for Myliobatiformes and Torpedinidae.
Source: Data modified from Fennessey, 1994a.

Table 3
Recorded South African landings of commercial line caught fish (mt)

Years	All areas Total Teleosts	All areas Total Chondrichthyans
1985	9 338	74
1986	12 241	127
1987	17 446	208
1988	14 766	170
1989	14 685	195
1990	16 756	189
1991	15 238	380
1992	16 239	466
1993	12 468	535
1994	15 567	518



Source: Unpublished Sea Fisheries Research Institute data.

Chondrichthyan landings reported from the entire South African coast are shown in Table 3. In Natal, the total reported annual chondrichthyan landings varied from <1-16 mt during 1985-1994 and the dominant species were probably *Carcharhinus obscurus* and other grey sharks. Further south off the eastern, southern and western Cape, soupfin, smoothhounds and grey sharks are probably the dominant species. The annual reported catch is between 74-535 mt. Not only is the contribution of sharks increasing in real terms by a factor of about five (Table 3) to >500 mt, they are also increasing as a proportion of the total reported catch.

The reported landings of chondrichthyans by the commercial line fishery (about 500 mt) is about three times as great as the landings of commercially trawled sharks but about a quarter of the trawl fleets total chondrichthyan landings. However, the lack of species identification in reported landings is a major problem, and the extent of underreported or undeclared landings is unknown.

6. Longline fisheries. Longlines of up to about 100 hooks, set in shallow water <10m, were used in the Cape soupfin fishery after World War II by coastal fishermen (Freer, 1992). Other species taken included Smoothhounds and Cowsharks *Notorynchus cepedianus* (Freer, 1992). Although currently prohibited by law, limited amounts of longlining may still occur at the Cape, but information on its extent is difficult to obtain because it is illegal.

An experimental demersal longline fishery on the Alguhas Bank at depths of 100-400 m was initiated in 1983 targeted at Kingklip and Hake (Japp *et al.*, 1994). Because of conflicting interests in targeting and resource management, this experimental longline fishery, which comprised 14 license holders (Badenhorst, 1988; Japp, pers. comm., 1995) was curtailed in 1990 when Kingklip stocks rapidly declined (Japp, 1993). Bycatches of chondrichthyans of this fishery were not quantified but it is likely that species such as Shortfin Mako *Isurus oxyrinchus* and Soupfin would have been used while others such as dogfish *Squalus* spp. would have been discarded (Japp, pers. comm., 1995).

A further pilot study into hake-directed demersal longlining was initiated from May 1994-May 1995. Results of this pilot study showed that unidentified sharks were caught on 31% of the lines, Spiny Dogfish on 5.6% and skates on 1.4 % of the lines (Japp *et al.*, 1995). Chondrichthyans recorded by Japp *et al.* (1995) were unidentified sharks, Spiny Dogfish, skates *Raja* spp., Shysharks *Haploblepharus* spp., Blue Shark *Prionace glauca*, Copper Shark *Carcharhinus brachyurus*, Shortfin Mako, Smoothhound, Soupfin Shark, and White Spotted Smoothhound *Mustelus palumbes*. The pilot study was expanded into an experimental fishery in December 1995 and is ongoing.

Shark-targeted longlining by boats normally fishing for tuna was allowed by permit in 1990, because of decline in availability of tuna. Although there was a high demand for these permits, a total of 21 were issued between 1991 and 1992 and presently the number of shark longline permits has increased to 31 (Kroese *et al.*, 1995). However, there was some controversy about the real intent of the fishery because the bycatch of Hake and Kingklip was often very substantial although the fishery ostensibly was 'targeted' at sharks. A bag limit of ten *Merluccius* spp. and five *Genypterus* spp. (prized teleosts) was instituted in 1992 which curtailed teleost catches and changed the fishing practices (Kroese *et al.*, 1995).

Demersal longlining in South Africa uses similar gear with minor modifications to target Hake, Kingklip or sharks and lines of up to 15 000 hooks are set, although the average is 4 000. However, only 3 000 hooks are set for sharks, and depths range from 50-450 m (Japp, 1993; Kroese *et al.*, 1995).

Pelagic longlining targeted at tunas was late to develop in South Africa (Talbot and Penrith, 1968). Experimental fishing was initiated in the early 1960s (Nepgen, 1970a), although Japanese vessels had been successful in the area for some time (Nepgen, 1970b). Sharks recorded by Nepgen (1970a) were Blue Sharks, Shortfin Makos, Threshers *Alopias vulpinus*, "brown sharks" *Carcharhinus obscurus* (species identification possibly erroneous), Soupfins and Mackerel Sharks *Lamna nasus*. The South African involvement in this fishery was brief, lasting from about 1962-1964, because the participants switched to other fisheries (Nepgen, 1970a).

Currently the Japanese and Taiwanese are the only foreign boats that have permits to fish in South African waters using longlines for tuna. In 1995, there were 90 Japanese and 30 Taiwanese license holders for tuna longlining. The bycatch of this fishery include sharks, and finning is also carried out. Landings of these vessels are not exclusively from South African waters because they can and do work larger areas, concentrating on the best fishing sites. Therefore, foreign landings to South African ports include animals caught thousands of miles away, but no records are available that detail this.

South African shark longline holders initially targeted shortfin mako sharks with a bycatch of blue sharks (Kroese *et al.*, 1995). With a growing demand for shark flesh, targeting has switched according to demand to Soupfin and Smoothhounds on the continental shelf. This was a result of market demands from Australia and Europe. Records of longline catches in Southern Africa are shown in Table 4.

Table 4
Longline catches in Southern Africa (mt)

Domestic shark longline	Species	Landed catch			CPUE mt/1000 hrs		
		1992	1993	1994	1992	1993	1994
Soupfin shark	*Galeorhinus galeus*	14	5.2	48	0.482	1.325	0.554
Mako shark	*Isurus oxyrinchus*	67	43	23	0.834	1.083	1.134
Blue shark	*Prionace glauca*	6	2.7	3.7			
Smoothhound shark	*Mustelus* spp.		1	0			
Unidentified shark		1	1	1			
Foreign tuna longline					**CPUE mt/day**		
Japanese		42.1	72	87	0.032	0.067	0.022
Taiwanese		97.3	32.3	70.4	0.019	0.017	0.018
TOTAL		227.4	157.2	233.1			

Source: Kroese *et al.*, 1995.
Note: Foreign longline species composition unknown, probably mainly Blue and Makos. Taiwan does not report shark catches but lumps these in "others" category. Landings estimated by using the lowest shark total catch (1.7%) of Japanese boats to calculate percentage of sharks in "others" category. Foreign data only available for July-December 1992 and January-June 1993.

Records of catch and effort are limited and probably imprecise. Severe underreporting of part of the catch is well known in several longline fisheries (Stevens, 1992; Bonfil, 1994). Kroese *et al.* (1995) guestimated a catch of 753 mt compared to the reported 87 mt, and suggested that there was large-scale under-reporting or discarding of sharks at sea. South African buyers state that the hatches and holds of Japanese vessels are small and are not suited for storing

carcasses, which suggests that discarding of carcasses may occur. Fins are retained and these are reported below as products. Similarly, Kroese *et al.* (1995) suggest that the Taiwanese catches could be in the region of 755 mt and that they, too, underreport their take. Because local buyers report that their hatches and holds are more suitable for storing large fishes, this may be under-reporting as opposed to discarding. They also keep shark fins.

7. Beach seine fisheries are presently limited to certain areas of the Cape and KwaZulu-Natal, particularly False Bay near Cape Town and Durban Bight in KwaZulu-Natal, and there are a total of 166 licenses for gillnets (Boonstra, 1995), most of which are in the western Cape. Although a traditional form of beach fishing for species such as mullet in the Cape and pilchards in Natal, the use of these nets has been controversial with other resource users; other fishermen complain of competition, inappropriate resource use and a number of other arguments. In the Cape, two species of Mullet *Liza* spp. and Yellowtail *Seriola lalandi* are the primary targets, but there is a large bycatch representing 47 teleost and 20 chondrichthyans species (Lamberth *et al.*, 1994). The chondrichthyans are normally released although St Joseph, Biscuit Skates and Diamond Ray *Gymnura natalensis* may be retained (Lamberth *et al.*, 1994). Since that report, however, the beach seiners have expressed an interest in marketing components of the chondrichthyan catch (Lamberth, pers. comm., 1995), so these may be marketed in future.

8. Set net fisheries involve bottom or surface drift, or bottom-set gillnets that are used with permits on the Cape west coast and target mullet or St Joseph. Licenses for gillnets totaled 780 in 1994 (Boonstra, 1995; Kroese *et al.*, 1995).

In addition, an illegal gillnet fishery exists in Saldanha Lagoon, for which no data are available, although it targets Smoothhounds (*Mustelus mustelus*). An experimental gillnet fishery for sandshark or Lesser Guitarfish *Rhinobatos annulatus* has recently been initiated on the Cape west coast (Kroese *et al.*, 1995). St Joseph gillnets are deployed on the bottom and measure 75 m long, 2.28 deep and stretched monofilament mesh of 17.6 cm (Kroese *et al.*, 1995). Products from these fisheries are largely meat and fins, which are discussed below. Recorded catches of seine and gillnets are shown in Table 5.

Table 5
Seine and gillnet landings in South Africa (mt)

Seine & gillnets	Species	1989	1990	1991	1992	1993
St Joseph	*Callorhinchus capensis*	457	152	282	180	309
Soupfin shark	*Galeorhinus galeus*	1	5	9	8	2
Unidentified rays		13	11	0	19	26
Unidentified shark		10	20	2	2	9
TOTAL		481	188	293	209	346

Source: Kroese *et al.*, 1995.

9. Natal Sharks Board (NSB) bather protection nets are large mesh braided set nets designed to prevent shark attacks off KwaZulu-Natal beaches. In 1978, the nets were 106 m long by 6.3 m deep with a 25 cm bar and secured at each end with a 35 kg anchor. They were doubled in length from 1983 and in general are black polyethylene with a breaking strain of 160 kg and set some 300-500 m offshore in water some 10-14 m deep (Cliff *et al.*, 1988). These nets effectively represent a subsidized fishery that kills off large sharks near bathing beaches, rather than working as shark exclusion zones. Shark netting was initiated on the Natal coast in 1952 off Durban Bay. After 1957, the number of netted beaches increased as a result of public fear of attack, and the NSB was charged with the responsibility of maintaining the nets along the coast from the early 1970s onwards (Davis *et al.*, 1989). In 1993, the total length of these nets on the Natal coast was 44 km (Cliff, 1995).

The mean annual mortality of sharks in the NSB nets totals about 1 470 sharks of some 14 species and averages 90 mt in the period 1978-1990. In addition, some batoids, teleosts and marine mammals are caught (Cliff and Dudley, 1992). Although there is currently a policy of releasing live captures of all species (Cliff and Dudley, 1992), dead animals are brought ashore and dissected when possible, and there is a trade in certain shark products (see below). The high cost of meshing, the present controversy of the practice and the development of alternatives such as non-lethal deterrents may reduce the size of this fishery in future.

3. Recreational

Recreational fisheries include boat and individual shore-based anglers. Some of these specialize in light tackle and are known as such. Shore-based recreational anglers are those that use rods and reels from beaches or rocks at the edge of the sea. Some of these anglers participate in competitions, particularly from spring to autumn. Recreational data is entered onto the National Marine Linefish database from a variety of sources, including voluntary shore-based catch return cards, shore-based competition data, skiboat catch cards and skiboat competitions (Mann-Lang, 1995). This database is incomplete in that there are areas of the South African coast from which no returns are made. Returns analysed in this study were shore angling records and competition records from KwaZulu-Natal and the Cape, and skiboat competition records from KwaZulu-Natal. The amount by which these data are an under-representation of all catches is unknown, but there is a research programme ongoing along the entire coast to try and estimate this variable. These results will not be available for at least one year.

Some recreational anglers return their chondrichthyan catches alive to the sea, although survival rate may vary according to species and individual angler handling. Many individuals, however, will purposely maim or kill any chondrichthyan hooked before returning them. This attitude is slowly changing with more enlightened anglers.

Although chondrichthyans are not targeted by recreational anglers normally, because teleosts are generally considered better eating, exceptions are found with those anglers trying to obtain records or competing in club, provincial or national competitions to maximise catch weight. Large sharks have long been considered challenging targets and some individuals have excelled in catching sharks larger than 500 kg, particularly in the 1950s and 1960s off Natal when whaling operations probably brought more large sharks close inshore (Mara, 1986). Although this shark fishing activity appears to be on the decline, competitions are ongoing, but in the last ten years anglers have increasingly returned their catch to the sea after weighing the sharks and rays, rather than leaving them lying on the beach, or buried in the sand.

Recorded recreational competition catches of chondrichthyans vary between 28-77 mt per year and catch per effort is higher for this group in competitions than regular angling catch cards or ski boat catches records reflect. This results from targeting chondrichthyans during competitions, and mainly teleosts during regular outings (Table 6).

Table 6
Recreational angling catch data summary (mt)

Shore angling competition - all areas	1994	1993	1992	1991	1990
Diamond Ray *(Gymnura natalensis)*	38.40	7.32	28.09	9.55	1.42
Giant Guitarfish *(Rhyncobatus djiddensis)*	5.30	6.11	6.11	3.53	2.48
Dusky Shark *(Carcharhinus obscurus)*	4.28	28.22	42.23	21.05	11.73
Milk Shark *(Rhizoprionodon acutus)*	2.27	3.89	5.39	2.48	1.67
Others (41 taxa)	10.45	31.15	18.08	13.88	11.08
Total chondrichthyans	60.70	76.68	99.90	50.50	28.37
Total hours fished	8 781	10 138	9 285	10167	10233
mt/1 000hrs	6.91	7.56	10.76	4.97	2.77
Shore angling catch cards	**1994**	**1993**	**1992**	**1991**	**1990**
Total chondrichthyans	9.52	9.77	9.37	12.37	9.08
Total hours fished	32 706	26 236	25 782	21 318	24 885
mt/1 000 hrs	0.29	0.37	0.36	0.58	0.37
Skiboat catches KwaZulu-Natal	**1994**	**1993**	**1992**	**1991**	**1990**
Total chondrichthyes	3.31	5.02	3.96	5.98	8.11
Total hours fished	45 065	50 760	71 196	61 980	64 181
mt/1 000 hrs	0.07	0.10	0.06	0.10	0.13

Source: Mann-Lang, 1995.

In addition to unknown levels of under-reporting and non-declaration, there is clearly an unmeasured bias in these data. Skiboats generally do not catch sharks intentionally although some individuals may kill those caught to retrieve their hooks. Currently this chondrichthyan catch is not used and does not therefore enter the shark markets. Although the National Marine Linefish system keeps records of catches, these are an unknown fraction of the total recreational catch.

4. Summary of South African Fisheries

A summary of the landings recorded for the different South African fisheries is provided in Table 7, which shows catches according to groups. St Josephs and skates are presently sold on the local market, although some were sold overseas in previous years. Breakdown of the proportion going to these different outlets are not available.

Table 7
Summary of landings according to group and gear type (mt)

Group	Gear	1988	1989	1990	1991	1992
St Joseph	Trawlers	259	385	258	363	674
St Joseph	Seine and gillnets	457	152	281	180	309
Skates	Trawlers	1 197	1 399	1 268	1 273	1 084
Skates	Seine and gillnets	13	11	0	19	26
Sharks	Trawlers	211	221	192	194	164
Chondrichthyans	Commercial line	195	189	380	466	535
Sharks	Seine	11	25	11	10	11
Sharks	Longline				227	157
Sharks	NSB (avg)	90	90	90	90	90
TOTAL		2 433	2 472	2 480	2 822	3 050

Note that the use of nominal catch in the database of most landings means that the amount of product used is considerably less than the "landings". In the case of skates, the factor applied is four, so that the product yield from this source would be a quarter of the data reflected below. The factor applied to trawled St Joseph is two (Stuttaford, 1995). Dressed weight of sharks recorded in longline and commercial line catches suggests that these weights would roughly equate to product, if the data are accurate and there is no underreporting. In reality, these data should be seen as minimum values because of undeclared catches and illegal catches. Quantification of this is impossible at present. Note that although the commercial line catches are chondrichthyans, a small proportion of Rhinobatidae (guitarfishes) would probably be dressed and sold as flesh in the same markets as sharks. The chondrichthyan catches used (at least in part) for fishery product purposes exceeds 2 433-3 050 mt, and products entering the world markets (including South African) would be at least 1 500 mt, excluding shark fins and illegal or undeclared catches. It is also worth noting that the NSB catch of sharks enter the market as fins and teeth and jaws only, because the carcasses are not suitable for marketing. In 1993, sharks available for export from this data source would have been in the region of 785 mt (using a factor of two for nominal weights of trawled shark nominal data). In 1992, it would have been in the order of 800 mt.

Table 8
FAO fishery statistics, catches and landings of chondrichthyans from South Africa, mt

Species group	Area	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Skates	47	1 539	1 763	1 624	1 327	1 313	1 316	1 266	1 410	1 268	1 292
Cape elephantfish	47	300	211	848	634	637	568	684	546	537	542
Sharks, rays, skates, etc.	47	362	256	291	362	392	397	609	471	569	651
Sharks, rays, skates, etc.	51	1					16				
TOTAL		2 202	2 230	2 763	2 323	2 342	2 297	2 559	2 427	2 374	2 485

Source: Anon., 1994a.

FAO fisheries statistics are reported by country, ocean and species groupings. FAO data for South Africa are presented in Table 8 for comparison with data collected from other sources above.

Although data in Tables 7 and 8 are not equal for overlap periods, the differences probably relate to relatively minor differences between inclusions of different components of catches, and factors used in obtaining nominal weights. In relation to the accuracy of recorded data compared to actual catches, the differences may be considered relatively minor. Nevertheless, the recorded landings from either source are certainly underestimates of total landings because of non-reporting and underreporting of catches.

TRADE

1. Products and Destinations

KwaZulu-Natal: Sharks taken in the line fishing operations are largely sent to overseas markets, often via companies in Johannesburg or Cape Town. Very little of the product is used locally.

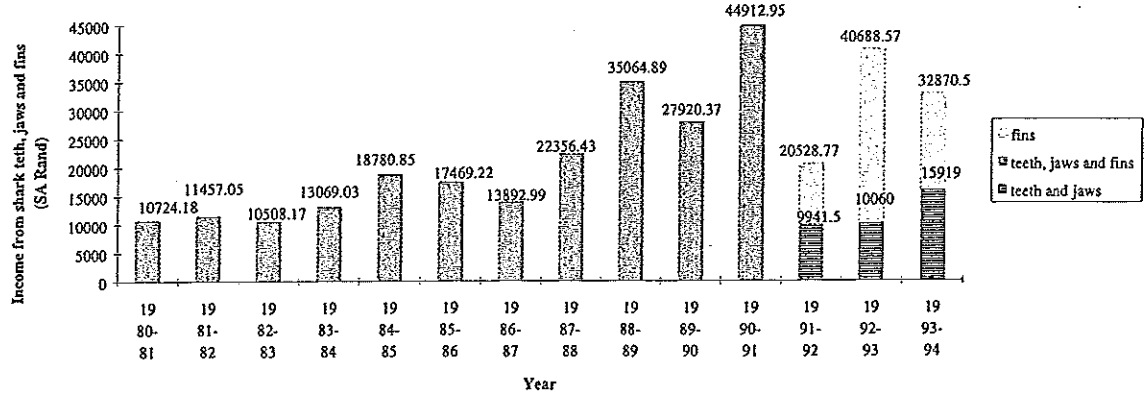
Products from the NSB fishery are marketed whenever possible. Owing to the large size of many of the sharks and the fact that the nets are serviced relatively infrequently, much of the shark catch is unsuitable for marketing either because of a high heavy metal content or the poor condition of the meat. Fins are sold by means of an annual tender and these are apparently exported. Teeth and jewelry made from shark teeth are sold at the NSB shop (Table 9).

Table 9
Shark products from Natal Sharks Board shop, 1995. Values in South African Rands and US $ (exchange rate R3.65 = US $1.00)

Product	Large (R)	Large (US$)	Medium (R)	Medium (US$)	Small (R)	Small (US$)
Shark teeth:						
Ragged tooth	5.00	1.37	3.00	0.82	2.00	0.55
Zambezi	10.00	2.74				
Grey sharks	10.00	2.74	5.00	1.37	3.00	0.82
Tiger shark (silver mount)	40.00	10.96				
Earrings	6.00	1.64				

The NSB uses shark products derived from net catches to offset some of the costs of the beach protection operation. In general, there has been an increase in the amount of revenue derived from these sales, but the decline during the 1991-1992 financial year was a result of lower catches than previous years (Cliff and Dudley, pers. comm., 1995). Income records combine sources of revenue (teeth, jaws and fins) until 1990 (solid bars), but thereafter revenue derived from the teeth and jaw sales (hatched bars) are illustrated separately from fin sales (light bars) in Fig. 1.

Figure 1
Income to Natal Sharks Board from sale of shark products



Note: Fins, teeth and jaws combined until 1990-91; teeth and jaws shown as hatched area from 1991-92 financial year.

Eastern and Western Cape: Apart from that taken by trawlers, there is currently no large catch of chondrichthyans in the Eastern Cape. Most of the shark products which derive from the bycatch of trawlers are sent to the larger commercial centres such as Cape Town. The high cost of transport probably limits the growth of the shark targeted fishing in the Eastern Cape.

A certain amount of the chondrichthyan catch goes onto the local market (for example, in Johannesburg) to be sold as either fresh or frozen fish, dried biltong, or as a smoked and dried product, which may be consumed in the Western Cape or sent to markets further afield. The size of this market is hard to judge directly because of undeclared catches and illegal sales and operations.

Most of the inshore trawled products are sold on the South African market. Skates are sold as skate wing and shark as "Ocean Fillets". St Joseph is sold as "Silver Flake" on the South African market. Around the Western Cape, there is also a local market for salted or smoked shark but there are no data on the size of this market.

In addition to the meat that is used locally, frozen shark meat and dried fins are exported abroad. The overseas market demands a high quality product and there are stringent requirements (especially with regard to health, labour, etc.) for exporting shark meat and skate wings to the EEC. These constraints and the costs of implementation of these facilities has dissuaded some of the smaller companies from exporting to the EEC. For example, EEC requirements have stopped export of skates to France in the recent past.

Livers and skins are presently not marketed either locally or exported. Shark jaws and teeth are rarely marketed on a formal basis, apart from those sold by NSB. Occasionally jaws of various sharks may be found in tourist shops for sale at R70-100 (US $19-27), but the size of this market appears to be small. The market for Great White Shark *Carcharodon carcharias* jaws, teeth and other parts has been outlawed by legislation banning the possession or sale of Great White Shark products. However, although Great White Sharks are protected in South Africa and neighboring Namibia, they are not in adjacent Mozambique, and are regularly being fished there. Compagno (*in litt.*, 1996) observes that it is likely that Great White Sharks are still being caught as bycatch, and that these catches go unrecorded. He also notes that an illegal international trade in jaws may exist. Great White Sharks are still caught in Natal shark nets by permit, and only one fifth of the catch survives (L. Compagno, *in litt.*, 1996).

2. Imports and Exports

Information on shark product imports and exports, obtained from Stuttaford (1993, 1994, 1995), are listed in Tables 10, 11 and 12. Generally speaking, "imports" represent fish products brought into South Africa usually for re-export to another country. This is necessary for pelagic vessel fleets that need to discharge their cargoes to meet market demands of freshness or to make space available for catches of forthcoming fishing operations. The quantities are declared by the companies, and these appear not to be checked or validated locally. Product descriptions are as reported and not verified and it is possible that to avoid disclosure of markets and products to competitors or other reasons, inaccuracies may be in the reported data. These so-called "imports" are actually landings, and any sharks landed may have been caught in South African waters by a foreign vessel, or may be off loaded by a passing ship with the catch from a distant fishing site.

Table 10
South African trade figures

	Import	Imports	Imports	Exports (inc. reexports)	Exports (inc. reexports)	Exports (inc. reexports)	Reexports only
	mt	Rand	US$	mt	Rand	US$	mt
Frozen shark							
1990	0.49	243.00	66.58	141.52	378 545.00	103 710.96	0.00
1991	0.00	0.00	0.00	180.22	735 011.00	201 372.88	1.29
1992	22.88	33 970.00	9 306.85	177.56	608 122.00	166 608.77	0.00
1993	0.95	1 428.00	391.23	189.58	1 033 270.00	283 087.67	0.00
Shark fins							
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	30.80	78 966.00	21 634.52	54.49	927 219.00	254 032.60	31.50
1992	56.18	1 098 031.00	300 830.41	55.85	2 637 715.00	722 661.64	0.00
1993	36.18	246 928.00	67 651.51	17.97	2 076 595.00	568 930.14	0.00

Source: Stuttaford, 1993, 1994, 1995. *Note*: Exchange rate R3.65 = US $1.00.

It should be noted that the estimated (minimal) amount of shark flesh available for the market was 785 and 800 mt for 1992 and 1993 (Table 10). While it is likely that the largest and most valuable market would be overseas, the declared

customs export quantities appear very low. Given that the amount of product would be higher, given the known but not yet quantified illegal and undeclared catches, this suggests that the data are of dubious accuracy because only some 23-24% of the product is reported to be exported. It is possible that shark products are being exported under other names (e.g. "other frozen fish" or something not shark-specific at all) either to confuse competing companies or for other purposes. Mislabelling of products is well known, particularly when illegal products are involved.

Table 11
South African fish product destinations, Customs Union trade, 1992 (mt)

	Imports	Imports	Imports	Exports	Exports	Exports
	mt	Rands	US$	mt	Rands	US$
Dogfish & shark frozen						
Belgium				2.59	22 494	6 163
Cayman Is.	0.45	324	89			
Greece				76.46	212 470	58 211
Hong Kong				19.44	120 040	32 888
Italy				60.85	162 085	44 407
Netherlands				16.04	84 505	23 152
Taiwan	22.43	33 646	9 218	2.18	6 528	1 788
Shark fins						
Hong Kong	0.05	4 347	1 191	43.85	1 612 932	441 899
Japan	17.96	110 711	30 332	9.82	960 163	263 058
Singapore				2.19	64 620	17 704
S. Korea	1.10	5 500	1 507			
Taiwan	37.07	977 473	267 801			
TOTALS	79.06	1 132 001	310 138	233.42	3 245 837	889 270

Source: Stuttaford, 1994.
Note: Exchange rate R3.65 = US $1.00.

As may be seen from Tables 11 and 12, a total of 233 and 206 mt of shark products (frozen meat and dried fins) was exported from South Africa in 1992 and 1993, respectively. The fins went to Far Eastern markets and the meat to a wider variety of destinations. The greater value of fins is clearly evident from the reported data, but the value per kg appears low and is possibly undervalued. For example, in 1993, the reported values for frozen shark meat were US $0.41 and US $1.49 for imports and exports respectively, while the average value of the fin trade was US $1.87 for imports and US $31.65 for exports. Regardless, the value of shark fins is clearly higher than the frozen meat and has the potential of driving an increase in the market.

Although the fishing companies buying fins generally prefer and pay higher prices for shark fins that are trimmed in the half moon cut, one company visited had purchased entire caudal fins that had been removed and dried, rather than only the lower lobe. However, the agents were not forthcoming about the price difference and, apart from the price of a sample of fins offered for sale, very limited data could be collected. However, different methods of fin preparation would influence the price of fins and may explain, at least in part, the apparently low values of fins imported and exported. The proportion of fins prepared without the half moon cut is uncertain and difficult to estimate. It should also be noted that the difference in preparation and the relationship of fins to carcass would influence calculations made on whole sharks exploited from reported fin weights.

The reliability of these data appears to be low. For example, there were no reported exports of shark fins to Taiwan in 1993, according to the South African data presented in Table 12, but Taiwanese import data shows that 3.28 mt of shark fins were received from South Africa that year (Lu, pers. comm., 1996). In 1992 South Africa reported fin exports to Taiwan of 37.07 mt (Stuttaford, 1994), but reported imports to Taiwan from South Africa were 1.526 mt (Lu, pers. comm., 1996). The extent South Africa's data conflicts with that of other countries is presently unclear.

The shark fin market is very competitive in South Africa, and there is evidence indicating the involvement of criminal gangs in the trade. For example, an immigrant Chinese shark fin dealer and owner of Kings International Exporters and Importers, Mr. Michael Shen, was murdered on the Western Cape coast. Subsequent court proceedings found that four South Africans had been hired for R 40 000 (US $11 000), apparently by members of a "Chinese Mafia", to murder Mr. Shen. The motive was reportedly to reduce competition in the shark fin trade, according to Eastern Province Herald newspaper articles in mid-1995.

Table 12

South African fish product destinations, Customs Union trade, 1993 (mt)

	Imports	Imports	Imports	Exports	Exports	Exports
	mt	Rands	US$	mt	Rands	US$
Dogfish & shark frozen						
Australia				16.56	181 927	49 843
Belgium				4.44	35 106	9 618
Germany				7.46	20 808	5 701
Greece				65.18	279 473	76 568
Hong Kong				5.00	5 357	1 468
Italy				57.24	416 797	114 191
Japan	0.95	1 428	391			
Netherlands				12.36	61 775	16 925
Taiwan				21.35	32 027	8 775
Shark fins						
Hong Kong				14.60	1 657 866	454 210
Japan	26.07	172 838	47 353	3.30	403 235	110 475
Singapore				0.07	15 494	4 245
Taiwan	10.09	74 090	20 299			
TOTALS	**37.11**	**248 356**	**68 043**	**207.56**	**3 109 865**	**852 019**

Source: Stuttaford, 1995. *Note*: Exchange rate R3.65 = US $1.00.

Data on South Africa's shark fin trade is absent in the FAO database as reflected in the annual yearbook statistics. FAO data on South African fisheries are supplied by the Sea Fisheries Research Institute (SFRI), and the fin trade is not reported to SFRI. However, South African records on commerce in shark fins are entered by Customs, but evidently these data are not passed to either SFRI or FAO. There is, however, one anomaly in the FAO data: in 1985, there are data indicating trade in shark meat "in brine or salted", and shark fins. Both these products are only recorded in the one year, but are not shown in the export fin section. The reason for this is unclear. The products are clearly lower than amounts recorded for the fishery. There is approximately an order of magnitude difference between recorded values of frozen shark product in the FAO data base and the export value. This could reflect the amount of product sold in South Africa, but is unlikely considering that it would be very lucrative to sell the products overseas, compared to sales on the local market. Another possibility is that there are inaccuracies in the recorded Customs export data. In addition, it seems likely that fillets from St Joseph (or elephantfish) are included in the shark fillet product grouping.

Table 13

FAO fishery statistics, commodities, 1983-1992 (mt) *Source*: Anon., 1994b.

PRODUCT	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Shark fins Import	0	0	0	0	0	0	0	0	0	0
Shark fins Export	0	0	0	0	0	0	0	0	0	0
Production										
Shark oil	0	0	0	0	0	0	0	0	0	0
Shark liver oil	0	0	0	0	0	0	0	0	0	0
Dried/salted sharks and rays	0	0	0	0	0	0	0	0	0	0
Sharks in brine/dried	0	23	0	0	0	0	0	0	0	0
Shark fins dried	0	5	0	0	0	0	0	0	0	0
Sharks frozen	581	776	468	503	840	656	850	1 298	1 100	1 200
Skates frozen	144	130	76	54	41	41	34	58	50	50
Shark fillets frozen	0	15	0	0	0	0	0	0	0	0
TOTAL	725	949	544	557	881	697	884	1 356	1 150	1 250

3. Shark Product Imports

Cartilage: Early in 1995, SOLGAR SA commenced operations in South Africa as a subsidiary of SOLGAR UK, (which is itself a subsidiary of SOLGAR USA). This company imports and markets a shark cartilage product whose trade name is "Cartilade". Actual trade volumes are unknown, but the product is used medically as it purports to fight cancer and other diseases. The cost of 180 capsules is R371 (US $102). Another supplier of similar products is Challenge International, which markets "Benefin" and Shark Cartilage. Shark cartilage is increasingly available at health shops as a result of a book by Lane and Comac (1993), which recommends the use of shark cartilage to combat a variety of diseases, especially cancer.

At the time of writing, there were no industries involved in the production of cartilage in South Africa, but some local entrepreneurs were making inquiries about the trade in 1994 and 1995. It is likely that exported sharks are used at their destination for this industry.

CONSERVATION IMPLICATIONS

Management of South Africa's fisheries is bedeviled by several conflicting interests. Firstly, management has been introduced usually only after a problem is perceived, while fisheries may be severely impacted before management procedures are investigated and implemented. Secondly, management authorities are often charged with conflicting roles of optimising the benefits to the participants of the fishery (short-term and long-term) and protecting the resource (which by definition must be long-term). Even the best intentioned management is dogged by limited data, uncertainty of complex ecological interactions and limitations in knowledge of the biology of the target species. In addition, almost all fisheries have multi-species impacts and usually these are ignored, at least in the majority of fisheries (Smale, 1992). Indeed, it is only recently that these effects have been acknowledged and attempts are presently underway in South Africa to investigate the bycatch of large commercial trawl fisheries.

The short-term financial interests of the participants are not necessarily linked to the long-term health of the targeted species. For example, an individual's best interest may be to exploit a species towards its commercial extinction, make a large profit in the fishery, sell off the capital equipment and move the profits into an alternative form of industry or investment. Although this may not be the intention of the majority of participants in fisheries, this attitude is difficult to guard against, particularly in new fisheries, or those in which regulation is difficult. Needless to say, the user groups in most industrial fisheries are a powerful and influential sector of society and actively protect their own interests. The level of complexity of managing fisheries increases substantially when part of the fishery occurs in another country or in the open sea outside waters included in a particular country's economic zone. The difficulties of regulating or even monitoring artisanal or informal fisheries are even greater, but the influence of small operators may be significant, particularly if driven by commercial interests.

Superimposed on these intricacies of management are the inherent life history constraints of the species being exploited (directly or as bycatch). Numerous studies have shown that chondrichthyans are generally ill-suited to intensive fisheries because of their life history characteristics, including late age at maturity, large size even as juveniles, low fecundity and long gestation periods making them typical "k - strategists" (e.g. Hoenig and Gruber, 1990; Compagno, 1990). Often sharks are amongst the apex predators in food webs and their population sizes are probably low. In addition, they may have extremely complex movement and habitat use patterns, which make many conventional fisheries models inappropriate, even if some data exist on population composition or recapture rates in tagging studies. Finally, because of the often held concept by most fishermen and managers that sharks are an unwanted nuisance of little consequence to fisheries, relatively little money has been spent on studies to investigate their role in ecosystems, and what consequences may result from changes in their population composition. Possible exceptions have been in those instances where sharks are the target of a particular fishery, for example, the soupfin fishery (Olsen, 1984) and gummy shark fishery of Australia (Walker, 1992).

Awareness of problems in fisheries management have been increasing in recent decades, with the increasing realisation of the importance of trying to address and manage large marine ecosystems, rather than single species (e.g.

Sherman and Alexander, 1986). Even in well-studied and apparently well-managed species (e.g. the South African hake fishery), some factors are difficult to account for in most models (e.g. subtle increase in effort by improved technology like position finders and echo sounders). Serious scientific investigation of multispecies interactions are in their infancy. When such interactions are understood by scientists, a major challenge will be the implementation of management recommendations.

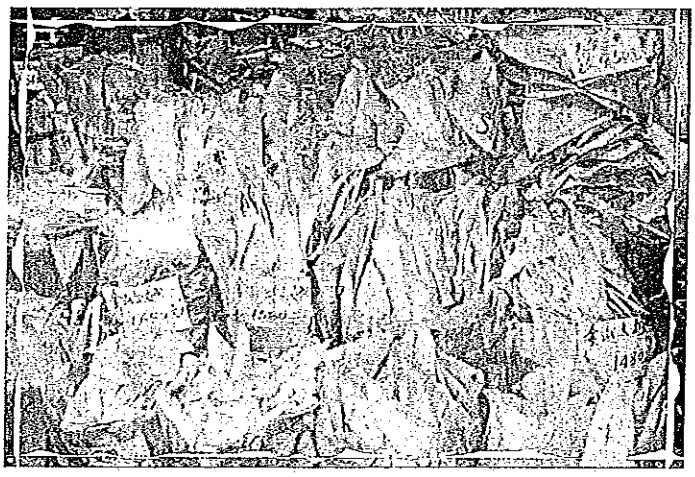
The need for the conservation of and research on chondrichthyans must be relayed to all governments, management bodies and fishery institutions. How conservation will be implemented will vary widely because of the diversity of species, life history styles and habitat use. In theory, the conservation of chondrichthyans should be ensured with the signing of the Biodiversity protocol by numerous world governments in the early 1990's. This, however, cannot be taken for granted, either in instances where governments do not have the ability or will to implement the protocol, or where there may be conflicting interests in short-term benefits to people. One example is the highly threatened status of all freshwater and estuarine chondrichthyans.

Conservation of chondrichthyans will depend on a broad based policy that includes education of people about the real role of chondrichthyans in ecosystems, rather than the paranoia and misconceptions that exist in the minds of many. In addition, serious attempts to find ways to conserve chondrichthyans will have to be initiated.

Freshwater and estuarine species in particular need urgent attention because of the rapid deterioration of these habitats both in South Africa and worldwide. The causes are various and include poor agricultural practices resulting in increased siltation, and dams reducing river flow and deforestation. It may be possible for some rivers and estuaries to be targeted as suitable conservation areas, hopefully within, or adjacent to, existing conservation areas. This merits urgent attention.

Conservation of chondrichthyans may be achieved in part through the use of existing marine reserves in South Africa. For example, the Tsitsikamma National Park on the south coast of the Eastern Cape includes part of the range of several chondrichthyans, including the endemic species *Poroderma africanum*, *P. pantherinum* and *Haploblepharus edwardsii*. However, the extent of this protection and the degree of benefit for these and other species in this and other marine reserves has not been directly assessed and deserves attention. The degree to which such reserves benefit wide ranging migratory species is unknown and should be investigated. Intuitively, one would expect the benefit to be related to the degree of residency and extent of movement to areas outside protected areas. Obviously, it is vital that areas closed to fishing need regulation and strict policing to ensure their efficacy.

In general, the need for conservation of elasmobranchs and the strategies most appropriate to the different species needs to be formulated and presented to management authorities. Although exploited species are most obviously in need of conservation, others, including deep dwelling forms on the continental slope and rise should also be considered, even though exploitation of this zone has only relatively recently started in some parts of the world. Given the diversity of species and habitats used, a management plan covering all species would be a major undertaking which is needed sooner than most people may realize, given the rapid expansion of human populations and demand for protein from the sea. Although the great white shark is currently protected from exploitation in South Africa, there is no guarantee that this will continue and contentious issues, such as how best to combine ecotourism with conservation and research, have yet to be addressed.



Shark fin for sale in Hong Kong
Rob Parry-Jones-TRAFFIC

Perhaps the largest problem with shark (and other chondrichthyan) fisheries is that the vast majority are either part of a bycatch for other target species (e.g. in trawl and longline fisheries) or that they are part of a suite of species taken in broad and untargeted fisheries. Prevention or even reduction of this component of the catch is often in the best interest of the operator anyway to reduce gear damage or to minimize catches of species which are not the most highly priced. Nevertheless, chondrichthyans are caught and are usually dead when the gear is retrieved. Without limiting the effort, or designating areas that may not be exploited (i.e. large areas closed for fishing purposes - analogous to very large marine sanctuaries that include extensive bodies of oceanic waters, the continental shelf and slope), the solutions to these problems will be difficult to resolve.

Conservation options such as regulating fisheries and controlling exploitation of numerous species will need to be addressed by international fisheries when species cross national boundaries, or when landings are made in a particular country but are caught elsewhere. It is questionable, however, whether the financial resources being directed at scientific investigations of chondrichthyans are adequate to address these questions within an acceptable time period. It may be necessary to implement some regulations prior to obtaining rigorous scientific data, as happened in South Africa with legislation on white sharks. Unfortunately, such an approach would be more difficult when proposed legislation is in conflict with the short-term interests of user groups, particularly if it involves international co-operation. Nevertheless, conservation of chondrichthyans deserves urgent attention.

REGULATORY/MANAGEMENT FRAMEWORKS

Fisheries legislation in South Africa is concerned almost exclusively with commercial species and, in the case of fishes, is focused on teleosts, with the exception of the laws extracted below from the Government Regulation Gazette No 14353 of 1992. It should be noted, however that with the recent democratic elections, the Sea Fisheries Act is currently under review and resulting legislation may be different from previous laws.

On 11 April 1991, the great white shark (*Carcharodon carcharias*) was given protection as follows:

> *13 (1) No person may, without the authority of a permit issued by the director-general, catch, attempt to catch, kill or attempt to kill, any great white (**Carcharodon carcharias**): Provided that if caught and killed unintentionally, such shark shall be handed over to a fishery control officer as soon as possible. (2) No person shall purchase, sell or offer for sale any great white shark (**Carcharodon carcharias**) or any part thereof, or any product thereof.*

The only other regulations concerning sharks are as follows:

> *25. Any person on board a fishing boat provided with refrigeration facilities -*
>
> *(a) may decapitate, gut or cut off the tail of a shark caught by him before it is landed;*
>
> *(b) shall retain the head, gut and tail of such shark in the refrigeration facilities until it is landed.*

The use or possession of driftnets in South African territorial waters is outlawed. Some species may also benefit from regulations governing the use of certain gear types of the various fisheries, and others may benefit from existing marine reserves.

There are no bag, size or season regulations which affect sharks specifically, except for the following regulations:

> *47 (11) No recreational fisherman or any vessel not registered as a fishing boat, or any rock and surf angler, or any spear fisherman may on one day catch, attempt to catch or be in possession of more than 10 fish in total of the species which appear on the exploitable list.*
>
> *(12) The exploitable list consists of the following species:*
>
> *More than 19 species of teleost fishes listed plus...*
>
> *Elasmobranchs (subclass Elasmobranchii) (excluding the great white shark).*

It should be noted that there are several provisions governing the number and size restrictions of numerous other teleosts that are not listed in the present document. It also needs to be recognized that the sale of fish of any description is restricted to commercial or semi-commercial fishermen. In practice, however, there is widespread breakage of these laws.

In the 1992 regulations, a new permit was introduced:

49(2)(v) shark fishing (L-permit).

CONCLUSIONS AND RECOMMENDATIONS

1. Data on fisheries landings and customs records should be accurately kept and validated periodically. Landings data should be at the species level, and clear records of whether the recorded weight is nominal (or whole animal weight) or dressed product need to be kept in order not to diminish the value of the data. Fishing effort should also be monitored whenever possible. It is not feasible to monitor patterns in catches over time without this information. Without checks, the strength and weaknesses of the data bases are unknown. It must be recognized that existing data on shark fisheries are very limited, even in South Africa.

2. Observers should be employed to document catches and discards of chondrichthyans (and other species) on all sectors of the fishing industry. This is important for both local fishermen and far seas fisheries whether they use national or international waters. This kind of independent data is essential to assess long-term changes in catch composition. Better information on the catch area would also be helpful.

3. The directed shark fishery should take a precautionary approach in order to reduce the pressure on sharks, in the light of the absence of information about the current status of shark stocks.

4. When fishing technologists initiate projects aimed at encouraging new fisheries (e.g. shark fisheries in developing countries), every attempt should be made to initiate a data collection programme to track trends in the fishery. Furthermore, the enthusiasm for such projects should be tempered with the realization that shark fisheries are highly prone to overexploitation, and in many cases may be short sighted "quick fix" solutions that are doomed to failure economically, with potentially far-reaching effects both on marine ecosystems and human communities.

5. Strategies for conserving chondrichthyans are urgently needed. These will vary according to the life history characteristics and ecology of each species. In some instances, large marine reserves may contribute to their conservation but the vulnerability of deep water forms as well as freshwater, estuarine and shelf species needs to be recognized. Investigations into the influence of exploiting nursery areas of chondrichthyans needs to be addressed. Those species at the highest levels of food webs (e.g. great white sharks) probably have small population sizes and may need particular attention. Investigations into the various management options most suited to the various species should be initiated immediately. An increase in research funding is urgently required to address these needs.

6. Urgent attention should be given to investigating the status of estuarine chondrichthyans in South Africa. This group may currently be the most immediately threatened by developments inland and along the coast.

7. Research into alternatives to shark nets for bather protection should be encouraged. Furthermore, education is of paramount importance. The public must be shown that sharks are not loathsome threats, but valuable components of healthy ecosystems and that they represent a minute threat to humans.

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SURVEY OF ELASMOBRANCH FISHERIES AND TRADE IN MADAGASCAR

Andrew J. Cooke

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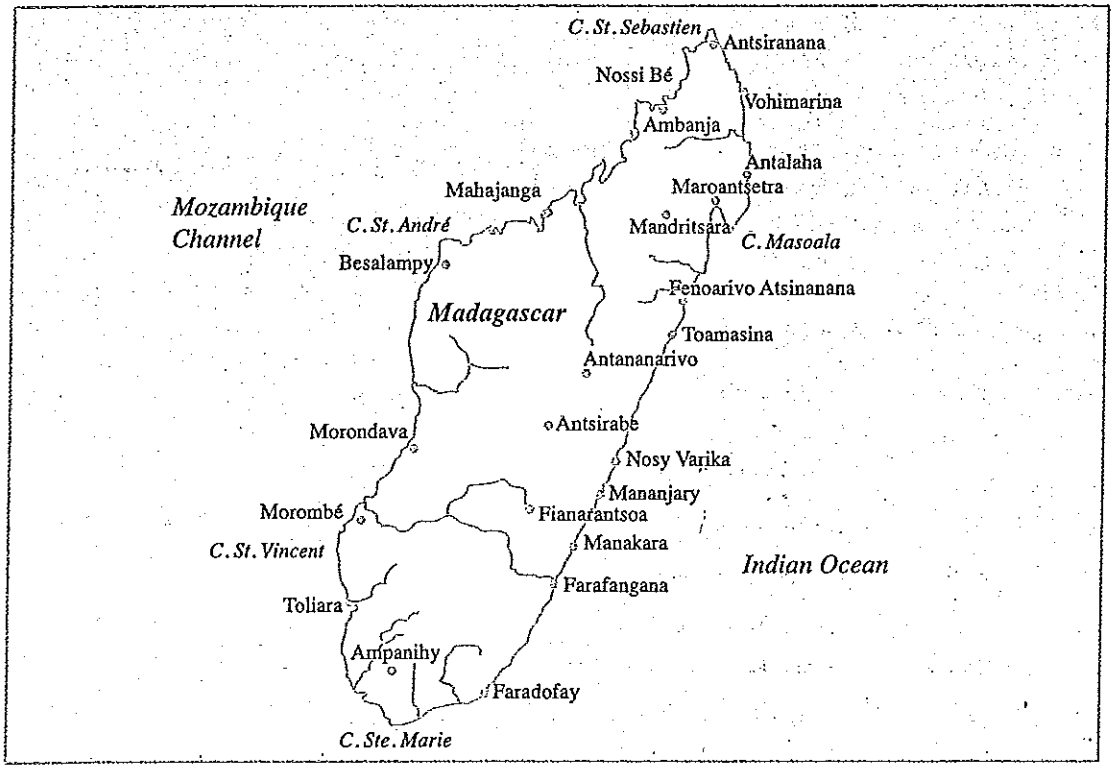


INTRODUCTION

Madagascar is a tropical island country, 587 040 sq km in area with a population of some 13 million, of which about 30% live in coastal areas (Jain, 1995). Madagascar's coastal zone provides a wide range of marine habitats and hosts a variety of species. With some 5 000 km of coastline, Madagascar has the potential to make a substantial contribution to world fisheries trade. However, the fisheries of Madagascar are some of the least studied in the Western Indian Ocean region.

A recent review of statistics published by Madagascar's Direction des Ressources Halieutiques (DRH) and the FAO indicates that there was a sharp increase in total fisheries exports from the early to mid-1990s (Anon, 1995). Reported exports rose from 7 802 metric tonnes (mt) in 1990, to 24 264 mt in 1994, an increase of 311%. Most of the increase can be accounted for by increased exports of shrimp and frozen fish, with exports of other fisheries products such as crabs, lobster (crayfish), tuna, seaweed, bêche-de-mer, squid and shellfish remaining relatively stable over the same period.

The total value of 1994 exports was Malagasy francs (FMG) 291 billion, or approximately US $97 million according to government export documents. The major importers of Malagasy fisheries products in 1994 were France (16 148 mt, including 11 129 mt of canned tuna, and 4 336 mt of shrimp), and Japan (2 135 mt, mainly fish).

Madagascar's Exclusive Economic Zone (EEZ) has not yet been formally adopted. The proposed 200 nautical mile zone is restricted in the Mozambique Channel owing to overlapping jurisdiction with Mozambique and a number of French island territories: Ile Europa, Bassas de India, Ile Juan de Nova, Ile Mayotte and Iles Glorieuses.

Although little was known of shark fisheries and trade in Madagascar prior to this study, available information indicated that such fisheries were likely to be significant. The present study was therefore commissioned by TRAFFIC International as a contribution to the wider 1996 TRAFFIC Network survey of shark fisheries and trade.

METHODOLOGY

The majority of information contained in this report was collected through field investigations in Madagascar. The author visited Madagascar during 1995 to coordinate research and conduct interviews. Field surveys of coastal fisheries and trade were conducted at key fishing centres around the coast of Madagascar by consultants from Cellule des Océanographes de l'Université de Toliara (COUT), based at Institut Halieutique et des Sciences Marines (IHSM), University of Toliara.

For the purposes of this study, survey zones were delineated according to logistical and transport considerations, and designed to incorporate: key coastal fishing centres, relevant Service Provincial des Ressources Halieutiques (SPRH) offices, and one or more fishing villages.

Table 1

Survey zones of Madagascar by provincial and district boundaries

Zone 1	North	Northwest:	Mahajanga and Nosy Be
		North:	Antseranana
		Northeast:	Antalaha to Tanjona Masoala
Zone 2	East	Island of Ste. Marie -> Toamasina (formerly Tamatave) -> Manakara	
Zone 3	Southeast	Tolagnaro (formerly Fort Dauphin)	
Zone 4	Southwest	Toliara -> Manombo -> Morombe (includes the coastline from the village of Beheloka, 50 km south of Toliara, to Morombe.)	
Zone 5	West	Morondava -> Belo-Tsiribihina	

In addition, field surveys and site visits were carried out by the author on the island of Nosy Be, at Antalaha and Cap Est (Zone 1), Toliara and Anakao (Zone 4). Visits were made to all provincial DRH offices with the exception of Fianarantsoa, and to a number of district offices. Interviews were conducted with government officials, fishers, traders, and other knowledgeable individuals. Species identification was based on FAO identification sheets (Bauchot and Bianchi, 1984; Compagno, 1984a; Compagno, 1984b). Staff at SPRH and DRH provided data and information on shark fisheries, production, exports, local consumption and trade. Such data were not available for Zone 3.

The following rates of exchange were used to convert Malagasy francs (FMG) to United States dollars (US $): (1989) 1603:1, (1990) 1494:1, (1991) 1835:1, (1992) 1864:1, (1993) 1913:1, (1994) 3067:1, and (1995) 4450:1.

HISTORICAL OVERVIEW

Fisheries have a long history in Madagascar, but sharks have only recently become an important and highly valued component of the catch. It seems likely that many sharks were taken as the bycatch of industrial fisheries off Madagascar's coast as far back as the 1950s, with longline fishing for tuna first undertaken in Malagasy waters in 1955. This fishery started in the north of the island, moving south down the east coast in 1958, spreading across to the west coast during 1960, and circumscribing the entire Madagascar coast by 1961 (Ardill, 1995). According to FAO data, the fishery declined during the 1970s, apparently ceasing completely late in that decade and again in 1983 and 1989, while remaining sparse in the neighbouring waters of the Mozambique Channel throughout the 1980s (Ardill, 1995). The longline fishery is seasonal, peaking in October and November, and occurs predominantly along the east coast.

Purse seining began in 1984, and was initially concentrated along the west, northwest and northeast coasts near Mahajanga, with a small fleet active west of Morombe. The purse seine fishing season is from March to June (Rabeson, 1992).

FAO Indian Ocean tuna fisheries data indicate that total catches in the Malagasy EEZ rose from 3 776 mt in 1986 to 10 000 mt in 1993 (Ardill, 1995). Principal tuna species caught are Yellowfin (Albacore) *Thunnus albacares* and Skipjack *Katsuwonus pelamis*.

Madagascar's shark fisheries are thought to have been relatively undeveloped prior to the mid-1980s, reflecting the country's isolation from world markets, and the smaller size of the world shark fin market at that time. According to Beurier (1982), sharks were not the subject of a targeted fishery in 1982, with harvest consisting primarily of bycatch of juveniles up to 1.5 m. Evidence of some commercial trade of shark products during the mid-1980s is provided by Dockerty (1992), who identified trade in shark fin from Madagascar reported in Customs data beginning in 1984, and FAO import data (Crispoldi, *in litt.* 1995) showing trade from 1987 onwards.

An important market for Madagascar shark meat became accessible with the opening of trade links to the Comoros in the mid-1980s. A directed shark fishery developed around the port of Mahajanga on the northwest coast of Madagascar, in response to a strong demand for dried shark meat in the Comoros. The Comoros market subsequently stimulated shark fishing as far away as Antseranana (formerly Diégo-Suarez) in the extreme north and Toliara in the far south. The dried meat produced by these fisheries could be transported long distances in the dry western climate without degrading. The trade in shark fin in Madagascar also developed rapidly in the late 1980s in response to increasing world prices.

CURRENT FISHERIES

The Madagascar Government *Decree 94-112* of 18 February 1994 (for the general regulation of fisheries) established the following definitions for fisheries:

Traditional • fishing conducted on foot or in non-motorised vessels;

Artisanal • fishing conducted using boats with motors of 50 horsepower (Hp) or less; and

Industrial • fishing conducted using boats with motors of more than 50 Hp.

However, DRH data do not distinguish between traditional and artisanal fisheries. Jain (1995) uses similar terms to describe Madagascar's fisheries:

Traditional • fishers using canoes without motors and simple gear, comprising the vast majority of fishers;

Artisanal • professional fishers often collecting catches from traditional fishers, and who use larger canoes or launches with outboard motors; and

Industrial • fishers whose catch is primarily for export, using large boats or trawlers and mechanised equipment.

Total marine fisheries production for 1994 was 86 692 mt, of which traditional and artisanal fisheries accounted for 65 090 mt, or approximately 75% of the total (Table 2). These figures exclude subsistence catch, which goes unreported. Industrial finfish fisheries (excluding tuna) accounted for only 2 511 mt (2.8%) of total fish production in 1994. Apart from shrimp trawling, coastal industrial fishing is less developed in Madagascar, and makes no significant contribution to Madagascar's shark fishery or shark mortality (Gilbert pers. comm.; Rabenomanana, pers. comm.).

Table 2
Madagascar fisheries production, 1986-1994 (mt)

Secteur/Année	1986	1990	1991	1992	1993	1994
MARINE FISHERIES	25 472	73 444	73 440	78 945	85 051	86 692
Industrial	11 788	19 244	18 500	20 545	21 861	21 602
Prawns	6 923	6 967	8 000	7 163	8 361	9 091
Fish	4 865	2 277	500	3 372	3 500	2 511
Tuna*	-	10 000	10 000	10 000	10 000	10 000
Artisanal and traditional	13 684	54 200	54 940	58 400	63 190	65 090
Prawns	483	2 200	2 200	2 300	1 300	3 000
Crabs	444	1 200	960	850	1 100	1 300
Lobster	234	310	440	550	360	390
Fish	12 523	50 000	50 000	50 000	57 500	50 200
Other	-	490	1 340	4 700	2 930	10 200
FRESHWATER FISHERIES*	30 000	30 000	27 500	27 500	30 000	30 000
Aquaculture	-	-	-	-	-	688
Fish	-	-	-	-	-	280
Prawns	-	-	-	-	-	408
TOTAL PRODUCTION	55 472	103 444	100 940	106 445	115 051	117 500#

*official estimates
as reported in 1995; revised to 119 987 (Anon., 1996b)
Source: Anon., 1995.

1. Traditional and artisanal fisheries

i. Composition and size of the traditional and artisanal fleet

The coastal fishery is primarily "*pirogue*" or canoe-based, with the use of outboard motors rare. DRH fisheries data do not distinguish between artisanal (motorised craft) and traditional (non-motorised) *pirogues*.

Fisheries surveys in 1995 and 1996 identified some 22 000 *pirogues* used by approximately 50 000 fishers (Anon., 1996a). This represents a four-fold increase over an earlier FAO estimate of 5 000 *pirogues* in 1982 (Beurier, 1982). More detailed information on the number of *pirogues* in use was only available for Morondava and Toamasina. An overall 7% decline in the number of boats in Morondava was noted since a survey was conducted in 1988, the numbers to the north decreasing by 17% while the numbers to the south increasing by 29%. This was attributed to the disappearance of the "farafatse" tree *Givotia madagascariensis*, which is traditionally used for hull construction in southwest Madagascar. In contrast, the number of *pirogues* in Toamasina, where rainforest hardwoods are used for *pirogue* construction, increased by over 30% to 4 349 (Anon., 1995).

FAO estimated that there were only 100 artisanal fishing vessels in 1982, with these being concentrated in the north (Beurier, 1982). A DRH official believed that there has been only a small increase in the number of artisanal vessels

in recent years (Rabenomanana, pers. comm.). Jain (1995) found that there was very little artisanal fishing activity in Toliara and, citing the overseas development agency, Deutsche Gesellschäft Für Technische Zuzammenarbeit (GTZ) information, noted that there were 11 artisanal fishing vessels in Nosy Be.

II. Distribution of fishing effort around Madagascar's coasts

The number and distribution of fishing *pirogues* should provide an indication of fishing effort along Madagascar's coasts once the breakdown of the most recent DRH *pirogue* census is complete. One study stated that 50% of all fishing *pirogues* are found in the Province of Toliara (Ramanarivo, 1990), which extends from the southeast corner of Madagascar to approximately 150 km north of Morondava in the west, almost a third of the total coastline. There were no reports of artisanal fishing in Toliara. Fishing intensity is also high in the northwest, around Mahajanga, and artisanal fishing has been reported as taking place in this area. The density of *pirogues* is lower along the east coast, where sea conditions are rougher and where a larger proportion of the population is engaged in agriculture.

Fisheries production data for 1988, reviewed by Raboanrijaona (1989), similarly show the highest fisheries production in the northwest and Toliara, as shown in Table 3.

Table 3

Malagasy fisheries production reported to SPRH data centres, 1988 (mt)

Coastal zone	Location of SPRH data collection centre	Fisheries production (mt)
North	Antseranana (Diego Suarez)	85
Northwest	Nosy Be	2 300
North	Mahajanga	4 900
West	Belo Tsiribihina	236
West	Morondava	265
Southwest	Morombe	113
Southwest	Toliara	770
Southeast	Tolagnaro (Fort Dauphin)	202
East	Toamasina	430
Northeast	Vohemar	25
TOTAL		9 326

Source: Raboinrajaona, 1989.

Of all fishing centres, Mahajanga records the highest production of shark meat and oil, as well as significant quantities of shark fin. As can be seen in Table 4, several hundred tonnes of shark meat as well as several tonnes of shark fin and oil were produced in the early 1990s. Reported declines in production in 1992 may reflect in part a decrease in data quality owing to political unrest at that time. It also appears that data showing the production by the one industrial shark fishery identified, the company Somapêche, are not included in 1992 data.

Table 4

Reported production of shark and ray products for Mahajanga, 1990 to 1994 (kg)

Product	1990	1991	1992	1993	1994
Shark meat	313 740	570 905	8 233	271 940	17.692
Shark fin	6 000	6 809	4 860	4 770	4 221
Shark oil	6 256	12 865	16 399	---	---
Ray meat	5 243	1 066	---	---	---

Source: SPRH, Mahajanga.

III. Subsistence versus commercial fishing

It is difficult to draw a distinction between subsistence fishing and fishing for financial gain, and similarly between directed and non-directed fishing. While there is a subsistence element to most fishing trips (since the fisher will set aside some of the catch for his/her family or friends), in practice the primary motive of fishing is to catch fish for sale. This is particularly true with respect to any sharks that are caught. It is important to note, however, that while most marketable shark fin enters the trade, much of the meat is retained for home or local consumption. This meat is not generally recorded in official production statistics.

There is a small but growing artisanal shark fishery in the northwest, primarily undertaking line fishing, and another in the northeast around Maroantsetra. In addition, a small (probably about 5%) but growing proportion of traditional fishing boats throughout the coastal areas are specifically seeking sharks as a component of the catch.

iv. Traditional fisheries

Traditional fishing techniques do not vary greatly between regions. Two types of fishing vessel are used:

Monohull *pirogues* of 6-7 m without balancers, sometimes equipped with a small sail of 1-1.5 sq m for use in a following wind. These are used on the east coast, from Tolagnaro to Sambava;

Monohull *pirogues* of 4-8 m with a balancer, with a square or triangular sail. These are used on the west coast, from Toliara to Antseranana.

The main fishing gears used are monofilament lines of 25-100 kg strength; nets with a mesh of about 20 cm known as "*jarifa*"; finer meshed nets; and, in Soalala and Cap Est, a submerged gear of suspended lines with hooks.

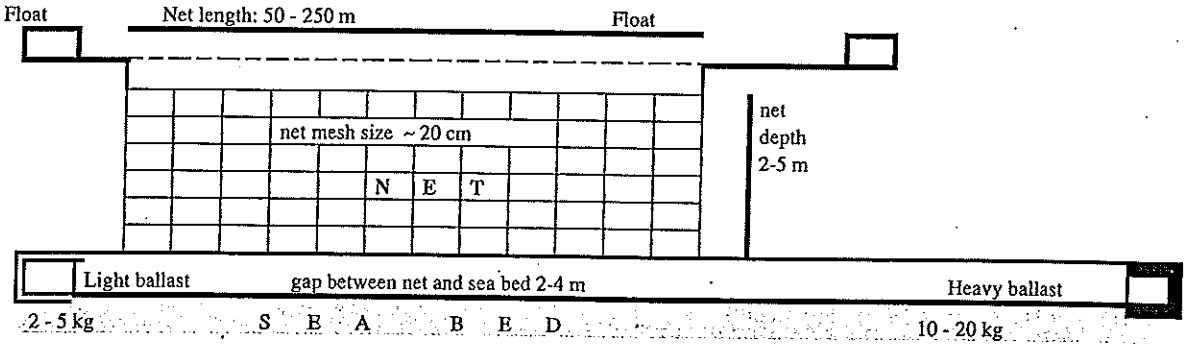
v. Line fishing

Line fishing is rarely targeted at sharks, since large sharks can so easily wreck precious gear. Relatively few fishing teams in Madagascar are using motorised launches to catch sharks by line fishing. However, line fishing from *pirogues* does make a significant contribution to the catch of small coastal sharks and reef sharks. Small fish, living or dead, are preferred for bait, but meat from larger fish or offal, such as beef heart, is also used. Catches vary from one to three sharks per day's outing, increasing in the warm season (October to March), when catches by fishing teams can reach 10 sharks per outing. Teams consist of two or three fishers per *pirogue*.

vi. Net fishing

Net fishing is used to catch the full range of large edible fish species, and is not targeted specifically at sharks. However, shark capture can be an important incentive, and has become the prime motivation for jarifa fishing in some areas. Jarifas, which are not in widespread use owing to their relatively high cost, are typically up to 100 m long, but may be as much as 250 m, such as those used by fishers from Anakao near Toliara (southwest). A diagram showing a typical jarifa is provided in Figure 1. Net baits used include tongues of large fish (e.g. tuna, trevally, rays), whole fish (e.g. sardines) and freshwater eels.

Figure 1
"*Jarifa*" shark fishing net used by traditional fishers



Typically, the fishers will depart early in the morning and travel several kilometres out to deeper water (up to about 50 m). The net is set and usually left for one night, sometimes several nights, and then pulled up and the catch removed. Most sharks are dead or near death at the time of collection; hence, fishers can take large sharks in small *pirogues*.

In general, fishers reported yields of 4-10 sharks per net per night. In Zone 5 (West) fishers reported catches of 10-20 sharks per net per night in the warm season of 1992, declining to 1-3 sharks in 1995. Two commercial fishers in the Mahajanga region claimed that a traditional fishing team could take up to 200 kg of fin in a season of three months, using a *pirogue* and a crew of three.

vii. Set hook and line fishing

An alternative to the *jarifa* was observed in Antalaha, a village south of Cap Est, where nets have been replaced with a line of suspended baited hooks up to 200 m in length, each supported by a buoy. The apparatus is fixed at each end to the sea bed with anchors. The hooks generally hang close to the sea bed at 20-30 m. This type of gear needs more maintenance than a net, and requires a heavy steel line and large hooks which are expensive to obtain and manufacture in Madagascar. Similar gear was observed by Durbin (1994) in use at Soalala.

viii. Species composition of traditional fisheries

Based on interviews with fishers and direct observations, a minimum of 30 chondrichthyan species are taken in coastal shark fisheries, including 25 species of sharks, several rays, Giant Guitarfish *Rhynchobatus djiddensis* and sawfish *Pristidae* spp. (Table 5). Local names for the same species were found to vary from one village or region to the next, for example six local names were identified for Blacktip Reef Sharks *Carcharhinus melanopterus*. The actual species being referred to by a given name could not be determined in a number of cases, with a total of 15 additional local names used in Toliara alone. However, it is believed that the 13 shark species identified in the fisheries of the Toliara region are fished in significant quantities.

The species composition of shark catches varied between regions, although two species stood out as a universal component of the catch: Blacktip Reef Shark and Scalloped Hammerhead *Sphyrna lewini*, the latter especially in the north. The results of interviews with fishers regarding the species most commonly represented in the catch are presented in Table 6.

Table 6
Commonly fished shark species in Madagascar's traditional fisheries

Zone	Species
Zone 1 (NW/N/NE)	Scalloped Hammerhead Shark *Sphyrna lewini*; Blacktip Reef Shark *Carcharhinus melanopterus*; Smalltooth Sand Tiger Shark *Odontaspis ferox*; Spot-tail Shark *C. sorrah*; Gray Reef Shark *C. amblyrhynchos*
Zone 2 (E)	Silky Shark *C. falciformis*; Blacktip Reef Shark; Scalloped Hammerhead Shark
Zone 3 (SE)	Silky Shark; Blacktip Reef Shark; Oceanic Whitetip Shark *C. longimanus*
Zone 4 (SW)	Oceanic Whitetip Shark; Gray Reef Shark; Spot-tailed Shark; Smalltooth Sand Tiger Shark; Scalloped Hammerhead Shark; Blacktip Reef Shark; Grey Bamboo Shark *Chiloscyllium griseum;* Zebra Shark *Stegostoma fasciatum*; sawfishes *Pristis* spp.
Zone 5 (W)	Silky Shark; Blacktip Reef Shark; Pigeye Shark *C, amboinensis*; Scalloped Hammerhead Shark; Smalltooth Sand Tiger Shark

Regional summaries for the traditional fishery:
Zone 1 (Northwest, North, Northeast)

In the north and northwest, the sea is warm and weather conditions good most of the year. The northwest accounts for the greatest amount of shark fishing and shark product trade in Madagascar, especially via Mahajanga.

The most commonly fished species in Antserarana are, in order of importance: Scalloped Hammerhead Shark, Blacktip Reef Shark, Tiger Shark *Galeocerdo cuvier* and Smalltooth Sand Tiger Shark *Odontaspis ferox*. Of the rays, the most commonly fished species were Thornback Ray *Raja clavata* and Blue Spotted Fantail Ray *Taeniura lymna*. To the southeast, at Cap Est, only one fisher could be found who fished traditionally. The catch was almost entirely small Scalloped Hammerhead, and might typically amount to six sharks per outing. Interestingly, the Giant Guitarfish was regarded as taboo and not fished in the area. A trader reported that the traditional fisheries of Maroantsetra catch small Scalloped Hammerhead, with at least 10-15 per day sold on the local market. Maroantsetra has also been reported to be an important area within Toamasina for shark fishing (Kroese, pers. comm.).

Zone 2 (East)

Fisheries in this region are growing, as indicated by the increase in the number of *pirogues* reported for Toamasina Province above. Silky Shark *Carcharhinus falciformis* is the main shark species caught.

Table 5

Chondrichthyan species exploited by Madagascar's coastal fisheries

Zone / Secteur	Toliara (SE)	Toliara (SW)	Morombe (SW)	Morondava (W)	Nosy Be (NW)	Mahajanga (NW)	Antsiranana (N)	Sambava (NE)	Ste Marie (NE)	Toamasina (E)	Mananjary (E)
Carcharhinidae Carcharhinus falciformis Fr.: Requin soyeux Eng.: Silky Shark	Ranorano			Lavaoro				Atsantsa	Antsingôra androromy	Atsantsa (=Antsigôra) "boeing"	Atsantsa vato
C. albimarginatus Fr.: Req. pointe blanche Eng.: Silvertip Shark									Antsingôra "boeing"	Atsantsa "boeing"	Atsantsa "tergal"
C. melanopterus Fr.:Req. pointe noire Eng.:Blacktip Reef Shark	Mentitehoky	Maintepate	Maintepate	Maintipaty			Botramavo	Botramavo (present at Cap Est)	Antsingoa fasina	Atsantsa "boeing"	Atsantsam ary
C. longimanus Fr.: Req. océanique Eng.: Oceanic Whitetip Shark	Bevombotsy Belay Besofy	Akio meso	Akio meso					Most comm. shark at Cap Est	Antsingôraeo	Atsantsa "boeing"	Atsantsara rany
C. sorrah Fr.: R. à queue tachetée Eng.: Spot-tail Shark		Akio fesoke	Akio fesoke	Akio fesotse	present						Atsantsaml ahona
C. amblyrhynchos Fr. requin dagsit Eng. Grey Reef Shark											
C. limbatus Fr. Requin bordé Eng. Blacktip Shark											
C. amboinensis Fr.: R. balestrine Eng.: Pigeye Shark				Dofokoro	Akio beloha = grosse tête			Present and caught at Cap Est			
C. brevipinna Fr. Requin tisserand Eng. Spinner Shark	Reported to be common by one trader										
Galeocerdo cuvier Fr.: R. tigre Eng.: Tiger Shark	Vasian-dahy Lay vanda					Absent according to 1 fisher	Akio kary	Present and caught at Cap Est	Antsingôra "tigre"	Atsantsa vandana Atsantsa vahona	Atsantsa vandana
Negaprion acutidens Fr: R.n limon faucille Eng: Sicklefin Lemon Shark								Present and caught at Cap Est			
Prionace glauca Fr.: Peau bleue Eng.: Blue Shark									Antsingôra firaka		
Loxodon macrorhinus Fr. Requin sagrin Eng. Sliteye Shark					present						
Triaenodon obesus Fr.: R. corail Eng.: Whitetip Reef Shark										Atsantsavy Atsantsama hery	Atsantsa satrana
Alopiidae Alopias vulpinus Fr.: Renard Eng.: Thresher Shark									Antsingôra firaka	Ambôso	Sarsatrana
A. superciliosus Fr.: Renard à gros yeux Eng.: Bigeye Thresher		Tomanima-nente	Tomanima-nente	Garamaso					Antsingôraeo	Ambôso	Sarisatrana
Sphyrnidae Sphyrna lewini Fr.: R. marteau halicorne Eng.: Scalloped Hammerhead	Satraha Amama	Akio viko Palapalan-doha	Akio viko	Akio viko Palaloha	present	Antendro-maso	Antendro-maso	Antendro-maso	Antendro-maso	Antendro-maso Satrana Sorokay	Sorokay Satrana
S. mokarran Fr.: Grand requin marteau Eng.: Great Hammerhead	Satraha Amama	Akio viko Palapalan-doha	Akio viko	Akio viko Palaloha		Antendro-maso	Antendromaso	Antendro-maso (rare at Cap Est)	Antendro-maso	Antendro-maso Satrana Sorokay	Sorokay Satrana
Stegostomatidae Stegostoma fasciatum Fr.: R. zèbre Eng.: Zebra Shark	Razan-kiahia Renieo	Akiontsaka	Akiontsaka	Andrangita Tandaly		Present but venerated or taboo			Ambôso	Ambôso vandana	Vontsora

inglymostomatidae inglymostoma evicaudatum r.: R. nourrice à queue urte ng.: Short-tail Nurse ark		Voritse	Voritse								
ebrius ferrugineus r.: R. nourrice fauve ng.: Tawny Nurse Shark		Valovomb-otse		Valovombotse						Ambôso	Valorirana Satrana
hiniodontidae hiniodon typus :.: Requin baleine ng.: Whale Shark	Ingahibe	Akio trozo		Akio kary							
dontaspidae dontaspis ferox :.: R. féroce ng.: Smalltooth Sand iger		Akio foty	Akio foty	Akio foty		present (requin blanc)					
amnidae urus oxyrhincus :.: Taupe bleue ng.: Shortfin Mako Shark		Bevombotse	Bevombotse								
emiscyllidae hiloscyllium griseum :.: R. chabot gris ng.: Grey Bamboo Shark		Hiahia	Hiahia	Hiahia							
lyliobathididae etobatus narinari :.: Aigle léopard ng.: White-spotted Eagle ay								Korombe			
ajidae aja clavata hornback Ray						Makoba		Makobo			
asyatididae aeniura lymna ng: Blue Spotted Fantail ay	Faimbilany	Faimbalany	Faimbalany			Fay		Fay			
hynchobatidae hynchobatus djiddensis ag: Giant Guitarfish	Lafitany							Occasion-ally caught, but considered taboo at Cap Est			
istidae istis spp. ng: sawfishes	Vavà	Vavà	Vavà	Vavà		present					Requin scie
otal	12	15	13	13	6	8	4	11	11	12	14

Note: Malagasy names are those provided to researchers during the field surveys. Comments in English indicate additional information obtained by the author, with "present" denoting that the species is fished in the area indicated.

Shark fishing on Ile Ste. Marie is incidental to ordinary fishing activities, and the catches are small, with fin production as little as 300 kg per year according to one trader. Shark fishing is more important in other parts of the east Coast, however, as evidenced by production data for meat compiled by SPRH, Toamasina, which covers several major fishing areas, and is discussed in more detail below.

Although not mentioned in a 1988 socio-economic fisheries survey for Manakara (Rafalimanana, 1988), shark fishing is now significant in this area. Several villages were found to have fishing teams fishing almost exclusively for sharks. Several nets of 100 x 2.5 m are used and catches can be high (4-15 sharks per outing). Carcasses are often discarded and only the fins kept. Shark fishing is undertaken in both shallow and deep water.

Zone 3 (Southeast)

Based on interviews with fishers and several traders, the shark fishery of this region was perhaps the least developed of any visited in the survey. SPRH fisheries statistics were unavailable. Shortly before the present survey, 34 people were hospitalised after eating shark meat, which led to an order by the local SPRH banning any shark fishing or trade in shark products.

Zone 4 (Southwest)

Although the southwest is dry most of the year, high winds and swell often interfere with fishing. As a result, fishing pressures are not as constant as in the northwest except in protected lagoons. Directed shark fishing has developed only in the last five years, in response to the shark fin trade. Most villages now have teams who fish for sharks, some fishing all year round. The number of fishers engaged in shark fishing has grown continuously since 1992, and the sale of fin has become a significant component of fishers' incomes. Shark fishing is not considered easy by fishers, however, with the result that the percent of those fishing sharks is still relatively low compared to other fisheries. For example, there are only four teams regularly fishing for sharks in Anakao, one of the larger fishing villages to the south of Toliara, representing about 5% of all fishing teams in this village.

Pirogues depart early in the morning and travel out up to 15 km. Very good weather is required. The best season is November-January, coinciding with the arrival of shoals of small fish and fine weather. Fishers use long nets of 15 cm mesh made in the village from 5 mm rope, spanning up to 200 m. Nets are expensive (FMG 1-2 million each, about US $220-440) and theft of gear is widespread. Catches vary greatly. Shark fishing is more productive further south where the densities of fishers are lower. This is said to be where the biggest come from, especially from Itampolo.

Production in the Toliara region is substantial, as indicated by SPRH data for meat production, which show that in 1994, 11 mt of fresh meat were consumed locally in Toliara town, and 36 mt of meat produced for the province as a whole. Allowing for the fact that only larger sharks tend to be reported (Randrianamiarana, pers. comm.), the total production of shark meat is likely to have been much higher.

The Indian Ocean Commission has installed several Fish Aggregation Devices (FADs) in Toliara in order to increase fishing yields. Sharks comprised 47% of all fish taken during experimental fishing between 1991 and 1994, although average capture rates were low, only 1.25 sharks per outing of an average of 4.5 hours (Razaoelisoa, 1995). Most of the sharks were small Silky Sharks. The FADs are being visited by a small but increasing number of line fishers, with the catch rates of these fishers unknown.

Zone 5 (West)

In the Menabe region (Morondava to Belo-Tsiribihina), fishing with shark nets is intensive in the warm season (November-March). The fishing is entirely traditional in nature, motorised artisanal and industrial fisheries not having been established.

ix. Artisanal fisheries

The artisanal fishery differs from the traditional with respect to both vessels and fishing gear used. Artisanal fishers use wooden or fibreglass hulled launches, with outboard or inboard motors of up to 40 Hp and crews of up to six fishers. Such vessels may either trawl or use longlines. Baits used are similar to those in the traditional fishery. Fishing locations are farther offshore, at depths of 50-120 m.

Artisanal fisheries are in general poorly developed in Madagascar and have been the subject of several fisheries development projects. Artisanal fisheries appear to be better developed around Mahajanga, but no precise data are available on the size of the fishery. Japanese-Malagasy projects to promote the development of artisanal fishing through co-operatives in Mahajanga have been disappointing, with catches being lower than expected (Ramanantsoa, 1990). Artisanal fisheries were not identified in Zones 3-5.

Zone 1 (Northwest, North, Northeast)

Mahajanga

The Mahajanga region has the highest concentration of small-scale shark fishers in Madagascar, operating from motorised launches "*vedettes*" at numerous sites between Cap St. André and Antseranana. Artisanal shark fishing centres in the area include Cap St. André, where at least four boats owned by the French company Coremadec, have been operating. Other shark fishing areas are Soalala, Besalampy and Tamborano, where according to fishers, yields of 200 kg dry fin in three months have been reported for a single three-person boat. One fisher reported fishing out of Marmandia with two boats, with fin yields said to be 200 kg per month.

Vessels operating from Mahajanga typically undertake four to five day outings targeting white fish and shark for the local market. Owners typically regard shark fin as a crew's perk. Each trip might yield 10-15 kg of wet fin, based on an estimated 1 kg fin for every two sharks caught. One fisher using a *vedette* to fish shark from 1993-1994 was said to have obtained up to six sacks of dry fins from one to two weeks fishing, equivalent to about 250-300 kg of fin per trip, although this claim could not be corroborated. A collector in Ambanja (Northwest) reported that launches operating in the area could produce up to about 50 kg of shark fin per "several-day outing", while commercial fishers from Mahajanga reported taking only 10-15 kg of wet fin in a similar period.

The species caught in the largest numbers were Scalloped Hammerhead Sharks and Smalltooth Sand Tiger Shark. Sawfishes were commonly caught in the past, but are said by fishers to have become rare owing to intensive netting across estuaries. Zebra Sharks *Stegostoma fasciatum* are caught occasionally but are considered to embody a human spirit and are therefore taboo. A trader in Ambanja indicated that motorised launches fishing further out off the northwest coast would take mainly Pigeye Shark (or "*akio beloha*") *Carcharhinus amboinensis*, Blacktip Reef Sharks (and/or others), and Oceanic Whitetip *C. longimanus*, as well as both Scalloped Hammerhead and Great Hammerhead *Sphyrna mokarran*.

Nosy Be

Nosy Be has not traditionally been a centre for shark fishing. However, this may change as a result of a GTZ project. The project is seeking to develop the practice of fishing with small gill nets (5 x 80 metres, 16 cm mesh). The aim of the project is to increase production of the artisanal fishery and to make it more efficient. GTZ provides training in fishing but not in marketing. The main activity of the project is to provide shark fishing nets to fishers at a low price (1 million FMG, or US $220) and on favourable credit terms, together with instruction in use. In return, fishers must provide catch data. Training is also being given to women in net-making and repair, with the intention that fishing communities should produce their own nets. By December 1995, 171 nets had been issued to fishers in the region, and the project is now starting to invite trainees from other parts of Madagascar.

Fishing rates remain low, at 11 days per fisher month. Even so, the project increased average individual fishing incomes from US $10-15 to US $150 per month, a tenfold increase. According to GTZ project staff, there was a clear correlation between shark fin prices and the number of fishing trips made by fishers (Alain, pers. comm.).

Motorised teams caught up to 11-20 mt of fish per year per boat. Catch ratios were: shark (53%); king fish *Scomberomorus* spp. (20%); rays (7%); and others (20%). This would suggest a catch of 5-10 mt of shark per motorised boat per year. The reported total catch was 81 mt in 1991, nearly doubling to 153 mt in 1992, and rising again to 207 mt in 1993 (Rabarison, pers. comm.).

Based on the average catch rates above, this indicates that over 100 mt of sharks were taken in 1993, and an additional 14 mt of rays. The GTZ project has been testing a prototype shark fishing boat with 10 nets, two longlines and 80 hooks. Catches were almost exclusively sharks - reaching 13 mt in five months (Heinz, pers. comm.). If such vessels become readily available, this could act as a catalyst increasing shark fishing in the region.

Cap Est

Until recently, two artisanal shark fishers operated regularly from this site. The main species caught were Oceanic Whitetip, Blacktip Reef Shark, Pigeye Shark, Sicklefin Lemon Shark *Negaprion acutidens* and Tiger Shark.

Maroantsetra

There are substantial artisanal shark fisheries, particularly around Maroantsetra in the Baie d'Antongil. Recent reports indicate that these shark fisheries are expanding, with a new colony of about 100 shark fishers established at Cap Masoala since November 1995 (Kroese, pers. comm.).

Zone 2 (East)

In Manakara, a local flotilla of eight boats with outboard motors was recently financed by the local Catholic mission, permitting fishing over a range of 80 km. Fishermen confirmed that sharks would be targeted..

2. Commercial Fisheries

i. Directed

The only known directed industrial shark fishery is the Mahajanga-based Somapêche, a Japanese-Malagasy company. From 1990-1992, Somapêche conducted deep sea shark fishing around the French island of Juan de Nova. The fishery was directed at an oil-bearing shark known as "*requin marron*", literally "brown shark". The species has not been determined. The fishery was closed in 1992 when France exercised its jurisdiction over the EEZ around the island.

Somapêche data for 1991 and 1992 relate principally to this fishery (Table 7). With the exception of February 1991, the data show a steady ratio of meat to oil production averaging 1.6:1, suggesting that Somapêche was consistently processing whole sharks during this period. Somapêche production data for subsequent periods were not available, consistent with closure of the Juan de Nova shark fishery.

Table 7

Production of shark meat and oil by Somapêche, Mahajanga (1991-1992)

Année	Qté	J	F	M	A	M	J	J	A	S	O	N	D	Totals
	meat	685	1 357	531	1 080	1 377	3 985	2 578	3 126	1 286	2 663	1 181	310	20 159
1991	oil	433	374	353	991	738	2 623	1 758	2 031	876	1 687	801	198	12 863
	ratio	1.6	3.6	1.5	1.1	1.9	1.5	1.5	1.5	1.5	1.6	1.5	1.6	1.6
	meat	880	1 449	425	1 783	4 429	2 844	1 026	1 638	5 022	584	2 862	3 812	26 754
1992	oil	615	851	206	1 019	2 649	1 688	538	965	3 135	384	1 906	2 443	16 399
	ratio	1.4	1.7	2.1	1.7	1.7	1.7	1.9	1.7	1.6	1.5	1.5	1.6	1.6

Source: SPRH, Mahajanga

The current extent of Somapêche's fishing activities were not established in the present survey. One fisher claimed that Somapêche engages in shark fishing and exports mainly shark meat, oil and fin, with fishing operations extending as far south as Morombe, near Toliara. Government staff provide conflicting reports on Somapêche's activities, however, with allegations that Somapêche boats tend to discard shark bodies, retaining only the liver and fins, contrasting with the opinion that Somapêche is acting primarily as an exporter of locally purchased fisheries products and is not significantly engaged in fishing.

ii. Bycatch

According to DRH staff, the only industrial fisheries capable of taking shark as bycatch are the shrimp fishery (domestic fleet) and the tuna fishery (foreign fleet).

Madagascar has a substantial coastal shrimp fishery, which is open from February to November and mainly concentrated in the northwest. The number of trawlers in the shrimp fleets are as follows:

Mahajanga region: approximately 39 (Somapêche, about 30; Pêche Export, 4-5; Refrigipêche, 4-5)

Nosy Be region: 13

Morondava region: 24

Toamasina region: 8

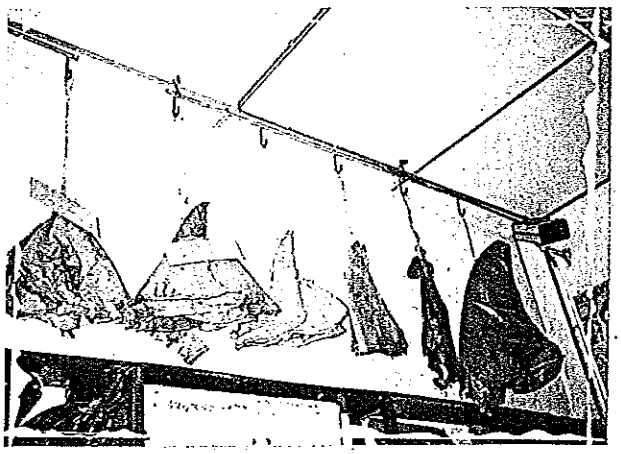
There are approximately 50 large trawlers involved in the fishery, many of these concentrating their efforts in the Morondava region. Approximately 75% of the total fleet are operational at any time during the nine-month shrimp fishing season (Randriamiarana, pers. comm.). There are approximately 24 smaller trawlers (25-75 Hp), which mainly work in the Mahajanga region. Two professional shrimp fishers working on large trawlers described the fishery in relation to sharks as follows:

A total of 30-60 days are spent at sea per large trawler per fishing trip. At the start of the trip, eight one-hour trawls are made per day, changing to three three-hour trawls per day by the end of the trip. Trawlers work 12-20 days at the trip's beginning to land 20-50 mt of shrimp, with as few as five or six sharks netted, or about 0.03-0.06 sharks per trawl. The bycatch of sharks per trawl increased towards the end of the trip with increasing trawl times.

At the end of the season the trawl may contain as little as 20 kg of shrimp, sometimes with sharks. At this stage the value of the sharks may exceed that of the shrimp; the crew is generally permitted by the captain to share the fins as a bonus. The shark carcass is usually discarded, especially early on in the trip.

Shark bycatch is said to vary by region as well as trawl duration. Near Cap St André to the south of Mahajanga, up to 8-10 sharks may be taken in a three-hour trawl. In the north, towards Nosy Be, bycatch is rarely more than three sharks, and often zero.

The fishers stated that the size of sharks caught as bycatch tends to be small, although they were not able to give length estimates. However, since trawling is carried out in shallow water, the catch is unlikely to include large pelagic sharks. A DRH official suggested that since damage to gear by sharks was unknown, any sharks caught must be of small size (Randriamiarana, pers. comm.).



Shark fin hanging above shop counter
Debra Rose

Rough estimates of shark bycatch associated with the shrimp fishery based on DRH fleet data combined with information provided by the shrimp fishers indicate that bycatch as a result of the shrimp fishery could involve from several hundred to over 100 000 sharks each year.

However, DRH believes that the bycatch of sharks by shrimp trawlers is far closer to the lower estimates, probably not more than 0.5% of the total catch (Randriamiarana, pers. comm.).

Jain (1995) cites a 1994 FAO study stating that over 30 000 mt of fish are caught as bycatch in Madagascar's shrimp fishery each year. However, the species composition of this bycatch is not described. Jain (1995) notes that 70% of Madagascar's shrimp exports are caught within two miles of the coast, despite there being a prohibition of commercial trawling in this area. Schultz (1989) estimated that 0.5% of total fish bycatch in a semi-industrial Mozambican shrimp trawler fishery operating in shallow waters and bays was composed of chondrichthyans (sharks and rays). This figure agrees with the estimate of Randriamiarana (pers. comm.), above. Schultz (1989) estimated a somewhat higher figure for the chondrichthyan bycatch of industrial shrimp trawlers fishing Sofala Bank, at 1% of total catch. Applying these figures to the shrimp fishery bycatch estimate provided in Jain (1995) would suggest that Madagascar's shrimp fishery may take in the order of 150-300 mt of sharks and rays per year.

Rabarison and Raveloson (1990) record the composition of bycatch for shrimp trawl data gathered between 1983 and 1984 and again from February to June 1987, using a 20 m trawler. The area covered was from Antseranana, south to Cap St André and on to Maintirano. Most of the species represented in the bycatch were fish characteristic of sandy-bottomed waters. Sharks were not reflected in the bycatch data, indicating that they represented less than 1% of the bycatch (Randriamiarana, pers. comm.).

It should be noted that the shark fishing season (when sharks are commonly considered to be more abundant in nearshore areas) and the shrimp season overlap but do not coincide - the shrimp season peaks in March and is closed from 15 December to 15 February, while shark fishing is concentrated in the period October to February.

Better data are required to produce a more accurate estimate of the bycatch. On the basis of present information, it seems likely that bycatch of sharks and rays is in the order of several thousand sharks per year.

Pelagic tuna and driftnet fisheries

The majority of pelagic fisheries in Madagascar's EEZ target tuna, and can be divided into two general categories:

(i) a longline tuna fishery comprising a minimum of 40 licensed, and possibly up to 300-500 unlicensed vessels from Taiwan, Korea and China operating mostly in the southern half of the Malagasy EEZ (Rabenomanana, pers. comm.); and

(ii) a licensed European purse seine fleet operating in the northern part of the Malagasy EEZ and Seychelles waters, comprising about 60 vessels and operating from January to May.

According to Ardill (1995), the total 1993 catch of tuna in the Malagasy EEZ was 10 000 mt, a figure equivalent to a DRH estimate for the same year, and probably derived from the same.

Longline fishery

Longline vessels working in the Malagasy EEZ are of a size capable of taking an estimated 500-700 mt of tuna per year (Gilbert, pers. comm.; Rabenomanana, pers. comm.), and operate year round. Tuna fishing with longlines has been demonstrated to result in significant shark bycatch, with an estimated catch rate ranging from 1-10 sharks per 1 000 hooks for the Indian Ocean (Bonfil, 1994). Based on data from the Taiwanese longline fishery, Bonfil (1994) estimates the average weight of sharks caught as 38.2 kg.

Gilbert (pers. comm.) provided available longline bycatch data, very few of which showed shark bycatch. However, data showing shark bycatch (undated) indicate that it is sizeable:

42 metre 1200 Hp vessel of 473 mt (10% of catch was sharks)

40 metre 850 Hp vessel of 376 mt (11% of catch was sharks)

52 metre 1600 Hp vessel of 798 mt (6% of catch was sharks)

Although insufficient data are available to make a gross estimate, it is clear that both the licensed and unlicensed tuna longliners are taking significant numbers of shark as bycatch in the Malagasy EEZ.

Shark bycatch of the European purse seine fleet

Fishing with purse seines takes relatively smaller numbers of sharks as bycatch (Pearce, pers. comm.), but would still be appearing to contribute to the shark catch in Malagasy waters. Shark fin traders in Madagascar stated that some of the fin in trade originates from French and Spanish tuna purse seiners which land their catch at the canning plant in Antseranana. Sharks are finned at sea and only the fins are brought ashore. They said that the fin was regarded as a perk of the fishers, and is traded at the port and transported to the Antananarivo for export. They said that no Certificat d'Origine et de Salubrité (COS) were issued in Antseranana, and no disclosure given of shark bycatch by the ships to Malagasy authorities. One trader stated that such vessels landed up to 200 kg of fin per stopover, without clarifying whether this was wet or dry weight. French and Spanish tuna purse seiners made increasing numbers of stopovers in Madagascar in the early 1990s, rising from 62 in 1992, to 110 in 1994.

Two traders commented that fin from the purse seine fleet lacked bulk and had a low fibre content. One trader described fins as being of all sizes including long ones (> 25 cm) with a white tip, suggesting that Oceanic Whitetip is a component of the catch.

3. Recreational Fisheries

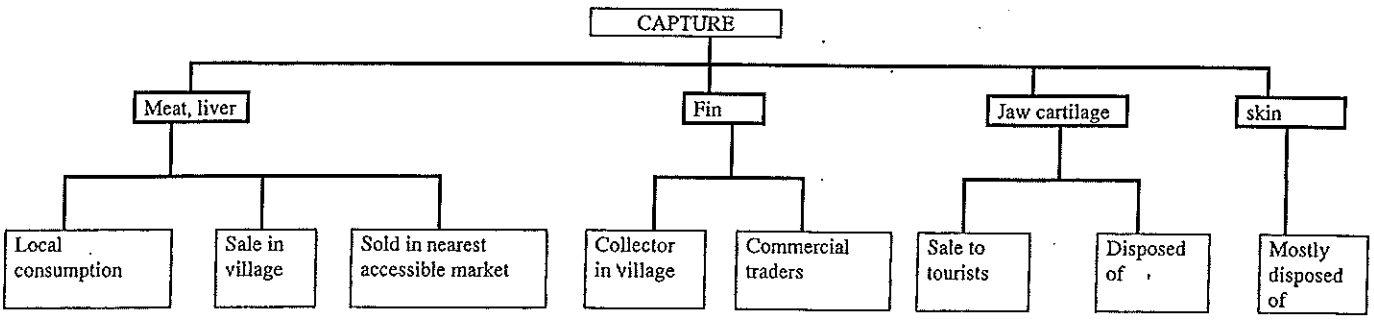
Overall, catches of sharks in recreational fishery (sport fishing) are considered to be negligible in Madagascar. Significant recreational fisheries occur only on Nosy Be (Northwest), where about five fishing boats operate regularly, and the total recreational catch is unlikely to exceed 100 sharks per year (Toussaint, pers. comm.). One fisher stated that the recreational catch was primarily targeted at large teleosts (e.g. marlin, sailfish, dorado) and that sharks were rarely caught. Of those that were caught, specimens over 35 kg were allegedly released, with only small sharks kept for eating, mostly Blacktip Reef Shark. Their fins were removed by staff for sale.

There is also a small amount of recreational fishing at Ste. Marie (two boats) and Toliara (one boat). Shark catches at Toliara are likely to be less than at Nosy Be (Feldman, pers. comm.).

UTILIZATION AND TRADE

Sharks are used for food and as a source of oil and cash income (Figure 2). Shark meat is consumed locally as well as dried and exported. Although oil is exported on a small scale, most is used or sold locally for wood waterproofing treatment and other applications. Dried shark fins are exported in large volumes to lucrative markets in Asia, primarily Hong Kong and Singapore. Skins are little used, the expertise for tanning them being scarce or non-existent in Madagascar. Shark teeth, jawbones and the saws of sawfish are sold locally to tourists in most areas. There was no evidence of any international trade in ray products, although it is likely that some dried ray flesh enters trade as dried shark meat.

Figure 2
Use of shark products after capture in the traditional and artisanal fisheries



Data on fisheries production and trade are compiled locally by SPRH offices and centrally by DRH. Data collection was disrupted periodically during the political transitions of the early 1990s, with the result that data are not available for certain provinces in certain years, with it also likely that those export and trade figures that are available are incomplète in some cases.

Production data reflect the fresh weight of shark products reported to SPRH by fish merchants in the province, including market vendors. These data exclude products consumed or sold locally without passing through a market. Export data are based on information provided on COS forms presented to SPRH, and reflect all exports from a province, regardless of whether they are interprovincial or international. Provincial production and export data were obtained for the provinces of Toliara, Mahajanga, Antseranana and Toamasina. Provincial data were not obtained for Antananarivo nor for Fianarantsoa. Complete datasets were not available for any of these provinces for the years 1990-1995. The provincial data collected during this study nevertheless provide an indication, although not comprehensive, of shark product production and trade.

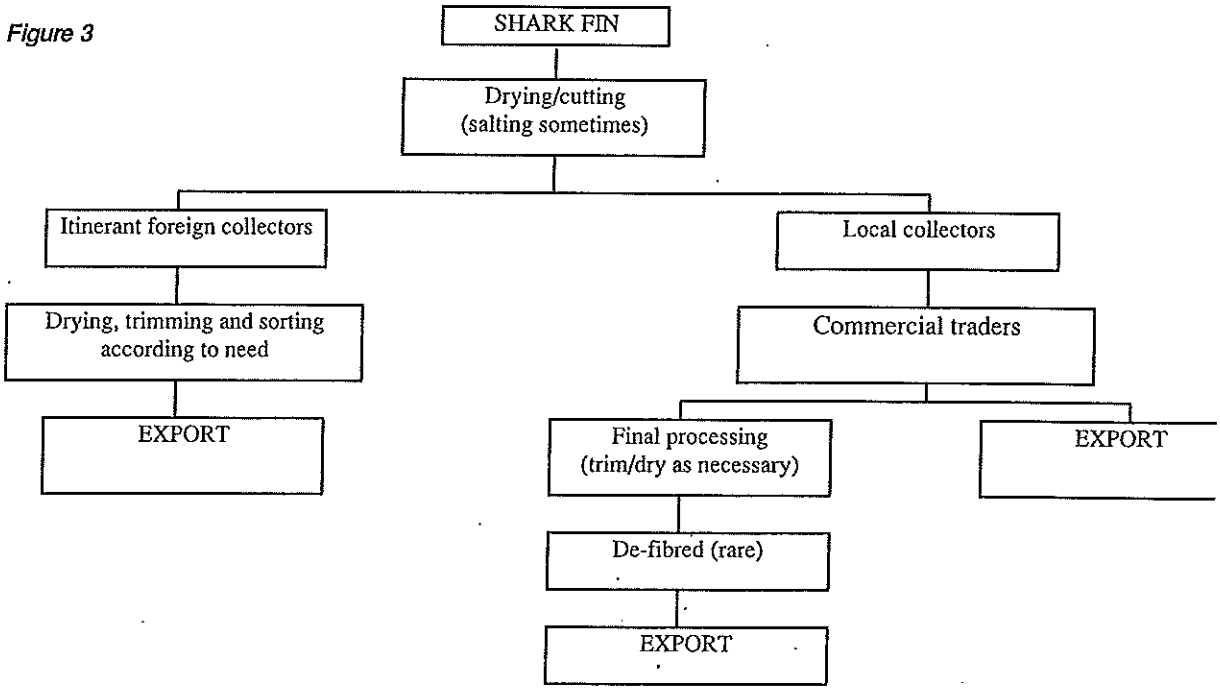
COS data are regularly analysed by DRH, with these analyses published in the FAO-sponsored fisheries bulletin *Infopêche Madagascar*. DRH data on shark fin exports are available for the years 1990-1995. Data on oil exports are not available prior to 1992, or for meat exports prior to 1993. Customs data lack sufficient detail to be used as a means of tracking exports of shark products.

I. Shark fin

Shark fin is produced primarily for export to markets in Asia, with smaller volumes exported to Europe. Production and trade were first recorded in the mid-1980s, with the market developing rapidly during the latter part of this decade. The rapid increase in exports was probably facilitated by the fact that Asian-Malagasy exporters of bêche-de-mer, a commodity with East Asian markets similar to those for shark fin, were already well-established in Madagascar.

Until 1992, trade patterns in shark fin typically followed: fisher > collector > commercial trader/exporter > major dealer (Figure 3).

Figure 3



Coastal fishers took some time to increase their prices in line with the price increases taking place in importing markets such as Hong Kong. As a result, a variety of 'opportunistic' traders entered the trade in the late 1980s,

exploiting the enormous difference between the fishers' selling price (in 1989, approximately FMG 10 000 per kg, or US $6 per kg), and prices paid by exporters (over FMG 100 000 per kg, US $62 per kg in 1989). However, this price gap soon narrowed, and most of the opportunists left the trade, which continued to be dominated by the Asian-Malagasy exporters. Export information for 1992, the year in which reported exports peaked, indicates that dealers of East Asian origin dominated the export trade at that time.

During the last several years, however, this pattern has been disrupted somewhat, primarily owing to the entry into the trade of West African buyers from Mali, Senegal, Guinea, Guinea Bissau and elsewhere. Durbin (1994) reports that West African shark fin collectors were operating in Soalala (Mahajanga) in 1991-1992. West African buyers purchase fins directly from fishers in the villages and take it by air to Hong Kong where they sell directly to dealers. In this way they operate as both collector and exporter, eliminating one level of middlemen. By delivering the fins themselves, these traders also ensure that they get a fair price in Hong Kong: some traders complained that Hong Kong buyers would refuse to pay the full amount on invoices on the grounds that quality was low, or the consignment damaged, a situation against which they had little recourse. Larger Malagasy exporters are addressing this competition to some extent by appointing pro-active collectors at strategic centres. However, at least two traders interviewed said the West African traders had seriously damaged their business.

Fishers in almost all areas have eliminated the village collectors by selling direct to traders. Several exporters of fin and bêche-de-mer have established provincial collection points to which village-based collectors sell dried fin every month or so. In a few remote areas (e.g. the Southeast), fin continues to be sold to "*marayeurs*", traditional itinerant fish merchants, who take fin on to collectors at the nearest town.

Table 8
Shark fin exports reported by DRH, 1992

Port	Destination	Transport	Quantity (kg)
Mahajanga	Europe	Ship	988
Mahajanga	Europe	Ship	225
Mahajanga	Europe	Ship	1 000
Mahajanga	Europe	Ship	1 000
Mahajanga	Japan	Ship	3 260
Mahajanga	Japan	Ship	5 420
Mahajanga	Asia (others)	Ship	444
Mahajanga	Singapore	Ship	580
Mahajanga	Singapore	Ship	1 154
Toamasina	Europe	Air	7
Toamasina	Singapore	Ship	74
Toamasina	Singapore	Ship	154
Toamasina	Singapore	Ship	186
Toamasina	Singapore	Ship	210
Toamasina	Singapore	Ship	245
Toamasina	Singapore	Ship	315
Toamasina	Singapore	Ship	1 155
Toamasina	Hong Kong	Ship	1 062
Toamasina	Hong Kong	Ship	1 866
Toamasina	Hong Kong	Ship	2 417
Toamasina	Hong Kong	Ship	2 495
Toamasina	Hong Kong	Ship	1 326
Antananarivo	Hong Kong	Air	100
Antananarivo	Hong Kong	Air	100
Antananarivo	Hong Kong	Air	150
Antananarivo	Hong Kong	Air	155
Antananarivo	Hong Kong	Air	447
Antananarivo	Hong Kong	Air	1 155
Antananarivo	Hong Kong	Ship	34
Antananarivo	Hong Kong	Air	815
Antananarivo	Hong Kong	Air	126
Antananarivo	Hong Kong	Air	175
Antananarivo	Hong Kong	Air	240
Toliara	Singapore	Ship	500
Morondava	Europe	Ship	80
Total			29 660

Source: DRH, Antananarivo

ii. Processing

Fishers remove the fins or "*mapeza*" from captured sharks and dry them for three to five days. Most fishers are aware of the need to prepare fin well in order to secure the best prices, and to "moon-cut" the fin ready for sale. One trader commented that additional processing was required for dry "crude cut" fin purchased from fishers. In Manakara, traders typically carry out additional drying before the product is ready for export. Kreuzer and Ahmed (1978) estimated that shark fins represented approximately 5% of total body weight, and that, if properly prepared, dry fins weigh approximately 36% of the weight of fresh fins, and dried fins represent approximately 1.8% of the total weight of sharks. Estimates of the ratio of dried fin to carcass weight among Malagasy fishers and traders ranged from 0.3% to 2%.

Only one trader in Madagascar has attempted to prepare fin fibre. However, the level of skill of the technicians was insufficient to prepare fins at a rate and quality competitive with fin processed in established centres such as China or Hong Kong. Fin processing to supply restaurants in the capital was reported to have taken place in the past, but has apparently been discontinued. Processing is now negligible to non-existent in Madagascar.

iii. Trade routes

The vast majority of shark fin exported in 1992, over 29 mt according to DRH records, was transported by sea, with only a small proportion shipped via air (Table 8). The proportion of exports transported via air may have increased subsequently in conjunction with shifts in the trade resulting from the entry of West African traders. The main exporters of shark fin to foreign destinations are located in Antananarivo, Mahajanga and Tamatave, with smaller exporters in Toliara and Morondava.

Ambanja is the major shark fin exporting centre in the north, with 5 mt reported by SPRH as exported from this city in 1994, the first year for which export data were available. SPRH data show that over 1 mt of fin was exported from both Ambanja and Antseranana in the first quarter of 1995. Two traders in Ambanja indicated that significant quantities of fin may also be exported from Antseranana by unregistered traders without being declared to SPRH. One Ambanja trader stated that he shipped fins to the capital, from which they were presumably then shipped overseas. The main destinations for fins from this province were said to be Hong Kong, Japan and France.

Toamasina is also an important centre for the shark fin trade, and is the base of operations for several major collectors and exporters. This province showed the largest volume of reported production of those provinces for which data were available (see Table 8).

Most shark fin exported from the southwest is shipped to overseas destinations via the capital. Some shark fin is exported directly from Toliara, this trade route being limited by the small number of ships visiting that port that are destined for the Far East. International export data maintained by SPRH Toliara (likely to be incomplete) show exports to Hong Kong, Singapore, Taiwan, Italy and the United Kingdom. Traders indicated that dried fins were also exported to Japan.

iv. Grading and value of fins in trade

While there were slight variations between regions, fins were classified primarily as "good" (i.e. those with plenty of cartilage fibre) and "bad" (those without). Good quality dried "moon-cut" fins were priced according to size (Table 9). Lower prices are paid where fins were still wet, poorly cut, blemished or otherwise spoiled, such as by excessive salting. Lower prices are also paid to fishers in remoter areas.

Table 9

Prices paid by collectors to fishers for dry shark fin, mid-1995.

Fin size	FMG per kg	US$ per kg
>25 cm	200 000-300 000	45-67
15-25 cm	100 000-200 000	22-45
<15 cm	<40 000	<9

Two Toliara traders said they observed the following set of rules to avoid buying worthless fin:

fins must have visibly high amounts of cartilage fibre when held against the light;
fins with spots or blotches are generally considered of bad quality;
blacktip fins are always good;
gold coloured fibrous fins are very good, and referred to as "*requin blanc*";
extremely long dark fins are bad;
sawfish pectorals are useless, but dorsal and lower tail fins are very good.

Slightly more may be paid for higher quantities of fin (> 10 kg) and for complete fin sets. One collector commented that sawfish fins were of high quality owing to high cartilage fibre content.

According to those traders interviewed, fins of the following species are the most commonly traded:

Scalloped Hammerhead	*Sphyrna lewini*
Blacktip Reef Shark	*Carcharhinus melanopterus*
Fierce Shark	*Odontaspis ferox*
Sawfish	*Pristidae* spp. (dorsal and lower tail only)

Within this group, price variation was governed primarily by fin size rather than by species.

The following species were said to have little or no commercial value for shark fin:

Tiger Shark	*Galeocerdo cuvier*
Thresher Shark	*Alopias vulpinus* and *A. superciliosus*
Nurse Shark	*Nebrius ferruginus*
Zebra Shark	*Stegastoma fasciatum*
Blue Shark	*Prionace glauca* (according to Manakara fishers)
Whale Shark	*Rhiniodon typus*

Referring to shark fin landed by tuna vessels at Antseranana, one collector noted that pelagic sharks tended to have thinner, less bulky fins, which were less valuable than those of coastal species. This view was reaffirmed by a trader, who described long white-tipped fins (possibly Oceanic Whitetip Shark *Carcharhinus longimanus*) as being thin and of moderate quality. It is interesting to note that some Madagascar fishers consider the fins of Blue Shark, a species frequently taken as bycatch by pelagic tuna fisheries, to be of little value. In contrast, Hong Kong traders consider the fins of this species to be top grade (Parry-Jones, 1996).

In addition to fins, West African buyers working in Toliara also purchase "*poussière*" (literally 'dust'), a rag-bag of small and medium-sized fin pieces. These can be purchased from fishers for as little as FMG 5 000 per kg or US $1 per kg. Apparently, the buyers' Chinese clients have the capacity to process this material into marketable shark fin products.

Fin from Toliara has a reputation for being the best in Madagascar owing to large fin size and high fibre content. This was confirmed locally as well as by traders outside Toliara. Fins from the northwest are generally smaller. The difference could reflect the superior fishing vessels and skills of the "*vezo*" fishers of the southwest, or a greater relative abundance of adult sharks.

v. Domestic prices paid for shark fin

Local shark fin prices rose rapidly during the early 1990s. The most dramatic increase in the west occurred between 1991-1992, with prices continuing to escalate until 1994. A trader noted similar increases on the east coast, where the value of fin was said to have risen from FMG 5 000 per kg (US $2.7 per kg) to FMG 50 000 per kg (US $27 per kg) during 1992. According to GTZ, demand for shark fin in Nosy Be greatly outstripped supply during 1992, with competing collectors constantly increasing their prices in order to secure fins.

Prices throughout the country dropped sharply in mid to late 1995, reportedly in response to a decline in prices paid in Hong Kong, the major import market for fin from Madagascar. West African traders interviewed in December 1995 said they were waiting for news of price changes in Hong Kong (HK) before investing in expensive collecting trips. Declared Hong Kong import values for Malagasy fin did in fact decline significantly from 1994 to 1995, as shown in Table 10 below.

vi. Value of fin exports

Two 'occasional' fin dealers stated that export prices peaked in 1992-1993 at approximately US $100 per kg, one adding that up to US $250 per kg was paid for the very best quality fin. Hong Kong Customs data do show a sharp rise in the average declared value of shark fin from 1991 to 1992 and a peak in the latter year, but at a level far below going prices claimed by Malagasy exporters (Table 10).

The average declared value for all shark fin imports reported in Hong Kong Customs data was only US $41 in 1992. As there is no import duty imposed on shark fin in Hong Kong, there would not appear to be any reason for this information to have been under-declared (Parry-Jones, 1996). An established exporter stated that Hong Kong fin prices were US $85 per kg in late 1995 but were falling rapidly, and were likely to fall as low as US $45-60, prompting him to suspend trading. Hong Kong Customs data for 1995 show that the average price for shark fin dipped slightly in 1993 and 1994, but had returned to approximately US $40 per kg in 1995.

Table 10

Declared value of Hong Kong imports of dried shark fin, 1989-1995 (US$/kg)

Year	Mean HK declared import value (all imports)	Mean HK declared import value (imports from Madagascar)
1989	26.84	15.30
1990	25.46	21.89
1991	28.69	17.48
1992	40.96	26.49
1993	38.49	40.27
1994	36.55	34.02
1995	40.60	24.87

Source: Hong Kong Customs data.

Up until 1993, HK Customs declared values of fin imported from Madagascar were much lower than the average value for fins imported from all sources. During that and the following year, however, the declared values were relatively similar.

Traders are required to declare the value of shark product exports at the time they obtain COS documents for export, and also to adhere to foreign currency controls including repatriation of foreign currency. Shark fin exports would appear to be significantly undervalued in this COS documentation: according to data compiled by DRH, the average export value in 1994 was FMG 49 882 per kg, or approximately US $16 per kg, compared to US $34 per kg for imports from Madagascar recorded in Hong Kong Customs data for that year. For 1995, the average declared export value was FMG 64 579 (US $14.5 per kg), significantly lower than the average declared value of Hong Kong imports during that year of approximately US $25.

The under-declaration may in some cases reflect efforts to avoid Madagascar's currency controls. Two traders interviewed said they sought payment in US dollars, and that in 1993-1994, US $40 per kg was the minimum price for shark fin which Customs would not query, although the actual export value might be significantly higher. One trader indicated that the balance would be paid to a foreign account by the buyer.

vii. Production and trade volumes

As noted above, provincial production and export data were obtained for the provinces of Toliara, Mahajanga, Antseranana and Toamasina, but not for Antananarivo or Fianarantsoa (Table 11). For those provinces for which data were collected, data were missing for one or more years, and even in years in which they were provided, may be incomplete. As a result, calculations of national production based on the figures presented below should be considered as minimum values. As export data include interprovincial as well as international exports, these data cannot be used to give more than an indication of the volume of exports to foreign markets.

Total reported production of shark fin in the four provinces rose to nearly 19 mt in 1992, declining slightly in 1993 and then dropping sharply in 1994. It is not clear whether these data reflect the fresh weight of fins, or the weight after drying, and is likely to be a combination of the two. Toamasina produced the largest amount of shark fin from 1990-1994, over 30 mt, followed by Mahajanga. According to SPRH personnel, the sharp rise in reported production in Toamasina in 1992 reflects a resumption in activities following the political turbulence of the previous year, at which time traders would have been likely to have stockpiled products. The true trade from Toamasina during this period was likely to be much larger: SPRH data, confirmed as correct by SPRH personnel, show that a single trader reported the collection over 49 mt of fin in 1993, which could similarly reflect stockpiling.

Table 11

Reported production and export of shark fin, 1990-1995 (kg)

Year	Toliara		Mahajanga		Antseranana		Toamasina		Total	
	Prod.	Export	Prod.	Export	Prod.	Export	Prod.	Export	Prod.	Export
1990	-	-	6 000	2 648	-	-	9 021	6 929	15 021	9 577
1991	-	-	6 809	17 907	-	-	-	-	6 809	17 907
1992	-	-	4 860	3 166	-	-	13 753	6 374	18 613	9 540
1993	8 684	2 050	4 770	420	-	-	4 701	4 701	18 155	7 171
1994	3 540	950	4 221	-	-	5 156	3 335	2 949	11 096	9 055
1995	-	-	-	3 875	-	2 763	-	-	-	6 638
Total	**12 224**	**3 000**	**26 660**	**28 016**	**-**	**7 919**	**30 810**	**20 953**	**69 694**	**50 842**

Note: "-" = no data retained at SPRH.
Source: SPRH.

However, the export of this volume of fin is not reflected in provincial SPRH export data. Similarly, the peak in exports from Mahajanga in 1991 resulted from a concentration of exports from this port at a time when others were closed owing to political instability. Data for Antseranana are only available from 1994 onwards.

Government data for exports of shark fin to foreign markets are based directly on an analysis of COS forms submitted to, or issued by, DRH in the capital. Reputable fin collectors in coastal regions are legally entitled by licence or "patente" to trade in marine products. They tend to send consignments of fin to their buyers in the capital on a fortnightly or monthly basis, by road, accompanied by a COS form declaring the weight of the product. Traders in the capital will seek COS for international export on the basis of the provincially issued COS documentation. Thus, the internal and international export weights should correspond with one another.

In practice, consignments are not weighed by the SPRH or DRH when COS are issued, although two traders thought weights would be questioned by DRH staff in the case of an obvious disparity between actual and declared weights. Interviews with collectors and exporters indicated that there was no incentive to understate the weight, since the trade was legal. No evidence that collectors and exporters were colluding to understate weights was uncovered during this study. As a result, licensed trade by the major collectors and traders is likely to be reasonably accurately recorded at the provincial and international level.

However, exporters also export fin from smaller, unlicensed, suppliers, which is sent to the capital without supporting COS documentation. In such cases, it is the exporters who "absorb" this unlicensed trade, in the process of obtaining a COS from DRH for the purposes of export. Staff of one major exporter said that fins exported under a single COS could be from multiple origins. DRH staff confirmed that DRH was willing to issue COS documentation for shark fin consignments for international export even where provincial COS had not been obtained. It is therefore likely that the weights of fin exports reported by provincial SPRH are less than the weights reported by DRH in the capital.

If production data are in fact primarily for dried fins, then comparison of SPRH data with DRH data tend to support the information gained through interviews that some shark fin is exported from the provinces without first obtaining provincial export documentation. With the exception of 1991, reported exports of shark fin to SPRH in the four provinces for which data were available are lower than reported production for each of the years 1990-1994. Bearing in mind that there is little if any domestic market for shark fin, and further, that SPRH export data include interprovincial as well as international trade, it seems likely that exports may therefore be under-recorded in SPRH data. This would seem to be supported by international trade data compiled by DRH for exports of dried shark fin from Madagascar, which show trade volumes well in excess of those recorded by SPRH (Table 12). However, it is important to note that SPRH data were not available for several years for one or more provinces. Similar to SPRH data, DRH data indicate that exports

Table 12

Reported exports of dried and salted shark fins from Madagascar (mt)

Year	Reported exports (mt)
1987	3
1988	14
1989	12
1990	7
1991	15
1992	29
1993	24
1994	17
1995	19
Total	**140**

Sources: Anon., 1995; Anon., 1996b; A. Crispoldi, *in litt.*, 1996.

peaked in 1992, remained relatively high in 1993, then declined considerably in 1994.

viii. Principal markets for Malagasy shark fin

The principal markets for Madagascar shark fin are Hong Kong, Singapore and Japan. Exports to Malaysia are relatively minor but could be increasing, with Malaysian Customs data showing the import from Madagascar of 444 kg of shark fin in 1992, and 1200 kg in 1994. France was also mentioned by traders as an important destination for shark fin. DRH data for 1992 and 1994 are compared with available Customs export data from Hong Kong and Singapore in Table 13. Hong Kong and Singapore import data reveal seasonal fluctuations in trade volumes, with imports peaking from November to January, presumably in anticipation of the festive season surrounding Chinese New Year.

Table 13

Reported international trade in shark fin from Madagascar, 1989-1995 (kg)

	1989	1990	1991	1992	1993	1994	1995
Europe				3 300			
France						311	
Hong Kong	13 376*	8 460*	22 416*	12 663 29 261*	18 079*	11 851 18 070*	33 157*
Japan				8 680			
Malaysia				444		1 200	
Reunion						20	
Singapore		3 318*	933*	4 573 4 676*	2 040*	1 647 4 527*	100*
Others						1 516	
TOTAL	13 376	11 778	23 349	46 361	20 119	25 644	33 257

Note: Total figures are calculated based on the largest reported trade per country of import per year.
Sources: DRH, Antananarivo; Hong Kong* = Hong Kong Customs Statistics;
Singapore* = Singapore Customs Statistics.

ix. Meat

The majority of meat produced by Malagasy fisheries is consumed in the country. Mahajanga was by far the largest producer of shark meat during the early 1990s, with SPRH records showing the production of nearly 1200 mt from 1990-1994 (presumably fresh weight), of which over 250 mt (likely to have been largely of dried and possibly of frozen meat) were exported from the province (Table 14). Reported shark meat production was lower on the east coast, averaging approximately 40 mt per year from 1990-1994 (excluding 1991, for which data were not available). SPRH data for Mahajanga also show the production of 5 mt of ray meat in 1990 and 1 mt in 1991. SPRH personnel believe that much of the actual shark meat production goes unrecorded as the meat is immediately used locally. During 1995, meat sold for FMG 500-1 000 (US $0.11-0.22) per kilogram fresh, and FMG 1 750-2 000 (US $0.39-0.45) per kg dried. Ray meat sold for similar prices.

Local consumption of shark meat in the far north is a very recent development, with fishers reportedly finning any sharks caught and discarding the body, prior to 1994. This could explain in part the lack of production data for Antseranana. The recent development of a local taste for shark meat and the drastic improvement of the road to Mahajanga in 1994 has prompted fishers to retain meat for local sale and for drying and sale to middlemen who ship it to Mahajanga. A domestic market for shark meat has similarly developed in Nosy Be, where strips of shark meat 2 cm wide, sold for FMG 500-800 per kg (US $0.11-0.18 per kg), and are now selling much of their production locally as well as on the mainland. These localised increases in domestic trade could also reflect the collapse of the Comoros market in the wake of two reported poisonings from consumption of shark meat in the Manakara region, one in 1993 and another in 1995 (Randriamiarana, pers. comm.).

Table 14
Reported production and export of shark meat, 1990-1995 (kg)

Year	Toliara		Mahajanga		Antseranana		Toamasina		Total	
	Prod.	Export	Prod.	Export	Prod.	Export	Prod.	Export	Prod.	Export
1990	-	-	313 740	86 894	-	-	41 100	-	354 840	86 894
1991	-	-	570 905	88 000	-	-	-	-	570 905	88 000
1992	-	-	8 233	50 776	-	-	36 939	-	45 172	50 776
1993	31 427	-	271 940	35 439	-	4 930	39 361	-	342 728	40 369
1994	42 653	-	17 692	3 438	-	600	38 388	-	98 733	4 038
1995	-	-	-	2 800	-	-	-	-	-	2 800
Total	74 080	-	1 182 510	267347	-	5 530	155 788	-	1 412 378	272 877

Notes: * known to be fresh weight for Toamasina, likely to be fresh weight or combination of fresh and dried weight for other provinces. "-" = no data retained at SPRH. *Source*: SPRH.

Only the Mahajanga area supports a large export trade, with dried meat exported in significant quantities to both the Comoros and Japan. GTZ project personnel in Nosy Be estimated that 80-90% of all shark meat produced in the northwest region was dried and exported to the Comoros via Mahajanga. Reported exports from this province (including interprovincial trade) totalled over 250 mt from 1990-1994. Shark meat is exported from Antseranana to Réunion and the Comoros, including shipments from Nosy Be that are exported to the Comoros via Mahajanga. Shark products are also landed on the mainland by Nosy Be fishermen for shipment by road to Ambanja and Ambilobe. Smaller quantities of shark meat are said to be exported from Morondava and Toliara, although SPRH export data for Toliara do not reflect this.

DRH data show the export of 81 mt of shark meat in 1993, declining to 31 mt in 1994 and 5 mt in 1995 (Anon., 1995; Anon., 1996b). Data were not available for previous years. It is likely that much of this trade was destined for Japan, as evidenced by Japan's Customs data, which show substantial imports of shark meat from Madagascar: imports increased from a low of approximately 5 mt in 1990 to a peak of over 31 mt in 1993, then fell to 9 mt in 1994. DRH export data for the latter year show the export of only 4 mt of shark meat to Japan, possibly indicating under-reporting of the trade. According to Japan's Customs data, the declared value of shark meat imported from Madagascar rose steadily, from approximately US $1 000 mt in 1991, to US $1 500 mt in 1994. Most of the meat exported to Japan in the early 1990s is likely to have been produced by the firm, Somapêche.

x. Oil

Shark oil has been traded for many years as a rich source of Vitamin A, but this trade has declined in recent years with the advent of formulated vitamins. Oil is also useful for waterproofing wood, and most of the oil produced in Madagascar is used and sold locally for this and other purposes, rather than exported.

Mahajanga was the only region from which significant production and exports of oil were documented, the oil being produced by the Malagasy-Japanese company Somapêche. Production was first reported by SPRH during 1990, and totalled 13 mt in 1991 and 16 mt in 1992, mirroring production volumes reported for Somapêche alone. No production data were available for 1993-1995. DRH export data show the export of 8 mt of oil in 1992, rising to 18 mt in 1993, then falling to approximately 3 mt in 1994 and 1995. Most of this oil is likely to have been exported to Japan.

The decline in reported production and exports is likely to reflect the closure in 1992 of Somapêche's deep sea fishery for Brown Shark, off the French island territory of Juan de Nova. This was in response to France having exercised its jurisdiction over the French EEZ around the island.

xi. Other products

Shark teeth, jaws and the saws of sawfish are sold to tourists in most areas, but there was no evidence of an organised trade. The jaws of larger sharks are retained for potential sale to tourists throughout most of the island, with prices ranging from FMG 5 000-25 000 (US $1.1-5.6) each. The trade in shark teeth appears to be very small. Teeth from larger sharks are retained by fishers in tourist areas for sale to tourists or to traders for use in jewellery making.

Shark-tooth jewellery is occasionally observed for sale at tourist souvenir shops, but nowhere on a large scale. East coast fishers reported selling teeth for FMG 500 (US $0.11) each. The saws of sawfish are sold occasionally to tourists or hoteliers for up to about FMG 125 000 (US $28) each.

Two European traders said they had tried tanning skins but had poor, unmarketable, results. Only one collector of skins, a Chinese trader visiting Ile Ste. Marie, was identified during this survey.

REGULATORY/MANAGEMENT FRAMEWORKS

1. Domestic

I. Fisheries policy

The Malagasy Government is seeking to develop fisheries resources for the increased economic benefit of Madagascar. National fisheries policy is defined by the Plan Directeur for fisheries and aquaculture. The plan is primarily concerned with expanding fisheries, increasing efficiency and improving the living standards of traditional fishing communities. Sharks are mentioned as one of several under-utilized resources meriting the provision of technical advice and support to commercial operators with regard to fishing, processing and sales techniques.

II. Fisheries legislation

The fisheries legislation of Madagascar is actively evolving, with assistance in this regard being provided by the FAO. *Fisheries Ordinance 93-022 of 4 May, 1993* repealed Part I of the *Code Maritime of 1966*, which governed fisheries administration in Madagascar. Any previous legislation, of which there are some 200 texts according to FAO (Beurier, 1982), inconsistent with the new law was automatically repealed. The *Ordinance* establishes a broad framework for fisheries regulation, but is not specific with regard to individual species other than banning the hunting of marine mammals. The *Ordinance* defines, *inter alia*, the following categories of fishing:

> subsistence fishing, where the essential purpose is to feed the fisher or the fisher's family;
>
> commercial fishing (whether traditional, artisanal or industrial) where fishing is carried out for profit and habitually involving the sale of catch.

It also provides for the creation of an inter-ministerial fisheries commission and a consultative fisheries council for each province, the latter charged with giving its opinion to the inter-ministerial commission. This reflects the constitutional shift known as "rational decentralisation", however, as the unit of province is now being phased out in favour of smaller collectives, it is uncertain whether this aspect of the law can be implemented. The relevant minister is obliged to develop plans for the management and conservation of stocks (Article 6). COS forms signed by DRH continue to be required to export fisheries produce (Article 17).

Decree 94-112 of 18 February 1994 provides for the general regulation of fisheries. Fishing is defined as follows:

> traditional fishing (on foot or in non-motorised vessels)
>
> artisanal fishing (using boats with motors of 50 Hp or less)
>
> industrial fishing (using boats of more than 50 Hp)

Licences are proposed to be required only for motorised vessels qualifying as ships ("*navires*"). For the time being, existing licensing systems apply. Licences are not currently required for artisanal or traditional fishers.

Under *Decree 71-238 of May 18 1971*, industrial vessels are not permitted to fish within two nautical miles of the coast. SPRH officials in Mahajanga reported that this rule was frequently infringed, for which fishers blamed catch declines. A professional diver in Nosy Be claimed he had seen longline vessels fishing within the two mile limit on the west and north of the island on several occasions, but that attempts at radio contact had been ignored. Jain (1995)

also reports illegal trawling within the two mile limit on the east side of Nosy Be. Agreements for deep sea fishing apparently prohibit fishing within the 200 m isobath (Jain, 1995).

No laws or regulations have been adopted specifically in relation to shark fishing. Thus, subject to general restrictions on fishing such as restrictions on the use of dynamite or poison, shark fishing may be carried out without restraint.

iii. Implementation of fisheries and trade controls

The Ministère de la Production Animale, Elêvage et Pêche, et des Eaux et Forêts (Ministry of Animal Production, Breeding, and Waters and Forests), (MPAEF) was responsible for Madagascar's fisheries until June 1995, when responsibility was transferred to the newly-formed Ministère de la Pêche et des Ressources Halieutiques (MPRH). The administrative structure for fisheries management otherwise remained unaltered, and is described in more detail below.

Since French colonial times, Government administration in Madagascar has been based on provinces "*faritany*", and subdivided into districts "*fivondronany*". Under the 1992 Constitution, the provincial unit was to be phased out in favour of smaller collectives of one or more districts. However, the provincial administration system was still operational at the time of this writing.

Fisheries are centrally administered by the Direction des Ressources Halieutiques (DRH). DRH has an administrative office (Service Provincial des Ressources Halieutiques (SPRH), as well as two district offices or "*circonscriptions*" in each of the six provinces, a total of 18 offices throughout the country.

SPRH offices collect and maintain data on the production and export of various categories of marine products. SPRH production data represent the fresh weight of fisheries products intended for sale or export from the district/province that is reported to SPRH by fish sellers. Fisheries products consumed within villages or sold locally without passing through a market are not recorded in SPRH production data. Substantial volumes of production may go unrecorded, either because fisheries products are consumed at the point of origin or because reporting requirements are not complied with. However, apart from the inconvenience and the paperwork, there appears to be no major financial or other disincentive to accurately reporting production and exports.

The FAO-supported Programme Sectoriel Pêche (Fisheries Sector Programme) is training personnel responsible for monitoring marine production, with the intention that trained individuals will spend extended survey periods at numerous strategic sites around the Madagascar coast. For example, in the southwest, monitors will spend 15 days per month covering Beheloka, Anakao and other nearby villages. They will be responsible for recording all marine production, including sharks and shark products. Some monitors had already been trained and begun monitoring at the time of this writing (Rabenomanana, pers. comm.).

iv. The "COS" system

Trade in agricultural and fisheries products is monitored under the Certificate of Origin and Health or "Certificat d'Origine et de Salubrité", the COS system, which was established under *Decree 62-213 of 18 May 1962*. This Decree set comprehensive health requirements and food preservation standards for marine animal products intended for human consumption (Beurier, 1982). The application of COS to fisheries products is expressly retained by *Fisheries Ordinance 93-022*.

The COS system was originally administered by MPAEF. Its ongoing application to marine products was complicated by the transfer of DRH to MPRH in 1992, as MPRH has no jurisdiction for administering the COS system. This situation led to a temporary disruption in data flow; inter-ministerial arrangements are being made to ensure that COS data will be made available to DRH (Randriamiarana, pers. comm.).

A COS must be issued every time a product is exported from a province (provincial export) or leaves the country (international export), and is valid for 24 hours from the time of issue. More than one COS can be required for products moved from one province to another prior to export to foreign markets. In practice, the requirement for

multiple COS is not enforced by DRH in Antananarivo, which frequently issues COS for marine product exports for which no COS has been issued at the provincial level. DRH staff specifically confirmed that the waiver applied for shark products (DRH staff, pers. comm.). However, two traders transporting goods from one province to another via road commented that they usually obtained COS in advance in order to avoid potential problems with police.

v. Retention and compilation of COS records

In 1988, only 11 of the 17 SPRH provincial and district offices were able to participate regularly in the COS system owing to staff shortages (Raboanrijaona, 1989). The situation has since considerably improved, and all SPRH provincial and district offices now participate. Bureaucratic and administrative functions suffered considerably from strikes and other work stoppages during the period of political transition between 1991 and 1993.

Provincial and international export records are retained by MPAEF, SPRH and Customs. However, only SPRH compile records relating exclusively to marine products and further organise them into product categories. DRH fisheries product trade analyses, such as those published in the *Infopêche Madagascar Bulletin*, are based on COS data from SPRH and DRH.

vi. Application of COS to shark products

COS product categories for marine products are prescribed by ministerial instruction on the recommendation of DRH, and communicated to provincial MPAEF and SPRH offices. There were 19 categories of marine products in 1988, including shark fin (Raboanrijaona, 1989). At that time, only SPRH Toamasina (1.2 mt) and SPRH Toliara (1.18 mt) recorded exports of shark fin, while SPRH Mahajanga recorded no such exports. Current elasmobranch categories are: whole sharks, dried shark meat, fins, jaw cartilages, and skin. There is an additional category, "horrus", the meaning of which was unclear to DRH officials, but could possibly be the saws of sawfish.

vii. International export procedures

COS procedures for international exports of marine products are as follows. The trader takes a consignment to the Service Provincial of MPAEF, where a health check is made and a COS filled out and stamped by an MPAEF official. The trader then takes the COS to the nearest district SPRH office where it is examined and stamped by SPRH officials. The COS and other export documentation are delivered to the Service Provincial des Douanes (Customs), which checks whether the documentation is complete and correct and gives the appropriate export clearance. Finally, export papers are inspected by the carrier taking the goods, and may also be inspected en route by Gendarmes or Police Militaire if the consignment goes by road.

Exports of marine products are also subject to currency-control procedures, with an export value required to be stated on the invoice accompanying shipments for export. Apparent abuse of this system is described above.

Malagasy Customs have made quite frequent and well-publicised interdictions of wildlife trade at the national airport, particularly of live reptiles (for which there is a substantial illegal trade). The small volume of international passenger traffic permits some inspection of personal baggage and freight. However, the situation at sea ports is radically different, where products such as shark fin can readily be shipped out with other products in containers without detection.

2. Regional/International

Madagascar has signed most of the key international conventions that relate to marine affairs or use and conservation of natural resources, although it has yet to ratify some of these conventions. The only current international fisheries agreement is with the European Union for tuna fishing, although there have been past agreements with other tuna fishing nations.

CONSERVATION IMPLICATIONS

Shark fisheries have not been systematically studied in Madagascar, thus no historical baseline data on catch or fishing effort exist. This survey has made a start by collecting qualitative data through discussions with experienced fishers on trends in shark size, species and catch per unit effort (typically recorded as the number of sharks caught per fishing trip).

i. Declining traditional catches

Investigators asked fishers for their impressions on shark catch and effort in recent years in order to gain a subjective assessment of stocks. Fishermen reported reduced catches, or the need to fish further afield, in all areas except Tolagnaro (Zone 3) and around Manombo, north of Toliara (Zone 4).

ii. Shark catch declines in Morondava (Zone 5)

Fishing families in seven villages were questioned closely over several days about the state of exploited shark stocks. Numerous fishers confirmed that the sharks had deserted the area, that it had become necessary to travel up to 20 km to catch the same species, and that catch rates had dropped from 10-20 per net per trip, to 1-3 per net per trip in 1995. There was intense competition between fishers, with reports of frequent theft or sabotage of gear and migration to new fishing grounds. According to fishers, the shark fishing season coincided with the presence of pregnant females, which typically contained 7-8 pups *in utero*.

iii. Nosy Be (Zone 1)

GTZ expressed concern that the catch rates for shark have become so high that local stocks may be threatened. In 1994 the catch per unit effort (CPUE) for sharks decreased slightly, while CPUE for all species increased. However, it is probably too early to draw firm conclusions from this observation.

Jain (1995) notes that a lack of data on the status of fish stocks and harvest rates makes it impossible to draw accurate conclusions regarding the impact of Madagascar's fisheries on fish populations. Nevertheless, the anecdotal information provided above indicates the likelihood of at least localised declines due to overfishing, and points to the need for more detailed study.

CONCLUSIONS AND RECOMMENDATIONS

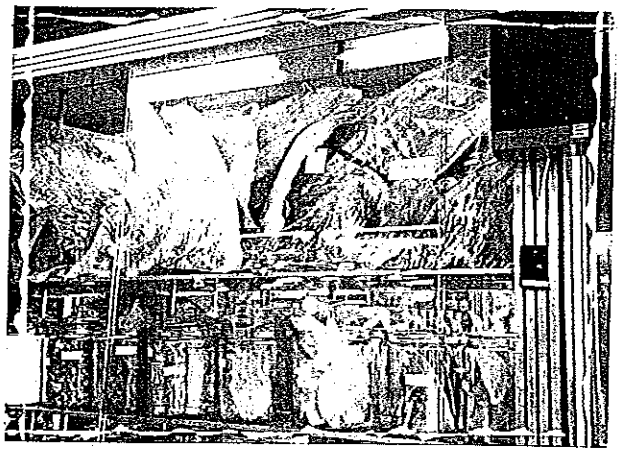
Sharks, rays and sawfish are clearly important fisheries resources in Madagascar. They provide a local source of cash income, especially from the export of shark fins, and to a lesser extent, meat and oil. The importance of shark fisheries has been recognized by the Madagascar Government which has identified sharks as an under-utilized resource, by the development agency GTZ which has developed a project to increase shark catches, and by Jain (1995) who notes the increasing demand for shark products for export.

Production from Madagascar's shark fisheries have increased in the last decade, with sharks the subject of new targeted fisheries as well as becoming an increasingly valuable component of non-targeted fisheries and bycatch. This increase was largely driven by an increased demand for shark fin, and a subsequent rise in prices paid to traditional fishers. Continued demand for shark fin is expected for the foreseeable future, although foreign demand for shark meat has declined in recent years. Sharks also feature prominently as bycatch in both the pelagic tuna and coastal shrimp fisheries. At least some of this bycatch is utilized, although there is no information to quantify bycatch associated mortality.

The status of shark and other chondrichthyan populations has yet to be studied in any detail, with the result that there is no quantitative information on which to assess the conservation impact of current fisheries or other factors. However, anecdotal information collected during this study suggests that some local shark and sawfish populations

have declined in the past several years. This is worrisome given the likelihood of continued and possibly increased fishing effort in future.

There are effectively no Government controls on shark fishing, with the result that sharks and other chondrichthyans remain "open access" resources in Madagascar. It appears that the value of shark fin exports is being under-declared on export documentation to some extent, with the potential that foreign currency regulations are being circumvented. As a result, Madagascar may be losing an important source of foreign exchange.



Shark fin in shop window
Debra Rose

More comprehensive research on the status of shark populations in Madagascar is necessary in order to assess whether shark stocks are being affected by current fishing levels. This research should be accompanied by the development of an appropriate management plan for the fishery to provide a means for maintaining future fisheries within sustainable levels. Better monitoring of shark fisheries and trade should be implemented in order to establish the species and number of sharks and other chondrichthyans involved. This should encompass both coastal fisheries and pelagic fisheries, including those of foreign vessels fishing in Madagascar's EEZ. With regard to the latter, efforts should be made to prevent unlicensed vessels from fishing in Malagasy waters. Recommendations made by Jain (1995) regarding fisheries management should also be considered, as many are appropriate to Madagascar's chondrichthyan fisheries and trade. In the case of processing, efforts should be made to determine and then eliminate the causes of poisonings associated with consumption of shark meat.

Controls on the export of shark products should be strengthened in order to ensure that currency regulations are adhered to and to provide information on the volume of products and species involved in international trade.

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APPENDIX 1.

Vernacular names of sharks not attributed to particular species:

Antseranana and Sambava: *Akiopasy* ('shark of the sand') - *Akiofotsy* (white shark, possibly *Odontsapis ferox*)

Mahajanga: *Akiovony* - *Fotraka* - *Botribondry*

Tolagnaro: *Hirahira* (no clear description; possibly equivalent to Hiahia found in Toliara, Morombe and Morondava (Grey bamboo shark - *Chilascyllium griseum*)) - *Atsantsatovy/Atsantsampangalo* (shark with fusiform head) - *Boriloha* (shark with short rounded head) - *Hazalava* (no clear description)

Toliara: *Matsiotsio* - *Sabonto* - *Fotirambo* - *Belidake* - *Soroboa* - *Akio Bemaso* - *Akiombato* - *Akio Bevombo* - *Maintilamosy* - *Akiomihira* - *Akiomitseke* - *Degodego* - *Lavalabary* - *Sampanòhy* - *Razankiahia*

Vernacular names of other chondrichthyans (all rays) not attributed to particular species:

Morombe/Manombo: *Faiangema - Faitombily - Faivato - Faivanda*

Tolagnaro: *Faimainte - Fairavy - Faiboka - Faisokitse - Faitombily* or *Faisampana* (colour black) - *Faikoaky* (white belly black back)

Toliara: *Faimiangitry - Faitatamo - Faifoty - Failejaleja - Faikida - Marofatike - Fairoaloha - Faiangema - Faibehoy - Faindramiango*

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