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ABSTRACT

Sharks comprise a major component of the landings in Trinidad and Tobago. Up to 34 species of sharks have been identified including two deep water species. Landings however generally comprise 15 species, five of which are very common. Three of these are landed by both the inshore and offshore fisheries. Five species of hammerhead sharks have been found around Trinidad and none around Tobago. A Shark nursery area has been identified as being a zone 2 miles from shore around Trinidad.

There are few targeted shark fisheries. Landings are primarily incidental catch of other fisheries. In the artisanal fishery over 90% of landings are by the gillnet fishery which targets *Scomberomorus brasiliensis* (Carite). In the offshore fishery the most significant landings are by the industrial longline fishery which targets tuna and swordfish.

Landings from the artisanal fishery for most years between 1972 and 1993 show fluctuations in landings with a general decline over the years. Landings were 918 tonnes in 1991, 531 tonnes in 1992 and 440 tonnes in 1993. This may possibly be due to a combination of factors related to the biology of the species and changes in fishing gear, methods and practices. Recorded landings by the industrial fishery are variable being 55 tonnes in 1990, 4 tonnes in 1991 and 341 tonnes in 1993, and are possibly due to probable discard at sea or changes in vessel operations.

Shark fins represented 19% of landings in 1993 and only fins (23 tonnes) were recorded in 1992. Finning at sea is suspected, in the industrial fishery. The fishery is currently unmanaged and will be affected by management measures proposed for other fisheries. Improved data collection methodologies will provide the basis for management strategies for shark resources at the national and regional levels.

INTRODUCTION

The Republic of Trinidad and Tobago an archipelagic state off Venezuela on the South American mainland, is perhaps the only Caribbean country where sharks comprise a significant component of fish landings. Sharks are landed year

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round by both the artisanal fishery and the industrial offshore fishery. There are however, few targeted shark fisheries, sharks being primarily the by-catch of other fisheries.

In the artisanal fisheries sharks are landed primarily as by-catch of the gillnet fishery which targets *Scomberomorus brasiliensis*. Other fisheries which land sharks include, the hook and line fishery (trolling and 'A La Vive' or live bait fishing) and the Seine fishery (Beach, Italian and Tuck Seines), all of which target *S. cavalla* and *S. brasiliensis*. Sharks are sometimes targeted by the artisanal longline fishery (palangre), which generally targets snappers and groupers. There is one industrial bottom longliner which targets sharks. In the industrial fisheries sharks are primarily landed as by-catch of the longline fishery which targets Swordfish and Tuna.

In 1983 the Government of Trinidad and Tobago, with the assistance of the United Nations Development Programme and the Food and Agriculture Organisation of the United Nations implemented an integrated development project entitled 'Development of an Artisanal Shark Fishery' to promote greater utilisation of shark resources and advanced shark fishing techniques. Shark biological studies were also initiated in support of future management of shark resources.

This document provides an overview of shark fisheries in Trinidad and Tobago including the artisanal and industrial components. It describes the vessels involved in the fishery and the gear employed. It presents a checklist of species, landings and an analysis of the artisanal and industrial fisheries.

BOATS/FISHERY UNITS

The most significant landings are by the artisanal gillnet vessels of which there are about 400. This is followed by the 280 artisanal vessels which use pelagic lines as the primary gear, and the industrial longliners of which there were 9 in 1993.

The artisanal vessels are primarily small wooden, fibreglass or fibreglass coated wooden boats between 6.71m and 9.14m in length called 'pirogues'. These boats are termed 'Bumboats' in Tobago. They are equipped with one or two outboard engines ranging from 15 - 235HP but commonly 45 - 75HP (La Croix, 1984). Most operate as day boats and fish inshore waters. Except in a few cases operations are entirely manual.

The industrial longliners are between 14m and 23m in length with diesel engines of about 180 - 359HP. They are equipped with echo sounders/fish finders, GPS and hydraulic equipment for setting and retrieving gear. Apart from the locally owned industrial type vessels which are described here there are a number of

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Taiwanese and other foreign vessels which tranship fish from Trinidad and Tobago. A quantity of shark is also landed by these vessels.

FISHING METHODS/GEARS

Gillnets Or Fillet Nets

The primary gear are gillnets locally called 'fillet nets'. These are either monofilament or multifilament nets. The former are made of transparent nylon with mesh size varying between 95 to 114 mm and net length 450 to 1098 m. When deployed the activity is locally referred to as 'transpearing' or 'monoflemming', depending on the area where they are used. The multifilament nets are made of nylon twine and are of similar mesh size but nets are 732 m to 1190 m long (Hodgkinson-Clarke, 1990).

These nets are fished in different ways. Monofilament nets are used either by day or night. They are set below the surface of the water anchored at both ends, or at one end with the other attached to the boat by the cork or float line. Multifilament nets are generally fished at night at the surface of the water, supported by a float line. They are allowed to drift freely in some cases or they may be attached to the boat at one end. One or infrequently 2 net sets are made per trip.

Trolling Or Towing

By this method, 4 to 6 lines are towed from bamboo outriggers off pirogues. Leader lines vary between 20m and 90m in length and usually have one hook per line. Lines may be steel, bronze or nylon and hook sizes vary (#2, #3, #4 or #5)

'A-la-vive'

This method refers to fishing with live bait using hooks (#1 to #3) and nylon twine or steel lines. Generally, the larger size ranges of the target species are captured by this method.

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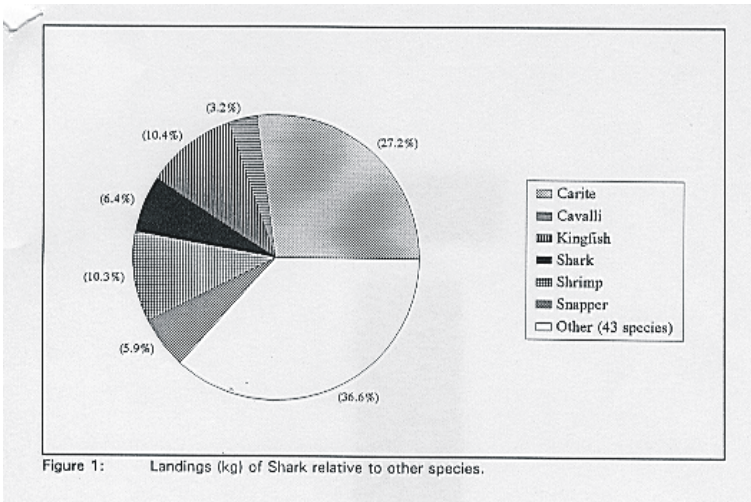


Figure 1. Landing (Kgs) of Sharks relative to other species.

TUCK AND ITALIAN SEINES

The former is now rarely used and has been largely replaced by the latter. It should be noted, however, that in some places the name ‘Italian Seine’ may be used to describe Tuck Seines. The Italian Seine is fished from the vessel during the day and it takes up to 7 men to deploy and retrieve it (Sturm and Julien, 1984).

Beach Seines

Beach seines are fished in the day. They vary between 340 m to 640 m in length with a cod end of 13mm. The seine is placed on a boat and one end of it is anchored on shore. The boat is taken out to sea in a wide arc during which the seine is deployed. The free end of the seine is then brought to shore and the net is hauled by the two ends. Between 10 to 40 persons are needed to haul the seine (Sturm and Julien, 1983).

Palangre

The ‘palangre’ is a longline. The term generally refers to an artisanal activity. This gear may be used to target pelagic or demersal species but is principally used for the latter. The specifications of the gear will vary depending on

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the target species. When sharks are targeted the lines are nylon rope and twine, and hooks are #1 to #3.

Local Industrial Longliners

Local industrial longliners use pelagic longlines. Generally 300 to 500 hooks are used per set.

SPECIES IDENTIFIED

Through examination of catches and exploratory fishing surveys, both inshore and offshore, 33 species of sharks have been identified (Appendix I). This includes five species of hammerheads and two deep water species. Of the species identified so far, landings generally comprise 15 species of which five are very common in the landings in Trinidad (*Carcharhinus porosus*, *C. limbatus*, *Sphyna tudes*, *S. lewini* and *Rhizoprionodon lalandii*). In Tobago two species are very common *R. porosus* and *Mustelus canis*. Hammerheads were found around Trinidad and the species diversity was greater around Trinidad than Tobago. Juvenile sharks of most species were found to segregate inshore within a two mile zone around the coast, a possible nursery area.

UTILIZATION AND MARKETING OF SHARKS

Sharks are exploited primarily for their flesh and fins. In some rural areas oil is extracted from the liver for a range of medicinal purposes. There is some processing (smoking and salting) for local consumption. Sharks like other fish are auctioned at the landing site and later wholesaled or retailed at market outlets or at the roadside. Most of the sharks are utilised fresh, while shark from the industrial fishery are generally processed.

COMMERCIAL CATCH AND EFFORT STATISTICS

The Inshore Artisanal Fishery Landings (all species combined)

As shown in Figure 1 of total annual landings by species, landings of shark rank fourth (1992). In Table 1 estimates of annual landings of sharks are presented for the period 1972 to 1991 (excluding 1975, 1979, 1980, 1983, 1986) by major gears.

Figure 2. Estimated monthly landings (Kg) of Shark for some years 1973-1991.

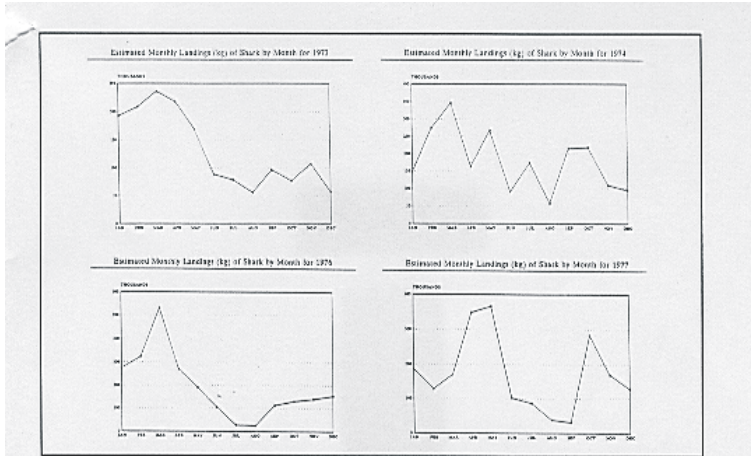


Figure 2: Estimated monthly landings (kg) of Shark by Month for some years between 1973 and 1991.

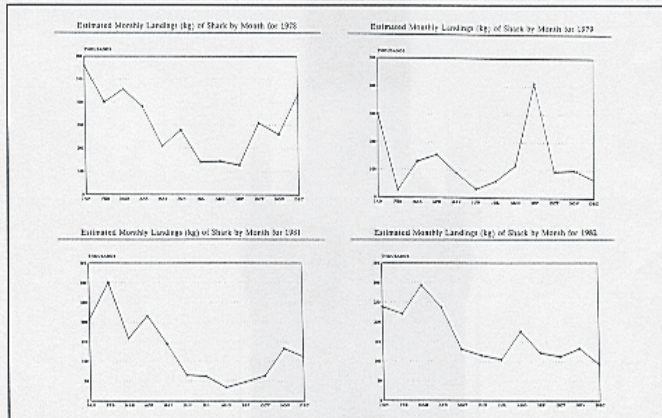


Figure 3: Estimated monthly landings (kg) of Shark by Month for some years between 1973 and 1991.

Fig
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3. Estimated monthly landings (Kg) of Shark for some years 1973-1991.

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The data shows fluctuations in landings over the years with a general decline in recent years. Also landings by gillnet were the highest compared to hook and line and seines, representing in some cases up to 90% of total landings. Figures 2-5 show monthly landings of sharks for some years between 1973 and 1991. Generally landings are higher during the early part of the year.

Fishing Effort

Fishing effort recorded as the number of boat trips per year, standardized to gillnet trips is given in Table 2. It should be borne in mind that sharks are only one component of the landings by the effort recorded. There appears to be no general trend in the relationship between landings and fishing effort (standard boat trips).

Catch per unit Effort

The annual catch per unit effort for all the major gears is presented in Table 3. CPUE was generally consistent with no apparent major trends

Gross Earnings (ex-vessel) From Sharks

The estimated annual gross earnings from sharks landed are presented Table 4. Shark landings for the period 1987 - 1991 were valued between TT\$2.9 and \$4.8 million. The average gross earnings for the period was TT\$3.8 million. It should be noted that the values shown are somewhat under-represented given that the price of shark fins (generally about TT\$25.00 per lb) is higher than the price of the shark. The quantity of fins sold is not known.

The Offshore Industrial Fishery Landings

A summary of annual landings for 1983 -1991, by the industrial fishery is presented in Table 5. These represent nominal statistics collected by the National Fisheries Company where these vessels land. These figures exclude sharks sold locally to processors as what is termed 'across the dock sales' which account for a substantial quantity of sharks landed. The figures for shark fins are also under represented since they exclude landings sold 'across the dock' as well as landings taken out of the company by vessel owners.

It is believed that sharks landed are but a small proportion of the sharks caught. It is suspected that sharks may be finned at sea, although this has been difficult to prove. There have been unsubstantiated reports of large quantities of shark fins landed with very few carcasses.

Figure 4. Estimated monthly landings (Kg) of Shark for some years 1973-

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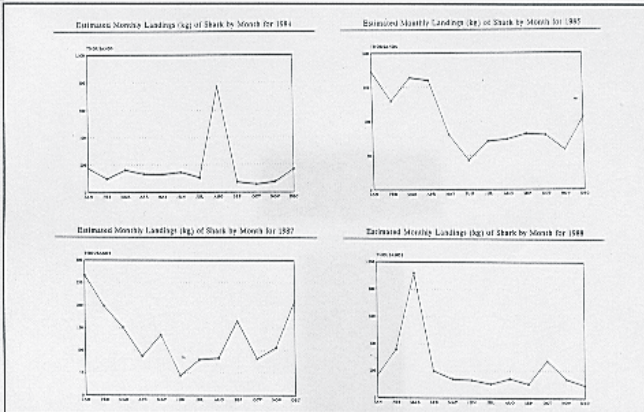


Figure 4: Estimated monthly landings (kg) of Shark by Month for some years between 1973 and 1991.

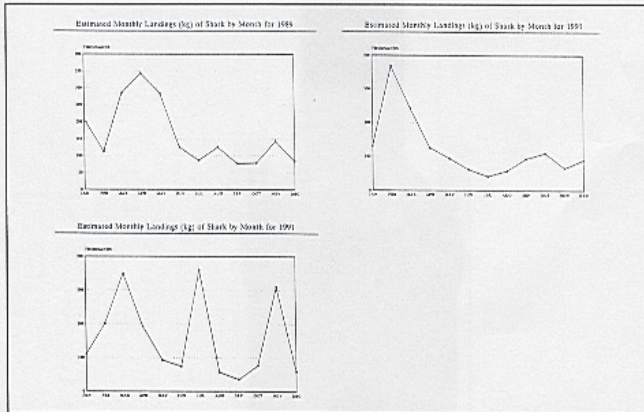


Figure 5: Estimated monthly landings (kg) of Shark by Month for some years between 1973 and 1991.

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Figure 4. Estimated monthly landings (Kg) of Shark for some years 1973-1991

Sharks And The Recreational Fishery.

Approximately 437 boats are involved in sport or recreational fishing. The vessels used are either pirogues or larger vessels with superstructures. Hand-lines are used and both pelagic and demersal species are targeted. There are no official regulations governing this activity.

Of the three fishing tournaments held annually by the Trinidad and Tobago Game Fishing Association, sharks are point rated at only one of them. Legislation

Although it is recognised that shark stocks are vulnerable to unrestrained exploitation there is currently no management regime for shark in Trinidad and Tobago. Regulations exist which limit mesh size and the length of nets used in the gillnet fishery (Fisheries Act. Act 39 of 1916).

The deficiencies in the existing legislation have long been recognised. While there have been initiatives to improve existing legislation related to different fisheries (eg. the trawl fishery), a holistic approach to upgrading fisheries legislation has only recently been developed. Given current trends in shark exploitation this is expected to be included in the legislation to be drafted, in co- operation with the United Nations Development Programme and the Food and Agriculture Organization of the United Nations.

Research

Under the project 'Development of an Artisanal Shark Fishery' studies of the fisheries biology of the major species were implemented which included research on the reproductive biology of the major species, ageing and identification of nursery areas.

Over the period 1990 to 1992 The Government of Trinidad and Tobago, in co-operation with the United Nations Development Programme and the Food and Agriculture Organisation of the United Nations implemented a project entitled 'Establishment of Data Collection systems and Assessment of Fisheries Resources'. Through this project recommendations were made for the upgrading of the existing data collection system to facilitate the collection of prerequisite data for assessment and management of shark resources, using the shark fishery models applied to the Southern Australian Shark Fishery (Walker, 1992).

CONCLUSIONS

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Generally shark fisheries in the Caribbean region are relatively undeveloped. However, this is perhaps not an indication of the status of shark resources in this area. National data collection mechanisms must be refined, and included in a regional framework to obtain a better understanding of shark resources and interactions of fisheries in the region.

Analysis Of The Inshore Artisanal Fishery

There is concern over the decline in shark landings. Sharks are characterised by slow growth, late maturity, low fecundity and a dependent relationship between parent stock and recruitment. Unregulated shark fishing has resulted in decline or collapse of the shark fisheries.

However, the decline in landings to Trinidad and Tobago over the years may be the result of a number of factors.

1. The gillnet fishing effort was lower in 1992 than previous years, although filling in the gaps in the effort data for recent years will contribute to an explanation of this decline.
2. Given that there are so few targeted shark fisheries and most of the shark landed is by-catch of other fisheries, any factor affecting these fisheries will consequently have an impact on shark resources.
3. There have been changes in the gillnet fishing practices since the shark project (1986) and this might have affected shark landings.

A preliminary stock assessment of the gillnet fishery (Henry and Martin, 1992), indicated that *S. brasiliensis* is fully exploited and that any increase in fishing effort could result in a decrease in landings. Increasing in returns from this fishery can only be achieved through increasing the mesh size of gillnets or decreasing gillnet effort while increasing the effort by line fishing, which lands larger fish.

Shark as a component of the gillnet fishery was not assessed. However, the conclusions of the assessment mentioned above supports in some way the recommendations of the project "Development of an Artisanal Shark Fishery", that the minimum mesh size for shark fishing be 6" stretched mesh. Further emphasis may also need to be placed on directing fishing away from sensitive areas such as shark nursery areas which have been identified as a 2 mile zone around Trinidad and Tobago.

Analysis Of The Offshore Industrial Fishery (Including Constraints To Analysis Of The Fishery)

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There is currently insufficient data to draw any conclusion about this fishery, but there are areas of concern.

The bulk of shark landings are highly migratory species such as Makos, Threshers and Blue sharks which may also be exploited by other fleets (Taiwanese, landing at other ports in the region Venezuelan or other fleets). Further, species landed by this fishery include Blacktip sharks (*Carcharhinus limbatus*), Lemon sharks (*Negaprion brevirostris*) and the Great hammerhead (*Sphyrna mokarran*) which are also landed by the inshore fishery and, being migratory species, may also be exploited by other fleets.

Most of the longliners land at the National Fisheries Company (NFC) where data is recorded in a number of ways with no apparent linkages or validation between the various data sources.

There is inadequate reporting by vessels as it is not mandatory and there is no tradition of fishing logs (logbooks). Data obtained, therefore, may not be a true reflection of catch or landings by these vessels and are probably underestimates.

A fisheries policy is being developed with accompanying legislation to support implementation of a mandatory logbook system.

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Table 1: Estimates of annual shark landings (tonnes) by the major gear types of the artisanal fishery. Year Estimated Shark Landings (Tonnes).Source: Partially obtained from Henry and Martin, 1992.

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Year	Fillet & Transpearing	Trolling & A-La-Vive	Bch. & Ital. Seines	All Gears
1972	659	1.0		689
1973	751	1.0	6.0	828
1974	1032	1.0	2.0	1122
1976	1070	11.0	4.0	1206
1977	1006	0.3		1028
1978	1677	4.0	35.0	1995
1981	828	5.0		842
1982	820	1.0		1154
1984	526	4.0	3.0	904
1985	477	68.0	0.90	675
1987	730	3.0		874
1988	961	7.0		1063
1989	885	4.0		1068
1990	602	7.0	2.0	873
1991	710	5.0	0.03	918
1992				531
1993				440

Table 2: Estimates of annual fishing effort (standard boat trips) by the major gear types. Year Estimated Fishing Effort (St. Boat Trips). Source: Henry and Martin, 1992.

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Year	Fillet & Transpearing	Trolling & A-La-Vive	Bch. & Ital. Seines	All Gears
1972	48,883	7,800		75,446
1973	58,442	15,238	8,048	81,762
1974	73,332	3,462	8,576	85,523
1976	61,862	1,739	4,482	68,106
1977	58,586	7,041		66,967
1978	83,757	1,770	3,126	89,956
1981	54,529	10,456		67,345
1982	56,244	8,438		66,829
1984	61,757	5,052	2,591	73,100
1985	73,120	14,642	2,966	92,490
1987	56,045	10,706		76,657
1988	56,342	8,818		72,474
1989	62,421	17,335		90,433
1990	53,107	10,638	3,024	90,018
1991	52,675	16,203	1,734	82,033

Table 3: Estimates of annual CPUE for sharks for the major gear types. Year Estimated CPUE for Shark (Kg/Boat Trip). Source: Henry and Martin, 1992.

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Year	Fillet & Transpearing	Trolling & A-La-Vive	Bch. & Ital. Seines
1972	13.48	0.06	
1973	12.85	0.05	0.71
1974	14.08	0.13	0.11
1976	17.30	1.47	0.25
1977	17.17	0.02	
1978	20.03	0.39	3.04
1981	15.19	0.22	
1982	14.58	0.08	
1984	8.52	0.21	0.46
1985	6.52	2.83	0.23
1987	13.03	0.20	
1988	17.06	0.34	
1989	14.18	0.15	
1990	11.33	0.26	0.56
1991	13.49	0.18	0.01

Table 4: Estimated annual gross earnings from shark (TT\$) from the artisanal fishery. Source: Henry and Martin, 1993.

Year	Estimated Gross Earnings
1987	2,875,991

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1988	3,541,616
1989	4,801,401
1990	3,761,437
1991	4,117,143

Table 5: Summary of annual landings (kg) for the industrial fishery 1983 - 1993.
Source: Chan A Shing, 1993 *=Data available for only six (6) months, ND=No Data
YEARS

	COMMON NAME
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Year	Mako Shark	Shark spp.	Shark fin	Blue Shark
1983	40,258	37,054	11,024	ND
1984	27,063	32,303	ND	ND
1985*	8,540	10,506	ND	ND
1986*	39,792	2,260	ND	ND
1987	120,018	ND	ND	ND
1988	12,085	55,732	ND	ND
1989	147,974	ND	28	ND
1990	ND	54,763	ND	ND
1991	ND	3,552	ND	ND
1992	ND	ND	23,000	ND
1993	113,547	104,214	65,000	58,300

APPENDIX I: LIST OF SPECIES EXAMINED FROM THE WATERS OF TRINIDAD AND TOBAGO

Lamnidae (Mackerel Sharks)

Isurus oxyrinchus Shortfin Mako shark

Carcharhinidae (requiem sharks)

Carcharhinus

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<i>acronotus</i>	Blacknose shark
<i>altimus</i>	Bignose shark
<i>brevipinna</i>	Spinner shark
<i>falciformis</i>	Silky shark
<i>isodon</i>	Finetooth shark
<i>leucas</i>	Bull shark
<i>limbatus</i>	Blacktip shark
<i>obscurus</i>	Dusky shark
<i>perezi</i>	Caribbean Reef shark
<i>plumbeus</i>	Sandbar shark
<i>porosus</i>	Smalltail shark
<i>signatus</i>	Night shark

<i>Galeocerdo cuvieri</i>	Tiger shark
<i>Negaprion brevirostris</i>	Lemon shark

Rhizoprionodon

<i>lalandii</i>	Brazilian sharpnose shark
<i>porosus</i>	Caribbean sharpnose shark

Ginglymostomatidae (Nurse or Carpet sharks)

<i>Ginglymostoma cirratum</i>	Nurse shark
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Hexanchidae (Cow sharks)

<i>Heptanchias perlo</i>	Sharpnose sevengill shark
<i>Hexanchus vitulus</i>	Bigeye sixgill shark

Rhiniodontidae (Whale shark)

<i>Rhiniodon typus</i>	Whale shark
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Scyliorhinidae (Cat sharks)

<i>Apristurus parvipinnis</i>	Cat shark
<i>Scyliorhinus boa</i>	Boa catshark

Sphyrnidae (Hammerhead, Scoophead sharks)

Sphyrna

<i>lewini</i>	Scalloped hammerhead shark
<i>media</i>	Scoophead shark

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<i>mokarran</i>	Great hammerhead shark
<i>tiburo</i>	Bonnethead shark
<i>tudes</i>	Smalleye hammerhead shark

Squalidae (Dogfish sharks)

Etmopterus polli African lantern shark

Squaliolus laticaudus Spined pigmy shark

Squalus blainvillei Blainville's dogfish, Longnose spurdog shark

Triakidae (Smooth Hound sharks)

Mustelus

canis Dusky smooth-hound shark

higmani Smalleye smooth-hound shark