

***DEVELOPMENT OF SHARK CONSERVATION  
PLAN AND SPECIES ACTION  
PLANS FOR THE CAYMAN ISLANDS***

by

***MARIA ANNA MAILY***

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Supervisor: Professor Rupert Ormond

School of Life Sciences

Heriot-Watt University, Edinburgh



SCHOOL OF LIFESCIENCES

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***Development of Shark Conservation Plan and Species Action Plans  
for the Cayman Islands***

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Signed                      Maria Anna Maily

Date                        31 August 2016

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## **ABSTRACT**

Following multiple international guidelines and the steep decline of the shark populations in the Central Western Atlantic, the Cayman Islands have decided to follow the example of other nations and declared their waters a shark sanctuary. This dissertation presents a refinement of their protection by drafting Species Action Plans for six shark species and an Elasmobranch Conservation Plan. This work was carried out in cooperation with Marine Conservation International and the Cayman Islands Department of Environment. It is based on collation of biological data of sharks and local threats to sharks and the environment. The plans presented in this dissertation are to be completed with recent data of local shark populations.

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## **Units:**

m = meter

km = kilometer

km<sup>2</sup> = square kilometer

nm = nautical mile

ft = feet

in = inches

## List of Acronyms

BAP	- Biodiversity Action Plan
CA	- Culinary Association
CAP	- Conservation Action Plan
CBD	- Convention on Biological Diversity
CIG	- Cayman Islands Government
CITA	- Cayman Islands Tourism Association
CITES	- Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	- Convention on the Conservation of Migratory Species of Wild Animals
DoE	- Department of Environment, for the Cayman Islands
DoT	- Department of Tourism, for the Cayman Islands
EEZ	- Exclusive Economic Zone
FAD	- fish aggregation device
FAO	- Food and Agriculture Organisation
HAP	- Habitat Action Plan
IntC	- International Collaborators
IPOA-Sharks	- International Plan of Action for the Conservation and Management of Sharks
IUCN	- International Union for Conservation of Nature
MCI	- Marine Conservation International
ME	- Ministry of Environment, for the Cayman Islands
MEA	- Multilateral Environmental Agreement
MP	- Members of the Public
MPA	- Marine Protected Area
NCC	- National Conservation Council
NT	- National Trust for the Cayman Islands
RFMO	- Regional Fishery Management Organization
RCIP	- Royal Cayman Islands Police Service (including Marine Police)
SAP	- Species Action Plan
SITA	- Sister Islands Tourism Association
SPAG	- Spawning Aggregation Site
SPAW	- Specially Protected Areas and Wildlife
UNCLOS	- United Nations Convention on the Law of the Sea
VOL	- Volunteers, local and international

# 1. INTRODUCTION

Globally shark populations have been declining drastically over the past decades, the global community has recognised the issue and created organisations and legislation frameworks to face this issue but so far they have not been successfully transport to national levels apart from a few exceptions. The Western Central Atlantic region has shown a dramatic population decline due to high fishing pressure, but within it the Cayman Islands have had comparatively good population numbers. In 2015 the Cayman Island Government decided to declare the Cayman Waters a Shark Sanctuary by fully protecting all species, and decided to increase the protection by preparing Species Action Plans for some of the most common species to summarise what is known about them and propose further actions to protect their population, and an Elasmobranch Conservation Plan that has the legislative power to protect them. This document presents the work carried out to draft those plans for Marine Conservation International and the Cayman Government Department of Environment.

Chapter one is about the origin of the study, it starts off with an introduction to the study area, the Cayman Islands, their place in the Central Western Atlantic and their environment. This is followed by a section on the international and national political framework of shark management and the reasons for the decision to increase the protection in the Cayman Islands that lead to the Conservation Plan and Species Action Plans. The third section gives an introduction to shark taxonomy, their life history and descriptions of the species. It continues with threats to sharks and the ecosystem of the Cayman Islands. The main aims and objectives conclude the introduction.

Methods used for this report and the literature review make up chapter two. Chapter three are the Results in form of the current Species Action Plans and Elasmobranch Conservation Plan drafts, created for the Cayman Islands Department of Environment.

Chapter four is a review of the Species Action Plans and The Elasmobranch Conservation Plan drafts, the major issues that came up and advise on further actions that should now be taken. It is followed by a summary of problems during the project and the conclusion.

## **1.1 Study Area**

The Cayman Islands are located 240 km south of Cuba and 268 km northwest of Jamaica, at 19° 30' N, 80° 30' W, and consist of the islands: Great Cayman, Little Cayman and Cayman



Brac. The Cayman Islands are part of the Cayman Ridge, which extends from the south of Cuba westwards. They are separated from Jamaica by the Cayman Trench, which is the deepest part of the Caribbean with a maximum depth of 7,686 m. See figure 1 for a map of the Cayman Islands in the Caribbean. The three islands make up a total area of 264 km<sup>2</sup> and have a 160 km coastline, which is protected by reefs and a mangroves fringe. The highest point is the Bluff on Cayman Brac with 43 m above the sea level, none of the islands have any rivers. It is estimated 31,000 (2014 estimate (cia.org 2016)) of the 56, 092 (2013 estimate (cia.org 2016)) people live in the capital city George Town on Grand Cayman. The self-governing British overseas territory imports 90% of food and consumer goods and depends on tourism for 70% of their GDP (cia.org 2016).

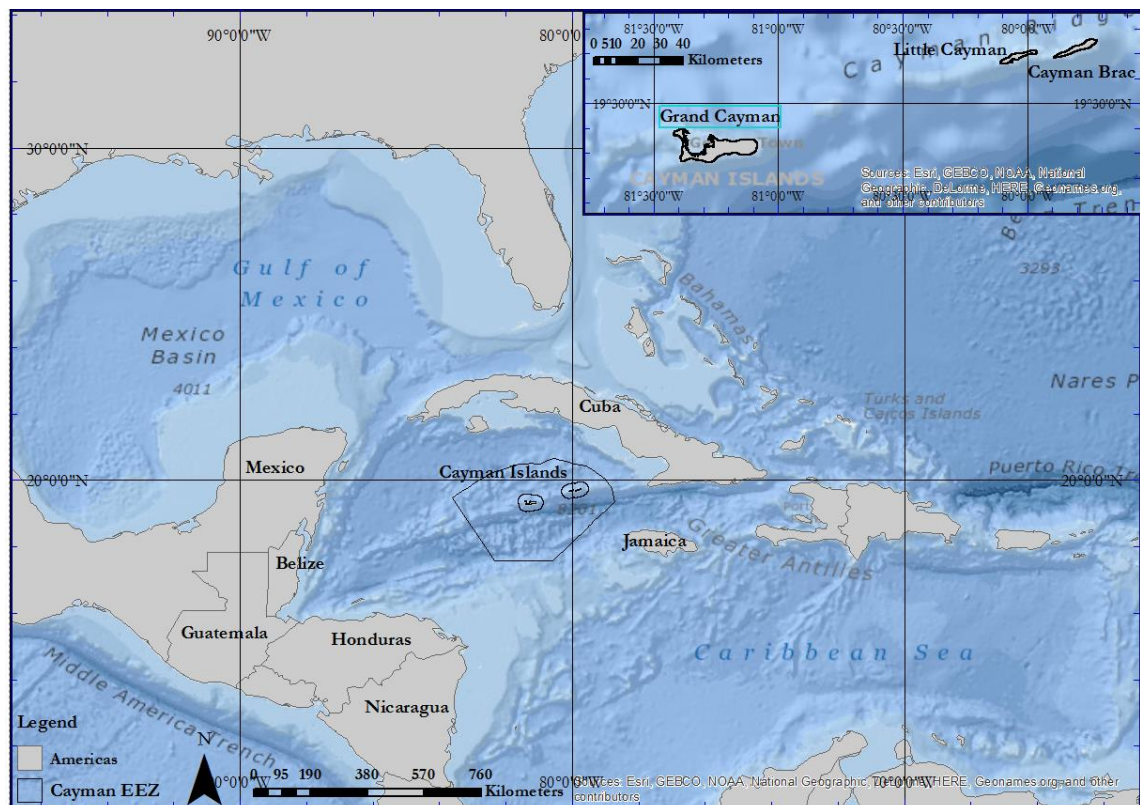


Figure 1: Map of the location of the Cayman Islands and EEZ in the Central Western Atlantic and inserted a map of the three islands that make up the Cayman Islands: Grand Cayman, Little Cayman and Cayman Brac. (source for layers: DoE)

According to the United Nations Convention on the Law of the Sea every state has the right to a territorial sea extending 12 nm and a 200 nm Exclusive Economic Zone, in which it has the sovereign rights for exploring, exploiting, conserving and managing its natural resources, living and non-living. Due to the close proximity of the Caribbean states the exclusive economic zones have to be agreed upon rather than a simple extension of 200

nm, for example the treaty between the Government of the Republic of Honduras and the Government of the United Kingdom of Great Britain and Northern Ireland concerning the delimitation of the maritime areas between the Cayman Islands and the Republic of Honduras 4 December 2001 (Colson & Smith 2005), the negotiations for boundaries with Jamaica and Cuba are still ongoing. See figure 2 for a map of current EEZs in the Central Western Atlantic using Median Lines for boundaries that are still in ongoing negotiations.

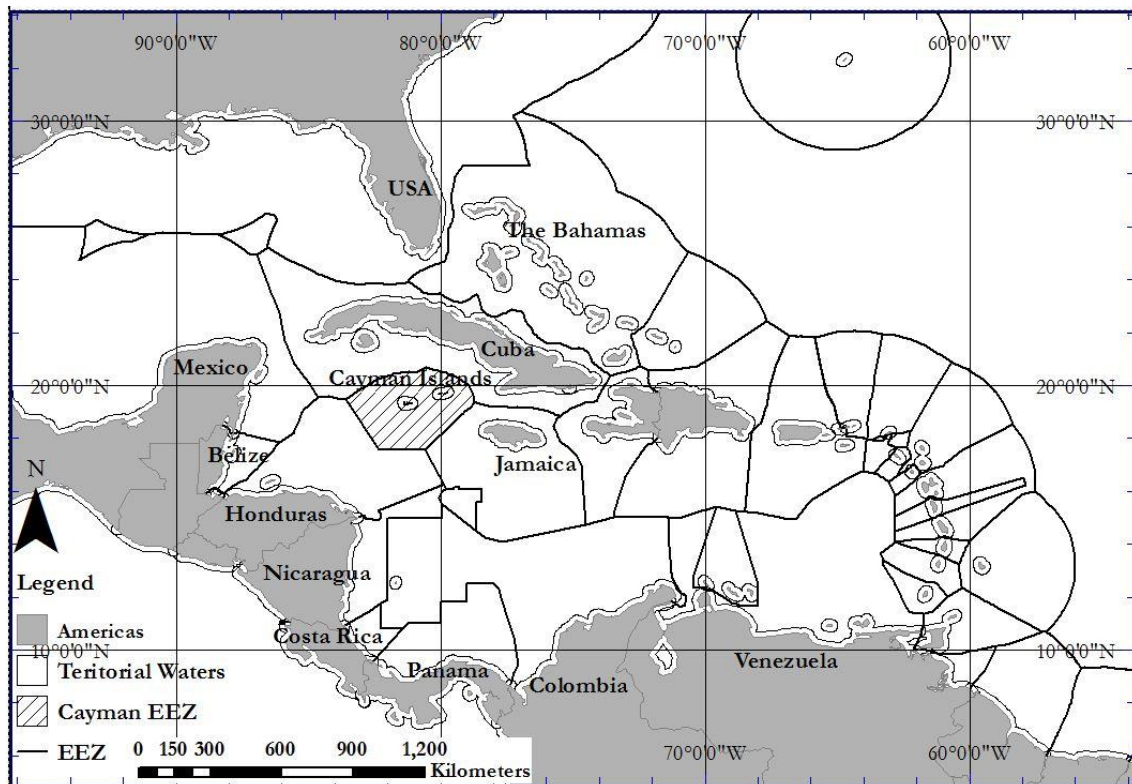


Figure 2: Map of the Territorial Waters and Exclusive Economic Zones (EEZs) of Central Western Atlantic States. (source for layers: DoE)

The Cayman Islands only have a narrow strip of shallow water around them before it drops to some of the deepest points in the Caribbean, leaving only a small area suitable as habitat for benthic species, and shallow and protected nurseries for juveniles. The sister islands are over 108 km apart from each other, limiting movement between them even further. On the other hand, oceanic and semi-oceanic are more likely to come closer to the shore as they would in other places.

The historic coastline most likely featured a lot of mangroves, providing plenty of hiding places for different species, now there are only few places where mangroves are able to freely spread out along the coastline, one of these places is the eastern side of the lagoon on Grand Cayman, North Sound. Apart from the mangrove fringe of the lagoon, the centre

is covered by seagrass beds and vegetated sand, as can be seen in the map of benthic marine habitats in figure 3. Along the east, north and south side are smaller patches of seagrass beds, as well as around Little Cayman. Much of the areas between coastline and the reef crest is either hard bottom, sediment, rubble or sand. The outer side of the reef rest has been identified as Spur and Groove around all three islands, making up a large part of the habitat. The map below (figure 3) shows the benthic marine habitats around the three islands. The information for the map was provided by the DoE.

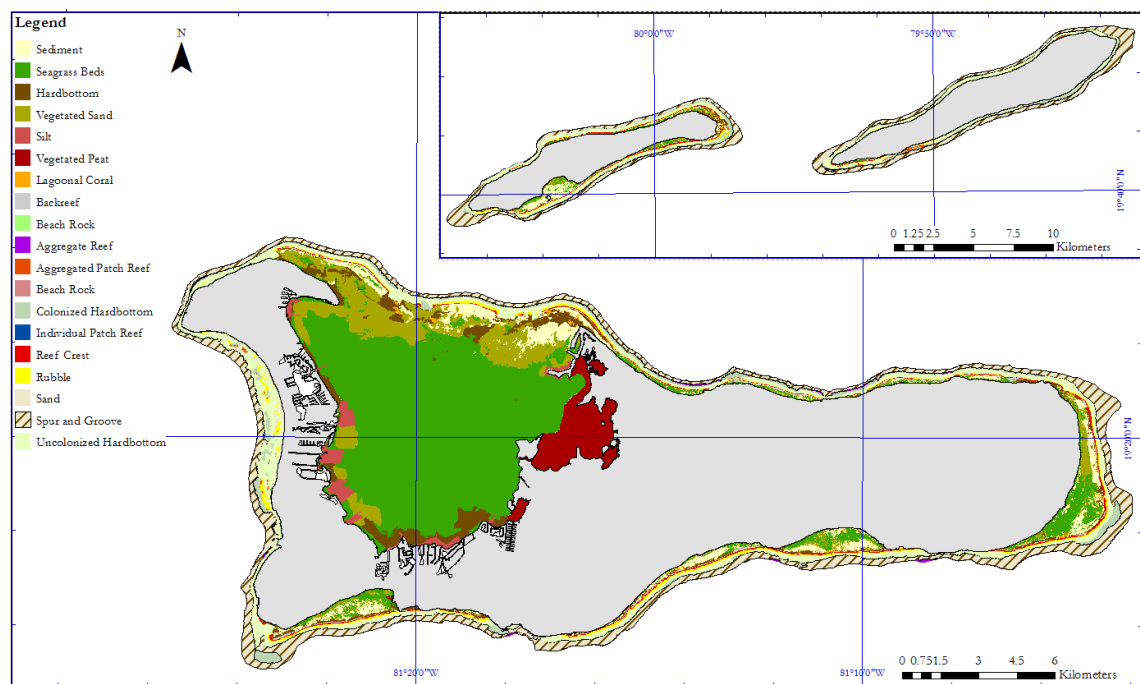


Figure 3: Map of Benthic Marine Habitats (source for layers: DoE).

Below is a map (figure 4) of the biomass of a number of sites around the Cayman Islands as documented by the Department of Environment (DoE) in 2011. Most sites are in Fair or Poor conditions, only few are in good or critical conditions. Majority of critical places are on Cayman Brac and the north side of Grand Cayman. In fairly good condition are the west side of Little Cayman and west and east end of Grand Cayman.

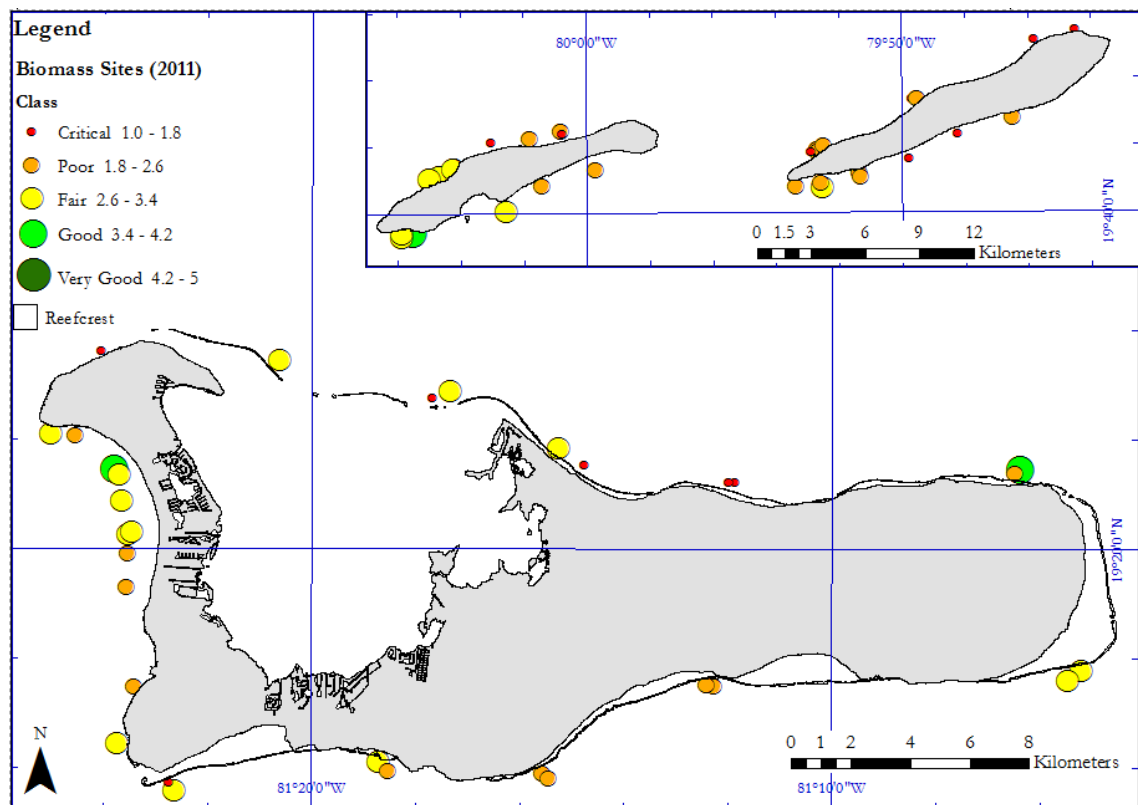


Figure 4: Map of biomass recorded by site by the DoE in 2011. (source for layers: DoE)

One of the most popular tourist attractions on the islands is the Stingray City Sandbar, east of the north eastern tip of the Lagoon. In this small area thousands of tourists gather every year to get close to southern stingrays (*Dasyatis americana*) which caused the localised population to spike but also a change in their behaviour. Due to their regular feeding, since 1986, they do not look for food in the surrounding area anymore, they are generally fatter, slower, show more scars as well as other factors a number of studies have pointed out (Corcoran et al. 2013, Shackley 2010, Semeniuk et al. 2009). The feeding requires licensing and is regulated but may need refinement. It is causing a relatively high biodiversity in the surrounding area and may possibly attract or sustain some sharks. Southern stingrays (*D. Americana*) is the only Elasmobranchii species up to now with a Species Action Plan.

An ecosystem based management approach is sometimes crucial to save individual species (Pikitch et al. 2004), so here some species worth mentioning. The numbers of Sea Turtles, Nassau Groupers, Queen Conch and Spiny Lobsters have gone back, deemed important for the islands and biodiversity and consequently gotten their own Species Action Plan and are tightly regulated on the islands. The improvement of their numbers will be beneficial to shark that feed on them as well as the entire ecosystem. One other species that

is worth noting is the invasive Red Lionfish (*Pterois volitans*), their rapid reproduction rate and huge appetite for fish has to be considered since it impacts the entire ecosystem.

## **1.2 Political Framework**

This Section is about the international and national legislation that have led to the development of Shark Species Action Plans and the Elasmobranch Conservation Plan in the Cayman Islands. It starts off with an introduction to international regulations of the ocean and resources with conventions and bodies like the Convention on the Law of the Sea, Regional Fishery Management Organisations, Convention on Migratory Species, International Trade in Endangered Species and the International Union for the Conservation of Nature. It is followed by the steps taken within the Cayman Islands, like the adaptation of the Convention on Biological Diversity to form a Nation Environmental Policy that lead to the National Conservation Law and subsequently to the formation of the Biodiversity Action Plan and Marine Parks.

The United Nation Convention on the Law of the Sea (UNCLOS) established the jurisdictional boundaries of territorial waters, the Exclusive Economic Zone (EEZ) and the high seas, granting nations control over areas of the sea and at the same time obligating them to protect and preserve the marine environment. It has added highly migratory species that need refined management in its Annex I, and Article 64 states that the range states of species listed in Annex I need to cooperate directly or through international organizations or regional governments to ensure conservation and sustainable use. Table 1 has the species listed in UNCLOS Annex 1.

To regulate the high seas Regional Fishery Management Organisations (RFMOs) were formed under the Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries. The Cayman Islands is within the limits of the Western Central Atlantic Fishery Commission (WECAFC), RFMOs in close proximity that may affect the highly migratory species of the region are the Latin American Organization for Fisheries Development and Central American Fisheries and Aquaculture Organization. Some of the WECAFCs guiding principles are to promote a precautionary and ecosystem based approach to fisheries management, to pay attention to small scale and artisanal fisheries and to coordinate and cooperate with international organizations. Some of the commissions functions are to encourage cooperation, assist in implementing International Plans of Action (IPOA), collect and exchange data, assist in conservation management for highly migratory or transboundary stocks and harmonize laws for conservation and management measures.

The IPOA-sharks was created to help parties design a long term sustainable management and conservation plan for all sharks, ray and chimaera species according to their individual priorities and resources. Managing all shark catches including target, by-catch, commercial and recreational with a precautionary approach. It calls for regional and national Plans of Actions to conserve and manage sharks on different levels, most suitable for the parties.

The Convention on Migratory Species (CMS) was designed to protect species listed in Appendix 1 and come to agreements on species listed in Appendix II as well as to promote and support research. Once a species has been listed in Appendix I signatory states should protect the habitat, prevent impacts on their migration and prevent factors that may further endanger the species. The CMS sets out the agreement for species listed in Appendix II, with the aim to improve the conservation status, see table 1 for species in the Cayman Island listed. The CMS also created the non-binding Memorandum of Understanding (MoU) in 2010, to strengthen the conservation for shark species listed in CMS Annex I and II. It calls for further co-operation and improvements to management plans.

The Convention on the International Trade in Endangered Species and Wild Fauna and Flora (CITES) was formed to control and prohibit the international trade of endangered Species. Species can be listed in one of the three appendices depending on their status. In Appendix I listed species are threatened with extinction, international trade of them or parts of them is prohibited. In Appendix II listed species are in need of close control to prevent threat of extinction, trade of these may be authorised with export permits. CITES is a key mechanism to reduce international shark trade, but only four of the species found in the Cayman Island waters are listed in Appendix II so far and agreement between the parties is difficult to achieve. It also does not prevent harvesting for domestic consumption. The species listed are Oceanic whitetip shark (*C. longimanus*), Scalloped hammerhead (*S. lewini*), Great hammerhead (*S. mokarran*) and Whale shark (*R. typus*) (see table 1). Appendix III is for the prevention and restriction of exploitation of species and requires cooperation of different nations.

In 1948 the International Union for Conservation of Nature (IUCN) was founded as an international environmental organization and network whose aim is to try to find solutions for environmental problems. They provide the IUCN Red List of Threatened Species with taxonomic, biological, conservation status and distribution information of the species. They determine the risk of extinction for species, taking into account the number of individuals, reproduction, range, habitat loss, and categorise them as followed:

Threatened	Extinct (EX)
	Extinct in the Wild (EW)
	Critically Endangered (CE)
	Endangered (EN)
	Vulnerable (VU)
	Near Threatened (NT)
	Least Concern (LC)
	Data deficient (DD)
	Not Evaluated (NE)

Of the ten species evaluated in this report five species are threatened with extinction in the Central Western Atlantic. Broken down into the IUCN categories the Oceanic whitetip shark (*C. longimanus*) is Critically Endangered; Scalloped hammerhead (*S. lewini*), Great hammerhead (*S. mokarran*) and Whale shark (*R. typus*) are Endangered and Silky shark (*C. falciformis*) is Vulnerable, the five other species are listed as Near Threatened (see table 1).

Table 1: Summary of species listing in CITES, CMS, UNCLOS and IUCN categories.

	IUCN Category	CITES Appendix	CMS Annex	UNCLOS Annex
Silky shark ( <i>C. falciformis</i> )	VU		II	I
Blacktip shark ( <i>C. limbatus</i> )	NT			
Oceanic whitetip shark ( <i>C. longimanus</i> )	CE	II		
Caribbean reef shark ( <i>C. perezi</i> )	NT			
Tiger shark ( <i>G. cuvier</i> )	NT			
Lemon shark ( <i>N. brevirostris</i> )	NT			
Scalloped hammerhead ( <i>S. lewini</i> )	EN	II	II	I
Great hammerhead ( <i>S. mokarran</i> )	EN	II	II	I
Nurse shark ( <i>G. cirratum</i> )	NT			
Whale shark ( <i>R. typus</i> )	EN	II	II	I

In 1992 one hundred and fifty countries came together at the Rio Earth Summit to sign the Convention on Biological Diversity (CBD) with the agreement to design and implement conservation management plans to preserve species and habitats, and to stop the global decline in biodiversity. It was the first global agreement to cover all aspects of biodiversity, with its three main goals being the conservation of biodiversity, the sustainable use of components of biodiversity and to share benefits arising from commercial and genetic



resources (Cottam et al. 2009). At the request of the Cayman Islands Government the CBD was extended to the Cayman Islands in 1992.

In 2001 the Government of the United Kingdom and the Cayman Island signed the Environment Charter requiring the Cayman Islands to provide a framework for conservation and implement Multilateral Environmental Agreements (MEAs) like Specially Protected Areas and Wildlife (SPA) and the CBD. Thus the National Environmental Policy was set up.

National Environmental Policies goals are to manage the impact of human use of the environment, consider the conservation and sustainable use of the environment in development plans, promote the protection of essential habitats, implement obligations under the MEA and seek expert advice and consult with interested parties on decisions affecting the environment. Some of the Strategies are to enact legislations such as the National Conservation Law and Endangered Species (Trade and Transport) Law, to address environmental issues as well as establish a National System of Protected Areas, promote and support scientific research and monitoring programmes, formalise requirement for environmental impact assessments in planning, promote cross-sectoral consultation, encourage green technologies, increase awareness and public education, and encourage NGO and volunteer organisation involvement ([www.doe.ky](http://www.doe.ky)).

In 2005 the DoE started working on the Biodiversity Action Plan (BAPs) for the Cayman Island which were required by the National Conservation Law even though it was not signed until 2013. The National Biodiversity Action Plan (NBAP) is made up of Habitat Action Plans (HAPs) to conserve key habitats and Species Action Plans (SAPs) to conserve key species. Species selected for SAPs are of special local significance, economic value, conservation concern, subject to pressures or likely to benefit from SAPs (Cottam et al. 2009). Some examples for HAPs are coral reefs, seagrass beds, mangroves and lagoons, for SAPs southern stingray, spiny lobster, Nassau grouper and marine turtles.

The National Conservation Law was implemented in 2013. It was created to protect and conserve endangered wildlife and habitats, with the goal to have zero extinction in the Cayman Islands, or no net loss of Biodiversity (Cottam et al. 2009). It prohibits damaging of coral, export of marine life, fishing with gill nets or poison, and dumping anything in the waters as well as feeding, using food to attract and since 2015 taking of sharks.

The Darwin Initiative was created by the Government of the United Kingdom to assist countries rich in biodiversity but restricted financial resources to implement the CBD by funding and assisting collaborative projects, research, training and environmental



education and awareness (Cottam et al. 2009). With help like funding from the Darwin Initiative the DoE was able to collaborate with Marine Conservation International, Save Our Seas foundation and Guy Harvey Institute to conduct research on sharks, for which these Species Action Plans and Species Conservation Plan were developed.

As required by the CBD, Article 8 and the National Environmental Policy a system of protected areas or areas with special measures for the conservation of biodiversity, the Cayman Island Marine Parks were created. A number of protected areas with different designations were created to protect areas of high ecological importance while allowing local communities to meet their socio economic needs. A new designation of Marine Park Areas has been proposed and is currently under review. See figure 5 for a map of the current Cayman Island Marine Parks. The regulations are as followed,

- In the Environmental Zone all taking of any marine life and in-water activities including anchoring are prohibited. The public may access but only at 5 m.p.h. or less.
- In the Marine Park Zone no marine life may be taken except when line fishing from shore or at 80 ft or deeper, taking fry and sprat with a fry or cast net. Anchoring is prohibited except when using fixed mooring line or small boats of 60ft or less in sand with grappling hook, or in designated Port areas or during emergencies when prohibit is suspended. In the Bloody Bay Marine Park only commercial operations with licence are permitted.
- In the Wildlife Interaction Zones (WIZ) it is prohibited to feed, remove or take marine life by any means, sell fish from boats, anchor in water 3 ft or shallower or so that boat or anchor is within 20 ft of any reef structure or wear footwear in water 4 ft or less. Commercial boats require licenses.
- In the Replenishment Zone no conch or lobsters may be taken. Line fishing and anchoring is permitted but anchor, chain or line must not touch coral. The outer edge of the reef down to 20 ft is included in this zone.
- In Designated Grouper Spawning Areas (SPAGs) fishing of Nassau groupers between 1<sup>st</sup> November and 31 March is prohibited, as well as fish pots and spear fishing within a one-mile radius of the area.
- Scuba diving is prohibited in the No Dive Zone.

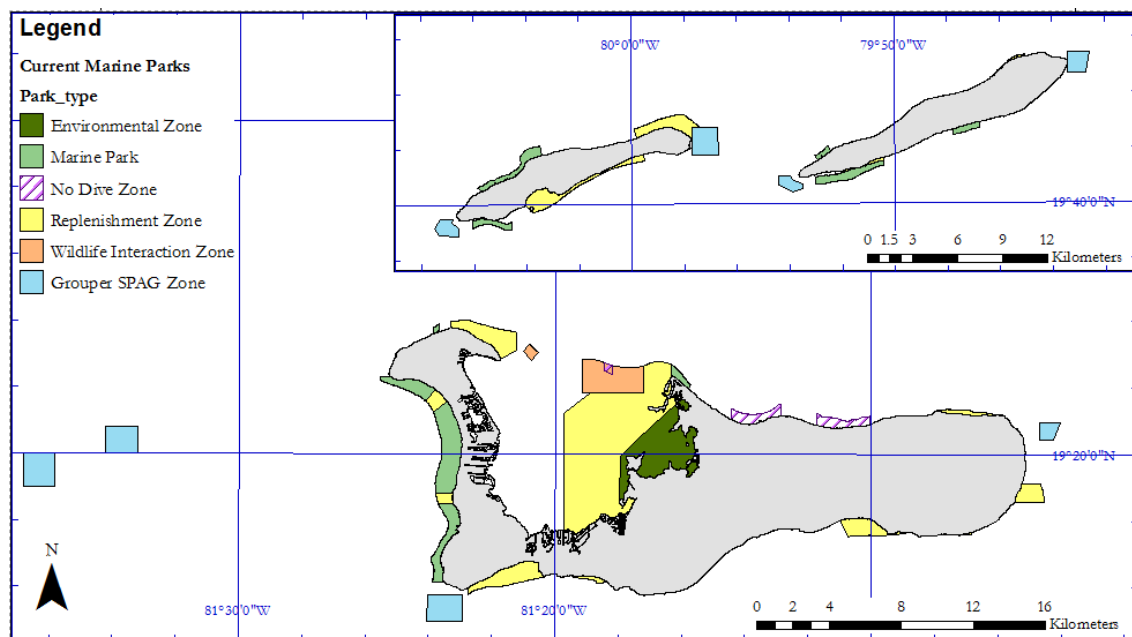


Figure 5: Map of the current Cayman Island Marine Parks. (source for layers: DoE)

### **1.3 Sharks**

Sharks are often managed under the same umbrella regulations as teleost fishes but they are quite different in their taxonomy, biology and life history and hence need different management to conserve their populations at a sustainable level. Below is an introduction to the reasons why it is important to manage sharks separately, starting off with an introduction to the taxa and life history.

Sharks, rays and chimeras make up the class Chondrichthyes, fish with a calcified cartilage skeleton, paired jaws with rows of replicating teeth, no lung or swim bladder, paired pectoral and pelvic fins with girdles and males have pelvic claspers for internal reproduction (Hamlett 1999). A cartilage skeleton gives sharks a greater flexibility compared to bony fish, the size and shape of their teeth depend on their function to cut, crush or impale food. Instead of a swim bladder or lung their liver is high in oil. Features that separate Elasmobranchii, sharks and rays, from chimaera are: they usually have five but some six or seven gill slits, tooth like dermal denticles that cover their body, their dorsal fin does not fold back and their upper jaw is separated from the neurocranium for greater forward movement (Hamlett 1999). Elasmobranchii also have electrosensitive ampullae of Lorenzini at the snout with which they can sense electromagnetic fields aka muscle movements within 1 m and a cephalic lateral line with which they can sense waves from about 1 meter away, their eyes are well developed enabling them so see things over 10 m away, they have spiracles for external gill openings for alternate respiration, and well developed sensory lamellae, covered by nasal

flaps with which they can smell things over several km or one in twenty billion parts (Hamlett 1999). The taxonomic position of Batoidea or Rajomorphii, the living rays, is debated and they have not been taken into consideration in this report on Selachii, the living sharks. According to Hamlett Selachii are defined by intact eyelids, the pectoral fins are not fused with the head and some more detailed features of pectoral girdle, fins and skull (1999) that go beyond the purpose of this report. See figure 6 below for a guide to shark terminology.

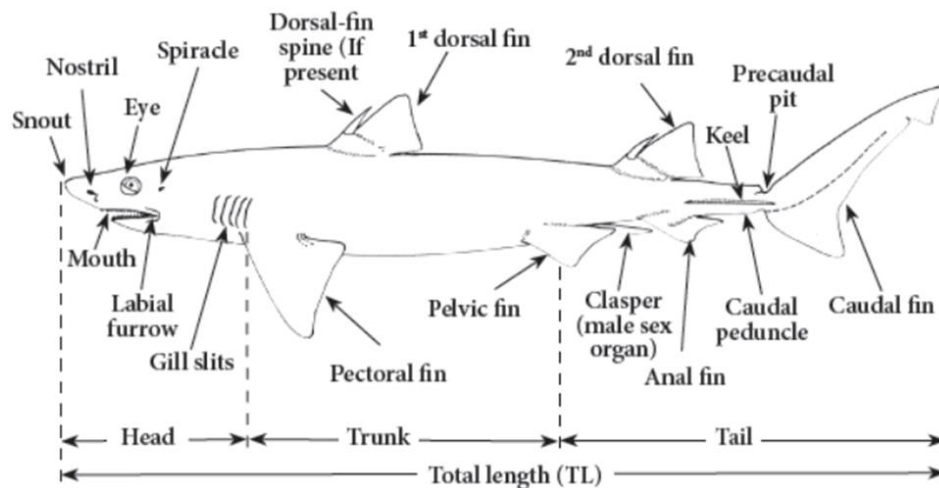


Figure 6: Shark terminology guide, Source: FAO 2016.

Sharks have had millions of years to evolve and adapt to specific environments, today they are found in almost all aquatic environments around the globe, here are some basic adaptations to consider when attempting to manage sharks. Some of the things listed here are habitat range, feeding, reproduction and behaviour like aggregation or segregation.

One way of grouping sharks for management is by focusing on their habitat range. Pelagic or oceanic species like Oceanic whitetip shark (*C. longimanus*), Silky shark (*C. falciformis*) and Whale shark (*R. typus*) spend most of their time off shore, they live and feed in the deep open sea, traveling over long distances and often migrating seasonally. Coastal-pelagic or semi-oceanic species like Great hammerhead (*S. mokarran*), Scalloped hammerhead (*S. lewini*) and Tiger shark (*G. cuvier*) migrate over long distances but spend a large portion of their time on continental and insular shelves, looking for food close to the shore. Benthopelagic and epibenthic species like Blacktip sharks (*C. limbatus*), Caribbean reef sharks (*C. perezi*), and Lemon sharks (*N. brevirostris*) are site affiliated, and usually near reefs but also known to migrate. Benthic or reef associated species have small ranges and are usually on or near the seafloor, example of this is the Nurse shark (*G. cirratum*).

Depending on their habitat range their feeding strategies and prey changes. Pelagic species will migrate towards seasonal food sources like plankton blooms or fish spawning

aggregations and sometimes associate with other species like schools of tuna. Some migratory species segregate by age and sex, some species hunt cooperatively in groups others are solitary hunters or opportunistic omnivores feeding on a wide variety of fish, reptiles, mammals, carrion and garbage, for example Oceanic whitetip sharks (*C. longimanus*) and Tiger sharks (*G. cuvier*). More Benthic species will adapt to feed on bottom dwelling crustaceans and molluscs or ambush local species.

Most teleost fishes lay thousands or even millions of eggs during spawning seasons, sharks on the other hand have comparatively few well developed young. In their position in the food chain and having well developed young they do not need large numbers of offspring but this means their reproduction is slow and makes it hard for populations to recover. Majority of species sexually mature late in life and only have young every other year which adds to the importance to protect the breeding females as well as the young in nursery areas. There are three modes of reproduction in sharks: oviparous, ovoviparous and viviparous. 40% of global species lay eggs, oviparity, none of the species found in the Cayman Islands is in this category. The second category is ovoviparous, the eggs are retained until the yolk sac is fully absorbed and the young developed before they give birth to live young. In some cases more eggs are produced to feed the young, called oophagy, or in case of Tiger sharks (*G. cuvier*) the young feed on each other, which is called uterine cannibalism. Nurse sharks (*G. cirratum*) can have 20-30 pups, Tiger sharks (*G. cuvier*) 10-82 and Whale sharks (*R. typus*) up to 300 pups. Most of the species found in the Cayman Islands are viviparous, the embryo is connected to a yolk sac placenta until they fully develop and the female gives birth to small litters. Blacktip sharks (*C. limbatus*) have 1-10 pups, Caribbean reef sharks (*C. perezi*) 3-6, Great hammerheads (*S. mokarran*) 6-42, Lemon sharks (*N. brevirostris*) 4-17, Oceanic whitetip sharks (*C. longimanus*) 1-15, Scalloped hammerheads (*S. lewini*) 13-31 and Silky sharks (*C. falciformis*) 2-14 pups.

Many of the over 500 selachii species are data deficient, it is mostly the species of economic interest that are most studied, but even for those a lot of location and population specific data is still missing. Table 2 summarises what is known about life history such as size, reproduction, distribution, habitats and range of the ten species most likely to be encountered in the waters around the Cayman Islands.

Table 2: Life history, distribution and habitat for shark species commonly found in the Cayman Islands. The information is based on IUCN reports and Compagno Sharks of the World (1984, 2001, 2005).

Life History									Distribution/Habitat					
Common and Scientific name	Size at birth (cm TL)	Size at maturity (cm TL)	Age at maturity (years)	Maximum size (cm TL)	Litter size	Gestation time (months)	Reproduction precocity	Reproduction (O, V) <sup>1</sup>	Birth of young	Distribution/Range	Habit range	Main habitat	Nursery	Maximum depth (m)
Order: Carcharhiniformes														
Family: Requiem sharks - <i>Carcharhinidae</i>														
Silky shark, <i>C. falciformis</i>	70-87	M:215-225, F:232-246	M:6-10, F:7-12	>330	2-14	no data	1-2	V	summer	coastal, oceanic, global tropical seas	Pelagic	deep water reefs, insular slopes	continental shelf edge, oceanic banks	500
Blacktip shark, <i>C. limbatus</i>	53-65	M:130-145, F: 150-156	M:4-5, F:6-7	>193	1-10	10-12	2	V	April-June	tropic and subtropical continental	Benthopelagic	insular shelf, bays, lagoons, mangroves	inshore	30
Oceanic whitetip shark, <i>C. longimanus</i>	60-65	M:175-198, F:180-200	no data	>400	1-15	10-12	2	V	early summer	global tropical and warm water	Pelagic	open sea	no data	1082 <sup>2</sup>
Caribbean reef shark, <i>C. perezii</i>	60-75	150-170	no data	>295	3-6	12	2	V	no data	western Atlantic	Benthopelagic	coral reefs, drop offs	no data	350

Tiger shark, <i>G. cuvier</i>	51-90	M:226-290, F:250-350	4-6	>550	10-82	13-16	no data	O	April-June	global temperate and tropical	Coastal-Pelagic	diverse, turbid water	no data	350
Lemon shark, <i>N. brevirostris</i>	60-65	M:224, F:239	12-13	>340	4-17	10-12	2	V	May-Sep.	W Atlantic, E Pacific	Benthopelagic	bays, docks, mangroves sand bottom, open sea	Florida, lagoons, shallow area	92
Family: Hammerhead sharks – <i>Sphyrnidae</i>														
Scalloped hammerhead, <i>S. lewini</i>	31-57	M:140-198, F: 210-250	M:10, F:15	>420	15-31	9-12	no data	V	spring-summer	global warm temperate and tropical	Coastal-Pelagic	continental shelf, inshore, bays	Florida, Brazil, inshore	275
Great hammerhead, <i>S. mokarran</i>	50-70	M:234-269, F:250-300	no data	>610	6-42	11	2	V	spring-summer	global tropic seas	Coastal-Pelagic	coral reefs, lagoons, offshore	no data	80
Order: Orectolobiformes														
Family: Nurse sharks – <i>Ginglymostomatidae</i>														
Nurse shark, <i>G. cirratum</i>	27-30	M:210, F:225-240	M:10-15, F:15-20	>430	20-30	5-6	2	O	spring-summer	subtropic & tropic E Pacific, W & E Atlantic	Benthic	reefs, mangroves, sand flats	shallow reefs	130
Family: Whale sharks – <i>Rhincodontidae</i>														
Whale shark, <i>R. typus</i>	55-56	700	no data	>1800	<300	no data	no data	O	no data	global tropic and warm seas	Pelagic	off and inshore	no data	no data
1. Reproductive strategies are viviparity (V) and ovoviviparity (O). See description in section above on life history. 2. Howey-Jordan LA, et al. 2013. Complex Movements, Philopatry and Expanded Depth Range of a Severely Threatened Pelagic Shark, the Oceanic Whitetip ( <i>Carcharhinus longimanus</i> ) in the Western North Atlantic. PLoS ONE 8(2): e56588. doi:10.1371/journal.pone.0056588														

## **1.4 Threats**

Sharks face a large number of threats, on global and local level, these should all be considered when attempting to sustainably manage and protect them, as well as the ecosystem as a whole. There are too many threats to consider and list them all here, some factors like rise in sea level, sea surface temperature, acidification, more intense storms, coral bleaching and invasive species are too big to change with these plans. The focus will be on smaller issues that have the potential for change and are likely to have an effect on the shark populations and ecosystem for example fishing and other human activities like coastal development, water activities and garbage.

Many of the threats affecting shark population also impact the entire local ecosystem and biodiversity. One of the highest pressures on marine environments globally is fishing, in the map below (figure 7a) one can see the local fishing pressure on the ecosystem as analysed by the DoE in 2011. The pressure is particularly high on the east and north west side of Grand Cayman, the reef crest at the lagoon entrance and the ends of the sister islands.

Once the Fishing pressure is overlaid with the Biomass and Marine Park maps (figure 7b) possible reasons for localised pressure become clearer. Three of the four Grouper SPAG zones on the sister islands are within areas of high fishing pressure, so is the zone on the east side of Grand Cayman. These sites tend to be used by a number of fish species but only Nassau Groupers are protected during their spawning season. Studies have shown that these sites are an important food source for a number of shark species (Mourier et al. 2016, Pickard et al. 2016). The high fishing pressures also overlap with a number of replenishment and Marine Park zones, most likely taking advantage of the spill over. Looking at the Biomass data, the high fishing pressure overlaps with areas where the Biomass is still categorised as Fair.

Sharks might be taken as bycatch in coastal fisheries but it is more likely that the majority of sharks caught are caught further offshore. Many of the shark species suffer from being accidentally caught in fisheries and low survival rates even when released. IUU is most likely a problem especially with the marine boundaries under negotiation, no own military or other agency to patrol the EEZ and the Asian Shark Fin market thriving. Sports fishing is an issue in some regions of the Central Western Atlantic but less so in the Cayman Islands.

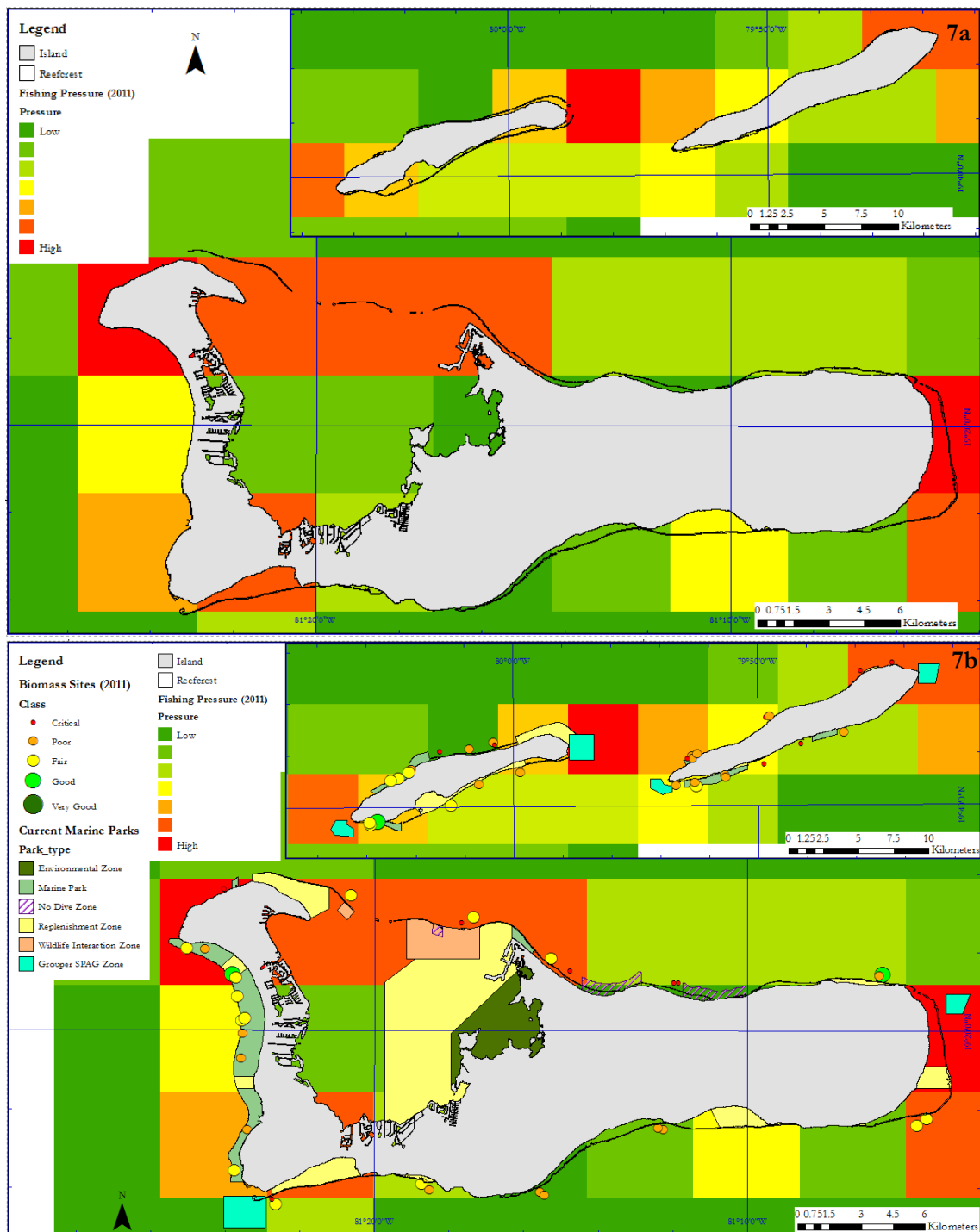


Figure 7: a) Fishing Pressure around the Cayman Islands, as assessed by the DoE in 2011. (source for layers: DoE). b) Fishing pressure, current Marine Parks and Biomass overlaying each other (source for layers: DoE).

One issue that is connected to fishing is that of ghost nets, traps and lines that can still claim many lives for many years because of the slow degradation of the plastics used. Because of the damage it does to turtles fishing line bins and notes to remove them from the



reef and bin them have been placed around the islands. On top of that there is other garbage that can be swallowed and harm animals.

Tourism is important for the people and economy of the Cayman Islands, but at the same time can impacting the environment negatively. 70% of the GDP in the Cayman Islands is coming from tourism and 80% of labour force is occupied by service related jobs (cia.org 2016). According to the Business Intelligence – Annual Statistic Report of 2016, in the first six months of the 2016 the Islands had 973.305 cruise based and 210.490 land based visitors, compared to 861.517 cruise based and 210.491 land based visitors in 2014 (Major 2014). The Business Intelligence report (20016) showed that about 80% of the visitors were from the USA, 7% from Canada and 7% from Europe. Over 75% of the visitors are on the islands for recreation and pleasure and slightly increasing 3.4 for a dive vacation, according to the Business Intelligence report (2016). The main activities include 87.9% of people going to the beach, 56.8% snorkelling and swimming, 12.7% Scuba diving and 3.2% fishing (Business Intelligence 2016). Some of the most popular sites visited on the Grand Cayman are marine related with 56.1% of people visiting Stingray City, 29.5% visiting Cayman Turtle Farm and 9.7% Dolphin Discovery (Business Intelligence 2016). There are a number of negative impacts resulting from these tourism numbers, examples are increased amount of coastal developments and light pollution, waste, boats and ships damaging reefs (CNS 2016), and scuba divers having a negative effect on the marine environment (Tratalos & Austin 2016) by for example damaging, taking or changing animal behaviour.

The cruise ships anchor offshore off George Town, on the western side of Grand Cayman, where the airport is located as well and where the majority of people live. A new port (PricewaterhouseCoopers 2013) is planned to increase the access of cruise ships and tourist numbers, which not only requires destructive coastal development but will also increase the number of tourists and trigger more coastal development to build capacity to facilitate them. An increased amount of ships coming to the islands will also increase the threat of ship strikes that are already threatening species like the whale shark (*R. typus*) but are hard to measure since many go unnoticed or unreported.

The map below (figure 8) depicts the environmental risk due to Human Activities as assessed by the DoE, combining things like boating activity, public mooring, water outfalls and dredging sites. It is highest and widest spread around the western side and the lagoon in the north west. Shallow areas with mangroves or other structures to hide are crucial for smaller species and juveniles but the high number of coastal development, high risk and disturbance due to human activities make it difficult for the entire ecosystem. Juvenile fish

struggle to find hiding places from potential predators before they are big enough to move to the reef, food becomes scarce and competition grows. Turtles struggle finding suitable nesting beaches.

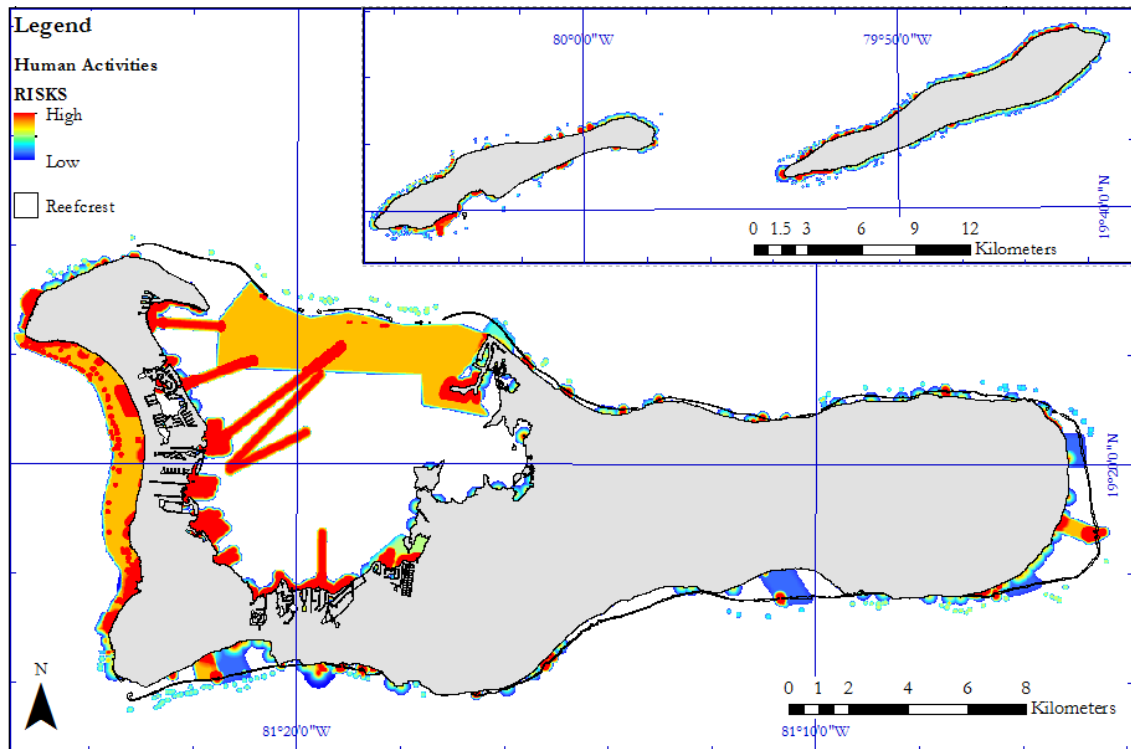


Figure 8: Map of high risk areas due to human activities on the Cayman Islands. (source for layers: DoE)

## 1.5 Aims and Objectives

The Aim of this study was to assist the Cayman Islands Department of Environment in the development of the Elasmobranch Conservation Plan and Species Action Plans, for the protection and conservation of three of the shark species found in Cayman Waters. The species assigned were Oceanic whitetip shark (*C. limbatus*), Caribbean reef shark (*C. perezi*), Tiger shark (*G. cuvier*). During the course of the project SAPs for Grey Snapper (*Lutjanus griseus*) and Mutton Snapper (*Lutjanus analis*) were also requested, but were replaced by additional SAPs for Blacktip shark (*C. limbatus*), Lemon shark (*N. brevirostris*) and Nurse shark (*G. cirratum*) and a general Shark SAP in this report.

The Objectives were to collate and review the available scientific information on the species for which SAPs were designed. Assess the geographic location, ecosystem, human activities and threats that need to be considered as well as actions that have already been taking, like relevant legislations, creation of Marine Parks and the National Conservation

Law. Review the existing National Biodiversity Action Plan for the Cayman Islands and the role and development of comparable management in other countries. Assess the issues arising in developing an enforcing BAPs both in the Cayman Islands and elsewhere. Produce draft SAPs for the species in concern and an Elasmobranch Conservation Plan. Consult with the DoE and other stakeholders to draft documents and incorporate feedback to finalise them so they can eventually be considered by the Cayman Islands Government.

## 2. METHODS and LITERATURE REVIEW

### 2.1 Methods

The report focuses on scientific literature and work done in cooperation with the Cayman Island DoE and Marine Conservation International (MCI) to draft seven Shark Species Action Plans (SAP) for the National Biodiversity Action Plan (NBAP) and Elasmobranch Species Conservation Plan (SAP). Due to problems with the data gathered in an ongoing study of sharks in the Cayman Islands waters by the MCI, an analysis of location specific information of the species was not possible within the time limit.

The ten species considered for this report (table 3) are listed on the current draft of the Elasmobranch Conservation Plan. As noted in it these are not the only species in the Cayman Island waters, but species most likely to be observed, or otherwise in most need for further protection.

Table 3: Taxonomy of species considered in this report as listed in the Elasmobranch Conservation Plan, for the Cayman Islands.

Order	Family	Scientific Name	Common Name
Carcharhiniformes	Carcharhinidae	<i>Carcharhinus falciformis</i>	Silky shark
		<i>Carcharhinus limbatus</i>	Blacktip shark
		<i>Carcharhinus longimanus</i>	Oceanic whitetip shark
		<i>Carcharhinus perezii</i>	Caribbean reef shark
		<i>Galeocerdo cuvier</i>	Tiger shark
		<i>Negaprion brevirostris</i>	Lemon shark
	Sphyrnidae	<i>Sphyrna lewini</i>	Scalloped hammerhead
		<i>Sphyrna mokarran</i>	Great hammerhead
Orectolobiformes	Ginglymostomatidae	<i>Ginglymostoma cirratum</i>	Nurse shark
	Rhincodontidae	<i>Rhincodon typus</i>	Whale shark

As part of the study in the Cayman Island, the Darwin Fund and DoE asked for three shark and two teleost SAPs, which were all drafted but instead of including the snapper SAPs (Grey Snapper *Lutjanus griseus*, Mutton Snapper *Lutjanus analis*) in this report three more shark SAP and one general shark SAP were drafted. The original three SAPs were Oceanic whitetip shark (*C. limbatus*), Caribbean reef shark (*C. perezii*), Tiger shark (*G. cuvier*), the three additional species added were Blacktip shark (*C. limbatus*), Lemon shark (*N. brevirostris*) and Nurse shark (*G. cirratum*), due to the limited time the other SAPs could not be drafted.

The plans were based on the already existing SAPs in the NBAP, overlap and similarities are to be expected with the lack of local data and limited time.

ArcMap in the ArcGIS 10.3.1 software package was used for all the maps in this report. All base maps, layers and information were supplied with permission to use from the Cayman Island Department of Environment.

## **2.2 Literature Review**

The objective of this review is to examine the literature on shark biology, behaviour, habitat and legislation framework in the Central Western Atlantic to inform Biodiversity Action Plans and Elasmobranchii Conservation Action Plan for better conservation of selachii species in the Cayman Islands.

FAO Species Catalogue. Vol 4. Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Part 1 and 2, by Compagno 1984 and 2001, Sharks of the World by Compagno 2005 and reports for the individual species by the IUCN Red List of Threatened Species [<http://www.iucnredlist.org>] were used to gather and compare information of the species listed in the Conservation Action Plan. The Web of Science [[www.webofknowledge.com](http://www.webofknowledge.com)], ScienceDirect [[www.sciencedirect.com](http://www.sciencedirect.com)], ERIC [[search.proquest.com](http://search.proquest.com)] and EbscoHost [[www.ebscohost.com](http://www.ebscohost.com)] were used as search engines to examine further in literature and case studies on shark behaviour including life history, migration patterns, territorial behaviour, feeding, habitats and nursery areas for the individual species in the Central Western Atlantic. Keywords used were the species name and Western Atlantic.

The homepages of the Cayman Island Government [[www.gov.ky](http://www.gov.ky)], Department of Environment of the Cayman Islands Government [[www.doe.ky](http://www.doe.ky)], and the National Trust for the Cayman Islands [[www.nationaltrust.org.ky](http://www.nationaltrust.org.ky)] as well as the CIA World Factbook page on the Cayman Islands (cia.org 2016) were viewed for background information. This includes policies, laws, marine park regulations, historic aspects and the socio economic situation.

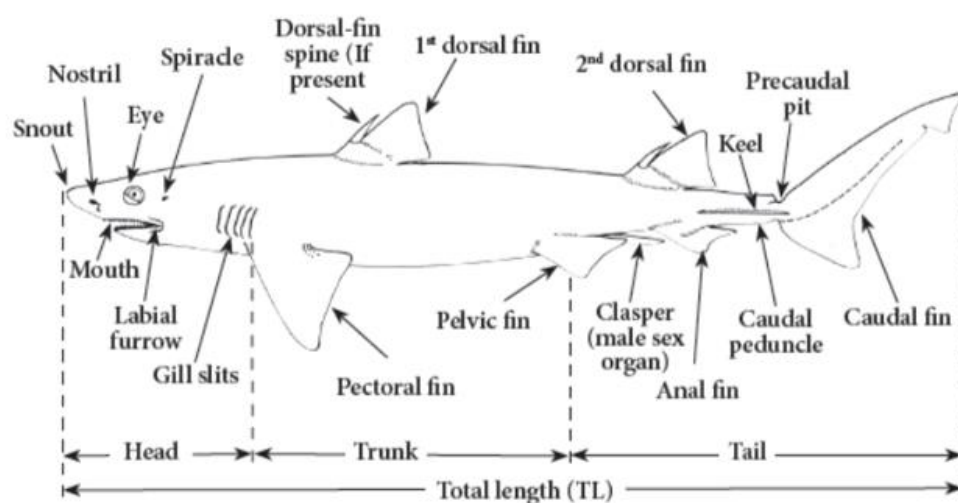
Cayman Islands National Biodiversity Action Plan 2009 and Species Action Plans on the DoE website [<http://www.doe.ky/nbap/>] were examined to design the shark BAPs. The current Fish Conservation Action Plan draft, National Conservation Law (2013) and management strategies from other nations were used to design the Elasmobranch Species Conservation Plan.

### 3. RESULTS

This chapter contains the draft SAPs and Elasmobranch Conservation Plan presented to the DoE, 26 August 2016. The plans were based on the already existing SAPs in the NBAP, overlap and similarities are to be expected with the lack of local data and limited time. At time of writing the report, too much information about the local shark populations was missing, so no specific advice could be given consequently the part on the Proposed Action was very limited and repetitive. Since all the information is stated in the Shark SAP it has been taken out of the individual shark SAPs in this report.

#### **3.1 Shark - Species Action Plan**

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the references added to the list at the end of the report, Appendixes from the original draft containing relevant sections of the National Conservation Law, CITES, CMS and a simple draft of a Shark Handling and Release guide as proposed in the plans were removed.



Terminology of sharks. Source: FAO Factsheets 2016.

#### **Taxonomy**

Kingdom: Animalia, Phylum: Chordata, Class: Chondrichthyes

Most commonly occurring species

Order	Family	Scientific Name	Common Name
Carcharhiniformes	Carcharhinidae	<i>Carcharhinus falciformis</i>	Silky shark
		<i>Carcharhinus limbatus</i>	Blacktip shark
		<i>Carcharhinus longimanus</i>	Oceanic whitetip shark
		<i>Carcharhinus perezii</i>	Caribbean reef shark
		<i>Galeocerdo cuvier</i>	Tiger shark
		<i>Negaprion brevirostris</i>	Lemon shark
	Sphyrnidae	<i>Sphyrna lewini</i>	Scalloped hammerhead
		<i>Sphyrna mokarran</i>	Great hammerhead
Orectolobiformes	Ginglymostomatidae	<i>Ginglymostoma cirratum</i>	Nurse shark
	Rhincodontidae	<i>Rhincodon typus</i>	Whale shark

**Description:** The skeleton of sharks is made out of cartilage, together with their relatives the rays and chimeras they form the class Chondrichthyes. Elasmobranchii (sharks and rays) have pelvic claspers (males only) and the upper jaw is not fused to their skull. Selachii (sharks) also have five to seven plate gills on the sides of their heads, nostrils below the head and the pectoral fins are not fused to the head. Guide to external terminology of sharks can be seen above.

### Status

**Distribution/Range:** Sharks can be found globally in almost all environments, but out of the about 500 species known to be living today only few have adapted to the conditions found in the Cayman Islands. The species listed above are the ones most commonly encountered. There are likely to be more especially deep water species. Based on their range they can be categories as:

- Pelagic or oceanic species like Oceanic whitetip shark (*C. longimanus*), Silky shark (*C. falciformis*) and Whale shark (*R. typus*) are usually off shore, they live and feed on the surface of the open ocean. They have wide ranges and often migrate over long distances (migratory species).
- Coastal-pelagic or semi-oceanic species are common on continental and insular shelves, they look for food inshore but are also known to migrate over long distances, they include Great hammerhead (*S. mokarran*), Scalloped hammerhead (*S. lewini*), and Tiger shark (*G. cuvier*).
- Benthopelagic or epienthic species like Blacktip sharks (*C. limbatus*), Caribbean reef sharks (*C. perezii*) and Lemon sharks (*N. brevirostris*) are usually associated with midwaters. They are often encountered near reefs, can have site affiliation but can also migrate.
- Benthic or reef associated species are bottom dwelling sharks that feed on benthic organisms. Nurse sharks (*G. cirratum*) have a small home range, can be seen in groups, lying on the seafloor sleeping during the day.

**Conservation:** IUCN listings:

- Critically Endangered: Oceanic whitetip shark (*C. longimanus*) (Baum et al. 20015);
- Endangered: Scalloped hammerhead (*S. lewini*) (Baum et al. 2007), Great hammerhead (*S. mokarran*) (Denham et al. 2007), Whale shark (*R. typus*) (Pierce et al. 2016);

- Vulnerable: Silky shark (*C. falciformis*) (Bonfil et al. 2009), Blacktip shark (*C. limbatus*) (Burgess et al. 2009);
- Near Threatened: Caribbean reef shark (*C. perezi*) (Rosa et al. 2006(a)), Lemon shark (*N. brevirostris*) (Sundström 2015), Nurse shark (*G. cirratum*) (Rosa et al. 2006(b)) and Tiger shark (*G. cuvier*) (Simpfendorfer, C. 2009).

#### Legal:

- **National:** Under the National Conservation Law (2013) no shark may be fed, attracted or taken in Cayman waters.
- **International:** Species occurring in the Cayman Islands that are listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are Oceanic whitetip shark (*C. longimanus*), Scalloped hammerhead (*S. lewini*), Great hammerhead (*S. mokarran*), Whale shark (*R. typus*). Export permits are needed to trade specimens of the species.  
Species listed in the Convention on the Conservation of Migratory Species of Wild Animals (CMS): Appendix II: Silky shark (*C. falciformis*), Whale Shark (*R. typus*), Scalloped hammerhead (*S. lewini*), Great hammerhead (*S. mokarran*).

#### Natural History

**Behaviour:** Most sharks are active nocturnally, but their behaviour can differ between species and region, depending on the habitat they live in and what food they feed on.

- **Feeding:** Some solitary hunters either swallow their prey whole, or take bites out of them. Opportunistic omnivores like Oceanic whitetip sharks (*C. longimanus*) and Tiger sharks (*G. cuvier*) have been known to eat bony fish, sharks, invertebrates, marine reptiles, mammals, carrion and garbage (Compagno et al. 2005). Cooperative feeders hunt in packs to herd and capture prey when they can find it. For example, Blacktip sharks (*C. limbatus*). Bottom dwelling sharks are either ambush hunters or prey on bottom dwelling crustaceans and molluscs which they either suck out or crush with their large flat molariform teeth. Nurse sharks (*G. cirratum*) can extract conch from intact shells (Compagno et al. 2005). Whale sharks (*R. typus*) are the only plankton feeding shark species occurring in tropical waters of the Caribbean.
- **Food:** Major food sources are different bony fish, smaller sharks, rays, crustaceans and invertebrates. With Great hammerhead (*S. mokarran*) specialising on groupers, catfish and hidden stingrays; Lemons sharks (*N. brevirostris*) on crustaceans and molluscs; Nurse sharks (*G. cirratum*) on conch, Blacktip (*C. limbatus*) on cephalopods; Whale sharks (*R. typus*) on plankton; and Oceanic whitetip sharks (*C. longimanus*) and Tiger sharks (*G. cuvier*) on birds, mammals, turtles and carrion (Compagno et al. 2005).
- **Aggregation and Migration:** Some species segregate into age and sex groups, some species aggregate to mate, feed or migrate, local examples for both are the Blacktip shark (*C. limbatus*), Great hammerhead (*S. mokarran*), Lemon Shark (*N. brevirostris*), Oceanic whitetip shark (*C. longimanus*) and Scalloped hammerhead (*S. lewini*).
- **Nursery:** The young are usually in protected shallow nursey grounds near sea grass beds, mangroves, reefs and even rivers to protect them from predation. As they grow they move further out into the deeper water.

**Reproduction:** Compared to most other fish sharks, especially large bodied species, are generally long lived, slow growing and have a small number of well-developed young. All sharks fertilize internally, but some lay eggs whereas others give live birth.



- Most of the species found in the Caymans are viviparous. They have a yolk sac placenta to which the embryo is connected with a cord, they develop fully to large pups before the female gives birth to comparatively small litters. Blacktip sharks (*C. limbatus*) have 1-10 pups, Caribbean reef sharks (*C. perezi*) 3-6, Great hammerheads (*S. mokarran*) 6-42, Lemon sharks (*N. brevirostris*) 4-17, Oceanic whitetip sharks (*C. longimanus*) 1-15, Scalloped hammerheads (*S. lewini*) 13-31 and Silky sharks (*C. falciformis*) 2-14 pups.
- Ovoviviparous species retain the eggs until the yolk sac is absorbed and the young fully developed. The young hatch inside before the female gives birth to the young. In some cases they keep producing eggs to feed the embryos or in case of the Tiger shark (*G. cuvier*) the young eat each other (Compagno et al. 2005). Nurse sharks (*G. cirratum*) can have 20-30 pups, Tiger sharks (*G. cuvier*) 10-82 and Whale sharks (*R. typus*) up to 300 pups.
- 40% of global shark species lay eggs, but none of them are common in Cayman waters.

### Current Factors Affecting Sharks

- **Accidental and Incidental Catch:** often caught on bottom nets, gillnet, hook and line, longline, spears and trawlers in tuna, snapper, grouper and other fisheries; sometimes landed instead of released live (Compagno 1984(a)).
- **Debris and Pollution:** Tiger shark (*G. cuvier*) and Oceanic whitetip shark (*C. longimanus*) have been known to swallow rubbish (Compagno 1984 (a)). Entanglement in ghost nets and other discarded materials causes a significant amount of deaths.
- **Habitat loss:** destructive development and extractive industry impacts the habitats for sharks as well as species they prey upon. Studies in Belize have shown that there is an age specific habitat partition in Nurse sharks, Lemon sharks, Caribbean Reef sharks (Pikitch et al. 2005), juvenile sharks depend heavily on mangroves, seagrass beds, lagoons and shallow reefs, which are most impacted by human activities.
- **Health and Safety:** Sharks may on rare occasions be encounter on scuba dives and during other activities in the water. There is little risk unless they are attracted by the scent of dead fish on a spear or provoked. It is advised to stay calm and treat them with respect. It is not advised to consume shark products due to the high mercury content especially in large bodied sharks.
- **Historical Pressure:** historic abundance cannot be confirmed but anecdotal reports together with fishery reports (Bonfil 1997) and comparative studies in other regions, have led to the conclusion of a steep decline of up to 98% of some populations (Baum et al. 2015). Targeted killing of pregnant female Nurse sharks (*G. cirratum*) for their skin lead to a sharp decline in their population in 1940s, and the consequent sharking industry collapse (National Trust 2011).
- **Illegal Take:** despite protection, there is expected to exist a certain level of background poaching due to local, national and international trade. As well as to protect intended catch like tuna that might be damaged by sharks.
- **Inter-Species Reliance:** The large bodied apex species are largely considered a key stone species, their role in the environment is to remove the weak and sick, to control invasive species and influence behaviour of herbivores (Roff et al. 2016). A healthy reef needs a certain amount of sharks but the sharks can only survive if the ecosystem is healthy enough to sustain them.

- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially in the EEZ and at night. Further steps are important to protect migratory species internationally and stop Illegal, Unregulated and Unreported (IUU) fishing to stop the decline in numbers.
- **Natural Predators** include few bigger fish, sharks and cetaceans.
- **Take:** although it is illegal now to take sharks in Cayman waters it can be presumed that some fishing is still continuing. Sharks are killed for their fins (Asian market), meat (dry, fresh and frozen), liver oil (vitamins), skin (leather), teeth and jaws for souvenirs. The liver of a shark can make up to about a quarter of the body weight, and contains up to 80% in weight of high quality squalene oil which is important for industry, cosmetics and pharmaceuticals (Compagno et al. 2005). In some regions in the Caribbean some of the species like Tiger shark (*G. cuvier*) and Great hammerhead (*S. mokarran*) are popular for sports angler (Compagno 1984(a)). Apart from fins and teeth shark products are considered low value and low quality. Nurse sharks (*G. cirratum*) are popular in the aquarium trade in the USA, Mexico and Brazil (Compagno 1984 (a)).
- **Tourism:** shark teeth are a popular souvenir in some holiday destinations but are often taken from caught sharks. Their importance in the dive tourism outweighs the economic value of all carcase parts and increases by the possibility of encountering sharks. Greater protection and focus on a positive image in tourism will be of long-term profit.
- **Value:** the economic value of sharks in tourism and recreation is estimated to be up to US\$ 80 million and their indirect value from their biological and environmental role up to US\$40 million annually (DoE et al. 2012).

#### Associated Habitats and Species for Sharks

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.1 Open Sea	Queen Conch <i>Strombus gigas</i>
2.M1.2 Coral Reefs	Southern Stingrays <i>Dasyatis americana</i>
2.M1.3 Lagoons	Nassau Grouper <i>Epinephelus striatus</i>
2.M1.4 Seagrass Beds	Invasive Red Lionfish <i>Pterois volitans</i>
2.M1.5 Dredged Seabed	Marine Turtles <i>Chelonia mydas</i> , <i>Caretta caretta</i> ,
2.M1.6 Artificial Installations	<i>Eretmochelys imbricata</i> , <i>Dermochelys coriacea</i>
2.S2.3 Mangrove	Spiny Lobster <i>Panulirus argus</i>

#### Opportunities and Current Local Action for Sharks

The feeding, attracting and taking of sharks is prohibited under National Conservation Law (2013). It is important to enhance enforcement for the oceanic and migratory species, as well as some of the reef associated species that are known to migrate into deeper water further offshore on a daily basis (Chapman et al. 2007), as well as during the night.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation are investigating the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value, which is estimated to be between US\$ 80 and US\$ 130 (DoE et al. 2012). Despite low abundance numbers they are optimistic compared to other western Atlantic nations.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme (National Trust 2015).

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

To increase the survival rate of incidentally caught sharks and reduce risk to people handling the shark, a shark handling guide should be distributed.

Sharks are not protected in the entire Caribbean and Central Western Atlantic, more sanctuaries have been declared but further steps for international agreements and protection of species are needed to recover populations that have been heavily exploited, especially nursery areas and to stop Illegal, Unreported and Unregulated fishing.

### **SPECIES ACTION PLAN for *Sharks***

<b>OBJECTIVES</b>	<b>TARGET</b>
<b>1.</b> Determine baseline levels of abundance, behaviour, distribution and threats, towards informing effective conservation management and ensuring the long-term stability of population.	ongoing
<b>2.</b> Ensure more compliance with current provisions of the law, and update as necessary, towards long-term stability of population.	ongoing
<b>3.</b> Ensure sustained support for the conservation of Sharks through targeted education and awareness programmes.	ongoing

<b>Shark PROPOSED ACTION</b>	<b>LEAD</b>	<b>PARTNERS</b>	<b>TARGET</b>	<b>OBJECTIVE</b>
<b>Policy &amp; Legislation</b>				
<b>PL1.</b> Pass and implement the associated Elasmobranch Conservation Plan.	CIG	DoE	Dec. 2017	1,2
<b>PL2.</b> Continue enforcement of relevant Marine laws and regulations.	DoE	RCIP	ongoing	2
<b>PL3.</b> Establish policy of discouraging Cayman Islands' involvement in activities likely to contribute to an increase in pressure on local or regional stocks of threatened marine species	DoE DoT NT	CIG CITA SITA	ongoing	2,3
<b>PL4.</b> Include all Sharks in the Endangered Species (Trade & Transport) Law in order to match the National Conservation Law.	DoE	CIG	Dec. 2018	2
<b>PL5.</b> Distribute and promote shark handling and release guide.	DoE	DoE	Jan. 2017 ongoing	1,2,3
<b>PL6.</b> Formally accede to SPAW and push for inclusion of sharks on SPAW lists. Encourage 'shark sanctuaries' around the Caribbean.	DoE	ME	ongoing	
<b>Safeguards &amp; Management</b>				

<b>SM1.</b> Implement stricter enforcement of National Conservation Law and associated regulations.	DoE	RCIP	ongoing	2
<b>SM2.</b> Implement associated HAPs.	DoE		2020	1,2
<b>Advisory</b>				
<b>A1.</b> Targeted awareness of the need for the National Conservation Law, Conservation Action Plan and Endangered Species (Trade & Transport) Law.	DoE	CIG NT	ongoing	2,3
<b>A2.</b> Address marine debris and litter control issues.	DoE	CIG		2,3
<b>Research &amp; Monitoring</b>				
<b>RM1.</b> Continue with comprehensive assessment of populations.	DoE		ongoing	1
<b>RM2.</b> Continue with regular monitoring of populations for changes in patterns, population trends and key habitats.	DoE		ongoing	1
<b>Communication &amp; Publicity</b>				
<b>CP1.</b> Target awareness events towards Government and local community to garner support for continued protection, eg SharKY fest.	DoE NCC	CIG MP	ongoing	3
<b>CP2.</b> Scientific publication of shark works when appropriate.	DoE	IntC	ongoing	1,3
<b>CP3.</b> Continue public awareness announcements.	DoE NCC	NT	ongoing	3
<b>CP4.</b> Promote participation in citizen science projects like Spot that Cayfish in order to increase the baseline knowledge.	DoE	VOL	ongoing	1,3
<b>CP5.</b> Continue constant reminders of Marine Park & fishery rules.	DoE		ongoing	2,3
<b>CP6.</b> Raise awareness of sustainable alternatives to threatened fisheries amongst members of the public through involvement with educational programmes e.g. Cayman Sea Sense, SharKY fest, Spot that Cayfish, (White Tip Lager).	NT	DoE DoT CA MP	ongoing	3
<b>CP7.</b> Utilise native flora and fauna, and associated preservation efforts, in the international promotion of the Cayman Islands, eg. 'shark sanctuary', dive tourism.	CIG	DoE MP NT DoT	ongoing	3

### **3.1 Blacktip Shark - Species Action Plan**

#### **Blacktip shark, *Carcharhinus limbatus* (Müller & Henle, 1839)**

The Blacktip shark *Carcharhinus limbatus* is typically found in tropical and subtropical continental near shore waters as well as some oceanic islands, it prefers shallow bays, mangroves, coral reefs as well as drop-offs and further off shore, it is neither reef associated nor a true pelagic shark. They can be found along the Western Atlantic between the USA and south Brazil, including the Gulf of Mexico and the Caribbean Sea, down to a depth of 30m (98 ft). The sharks are known to sexually segregate as well as form large schools at the surface during seasonal migrations, typically in winter. As a very fast and active species they are known to leap out of the water during feeding frenzies (Compagno 1984(a)). The young are usually in shallow inshore nursery areas, protected from adults and other potential predators.

The Blacktip shark (*C. limbatus*) was assessed as Near Threatened by the IUCN Red List of Threatened Species, with an unknown population trend (Burges & Branstetter 2009). Their historic abundance cannot be confirmed but anecdotal reports together with fishery reports and comparative studies in other regions (Bonfil 1997) point towards a steep decline in their numbers. Blacktip sharks (*C. limbatus*) have been targeted for their meat, fins, oil and skin. In the Gulf of Mexico, it is the second most important species landed, and the most popular shark meat on the US market (Burges & Branstetter 2009). Natural predators include bigger sharks and cetaceans but the biggest mortality numbers are due to human activities. Apart from direct catch Blacktip sharks (*C. limbatus*) suffer from mortality in bycatch, they are caught in floating longlines, hook and line, fixed bottom nets and bottom trawls like shrimp trawlers which they are known to follow as well as discarded fishing gear and other debris. Destructive developments and extractive industries impact essential habitats like nursery grounds as well as species they prey on. They are frequently misidentified as Caribbean Reef Shark (*C. perezii*).

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the references added to the list at the end of the report.



Picture source: Shark Conservation Society, <http://www.arkive.org/blacktip-shark/carcharhinus-limbatus/image-G75689.html>. Downloaded on 21 July 2016.

### Blacktip Shark *Carcharhinus limbatus*

#### Taxonomy

Kingdom: Animalia, Phylum: Chordata, Class: Chondrichthyes, Order: Carcharhiniformes, Family: Carcharhinidae, Genus: Carcharhinus, Species: limbatus.

**Description:** grey shark with moderately long and pointed snout, moderately large pectoral fins and first dorsal fin. Their fins usually have black tips in juveniles to adults (Compagno 1984(a)).



Range of Blacktip Shark (*C. limbatus*).  
Source: FAO Factsheets 2016.

#### Status

**Distribution/Range:** occurring in most tropical and subtropical continental near shore waters and around some oceanic island. In the Western Atlantic between the USA and south Brazil including the Gulf of Mexico and the Caribbean.

**Conservation:** Blacktip sharks (*C. limbatus*) are assessed as Near Threatened by the IUCN Red List, trend unknown (Burgess & Branstetter 2009).

**Legal:** Under the National Conservation Law (2013) no sharks may be fed, attracted or taken in Cayman waters.

## Natural History

Blacktip sharks (*C. limbatus*) can commonly be found inshore, in shallow bays, mangroves, lagoons, coral reefs, and drop offs as well as far offshore, but they are not truly pelagic sharks. They sexually segregate but often form large schools at the surface and migrate, especially during winter. The fast and very active species has been known to leap out of the water, possibly as a hunting strategy during feeding frenzies (Compagno 1984(a)). Young are in shallow nursery and pupping grounds, away from adult populations or other predators.

They feed on a variety of teleosts like sardines, herring, anchovies, sea catfish, mullets, spanish mackerel, jacks, groupers, emperors, grunts, triggerfish, boxfish, porcupine fish as well as smaller sharks, rays, squids, cuttlefish, octopi, crabs and lobsters (Compagno 1984(a)).

Blacktip sharks (*C. limbatus*) are viviparous; after a gestation period of 10 to 12 month females give birth to 1-10 young between April to June (Compagno 1984(a)), every other year. At birth they are between 53 to 65 cm TL (20.1–25.6 in) long, males reach maturity at about 130-145 cm TL (4.3-4.8 ft) or 4-5 years, females at 150-156 cm TL (4.9-5.1 ft) or 6-7 years (Burgess & Branstetter 2009). In the Western Atlantic they can reach a maximum length of 193 cm (6.33 ft) (Burgess & Branstetter 2009) but are usually around 165-175 cm (5.4-5.7 ft) (Burgess & Branstetter 2009).

## Current Factors Affecting Blacktip Sharks

- **Debris and Pollution:** Entanglement in ghost nets, fishing lines and other discarded materials causes a significant amount of shark mortality.
- **Habitat loss:** destructive development and extractive industry impacts the habitats, especially nursery grounds, as well as species they prey on.
- **Health and Safety:** Occasionally Blacktip sharks (*C. limbatus*) may be encounter on scuba dives and during other activities in the water, they can be curious and my circle at a distance but are generally no hazard to people. When bait or other larger sharks are present they might become aggressive or hyper stimulated and an incident can occur (Compagno 1984(a)) but generally there is little risk when people stay calm and treat them with respect.
- **Historical pressure:** historic abundance cannot be confirmed but anecdotal reports together with fishery reports and comparative studies in other regions (Bonfil 1997) a decline in numbers. Blacktip sharks (*C. limbatus*) have been targeted for their meat, fins, oil and skin. In the Gulf of Mexico it is the second most important species landed, and the most popular shark meat on the US market (Burgess & Branstetter 2009).
- **Illegal Take:** despite protection, there is expected to be a certain level of background poaching due to local, national and international trade
- **Incidental catch:** they tend to follow fishing vessels, especially shrimp trawlers, in which they often get caught, as well as floating longlines, hook and line, fixed bottom nets and bottom trawls.
- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially beyond the Marine Protected Areas.
- **Natural Predators** include few bigger fish, sharks and cetaceans.



- **Tourism:** sharks are of great importance to dive industry, especially if they are harmless but curious around divers. They are often confused with Caribbean reef sharks (*Carcharhinus perezi*) that look very similar.
- **Value:** their economic value is estimated to be very high due to the growing dive industry, it far outnumbers any economic gain that could be made by a dead shark. Their biological and environmental importance adds to that.

#### Associated Habitats and Species for *Blacktip Sharks*

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.1 Open Sea	Nassau grouper <i>Epinephelus striatus</i>
2.M1.2 Coral Reefs	Southern stingrays <i>Dasyatis Americana</i>
2.M1.3 Lagoons	Spiny Lobster <i>Panulirus argus</i>
2.M1.4 Seagrass Beds	
2.S2.3 Mangrove	

#### Opportunities and Current Local Action for *Blacktip Sharks*

The feeding, attracting and taking of sharks is prohibited under National Conservation Law. It is important to enhance enforcement in the entire EEZ. They should be added to the Endangered Species (Trade & Transport) Law.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation are investigating the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value. Despite low abundance numbers are optimistic compared to other western Atlantic nations.

More research is needed to identify local nursery areas and areas with large populations for better management plans. Little is known about their migrations and vertical movements around the Cayman Islands.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme.

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

#### SPECIES ACTION PLAN for *Blacktip Sharks*

See 3.1. Shark - Species Action Plan for Proposed Actions.



### **3.3 Oceanic Whitetip Shark - Species Action Plan**

#### **Oceanic whitetip shark, *Carcharhinus longimanus* (Poey, 1861)**

Oceanic whitetip sharks (*C. longimanus*) can be found globally between 30° N and 35° S, in tropical and warm temperate waters, deeper than 200m (656 ft) and preferably between 18°C and 28°C (Baum et al. 2015). They live geographically and sexually segregated, aggregating only around food sources (Baum et al. 2016), abundance increases with the distance from land. They feed largely on teleosts and cephalopods but also birds, mammals, stingrays and sometimes garbage (Compagno 2005).

The species was listed as Vulnerable by the IUCN Red List of Threatened Species, with population trend decreasing (Baum et al. 2015). Used to be one of the most abundant oceanic shark species, now encounters are rare with studies showing a population decline of 70%-99.8% in the Central Western Atlantic (Baum et al. 2015). Large numbers have been caught in pelagic longlines and drift nets. Oceanic whitetip sharks (*C. longimanus*) constitute to 30% of tuna longline catches (Baum et al. 2015).

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the reverences added to the list at the end of the report.



Picture source: Masa Ushioda / imagequestmarine.com, <http://www.arkive.org/oceanic-whitetip-shark/carcharhinus-longimanus/>. Downloaded on 13 June 2016

## Oceanic Whitetip Shark *Carcharhinus longimanus*

### Taxonomy

Kingdom: Animalia, Phylum: Chordata, Class: Chondrichthyes, Order: Carcharhiniformes, Family: Carcharhinidae, Genus: *Carcharhinus*, Species: *longimanus*

**Description:** Brown to grey brown upper body and yellowish white underside. Rounded snout, large rounded dorsal fin with large white tip. Long pectoral fins usually have white tips.



Range of Oceanic whitetip shark (*C. longimanus*). Source: FAO Factsheets 2016.

### Status

**Distribution/Range:** Oceanic whitetip sharks (*C. longimanus*) can usually be found in offshore deep sea tropical and warm temperate waters. Globally they reach between 30° N and 35° S, in the west Atlantic between the USA and Argentinian. With increasing distance from land the abundance usually increases. They prefer temperatures between 18°C and 28°C and water that is deeper than 200 m (656 ft) (Baum et al. 2015).

**Conservation:** Listed as Critically Endangered in the Western Central Atlantic in the IUCN Red List, population decreasing (Baum et al. 2015).

**Legal:** Under the National Conservation Law (2013) no sharks may be fed, attracted or taken from Cayman waters. Listed in CITES Appendix II, export permits are required to control trade, to ensure the survival of the species. It is prohibited to land Oceanic whitetip sharks for members of the regional fishery management organisations: International Commission for the Conservation of Atlantic Tuna (ICCAT), the Inter-American Tropical Tuna Commission (IATTC) and the Western and Central Pacific Fisheries Commission (WCPFC) (Howey-Jordan 2013).

### Natural History

Oceanic whitetip sharks (*C. longimanus*) are viviparous with a yolk-sac placenta; after a gestation period of 10-12 months females give birth to 1-15 young in early summer (Compagno 1984(a)). At birth Oceanic whitetip sharks are 60 to 65 cm TL (1.9–2.1 ft) long. They reach maturity at about 170 cm TL (5.6 ft) with individuals reaching a size of up to 4 m TL (13 ft) (Compagno 1984(a), Baum et al. 2015)

They live geographical and sexually segregated and usually only aggregate around food sources (Baum et al. 2016). Oceanic Whitetip sharks (*C. longimanus*) feed largely on bony fish and cephalopods, but also some birds, mammals, stingrays and sometimes garbage.

### Current Factors Affecting Oceanic Whitetip Shark

- **Debris and Pollution:** Entanglement in ghost nets, fishing lines and other discarded materials cause a significant amount of deaths. Oceanic whitetip sharks (*C. longimanus*) have been known to swallow rubbish (Compagno 1984(a)) which could become a problem.

- **Health and Safety:** Sharks may on rare occasions be encountered on scuba dives and during other activities in the water. They appear unafraid and on rare occasion pass by, circle or bump divers (Baum et al. 2015). There is little risk unless they are attracted by the scent of dead fish or provoked. It is advised to stay calm and treat them with respect. It is not advised to consume shark products due to the high mercury content, especially in large bodied sharks.
- **Historical pressure:** Historically the most common pelagic shark (Baum et al. 2015), the Western Central Atlantic population has been estimated to have dramatically declined by about 98% (Baum et al. 2015).
- **Illegal take:** despite effective enforcement of the and National Conservation Law (2013), there is likely a certain level of background poaching, adding to the high seas background poaching for their large fins. They are considered a big problem, damaging tunas and hence often killed instead of released live.
- **Incidental catch:** Oceanic whitetip sharks (*C. longimanus*) often follow fishing vessels and are caught in pelagic longline and drift net fisheries, especially tuna.
- **Inter-Species Reliance:** Their role in the environment is uncertain due to lack of studies and accessibility. Their large historic numbers and migratory behaviour together with their presence at carrion and fish aggregation devices point to a complex role.
- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially in the EEZ. They are also listed under CITES Appendix 2, which needs to be adapted and enforced by nations. Further steps are important to protect migratory species internationally by reducing bycatch, finning and Illegal, Unregulated and Unreported (IUU) fishing to stop the decline in numbers.
- **Natural Predators** include few bigger sharks and cetaceans.
- **Value:** The combined economic and environmental value, makes threats to sharks a concern for all nations.

#### Associated Habitats and Species for *Oceanic Whitetip Sharks*

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.1 Open Sea	Southern stingrays <i>Dasyatis americana</i>
2.M1.6 Artificial Installations	Nassau grouper <i>Epinephelus striatus</i>
	Marine Turtles <i>Cheloniidae</i>

#### Opportunities and Current Local Action for *Oceanic Whitetip Shark*

The feeding, attracting and taking of sharks is prohibited under National Conservation Law. For oceanic and migratory species it is important to enhance enforcement in the entire EEZ. They should be added to the Endangered Species (Trade & Transport) Law.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation have investigated the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value. Despite low abundance numbers are optimistic compared to other western Atlantic nations.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme.

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

### **SPECIES ACTION PLAN for *Oceanic Whitetip Shark***

See 3.1. Shark - Species Action Plan for Proposed Actions.

## **3.4 Caribbean Reef Shark - Species Action Plan**

### **Caribbean reef shark, *Carcharhinus perezi* (Poey, 1876)**

It is one of the most common species in the Caribbean and can be found between the USA and Brazil, inhabiting coral reefs, fore-reefs, deep lagoons and can be found near drop offs down to a depth of 350m (1148 ft) (Pikitch et al. 2005, Chapman et al. 2007). A study by Chapman (2007) in Belize has shown that juveniles mostly stay in the same shallow areas whereas adults migrate to deeper offshore waters on a daily base. Another study in Belize showed that despite being a reef associated species they sometimes migrate over long distance, crossing deep open water (Chapman et al. 2005, Garla et al. 2006). As adults they segregate sexual. Breeding, pupping and nursery grounds are known in many regions (Compagno 1984(a), Garla et al. 2006), more research needs to be done including the Cayman Islands.

The IUCN Red List of Threatened Species assessed the Caribbean reef shark (*C. perezi*) as Near Threatened, with possible future change to Vulnerable, and decreasing population trend (Rosa et al. 2006(b)). The historic numbers are uncertain but after steep declines in the mid-1900s (Rosa et al. 2006), their numbers are still decreasing, even after protection. They are killed for their fins for the Asian market, meat for dry, fresh and frozen human consumption, liver oil for vitamins, skin for leather, and teeth and jaws for souvenirs. Studies in Belize by Pikitch (2005) have shown that there is an age specific habitat partition in Caribbean Reef sharks, juvenile sharks depend heavily on mangroves, seagrass beds, lagoons and shallow reefs, which are most impacted by human activities such as destructive development and extractive industry. Their full role in the environment is not yet completely understood but it is presumed they remove the weak and sick, and influence the ecological behaviour of those prey fish and related species (Roff 2016). A healthy reef needs an abundance of sharks but the sharks can only survive if the ecosystem is healthy enough to sustain them. Overfishing reef fish especially during times of plenty, like during spawning, of their main prey is one of the factors influencing their decline.

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the reverences added to the list at the end of the report.

Cayman Islands National Biodiversity Action Plan 2016  
3.M.2.1 Marine Species - Fish  
Caribbean Reef Shark



Rev. August 2016



Picture source: Masa Ushioda / SeaPics.com, <http://www.arkive.org/caribbean-reef-shark/carcharhinus-perezi/image-G43511.html>. Downloaded on 13 June 2016

**Caribbean Reef Shark *Carcharhinus perezii***

**Taxonomy**

Kingdom: Animalia, Phylum: Chordata, Class: Chondrichthyes, Order: Carcharhiniformes, Family: Carcharhinidae, Genus: *Carcharhinus*, Species: *perezi*

**Description:** The heavy body is silvery grey with a white underside. The inside tips of the pectoral fins and tips of ventral, anal and lower lobe of tail are dark. Gill slits and first dorsal fin are relatively small.



Range of Caribbean Reef Shark (*Carcharhinus perezii*). Source: Naylor 2016, Chondrichthyan Tree of Life.



## Status

**Distribution/Range:** Caribbean reef shark (*Carcharhinus perezii*) is one of the more commonly found species of sharks in the Caribbean, and range between the USA and Brazil.

**Conservation:** Listed as Near Threatened in the IUCN Red List but lacking in data in some regions - possible future classification as Vulnerable (Rosa et al. 2006(b)).

**Legal:** Under the recent National Conservation Law (2013) no sharks may be fed, attracted or taken in Cayman waters.

## Natural History

Caribbean reef sharks (*Carcharhinus perezii*) can be found around coral reefs, fore-reefs, deep lagoons and near drop-offs, down to a depth of about 350 m (1148 ft) (Pikitch et al. 2005, Chapman et al. 2007). A study in Belize has shown that juveniles mostly stay in the same shallow areas whereas adults migrate to deeper offshore waters on a daily base (Chapman et al. 2007). Another study in Belize showed that despite being a reef associated species they sometimes migrate over long distance, crossing deep open water (Chapman et al. 2005, Garla et al. 2006). As adults they segregate sexual. In some regions breeding, pupping and nursery grounds are known, more research needs to be done for the Cayman Islands. (Compagno 1984(a), Garla et al. 2006).

Caribbean reef sharks (*Carcharhinus perezii*) feed on bony fish and other elasmobranchs (such as Spotted Eagle Rays (*Aetobatus narinari*)) (Rosa et al. 2006(b)).

Caribbean reef sharks (*Carcharhinus perezii*) are placental viviparous; after a gestation period of about a year females give birth to 3-6 young, every other year (Compagno 1984(a), Rosa et al. 2006(b)). At birth they are between 60 to 75 cm TL (2-2.5 ft) long and reach maturity at 150-170 cm TL (4.9-56 ft). Most adults are between 200 to 295 cm TL (6.6-9.7 ft) (Compagno 1984(a), Rosa et al. 2006(b)).

## Current Factors Affecting Caribbean Reef Sharks

- **Debris and Pollution:** Entanglement in ghost nets, fishing lines and other discarded materials causes a significant amount of shark mortality.
- **Habitat loss:** destructive development and extractive industry impacts the habitats for sharks as well as species they prey on like bony fish and rays. Studies in Belize have shown that there is an age specific habitat partition in Caribbean Reef sharks (Pikitch et al. 2005), juvenile sharks depend heavily on mangroves, seagrass beds, lagoons and shallow reefs, which are most impacted by human activities.
- **Health and Safety:** Sharks may on rare occasions be encounter on scuba dives and during other activities in the water. There is little risk unless they are attracted by the scent of dead fish for example on a spear or if they are provoked. It is advised to stay calm and treat them with respect.
- **Historical pressure:** The numbers are uncertain but after steep declines in the mid-1900s (Rosa et al. 2006(b)), their numbers are still decreasing, even where protected. They are killed for their fins (Asian market), meat (dry, fresh and frozen), liver oil (vitamins), skin (leather), teeth and jaws for souvenirs. Possible future change from Near Threatened to Vulnerable in the IUCN Red List (Rosa et al. 2006(b)). Overfishing reef fish especially during times of plenty of their main prey is one of the factors influencing their decline.

- **Illegal Take:** despite protection, there is expected to be a certain level of background poaching due to local, national and international trade
- **Incidental catch:** often caught on longline and gillnet in snapper and grouper fisheries and landed instead of released live (Rosa et al. 2006(b)).
- **Inter-Species Reliance:** Their full role in the environment is not yet completely understood but they remove the weak and sick, and influence the ecological behaviour of those prey fish and related species (Roff et al. 2016). A healthy reef needs an abundance of sharks but the sharks can only survive if the ecosystem is healthy enough to sustain them.
- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially in the EEZ and at night.
- **Natural Predators** include few bigger fish, sharks and cetaceans.
- **Tourism:** They are a major attraction for the diving industry for example in the Bahamas, Belize, Cuba and Florida. (Rosa et al. 2006(b))
- **Value:** their economic value is estimated to be very high due to the growing dive industry, it far outnumbers any economic gain that could be made by a dead shark. Their estimated high biological and environmental importance adds to that.

#### Associated Habitats and Species for *Caribbean Reef Sharks*

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.1 Open Sea 2.M1.2 Coral Reefs 2.M1.3 Lagoons 2.M1.4 Seagrass Beds 2.S2.3 Mangrove	(Southern stingrays <i>Dasyatis Americana</i> ) Nassau grouper <i>Epinephelus striatus</i>

#### Opportunities and Current Local Action for *Caribbean Reef Sharks*

The feeding, attracting and taking of sharks is prohibited under Marine Conservation Law. It is important to enhance enforcement to protect them during daily migrations into deeper water further offshore on. They should be added to the Endangered Species (Trade & Transport) Law.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation are investigating the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value. Despite low abundance numbers are optimistic compared to other western Atlantic nations.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme.

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

#### SPECIES ACTION PLAN for *Caribbean Reef Sharks*

See 3.1. Shark - Species Action Plan for Proposed Actions.

### **3.5 Tiger Shark - Species Action Plan**

#### **Tiger shark, *Galeocerdo cuvier* (Péron & Lesueur, 1822)**

Tiger sharks *Galeocerdo cuvier* can be found globally in tropical and warm temperate waters, in the Central Western Atlantic their range extends between Cape Cod and Uruguay, including the Gulf of Mexico and the islands of the Caribbean. They are not a true pelagic species, even though they spend their days in deep offshore waters down to a depth of 350m (1148 ft), they move inshore to feed in turbid intertidal waters like river estuaries, jetties, coral atolls and lagoons at night. As opportunistic predator scavengers they feed on almost anything from turtles, rays, teleosts, birds, cetaceans, carrion, or other mammals to other sharks, but have also been known to swallow garbage like plastic bags, vegetables, cans, metal pieces and barrels. Apart from seasonal migrations, they are solitary residential or semi residential predators (Simpfendorfer 2009).

The species was assessed as Near Threatened by the IUCN Red List of Threatened Species, the population trend is unknown (Simpfendorfer 2009). Also historic numbers cannot be confirmed higher numbers are assumed to have existed, threats towards their numbers include bycatch in tuna and swordfish longline fisheries, direct take for meat, hide, fins and liver oil as well as sport anglers. Their ecological role is to nutrient cycle by consuming carrion and influence the behaviour of prey.

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the references added to the list at the end of the report.





Picture source: Cole, B. / Biosphoto, <http://www.arkive.org/tiger-shark/galeocerdo-cuvier/image-G37326.html>. Downloaded on 13 June 2016.

### Tiger Shark *Galeocerdo cuvier*

#### Taxonomy

Kingdom: Animalia, Phylum: Chordata, Class: Chondrichthyes, Order: Carcharhiniformes, Family: Carcharhinidae, Genus: *Galeocerdo*, Species: *cuvier*

**Description:** Bluish to brownish grey with pale underside, and bars and blotches along the body which might fade over the years. Short, broad snout and long upper lobe of tail (Compagno 1984(a)).

#### Status

**Distribution/Range:** Tiger sharks (*G. cuvier*) can be found in tropical and warm temperate waters globally, around the western Atlantic from Cape Cod to Uruguay, including the Gulf of Mexico and islands of the Caribbean. Shallow intertidal waters and down to a depth of 350 m (1148 ft). They prefer turbid areas, river estuaries, jetties, coral atolls, lagoons as well as offshore open ocean.

**Conservation:** Listed as Near Threatened in the IUCN Red List (Simpfendorfer 2009).



Range of Tiger Shark (*G. cuvier*).

Source: Naylor 2016 Chondrichthyan Tree of Life.

**Legal:** Under the National Conservation Law (2013) no sharks may be fed, attracted or taken from Cayman waters.

### Natural History

Tiger sharks (*G. cuvier*) are ovoviviparous; after a gestation period of 13-16 months females give birth to 10-82 young between April and June. At birth Tiger sharks (*G. cuvier*) are between 51 to 90 cm TL (1.7-3 ft) long. Males reach maturity at 226 – 290 cm TL (7.4-9.5 ft), females at 250-350 cm TL (8.2-11.5 ft); most Tiger sharks are smaller than 5 m TL (16.4 ft) but some females reach over 5.5m TL (18 ft) (Compagno 1984(a)).

Tiger sharks (*G. cuvier*) usually spent the days in deep offshore waters but move inshore to feed in bays and lagoons during the night. Apart from seasonal movements they are usually solitary residential or semi residential predators (Simpfendorfer 2009).

In nature they are preyed upon by bigger sharks or cetaceans. Tiger sharks (*G. cuvier*) are opportunistic predator scavengers, feeding on almost anything from turtles, rays, bony fish, birds, cetaceans or other mammals, to other sharks. They have been known to swallow garbage like plastic bags, vegetables, cans, metal pieces and barrels.

### Current Factors Affecting *Tiger Shark*

- **Debris and Pollution:** Entanglement in ghost nets, fishing lines and other discarded materials cause a significant amount of deaths. Tiger sharks (*G. cuvier*) have been known to swallow rubbish (Compagno 1984(a)) which could become a problem.
- **Health and Safety:** Sharks may on rare occasions be encounter on scuba dives and during other activities in the water. They appear unafraid of divers but shy and tend to pass by or swim away (Simpfendorfer 2009). There is little risk unless they are attracted by the scent of dead fish or provoked. It is advised to stay calm and treat them with respect. It is not advised to consume shark products due to the high mercury content, especially in large bodied sharks.
- **Historical pressure:** Globally the populations have decreased due to commercial fisheries for meat, hide, fins and liver as well as sport anglers and incidental catch (Simpfendorfer 2009). Reduction of prey like turtles caused further stress. Although historical abundance cannot be confirmed, it is reasonable to assume that higher numbers existed.
- **Illegal take:** despite effective enforcement of the National Conservation Law, there is to be expected a certain level of background poaching. Popular for sports anglers and fin trade.
- **Incidental catch:** as opportunistic hunter they often attack bait or fish caught on hooks and nets and subsequently get caught themselves.
- **Inter-Species Reliance:** Their environmental role is to consume carrion, which is important for the nutrient cycle and furthermore their presence influences the behaviour of herbivores. They depend on healthy turtle and bird population as their preferred food source.
- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially in the EEZ and at night when Tiger sharks (*G. cuvier*) move to shallower waters to hunt. Further steps are important to protect migratory species internationally by reducing bycatch, finning and Illegal, Unregulated and Unreported (IUU) fishing to stop the decline in numbers.

- **Natural Predators** include few bigger sharks and cetaceans.
- **Value:** a combination of economic and environmental value, makes threats to sharks a concern for many nations.

#### Associated Habitats and Species for *Tiger Shark*

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.1 Open Sea 2.M1.2 Coral Reefs 2.M1.3 Lagoons 2.M1.4 Seagrass Beds 2.M1.6 Artificial Installations	Southern stingrays <i>Dasyatis americana</i> Nassau grouper <i>Epinephelus striatus</i> Marine Turtles <i>Cheloniidae</i>

#### Opportunities and Current Local Action for *Tiger shark*

The feeding, attracting and taking of sharks is prohibited under National Conservation Law. For oceanic and migratory species, it is important to enhance enforcement in the entire EEZ and during the night when Tiger sharks (*G. cuvier*) are most active in shallower waters. They should be added to the Endangered Species (Trade & Transport) Law.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation have investigate the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value. Despite low abundancy numbers are optimistic compared to other western Atlantic nations.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme.

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

#### SPECIES ACTION PLAN for *Tiger Shark*

See 3.1. Shark - Species Action Plan for Proposed Actions.

### **3.6 Lemon Shark Species Action Plan**

#### **Lemon shark, *Negaprion brevirostris* (Poey, 1868)**

Lemon shark *Negaprion brevirostris* populations exist along the coasts of the West Atlantic West Africa and East Pacific. In the Central West Atlantic, they are distributed between New Jersey, USA and southern Brazil, occurring in coastal and inshore waters around continental and insular shelves, including Gulf of Mexico, the Bahamas and the Caribbean. Their preferred habitats include coral keys, docks, sounds, bays, mangroves, and on sand or coral mud bottoms down to a depth of 92 m (302 ft). At the onset of winter, they migrate, when they can be found in deeper open ocean, leaving their home range, which can be as far as 300 km (Compagno 1984 (a)). Adults are solitary and most active during dawn and dusk, sometimes they aggregate in size and sex segregated groups of up to 20. Young Lemon sharks (*N. brevirostris*) are site attached, returning to the same spot every day before they are big enough to leave the shallow areas and lagoons of their nursery area. *Negaprion brevirostris* feed on fish like sea catfish, mullets, jacks, croakers, porcupine fish, guitarfish, stingrays and eagle rays as well as amphipods, conch, crabs, crayfish, barnacles and sea birds (Compagno 1984(a)).

The IUCN Red List of Threatened Species lists the Lemon shark (*N. brevirostris*) as Near Threatened, the population trend is unknown (Sundström 2015). Anecdotal reports together with fishery reports and comparative studies in other regions (Bonfil 1997) suggest larger historic numbers, but exact abundance cannot be confirmed. Lemon sharks (*N. brevirostris*) have been targeted for their skin, fins, liver oil and meat as well as for the aquarium trade, because they do well in captivity, young have been taken as objects for physiological and behavioural studies (Compagno 1984(a)).

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the reverences added to the list at the end of the report.



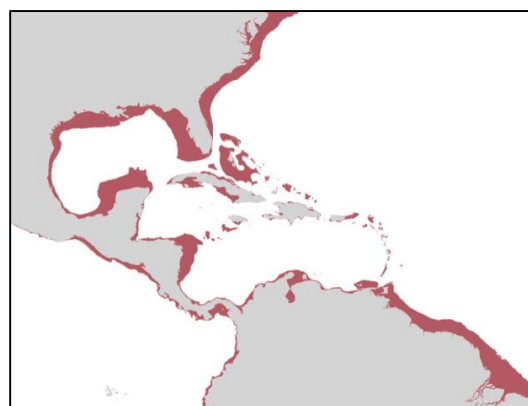
Picture source: Andy Murch / Elasmodiver.com, <http://www.arkive.org/lemon-shark/negaprion-brevirostris/image-G26868.html>. Downloaded on 19 July 2016

### Lemon Shark *Negaprion brevirostris*

#### Taxonomy

Kingdom: Animalia, Phylum: Chordata,  
Class: Chondrichthyes, Order:  
Carcharhiniformes, Family: Carcharhinidae,  
Genus: Negaprion, Species: brevirostris.

**Description:** pale yellow-brown body with a short nose, the first and second dorsal fins are about the same size.



Range of Lemon Shark (*N. brevirostris*).

Source: FAO Factsheets 2016

#### Status

**Distribution/Range:** occurring in coastal and inshore waters along the continental and insular shelves of West Atlantic coasts between the US and Brazil, as well as some areas of West Africa and East Pacific.

**Conservation:** Lemon sharks (*N. brevirostris*) are assessed as Near Threatened by the IUCN Red List, trend unknown (Sundström 2015).

**Legal:** Under the National Conservation Law (2013) no sharks may be fed, attracted or taken in Cayman waters.

## Natural History

Lemon sharks (*N. brevirostris*) can be found around coral keys, docks, in sounds and bays, at mangrove fringes, on sand or coral mud bottoms, down to 92 m (302 ft) (Compagno 1984(a)) and occasionally in deeper open ocean during migrations at the onset of winter (Sundström 2015). Young Lemon sharks (*N. brevirostris*) tend to be more site attached than adults, returning to the same spot every day especially during their time in nursery areas, whereas adults can range about 300 km (Compagno 1984(a)). Adults are most active during dawn and dusk, they can aggregate in size and sex segregated groups of up to 20 but are usually on their own.

They feed on a number of different fish species like sea catfish, mullet, jacks, croakers, porcupine fish, guitarfish, stingrays and eagle rays but also amphipods, conch, crabs, crayfish, barnacles and sea birds (Compagno 1984(a)).

Lemon sharks (*N. brevirostris*) are viviparous; after a gestation period of 10 to 12 month females give birth to 4-17 young in late spring and summer (Compagno 1984(a)), every other year. At birth they are between 60 to 65 cm TL (23.6-25.6 in) long, males reach maturity at about 224 cm TL (7.3 ft), females at 239 cm TL (7.8 ft) (Compagno 1984(a)), when they are 12 to 13 years old (Sundström 2015). They can reach 340 cm (11.2 ft) but are usually around 280 cm (9.2 ft) (Compagno 1984(a)).

## Current Factors Affecting Lemon Sharks

- **Debris and Pollution:** Entanglement in ghost nets, fishing lines and other discarded materials causes a significant amount of shark mortality.
- **Habitat loss:** destructive development and extractive industry impacts the habitats, especially nursery grounds, as well as species they prey on, like rays and sea birds.
- **Health and Safety** Lemon sharks (*N. brevirostris*) may be encounter on scuba dives and during other activities in the water but they are shy and reluctant to approach. There is little risk when people stay calm and treat them with respect. When harassed incidents might be dangerous because of their size, jaws and tendency to defend themselves (Compagno 1984(a)).
- **Historical pressure:** historic abundance cannot be confirmed but anecdotal reports together with fishery reports and comparative studies in other regions (Bonfil 1997) suggest larger historic numbers. Lemon sharks (*N. brevirostris*) have been targeted for their skin, fins, oil and meat. They do very well in captivity which has led to a large taken for the aquarium trade, and young as objects for physiological and behavioural studies (Compagno 1984(a)).
- **Illegal Take:** despite protection, there is expected to be a certain level of background poaching due to local, national and international trade
- **Incidental catch:** they are easily caught on longline and probably other gear.
- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially beyond the Marine Protected Areas and at dawn and dusk when they are most active.
- **Natural Predators** include few bigger fish, sharks and cetaceans.
- **Tourism:** Their shy and reluctant behaviour around divers makes encounters unlikely but their presence in Cayman waters might still attract tourists.



- **Value:** their economic value is estimated to be very high due to the growing dive industry, it far outnumbers any economic gain that could be made by a dead shark. Their biological and environmental importance adds to that.

#### Associated Habitats and Species for *Lemon Sharks*

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.1 Open Sea 2.M1.2 Coral Reefs 2.M1.3 Lagoons 2.M1.4 Seagrass Beds 2.S2.3 Mangrove	Nassau grouper <i>Epinephelus striatus</i> Southern stingrays <i>Dasyatis americana</i> Queen Conch <i>Strombus gigas</i>

#### Opportunities and Current Local Action for *Lemon Sharks*

The feeding, attracting and taking of sharks is prohibited under National Conservation Law. It is important to enhance enforce the law in the entire EZ, especially at dawn and twilight when they are most active, looking for food. They should be added to the Endangered Species (Trade & Transport) Law.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation are investigating the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value. Despite low abundancy numbers are optimistic compared to other western Atlantic nations.

More research is needed to identify local nursery areas and areas with large populations for better management plans. A study in St. Thomas, United States Virgin Islands (Pickard et al. 2016) has shown seasonal migration of Lemon sharks (*N. brevirostris*) to grouper spawning aggregation sites (SPAGs) which should be studied in more detail locally for better management.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme.

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

#### SPECIES ACTION PLAN for *Lemon Sharks*

See 3.1. Shark - Species Action Plan for Proposed Actions.

### **3.7 Nurse Shark - Species Action Plan**

#### **Nurse shark, *Ginglymostoma cirratum* (Bonnaterre, 1788)**

Nurse sharks, *Ginglymostoma cirratum*, inhabit coral and rocky reefs, channels, mangroves and sand flats at the bottom of inshore continental and insular shelves. It has been suggested that there are at least three geographically isolated populations in the Eastern Atlantic, Western Atlantic and Eastern Pacific (Compagno 1984(b)). After hunting at night they return to their usual resting sight, where they rest motionless in groups, coral reefs or in caves in shallow water during the day (Compagno 2001). They have an age specific habitat partition (Pikitch et al. 2005) and a strong site preference which makes them vulnerable for local overexploitation and habitat destruction (Compagno 2001). Nursery areas are on shallow reefs and turtle-grass beds. They feed on a range of bottom invertebrates, like spiny lobsters, conchs, shrimps, crabs, sea urchins, squid, octopi, snails and bivalves using their powerful suction feeding. They also feed on fish like herring, sea catfish, parrotfish, surgeonfish, puffers and stingrays (Compagno 2001).

The Nurse shark (*G. cirratum*) subpopulation is assessed as Near Threatened by the IUCN Red List of Threatened Species, the population trend is decreasing (Rosa et al. 2006(a)). The South American population is assessed as Vulnerable but the US North Western Atlantic and Bahama population as Least Concern, with Central America lacking information (Rosa et al. 2006(a)). Nurse sharks (*G. cirratum*) have been caught on lines and with gillnets for their thick, tough, armour-like skin, meat is usually used for human consumption or pet food, juveniles are collected for the aquarium trade (Rosa et al. 2006(a)). In the Lesser Antilles they have been seen as pest because of their habit of emptying fish traps (Compagno 1984(b)). Destructive development and extractive industry impacts their essential habitats as well as that of their prey.

The SAP below was prepared by Maria Maily for MCI for the DoE, the draft was last updated 26 August 2016. The format was appropriated for this report, the reverences added to the list at the end of the report.





Picture source: Andy Murch / Elasmodiver.com, <http://www.arkive.org/nurse-shark/ginglymostoma-cirratum/image-G131187.html>. Downloaded on 18 July 2016

### Nurse Shark *Ginglymostoma cirratum*

#### Taxonomy

Kingdom: Animalia, Phylum: Chordata, Class: Chondrichthyes, Order: Orectolobiformes, Family: Ginglymostomatidae, Genus: Ginglymostoma, Species: cirratum.

**Description:** The body is yellow-brown to grey-brown, with broadly rounded dorsal fins, juveniles can have spots or a dorsal saddle. (Compagno 2001). The mouth is small and well in front of the eyes, with moderately long barbels (Compagno 2001).



Range of Nurse Shark (*G. cirratum*).  
Source: FAO Factsheets 2016.

#### Status

**Distribution/Range:** Living on the bottom of inshore continental and insular shelves it has been suggested that there are at least three geographically isolated populations: eastern Atlantic, western Atlantic and eastern Pacific (Compagno 2001).

**Conservation:** The South American population is assessed as Vulnerable whereas the US North West Atlantic and Bahamas populations are of Least Concern, Central America is

lacking information but overall the Western Atlantic subpopulation is listed as Near Threatened and decreasing in the IUCN Red List (Rosa et al. 2006(a)).

**Legal:** Under the National Conservation Law (2013) no sharks may be fed, attracted or taken in Cayman waters.

### Natural History

Nurse sharks (*G. cirratum*) can be found around coral and rocky reefs, channels, mangroves and sand flats, in water between 1-130 meter (3-427 ft) deep (Compagno 2001). The nocturnal species tends to rest in groups of 3 to 36 on sandy bottom, coral reefs or in caves in shallow water during the day (Compagno 2001). After hunting at night they return to their usual resting sight. They have an age specific habitat partition (Pikitch et al. 2005) and a strong site preference which makes them vulnerable for local overexploitation and habitat destruction (Compagno 2001). Nursery areas are on shallow reefs and turtle-grass beds.

With their powerful suction feeding they are able to feed on a range of bottom invertebrates other sharks would struggle with, like spiny lobsters, conchs, shrimps, crabs, sea urchins, squid, octopi, snails and bivalves as well as fish like herring (*Clupeidae*), sea catfish (*Ariidae*), parrotfish (*Scaridae*), surgeonfish (*Acanthuridae*), puffers (*Tetradontidae*) and stingrays (*Dasyatidae*) (Compagno 2001).

Nurse sharks (*G. cirratum*) are ovoviviparous; after a gestation period of five to six month females give birth to 20-30 young in late spring and summer, every other year (Compagno 2001). At birth they are between 27 to 30 cm TL (10-12 in) long, males reach maturity at about 210 cm TL (6.9 ft), females at 225 to 235 cm TL (7.4-7.7 ft), when they are about 15 years old (Compagno 2001). Most adults are under 300 cm TL (9.8 ft) with one report of a 430 cm (14 ft) nurse shark (Compagno 2001).

### Current Factors Affecting Nurse Sharks

- **Debris and Pollution:** Entanglement in ghost nets, fishing lines and other discarded materials causes a significant amount of shark mortality.
- **Habitat loss:** destructive development and extractive industry impacts the habitats, especially of site specific sharks, as well as species they prey on like lobsters, conch and rays.
- **Health and Safety:** Nurse sharks (*G. cirratum*) may be encounter on scuba dives and during other activities in the water. There is little risk unless people attempt to ride, spear, grab or otherwise harass, or accidentally step on the shark, juveniles are more likely to react whereas adult will most likely swim away (Compagno 2001). It is advised to stay calm and treat them with respect.
- **Historical pressure:** historic abundance cannot be confirmed but anecdotal reports together with fishery reports and comparative studies in other regions (Bonfil 1997), have led to the conclusion of a steep decline. Nurse sharks (*G. cirratum*) were targeted for their extremely tough, thick, armour like hide which makes good leather (Compagno 2001) in some regions the species has thus disappeared. On the Cayman Islands the targeted killing of pregnant female Nurse sharks (*G. cirratum*) resting in groups in shallow water for their skin lead to a sharp decline in their population in 1940s, and the consequent sharking industry collapse (National Trust 2011). They tend to empty fish traps for food (Compagno 2001) which caused some fishermen to kill them as preventative measure.

They have been taken for the aquarium trade, for their fins and liver oil and meat for human consumption and fish meal.

- **Illegal Take:** despite protection, there is expected to be a certain level of background poaching due to local, national and international trade
- **Incidental catch:** they are easily caught in inshore line gear, gill net, fixed bottom nets and bottom trawls fisheries.
- **Legal:** Sharks have recently been protected in Cayman Waters but enforcement will remain of key importance, especially at night.
- **Natural Predators** include few bigger fish, sharks and cetaceans.
- **Tourism:** They are a major attraction for the diving industry because of their sluggish behaviour and resting in shallow areas during the day time (Compagno 2001).
- **Value:** their economic value is estimated to be very high due to the growing dive industry, it far outnumbers any economic gain that could be made by a dead shark. Their biological and environmental importance adds to that.

### Associated Habitats and Species for Nurse Sharks

ASSOCIATED HABITAT PLANS	ASSOCIATED SPECIES PLANS
2.M1.2 Coral Reefs	Southern stingrays <i>Dasyatis americana</i>
2.M1.3 Lagoons	Spiny Lobster <i>Panulirus argus</i>
2.M1.4 Seagrass Beds	Queen Conch <i>Strombus gigas</i>
2.S2.3 Mangrove	

### Opportunities and Current Local Action for Nurse Sharks

The feeding, attracting and taking of sharks is prohibited under National Conservation Law. It is important to enhance enforcement especially at night when they are active, looking for food. They should be added to the Endangered Species (Trade & Transport) Law.

Since 2009 the Department of Environment, Marine Conservation International and the Save our Seas Foundation are investigating the status and value of sharks. The first report published in 2012 highlighted the direct and indirect value. Despite low abundance numbers are optimistic compared to other western Atlantic nations. More research is needed to identify local nursery areas and areas with large populations for better management plans.

Sharks are listed as a seafood to “Avoid” under the Cayman Sea Sense education programme.

The Department of Environment, Marine Conservation International and CayBrew have teamed up to create White Tip Lager. Along with donating five cents from the purchase price of each can to Cayman Sharks they spread positive awareness about sharks.

### SPECIES ACTION PLAN for Nurse Sharks

See 3.1. Shark - Species Action Plan for Proposed Actions.

### **3.8 Elasmobranch Conservation Plan**

The Elasmobranch Conservation Plan was drafted in collaboration with MCI and the DoE, last updated 02 August 2016. Its' Appendix contains the proposed Shark and Ray handling and release guide.

The Conservation Plan was designed to be a refinement of the already existing legislations; no completely new regulations were allowed to be introduced so the first drafts had extensive footnotes and Appendices of exact workings and definitions of the Marine Conservation Plan and National Biodiversity Plan that were later removed once it was confirmed that it was within the limits set out by them. It also had examples from different management plans and legislations used by other nations. Batoids were added so no separate plan had to be produced for them at a later stage.

Space Reserved For Council Logo	<b>ELASMOBRANCH CONSERVATION PLAN</b>
	CONSERVATION PLAN # [00x] DATE OF EFFECT: [DD Month YYYY]
National Conservation Law 2013: Section 17 Take of protected species is permitted only in accordance with this Conservation Plan	

**Contravention of this Species Conservation Plan may constitute an offence under Sections 31(1) and 33 of the National Conservation Law, 2013.**

#### **SCOPE**

**THIS SPECIES CONSERVATION PLAN SETS OUT THE RULES FOR CONSERVATION OF ALL ELASMOBRANCH SPECIES AND THEIR HABITATS. IT INCLUDES STATUTORY PROVISIONS FROM THE NATIONAL CONSERVATION LAW, 2013, REGULATIONS AND DIRECTIVES MADE THEREUNDER AND FROM THE MARINE CONSERVATION LAW (2013 REV.), REGULATIONS AND DIRECTIVES THEREUNDER.**

**IN THE EVENT OF ANY INCONSISTENCES BETWEEN THE LAWS, THE REGULATIONS AND THE DESCRIPTION OF SUCH STATUTORY PROVISIONS IN THIS PLAN THE STATUTORY PROVISIONS SHALL PREVAIL.**

#### **SPECIES COVERED BY THE PLAN**

**THE SPECIES COVERED BY THIS CONSERVATION PLAN SHALL INCLUDE ALL SPECIES OF THE BIOLOGICAL SUB-CLASS ELASMOBRANCHII INCLUDING**

ALL SPECIES OF SHARKS (SUBDIVISION SELACHII) AND ALL SPECIES OF RAY, SKATE<sup>1</sup> AND SAWFISH<sup>2</sup> (SUBDIVISION BATOIDEA).

Scientific Sub-class	Scientific Sub-Division	Scientific Order	Common Name	Schedule Part
Elasmobranchii	Selachii		All Extant Sharks	1
Elasmobranchii	Batoidea	Myliobatiformes	Sting Rays	1
Elasmobranchii	Batoidea	Torpediniformes	Electric Rays	1
Elasmobranchii	Batoidea	Rajiformes	Skates	1
Elasmobranchii	Batoidea	Pristiiformes	Sawfish	1

THE SPECIES COVERED BY THIS CONSERVATION PLAN SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING COMMONLY OCCURRING SPECIES.

Scientific Name	Common Name
<i>Carcharhinus falciformis</i>	Silky shark
<i>Carcharhinus limbatus</i>	Blacktip shark
<i>Carcharhinus longimanus</i>	Oceanic whitetip shark
<i>Carcharhinus perezi</i>	Caribbean reef shark
<i>Galeocerdo cuvier</i>	Tiger shark
<i>Ginglymostoma cirratum</i>	Nurse shark
<i>Negaprion brevirostris</i>	Lemon shark
<i>Rhincodon typus</i>	Whale shark
<i>Sphyrna lewini</i>	Scalloped hammerhead shark
<i>Sphyrna mokarran</i>	Great hammerhead shark
<i>Aetobatus narinari</i>	Spotted eagle ray
<i>Dasyatis americana</i>	Southern Stingray
<i>Manta alfredi</i>	Reef manta ray
<i>Manta birostris</i>	Giant manta ray

## PROTECTION MEASURES & CRITICAL HABITAT

### 1) Regulation of Take, Possession and Sale

- It is an offense without a permit or licence to take from the wild, possess, sell or cause to be taken, possessed or sold any Shark or Ray or Skate or Sawfish of any species.<sup>3</sup>
- It is an offense without a permit or licence intentionally to harass or cause stress to any species of Shark or Ray or Skate or Sawfish.
- It is an offense without a permit or licence to possess or sell or cause to be sold any part of a Shark or Ray or Skate or Sawfish, taken from Cayman waters.

<sup>1</sup> Two species of ray (*Rajana eglanteria* & *R. texana*) occur in Florida, and may be expected to occur occasionally in Cayman waters.

<sup>2</sup> All species of sawfish are considered threatened and in need of protection. The Cayman Islands are within the distribution area of two species of sawfish (*Pristis pectinata* & *P. pristis*) although both are rare, giving force to their need for protection.

<sup>3</sup> According to the National Conservation Law 2013. Part I, 2. In this Law- "Specimen" means an animal or plant, whether live or dead, or any part or derivative thereof and includes, in the case of an animal, an egg, sperm, gamete or nest (...). "Take" means to collect, hunt, kill, destroy, damage, injure, disturb, harass, harm, wound, capture, molest or impede a live specimen in any way or to attempt to do so, and includes incidental taking.

2) Release of Incidental Catch

- a) Where a Shark or Ray or Skate or Sawfish is caught unintentionally on a hook or in a net or trap or by other means it should be released in to the sea as soon as practicable and in such a way as to cause the minimum practical amount of harm or stress to the animal.
- b) It is an offense not to release in to the sea as soon as practicable and with the minimum of harm any Shark or Ray or Skate or Sawfish taken or caught intentionally or unintentionally in Cayman waters.
- c) The method used to release a hooked Shark or Ray or Skate or Sawfish should follow as closely as practicable the guidelines attached to this Plan.

3) Feeding of Sharks or Rays

- a) It is an offense to, without a permit under the National Conservation Law, feed or attract with food or cause to be fed or attracted with food any Shark.
- b) Stingrays may be fed as a form of wildlife interaction as allowed within the regulations or management plan of a designated Protected Area.
- c) Where anyone, not being authorised or permitted by the National Conservation Law, puts food, fish heads or offal, or other material which may attract fish in the water, and more than one shark becomes visible at any time in the vicinity of the activity and does not stop while the sharks are visible and for 10 minutes thereafter, commits an offence.

4) Critical Habitat

- a) At this time there is no one single area of Critical Habitat considered essential to the survival of any species of elasmobranch within the Cayman Islands.

## **SPECIES SUCCESS CRITERIA & COST ESTIMATES**

### **17. (3) (a) (i)**

The measures described in this Conservation Plan shall be considered to have been successful where in relation to an individual species of Shark, Ray, Skate or Sawfish

- a) The abundance of that species in the Cayman Islands shall have returned to (80% to be revised) or more of the abundance demonstrated by scientific studies to be characteristic of comparable parts of the Caribbean where that species has been unaffected by human activity; and
- b) In the case of an individual species protected by or listed within an international convention, that species has been de-listed as a result of its population recovery; and
- c) There is a species-specific Species Conservation Plan in place for that species.

### **17. (3) (a) (ii)**

The estimated time required to carry out these measures cannot be estimated accurately.

The **costs** involved to carry out these measures: Estimated to be \$60,000 per year for dedicated research and enforcement activities aimed towards managing elasmobranchs in the Cayman Islands.

## **EXEMPTIONS FROM THIS LAW**

- For the purposes of research, the Department of Environment, employees, agents and volunteers, may take protected species.
- Permits may be issued to take protected species for research and monitoring purposes.

## **GUIDELINES FOR RELEASING SHARKS AND RAYS**

**Fishers in the event that they unintentionally catch a Shark or Ray that is required to be released are recommended to follow the advice set out below:**

### **Safety Precautions**

Sharks and stingrays should be handled with great care.

- Keep hands away from a shark's mouth and teeth.
- Be aware of the risk that a thrashing body or tail which may also cause injury
- A basic First Aid Kit should be carried on board or be otherwise available.
- Where practicable restrain the head of the shark by attaching the leader or line near the animal's head to a cleat or other attachment point.
- If necessary and where practicable restrain the tail of the shark by applying a tail rope that is attached to a cleat or other attachment point several feet away from the cleat to which the leader is attached, in order to keep the shark immobilized.
- Following removal of a hook handle and dispose of it with care to avoid it being leaned on or stood on.

### **Handling the Shark or Ray**

- Throughout the catch and release process so far as at all possible keep the shark or ray in the water e.g. by bringing it alongside the boat and removing the hook by leaning over the side of the boat. Do not bring the shark or ray on to the boat or land.
- The internal organs of many species of shark are only loosely held in place by connective tissue. In the water, these organs are supported, but if the shark is lifted by the tail, the tissue may tear, causing damage to the organs.
- If possible, secure the shark or ray as described above by tying the leader and a tail rope to cleats or other secure points several feet apart.
- Where practicable turn the shark or ray on to its back by holding its pectoral fins or wings – many sharks and rays when held in this position will enter a state of tonic immobility akin to hypnosis and lie relatively still until released. This is best done by a second person to the person removing the hook.

### **Removing the Hook**

- Remove the hook as soon as possible following catching of the shark.
- Using pliers, remove the hook by backing it out the way it went in.
- If the hook cannot be removed or the fish is hooked deeply in its mouth or throat using wire-cutters cut the leader as close to the hook as possible.
- Loosen the tail rope and be ready to slip it immediately the hook is removed or the leader cut.

### **GENERAL FISHERY RECOMMENDATION:**

- Use non-offset, non-stainless steel circle hooks. Circle hooks tend to hook fish in the jaw, making them easier to remove. Non-stainless hooks will corrode away faster if they are left in released fish or if the fish gets away. This will allow the hooks to fall out or possibly digested by (passed out of) larger fish.

## 4. DISCUSSION

The National Conservation Law was amended to make the Cayman Waters a shark sanctuary one year ago, the next chapter will review the SAPs and Elasmobranch Conservation Plan, the problems that still need to be faced and actions that need to be taken next. A review of the work done for this project follows and finally the chapter ends with a conclusion to this report.

### **4.1 Major issues**

The biggest issue in creating the SAPs was lack of access to data; not knowing what the current population is, their behaviour or preferred area or nursery made it hard to advice on actions to be taken to improve the status of the population. The geographic difference of the area, to studies around the Central Western Atlantic suggest a number of studies but makes it hard to apply their findings with any confidence. For example, because the shallow water is confined to such a small area before dropping down, compared to the east coast of the US and Brazil, are they more likely to dive deeper than those other subpopulations or stay closer to shore and hence have smaller ranges. Not knowing the number of the population also makes it hard to know if numbers are steady, dropping or increasing and hard to compare to other regions.

Enforcement is a key issues for all regulations, since the number of local coastal fisheries is small the threat is comparatively small and illegal takes are most likely minimal close to the coast. But as has been pointed out for species with a wider range and highly migratory species it is crucial to make sure the enforcement is enhanced in the entire EEZ, so IUU is at least within the sanctuary at a minimum. Highly migratory species are often at greatest threat because the high seas are least regulated and even within EEZs countries often struggle to enforce regulations.

As long as only few countries protect or sustainably manage sharks within their waters, many migratory species are under major threat and bound to keep declining in most of the oceans. In the Central Western Atlantic are seven shark sanctuaries at the moment, as listed in table 4, the biggest being The Bahamas, followed by Honduras and the Cayman Islands (The Pew Trust 2016, MPATLAS 2016). See a map for the Sanctuaries in the Central Western Atlantic in figure 9.



**Table 4: Shark Sanctuaries in the Central Western Atlantic** (The Pew Trust 2016, MPATLAS 2016).

Name	Established	Size
Bahama Shark Sanctuary	2011	629,293 km <sup>2</sup>
Honduras Shark Sanctuary	2011	240,240 km <sup>2</sup>
Venezuela Shark Sanctuary (Roques Archipelago)	2012	3,730 km <sup>2</sup>
British Virgin Islands Shark Sanctuary	2014	80,117 km <sup>2</sup>
Cayman Islands Shark Sanctuary	2015	119,134 km <sup>2</sup>
Yarari Sanctuary (Bonaire & Saba)	2015	17,739 km <sup>2</sup>
Sint Maarten Shark Sanctuary	2016	499 km <sup>2</sup>

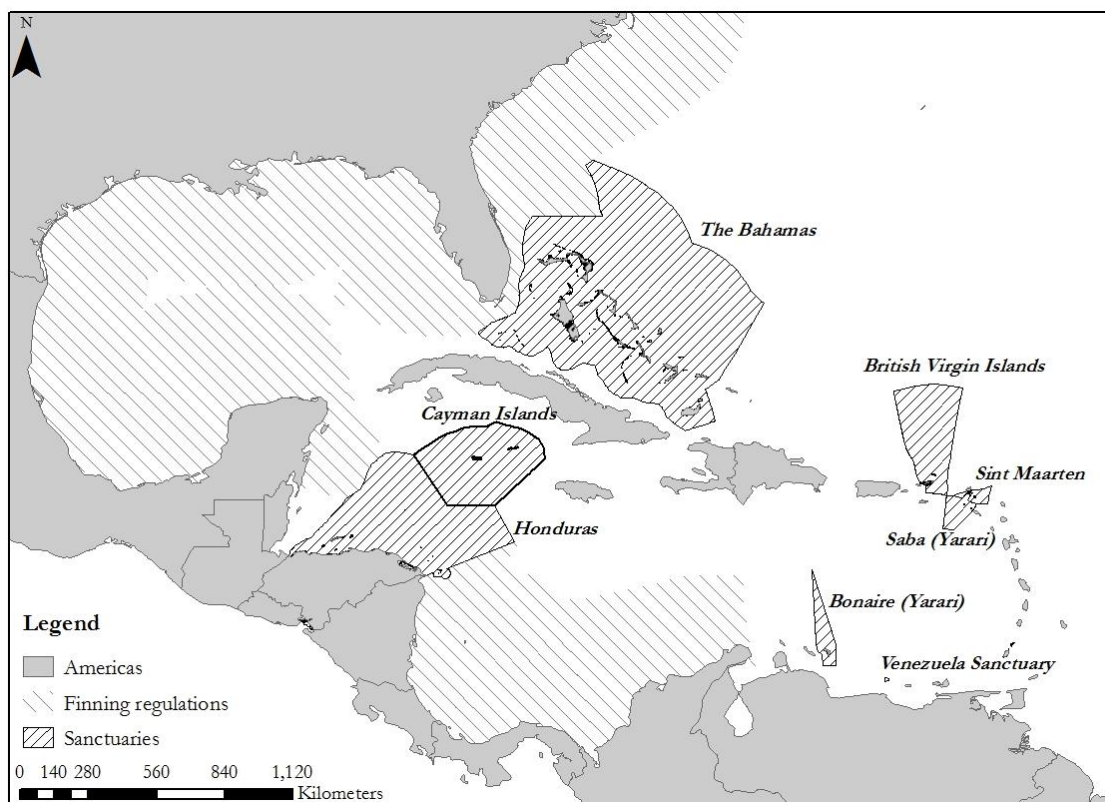


Figure 9: Map of shark sanctuaries and areas with shark fishery regulations in the Central Western Atlantic (information source: MPATRUST 2016, The Pew Trust 2016, WildAid 2016)

Figure 9 also shows countries that have shark fishing and specifically finning regulations. According to WildAid (2016) in Costa Rica, Colombia, Panama industrial fisheries, and the United States fins must be attached when sharks are landed, Nicaragua and Panama artisanal fisheries have a 5% of the total weight limit and Mexico has a shark finning ban as well as a fishing ban between May and August. Despite these improvements looking at the map above (figure 9) it is clear that much of the Central Western Atlantic is still unregulated and migratory species under much threat as well as IUU is very likely.

Having a large population and even larger number of tourists on a small island group leaves little space for consideration regarding the environment. Social and economic needs are usually placed above the environment, so mangroves are cut back, the sea floor dredged, resources exploited and the environment polluted. These actions can be limited with things like environmental impact assessment or getting the public to join the collection of fishing lines and sea turtle protection, but positive actions like these from the actions are usually rare.

New Marine Park zoning has been proposed, so the focus right now is more on these rather than species plans, especially for species that already have full protection. It might be considered as an approach to sustainably manage the ecosystem as a whole to improve the status of the individual species. As so often in politics and economics for the DoE the priority is on the next biggest economically valuable fish that have not been protected so far, which are Mutton and Grey Snapper, which was the reason for adding them to the assigned species list. As the biggest species are exploited and the yield drops, fisheries will fish down the food chain, targeting the next biggest fish in turn and possibly start fishing sharks for human consumption. Locally the fishermen are split between supporting greater protection and those who are against it.

Apart from having limited information on the species in focus, so far there are only six SAPs, four of the most common shark species and Batoides, apart from the Southern Stingray (*D. Americana*), are still missing. Which is why the shark SAP and Conservation Action Plan are vague to include as many species as possible.

## **4.2 Further Actions**

The next step that has to follow is adding the local data into the plans, revising the plans so they can be put to the public and Cayman Island Government for consideration. Once they are implemented steps will have to be taken to enforce the Conservation Action Plan and possibly some of the steps advised in the SAPs. Some of the steps would include identifying essential information about the local species and their habitats and nursery grounds, frequent monitoring of the populations, enhancing enforcement throughout the entire EEZ and working with the public and neighbouring or regional governments to increase shark conservation around the Caribbean and the Central Western Atlantic.

Some of the studies that were proposed would include studying the vertical movement of some of the species (Caribbean reef shark (*C. perezi*), which might show different results compared to other studies in the region (Chapman et al. 2007, Vaudo et al.

2014) due to the unique geography of the Caymans with a small band of shallow water before it drops down to some of the deepest points in the Central Western Atlantic. Another would be the importance of SPAGs for some of the shark populations, examples would be a similar study of Lemon sharks (*N. brevirostris*) by Pickard (2016). By increasing information about the species next steps about their protection can be proposed like protecting essential habitats.

One year into the full protection is too soon to judge if the protection has had any effect at all. But either way all sharks should be added to the Endangered Species (Trade & Transport) Law not only to introduce CITES to the national legislations but also so it matches the National Conservation Law and the legislation has greater effect.

Despite the negative media image sharks globally are usually victims of, the public has been positive toward the protection of sharks in Cayman Waters and has been further improved with efforts like SharKYfest and the White Tip Lager by CayBrew. Public awareness and involvement need to continue to increase so they become as passionate about shark protection as they are about marine turtles. As for many other issues public awareness and involvement are key to making a management plans work. One example of this attempt to improve it is the introduction of a citizen science project Spot that Cayfish, where people have been asked, especially during diving and snorkelling, to note when they see sharks. Overall the public will profit over long term due to the improvement of the ecosystem.

Sharks have been assessed to have a direct and indirect value of US\$ 80 to US\$ 130 (DoE et al. 2012) at the moment, which could increase with an increasing number of sharks. Shark sanctuaries can increase the number of tourist drawn to a place, due to the already high numbers on the islands this could turn into a negative effect to the environment if not properly regulated and controlled. It is advised not to open the islands to shark feeding dives.

### **4.3 Main Problems in the Project**

Although interesting, there were a number of issues during the project. Firstly, there was no access to the local data gather by MCI and the DoE as was originally planned, or join the team gathering information, apart from three days. Secondly there were issues in the data collection, leading to a postponement of the analysis beyond the time limit of this report. The project was during a busy time with many of the people occupied otherwise leaving little time to review my work or get feedback, leading to the plans being very vague and barely more than first drafts. Due to time pressure, lack of feedback and communication there was no time to review and compare the management plans in different nations.

## **4.4 Conclusion**

To summaries this dissertation, chapter one is an introduction to the study area, international and national legislations, sharks, threats facing them and the environment as well as stating the aims and objectives of the study. After presentation of the methods and a literature review in chapter two, chapter three presents the Species Action Plans and Elasmobranch Conservation Plan drafts prepared for the Department of Environment. Finally, chapter four is a review of these plans, their major issues and further work suggested by them.

I believe the work I carried out and the plans prepared is a major step towards shark conservation in the Cayman Islands, which might improve the status of the sharks in the Central Western Atlantic overall. I think this work is important because sharks are an important part of the marine ecosystem and biodiversity. Globally shark populations are being dramatically reduced and I hope that this work and the creation of shark sanctuaries will counteract this decline and the fatal consequences of it.

To improve the work carried out in this project the local population data needs to be added to the Species Action Plans and the advice section revised and finally presented to the public. The Elasmobranch Conservation Plan needs to be presented to the public and the Cayman Island Government to be put into action.

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