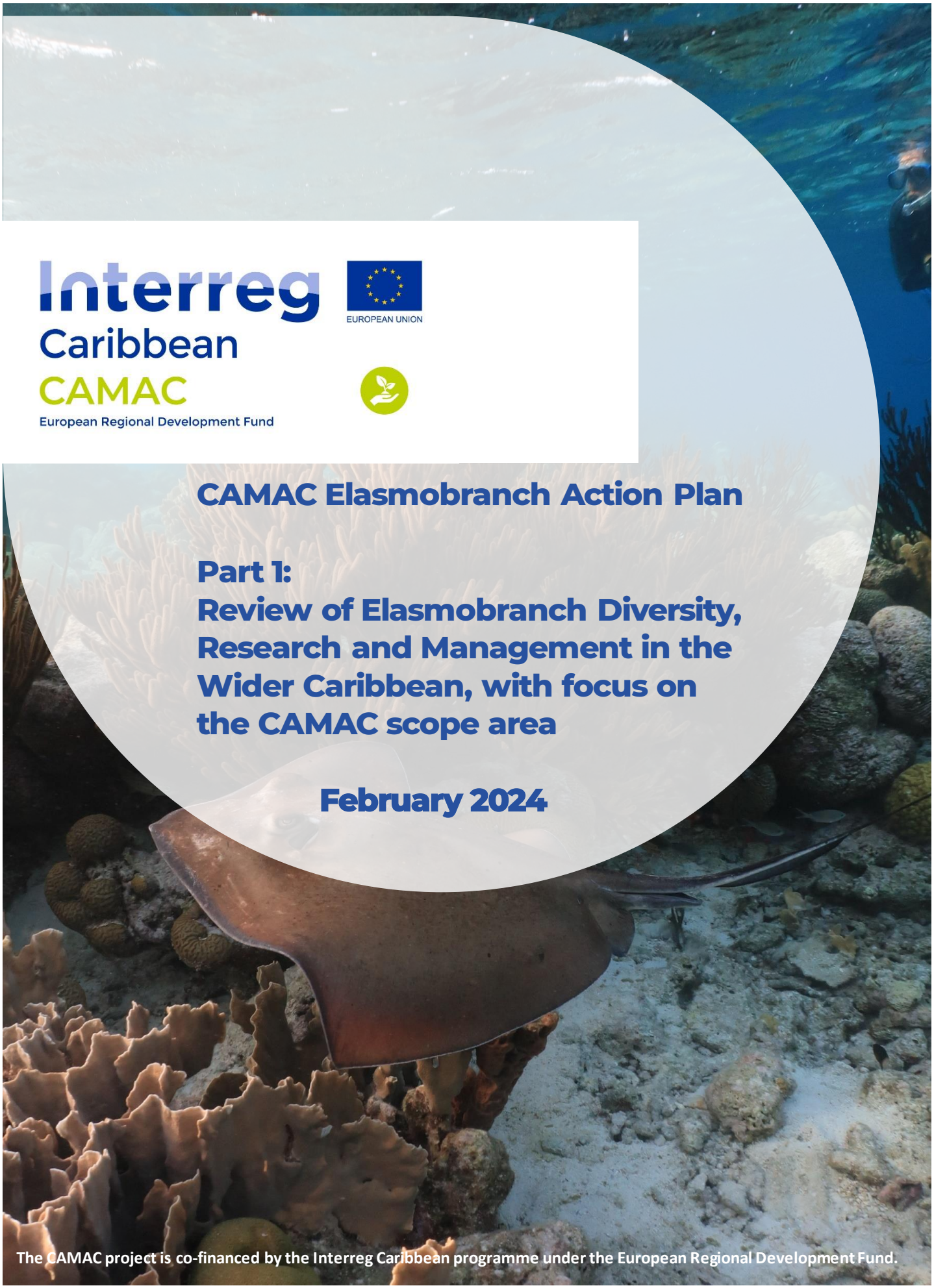

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CAMAC Elasmobranch Action Plan

Part 1:
Review of Elasmobranch Diversity, Research and Management in the Wider Caribbean, with focus on the CAMAC scope area

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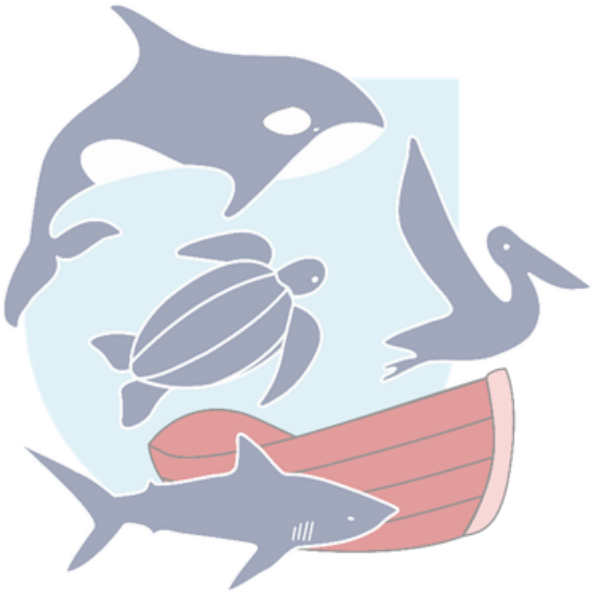

CAMAC Elasmobranch Action Plan

Part 1: Review of Elasmobranch Diversity, Research and Management in the Wider Caribbean, with focus on the CAMAC scope area

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CAMAC project

This report was drafted tin the framework of the CAMAC project. CAMAC stands for CAribbean marine Megafauna and anthropogenic Activities; it is a 4-year project (2023-2027) co-funded by the European Union and led by the Agoa Sanctuary and the SPAW RAC. It aims to enhance regional collaboration and better characterize interactions between marine megafauna and human activities, in order to provide Caribbean governing bodies and environmental stakeholders with recommendations and tools to reduce the negative anthropogenic impacts.

Content

1 Executive summary

1.1 English

CAMAC scope area

The CAMAC scope area can be divided into three sections when looking at bathymetry and ocean currents. To the North, there is a deep trough between Cuba and Jamaica and several large islands (Hispaniola, Jamaica and Puerto Rico) with intricate coastlines that have a multitude of habitats. To the East, there is the lesser Antilles Island chain that is characterized by smaller, often volcanic, islands that lie very close together. Lastly there is the part on the South American mainland from Venezuela to French Guyana. The ocean in this area is fed by nutrient rich waters from the Orinoco and the Amazon. The island of Tobago forms the border between the Eastern and Southern sections.

This different oceanographic and ecological conditions lead to varied elasmobranch assemblages and abundances. The most notable difference is between the South American coast and the parts of Insular Caribbean that are more open to the Atlantic Ocean. The murky coastal waters along the continent have many bottom dwelling ray species as well as small sharks that feed on the abundant crustaceans, whilst the clear waters to the North and East have larger sharks that feed on teleost fish and other larger marine species.

Species diversity in CAMAC area

Overall, the area is highly diverse with over 80 shark species observed, including several genera of deep-water sharks. There are also over 40 skates and rays, including critically endangered sawfishes and 4 species of chimaera. As few of the countries within the CAMAC scope have dedicated shark and ray research in their waters, the actual number of species present in the area could be higher.

All elasmobranch species listed on Annex 2 and 3 of the SPAW protocol are present in the CAMAC scope area although whale sharks only seem to be migrating through the area:

I. Although there are few recent confirmed sightings of either of the two sawfish species, both smalltooth sawfish (*Pristis pectinata*) as well as largetooth sawfish (*Pristis pristis*) are still thought to be present in Venezuela, Guyana, Surinam and French Guyana. Small tooth is thought to be present in the waters of Jamaica and possibly Haiti. In the CAMAC scope area, the populations are severely depleted due to overfishing and habitat loss. Its unique morphology, particularly the rostrum, heightens its susceptibility to entanglement in fishing gear. Crucial estuarine, mangrove, and freshwater habitats have been compromised, posing a substantial risk to the species.
II. The oceanic whitetip shark (*Carcharhinus longimanus*) occurs throughout the CAMAC scope area. Although the species can be found offshore at depths of up to 1000 m, it is often found in the upper part of the water column near the surface. Sightings in the north near Haiti are almost exclusively neonates and juvenile individuals, which leads to the hypothesis that this is a nursery area for the species. Further south, off Venezuela, both juveniles and adults are caught. Of the adults, around 60% are females.
III. The Caribbean reef shark (*Carcharhinus perezi*) is a dominant predator and a keystone species in the marine ecosystems of the Caribbean region. The population status of this species has seen a significant decline over the past decades. Historically, this species was abundant throughout the Caribbean region, but due to overfishing and habitat degradation, its population has experienced a decline of approximately 30% over the last ten years, signaling a cause for concern.

IV. The silky shark (*Carcharhinus falciformis*) is a pelagic species that can move over long distances, it has a circumtropical distribution and occurs in the CAMAC scope area. However, information on the silky shark in the Caribbean is very limited, and the biology and ecology of the species and its subpopulations in the region are largely unknown.

V. Three hammerhead species - great hammerhead (*Sphyrna mokarran*), scalloped hammerhead (*Sphyrna lewini*) and smooth hammerhead (*Sphyrna zygaena*) are present in the waters of all countries in the CAMAC scope area, with most information available on the scalloped hammerhead. For this species, nursery areas have been identified in Puerto Rico to the North and Trinidad to the South of the region, with a suspected aggregation site in the waters of St Lucia. Longline data from Venezuela shows that all 3 hammerheads are regularly bycaught in tuna fisheries. The South American coastline (Venezuela to French Guiana) has a higher diversity of hammerhead species.

VI. The oceanic manta ray (*Mobula birostris)* is the largest ray species in the world and is widely distributed throughout the tropical and subtropical oceans of the world. It appears to spend much of its time in the open ocean away from reefs, diving hundreds of meters into the deep scattering layer to find its zooplankton prey. In the CAMAC scope area, it has been seen off the coasts of French Guiana, Suriname and Venezuela and is often found in areas relatively close to land formations, i.e. continental slope, rises/seamounts, islands and reefs in the region.

Research in the CAMAC scope area

The research on elasmobranchs effort within the CAMAC scope area is limited compared to other regions within the Wider Caribbean region, like Florida and the Gulf of Mexico. This is particularly prevalent in the lack of long-term monitoring studies and very few telemetry studies that have been carried out in comparison to those done in waters closer to Florida. Many countries have participated in BRUV studies, often through Global Fin Print, which provides a baseline for shark abundances that can be compared to other areas. However, as these studies were mainly done on reef sites, they provided only limited information, especially for places where the BRUV drops were limited to only a few locations, depth or a short time frame. In places where more in depth research was possible, this invariably provides insight into complex patterns of biology and behavior. For example, telemetry studies in the Dutch Caribbean found variations in habitat use for different reef associated and coastal species. There are many NGOs throughout the region who engage in some form of data collection or monitoring, but this is rarely published in peer reviewed publications due to lack of capacity and funds. In addition, there is no central database for storing or accessing information related to species and habitat.

Almost all countries have some form of fisheries data collection; for most, this is based on landings data where a sample of catches is described when fishers bring them into port. The accuracy of this data depends greatly on the personnel available, as well as the logistics of the fishery (number of landing sites, accessibility, number of fishers). Countries that are member of ICCAT (International Convention for the Conservation of Atlantic Tuna) are obligated to report on catches of sharks on an annual basis, in particular on species that have catch prohibitions or restrictions under ICCAT, such as the oceanic whitetip shark.

While there is some research on sharks for the CAMAC scope area, the research on batoids is virtually non-existent. Both in fisheries dependent and independent research, very few studies could be found on rays and skates and most countries collect only limited data on them in their fisheries monitoring. As a consequence, there is also little information on the fishing pressure on batoids.

Elasmobranch protection and management

Internationally, some species are protected under the Convention of Migratory Species (CMS) and the CMS MoU sharks. Trade in endangered species is regulated through the Convention on International Trade in Endangered Species (CITES) and pelagic fisheries are regulated through ICCAT. As these conventions provide general restrictions and direction, they can only be meaningfully implemented if there is also regional and local legislation in management.

Cross border legal species protection for the Wider Caribbean Region is established through the Cartagena Convention and coordinated based on the Special Protection for Areas and Wildlife Protocol (SPAW) of the convention. Endangered or threatened species present in the region can be listed on the annexes of this protocol to mandate legal protection in countries that have ratified the protocol. Twelve species of sharks and rays are found in these annexes. The Western Central Atlantic Fisheries Commission (WECAFC) was set up to help regulate fisheries for the Wider Caribbean. In 2022, the WECAFC adopted a Regional Plan of Action for the Protection of sharks which endeavors to streamline sustainable management of sharks in the region and formulate joint actions for the WECAFC members.

At a national level there is great variance in elasmobranch management. Where some countries have banned all fisheries for them, others have no restrictions on catches and landings. Although most Marine Protected Areas (MPAs) within the CAMAC scope area are not established for the protection of sharks and rays some of the larger existing MPAs protect essential habitat for them. All experts interviewed indicated that control and enforcement capabilities were inadequate to effectively implement any management measures in fisheries.

Conclusion

This review shows that even though there is a high diversity of elasmobranchs in the CAMAC scope area, including many endangered species, and that the region harbors many suitable habitats for elasmobranchs, research on these animals is limited and protective measures are not implemented consistently throughout the region.

Many of the elasmobranch species in the area are migratory or highly migratory. One of the issues highlighted by many of the experts interviewed, is the need for enhanced collaboration between countries in order to exchange information and give mutual support to adequately understand and manage these species across their distributional range.

1.2 Español

La zona cubierta por el proyecto CAMAC

El área cubierta por el proyecto CAMAC puede dividirse en tres zonas en función de la batimetría y las corrientes oceánicas. Al norte, hay una profunda depresión entre Cuba y Jamaica y varias islas grandes (La Española, Jamaica y Puerto Rico), con costas complejas que ofrecen multitud de hábitats. Al este, la cadena de las Antillas Menores se caracteriza por islas más pequeñas, a menudo volcánicas, muy próximas entre sí. Por último, está la zona continental sudamericana, que se extiende desde Venezuela hasta la Guayana Francesa. En esta región, el océano se alimenta de las aguas ricas en nutrientes de los ríos Orinoco y Amazonas. La isla de Tobago constituye el límite entre la parte oriental y la meridional.

Estas diferentes condiciones oceanográficas y ecológicas provocan variaciones en los ensamblajes y la abundancia de las especies de elasmobranquios. La diferencia más notable se da entre la costa sudamericana y el Caribe insular, más abierto al océano Atlántico. Las turbias aguas costeras del continente albergan muchas especies de rayas que viven en el fondo y pequeños tiburones que se alimentan de los crustáceos tan abundantes en la zona, mientras que las aguas claras del norte y el este albergan tiburones más grandes que se alimentan de peces teleósteos y otras especies marinas de mayor tamaño.

Diversidad de especies en la zona CAMAC

En general, la zona es muy diversa, con más de 80 especies de tiburones observadas, incluidos varios géneros de tiburones de aguas profundas. También hay más de 40 especies de rayas, entre ellas el pez sierra, en peligro crítico, y 4 especies de quimeras. Dado que pocos países de la zona CAMAC llevan a cabo algo más que investigaciones ad hoc sobre tiburones y rayas en sus aguas, el número real de especies presentes en la zona podría ser mayor.

Todas las especies de elasmobranquios enumeradas en los Apéndices 2 y 3 del Protocolo SPAW están presentes en la zona CAMAC, aunque parece que los tiburones ballena sólo migran a través de la zona.

I. Aunque hay pocos avistamientos recientes confirmados de pez sierra peine (*Pristis pectinata*) y pez sierra común (*Pristis pristis*), se considera que ambas especies siguen estando presentes en Venezuela, Guyana, Surinam y Guayana Francesa, así como probablemente en aguas de Jamaica y posiblemente Haití. En la zona de intervención del CAMAC, las poblaciones de pez sierra están gravemente mermadas debido a la sobrepesca y a la pérdida de hábitat. La morfología única de este taxón, en particular su rostrum, aumenta su vulnerabilidad a los enredos en las artes de pesca. Los hábitats críticos de estuarios, manglares y agua dulce se han degradado, lo que supone un grave riesgo para la especie.

II. El tiburón punta blanca oceánico (*Carcharhinus longimanus*) está presente en toda la zona cubierta por el proyecto CAMAC. Aunque la especie puede observarse mar adentro a profundidades de hasta 1.000 m, a menudo se encuentra en la parte superior de la columna de agua, cerca de la superficie. Los avistamientos en el norte, cerca de Haití, son casi exclusivamente de recién nacidos y juveniles, lo que lleva a la hipótesis de que se trata de una zona de reproducción de la especie. Más al sur, frente a Venezuela, se capturaron juveniles y adultos. De los adultos, alrededor del 60% eran hembras.

III. El tiburón de arrecife del Caribe (*Carcharhinus perezi*) es un gran depredador y una especie clave en los ecosistemas marinos de la región del Caribe. El estado de la población de esta especie ha disminuido significativamente en las últimas décadas. Históricamente, esta especie era abundante en

toda la región del Caribe, pero debido a la sobrepesca y a la degradación del hábitat, su población ha disminuido alrededor de un 30% en los últimos diez años, lo que es motivo de preocupación.

IV. El tiburón sedoso (*Carcharhinus falciformis*) es una especie pelágica que puede recorrer grandes distancias, tiene una distribución circuntropical y está presente en la zona del CAMAC. Sin embargo, la información sobre el tiburón sedoso en el Caribe es muy limitada, y la biología y ecología de la especie y sus subpoblaciones en la región son en gran parte desconocidas.

V. Tres especies de tiburón martillo - el tiburón martillo gigante (*Sphyrna mokarran*), el tiburón martillo festoneado (*Sphyrna lewini*) y el tiburón martillo liso (*Sphyrna zygaena*) - están presentes en las aguas de todos los países de la zona CAMAC. La mayor parte de la información disponible se refiere al tiburón martillo festoneado. Se han identificado zonas de reproducción de esta especie en Puerto Rico, al norte, y en Trinidad, al sur, y se sospecha que hay un lugar de concentración en aguas de Santa Lucía. Los datos de pesca con palangre de Venezuela muestran que los tres tiburones martillo se capturan regularmente en las pesquerías de atún.

VI. La manta raya oceánica (*Mobula birostris*) es la especie de raya más grande del mundo y está ampliamente distribuida en los océanos tropicales y subtropicales del planeta. Parece pasar la mayor parte del tiempo en mar abierto, lejos de los arrecifes, sumergiéndose cientos de metros en la capa de dispersión profunda para encontrar sus presas de zooplancton. En la zona CAMAC, se ha observado frente a las costas de Guyana Francesa, Surinam y Venezuela, con mayor frecuencia en el talud continental, montes submarinos, islas y arrecifes.

Investigación en la zona CAMAC

La investigación sobre elasmobranquios en la zona CAMAC es limitada en comparación con otras partes del Caribe, como Florida y el Golfo de México. Esto es especialmente obvio a la vista de la falta de estudios de seguimiento a largo plazo y de los pocos estudios de telemetría que se han llevado a cabo en comparación con los realizados en aguas más cercanas a Florida. Muchos países han participado en estudios de la BRUV, a menudo a través del proyecto Global Fin Print, que proporciona una base de referencia de la abundancia de tiburones que puede compararse con otras zonas. Sin embargo, como estos estudios se han llevado a cabo principalmente en lugares de arrecifes, sólo han proporcionado información limitada, sobre todo cuando las sueltas de BRUV se han limitado a unos pocos lugares, a unas pocas profundidades o durante un corto periodo de tiempo. En los casos en que ha sido posible una investigación más profunda, ésta ha revelado invariablemente patrones complejos de biología y comportamiento. Por ejemplo, los estudios de telemetría en el Caribe neerlandés han revelado variaciones en el uso del hábitat por parte de distintas especies costeras y asociadas a los arrecifes. Muchas ONG de la región se dedican a la recogida de datos o al seguimiento, pero los resultados rara vez se publican en revistas especializadas debido a la falta de capacidad y financiación. Además, no existe una base de datos central para almacenar o acceder a información sobre especies y hábitats.

Casi todos los países cuentan con un sistema de seguimiento de la pesca; en la mayoría, éste se basa en los datos de desembarque, donde se describe una muestra de las capturas cuando los pescadores las llevan a puerto. La exactitud de estos datos depende en gran medida del personal disponible, así como de las características de las pesquerías (número de lugares de desembarque, accesibilidad, número de pescadores). Los países miembros de la ICCAT (Convención Internacional para la Conservación del Atún Atlántico) están obligados a declarar cada año las capturas de tiburones, sobre todo de aquellas especies cuyas capturas están prohibidas o limitadas por la convención, como el tiburón oceánico de puntas blancas.

Si bien en la zona del proyecto CAMAC se realizan algunas investigaciones sobre tiburones, la investigación sobre batoideos es prácticamente inexistente. Tanto si dependen de la pesca como si son independientes, se han realizado muy pocos estudios sobre rayas, y la mayoría de los países sólo recopilan datos limitados sobre estas especies como parte de su seguimiento de la pesca. Como consecuencia, también existe poca información sobre la presión pesquera ejercida sobre los batoideos.

Protección y gestión de los elasmobranquios

A escala internacional, algunas especies están protegidas por la Convención sobre Especies Migratorias (CMS) y el MoU (memorándum of understanding - memorándum de acuerdo) de la CMS sobre tiburones. El comercio de especies amenazadas está regulado por la Convención sobre el Comercio Internacional de Especies Amenazadas de Fauna y Flora Silvestres (CITES) y la pesca pelágica por la ICCAT. Dado que estos convenios establecen restricciones y recomendaciones generales, sólo pueden aplicarse eficazmente si también existe una legislación regional y local.

La protección jurídica transfronteriza de las especies de la región del Caribe se establece en el Convenio de Cartagena y se coordina sobre la base del Protocolo sobre Áreas y Flora y Fauna Silvestres Especialmente Protegidas (SPAW) del Convenio. Las especies en peligro o amenazadas presentes en la región pueden incluirse en los apéndices de este protocolo para obtener protección legal en los países que lo han ratificado. Doce especies de tiburones y rayas figuran en estos anexos. La Comisión de Pesca para el Atlántico Centro-Occidental (COPACO) se creó para ayudar a regular la pesca en el Caribe. En 2022, la COPACO adoptó un Plan de Acción Regional para la Protección de los Tiburones, cuyo objetivo es promover la gestión sostenible de los tiburones en la región y formular acciones comunes para los miembros de la COPACO.

A escala nacional, la gestión de los elasmobranquios varía mucho. Mientras que algunos países han prohibido totalmente la pesca de estas especies, otros no imponen restricciones a las capturas ni a los desembarques. Aunque la mayoría de las áreas marinas protegidas (AMP) situadas en la zona CAMAC no se han establecido para la protección de tiburones y rayas, algunas de las más grandes protegen hábitats esenciales para estas especies. Todos los expertos entrevistados indicaron que las capacidades de control y ejecución eran insuficientes para aplicar medidas eficaces de gestión pesquera.

Conclusión

Este estudio demuestra que, aunque existe una gran diversidad de elasmobranquios en la zona CAMAC, incluidas muchas especies amenazadas, y la región alberga muchos hábitats clave para los elasmobranquios, la investigación sobre estos animales es limitada y las medidas de protección no se aplican de forma coherente en toda la región.

Muchas especies de elasmobranquios de la región son migratorias o altamente migratorias. Uno de los principales retos destacados por muchos de los expertos entrevistados es la necesidad de reforzar la colaboración entre países para intercambiar información y apoyarse mutuamente para comprender y gestionar mejor estas especies en toda su área de distribución.

1.3 Français

La zone couverte par le projet CAMAC

La zone couverte par CAMAC peut être divisée en trois zones si l'on considère la bathymétrie et les courants océaniques. Au nord, on observe une profonde dépression entre Cuba et la Jamaïque et plusieurs grandes îles (Hispaniola, Jamaïque et Porto Rico), avec des côtes complexes qui présentent une multitude d'habitats. À l'est, la chaîne des petites Antilles est caractérisée par des îles plus petites, souvent volcaniques, très rapprochées les unes des autres. Enfin, il y a la zone continentale sud-américaine, qui s'étend du Venezuela à la Guyane française. Dans cette région, l'océan est alimenté par les eaux riches en nutriments de l'Orénoque et de l'Amazone. L'île de Tobago constitue la frontière entre les parties orientale et méridionale.

Ces conditions océanographiques et écologiques différentes entraînent des variations des assemblages et de l'abondances des espèces d'élasmobranches. La différence la plus notable se situe entre la côte sud-américaine et la Caraïbes insulaires qui est plus ouverte sur l'océan Atlantique. Les eaux côtières troubles du continent abritent de nombreuses espèces de raies vivant sur le fond ainsi que de petits requins qui se nourrissent des crustacés très abondants dans la zone, tandis que les eaux claires du nord et de l'est abritent des requins plus grands qui se nourrissent de poissons téléostéens et d'autres espèces marines de plus grandes tailles.

Diversité spécifique dans la zone CAMAC

Dans l'ensemble, la zone est très diversifiée, avec plus de 80 espèces de requins observées, dont plusieurs genres de requins d'eau profonde. Il y a également plus de 40 espèces de raies, y compris des poissons-scies, en danger critique d'extinction, et 4 espèces de chimères. Étant donné que peu de pays de la zone CAMAC se consacrent autrement que ponctuellement à la recherche sur les requins et les raies dans leurs eaux, le nombre réel d'espèces présentes dans la zone pourrait être plus élevé.

Toutes les espèces d'élasmobranches figurant aux annexes 2 et 3 du protocole SPAW sont présentes dans la zone couverte par CAMAC, bien que les requins-baleines ne semblent que migrer à travers la zone :

I. Bien qu'il y ait peu d'observations récentes confirmées du poisson-scie trident (*Pristis pectinata*) et du poissons-scies commun (*Pristis pristis*), les deux espèces sont toujours considérées comme présentes au Venezuela, au Guyana, au Suriname et en Guyane française, ainsi que probablement dans les eaux de la Jamaïque et peut-être d'Haïti. Dans la zone d'intervention de CAMAC, les populations sont fortement réduites en raison de la surpêche et de la perte d'habitat. La morphologie unique de ce taxon, en particulier son rostre, accroît sa vulnérabilité à l'enchevêtrement dans les engins de pêche. Des habitats critiques d'estuaire, de mangrove et d'eau douce ont été dégradés, ce qui représente un risque majeur pour l'espèce.

II. Le requin océanique à pointes blanches (*Carcharhinus longimanus*) est présent dans toute la zone couverte par CAMAC. Bien que l'espèce puisse être observée au large à des profondeurs allant jusqu'à 1000 m, elle est souvent trouvée dans la partie supérieure de la colonne d'eau, près de la surface. Les observations dans le nord, près d'Haïti, sont presque exclusivement des nouveau-nés et des juvéniles, ce qui conduit à l'hypothèse qu'il s'agit d'une zone de reproduction pour l'espèce. Plus au sud, au large du Venezuela, des juvéniles et des adultes sont capturés. Parmi les adultes, environ 60% sont des femelles.

III. Le requin de récif des Caraïbes (*Carcharhinus perezi*) est un grand prédateur et une espèce clé des écosystèmes marins de la région des Caraïbes. L'état de la population de cette espèce a connu un

déclin significatif au cours des dernières décennies. Historiquement, cette espèce était abondante dans toute la région des Caraïbes, mais en raison de la surpêche et de la dégradation de l'habitat, sa population a connu un déclin d'environ 30 % au cours des dix dernières années, ce qui est préoccupant.

IV. Le requin soyeux (*Carcharhinus falciformis*) est une espèce pélagique qui peut se déplacer sur de longues distances, il a une distribution circumtropicale et est présent dans la zone CAMAC. Cependant, les informations sur le requin soyeux dans les Caraïbes sont très limitées, et la biologie et l'écologie de l'espèce et de ses sous-populations dans la région sont largement inconnues.

V. Trois espèces de requins-marteaux - le grand requin-marteau (*Sphyrna mokarran*), le requin-marteau halicorne (*Sphyrna lewini*) et le requin-marteau lisse (*Sphyrna zygaena*) - sont présentes dans les eaux de tous les pays de la zone CAMAC. La plupart des informations disponibles concernent le requin-marteau halicorne. Pour cette espèce, des zones de reproduction ont été identifiées à Porto Rico au nord et à Trinidad au sud, avec un site d'agrégation suspecté dans les eaux de Sainte-Lucie. Les données de pêche à la palangre du Venezuela montrent que les trois requins-marteaux sont régulièrement capturés dans les pêcheries de thon.

VI. La raie manta océanique (*Mobula birostris*) est la plus grande espèce de raie au monde et est largement distribuée dans les océans tropicaux et subtropicaux du monde. Elle semble passer la majeure partie de son temps en haute mer, loin des récifs, plongeant à des centaines de mètres dans la couche de dispersion profonde pour trouver ses proies zooplanctoniques. Dans la zone CAMAC, elle a été observée au large des côtes de Guyane française, du Suriname et du Venezuela, le plus souvent au niveau du talus continental, des monts sous-marins, des îles et des récifs.

Recherche dans la zone CAMAC

La recherche sur les élasmobranches dans la zone couverte par CAMAC est limitée par rapport à d'autres régions des Caraïbes, comme la Floride et le Golfe du Mexique. Ceci est particulièrement évident dans le manque d'études de suivi à long terme et dans le peu d'études de télémétrie qui ont été réalisées par rapport à celles effectuées dans les eaux plus proches de la Floride. De nombreux pays ont participé à des études BRUV, souvent par l'intermédiaire du projet Global Fin Print, ce qui permet de disposer d'une base de référence pour l'abondance des requins, qui peut être comparée à d'autres zones. Toutefois, comme ces études ont été réalisées principalement sur des sites récifaux, elles n'ont fourni que des informations limitées, en particulier dans les endroits où les lâchers de BRUV n'ont porté que sur quelques sites, quelques profondeurs ou sur une courte période. Dans les endroits où des recherches plus approfondies ont été possibles, elles permettent invariablement de mettre en évidence des schémas complexes de biologie et de comportement. Par exemple, des études télémétriques menées dans les Caraïbes néerlandaises ont révélé des variations dans l'utilisation de l'habitat pour différentes espèces côtières et associées aux récifs. De nombreuses ONG de la région s'engagent dans la collecte de données ou le suivi, mais les résultats sont rarement publiés dans des revues à comité de lecture en raison d'un manque de capacité et de fonds. En outre, il n'existe pas de base de données centrale permettant de stocker ou d'accéder aux informations relatives aux espèces et aux habitats.

Presque tous les pays ont mis en place un suivi des pêches ; pour la plupart d'entre eux, cette collecte est basée sur les données de débarquement, où un échantillon de prises est décrit lorsque les pêcheurs les amènent au port. La précision de ces données dépend fortement du personnel disponible, ainsi que des caractéristiques des pêcheries (nombre de sites de débarquement, accessibilité, nombre de pêcheurs). Les pays membres de l'ICCAT (Convention internationale pour la conservation des thonidés

de l'Atlantique) sont tenus de déclarer chaque année les captures de requins, en particulier les espèces dont la convention interdit ou limite les captures, comme le requin océanique à pointes blanches.

S'il existe quelques recherches sur les requins dans la zone CAMAC, les recherches sur les batoïdes sont pratiquement inexistantes. Qu'il s'agisse de recherches dépendantes des pêcheries ou de recherches indépendantes, très peu d'études ont été menées sur les raies et les mantes, et la plupart des pays ne collectent que des données limitées sur ces espèces dans le cadre de leur suivi des pêches. Par conséquent, il existe également peu d'informations sur la pression de pêche exercée sur les batoïdes.

Protection et gestion des élasmobranches

Au niveau international, certaines espèces sont protégées par la Convention sur les espèces migratrices (CMS) et le MoU de la CMS sur les requins. Le commerce des espèces menacées est réglementé par la Convention sur le commerce international des espèces de faune et de flore sauvages menacées d'extinction (CITES) et la pêche pélagique est réglementée par l'ICCAT. Comme ces conventions donnent des restrictions et des recommandations générales, elles ne peuvent être mises en œuvre de manière efficacement que s'il existe également une législation régionale et locale.

La protection juridique transfrontalière des espèces pour la région des Caraïbes est établie par la convention de Carthagène et coordonnée sur la base du protocole relatif aux zones et à la vie sauvage spécialement protégés (SPAW) de la convention. Les espèces en danger ou menacées présentes dans la région peuvent être répertoriées dans les annexes de ce protocole afin d'obtenir une protection juridique dans les pays qui ont ratifié le protocole. Douze espèces de requins et de raies figurent dans ces annexes. La Commission des pêches pour l'Atlantique Centre-Ouest (COPACO) a été créée pour aider à réglementer la pêche dans les Caraïbes. En 2022, la COPACO a adopté un plan d'action régional pour la protection des requins, qui vise à promouvoir la gestion durable des requins dans la région et à formuler des actions communes pour les membres de la COPACO.

Au niveau national, la gestion des élasmobranches est très variable. Alors que certains pays ont interdit toute pêche de ces espèces, d'autres n'imposent aucune restriction sur les captures et les débarquements. Bien que la plupart des aires marines protégées (AMP) situées dans la zone CAMAC ne soient pas établies pour la protection des requins et des raies, certaines parmi les plus grandes protègent des habitats essentiels pour ces espèces. Tous les experts interrogés ont indiqué que les capacités de contrôle et d'application de la réglementation étaient insuffisants pour mettre en œuvre des mesures efficaces de gestion des pêches.

Conclusion

Cette étude montre que même s'il existe une grande diversité d'élasmobranches dans la zone CAMAC, y compris de nombreuses espèces menacées, et que la région abrite de nombreux habitats clés pour les élasmobranches, la recherche sur ces animaux est limitée et les mesures de protection ne sont pas mises en œuvre de manière cohérente dans toute la région.

De nombreuses espèces d'élasmobranches de la région sont migratrices ou hautement migratrices. L'un des enjeux majeurs souligné par de nombreux experts interrogés est la nécessité de renforcer la collaboration entre les pays afin d'échanger les informations et de se soutenir mutuellement pour mieux connaître et gérer ces espèces dans toute leur aire de répartition.

2 General considerations on sharks and rays in the Wider Caribbean

2.1 Introduction

Sharks, skates and rays belong to the group of 'elasmobranchs' – a subgroup of cartilaginous fishes. The group is an evolutionary success, having been around for 450 million years, and species are present in almost all marine environments, including deep-water and coastal waters, as well as tropical and cold-water regions. Some species even spend all or part of their lives in freshwater. They all share the same biology, being slow-growing, late to mature and producing a small number of young. Most sharks and some rays are live-bearing and produce a few pups each reproductive cycle. The skates and rays predominantly lay egg-cases, from which the young hatch after a few months. These characteristics make elasmobranch species especially vulnerable to threats such as overexploitation and loss of essential habitats. International research estimates that world-wide one in four elasmobranch species is threatened.

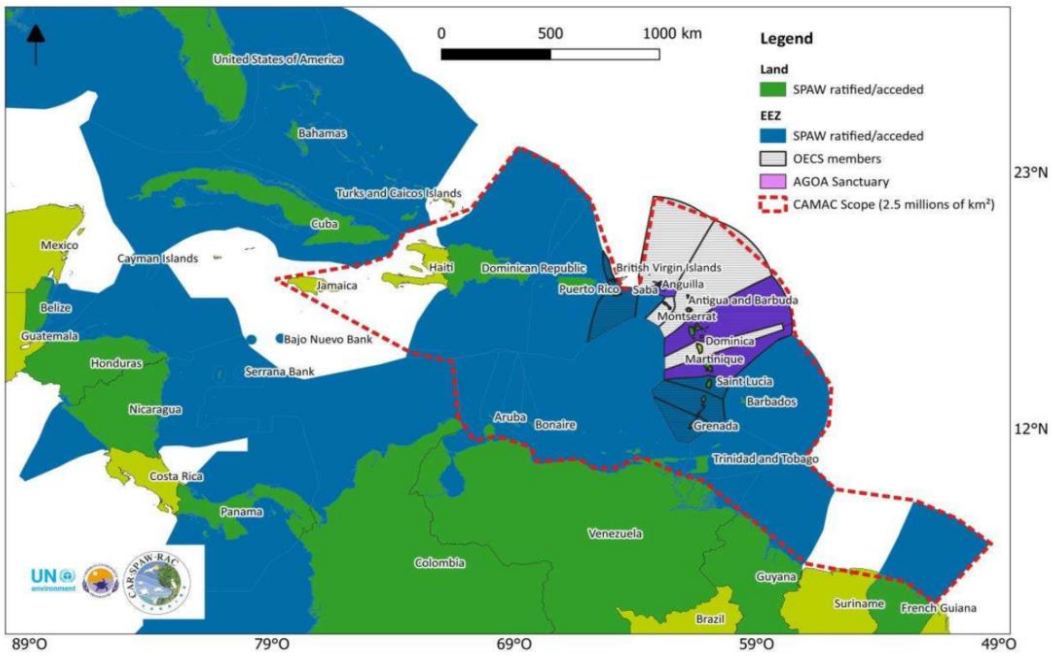


Figure 1. Map of the CAMAC project scope area.

The Wider Caribbean is one of the world's most complex mosaics of marine and coastal habitats, comprising 10% of global coral reefs (26,000 km2), 18% of global seagrass beds (66,000 km2), and 12% of global mangrove forests (22,000 km2), according to Miloslavich *et al.* (2010). These highly diverse marine habitats provide diverse habitats for a high abundance of marine life. The Wider Caribbean supports over 100 shark species, ranging from the world's largest fish species, the whale shark (*Rhincodon typus*), to rarely seen deep water species like the sixgill shark (*Hexanchus griseus*). These sharks are integral components of the marine food web, occupying different niches and contributing to the overall structure and function of the ecosystem. For example, the Caribbean reef shark (*Carcharhinus perezi*) is an apex predator, helping to control the populations of other fish species and maintaining the balance of the coral reef ecosystem, but juveniles of these species are a welcome prey for larger shark species like tiger sharks (*Galeocerdo cuvier*).

In addition to sharks, the Eastern Caribbean is also home to over 60 of ray species both stingrays and skates. Rays are primarily bottom feeders, feeding on benthic invertebrates, such as crustaceans and molluscs but also on other bottom dwelling fish, the exception to this are manta and mobula ray species, these filter feeders are also present throughout the Wider Caribbean.

The abundance and diversity of sharks and rays in the Wider Caribbean are influenced by various factors, including water temperature, nutrient availability, and habitat quality as well as the connectivity between different oceanic systems (Flowers *et al.* 2022; Simpfendorfer *et al*., 2023). Additionally, the presence of diverse habitats, such as coral reefs, seagrass beds, and mangroves, offers suitable feeding and nursery areas for sharks and rays.

This review provides an overview of shark and ray research conducted in the Wider Caribbean region, specifically focusing on the countries in the CAMAC project scope area (Figure 1). The studies discussed within this review shed light on various aspects of these charismatic marine species, including their diverse species composition, habitat utilization patterns, challenges faced by fisheries, ecological interactions, and the importance of public engagement in their conservation.

2.2 Bathymetry and Ocean Circulation

The Wider Caribbean's unique geography and currents contribute to the region's climatic diversity, impacting precipitation patterns, hurricane formation, and coastal erosion. Moreover, these oceanographic features have substantial implications for marine biodiversity, fisheries, and shipping routes. Nutrient-rich currents support productive marine ecosystems, while coastal currents affect larval transport and the connectivity of coral reefs.

The sea basin of the Wider Caribbean is characterized by its jagged contours and varying depths, the bathymetric profile of the region features a prominent trench known as the Puerto Rico Trench, a product of the convergence between the North American and Caribbean tectonic plates. This trench reaches a depth of over 8,400 meters, making it one of the deepest points in the Atlantic Ocean (Pike *et al*., 2019; Krause, 1971).

The Caribbean's bathymetry also comprises shallower features such as banks, seamounts, and continental shelves, for example the Saba Bank which is the largest submerged atoll (2200 km2) in the world. These underwater structures serve as vital habitats for marine life forms and as an essential landmark in migration routes and can influence the propagation of ocean currents.

The ocean currents of the Wider Caribbean play a pivotal role in the redistribution of heat, nutrients, and help transport marine organisms. The Caribbean Current, a western boundary current, transports warm and nutrient-rich waters from the tropical Atlantic Ocean into the Caribbean Sea. This current interacts with the North Equatorial Current which, in part, fuels the Gulf Stream further north. The interplay between these currents contributes to the regulation of temperature and climate, as warm waters move poleward and colder waters flow equatorward.

Furthermore, the Caribbean Sea harbors eddies and gyres that emerge as a consequence of the complex bathymetry. These mesoscale features are essential in redistributing water properties and influencing regional circulation patterns.

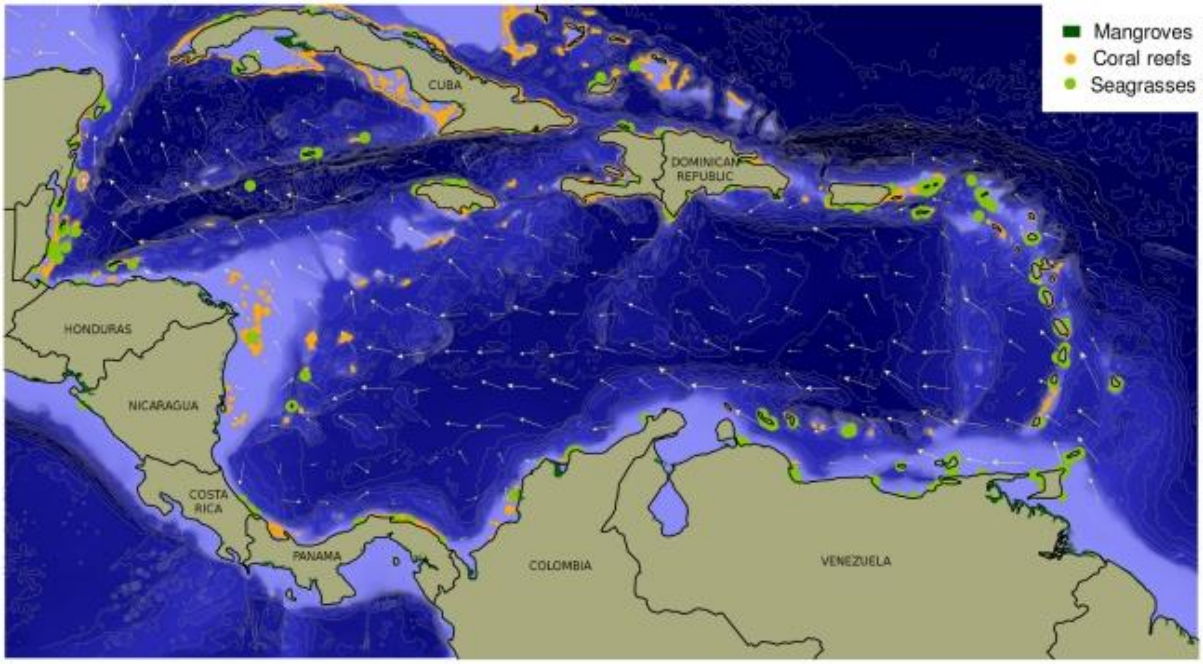


Fig 2. Bathymetry, main currents, and ecosystems of the Caribbean Sea (source: Miloslavich *et al*., 2010)

On the South side of the region, nutrient rich waters from the Amazon and Orinoco River flow along the coast creating unique conditions that have a led to a different species assemblage along the coast of French Guiana, Suriname, Guyana, and Venezuela compared to the insular Caribbean. The island of Trinidad forms a natural barrier for the flow of this nutrient rich water, and this is reflected in the species around the island with species typical of the coast of South America on the south side and species that resemble those of the insular Caribbean to the North (Miloslavich *et al*. 2010).

2.3 Threats to Sharks in the Wider Caribbean

The decline of shark and ray populations globally has been well documented over the past decade (Sherman *et al*., 2023). Unsustainable fishing practices as well as loss of habitats are the primary factors contributing to the decline of shark and ray populations worldwide. Currently nearly two-thirds (59%) of the 134 coral-reef associated shark and ray species are threatened with extinction globally (Sherman *et al*., 2023). According to Simpfendorfer *et al*. (2023) five of the most common reef shark species have experienced a decline of up to 73%. As shark species decline on coral reefs, ray species increase, indicating a community-wide shift.

For pelagic shark species, unsustainable fishing practices, both targeted fisheries and bycatch in fisheries for other species, are the main cause of decline. The fishery is driven by the demand for their fins, meat, and other shark products. It has been estimated that the global population of the oceanic whitetip shark (*Carcharhinus longimanus*) has decreased by over 97% and Hammerhead sharks (*Sphyrna spp*) by over 75%.

Until recently it was thought that global populations of reef sharks are in a better state than pelagic sharks as they experience less intense fishing pressure. However, a recent study (Simpfendorfer *et al.,* 2023) that looked at the world's 5 most commonly observed reef shark species (including the Caribbean reef shark and the nurse shark) shows an average decline of over 70% throughout their

range. Again, fishing is seen as the key driver of the decline. An earlier study, using information from reef transects by divers, had already flagged absence of as source for concern and need for further study (Ward-Paige *et al.* 2010).

Although not quantified, it is likely that Wider Caribbean loss of essential habitats, including the destruction of coral reefs and mangrove forests, also poses a significant threat to reef shark populations in the Wider Caribbean. These habitats provide essential nursery areas and shelter for young sharks, and their destruction disrupts the reproductive cycles and overall health of shark populations. Coral reefs, in particular, are critical for the survival of reef sharks, as they provide feeding grounds and refuge. However, factors such as pollution, sedimentation, and destructive fishing practices contribute to the degradation of coral reefs. Additionally, climate change exacerbates these issues by causing ocean acidification and coral bleaching, further damaging the already fragile ecosystems that support reef sharks.

2.4 Protective management of sharks and rays

In recent years, the establishment of marine protected areas (MPAs) has been seen as a potential way to protect sharks and rays across the globe (Figure 3). MPAs provide a refuge for sharks and other marine species by limiting or prohibiting human activities such as fishing and development. By designating specific areas as protected zones, MPAs enable shark populations to recover, restore biodiversity, and safeguard critical habitats. These protected areas not only benefit sharks but also the overall health of marine ecosystems.

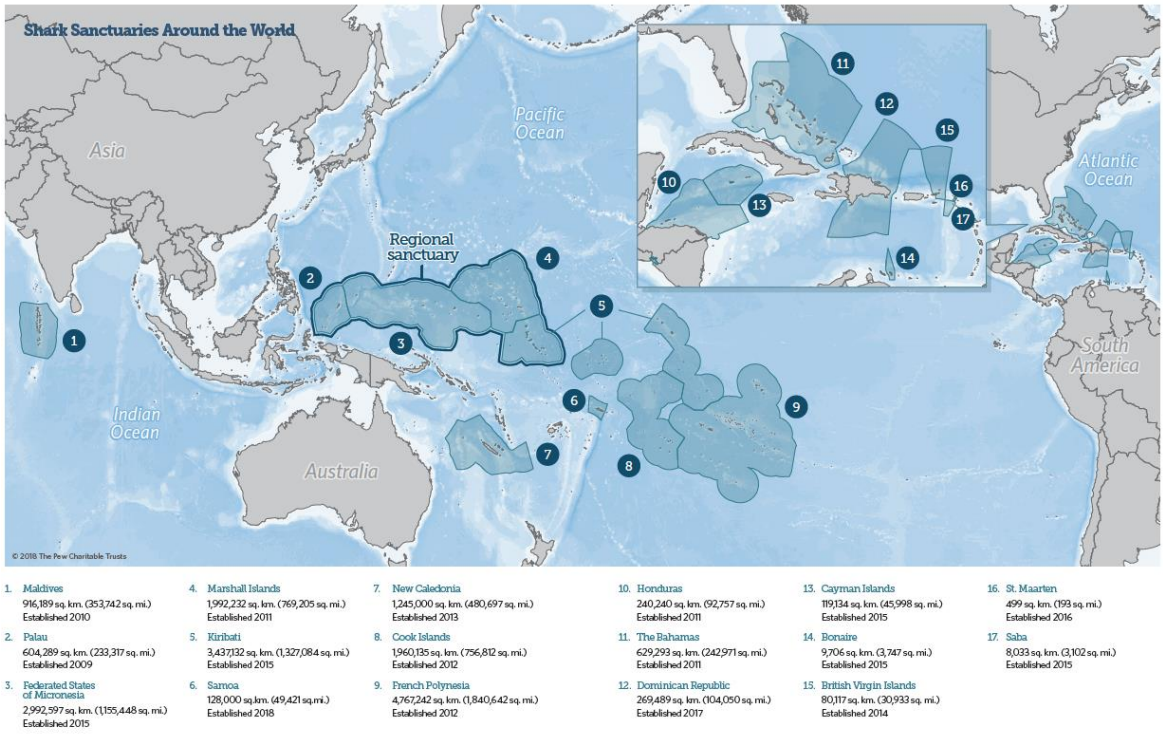


Figure 3. Shark sanctuaries around the world. Source: Pew Trusts (*https://www.pewtrusts.org/-/media/assets/2018/02/shark_sanctuaries_2018_issuebrief.pdf*)

Research has shown that MPAs can have a positive impact on shark populations. A study conducted in the Bahamas found that the establishment of a shark sanctuary led to a significant increase in the abundance and size of reef sharks within the protected area (Flowers *et al.,* 2022). Similar success stories have been observed in other regions where MPAs have been implemented (Chapman *et al.,* 2021 & Goetze *et al.,* 2021). The presence of MPAs not only allows shark populations to rebound but can also create spillover effects, with the MPA acting as a source for population increase outside the protected areas and benefiting adjacent regions.

However, it is crucial to recognize that marine protected areas alone may not be sufficient to address the decline of elasmobranch populations (Ward-Paige & Worm, 2017). Effective fisheries management practices outside MPAs and laws protecting nature and the environment are equally important. Sustainable fishing practices, such as implementing catch limits, regulating fishing gear, and enforcing seasonal closures, are essential for maintaining healthy fish populations outside MPAs and protective legislation for endangered species and to prevent population declines.

A good example of a regional effort for the sustainable management of elasmobranchs is the recently agreed Regional Plan of Action by the Western Central Atlantic Fisheries Commission (WECAFC) which outlines a regional agenda for the shark and ray conservation as well as providing guidelines for national plans of action for WECAFC members. See also Chapter 3.2.4 on Regional Management for an overview of WECAFC.

At the most recent SPAW 12th Conference of Parties (COP) held on October 4th, 2023, progress was made for the conservation and management of sharks and rays. The oceanic whitetip shark, whale shark and the giant manta ray were up listed from Annex III to Annex II and the Caribbean reef shark was added to Annex III. Recommendation II-4 from the SPAW-COP 12 to "Invite the Scientific and Technical Advisory Committee, through the species working group, to develop **conservation and management recommendations for the Whale Shark, Giant Manta Ray and Hammerhead Sharks** to be presented to the 11th meeting of the Scientific and Technical Advisory Committee" is a good step forward.

Education and public awareness campaigns are also vital components in the conservation of reef sharks. Promoting awareness about the importance of these apex predators and their role in maintaining healthy ecosystems can help generate public support for conservation initiatives. By fostering a sense of stewardship and encouraging responsible behaviors, we can reduce the demand for shark products and promote sustainable fishing practices.

Furthermore, international cooperation is essential for the conservation of reef shark populations. Many species of reef sharks are migratory, crossing national borders during their life cycles. Cooperation between countries is crucial to ensure the protection of these species throughout their range. International conventions like SPAW, CMS and CITES and Regional Fisheries Management Organizations play a crucial role in protecting vulnerable species, regulating the international trade of shark products and promoting sustainable fishing practices.

3 Species diversity

3.1 Introduction

Over 130 species of elasmobranchs (86 shark species and 47 rays) have been recorded in the CAMAC scope area. Annex 1 provides a full overview of the species diversity across the area. For the sharks, 7 taxonomic families are represented. With the requiem sharks (Carcharhiniforms) representing more than half the species present, followed by the dogfish (Squaliformes).

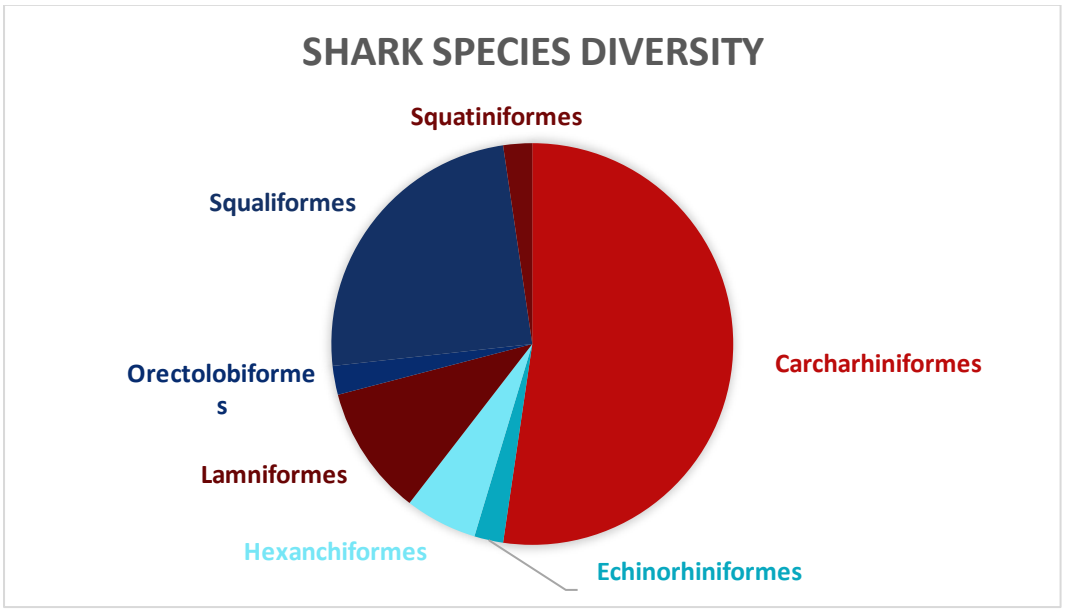


Figure 4: Shark species diversity in the CAMAC scope area

Four families of skates and rays, also known as batoids, are present in the area with the Myliobatiformes (including stingrays and mobulid rays) and the Rajiformes (skates) representing the largest groups. We left the freshwater stingrays out of this analysis as the scope of the research was on marine species only.

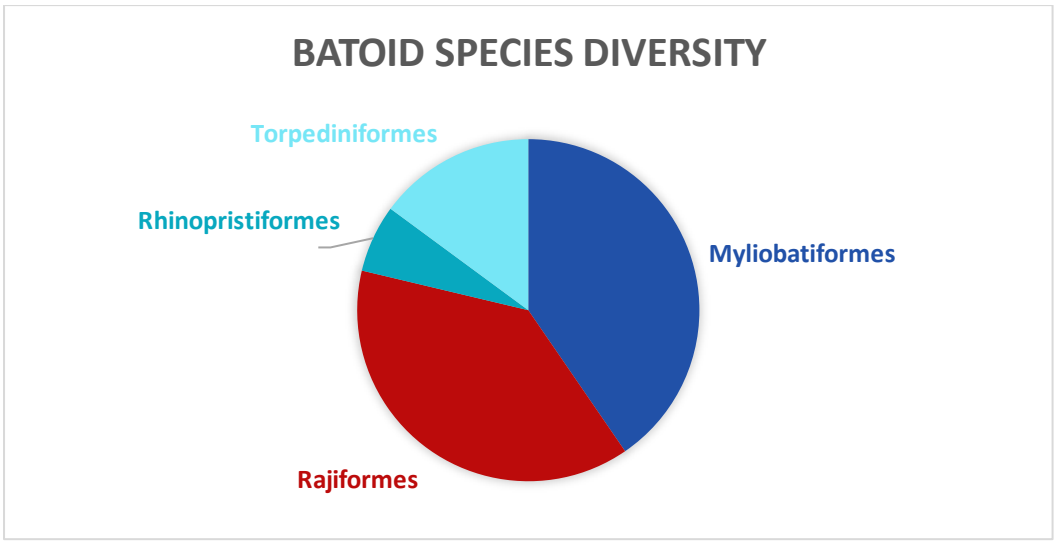


Figure 5: Batoid species diversity in the CAMAC scope area

It is clear from literature and interviews with experts that the areas, which are influenced by large riverine run-off from the Amazon and Orinoco, such as in the Gulf of Paria along the coasts of Venezuela and around Trinidad, have a high species diversity and abundance; whereas in areas further North and East, the species diversity appears to be lower. In some interviews it was noted that sharks and rays were rarely seen although this could also be associated with a lack of dedicated research on them.

Of the 20 most commonly described shark species, six of them have been reported from all countries in the CAMAC region with four more present in all but one. The following 67 species have been recorded in six or less countries. It is of note here that these 20 species include all SPAW listed species and most of the CMS and CITES listed species. For a full list of observed species see annex 1 & 2 to this report.

Shark species	Common name	IUCN Category	Nr countries	SPAW	CITES	CMS
Carcharhinus falciformis (Müller & Henle 1839)	Silky shark	VU	22	Annex 3	App II	App II
Sphyrna lewini (Griffith & Smith 1834)	Scalloped hammerhead	CR	22	Annex 3	App II	App II
Sphyrna mokarran (Rüppell 1837)	Great hammerhead	CR	22	Annex 3	App II	App II
Isurus oxyrinchus Rafinesque 1810	Shortfin mako shark	VU	22		App II	App II
Ginglymostoma cirratum (Bonnaterre 1788)	Nurse shark	VU	22			
Rhincodon typus (Smith 1828)	Whale shark	EN	22	Annex 3	App II	App II
Carcharhinus longimanus (Poey 1861)	Oceanic whitetip shark	CR	21	Annex 3	App II	App I
Galeocerdo cuvier (Péron & LeSueur 1822)	Tiger shark	NT	21			
Negaprion brevirostris (Poey 1868)	Lemon shark	VU	21		App II	
Prionace glauca (L. 1758)	Blue shark	NT	21		App II	App II
Carcharhinus acronotus (Poey 1860)	Blacknose shark	EN	19		App II	
Carcharhinus leucas (Valenciennes 1839)	Bull shark	VU	19		App II	

Carcharhinus limbatus (Valenciennes 1839)	Blacktip shark	VU	19		App II	
Mustelus canis (Mitchill 1815)	Dusky smoothhound	NT	19			
Carcharhinus perezi (Poey 1876)	Caribbean reef sharks	EN	18		App II	
Scyliorhinus boa (Goode & Bean 1896)	Boa catshark	LC	17			
Rhizoprionodon porosus (Poey 1861)	Caribbean sharpnose shark	VU	16		App II	
Galeus antillensis (Springer 1979)	Antilles catshark	LC	11			
Carcharodon carcharias	Great white shark	VU	11		App II	App I
Sphyrna zygaena (L. 1758)	Smooth hammerhead	VU	9	Annex 3	App II	App II

Table1: the 20 shark species observed in the most countries

For rays the number of reported species throughout the region is considerably lower. Only one species (the white spotted eagle ray) was reported from all countries and just six species were reported for more than 10 countries. All SPAW, CITES and CMS listed species, apart from large tooth sawfish, are in the top 10 of the list.

Batoids Species	Common name	IUCN Category	Nr countries	SPAW	CITES	CMS
Aetobatus narinari (Euphrasen 1790)	Whitespotted eagle ray	EN	22			
Hypanus americanus (Hildebrand & Schroeder 1928)b	Southern stingray	NT	16			
Urobatis jamaicensis (Cuvier 1816)	Yellow stingray	LC	16			
Hypanus guttatus (Bloch & Schneider, 1801)b	Longnose stingray	NT	14			
Hypanus say (Lesueur 1817)b	Bluntnose stingray	NT	14			
Pseudobatos percellens	Chola guitarfish	EN	12			

(Walbaum 1792)b						
Mobula birostris (Walbaum 1792)b	Gaint manta ray	EN	9	Annex 3	App II	App I
Mobula hypostoma (Bancroft 1831)	Atlantic pygmy devil ray	EN	7		App II	App I
Pristis pectinata (Latham 1794)	Smalltooth sawfish	CR	7	Annex 2	App I	App I
Rhinoptera bonasus (Mitchill 1815)	Cownose ray	VU	6			
Fontitrygon geijskesi (Boeseman 1948)b	Sharpsnout stingray	NT	5			
Urotrygon microphthalmum (Delsman 1941)	Smalleye round stingray	CR	5			
Myliobatis freminvillei (LeSueur 1824)	Bullnose eagle ray	VU	5			
Dactylobatus clarkii (Bigelow & Schroeder 1958)	Hookskate	LC	5			
Dipturus bullisi (Bigelow & Schroeder 1962)	Tortuga skate	LC	5			
Gurgesiella atlantica (Bigelow & Schroeder 1962)b	Atlantic pygmy skate	LC	5			
Schroederobatis americana (Bigelow & Schroeder 1962)b	American legskate	LC	5			
Pristis pristis (L. 1758)	Largetooth sawfish	CR	5	Annex 2	App I	App I
Diplobatis picta (Palmer 1950)	Painted electric ray	VU	5			
Gymnura micrura (Bloch & Schneider 1801)	Smooth butterfly ray	NT	4			

Table2: 20 batoid species observed in the most countries

To assess the threats to wildlife, the International Union for the Conservation of Nature (IUCN) has developed a red list of threatened species which characterizes the threat level to species in the wild. The red list has 5 threat categories: Least Concern (LC), Near threatened (NT), Vulnerable (VU), Endangered (EN) and Critically Endangered (CE), Species for which there is no data available on the threats they face are classed as Data Deficient (DD).

Of the shark species in the area, 27% are classified as Endangered or Critically, and 21% of the skates and rays are in these highest threat categories. This includes the SPAW listed species but there are other threatened species that do not appear to have protective measures in place.

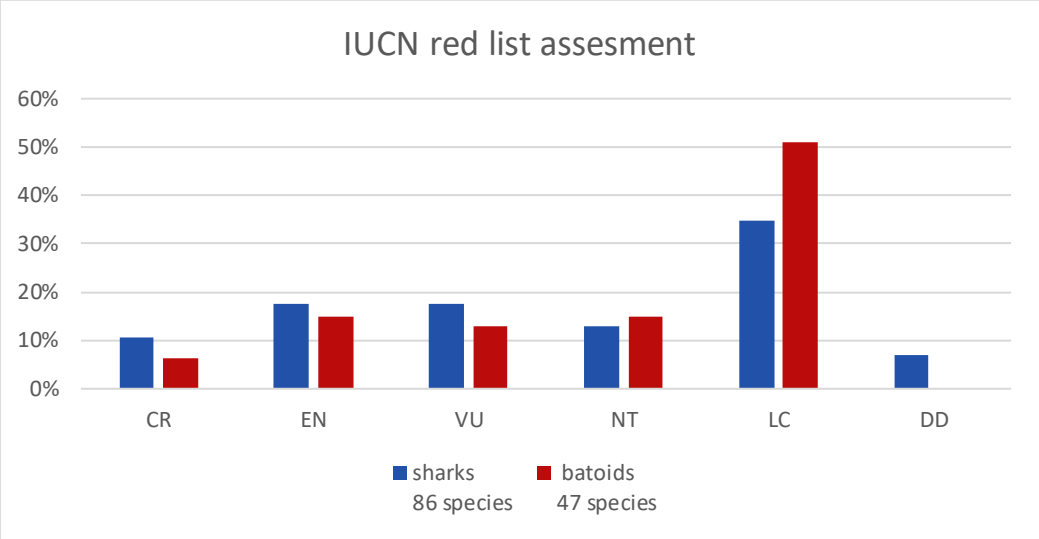


Figure 6: Conservation status of elasmobranchs within the CAMAC scope area

In recent years, the number of data deficient species has gone down considerably with many of the species moving from the DD to LC (least concern) category. It is important to note here that the biological and ecological information on these species is still largely absent, but the classification LC is given as at this time the fisheries in the region have only limited overlap with the suspected range of the species (Talwar *et al*. 2022b).

Knowledge on the presence and abundance of elasmobranch species is dependent on data, both from fisheries and from surveys and observations. As in many areas throughout the world, data collection on elasmobranchs in the CAMAC scope area is patchy and is not coordinated well. According to Arocha *et al*. (2023) these species were historically not deemed economically important in most countries of the region and there was little incentive to collect data on population sizes or other demographics.

3.2 Species overviews

Species overviews have been made for the species included in the SPAW Protocol: oceanic whitetip shark (*Carcharhinus longimanus*); Caribbean reef shark (*Carcharhinus perezi*); largetooth and smalltooth sawfish (*Pristis pristis & Pristis pectinata*); silky shark (*Carcharhinus falciformis*); three hammerhead species: great hammerhead (*Sphyrna mokarran*), scalloped hammerhead (*Sphyrna lewini*) and smooth hammerhead (*Sphyrna zygaena*); and the oceanic manta ray (*Mobula birostris*). The whale shark, which is also listed on annex 2 of the SPAW protocol was not included because at this time it is assumed that this species only migrates through the CAMAC scope area and has areas of vital importance for its life history outside the area.

Information on the SPAW listed species has been analyzed and it is clear that the main threats are still overfishing, trade and habitat loss. Although the species may not be targeted, many are taken as bycatch. From the interviews carried out it is clear that catches are mostly form artisanal fleets, but large-scale pelagic fishery also takes place. The international fin trade is not wide scale across the region, although it does occur sporadically. Coastal development, pollution, and climate change have damaged critical habitats such as coral reefs and mangroves, disrupting breeding and foraging grounds for many species (e.g., MacNeil *et.al* 2020).

3.2.1 Oceanic whitetip shark (Carcharhinus longimanus)

Introduction

The Oceanic Whitetip Shark (*Carcharhinus longimanus*) occurs worldwide in tropical and temperate waters (Last and Stevens 2009; Ebert *et al.,* 2013). Oceanic whitetip sharks are large (up to 350 cm total length) pelagic sharks found in tropical and subtropical oceans throughout the world. They live offshore in deep water but spend most of their time in the upper part of the water column near the surface (Young and Carlson, 2020) which makes them particularly susceptible to fishing (Rigby *et al*., 2019). Oceanic whitetip sharks are long-lived, late maturing, and have low to moderate productivity (Rigby *et al*., 2019; Young and Carlson, 2020).

Biology and Life History

The oceanic whitetip shark is a wide-ranging, ectothermic, oceanic species of tropical and temperate seas worldwide with a preference for surface waters, though it has been reported to depths of 1,082 m. It has litters of 1–15 pups and likely has a biennial reproductive cycle (Rigby *et al*., 2019).

The size at maturity for females is estimated to be 175-224 cm and for males 168-198 cm. The species has placental viviparous reproduction and litter size of 1-15 pups, depending on the size of the female. The reproductive cycle is likely biennial, with a gestation period of 10-12 months. Size at birth is between 57 and 77 cm (Rigby *et al*., 2019). In the southwest Atlantic the females mature around age 6.5 years and reach a maximum age of around 17 years (Rigby *et al*., 2019)

Based on visual evidence of mating (bite wounds), concentrations of testosterone in males, and observed mating behavior, Talwar *et al.* (2023) have suggested that mating could occur in the eastern Bahamas, maybe already in May, but is more likely to be concentrated in July. They further suggest that Columbus Point, Cat Island, Bahamas may be a mating habitat for the oceanic whitetip shark.

Observations around the southern peninsula of Haiti suggest that this area is a nursery area for the species due to the numbers of neonate and juvenile individuals, while adults are seldom encountered (personal communication J. Aquino).

Movement and Connectivity

Although there are few data on movement and connectivity of the oceanic whitetip shark in the CAMAC scope area, just outside the region, seasonal aggregations of adults of the species have been seen around Cat Island in the Bahamas (Madigan *et al*., 2015). The aggregations consisted of mostly

adult females of which more than 50% were gravid. The authors used tag-recapture to assess site-fidelity of adult oceanic whitetips to Cat Island and stable isotope analysis (SIA) of 2 different tissues (blood plasma and white muscle) to compare short- and long-term feeding patterns. The results confirmed that individual whitetips exhibit site-fidelity to Cat Island and that the short-term diets (i.e., close to Cat Island) showed more large pelagic teleosts (72%) than the long-term diets (47%). These results depict spatio-temporal difference in oceanic whitetip feeding habits (Madigan *et al.,* 2015), leading to the hypothesis that Cat Island is an important foraging site for the oceanic whitetip shark. In contrast to Telwar *et al.* (2023), the authors did not see any evidence of mating, either physical or behavioral.

The oceanic whitetip shark is considered to be an epipelagic predator with a distribution mostly restricted to the mixed layer (Tolotti *et al.*, 2017). Vertical migration of oceanic whitetip sharks has been seen around Cat Island (Andrzejaczek *et al*. 2018) and off the coast of Brazil (Tolotti *et al.*, 2017), based on analysis of satellite tags. It appears that around Cat Island the individuals spent most time in the first 50 m of the water column, especially in winter months when it was cooler and vertical mixing was greater (Andrzejaczek *et al.,* 2018). However, as the sea surface temperature increased throughout the summer, the individuals avoided the upper levels and the diurnal oscillations increased in amplitude and cycle length as compared to the winter. A temperature of 28 degrees C sea surface temperature seemed to be the trigger for the onset of this behavior of thermoregulation strategy (Andrzejaczek *et al.,* 2018). A similar behavior was seen off the coast of Brazil where the vertical amplitude of movement increased when sea surface temperature increased, regardless of the reduction of the mixed layer (Tolotti *et al.,* 2017). Moreover, the authors identified three behavioral types based on the diurnal use of the water column by the individuals studied (Tolotti *et al.,* 2017).

Although the data are not from the CAMAC scope area, these insights into movement and habitat use are valuable to inform management.

Threats & Conservation Status

The main threat to oceanic whitetip sharks is bycatch in commercial fisheries. Individuals are frequently caught in pelagic longline, purse seine, and gillnet fisheries worldwide and their fins are highly valued in the international trade for shark products. Due to its partiality for surface waters and the fact that this species is recognized as being inquisitive, the oceanic whitetip shark has a high catchability. The species was once one of the most abundant pelagic shark species in tropical seas worldwide, but populations have declined throughout the global range of the species, and it is now rare in some regions including the WECAFC region (Young & Carlson, 2020; Young *et al.*, 2017).

According to Rigby et al. (2019) "the global population of oceanic whitetip shark is estimated to have undergone a reduction of >98%, with the highest probability of >80% reduction over three generation lengths (61.2 years)."

The oceanic whitetip shark is:

- currently classified as critically endangered (CR) by IUCN (Rigby *et al.*, 2019)
- on Annex III of SPAW since 2017
- on Annex II of the SPAW Protocol since October 2023
- on Appendix II CITES since 14th September 2014. See the proposal: https://cites.org/sites/default/files/eng/cop/16/inf/E-CoP16i-26.pdf
- on Appendix I of CMS Sharks MOU since 2000. See https://www.cms.int/en/species/carcharhinus-longimanus
- listed under the U.S. Endangered Species Act (ESA) as a threatened species.

Every major tuna Regional Fishery Management Organization (RFMO) has a retention prohibition for the species, which means the species is protected in the CAMAC scope area for those signatories to ICCAT (Young & Carlson, 2020).

Oceanic whitetip shark in the CAMAC scope area

IUCN mentions the species as being native in the entire Caribbean and includes specifically the following CAMAC countries**:** Anguilla; Antigua and Barbuda; Aruba; Bahamas; Barbados; Bermuda; Bonaire, Sint Eustatius and Saba; Costa Rica; Curacao; Dominican Republic; French Guiana; Grenada; Guadeloupe; Guyana; Haiti; Jamaica; Martinique; Puerto Rico; Reunion; Saint Barthelemy; Saint Kitts and Nevis; Saint Lucia; Saint Martin (French part); Saint Vincent and the Grenadines; Sint Maarten (Dutch part); Suriname; Trinidad and Tobago; Turks and Caicos Islands; Venezuela, Virgin Islands, British; Virgin Islands.

According to Arocha *et al*. (2023), the main requiem shark species from a fisheries point of view in the WECAFC region are blue shark (*Prionace glauca*), silky shark (*Carcharhinus falciformis*), oceanic whitetip shark (*Carcharhinus longimanus*) and tiger shark (*Galeocerdo cuvier*). See Chapter 3.2.4 for more information on WECAFC.

Arocha *et al*. (2107) have analyzed the Venezuelan fisheries and observer data from the pelagic long-line fleet for the oceanic whitetip shark and carried out a back-tracking exercise. This has resulted in insight into the distribution and spatio-temporal size range and gender for the past decades.

The overall spatial distribution of the total relative abundance of OCS (numbers of sharks/ hooks×1000) observed by the pelagic longline observer programs for the period of 1994-2015 indicated high concentrations (>3 OCS/hooks×1000) in the Caribbean Sea off the northeast coast of Venezuela and around the eastern off-shore islands (Figure 7); while important catches (1.6-3 OCS/hooks×1000) were more common in the ATL area off the northern shelf of South America. In general, catch rates were low in the central areas of the Caribbean Sea.

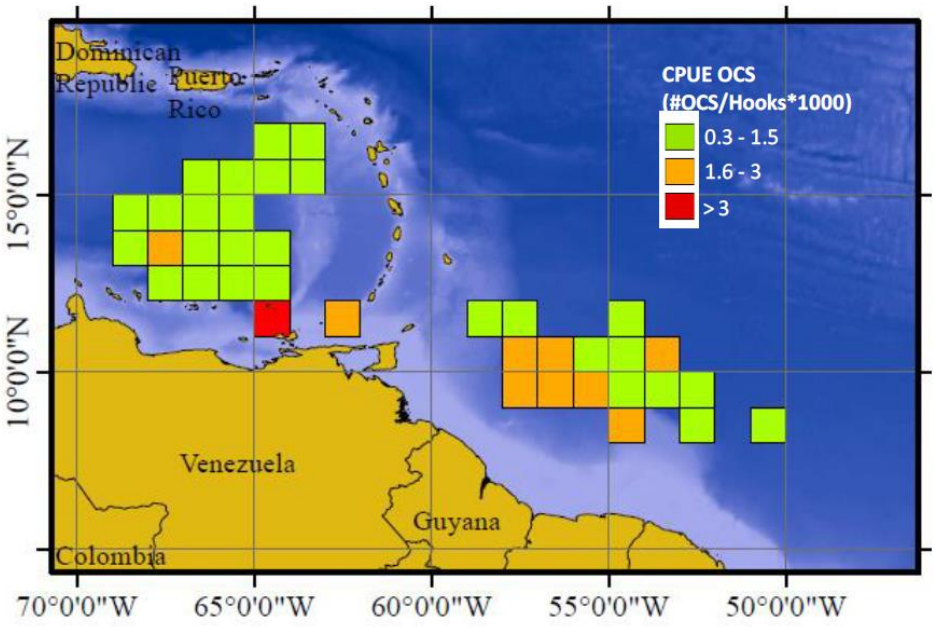


Figure 7. Overall spatial distribution of oceanic whitetip shark (*Carcharhinus longimanus*) nominal catch rates (numbers of sharks/1000 hooks) during 1994-2015, from observed sets. Source: Arocha *et al*. (2017).

Based on the data, the sex ratio was higher for males in the Atlantic and for females in the Caribbean (Figure 8). The highest ratio for females was in the second and third quarters of the year (Figure 8) (Arocha *et al.*, 2017).

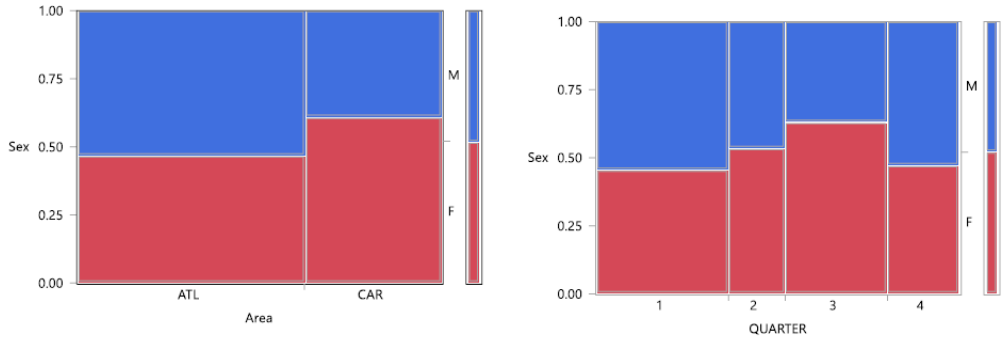


Figure 8. Sex ratio by area (ATL=Atlantic, CAR=Caribbean), and season of oceanic whitetip shark (*Carcharhinus longimanus*) during the study period (1994-2015). Male (blue) and female (red). Source: *Arocha et al*. (2017)

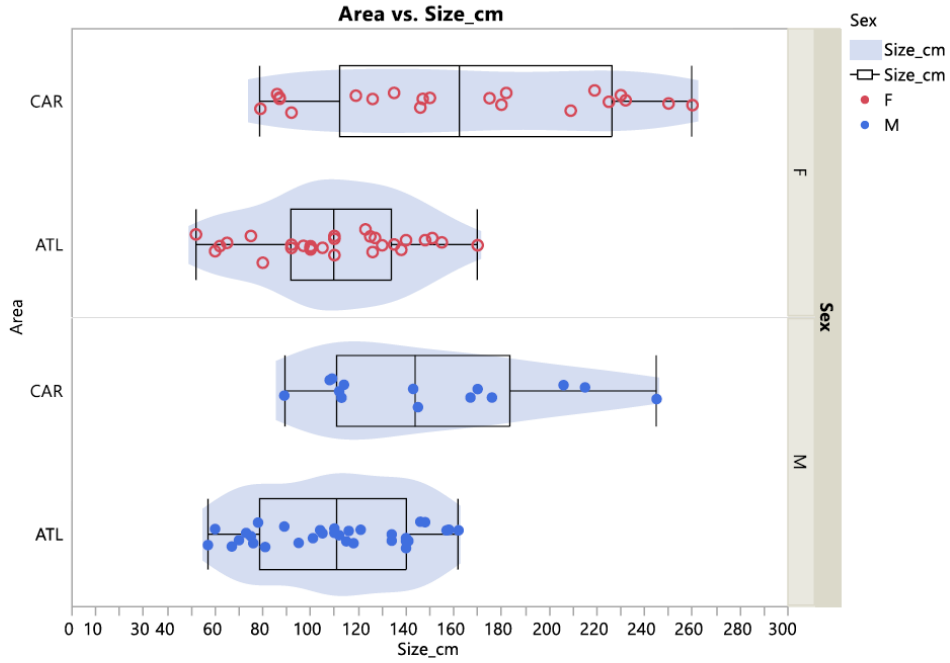


Figure 9. Sex-specific size distribution of oceanic whitetip shark (*Carcharhinus longimanus*) by areas caught by the observed Venezuelan large pelagic fisheries in the Caribbean Sea and adjacent Atlantic waters during 1994-2015. Source: Arocha *et al*. (2017).

Length at maturity is estimated to be 168-198 cm for males and 175-224 cm for females Rigby *et al*. (2019).This means that all individuals caught in the Atlantic were juveniles and a small number of those caught in the Caribbean Sea were adults, especially adult females (Figure 9).

3.2.2 Caribbean Reef Shark (Carcharhinus perezi)

Introduction

The Caribbean reef shark (*Carcharhinus perezi*) is an endemic species to the tropical coastal waters of the Western Atlantic, in particular the Caribbean Sea and the Gulf of Mexico. It occurs throughout the Western Central and Southwest Atlantic Oceans from North Carolina (United States of America), the Bahamas, the Gulf of Mexico and Caribbean Sea to Brazil. It is a reef dwelling species associated with continental and insular shelves. Individuals are mainly found in the upper part of the water column and have not been observed below 400m depth (Tavares, 2009). As one of the most well-known elasmobranchs in the region, understanding its biology and life history is crucial for conservation efforts and management strategies. The species has seen a significant decline of over 50% in the past few decades according to the IUCN red list assessment (Carlson *et al.,* 2021). This decline is most severe in areas in which extraction (fishing) is not regulated whereas in areas with high protection (sanctuaries) the populations are in much better shape.

Biology and Life History

Taxonomy and Morphology

The Caribbean reef shark belongs to the family Carcharhinidae, commonly known as requiem sharks. The species is characterized by a streamlined body and distinctive coloration - grey to grey-brown on the dorsal side and white on the belly. It is medium sized shark, with a maximum length of 295 cm and can weigh up to 90 kilograms (Carlson *et al.,* 2021).

Feeding Behavior

Caribbean reef sharks are opportunistic predators and have a varied diet that primarily consists of bony fishes, including reef-associated species like parrotfish, snappers, and groupers. They also feed on crustaceans, squid and stingrays. Their hunting strategy involves bursts of speed and agility, which aids in capturing fast-moving prey. Contrary to larger shark species they do not have the role of apex predators in their ecosystem as they do not feed on the large predatory teleost fish in their system but on animals of lower trophic levels (Bond *et al.*, 2018).

Life History & Reproduction

Age at maturity for male Caribbean reef shark is estimated at 150-170 cm, for females it is considerably larger at 180 to 190 cm. Previously the age at maturity was calculated at 4.2 years of age with a generation time of 9.6 years (Carlson *et.al* 2021) but a recent study by (Talwar *et.al*, 2022), which used tag-recapture data from the Bahamas to calculate growth, found a much slower growth rate. The authors calculated age at maturity to be around 15 years old with a maximum lifespan of 43.3 to 57.8 years. The species is viviparous, with embryos nursed through a placental sac and females have 3 to 6 pups per litter. Size-at-birth is app 70 cm. A recent study confirmed the likelihood of a bi-annual reproduction cycle based on recapture of individual female sharks in the Bahamas (Campbell *et.al* 2024).

Movement and Connectivity

Over the past decade there have been numerous telemetry studies on Caribbean reef sharks, both acoustic and satellite telemetry. These studies help to better understand population dynamics and are essential to develop conservation plans for the species.

Migration Patterns

Telemetry studies provide insight into fine scale movement patters of Caribbean reef sharks and give a clear insight in the level of site fidelity. Several acoustic telemetry studies around Belize showed that Caribbean reef sharks are present in the area year-round. There is variety between life stages (juveniles vs adults) and sex (makes vs females) in the amount of time they remain in certain areas (Baremore *et al.,* 2021) with females showing a higher overall presence. Interestingly a study of the sharks in Glover's Reef Marine Reserve in Belize, which combines acoustic telemetry and BRUV work showed that the sharks hardly ever left the MPA (Bond *et al.,* 2012). Indicating that spatial protection of high abundance areas is a suitable conservation measure for this species. Another study found that mature males and females are present in the late spring, indicating that this might be a time for mating, although the authors do not indicate if mating scars were observed on females (Pikitch *et al*, 2005). Similar studies from the Bahamas shark sanctuary also showed high site fidelity in Caribbean reef sharks.

Although Caribbean reef sharks are not known to be (highly) migratory, recaptures are often in the same area as where they were originally caught (Talwar, 2022a), there are records of individuals recaptured hundreds of miles from the location where they were tagged (Baremore *et al.,* 2021).

Habitat Preferences

As shown in the section above, Caribbean reef sharks exhibit strong site fidelity and small home ranges, frequently returning to specific areas for many years. They are known to be territorial and display threat behavior when challenged within their territory. Studies from the Bahamas shark sanctuary that analyzed vertical movement patterns using pop-up archival tags show complex habitat and spatiotemporal patterns. The sharks spend most of their time above 50 m but on regular occasions they will venture out to greater depths (up to 400m) further offshore (Shipley *et al.*, 2017). A study in Belize (Chapman *et al.*, 2007) found that at night adult sharks would be found at greater depth and further offshore than during the day, whilst juvenile sharks tended to move in the opposite direction. They could be found in shallow lagoon areas during the night, probably for safety. A preference for more shallow reef areas for juvenile sharks was also observed in a study in Northern Brazil (Garla *et al.*, 2006)

Connectivity and Population Structure

Mitochondrial DNA study conducted by Bernard *et al*. (2021) has provided valuable insights into the population structure and connectivity of Caribbean reef sharks. They found, similar to patterns observed in telemetry and BRUV studies, that there is residency and side fidelity for individual sharks. The level of genetic connectivity was greater between sharks that inhabit continuous and semi-isolated reef habitats in comparison to fully isolated habitats.

The research on the movement and connectivity of the Caribbean reef shark has provided valuable insights into the species' ecology and behavior. The strong site fidelity, limited migration patterns and strong site fidelity to specific habitats underline the significance of protecting areas that have high abundances as well as those with vulnerable life stages (Bond, 2017). `

Threats & Conservation Status

The Caribbean reef shark is classed as endangered on the IUCN red list as it has undergone a population decline of over 50% in the past 3 decades (Carlson *et al.,* 2021), driven by the high level of unmanaged fishing, both targeted and bycatch, throughout its range.

Overexploitation

Due to their slow life history and long generation time Caribbean reef sharks are highly vulnerable to fishing pressure. This has been clearly documented in studies that compared shark populations inside and outside Marine Protected Areas (MPAs) or other areas where fishing is prohibited (Clementi *et al.* 2021, Bond *et al.* 2017) even showing that abundances can be six times higher within no-take MPAs (Flowers *et al.* 2022).

Other threats

Although direct exploitation by humans is the main driver for the decline in this species other factors such as (reef) habitat loss, pollution and climate change can also have a negative impact on shark populations (Clementi *et al.* 2021).

Human Interactions

The increasing human presence in coastal areas has raised concerns about potential interactions between reef sharks and humans. Although Caribbean reef sharks are naturally evasive of humans they can be habituated to human presence, in particular through feeding. This is a controversial practice as it has been shown to alter the shark's behavior and population dynamics (Brena *et al.* 2015). It has also been suggested that it increases the risk of human-shark incidents as sharks learn to associate humans with food, although this has not been confirmed by data. The International Shark Attack File list only 4 unprovoked attacks by Caribbean reef sharks since the start of their project in 1958.

Conservation Efforts

Regional Shark Sanctuaries

As shown in the Movement and Connectivity section of this chapter, spatial management is particularly well suited for Caribbean reef sharks due to their small home range and strong site fidelity. In the Bahamas longline fishing has been banned for more than 30 years and it has been a shark sanctuary since 2011. This has led to an overall increase in sharks around the Bahamas (Haas, *et al*. 2017) showing the effectiveness of such a measure.

International Agreements

The Caribbean reef shark is covered by the following agreements:

- During the latest meeting of the CITES Conference of Parties all carcharhinid species (that had not been listed before) were listed on CITES Appendix ÌI. CITES has a look-a-like criterion to prevent misidentification of species. This was deemed relevant for requiem sharks as most landings are without the head and tail of the shark, making identification to species level problematic (CITES 2022).
- The species is listed as Endangered on the IUCN Red List and the population is determined to be declining (Carlson *et al.*, 2021).
- Since October 2023 the species is listed on Annex III of the SPAW Protocol

National Fishing Regulations

In the United States Caribbean reef sharks have been listed as prohibited species since July 2006, the Consolidated Atlantic Highly Migratory Species Federal Management Plan. This Federal Management Plan since 2006.

Despite the establishment of shark sanctuaries and international agreements, effective enforcement remains a challenge. Lack of conservation measures, inadequate resources, limited monitoring, and lax regulations in some regions hamper effective enforcement.

The conservation status of the Caribbean reef shark remains a matter of concern due to ongoing threats, primarily overexploitation in unregulated fisheries. While efforts such as the establishment of shark sanctuaries and international agreements have been promising, effective enforcement and further research on the species' ecology are vital to ensure its long-term survival. Collaborative efforts at regional and international levels are essential to protect the Caribbean reef shark.

Caribbean Reef Sharks in the CAMAC Scope Area

The Caribbean reef shark is a prominent elasmobranch species found throughout the CAMAC scope area; it is having been documented for 18 of the 24 countries (see Annex 1 of this report). In the islands of the Eastern Caribbean, it is frequently the most observed reef dwelling species (together with nurse sharks).

The Global Fin Print project (see Chapter 4.2 of this report), in which sharks were assessed using Baited Remote Underwater Video (BRUV), surveyed reefs around several countries within the CAMAC scope area and found Caribbean reef shark to be the most observed species, although they frequently noted an absence of reef sharks in habitats that would be suitable for sharks (Flowers *et al.* 2022).

In the Dutch Caribbean (see section 4.3.9 of this report) there is ongoing research on Caribbean reef sharks both with acoustic and satellite telemetry as well as BRUV studies.

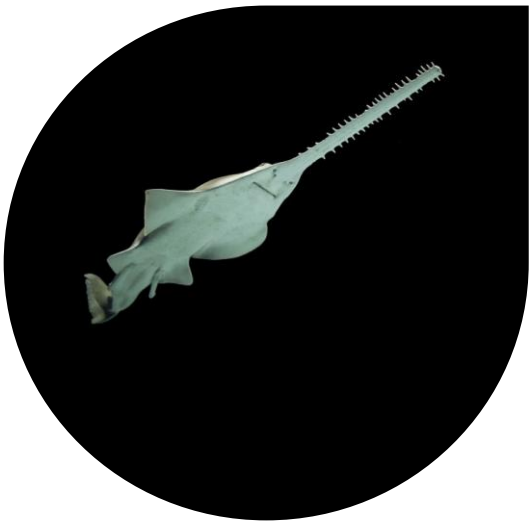
Threats to the Caribbean Reef Shark

There are active fisheries for sharks in a number of countries in the CAMAC scope area and in other countries sharks are seen as wanted bycatch. As Caribbean reef sharks live close to shore in relatively shallow waters, they have a high potential overlap with fishers and populations can be decimated quickly as the rebound potential of this species is low.

Conclusion

The Caribbean Reef Shark is a critical species in the marine ecosystem of the CAMAC area, but it is facing severe threats to its survival. The challenges it faces, necessitate immediate and comprehensive conservation efforts. Through the establishment of marine protected areas, the enforcement of strict fishing regulations, and the promotion of public awareness and education, it is possible to safeguard the future of the Caribbean reef shark and ensure the ecological balance of the region's coral reefs ensuring the continued vitality of marine ecosystems across the region.

3.2.3 Sawfish (Pristis spp.)



Sawfish (*Pristis* spp.) populations are at risk across the globe (Dulvy *et al*., 2014). According to IUCN, of the five species of sawfish, three are Critically Endangered (smalltooth sawfish *Pristis pectinata*, largetooth sawfish, *Pristis pristis,* and green sawfish, *Pristis zijsron*) and two are Endangered (narrow sawfish, *Anoxypristis cuspidata*, and dwarf sawfish, *Pristis clavata*) (Dulvy *et al*., 2014). Exploitation and habitat loss have contributed to the declines worldwide. In 2014 the IUCN developed a global strategy for conservation of sawfish with the ultimate aim of developing regional capacity and more focused and tailored regional conservation actions (Harrison and Dulvy 2014).

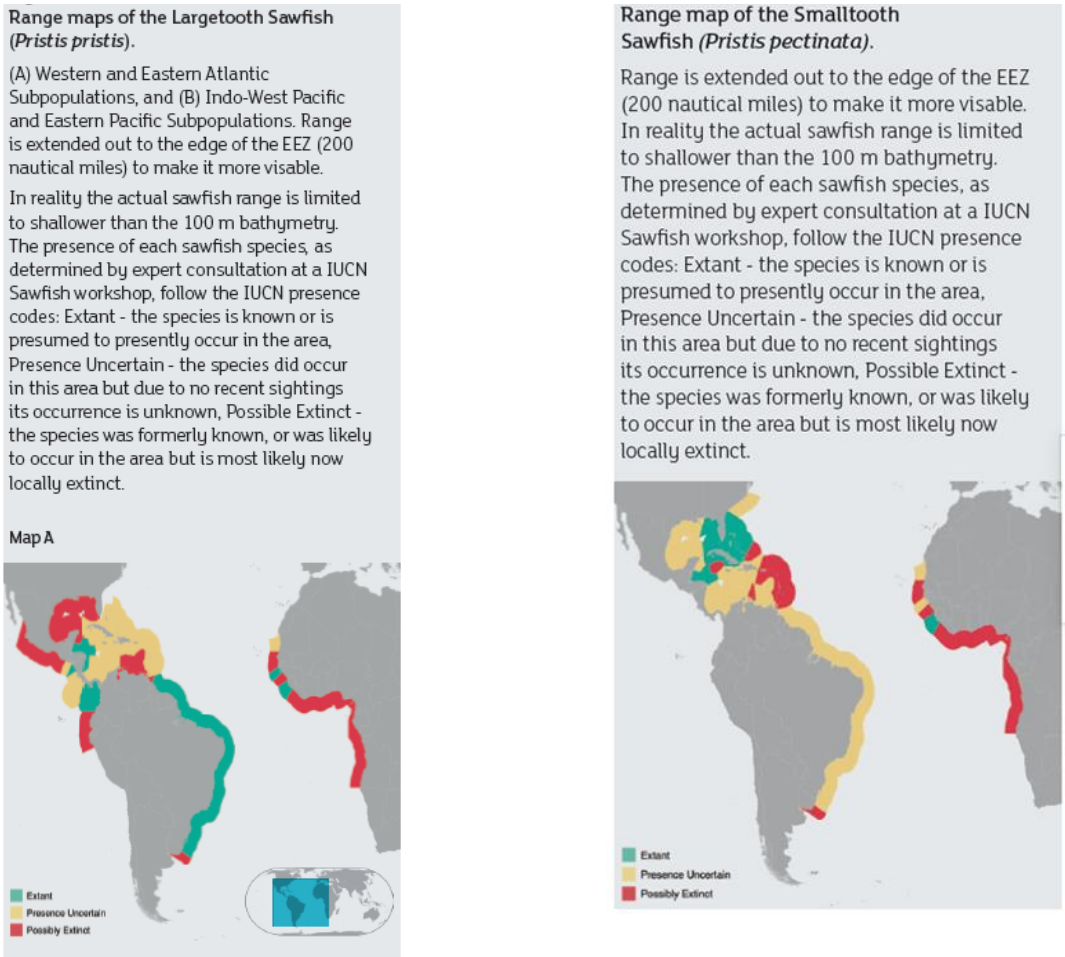


Figure 10. Range maps of the presumed distribution of largetooth sawfish (Pristis pristis) and the smalltooth sawfish (Pristis pectinata). Source: Harrison and Dulvy (2014)

Inclusion in international agreements such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS) has conferred legal safeguards on sawfish species. However, proactive strategies are indispensable to curbing illegal trade and ensuring their survival (Harrison and Dulvy, 2014; Dulvy *et al*., 2017). Although the sawfish species, both small- and largetooth, are included in the mandates of a number of binding international treaties, they are still poorly protected in a great number of countries due to the fact that there are no regulations or that these are not adequately enforced (Carlson *et al*, 2022). This lack of effective enforcement of protective measures remains a challenge due to limited resources and varying levels of commitment across regions (Naylor *et al*., 2012). Bycatch is also a problem whereby unintended capture in fishing gear persists as a threat. Addressing bycatch demands a mixture of technological innovations and regulatory frameworks (Simpfendorfer *et al*., 2011). An analysis from 2018 identified the Caribbean and Amazon Delta as being priority regions for concerted, international sawfish conservation policy action (Fordham *et al.* 2018). A few countries in the Caribbean and Pacific, as well as the Maldives have established sanctuaries to safeguard not only sharks but also sawfish populations. Figure 3 in Chapter 1.3 gives an overview of shark sanctuaries worldwide.

The largetooth and smalltooth sawfish are on Appendix II of SPAW and will be discussed in detail in this chapter.

3.2.3.1 The largetooth sawfish (Pristis pristis)

Introduction

The largetooth sawfish (*Pristis pristis*) is a large shark-like ray occurring in freshwater, estuarine and coastal waters with a widespread circumtropical distribution and four subpopulations (Western Atlantic, Eastern Pacific, Eastern Atlantic, and Indo-West Pacific). The species can reach lengths of up to 705 cm and occurs at depths of 0–60 m, with juveniles occupying freshwater and estuarine habitats, and adults occurring in both estuarine and coastal waters. As for the smalltooth sawfish, the species was historically targeted for their meat and highly valuable fins but is now taken as bycatch, both in commercial and small-scale fisheries. The high value of the fins was responsible for the increased exploitation of the species throughout its entire range for the past tens of years. Habitat loss in coastal areas and the specific morphology of the rostrum (which makes them highly catchable in fishing gear) have also driven declines (Espinoza *et al*., 2022).

Biology and Life History

The largetooth sawfish is a distinctive species, with a maximum length of 705 cm, inhabiting various depths ranging from shallow waters to depths of up to 60 meters (Compagno, 2005). Juveniles predominantly occupy freshwater and estuarine environments and spend much of their early life in rivers up to 400 km from the sea (Simpfendorfer *et al*., 2011), while adults inhabit estuaries and coastal waters (Dulvy *et al.,* 2014). This species practices aplacental viviparity, with litter sizes ranging from 1 to 20, and the size at birth measuring between 72 and 90 cm (Last et al., 2016). Maturation occurs at around 300 cm total length, with females reaching maturity at around 8-10 years of age. The largetooth sawfish has a maximum lifespan of 36 years, translating to a generation length of approximately 22.5 years (Dulvy *et al*., 2014). It is distinguished by its toothed rostrum that resembles a saw (Naylor *et al*., 2012). This distinctive feature increases the species' vulnerability to entanglement in fishing gear (Simpfendorfer *et al*., 2011; Dulvy *et al*., 2014). Sawfish are apex predators, preying on a diverse range of aquatic organisms including fish and crustaceans. The unique rostrum functions as a hunting tool, allowing sawfish to incapacitate prey by slashing through schools (Dulvy *et al*., 2014).

Movement and Connectivity

Historically, the largetooth sawfish enjoyed a broad distribution across the Western Atlantic, Eastern Pacific, Eastern Atlantic, and Indo-West Pacific (Espinoza et al., 2022). The survival of the largetooth sawfish is intricately linked to freshwater, estuarine, and coastal habitats, which function as vital nurseries for juvenile individuals and provide essential resources for adults (Naylor *et al.*, 2012). There is no information on movement and connectivity of the largetooth sawfish in the Wider Caribbean, but studies in the San Juan River, which forms a natural border between Costa Rica and Nicaragua, have shown how important the presence of such a freshwater system is in the connectivity of sawfish populations (Espinoza *et al.*, 2022).

Threats & Conservation Status

The largetooth sawfish confronts a large number of threats including overfishing and habitat loss, culminating in a large decline across its distribution. Preserving the largetooth sawfish necessitates multifaceted endeavors, encompassing legal protections, international collaborations, and enhanced monitoring and enforcement measures (Last *et al.*, 2016). International agreements such as the Convention on International Trade in Endangered Species (CITES) have provided some protection, yet illegal trade and ongoing threats persist (Harrison and Dulvy, 2014).

The species is covered by the following international agreements:

- The entire family Pristidae has been on CITES Appendix I since 2007
- The species has been listed on Appendix I and II of CMS since 2014 (https://www.cms.int/sharks/en/species/pristis-pristis)
- Since 2019 the species is on Annex II of the SPAW Protocol
- The IUCN status is Critically Endangered in all regions assessed (global, Europe and Mediterranean) and the populations are decreasing (Espinoza *et al.*, 2022)

The deterioration of largetooth sawfish populations is influenced by various factors, including overfishing and habitat loss. Its unique morphology, particularly the rostrum, heightens its susceptibility to entanglement in fishing gear (Simpfendorfer *et al.*, 2011). Moreover, due to their large size, sawfish fins are highly valuable for shark fin soup, and their rostra are sold as ornaments (Harrison & Dulvy, 2014; Dulvy *et al.*, 2014). Crucial estuarine, mangrove, and freshwater habitats have been compromised, posing a substantial risk to the species. Human-induced activities like land use changes and pollution exacerbate habitat degradation (Carlson *et al.*, 2022).

Largetooth sawfish in the Wider Caribbean and CAMAC Scope Area

Recent studies spotlight significant reductions in largetooth sawfish populations across the Wider Caribbean (Dulvy *et al.,* 2014). In the Western Atlantic, current records indicate that at present, largetooth sawfish can only be regularly encountered in the Amazon River basin, the Rio Colorado-Rio San Juan area in Nicaragua, and possibly some remote areas of French Guiana, Suriname, and Guyana (Harrison & Dulvy 2014).

Until around 1995-2004 up to 77% of fishers saw 'sawfish' in the waters of French Guiana, in 2010-2017 it was only 8%. In the waters of Suriname, the decline started around 1984, but was less rapid than in French Guiana, and in the period 2010-2018, 25% of fishermen still reported sawfish (personal communication Michel Nalovic, CAMAC workshop 4th November 2023). Although these sightings are likely either large- or smalltooth sawfish, the species were not further distinguished.

Threats in the Wider Caribbean

The threats occurring for the largetooth sawfish in the Wider Caribbean region and CAMAC scope area are the same as across the entire range of the species. Overfishing and loss of essential habitats for reproduction and feeding, as well as lack of enforcement of international agreements and inadequate management strategies (Dulvy *et al.*, 2014).

Conservation Efforts in the Caribbean

There are MPAs and shark sanctuaries in the area (see Chapter 1.3), which coincide with the (historical) distribution of the largetooth sawfish (Harrison and Dulvy, 2014). Despite partial protection in specific zones, the presence of largetooth sawfish in the Caribbean remains uncertain.

3.2.3.2 The smalltooth sawfish (Pristis pectinata)

Introduction

The smalltooth sawfish (*Pristis pectinata*) is a large shark-like ray occurring in estuarine and coastal areas and occurs entirely in the Atlantic Ocean. It has a circumtropical distribution, occurring along the coast of West Africa and the south of the US down the coast of Brazil and including the Caribbean. The species can reach up to 500 cm length and occurs at depths of 0–122 m with juveniles occupying estuarine habitats and adults occurring in both estuarine and coastal waters. As for the largetooth sawfish, the species was historically targeted for its meat and highly valuable fins but is now taken as bycatch, both in commercial and small-scale fisheries. The high value of the fins was responsible for the increased exploitation of the species throughout its entire range for the past tens of years. Habitat loss in coastal areas and the specific morphology of the rostrum (which makes them highly catchable in fishing gear) have also driven declines (Carlson *et al.*, 2022). The species has undergone local and regional extinctions from large areas of its former range. Potentially viable populations of smalltooth sawfish now only exist in the southeast United States, Mexico, Bahamas and Cuba (Carlson *et al.* 2022; Harrison and Dulvy 2014).

Biology and Life History

The smalltooth sawfish reaches a maximum size of approximately 500 cm and both males and females mature at around 340–370 cm (Brame *et al.,* 2019). Reproduction is aplacental viviparous, with litter sizes of 7–14, a biennial reproductive cycle, and a size-at-birth of 64–81 cm STL (Feldheim *et al.* 2017, Brame *et al*. 2019). Female age-at-maturity is 7–11 years (Brame *et al.* 2019). Smalltooth sawfish grow rapidly, especially as juveniles (Simpfendorfer *et al.* 2008, Scharer *et al.* 2012). Using data from Scharer *et al.* (2012), Carlson and Simpfendorfer (2015) extrapolated a maximum age in the wild of approximately 30 years, translating to a generation time of 19.5 years.

Sawfish are apex predators, preying on a diverse range of aquatic organisms including fish and crustaceans. The unique rostrum functions as a hunting tool, allowing sawfish to incapacitate prey by slashing through schools (Dulvy *et al.*, 2014).

Movement and Connectivity

Very little information is available on the movement and connectivity of the smalltooth sawfish. There is an ontogenetic shift in distribution. Juveniles up to 150 cm are dependent on estuaries for food and protection whilst those individuals larger than 200 cm move into water deeper than 5 m and larger still (> 300 cm) are found in deeper water (Simpfendorfer 2006). Studies in Florida have identified essential nursery habitats for the conservation of the species as being adjacent to red mangroves *Rhizophora mangle* and euryhaline habitats with water depths ≤0.9 m (Norton *et al.,* 2012). Other studies show freshwater as possibly being an environmental driver (Simpfendorfer *et al*., 2011).

Threats & Conservation Status

The smalltooth sawfish undergoes intense fishing pressure, both present day and historically. There is effectively no management or regulation of fisheries, and the species is caught in gillnets and trawls and taken as bycatch in commercial and small-scale fisheries (including artisanal, cultural, and subsistence) and is kept for the valuable fins and meat (Dulvy *et al.*2016, Yan *et al*. 2021). From a study by Okes and Sant (2019) it is apparent that fishing effort has increased over the past decades across the species' range, driven by the fin and meat trade. Moreover, due to their large size, sawfish fins are highly valuable for shark fin soup, and their rostra are sold as ornaments (Dulvy *et al.*, 2014).

For smalltooth sawfish, crucial estuarine, mangrove, and freshwater habitats have been depreciated, posing a substantial risk to the species. Human-induced activities such as land use changes and pollution exacerbate habitat degradation (Carlson *et al*., 2022). Removal of red mangroves (*Rhizophora mangle*) and destruction of shallow waters habitats, features upon which juvenile smalltooth sawfish rely, are immediate habitat threats. Agricultural and urban development, aquaculture, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff because of continued coastal and catchment development has caused substantial loss or modification of their inshore habitats (Brame *et al.* 2019).

The species is covered by the following international agreements:

- The entire family Pristidae has been on CITES Appendix I since 2007
- The species has been listed on Appendix I and II of CMS since 2014 (https://www.cms.int/en/species/Pristis-pectinata)
- Since 2019 the species is on Annex II of the SPAW Protocol
- The IUCN status is Critically Endangered in all regions assessed (global, Western and Eastern Atlantic) and the populations are decreasing (Carlson *et al*., 2022)

Smalltooth sawfish in the Wider Caribbean and CAMAC Scope Area

There appear to be a few areas in the CAMAC scope area where the smalltooth sawfish may still be present, such as Costa Rica and Suriname. Costa Rica has domestic measures in place to protect sawfish (Carlson *et al*., 2022). In the wider Caribbean there are potentially viable populations of smalltooth sawfish in the southeast United States, Mexico, Bahamas, and Cuba (Carlson *et al.* 2022). Along the Caribbean coast of Guatemala, the smalltooth sawfish is 'possibly extinct' with the last known records from over 30 years ago (Carlson *et al*., 2022). For the rest of central and northern South America, the presence of smalltooth sawfish is considered 'uncertain' due to lack of data for the past 15–30 years. The species is 'possibly extinct' in Jamaica and in Brazil (Carlson *et al*., 2022), where the last confirmed records were from the 1970s and 1980s (Faria and Charvet 2008).

Until around 1995-2004 up to 77% of fishers saw 'sawfish' in the waters of French Guiana, in 2010-2017 it was only 8%. In the waters of Suriname, the decline started around 1984, but was less rapid than in French Guiana, and in the period 2010-2018 25% of fishermen still reported sawfish (Personal communication Tony Nalovic, CAMAC workshop 4th November 2023). Although these sightings are likely either large- or smalltooth sawfish, the species were not further distinguished.

Threats in the Wider Caribbean

The threats occurring for the smalltooth sawfish in the Wider Caribbean region and CAMAC scope area are the same as across the entire range of the species. Overfishing and loss of essential habitats for reproduction and feeding, as well as lack of enforcement of international agreements and inadequate management strategies (Dulvy *et al.*, 2014).

Conservation Efforts in the Caribbean

There are MPAs and shark sanctuaries in the area (see Chapter 1.3), but these do not necessarily coincide with the (historical) estuarine and inshore distribution of the smalltooth sawfish. More concerted actions are needed specifically in the estuaries and inshore areas where the species was once found (Harrison and Dulvy, 2014).

3.2.4 Silky Shark (Carcharhinus falciformis)

Written by Guido Leurs

Introduction

The silky shark (*Carcharhinus falciformis*) is one of the most widespread species of sharks, with a circumtropical distribution (Bonfil 2008, Clarke *et al.* 2015, Ebert *et al.* 2021). The species is a relatively large-bodied shark from the requiem shark family (Carcharhinidae). It is one of the most captured shark species as it overlaps in distribution with many commercial pelagic fish species (e.g., tunas, billfish) and thus also is a common bycatch species. Currently this species is listed as Vulnerable on the IUCN Red List, and its conservation status has deteriorated over the past years (Rigby *et al.* 2017). We here review the biology of this species and the threats that is faces, including a special focus on what is known about this species within the CAMAC scope area.

Biology and Life History

The silky shark is a widespread shark species with a global distribution that is limited to the tropics. Here it occurs mostly in oceanic waters in surface waters to a depth of 500 meters deep. However, the species mostly uses waters between the surface and 200 meters deep (Bonfil 2008, Hueter *et al.* 2018, Ebert *et al.* 2021). As it is one of the most caught shark species in pelagic fisheries, most of its biology and life history is known through fisheries research.

Taxonomy and Morphology

The silky shark is a carcharhinid shark (Carcharhinidae), commonly referred to as the requiem sharks. It is a large-bodied, slender shark reaching a maximum total length of at least 350 cm (Voigt and Weber 2011, Ebert *et al.* 2021). The common name of this species refers to the relatively smooth skin that this species has compared to other related shark species (Voigt and Weber 2011). This species is often misidentified as other carcharhinid species, like the dusky shark (*Carcharhinus obscurus*) or the Galapagos shark (*Carcharhinus galapagensis*). Identifying features of this species includes the rounded first dorsal fin which originates behind the anterior edge of the pectoral fins (Voigt and Weber 2011, Ebert *et al.* 2021).

Feeding Behavior

As many shark species, silky sharks have a general diet based on varied prey species. The most common prey species in the diet of the silky shark are cephalopods, pelagic crustaceans and bony fishes (Cabrera-Chávez-Costa *et al.* 2010, Filmalter *et al.* 2017, Flores-Martínez *et al.* 2017). Young silky sharks live on habitats closer to continental shelves or oceanic banks, and thus can have a diet consisting also of more reef-associated prey (Bonfil 2008). The species is often associated with fish aggregating devices (FADs) where it supplements its diet with schooling fish (Filmalter *et al.* 2015, 2017, Hutchinson *et al.* 2019).

Reproduction

Male silky sharks mature between 180 and 230 cm in total length, and female silky sharks mature between 180 and 246 cm (Bonfil 2008, Voigt and Weber 2011, Ebert *et al.* 2021). Age at maturity is around 10 years in males and a minimum of 12 years in females (Voigt and Weber 2011). However, age at maturity varies between oceanic regions for this species (Rigby *et al.* 2017, Ebert *et al.* 2021). The species is viviparous with embryos being fed through a yolk-sac placenta (Bonfil 2008, Ebert *et al.* 2021). Gestation is approximately 12 months, after which between 2 and 18 pups are born at a length between 56 and 87 cm (Bonfil 2008, Voigt and Weber 2011, Rigby *et al.* 2017, Ebert *et al.* 2021). The species is thought to reproduce with intervals of two years (Voigt and Weber 2011). Maximum reported age for this species is up to 36 years (Ebert *et al.* 2021).

Movement and Connectivity

The silky shark is a pelagic shark species that moves over long distances and therefore also overlaps with many potential threats. Understanding its movement ecology is therefore crucial to prevent the conservation status of this species from deteriorating further.

Migration Patterns

Studies focusing on the migration and movement patterns of the silky shark are limited. Silky sharks are thought to associate with specific areas, but with occasional long-distance migrations. One study showed that a silky shark moved from the Chagos Archipelago to the Kenyan coast (approximately 3,500 km), which is the longest recorded movement distance for this species (Curnick *et al.* 2020). This same study showed that the majority of individuals stayed within the Chagos marine protected area (640,000km^2) and were highly associated with sea mounts (Curnick *et al.* 2020).

Habitat Preferences

The species likely segregates by size with young individuals using continental shelf habitats or habitats associated with oceanic banks, and larger (sub-)adults using pelagic habitats (Bonfil *et al.* 2008). Young silky sharks are thought to use reef-associated habitats until a size of approximately 130 cm (Bonfil *et al.* 2008). Larger individuals then move to more pelagic habitats. The species has a clear preference for habitats ranging between 20-29 degrees Celsius (Hueter *et al.* 2018, Hutchinson *et al.* 2019).

Connectivity and Population Structure

Clarke *et al.* (2015) determined that, although the species has a circum-tropical distribution, the species is separated in distinct populations. At least five distinct populations exist, with smaller scale isolated populations in the Indo-Pacific region. This highlights the need for conservation efforts on a regional scale for this species and not only on a global scale.

Human Interactions

Overlap with human activities other than fisheries is limited for this species due to its oceanic nature. However, some studies suggest that silky sharks may alter diurnal movements due to association with baited dives for shark ecotourism (Hueter *et al.* 2018).

Threats & Conservation Status

As the silky shark is one of the most common shark species in pelagic habitats, it most likely also fulfils an important predatory role in pelagic ecosystems. However, the species has experienced population declines throughout its range, which now threatens the species and its ecological role with extinction.

Overfishing

After the blue shark (*Prionace glauca*), the silky shark is the most captured pelagic shark species (Ebert *et al.* 2021). Fins of the silky shark were the second-most common shark fins encountered in major shark fin markets (Careñosa *et al.* 2020), indicating that the species is also captured specifically for its commodities. The species is captured in pelagic fisheries like tuna long-liners or purse seiners but is also associated with fish aggregating devices (Bonfil 2008, Clarke *et al.* 2013, Rigby *et al.* 2017). According to the latest IUCN Red List assessment of the species, overfishing is the sole cause of the deteriorating conservation status of this species (Rigby *et al.* 2017).

Habitat Loss

Compared to coastal shark species, the silky shark is less likely to be impacted by a loss of habitat. However, as early life stages of the species are more associated with reef ecosystems (Bonfil *et al.* 2008), the loss of reefs is likely to impact this species. In addition, pollution deteriorates habitats of sharks and pollutants have been found to accumulate in this species, likely impacting the health and survival of the species (Terrazas-López *et al.* 2016).

Conservation Efforts

Regional Shark Sanctuaries

The silky shark is a pelagic species that can move over long distances, but large marine protected areas are likely to still benefit this species. In the Indian Ocean, silky shark movements mostly took place within a large marine protected area with only some individuals moving out of protected waters (Curnick *et al.* 2020). However, other studies focused on this species suggest that marine protected area design should incorporate the long-distance movements of the species, as current designs may not be beneficial for the species (Murray *et al.* 2023). This suggests that large-scale protected areas can be beneficial if the movement ecology of the silky shark is considered.

International Agreements

The silky shark is covered by the following international agreements:

- Due to the global trade in fins of the silky shark and its deteriorating conservation status throughout its distribution, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listed the silky shark on Appendix II in 2017 (CITES 2016). This means that trade in any commodities of the species have to be regulating by the importing and exporting parties of silky shark commodities. During the latest meeting of the CITES Conference of Parties the listings of sharks were extended to include other carcharhinid species, preventing misidentification of species (CITES 2022).
- The silky shark is also listed on the Convention of Migratory Species (2014)
- The species has been on Annex III of the SPAW protocol since 2019
- The species is considered to be Vulnerable globally by IUCN and the populations are decreasing (Rigby *et al.* 2021)
- Catches of silky sharks are regulated in many regional fishing agreements (i.e., ICCAT; Rigby *et al.* 2017).

Silky sharks in the CAMAC scope area

Information on the silky shark in the Wider Caribbean is very limited. As the species is the second most common pelagic species and has a circum-tropical distribution, this species is likely also common within the CAMAC scope area. However, studies describing the biology and ecology of the species and its subpopulations in the region are lacking.

Population Status and Decline

The last estimates of population status of the silky shark that overlaps with the CAMAC scope area was conducted in 2007. Cortes *et al.* (2007) showed a negative trend in silky shark catches based on fisheries logbook data and observer data for the Gulf of Mexico and Caribbean Sea. However, the species is known to have declines significantly over the past decades on a global scale, and in this assessment many countries from the CAMAC scope area are listed as countries of occurrence of the silky shark (Rigby *et al.* 2007).

Threats to silky shark

Overfishing

The widespread use of fish aggregating devices and targeted tuna catches within the CAMAC scope area is a potential indicator of increased catches of silky sharks, either targeted or as bycatch. Species-specific information on the species is limited, but unpublished data from studies on this species on the Saba Bank and Curaçao suggest that the species is associated with fish aggregating devices in these two areas (Leurs *et al.* in prep.). These study on Curaçao also confirms that juvenile silky sharks occur around fish aggregating devices around the island and are also landed by fishers (Leurs *et al.* in prep.).

Habitat Loss

The loss of habitat is often not considered for this pelagic shark species. However, the loss of reefs and associated biomass of prey species throughout the CAMAC scope area can likely impact the silky shark, as early life stages of the species are associated with more coastal habitats and reef-associated prey species. In addition, pollution impacts all marine food webs, including pelagic food webs. Elevated levels of pollutants in the waters of the CAMAC scope area (personal communication ERIC Tobago – see Chapter 4.20) should therefore also be considered as a potential threat to common pelagic shark species.

Conservation Efforts

Data collection: no recent estimates of population trends or assessment of threats for the Caribbean Sea or CAMAC scope area exist, making the current status of the silky shark within the Wider Caribbean region unknown. Species-specific data collection and preventing misidentification of the species in fisheries-dependent data should be prioritized to inform better management strategies for this species within the region. This also includes training all involved stakeholders in species-identification and data collection.

Implementation of regulations: the implementation of stricter fishing regulations can likely benefit this species within the CAMAC scope area. Fishing bans and retention bans should be enforced and overlap between fisheries and this species should be regulated to prevent overexploitation of the species. In addition, governments within the CAMAC scope area should mitigate overfishing of any shark species and enforce international agreements (e.g., CITES, regional fishing agreements).

3.2.5 Hammerhead sharks (Sphyrna spp.)

Introduction

Hammerhead sharks belonging to the Family Sphyrnidae represent a distinctive group of large sharks characterized by a laterally elongated rostrum or cephalofoil. There are nine species recognized, of which seven have been observed in the CAMAC scope area, with several having a global distribution. Hammerhead sharks exhibit slow growth rates and are susceptible to exploitation by commercial, recreational, and artisanal fisheries, rendering them vulnerable to population decline.

Scientific name	Common name	Present in CAMAC scope area
Sphyrna lewini	Scalloped hammerhead	YES
Sphyrna media	Scoophead	YES
Sphyrna mokarran	Great hammerhead	YES
Sphyrna tiburo	Bonnethead	YES
Sphyrna tudes	Smalleye hammerhead	YES
Sphyrna gilberti	Carolina Hammerhead	YES
Sphyrna zygaena	Smooth hammerhead	YES
Sphyrna corona	Scalloped bonnethead	NO
Eusphyra blochii	Winghead shark	NO

Table 3: presence of hammerhead species in the CAMAC scope area

Of the species within the hammerhead shark complex three species: *Sphyrna mokarran* (great hammerhead), *Sphyrna lewini* (scalloped hammerhead), and *Sphyrna zygaena* (smooth hammerhead) are present throughout the CAMAC scope area. Of these, the information available for the great and scalloped hammerhead is more extensive than for the smooth hammerhead. There is very limited information available on the other 5 species in the group and since these are not listed on the annexes of the SPAW Protocol they are not included in this review.

While sharing morphological similarities, the three large hammerhead species display distinctive variations in their head shape, which is primarily focus for species differentiation. The rostrum of *Sphyrna mokarran* is linear, whereas *Sphyrna lewini* possesses a bifurcated rostrum with rounded lobes

separated by a mid-line. *Sphyrna zygaena*, on the other hand, exhibits a rostrum with a single rounded lobe and a rounded mid-line. Further differences include a larger body size and a disproportionately large, sickle-shaped dorsal fin for the great hammerhead. The distribution patterns also differ, with the great hammerhead predominantly inhabiting tropical and subtropical regions, while scalloped and smooth hammerhead are more prevalent in subtropical and temperate waters. Behavioral characteristics among the species vary, ranging from the great hammerhead's who have a solitary life style to the well documented aggregating behavior in scalloped hammerheads.

Biology and Life History

Great Hammerhead

Great hammerhead sharks are relatively slow growing and attain large sizes. In the Northwest Atlantic and Gulf of Mexico, median length at maturity was 285 cm for females and 238 cm for males with a mean age at maturity of 20 years with longevity calculated at 42 years for males and 44 years for females in the Northwest Atlantic and Gulf of Mexico. This species likely reproduces on a biennial cycle (at least in the Atlantic). The average fecundity is 15 pups per but a litter of up to 33 pups has been observed.

Great hammerheads are apex predators and feed primarily on teleost fishes and other elasmobranchs, from small rays to large sharks. They have sharp pointed teeth on the lower jaws for seizing and holding prey and serrated triangular teeth in the upper jaws for cutting prey.

Scalloped Hammerhead

There is a larger base of information on the life history of the scalloped hammerhead shark, suggesting that this species is relatively faster growing than other hammerheads. Throughout its global range, large differences have been reported for age/size at maturity, longevity and fecundity. in this paper we will only use those reported for the Wider Caribbean, Gulf of Mexico and Northwest Atlantic. Age at maturity has been estimated at 15 years for females and 9–10 for males in the Northwest Gulf of Mexico (Cortes 2000) with the size at maturity estimated at 303 cm in both sexes for the North Atlantic but a smaller size of 250 cm for females and 180 cm for males in the Northwest Gulf of Mexico. For both the Northwestern Gulf of Mexico and the North Atlantic maximum age was estimated around 31 years for both sexes this is a lot older than the 14 years max ago reported for the Western Pacific (with age at maturity estimate at 4 years). The scalloped hammerhead is a viviparous shark with fecundity reportedly ranging from 30–40 pups in the Northwest Gulf of Mexico and an average of 24 pups in the North Atlantic (Cortes *et al*. 2015).

The diet and foraging of scalloped hammerheads have been relatively well-studied, and depending on life stage and geography they have been described as both generalist and specialist feeders Scalloped hammerheads feed on a mixture of fish, crustaceans, and cephalopods, with squid as a primary prey item, reflected by their smaller teeth than the great hammerhead.

Females have been documented to have different feeding strategies than males, this is a possible driver of the sexual segregation for this species.

Smooth hammerhead

There is a lack of regional information on smooth hammerhead life history although the estimated growth rates appear to be slightly lower than their relatives the great and scalloped hammerheads (Coelho *et al.* 2011), suggesting the smooth hammerhead is the slowest-growing species of large hammerhead complex. In the southern hemisphere, it is thought males appear to reach sexual

maturity between 250 and 260 cm total length, whereas females attain maturity around 260 cm (Cortes 2000) maturity is estimated to be reached between 210 and 240 cm total length for all for both sexes. Fecundity is relatively high, with a range of 20–49 pups per litter (Cortes 2000).

Movement and Connectivity

The scalloped hammerhead shark is a circumglobally present species that lives in coastal warm temperate and tropical seas. It occurs over continental and insular shelves, as well as adjacent deep waters, but is seldom found in waters cooler than 22° C (Compagno 1984, Schulze-Haugen and Kohler 2003). It ranges from the intertidal and surface to depths of up to 450-512 m (Sanches 1991, Klimley 1993), with occasional dives to even deeper waters (Jorgensen *et al.* 2009). It has also been documented entering enclosed bays and estuaries (Compagno 1984). There are known aggregation sites throughout their range with the most famous ones around sea mounts in the Galapagos islands. Adults spend most of the time offshore in midwater and females migrate to the coastal areas to pup (Rodriguez-Arana, 2022).

Such aggregations are unknown for the other two species. Great hammerhead sharks are generally solitary and coastal but display movements to open ocean waters in the high seas (Hammerschlag *et al*. 2011). *Sphyrna mokarran* have been tagged frequently in the Bahamas and Florida and seem to migrate along the North American coastline and possible also down towards the Southern Caribbean.

Sphyrna zygaena is generally a coastal and semi-oceanic pelagic shark, it is the most oceanic of the hammerhead species and capable of long distances over open ocean waters in the high seas (Santos and Coelho, 2018), commonly leaving coastal habitats at 2-3 years of age (Clarke et al., 2015). Of the three species the Smooth hammerhead is least observed within the CAMAC scope area although they are the most recorded hammerhead shark species in the Venezuelan longline fisheries observer program. Smooth hammerhead is caught as bycatch in pelagic industrial and small-scale longline, and gillnet fisheries, and is often retained for the fins, and sometimes the meat (Tavares and Arocha 2008).

Threats & Conservation Status

The largest threat to hammerhead sharks is fishing mortality, both in targeted fisheries and as bycatch in other fisheries. Due to the similarities between the species, misidentification of hammerhead species is a common problem in fisheries data (Clarke et al. 2006). As a result, species-specific data on hammerhead catch rates, bycatch, and fins are often referred to as ‘‘Sphyrna spp.’’ and not identified to the species level. Analysis of the shark fin trade in Hong Kong shows that hammerhead shark fins of the larger species are among the most valuable and sought-after fins on the market, they represent 5,9% of the total trade (Clarke *et al.* 2006).

Bycatch remains a significant threat to over 75% of pelagic shark species, and it is well-known that large hammerhead sharks (*Sphyrna* spp.) are highly vulnerable to bycatch due to their aggregative behavior and high rates of at-vessel and post-release mortality following capture.

All 3 species are listed as endangered globally on the IUCN red list as they have seen a population decline of over 70% in the past 3 generations and globally populations are still on a downward trend. Within the assessment it is flagged that the population in the Eastern Atlantic seems to be on a positive trend mainly due to protective measures taken in the Gulf of Mexico that reduced the (by)catches in fisheries, indicating that this is a species that responds well to management measures coming in Pacours *et al*. in their 2021 paper on the decline of pelagic shark species listed the hammerhead as one of the species that has suffered the largest decline in the past 3 decades.

All three species of Hammerhead sharks are:

- Listed on CITES Appendix II since 2019;
- on Appendix II from CMS since 2011 and *Sphyrna mokarran* and *Sphyrna lewini* have been on the Sharks MOU since 2016 with *Sphyrna zygena* added in 2019
- on Annex III of the SPAW Protocol since 2017
- ICCAT has prohibited catches of hammerhead sharks for all contracting parties since 2018

Large hammerhead in the CAMAC scope area

All nations in the CAMAC scope area report the presence of hammerhead sharks in their waters although due to the difficulty of identifying the different species it is unclear if all three large hammerhead species have been recorded in all CAMAC countries although based on their distribution it is to be assumed that they are present in almost all countries' waters.

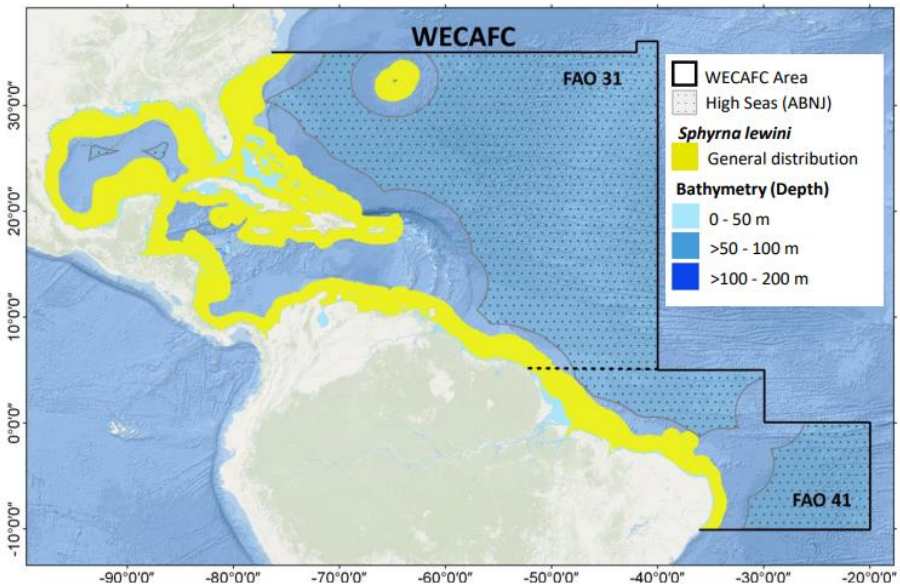


Figure 11: *Sphyrna lewini* (Scalloped hammerhead shark, SPL) general distribution in the Wider Caribbean (source: Arocha, 2022)

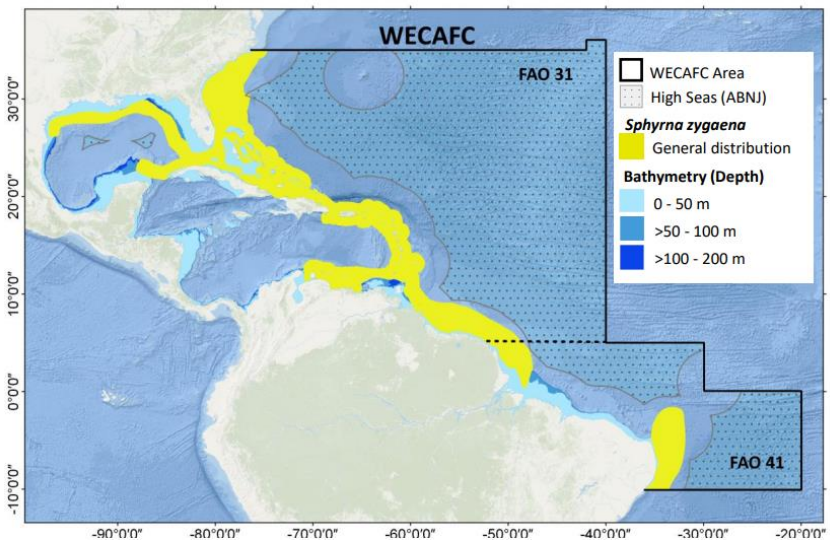


Figure 12: *Sphyrna zygaena* (Smooth hammerhead shark, SPZ) general distribution in the Wider Caribbean (source: Arocha, 2022)

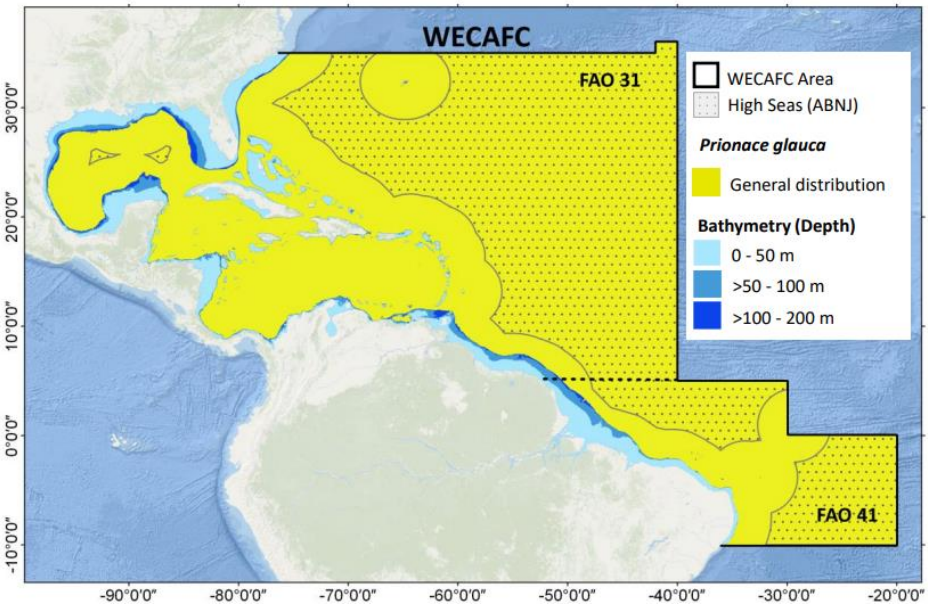


Figure 13: *Prionace glauca* (Blue shark, BSH), *Carcharhinus falciformis* (Silky shark, FAL), *Carcharhinus longimanus* (Oceanic whitetip shark, OCS), *Sphyrna mokarran* (Great hammerhead, SPK), *Isurus oxyrinchus* (Shortfin mako, SMA) and *Alopias superciliosus* (Bigeye thresher shark, BTH) general distribution in the Wider Caribbean (source: Arocha, 2022)

In the Venezuelan longline surveys for ICCAT *Sphyrna* spp is a distinct category and bycatch was regularly reported up to 2019 when the observer program was aborted. In the interviews carried out as part of this project, experts reported catches of hammerhead in artisanal fisheries from Trinidad and Haiti. These were mainly scalloped hammerhead sharks although other hammerhead species were also reported.

Several experts referred to potential scalloper hammerhead shark nurseries in their waters, Trinidad has a known nursery of the West coast of the islands, Puerto Rico has a potential nursery just North of the main part of San Juan and in Sint Lucia fishers have reported an area with high abundance of juvenile scalloped hammerheads a few miles to the east of the island. These areas should be of high priority for further research and conservation efforts.

Additional hammerhead species in the CAMAC scope area

There is very little information available on the four additional hammerhead species that are present in the CAMAC scope area. These are Scoophead (*Sphyrna media*), Bonnethead (*Sphyrna tiburo*), Carolina hammerhead (*Sphyrna gilbertil*) and Smalleye hammerhead (*Sphyrna tudes*). The authors of this report found no studies on these species for this region. The life history parameters for these species are similar to those of the large hammerhead species which would make them as vulnerable to depletion as the well-known species. There is some indication that these smaller species are even more vulnerable to local extinction as there is limited connectivity between populations (Diaz-Jamer et.al., 2021).This would warrant further study to assess the conservation needs of these species.

3.2.6 Oceanic manta ray - Mobula birostris

Introduction

The oceanic manta ray (*Mobula birostris)* is the largest ray species in the world with a maximum disc width of around 700 cm (Marshall *et al.,* 2019). These rays are widely distributed throughout the tropical and subtropical oceans of the world (Ehemann *et al*., 2022) and appear to spend much of their time in the open ocean away from reefs, diving hundreds of meters into the deep scattering layer to find their zooplankton prey (mantatrust.org). There is very little information on the basic biology and population dynamics of the species, but it is known that the species is threatened by fisheries, both targeted and bycatch (Marshall *et al*., 2019; Ehemann *et al*, 2022).

Manta and devil rays (collectively mobulids) belong to the monogeneric Mobulidae, which currently comprises 10 species. Genetic evidence has resulted in the genus *Manta* being subsumed within the genus *Mobula* (Poortvliet *et al*., 2015; White *et al*., 2018). Whereas previously the genus Manta was assumed to only have one species, two species have now been identified - *Mobula alfredi* and M. *birostris* -, as well as an alleged third manta ray species (*Mobula* cf. *birostris*) (Marshall *et al*. 2019; Ehemann *et al.*, 2022).

Biology and Life History

The oceanic manta ray is around 150 cm disc width (DW) at birth, and it grows to a maximum size of 710 cm DW. Size at maturity for females is between 410 and 430 cm DW, for males it is 375-400 cm DW, and the average litter size is one pup. The age at maturity, gestation time and reproductive periodicity are unknown, but the generation time is estimated to be 24-25 years (Marshall *et al*., 2019).

Movement and Connectivity

Outside the CAMAC scope area, Stewart *et al*. (2018) have proposed that Flower Garden Banks National Marine Sanctuary in the Gulf of Mexico could be a nursery habitat for *M. birostris* and *M. cf. birostris*, based on the large numbers of individuals sighted (95%) which are smaller than the size at maturity as well as the temporal patterns of use of the area (Stewart *et al*., 2018).However, further research into how important the region is to the juveniles is needed.

Threats & Conservation Status

The major threat to the oceanic manta ray is targeted fishery as well as bycatch in the long-line fishery. There is high demand for the gill plates, which are used in medicine. It is likely that climate change will affect the abundance of the zooplankton prey upon which this species relies (mantatrust.org). Unsustainable tourism, boat strikes and becoming entangled in mooring lines have also been identified as threats to the species (mantatrust.org).

The oceanic manta ray is:

- classified as endangered by IUCN and the population is decreasing globally
- on CITES Appendix II since 2017 (*Manta birostris*), new nomenclature adopted in 2022;

- on Appendix I and II from CMS since 2011 and has been on the Sharks MOU since 2016 (https://www.cms.int/sharks/en/species).
- on Annex III of the SPAW Protocol since 2017
- on Annex II of the SPAW Protocol since October 2023

Oceanic manta ray in the CAMAC scope area

During boat surveys in Suriname offshore waters, de Boer *et al*. (2015) visually documented the presence and behavior of the free-ranging whale shark *Rhincodon typus* and two mobulid rays: the oceanic manta ray *Mobula birostris* and the Chilean devil ray *Mobula tarapacana* (de Boer *et al*., 2015). *Mobula birostris* was positively identified on five occasions while at the surface, all in shallow waters of less than 57 m deep. These records of *R. typus*, *M. birostris* and *M. tarapacana* are the first for Suriname and therefore add to the documented information of these species within the Wider Caribbean Region and contribute to the knowledge of the pelagic distribution of these species (de Boer *et al*., 2015).

In French Guyana, aerial surveys have shown that *Mobula birostris* is observed all along the coastal area, mainly between 10 and 40 m depth, and that the species' presence is maximum between July to December, with densities up to 28 +/-2 individuals per 100 km² (Girondot et al., 2015; GEPOG, 2024).

Six mobulid species are reported for the western Atlantic Ocean and the Caribbean Sea, three of which had previously been reported in Venezuela (*Mobula birostris*, *Mobula tarapacana*, and *Mobula hypostoma*) (Ehemann *et al.,* 2022). The authors carried out an assessment of fishery landing data from Margarita Island (2006, 2007 and 2014) and did extensive data mining as well as using citizen science data. This led to the conclusion that there are four mobulid species in Venezuela: *Mobula birostris*, *M. tarapacana, M. mobular,* and *M. thurstoni,* and that records of *M. hypostoma* could not be verified (Ehemann *et al.*, 2022). The numbers of juvenile manta rays and pregnant *M. mobular* and *M. thurstoni* recorded in this study, leads the authors to that suggest Venezuela provides an important habitat for these species (Ehemann *et al*., 2022).

According to Arocha *et al*. (2023), *Mobula birostris* is often found in areas relatively close to land formations, i.e., continental slope, rises/seamounts, islands and reefs in the WECAFC region.

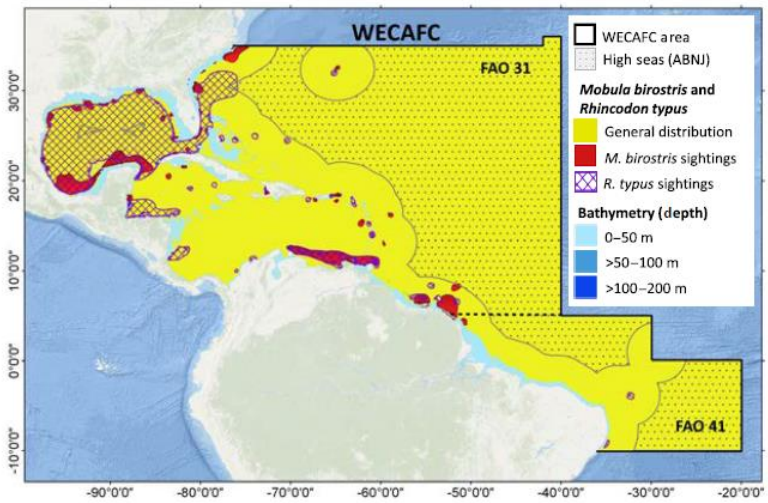


Figure 14. *Mobula birostris* (giant oceanic manta ray) and *Rhincodon typus* (whale shark) general distribution and sightings in the Wider Caribbean Region. Source: Arocha *et al*. (2022).

4 Elasmobranch Management relevant to the CAMAC scope area

4.1 International Management

Due to the interconnected nature of marine ecosystems and the migratory nature of many sharks and rays which spans all the worlds ocean, globally, coordinated efforts are essential. By establishing global legislative and policy frameworks, nations can collaboratively set conservation standards, share research findings, and enforce measures to curb illegal fishing activities that transcend national boundaries. At the regional level, considering the unique ecological dynamics of specific areas, tailored management strategies can be implemented to address regional challenges and protect diverse elasmobranch species. This involves understanding migration patterns, addressing habitat-specific threats, and fostering cooperation among neighboring countries. On a national scale, community engagement and management become crucial for the sustainable coexistence of sharks and humans. Local initiatives can focus on habitat protection, responsible fisheries practices, and education to raise awareness about the significance of sharks and rays in local ecosystems.

Within the CAMAC scope area there a large variety in commitments to conservation and sustainable management legislation and treaties. Annex 3 gives a full overview of which relevant global and regional legislation and policy framework applies withing each of the countries.

4.1.1 IPOA-SHARKS

Widespread concern over the lack of management of shark fisheries and the impact that expanding catches may have on shark populations led to the adoption and endorsement of the Food and Agriculture Organization of the United Nations (FAO) International Plan of Action for the Conservation and Management of Sharks (IPOA–SHARKS) in 1999.

The IPOA-Sharks is a voluntary international instrument, developed within the framework of the 1995 FAO Code of Conduct for Responsible Fisheries, that guides nations in taking positive action on the conservation and management of sharks and their long-term sustainable use. Its aim is to ensure the conservation and management of sharks and their long-term sustainable use, with emphasis on improving species-specific catch and landings data collection, and the monitoring and management of shark fisheries. The code sets out principles and international standards of behavior for responsible fishing practices to enable effective conservation and management of living aquatic organisms while considering impacts on the ecosystem and biodiversity. The IPOA-Sharks recommends that FAO member states 'should adopt a national plan of action for the conservation and management of shark stocks (NPOA-Sharks), if their vessels conduct directed fisheries for sharks or if their vessels regularly catch sharks in non-directed fisheries'. Additionally, the IPOA-Sharks directs that states that implement a NPOA-Sharks should regularly, at least every four years, assess its implementation for the purpose of identifying cost-effective strategies for increasing its effectiveness.'

To assist countries in implementing the IPOA-Sharks the FAO developed a dedicated set of technical guidelines for the conservation and management of sharks. The guidelines provide general advice and a framework for development and implementation of national level shark assessment and management consistent with the IPOA-Sharks, including the preparation of shark assessment reports. This framework is the basis for the WECAFC Regional Plan of Action. See further Chapter 3.2.4.

4.1.2 CITES

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES – www.cites.org) provides a legal framework to monitor and control the international trade in species that are overexploited by such trade. It is one of the most effective agreements in regulating natural resource use (Fowler and Cavanagh 2005). Animals and plants threatened with extinction may be listed in Appendix I, essentially banning international trade in these species or their parts. Appendix II is reserved for species that could become threatened if trade is not controlled; trade in these species is closely monitored and allowed only after exporting countries provide evidence that such trade is not detrimental to populations of the species in the wild. In 2017, 183 countries were Party to CITES, including all Wider Caribbean, North American, and Central American countries except for Haiti (CITES 2017a).

The meaning of a CITES listing

CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorized through a licensing system. Each Party to the Convention must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species.

The species covered by CITES are listed in three Appendices, according to the degree of protection they need:

Appendix-I specimens

Appendix I lists species that are the most endangered among CITES-listed animals and plants. They are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instance for scientific research. In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate). Exemptions to this general prohibition are covered by Article VII of the Convention.

Appendix-II specimens

Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. It also includes so-called "look-alike species", i.e., species whose specimens in trade look like those of species listed for conservation reasons. International trade in specimens of Appendix-II species may be authorized by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires). Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild. (See Article IV of the Convention)

Introduction from the Sea (IFS) covers those individuals caught in an area outside national jurisdiction. For sharks it is also important to note that if a specimen is introduced from the sea, the rules on transport depend on the registration country of the vessel and the charter state, for more information see CITES Conf. 14.6 (Rev. CoP16).

Appendix III specimens

Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal

exploitation. International trade in specimens of species listed in this Appendix is allowed only on presentation of the appropriate permits or certificates.

Shark and Ray species on CITES

The first shark species listed under CITES – whale shark (*Rhincodon typus*) and basking shark (*Cetorhinus maximus*) – were added to Appendix II at the Conference of the Parties (CoP) in 2002, whereas great white sharks (*Carcharodon carcharias*) were listed on Appendix II at the 2004 COP. All but one species of sawfish (family Pristidae) was listed on Appendix I in 2007 (the freshwater sawfish, *Pristis microdon*, was listed in Appendix II).

Seven proposals to include shark species in CITES Appendix II were submitted for consideration at the 16th CoP in 2013. Oceanic whitetip shark (*Carcharhinus longimanus*), scalloped hammerhead shark, great hammerhead shark and smooth hammerhead shark (*Sphyrna lewini, S. mokarran* and *S. zygaena*) Porbeagle shark (*Lamna nasus*) were adopted with an annotation for an 18-month delay to enter into force to enable Parties to resolve related technical and administrative issues. Also adopted was a proposal to include all manta rays (*Manta* spp) in Appendix II and a proposal to transfer *Pristis microdon* (freshwater sawfish) from Appendix II to Appendix I.

An additional four shark species and all devil rays were included in Appendix II of CITES at the 17th Meeting of the Conference of the Parties (CoP17, Johannesburg) in 2016. These were: silky shark (*Carcharhinus falciformis*); thresher sharks (*Alopias* spp. – 3 species); and devil rays (*Mobula* spp.).

During the 18th Conference of Parties (CoP18) in 2019 two species of mako shark were listed on Appendix II: *Isurus paucus* and *I. oxyrhinchus*

At the 2022 Conference of Parties (CoP19) nearly 100 species of sharks and rays were included in the Appendices. All 58 species of requiem sharks (*Carcharhinus* spp.) not already listed were included on Appendix II on the basis of 19 species which reached the criteria for Appendix II. The rest were listed as 'look-alike' species due to the difficulties of identifying fins and other products to species level. The bonnethead shark (*Sphyrna tiburo*) was listed on Appendix II as well as all remaining species in the family Sphyrnidae as look-alikes, again due to the difficulty of distinguishing these species with the hammerhead species already listed. Six species of guitarfish (*Acroteriobatus variegatus*; *Pseudobatos horkelii*; *Rhinobatos albomaculatus*; *R. irvinei*; *R. rhinobatos; R. schlegelii*) were listed in Appendix II, in addition to 37 species as "look-alikes", leading to the family Rhinobatidae being listed. The Carcharhinidae listings had a 12-month delay to enter into force to enable Parties to resolve related technical and administrative issues.

4.1.3 Convention on Migratory Species

The Convention on Migratory Species (the full name is the Convention on the Conservation of Migratory Species of Wild Animals) is an environmental treaty under the aegis of the United Nations Environment Programme (UNEP). The CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. Within the CAMAC scope area

Antigua & Barbuda, Dominican Republic, Granada, Trinidad & Tobago, the Kingdom of the Netherlands and the EU are members.

CMS Appendix I - include migratory species threatened with extinction. Signatory states are asked to protect these animals, conserve or restore the habitats in which they live, remove obstacles to migration and control other factors that might endanger them. It is prohibited for any Range State to catch these species.

CMS Appendix II - includes migratory species with an unfavorable conservation status or those that would significantly benefit from international co-operation. Range States have to enter into auxiliary agreements with each other to protect these species.

An overview of the species listed under the convention that are present in the CAMAC scope area can be found in Annex 1.

4.1.4 CMS MOU SHARKS

The Memorandum of Understanding (MOU) on the Conservation of Migratory Sharks is the first global instrument for the conservation of migratory species of sharks negotiated under the auspice of CMS. It was first adopted in 2010 and has 39 signatories supporting is objectives. The MOU is a non-binding international instrument. It aims to achieve and maintain a favorable conservation status for migratory sharks based on the best available scientific information and taking into account the socio-economic value of these species for the people in various countries.

The objectives of the Conservation Plan are listed in Annex III of the MoU and include:

- Improving the understanding of migratory shark populations through research, monitoring and information exchange
- Ensuring that directed and non-directed fisheries for sharks are sustainable
- Ensuring to the extent practicable the protection of critical habitats and migratory corridors and critical life stages of sharks
- Increasing public awareness of threats to sharks and their habitats, and enhancing public participation in conservation activities
- Enhancing national, regional and international cooperation

In pursuing activities described under these objectives, Signatories should endeavor to cooperate through regional fisheries management organizations (RFMOs), the FAO, Regional Seas Conventions (RSCs) and biodiversity-related Multilateral Environmental Agreements (MEAs).

In 2016 the Sharks MoU set up an Advisory committee and a Conservation Working group to assist signatories in the implementation of the MoU. In this role the shark MoU is a facilitating body to assist signatories in implementing measures associated with the CMS listings.

4.1.4.1 Responsibilities of a signatory

New signatories should designate a Focal Point who will be in charge of the communication among Signatories and for the coordination of implementation measures and activities under the MOU.

- Signatories should strive to adopt, implement and enforce such legal, regulatory and administrative measures as may be appropriate to conserve migratory sharks and their habitats, in a spirit of consensus, cooperation and mutual support, and to the extent that resources permit.
- Signatories should endeavor to coordinate their efforts; to cooperate in emergency situations requiring concerted international action; to take appropriate measures for the recovery of

shark populations; to exchange information, and to cooperate with a view to assisting each other to implement the Sharks MOU, particularly in the areas of research and monitoring.

- Signatories should report on the implementation of the MOU at each Meeting.

Financial contributions to the MOU are voluntary, which gives signatories the flexibility to make a voluntary contribution when they have the capacity to do so. They are however the only source of funding to the Sharks MOU; this is reflected in the little process that has been made since its inception.

4.2 Regional Management

4.2.1 SPAW

The Protocol Concerning Specially Protected Areas and Wildlife (the SPAW Protocol), adopted in 2000, is the only binding tool for cross-border wildlife protection in the Wider Caribbean region. It is one of three Protocols to the Cartagena Convention—the other two deal with cooperation to combat oil spills, adopted in 1983, and land-based marine pollution, adopted in 1999. The Cartagena Convention is the only legally binding environmental treaty for the Wider Caribbean area. The Convention and its Protocols constitute a legal commitment by the participating governments to protect, develop and manage their common waters individually or jointly

The objective of the Protocol is to protect rare and fragile ecosystems and habitats, thereby protecting the endangered and threatened species residing therein. The Caribbean Regional Co-ordinating Unit pursues this objective by assisting with the establishment and proper management of protected areas, by promoting sustainable management (and use) of species to prevent their endangerment and by providing assistance to the governments of the region in conserving their coastal ecosystems.

The protocol deals with area protection for unique and/or fragile habitats and has three annexes that deal with species-specific protection. Annex I only concerns plants, Annex II lists animal species that should not be commercially exploited, and Annex III is meant for vulnerable plant or animal species that need to be managed to prevent further depletion. In March 2017 Small Tooth Sawfish was listed on Appendix II and Whale sharks, Oceanic Whitetip Shark, 3 species of Hammerhead Sharks and Manta Rays were added to Appendix III of the protocol. In 2019 Large tooth sawfish was included in annex II. In October 2022 contracting parties agreed to include Caribbean reef shark in Annex III and uplist Whale shark, Manta ray and Oceanic Whitetip shark to Annex II at the CoP in Aruba.

Contrary to the IPOA-Sharks, SPAW is a legally binding agreement. By ratifying the protocol countries commit themselves to imbedding the protection under SPAW in their national legislation.

Countries that have ratified the SPAW protocol within the CAMAC scope area are the Bahamas, Barbados, Belize, Colombia, Cuba, Dominican Republic, France, Grenada, The Kingdom of the Netherlands, Panama, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, USA, and Venezuela.

4.2.2 ICCAT

International Commission for the Conservation of Atlantic Tunas (ICCAT) contracting parties and cooperating non-contracting parties include the following countries in the CAMAC scope area: U Venezuela, Rep of Guinee, UK (overseas territories), EU, Trinidad & Tobago, Panama, Barbados, St. Vincent & the Grenadines, Curacao, Guyana, Suriname and the US territories.

ICCAT has published a 'Compendium of Management Recommendations and Resolutions Adopted by ICCAT for the Conservation of Atlantic Tunas and Tuna-like-Species' which includes sharks and which can be sourced from the ICCAT website (ICCAT, 2024). The information below is taken from the document.

In 2004, ICCAT became the first RFMO to ban shark finning; the rule sets forth a 5% limit on the fin-to-carcass weight ratio for enforcement. The same binding 'Recommendation' mandates Contracting Parties, and Cooperating Non-Contracting Parties, Entities or Fishing Entities (CPCs) to report annual catch (Task I) and catch-effort data (Task II) for sharks, and encourages release of live sharks, full utilization of retained sharks, research to identify ways to make fishing gear more selective, and the identification of shark nursery areas.

A 2005 ICCAT Recommendation called on CPCs to reduce fishing mortality for North Atlantic shortfin makos (*Isurus oxyrinchus*) and a 2007 ICCAT Recommendation reiterated this call and imposed a similar requirement for porbeagles (*Lamna nasus*). ICCAT has, however, not adopted any specific limits to ensure such reductions. In 2009, ICCAT adopted a Recommendation prohibiting (for all CPCs except Mexico) the retention, transshipment, landing, storage, and sale of bigeye thresher sharks (*Alopias superciliosus*), based on an ecological risk assessment (ERA) that indicated this species was the most vulnerable to ICCAT fisheries. In 2010, Mexico ended its exception to the ICCAT bigeye thresher shark measure, and ICCAT adopted the same prohibitions for oceanic whitetip sharks (*Carcharhinus longimanus*).

A 2010 ICCAT prohibition on retaining hammerhead sharks (family Sphyrnidae with the exception of the bonnethead shark - *Sphyrna tiburo*) included exemptions for developing CPCs, while encouraging those countries to report data and to prevent increased catches and international trade in hammerheads. Also in 2010, after the failure of several U.S. and European Union initiatives to set ICCAT shortfin mako catch limits, ICCAT CPCs agreed that the shortfin mako would become a prohibited species in 2013 for CPCs not reporting catch data on the species. In 2011, prompted by an updated ERA that ranked the silky shark (*Carcharhinus falciformis*) as the most vulnerable shark species with respect to ICCAT fisheries, ICCAT Parties adopted a Recommendation prohibiting the retention, transshipment, and landing (but not sale) of silky sharks; the measure exempts developing countries with the same conditions set forth in the hammerhead measure along with new requirements with respect to reporting and improving shark data. In 2014 the recommendations on mako shark were further strengthened by calling on CPS's to increase their catch reporting and data collection effort aimed at enabling a full stock assessment (the assessment was carried out in 2017). For blue shark (*Prionace glauca*) a recommendation was fist adopted in 2016 which sets out a clear time path for CPCs to improve data collection and research and gives the option for setting catch limits after 2017 if catches prove higher than the long-term average over the period 2011-2015. The most recent blue shark assessment dates from 2023, but at time of writing this was not yet published.

4.2.3 OSPESCA

The Organization of the Fisheries and Aquaculture Sector of the Central American Isthmus (Organización del Sector Pesquero y Acuícola del Istmo Centroamericano) OSPESCA aims at promoting coordinated and sustainable development of fishing and aquaculture, in the framework of the Central American integration process (SICA), defining, approving and implementing policies, strategies, programmes and regional projects on fisheries and aquaculture. This is a legally binding framework, and its members are Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

In 2011 it adopted measures on shark finning and for the management of whale sharks.

- Regional Regulation OSP-05-11 which prohibits the practice of shark finning and establishes regional management measures for the sustainable use of sharks, which contributes to finning eradication.
- Regional Regulation OSP-07-2014 which strengthens the sustainability of the Whale Shark species (*Rhincodon typus*) by adopting management measures by the SICA Member States.

4.2.4 The FAO Western Central Atlantic Fishery Commission (WECAFC)

The Western Central Atlantic Fishery Commission (WECAFC) was established in 1973 by resolution 4/61 of the FAO Council under Article VI (1) of the FAO Constitution. Its main objective is to promote the effective conservation, management and development of the living marine resources in its area of competence and address common problems of fisheries management and development faced by its members.

The area of competence covered by the WECAFC is shown in blue Figure 15 below and includes FAO Statistical Area 31 and the northern part of Statistical Area 41. Countries shown in grey are members of WECAFC. See further below for a list of members in the CAMAC scope area.

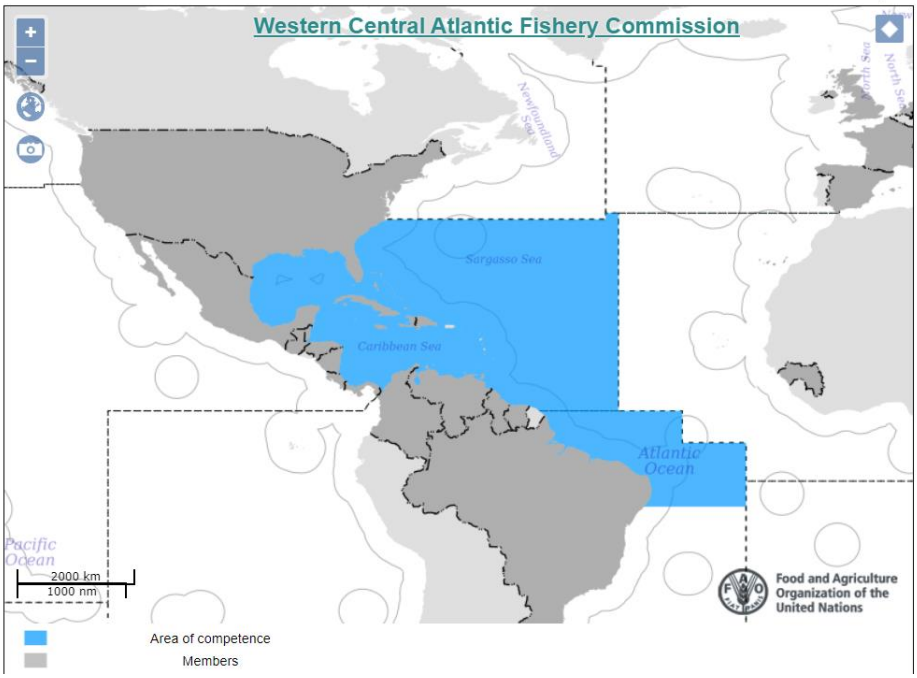


Figure 15. Area of competence and members to WECAFC (Western Central Atlantic Fishery Commission). Source: https://www.fao.org/wecafc/about/ar/

The work of WECAFC is guided by three principles:

- promote the application of the provisions of the FAO Code of Conduct for Responsible Fisheries and its related instruments, including the precautionary approach and the ecosystem approach to fisheries management;
- ensure adequate attention to small-scale, artisanal and subsistence fisheries; and
- coordinate and cooperate closely with other relevant international organizations on matters of common interest.

Current WECAFC members are: Antigua and Barbuda, Bahamas, Barbados, Belize, Brazil, Canada, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, European Union, France, Grenada, Guatemala, Guinea, Guyana, Haiti, Honduras, Jamaica, Japan, Mexico, Netherlands, Nicaragua, Panama, Republic of Korea, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Spain, Suriname, Trinidad and Tobago, United Kingdom, United States of America, Venezuela.

All members have a seat in the Commission of the WECAFC and a Conference of the Parties is normally held once every two years. Whilst the Commission is the only group with decision power within WECAFC, the work is prepared by the Scientific Advisory Group (SAG) consisting of independent scientists and several working groups. These working groups can be set up on an ad hoc basis by the commission. In 2016 an ad hoc shark working group was established.

4.2.4.1 WECAFC Regional Plan of Action for the Protection of Sharks

In 2022, the WECAFC adopted a Regional Plan of Action for the Protection of Sharks (RPOA) after beginning work on that in 2016. A Regional Plan of Action (RPOA) is a comprehensive and coordinated strategy designed to address specific challenges faced by a particular region. In the case of shark conservation in the Wider Caribbean, the RPOA provides a unified framework for countries and stakeholders to collaborate effectively in safeguarding shark populations and their habitats. Once implemented a well-structured RPOA will bring several benefits:

1. Enhanced Conservation Efforts: A coordinated approach would streamline conservation efforts and ensure that resources are utilized efficiently across the region. Collaboration between countries would facilitate the exchange of knowledge and best practices.
2. Effective Monitoring and Research: An RPOA would encourage standardized data collection, allowing for accurate assessments of shark populations, migration patterns, and other ecological dynamics. This information is vital for evidence-based decision-making.
3. Sustainable Fisheries Management: By including measures to reduce bycatch and regulate fishing practices, an RPOA could contribute to the sustainable management of fisheries. This would not only benefit shark populations but also ensure the livelihoods of local fishing communities.
4. Public Awareness and Education: An RPOA could allocate resources for educational campaigns aimed at raising awareness about the importance of sharks in the ecosystem. Educating the public would foster a sense of responsibility and encourage support for conservation initiatives.

The adoption of the RPOA is a critical step towards addressing the rapid decline of shark populations in the region. As the challenges facing shark populations intensify, timely and collaborative action becomes paramount to secure a sustainable future for both the sharks and the communities that depend on healthy oceans.

4.3 National shark conservation measures

Measures for elasmobranch conservation and management vary considerably throughout the CAMAC scope, with some countries banning all shark and ray fishing, and others undertaking only limited activities to protect and restore shark and ray populations in their waters. In Annex 3 we provide an overview of laws and measures active in countries in the CAMAC scope area. It is of note here that we did not differentiate between countries that have measures incorporating protections for both sharks and rays and those that only focus on sharks. Overall, it can be observed that the protection of rays is less advanced than protection of sharks.

4.3.1.1 Implementation of international treaties and conventions

By signing on to international accords, countries commit themselves to translating the agreed text in those fora into their national law. For example, all countries that are contracting parties to ICCAT will need to have a finning ban implemented for their fisheries and collect data on the fishing of certain shark species in their waters. Whilst for some treaties the measures that need to be taken are clear and reporting on implementation is mandatory, for others the required action is less clear. For species listed on SPAW Annex 3 and CMs Appendix II, countries are asked to implement measures that ensure the populations do not decline further and any harvest is sustainable which is a form of words that is widely open for interpretation. Combined with the fact that many countries lack information on the elasmobranch populations in their water as well as the ways these interact with fisheries taking any meaningful action will be difficult as there is no baseline to start from.

Lack of enforcement capacity for international treaties could also be a factor in slow pace in which these are implemented. Not all countries that have ratified the SPAW protocol have put in place strict protection measures for species listed on Annex 2 for example, even though this is compulsory if one reads the text of the protocol.

4.3.1.2 Finning bans

Shark finning, the practice of removing a shark's fins and discarding the rest of the body at sea, has significantly contributed to the decline of global shark populations. In response to this ecological threat, countries have instituted prohibitions against this destructive practice, underscoring the importance of safeguarding shark species and marine ecosystems. As mentioned above, the countries that are part of ICCAT all have finning bans in their waters, as do the French islands (under the EU finning regulation), the fully Dutch islands of Bonaire, Saba and Statia and the US islands because of US Plan of Action (in federal water). In addition, Antigua & Barbuda, the Dominican Republic and Sint Maarten have national finning bans (Talwar *et al.*, 2022).

Within the CAMAC scope area, there is little evidence fins being exported to Asia. Trinidad is one of the few nations that has some exports to Hong Kong although some of the experts interviewed in this project mentioned that there was a small local market for fin sales to Chinese restaurants, but that was low value and only worth pursuing if the rest of the shark was sold too. This means that the incentive for finning appears to be low in the CAMAC region, at least in countries that have some measure of inspection on their fisheries.

4.3.1.3 National Plans of Action of Action

National Plans of Action (NPOAs) for sharks are comprehensive strategies that address the specific challenges faced by elasmobranch species in a nation's waters, encompassing measures to mitigate overfishing, protect critical habitats, and enhance scientific research and monitoring efforts. By integrating international best practices and aligning with regional initiatives such as the WECAFC Regional Plan of Action for sharks (RPOA), these NPOAs can serve as frameworks for the development

of targeted policies and regulations tailored to the unique characteristics of national marine ecosystems, recognizing the importance of local perspectives and practices in effective shark conservation.

All countries in the CAMAC scope area are part of WECAFC and therefore support the (voluntary) RPOA. In addition to this, Antigua & Barbuda, Dominican Republic, Venezuela, Puerto Rico, the US Virgin Islands (as well as the US POA), the British Virgin Islands and Sint Maarten have NPOAs (Talwar *et al.*, 2022). The French islands fall under the EU plan of action for sharks and for the fully Dutch islands of Saba, St Eustatius and Bonaire an International Shark Strategy applies.

4.3.1.4 Shark Sanctuaries

Through the establishment of shark sanctuaries, countries acknowledge the pivotal ecological roles played by elasmobranch species within its marine ecosystems. These sanctuaries function as designated areas where various shark species receive protection from anthropogenic threats, such as overfishing and habitat degradation. This deliberate conservation effort underscores commitment to preserving biodiversity and recognizes the inherent economic and ecological significance of apex predators in marine environments. Within the CAMAC scope area, the EEZ of the Dominican Republic, the EEZ of some British Virgin Islands, the EEZ of the Dutch islands of Saba, St Eustatius and Bonaire and the Los Roques Archipelago in Venezuelan waters are shark sanctuaries. Sint Maarten's shark sanctuary is currently under review and will likely be reinstated in 2024.

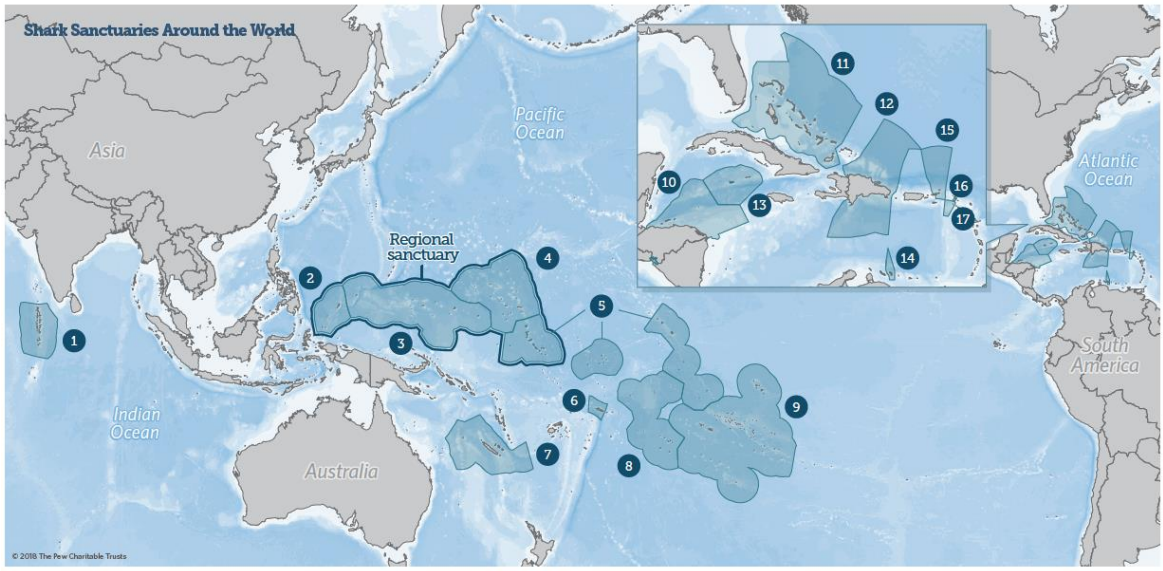


Figure 3. Shark sanctuaries around the world. Source: Pew Trusts (*https://www.pewtrusts.org/-/media/assets/2018/02/shark_sanctuaries_2018_issuebrief.pdf*)

4.4 Overview of prevailing conservation treaties, management & legislation per country

	Country	CITES - Party to the Convention	CMS - Party to the Convention	CMS MoU Sharks – Signatory	SPAW Protocol Ratified	Cartagena Convention Ratified	WECAFC Member	ICCAT Contracting Party	NPOA adopted	Finning Ban	Shark sanctuary
	Antigua and Barbuda	X	X			X	X		X	X	
	Barbados	X			X	X	X	X			
	Dominica	X				X	X				
	Dominican Republic	X	X		X	X	X		X	X	X
	Grenada	X	X		X	X	X				
	Guyana	X			X	X	X	C		X	
	Haiti						X				
	Jamaica	X				X	X				
	St Kitts and Nevis	X				X	X				
	St Lucia	X			X	X	X				
	St Vincent & Grenadines	X			X	X	X	X		X	
	Suriname	X					X	C			
	Trinidad and Tobago	X	X		X	X	X	X		X	
	Venezuela	X			X	X	X	X	X	X	
US territories	Puerto Rico	X		X	X	X	X	X	X	X	
	US Virgin Islands	X		X	X	X	X	X	X	X	
UK territories	Montserrat	X				X	X				
	Anguilla	X				X	X				
	British Virgin Islands	X		X		X	X		X	X	X
Dutch Carib bean	Saba	X	X	X	X	X	X		X	X	X
	St Eustatius	X	X	X	X	X	X		X	X	X
	Bonaire	X	X	X	X	X	X		X	X	X
	Sint Maarten	X	X	X	X	X	X			X	
	Curacao	X	X	X	X	X	X	X		X	
	Aruba	X	X	X	X	X	X				
French Antilles	St Martin (FR)	X	X	X	X	X	X	X	EU	EU	
	Guadeloupe (FR)	X	X	X	X	X	X	X	EU	EU	
	St Barths (FR)	X	X	X	X	X	X	X			
	Martinique (FR)	X	X	X	X	X	X	X	EU	EU	
	French Guiana (FR)	X	X	X	X	X	X	X	EU	EU	

5 Review of Shark and Ray Research within the CAMAC scope area - combination of bibliographical review and expert interviews

This country overview provides information on shark and ray research conducted in the countries of the CAMAC scope area. The studies reviewed here have made their own contributions to our understanding of sharks and rays in the Wider Caribbean. They have investigated the array of species inhabiting these waters, ranging from large pelagic sharks to small, endemic ray species. Moreover, these studies have provided insights into the specific habitats utilized by these animals, from coral reefs and seagrass beds to deep-sea environments and open ocean migration routes.

Regional research into elasmobranch species has gained substantial traction across the Wider Caribbean region, although for most countries in the CAMAC scope area there is very limited data available. Most research is conducted in the Northern Caribbean around Florida and the Bahamas as well as by some larger research groups in the Latin Caribbean.

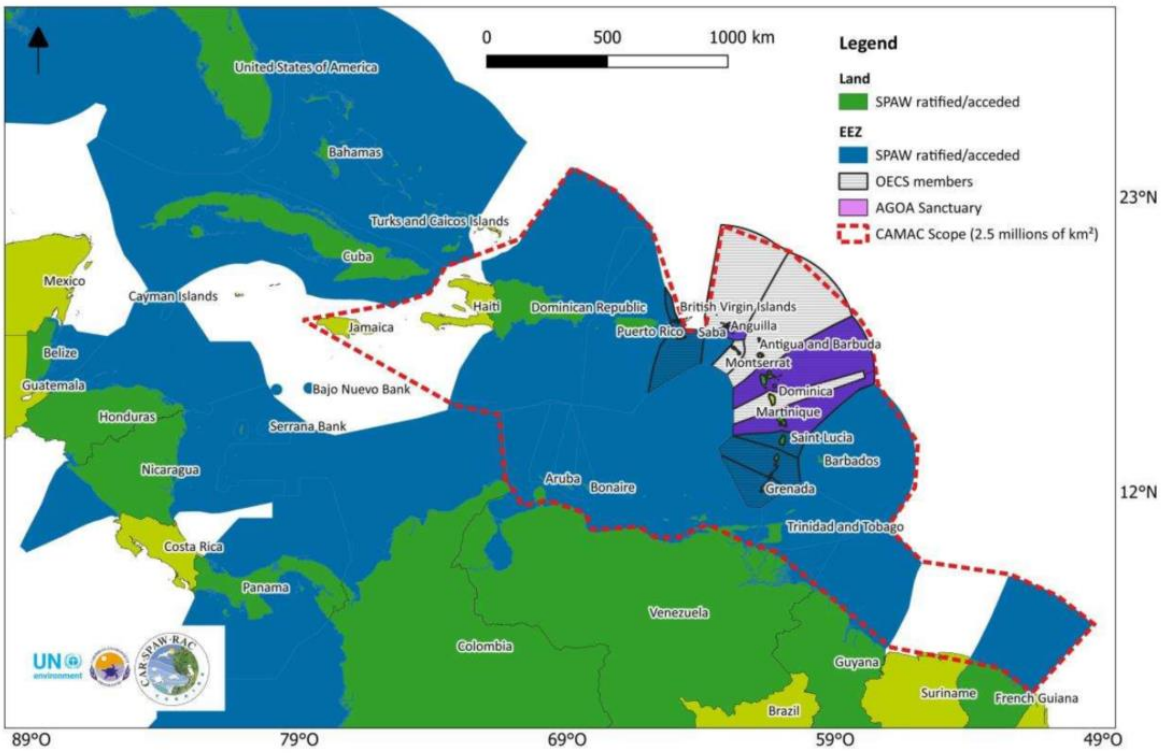


Figure 16. Map of the CAMAC scope area

Within the CAMAC scope area, significant knowledge gaps persist. This literature review highlights the need for further investigation into crucial areas such as reproductive biology, population dynamics, and the impact of fisheries on these species. Addressing these gaps is essential for implementing effective conservation measures and safeguarding the rich diversity of sharks and rays in the Wider Caribbean region.

5.1 Research Methodology Country Overviews

Literature review

To conduct this literature review, various scientific databases were explored, including Web of Science, Scopus, and Google Scholar. The search terms used were "sharks," "rays," "elasmobranchs," "Caribbean," and the respective countries and territories within the CAMAC scope area.

Interviews

We conducted a series of semi-structured interviews with experts working on sharks in several of the countries in the CAMAC scope area. These interviews provided additional information on species, management and research. Interviews were conducted with experts from Haiti, Puerto Rico, Sint Lucia, Trinidad, Tobago, two experts from Venezuela and French Guyana. In addition, we had interviews with the WECAFC secretariat and with an expert on pelagic sharks working for NOAA in the US.

Overall, we observed that the information from the interviews often provided a better overview of the shark diversity and research as it would include the knowledge of the interviewee, references to unpublished data as well as grey literature which is not available through scientific search engines.

Species diversity data and fisheries data

For most countries there was no species list available, we therefore made use of country specific information from FishBase. This is a global relational database with information on fish and fisheries. FishBase was developed at the WorldFish Center in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and many other partners, and with support from the European Commission (EC). Since 2001 FishBase is supported by a consortium of nine research institutions. The matrix species information per country can be found in Annex 1 (sharks) and 2 (batoids) of this report. Where we had additional information, we used this to augment the information in the table, we mention where this occurred in the country profile sections.

Similarly, we made use of the FAO Fishery and Aquaculture Country Profiles (FACP) for countries for which we could not find information on the fisheries. These detailed profiles provide a comprehensive overview of the fisheries and aquaculture sector for each country (or areas / territories recognized by the FAO) as well as the prevailing fisheries legislation and management.

For the brief description of the countries in the introduction we made use of the Encyclopaedia Brittanicica, entering a search for the relevant country.

5.2 BRUVs and Global Fin Print

A notable conservation research methodology that has been embraced across many of these islands is the deployment of Baited Remote Underwater Video (BRUV) monitoring systems. BRUVs have proven to be an effective tool for assessing and monitoring the presence of various shark and ray species. This technique involves placing underwater cameras at strategic locations, often baited with attractants, to record and analyze the diversity and abundance of marine life. Such monitoring initiatives have provided valuable insights into the population dynamics, behavior, and habitat preferences of sharks and rays in these regions. By capturing visual data, researchers can identify species, estimate sizes, and monitor changes over time, aiding in the formulation of informed conservation strategies.

Global FinPrint

The Global FinPrint project stands as a pioneering initiative of paramount importance in advancing our understanding of shark abundance and advocating for intensified conservation efforts. From 2015 to 2018, over 400 reefs in 58 countries around the world were surveyed with BRUVs, including over 20 sites in the Wider Caribbean, all using the same protocol thus making the collected data fully comparable. The project provided unprecedented insights into the distribution and abundance of sharks. The data generated not only illuminates the ecological significance of sharks but also underscores the urgent need for targeted conservation measures. The information gathered through Global FinPrint is instrumental in identifying critical habitats, understanding the factors influencing shark populations, and assessing the impact of human activities on these apex predators.

A meta-analysis of their data revealed a global average decline of 63% in five main shark species living on coral reefs. The Caribbean reef shark in particular was shown to have greatly declined (Simpfendorfer *et al.,* 2023). The main reason given was direct overexploitation as well as prolonged depletion of the fisheries resources in its habitat. However, in the review of all their collected data, they also found that the abundance of sharks was higher in no-take MPAs in comparison to MPAs that still allowed some human activities to take place (Chapman *et al.,* 2021 & Goetze *et al.,* 2021). In addition, the size of the MPA is of high importance as some species still declined in no-take MPAs, which was believed to be due to fishing activities along the edges of the MPA (Flowers *et al.,* 2022).

The success of BRUV monitoring in several Caribbean islands is paving the way for an extended focus on shark and ray conservation research. As more BRUV data accumulates, scientists are gaining a better understanding of the migratory patterns, breeding sites, and critical habitats that are essential for the survival of these apex predators. Collaborative efforts between governments, research institutions, non-governmental organizations, and local communities have facilitated the establishment of marine protected areas and conservation policies aimed at safeguarding these species.

5.3 Country Overviews

5.3.1 Review of Shark and Ray Research for Jamaica

Introduction

Jamaica, the third largest island in the Caribbean Sea after Cuba and Hispaniola, spans approximately 235 km in length and varies between 35 to 82 km in width. Located 160 km west of Haiti, 150 km south of Cuba, and 630 km northeast of the nearest point on the mainland of Central America, it is geographically significant in the Caribbean context. Notably, to its east lies the Cayman Trough, the deepest point in the Caribbean Sea at 7,686 meters below sea level. This review provides a comprehensive overview of the research conducted on sharks and rays in Jamaican waters, underscoring crucial discoveries, ongoing research, and prospective avenues for future studies.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in Jamaica's waters, according to FishBase it has 30 elasmobranch species, 19 sharks and 11 rays. This is assumed to be an underestimation of the total number of species present as very limited research has been done into the deep water around Jamaica. A very small study from 2004 captured 6 species from deep water with little effort (McLaughlin and Morrissey, 2004). The complexity of this ecosystem underscores the necessity of further taxonomic research to fully understand the species composition within the region.

In a paper from 2010 that used data from transact dives on reefs the authors found virtually no presence of sharks in Jamaican waters (Ward-Paige *et.al.*, 2010). Since the sharks around Jamaica are not habituated to divers this could be an under estimation as sharks tend to avoid humans, but it does reflect an alarming trend of decreasing abundances of sharks on Caribbean reefs.

Habitat Use and Movement Patterns

The authors found no studies on this topic for the country of Jamaica.

Fisheries and Fisheries management

Based on the Jamaica National Marine Atlas from 2000 the fishing fleet is made up over 3000 largely artisanal fishing vessels operating from open canoe type boats powered by either outboard motors or oars. Up to 20.000 Jamaicans are estimated to be working as fishers.

The inshore fishery takes place in the coastal waters of the Island shelf and its nine proximal banks. The major fishing gear used for reef fish is the Z-shaped Antillean fish trap. Other common gears include the gill nets, seine nets, hook-and-line, and spearguns. There is some collection of crustaceans, mollusks and algae by SCUBA or skin divers.

Offshore fishing is limited to the south coast where a variety of larger vessels are required to exploit the fisheries resources of the much larger shelf area and the offshore banks.

Larger decked vessels target lobster and conch on the offshore banks, these are mostly exported. Almost all fishing apart from conch and lobster is for local markets, there is some export of valuable species such as snapper. In addition, there is recreational fishing such as spearfishing and there are other recreational vessels, such as yachts, which fish in Jamaican waters. In addition, there is some aquaculture on Jamaica for the farming of tilapia, this activity, sponsored initially by the World Bank, has decreased over recent years.

There is no data available on shark and ray catches apart from a note that there is limited bycatch of nurse shark (*Ginglymostoma cirratum*) and Caribbean sharpnose shark (*Rhizoprionodon porosus*).

Fisheries are governed by the 1975 fishing industry act, there is a draft updated fisheries policy available on the website of the Jamaican Government bit this does not appear to have been adopted. There are closed seasons for queen conch and spiny lobster (both have closed seasons) and there are seventeen Special Fishery Conservation Areas (SCFA) – also known as fish sanctuaries spread along the coast.

Threats and Conservation

Studies like those of Chapman et al. (2021) and Ward-Paige *et al*. (2010) have highlighted the impacts of human pressures on shark populations in the Caribbean and the need for transboundary conservation measures.

Jamaica has no shark conservation measures specific to its waters. They are a member of WECAFC and so through this channel have committed to the Regional Plan of Action for Sharks. They are a member of the Cartagena Convention but have not ratified the SPAW protocol (see Chapter 3 of this report). Jamaica is also a party to the CITES convention which regulated trade in endangered species. As the country exports Queen conch, they are obliged to have an CITES administration.

5.3.2 Review of Shark and Ray Research in Haiti

Includes information from interview with J. Aquino, Haiti Ocean project (3 August 2023)

Introduction

Haiti covers the western third of the island of Hispaniola, to the East the Dominican Republic covers the rest of this island. The country also includes smaller islands as Gonâve, Tortue (Tortuga), Grande Caye, and Vache. It is bordered to the south and west by the Caribbean Sea, and to the north by the Atlantic Ocean. Cuba lies 80 km west of Haiti's northern peninsula, across the Windward Passage, a strait connecting the Atlantic to the Caribbean Sea. Jamaica lies 190 km west of the southern peninsula, across the Jamaica Channel, and Great Inagua Island (of The Bahamas) lies roughly 110 km to the north.

Diversity and Distribution

Limited information is available about shark and ray populations in Haiti's waters, according to FishBase it has 25 elasmobranch species, 20 sharks and 5 rays. This is assumed to be an underestimation of the total number of species present as very limited research has been done into the deep water around island and no fisheries data is collected. Haiti's unique geography, especially the steep drop-off very close to shore, where depth increase to over a thousand meters a short distance from the coast, are known to contributes to a diverse shark population. The southern peninsula, particularly the Gulf of Gonâve, hosts a significant range of shark species due to this diverse ecology and geology.

One species for which the Haiti inshore waters are of particular importance is the oceanic whitetips (*Charcharinus longimunus*), most notably, while they are usually found in deeper offshore waters, in Haiti, researchers have encountered newborn and juvenile oceanic whitetips close inshore. This unique distribution and abundance pattern suggests that there may be specific pupping and nursery areas around the southern peninsula.

The southern peninsula's shallow-to-deep water transition, the likely attraction of sharks to the fish aggregating devices (FADs) present in the area, and the absence of significant water pollution or disturbance from large boats contribute to this uniqueness of distribution and abundance.

There are ongoing efforts to confirm the presence of smalltooth sawfish (*Pristis pectinate*) in specific areas of Haiti's coastline (the mangroves and sheltered areas of Baie des Garcons & Baie des Baraderes on the southern peninsula).

The Haiti Ocean Project is engaged in collecting data on marine megafauna, including large rays, and have developed visual guides to assist illiterate fishers in identifying different species.

Habitat Use and Movement Patterns

The authors found no studies on this topic for the country of Haiti, although in collaboration with HOP is starting up some tagging efforts to better understand the role Haitian waters play in the life history of some endangered shark species like the Oceanic whitetip.

Fisheries and Fishing management

Haiti has a large fishing community with up to 50.000 people active in the fishery. The coastal communities predominantly engage in handline fishing methods, using basic tools such as Styrofoam with a line wrapped around it and a single hook. Fishing occurs in both dugout canoes and small motorboats. Species of sharks found in the region are primarily caught as bycatch or opportunistically, with fishers targeting species like tuna and mahi-mahi. Notably, sharks, such as oceanic whitetips, silky

sharks, tiger sharks, Cuban night sharks, blue sharks, and others, are caught mainly through handline fishing, with some encounters around fish aggregating devices (FADs) located relatively close to the shore in the Gulf of Gonâve. The FADs, placed 1 to 2 miles from the shore in waters 1,5 to 1700 m deep, attract various fish species, including pelagic sharks like oceanic whitetips, silky sharks, tiger sharks, Cuban night sharks, blue sharks, and even rare species like goblin sharks. All fisheries on Haiti are subsistence fisheries for local consumption. This means all sharks, also endangered ones are landed and consumed. There are records of whale sharks being landed for example.

There is a deep-rooted cultural fear of large marine creatures like whale sharks and devil rays. Despite these animals being largely docile, fishermen often view them as potential dangers due to their size. The fear, often stemming from a lack of education and understanding, can lead to the killing of these creatures out of a sense of self-preservation.

Despite the significant presence of sharks in Haiti's waters, the country faces various challenges in terms of data collection, management, and enforcement. The artisanal fishing practices prevalent in the region make it challenging to collect accurate and comprehensive data on shark catches. The reliance on handline fishing also poses difficulties in obtaining precise species-specific information.

Moreover, Haiti's socioeconomic dynamics and limited resources create obstacles for effective management and enforcement of conservation efforts. Poverty, lack of awareness, and immediate food security concerns can undermine long-term conservation goals. Ensuring sustainable fishing practices requires addressing not only ecological concerns but also the economic and social needs of the fishing communities.

There are fishery laws in Haiti, but enforcement is almost non-existent. Aquino emphasized that local community involvement is crucial for the development and effectiveness of management plans, as simply imposing laws without considering the livelihoods of the people won't yield positive results. HOP is working on a management plan for a coastal MPA that has been designated in collaboration with the Haitian government and local communities. Their approach involves engaging with the community to build trust and ensure that conservation efforts align with local needs and priorities.

Threats and Conservation Status

The shark and ray populations in Haiti face numerous threats, primarily driven by unsustainable fishing practices. Overfishing, particularly through the use of destructive fishing gear like longlines and gillnets, poses a significant threat to these species. Moreover, habitat degradation, including coral reef destruction and pollution, further exacerbate the challenges faced by sharks and rays in Haiti.

Despite the evident threats, limited research has been conducted on the conservation status of shark and ray populations in Haiti. The International Union for Conservation of Nature (IUCN) Red List assessment for Haitian shark and ray species is lacking comprehensive data, and further research is needed to evaluate the population trends, distribution, and conservation requirements of these species.

Conservation and Research Efforts

Efforts to conserve sharks and rays in Haiti are currently limited but gaining momentum. Collaborative initiatives between local and international organizations have emerged to address the urgent conservation needs of these species. For instance, the Haiti Ocean Project (HOP) has been conducting educational programs and community outreach to raise awareness about the importance of shark and ray conservation among local fishing communities (HOP, 2022).

Haiti's unique shark population and its complex coastal dynamics highlight the critical need for ongoing research and conservation efforts. Collaborative initiatives between local communities, NGOs, and international researchers play a crucial role in understanding the region's shark species, their behaviors, and their ecological roles. By involving local fishermen and community members, researchers can gather essential data and promote sustainable fishing practices. By engaging fishermen in releasing captured sharks, taking samples, and observing the creatures swim away, a shift in perspective has been observed. The fishermen come to view these animals as living creatures rather than just potential threats or sources of income. The same approach has been effective with turtles caught by fishermen, fostering a connection between the fishermen and the marine life.

Research gaps include understanding shark migration patterns, pupping and nursery locations, and identifying potential threats to the shark populations. Conservation efforts must take into account the socioeconomic context of the communities and address challenges related to poverty, education, and alternative livelihoods. Capacity building, knowledge sharing, and community engagement remain vital strategies for ensuring the long-term survival of shark and rays and their ecosystems. As research expands and conservation strategies evolve, collaboration and adaptability will remain key components in safeguarding Haiti's marine biodiversity.

Conclusion

Research on sharks and rays in Haiti is still in its infancy, with limited data available on their diversity, distribution, and conservation status. The presence of diverse species highlights the ecological significance of these marine creatures in Haitian waters. However, unsustainable fishing practices and habitat degradation pose significant threats to their survival. To effectively conserve and manage shark and ray populations in Haiti, further research efforts are needed to assess population trends, develop conservation strategies, and implement sustainable fishing practices.

Overall, the interview provides insights into the high shark and ray abundances around Haiti, specifically the potential nursey area for the critically endangered oceanic white tip shark. It also highlights the complex interplay between economic circumstances, education, conservation efforts and cultural beliefs in Haiti. It underscores the importance of working closely with local communities, fostering understanding, and addressing immediate needs while striving for long-term sustainability.

5.3.3 Review: Shark and Ray Research in the Dominican Republic

Includes information from interview with Rubén Torres from Reef Check Dominican Republic and Rebecca Garcia Camps from Punta Cana Ecological Foundation(31 July 2023)

Introduction

The Dominican Republic occupies the eastern two-thirds of Hispaniola, the second-largest island in the Greater Antilles chain in the Caribbean Sea. Haiti occupies the western third of the island. The country is bordered by the Caribbean Sea to the south and the Atlantic Ocean to the north, with Puerto Rico 130 km to the east across the Mona Passage, the Turks and Caicos Islands 145 km to the north, and Colombia 500 km to the south. Its territory also includes the adjacent small islands of Saona, Beata, and Catalina. The Dominican Republic has approximately 15,000 registered fishermen employing various methods, including hook and line, spearfishing, compressor diving with spears, and large-scale fishing vessels.

Taxonomy and Population Dynamics

The waters surrounding the Dominican Republic support a diverse array of shark and ray species. FishBase recorded 20 shark species and 5 species of batoids. Historical data indicate that shark sightings have been sporadic over the past 25 years, with nurse sharks, Caribbean reef sharks (*Carcharhinus perezi*), and occasionally tiger sharks (*Galeocerdo cuvier*) being the most commonly observed species. Spear fishers occasionally report shark sightings. Other shark species are reported more infrequently. Yellow stingrays (*Urobatis jamaicensis*), southern stingrays (*Hypanus americanus*), and spotted eagle rays (*Aetobatus narinari*) are commonly observed ray species. Manta rays were rarely sighted.

The Global Fin Print project conducted Baited Remote Underwater Video (BRUV) drops in 2017 to assess shark populations. These drops, including those on the Silver Banks, reported low incidents of shark encounters. See also Chapter 4.2 and Simpfendorfer *et al*. (2023).

Disparities in shark abundance between the Dominican Republic and Haiti which has a high number of sharks, have been noted. Factors contributing to the relatively high shark abundance in Haiti include poverty and limited access to deep or pelagic waters for Haitian fishers. In contrast, the Dominican Republic faces higher fishing pressure due to technological advancements and the availability of a high seas fleet.

Habitat Use and Movement Patterns

The authors found no studies on this topic for the Dominican Republic

Conservation and Management Strategies

Several initiatives have been implemented to conserve and manage shark and ray populations in the Dominican Republic. More than 20% of the waters around the Dominican Republic are MPAs with legal protection. The Parque Nacional Jaragua is 1543 km^2 large, with 900 km^2 as a marine park and is part of the UNESCO biosphere reserve in the Dominican Republic.

In 2017, a resolution from the Ministry of Environment (#23-2017) was passed to ban shark fishing in the country, prohibiting the catch of all shark species and prohibiting landing of sharks. The ban aimed to conserve shark populations, without significant impact on fisheries as sharks are not the primary target. The government entity CODOPESCA regulates fishing, with the Ministry of Environment enforcing the shark fishing resolution and managing fisheries regulations. This includes oversight by a

specialized police force and the Dominican Republic Navy. The well-organized fishing lobby and the lack of consistent enforcement were identified as challenges, along with corruption affecting effective regulation. Funding gaps in understanding shark density, distribution, and migratory patterns in Dominican Republic waters were highlighted, along with the potential threat posed by the increasing use of fish aggregating devices (FADs) for pelagic species.

The potential establishment of shark diving tourism in Bavaro, on the Punta Cana coast, might provide a conservation and economic initiative. The Dominican Republic conducts biennial national reef monitoring. Coral reef health varies across locations with no significant improvements observed. Shark-focused research is lacking but the first BRUV surveys are planned in 2024.

Despite the ongoing progress, funding gaps have been highlighted in understanding shark density, distribution, and migratory patterns in Dominican Republic waters. Continued research and collaboration are needed to ensure long-term protection and management.

5.3.4 Review: Shark and Ray Research in Puerto Rico

Includes information from interview with Paola Sotomayor Landron and Raimundo Espinoza Chirinos from Conservación ConCiencia (27 July 2023)

Introduction

Puerto Rico is the easternmost island of the Greater Antilles chain, it lies approximately 80 km east of the Dominican Republic, 65 km west of the US Virgin Islands, and 1,600 km southeast of Florida. It is situated in the northeastern Caribbean Sea, with the north on the Atlantic Ocean. Three small islands Vieques and Culebra to the east and Mona Island to the west are administrative parts of the country. Puerto Rico is a self-governing island that is part of the commonwealth of United States, this means that even though they have autonomous management over their territory US federal law applies as well. For fisheries this means that Puerto Rico has autonomy over territorial waters until 9 nm but US federal law applies beyond that for the rest of the EEZ.

Conservación ConCiencia is an NGO founded in 2016 and works towards the implementation of effective, science based conservation actions on the island of Puerto Rico. The interviewee outlines the organization's goal of establishing a no-take zone in the identified shark nursery area, involving fishers in conservation. They work on baseline characteristics of the fishery, collecting landing data to understand species, sizes, and locations. The broader context includes collaboration across the wider Caribbean region, forming part of a comprehensive project for shark conservation and assessment.

Mr. Espinoza is the founder and director of the organization and Ms. Sotomayor is the coordinator of the shark research and conservation program. They work with fishermen who collect data, including tagging sharks with dart and pet tags. Within the program they work on in satellite tagging, acoustic tagging, and baseline data collection on shark populations.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in Puerto Rico's waters, according to FishBase it has 28 elasmobranch species, 21 sharks and 7 rays. In recent years, due to the efforts of Conservacion ConCiencia more information is being collected on the elasmobranchs around the island including market surveys to collect information on deep water elasmobranchs bycaught in fisheries around the island. In recent years some first reports of species have been published for Puerto Rico, these include the long fin mako shark, *Isurus paucus* (Mignucci-Giannoni et.al, 2020) and the night shark, *Carcharhinus signatus* (Scharer-Umpierre and Franqui-Rivera, 2022).

They are also deep-water fisheries around Puerto Rico, in particular for deep-water snapper, in this fishery there is some bycatch of a variety of shark species. The fishery uses artisanal methods with vertical lines and electric grills, often catching tiger sharks, silky sharks, oceanic white tips, cow sharks, dogfish, smooth hounds, and other species.

One specific location mentioned was the Bay of Aguada on the west coast, where deep-water snapper fishers reported consistently catching sixgill sharks. Exploratory fishing revealed the presence of juvenile and young-of-the-year sixgill sharks in the area, providing valuable insights into the diversity and population structure of these sharks.

The interviewees briefly mentioned the presence of whale sharks and basking sharks in Puerto Rico, indicating a need for further research to understand migration routes and population dynamics.

Regarding rays, the interview noted the presence of eagle rays as well as ruff tail and southern stingrays, in the same areas as lemon sharks. Mantas, specifically reef mantas, were also mentioned

as being observed in Puerto Rican waters. The ray populations were described as relatively healthy, with no significant commercial interest in these species.

Of interest to note here is that in a paper from 2010 that used data from transact dives on reefs the authors found virtually no presence of sharks in Puerto Rican waters (Ward-Paige *et.al.*, 2010). This is in complete contradiction to the findings of Mr. Espinosa. One reason for this could be that since the sharks around Puerto Rico are not habituated to divers, they do not come near them in the water.

Habitat Use and Movement Patterns

One element that was clear in the interview was the importance of collaboration with local fishers. In recent years they uncovered a scalloped hammerheads nursery area off San Juan. The surprise discovery challenges assumptions about suitable shark habitats in industrialized regions. The collaboration with a seasoned targeted shark fisher (who had fished in the area for 30 years) highlights the importance traditional knowledge integration into conservation. In working closely with the fisher and building trust he was persuaded to relocate his fishing slightly to sustainably shift from hammerheads to other shark species.

Fisheries and Fisheries Management

Insights into Puerto Rico's shark market reveal local consumption, minimal export, and a decline in illegal fin trade due to the U.S. ban. The small-scale nature of Puerto Rico's fishing sector, comprising 1,200 to 1,500 licensed commercial small-scale fishers, of which a hand full are targeted shark fishermen, allows for manageable collaboration. The interview provides details on fishing techniques, including scuba diving and "punta" (anchor) with hooks and long line, with restrictions on long-line length and jurisdictional waters.

A recent paper of which Espinosa (Espinosa et.al 2024) is the lead author details the results of port and market samplings for shark catches from 2019 to 2021: “There are at least 16 species caught: a small number of large Tiger (*Galeocerdo cuvier*) and Blacktip (*Carcharhinus limbatus*) sharks and many small but adult Sharpnose sharks (*Rhizopriodon* spp.) accounted for >80% of landed weight. Juvenile Scalloped Hammerhead sharks (*Sphyrna lewini*) were the second-most caught species but accounted for a small proportion of the landed weight and value given their small size.”

There is some longline fishing for swordfish and tuna in the federal waters of the Puerto Rican EEZ (3 vessels based out of Texas according to Espinoza). These have some bycatch of sharks which is reported through NOAA channels and feed into the ICCAT reporting by the US.

One of the reasons Conservación ConCiencia was founded was to work on uncertainties in shark regulations, primarily concerning conflicts between United States federal and Puerto Rican regulations, the territorial waters (within 9 nautical miles of the coast) fall under the sole jurisdiction of the island whilst the federal waters are governed by the US . This creates legal ambiguities for the local fishing sector. There is a fisheries management plan for the whole Puerto Rican EEZ, drafted by NOAA in 2019, but this has not been translated into measures for territorial waters.

Conclusion

The main priorities for shark and ray conservation, research and management in Puerto Rico would be updating fishing regulations for sustainability, integrating coastal communities into research efforts, and the importance of collaboration with local fishermen. They emphasize the need for financial support, highlighting the value of paying fishermen for their contributions to research, while also acknowledging the challenges of owning a research vessel and proposing a network-based approach

for better community involvement. They express interest in genetic studies of scalloped hammerheads to determine their relation to other populations. They also discuss plans for studying thresher sharks' habitat utilization and connectivity, along with survivorship studies related to incidental catches by recreational fishing. Overall, their focus is on comprehensive conservation measures and fostering collaboration between scientists and local communities.

5.3.5 Review: Shark and Ray Research in the British Virgin Islands

Introduction

The British Virgin Islands (BVI), part of the Virgin Islands chain, lie at the northeastern tip of the Greater Antilles with Puerto Rico to the west. This UK overseas territory comprises larger islands like Tortola and Anegada, along with over 30 smaller islands, many uninhabited. Since 2007, the BVI has enjoyed greater internal self-governance under a new constitution. In 2014 a shark sanctuary was designated within their EEZ and includes around 60 islands, big and small (Live Science 2014). There is a ban on commercial fishing in the area which covers 80,117 km^2 . There are agreements on wide number of issues: catches for scientific purposes; catch allowed for private subsistence for registered local fishermen for non-threatened species; a ban on finning, a prohibition to be in possession of sharks or shark products; immediate release after catch; and a prohibition to feed sharks or rays; and there are fines for non-compliance (Ward-Page, 2017)

Taxonomy and Population Dynamics

The BVI's waters harbor various shark species, such as nurse sharks (*Ginglymostoma cirratum*) and Caribbean reef sharks (*Carcharhinus perezi*) and batoids such as the white spotted eagle ray (*Aetobatus narinari*) and southern stingray (*Hypanus americanus*) (FISHBASE). According to FishBase there are 20 shark species and 4 batoids in the waters of the BVI. Despite some exploration into their species composition and abundance, detailed long-term studies on population trends and distributions are still lacking, necessitating further research. This gap in knowledge is crucial for understanding their ecological roles and conservation needs.

Habitat Preferences and Movement Patterns

There is little information on habitat and movement from the BVI, but a study on the movements of juvenile blacktip (*Carcharhinus limbatus*) and lemon sharks (*Negaprion brevirostris*) carried out in the US Virgin Islands showed that a low number tagged individuals were recaptured in the waters of the BVI (Legare *et al*. 2020). In 2020 a tagging programme was started in the BVI by the organization 'Beyond the Reef' to study populations, habits and migratory patterns of multiple shark species within the BVI. This is in a partnership with the US based NPO, Fins Attached (Beyond the Reef Shark Tagging Program) And in 2022 a tagging and research program focusing on tagging juvenile sharks within the British Virgin Islands was initiated in conjunction with Bryan Legare from the Center For Coastal Studies (Beyond the Reef Shark Tagging Program)

5.3.6 Review of Shark and Ray Research in the US Virgin Islands

Introduction

The US Virgin Islands (USVI), a United States unincorporated island territory, consist of three large islands—St. Croix, St. John, St. Thomas—and about 50 smaller islets and cays. Located at the eastern end of the Greater Antilles, east of Puerto Rico, the USVI is part of the Virgin Islands archipelago, which also includes the British Virgin Islands.

Habitat and movement

A study by DeAngelis, *et al*. (2008), looked at species diversity and the relative abundance of elasmobranchs in the USVI. In a 1.5-year period 5 species of sharks and 1 species of batoid were caught. Lemon sharks *Negaprion brevirostris* had the highest relative abundance, followed by blacktip sharks *Carcharhinus limbatus*, southern stingrays *Hypanus americanus,* nurse sharks *Ginglymostoma cirratum*, blacknose sharks *Carcharhinus acronotus* and the Caribbean sharpnose *Rhizoprionodon porosus*. There were seasonal differences with the summer showing higher relative abundance than during the winter. Blacktip and lemon shark individuals were mostly neonatal and young-of-the-year and the recapture rates for blacktip and lemon sharks show a high degree of site fidelity. The two species showed differing habitat use. Lemon sharks appearing to be limited to the shallow, mangrove-fringed seagrass habitat, while blacktip sharks utilized a wider area of the bay. The authors concluded that Fish Bay was an important nursery habitat for young juvenile lemon and blacktip sharks in the USVI (DeAngelis *et al.*, 2008)

A study on the movements of juvenile blacktip (*Carcharhinus limbatus*) and lemon sharks (*Negaprion brevirostris*) carried out in the US Virgin Islands showed that a low number tagged individuals were recaptured in the waters of the BVI and 32% of blacktip and 24% of lemon sharks were detected outside the nursery area where tagging had taken place (Legare *et al.*, 2020). The authors state that blacktip sharks travelled high distances with individuals being detected beyond territorial waters as far as Florida, a distance of 1,881 km. It appears that although both species passed through local marine protected areas they did not stay there (Lagare *et al*. 2020).

Feeding biology

In a study on the interactions between grouper spawning aggregations and sharks on the US Virgin Islands three species of groupers and three species of sharks were tagged with acoustic tags (Nemeth *et al.,* 2010). The authors identified temporal and spatial patterns of movement of lemon sharks (*Negaprion brevirostris*) appeared to be closely associated with spawning events, but for the tiger sharks (*Carcharhinus perezi*) and Caribbean reef sharks (*Galeocerdo cuvier*) there was little connection between spawning aggregations and shark behavior. The authors concluded that prey availability may influence the spatial and temporal patterns of activity of co-occurring species of sharks in different ways (Nemeth *et al.,*2010).

5.3.7 Review of Shark and Ray Research for St. Barths / Saint-Barthélemy

Introduction

Saint Barths, officially known as Saint-Barthélemy, is a French Overseas Territory in the North-Eastern Caribbean. Noted for its marine life, the island measures about 17.5 km in length and 4 km in width. Located approximately 120-200 km north of Guadeloupe, it provides a unique ecological setting for marine research. A key focus has been on the study of sharks and rays, pivotal components of the island's marine biodiversity.

Taxonomy and Population Dynamics

More than 50 species of sharks and rays have been recorded in the French West Indies (FWI), but over 35% of these are listed on the IUCN Red List and 33% are near threatened (Beaufort, 2017).

A comprehensive study around St Barths was started in 2018 and has been instrumental in advancing our understanding of shark and ray populations in the area by delving into aspects such as species identification, population dynamics, habitat preferences and socio-economics, as well as identifying the factors impacting shark and ray distribution and priority actions (Beaufort & Greaux 2022). The research consists of deployment of baited underwater videos (BRUVs) and stakeholder surveys and has three main pillars: to improve biological, ecological and socio-economic knowledge on elasmobranchs; a consultation process with international experts and managers of neighboring islands; and communication.

Habitat use

The research is ongoing and preliminary results from BRUV work showed that the most common species found around the island are nurse shark (*Ginglymostoma cirratum*), stingrays (*Hypanus* sp.) and Caribbean reef shark (*Carcharhinus perezi*). There were also observations of pregnant females, neonates and juveniles (Beaufort & Greaux, 2022). Ongoing work

Ongoing work by Beaufort & Greaux on habitat preferences is complemented by regional research, such as that by Gallagher *et al.* (2020) and Arocha *et al.* (2023). These studies collectively enhance our understanding of the ecological roles and behavioral patterns of sharks and rays in the Caribbean, including St. Barths.

Fisheries

There is a low demand for shark meet from the local fisheries (Beaufort & Greaux, 2022). The main issue is bycatch of nurse sharks in traps which is problem due to the high numbers caught (up to 50 per month per fisherman) and the fact that shark fishing is forbidden. As the sharks can cause serious damage to the traps, the fishermen have taken steps to improve the fishing traps (Beaufort & Greaux, 2022).

Conservation and Management Implications

Since 2015, St. Barths has established its own fishing regulations, and the Environmental Agency of Saint Barthélemy (ATE) is responsible for managing marine resources and fishing permits in its waters.

According to Beaufort & Greaux (2022) there may be a potential to promote responsible shark/ray tourism and shark/ray "friendly fishing" on the island because there is a relatively large population of sharks, the species present are attractive for tourists, and the consumer demand for shark meat is low.

An important part of the study on St Barths is cooperation and collaboration with all parties, also in the region and the authors hope that this study will serve as an impulse for the rest of the French West Indies (Beaufort & Greaux, 2022). This study stands as a cornerstone for understanding the specific conditions and challenges in St. Barths, highlighting the unique characteristics of the region's elasmobranch fauna.

The work done by Beaufort & Greaux (2022) aligns with broader research by organizations such as Western Central Atlantic Fishery Commission (WECAFC) which emphasize the importance of marine protected areas and community-led initiatives in shark and ray conservation.

5.3.8 Review: Shark and Ray Research in Anguilla

Introduction

Anguilla is a British overseas territory, the most northerly of the Leeward Islands in the Lesser Antilles. It is located about 19 km north of the island of Sint Maarten and approximately 100 km northwest of Saint Kitts. Executive power in Anguilla is vested in a governor appointed by the British monarch.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in the waters of Anguilla, according to FishBase there are 21 elasmobranch species, 16 sharks and 5 rays present.

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for Anguilla.

Fisheries and Fisheries management

The Anguilla Fisheries Development Plan, developed by the Anguillan Department of Fisheries and Marine Resources gives an overview of the shark and ray fisheries on the island, both targeted fisheries and bycatch. In 2015 there were approximately 10 fishers with shark as their main target fishery. They fish for sharks using a drumline. Sharks are landed whole and stored separately from other fish. Larger Sharks are often tied to the broadside of the boat and pulled to shore alive. Sharks are targeted throughout the year and due to their notoriety, it usually leads to a gruesome spectacle when a large shark is landed at a port. Video of this is often shared on social media.

Sharks are caught occasionally as bycatch in trap, seine, handline and longline fishing. Sharks are considered a nuisance by fishers using these methods, particularly those deploying longlines which can be more than a 1000ft in length. These fishers often find Sharks entangled in their fishing gear. Sharks tend to either disrupt or destroy fishing gear. Spear fishers, when presented with the opportunity, would target small nurse, Caribbean reef and blacktip sharks.

Southern Stingray (*Hypanus americanus*) is the most common in Anguillan waters and the only one that is commonly targeted by spear fishers. Occasional bycatch of this species or other batoid species can occur in seine nets for rounding jacks or cast nets for bait fishing. Fishers have also been known to target Manta rays when on the rare occasion that they are found in the waters around the island. Both shark and ray catches are sold for local consumption, no elasmobranch products are exported.

There are no management measures to prevent over exploitation of elasmobranchs in Anguilla and no reliable data is available on the catch level or the impact this has on the populations around the island.

Conservation Status

Shark conservation for Anguilla should be of high priority as the country has a targeted shark fishery that is fully unregulated. Unfortunately, the current fisheries development plan has a section on the promotion of shark and ray fishing as the government seas sharks as a nuisance.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention but have not ratified the SPAW protocol (see chapter 3 of this report). They are also a party to CITES as part of the British commonwealth.

5.3.9 Review Status of Sharks and Rays in the Dutch Caribbean Islands

Introduction

The term Dutch Caribbean refers to the islands in the Kingdom of the Netherlands that are located in the Caribbean Sea. These six islands: Aruba, Bonaire, Curaçao, Saba, Sint Eustatius (Statia), and Sint Maarten (the southern part: northern is French) can be grouped in two groups of three based on their geographic location. The ABC islands (Aruba, Bonaire and Curaçao) are located off the coast of Venezuela in the southern Caribbean (also known as the leeward islands and Sint Maarten, Saba and Statia (the SSS islands) lie almost 1000km away in the north-eastern part of the Caribbean as part of the Lesser Antilles islands chain in the West-Indies, also known as the windward islands. Before 2010 the islands were known as the Dutch Antilles but since the constitutional reform they are known as the Caribbean part of the Kingdom of the Netherlands or Dutch Caribbean for short. Three of the islands Curaçao, Aruba, and Sint Maarten (CAS-islands), are autonomous constituent states (within the Dutch Kingdom whilst the three other islands; Bonaire, St. Eustatius and Saba (BES-islands) are special municipalities of the Netherlands.

The Dutch Caribbean's "Save Our Sharks" project stands as a pioneering initiative dedicated to the conservation and protection of sharks and rays within the waters of the Dutch Caribbean. The project, which ran from 2014 to 2019, was a collaborative effort involving various stakeholders, governmental bodies, local communities, and conservation organizations. It had a variety of project elements raging from research, to policy change to education and public awareness.

Taxonomy and Population Dynamics

In 2013 Van Beek et.al. published a shark protection plan for the Dutch Caribbean EEZ. According to this study there are 25 elasmobranch species in the EEZs of the Dutch Caribbean islands, 23 shark species and 3 ray species. It needs to be noted here that since then more species have bene identified in Dutch Caribbean waters but the list has not been updated officially.

From 2015 to 2017 Baited Remote Underwater Video (BRUV) studies were conducted on all six islands (Winter & de Graaf, 2019). Within the BRUV studies a total of 11 shark species were observed in the Dutch Caribbean combined. Species richness was highest around Aruba with 8 species and lowest around Bonaire with 3 species. In Saba's coastal waters 5 shark species were observed, Saba Bank 7 shark and ray species, Curaçao 4 species in the regular BRUV survey, additionally more species (Cuban dogfish - *Squalus cubensis*) were observed in a submarine trail at 300m depth, and St Eustatius and St Maarten all had 3 shark species.

Habitat Preferences and Movement Patterns

Part of the same research project by Winter and de Graaf was an acoustic telemetry analysis around de windward Caribbean islands in the Dutch Caribbean (Saba, St Eustatius and Sint Maarten). The acoustic telemetry project focused on the movements of sharks, habitat use, migration and connectivity between islands. Two shark species were tracked: Caribbean reef shark (*Carcharhinus perezi*) and nurse shark (*Ginglymostoma cirratum*) around Saba (from 2014) and then around Saba Bank, Sint Maarten and Sint Eustatius (from 2015).

The study demonstrated that both shark species have small home ranges and strong site fidelity. Large crossings between areas were rare, only found for two Caribbean reef sharks and one nurse shark that travelled between Saba and Saba bank. The two Caribbean reef sharks made short directed journeys back and forth, whereas the nurse shark showed up at the Saba Bank after two years absence before

returning to Saba. One nurse shark from another study on the US Virgin Islands was detected in the network on the Saba Bank: a distance of at least 160 kilometers. Based on the BRUV-dataset an additional study found that there was a higher occurrence of sharks within no-fishing zones (Marine Protected Areas) and that within the study almost all observed reef associated sharks were within juvenile size ranges, indicating this area is a potential nursery area for these species.

Fisheries and Fisheries management

Most fisheries in the Dutch Caribbean are small scale artisanal fisheries. There are no targeted fisheries for sharks although bycatch is landed, especially on Curacao where shark is used in a local dish called kari-kari. Rays are not consumed by the local people although there are some recent reports from Bonaire of illegal landings of stingrays for sale to Asian or Venezuelan immigrants.

The only commercial fishery on Saba is the fishery for lobster and snapper with traps on the Saba Bank. As the Saba Bank is a national park this fishery is strictly licensed. Through anecdotal evidence it is known that fishermen fishing with traps for spiny lobster on Saba Bank frequently have nurse sharks smaller than 100cm total length as unwanted bycatch in their traps. More than 95% of these sharks are discarded and there are no data available on post-release survival of these sharks. Fishers consider this bycatch a nuisance as the sharks can damage the traps and fishers believe they will dam age the lobsters inside. From 2018 to 2020 the Dutch Elasmobranch Society together with the Saba Conservation Foundation ran a project with the aim to 1) gain a better understanding of the bycatch levels of nurse sharks in the fishery and 2) look for ways to reduce the bycatch in traps.

The study found a high (30%) recapture rate of tagged nurse sharks and it was confirmed that only juvenile and sub-adult sharks end up in traps showing that there is significant bycatch of nurse sharks in the lobster fishery but it is likely to be lower than previously estimated because of high instances of recapture. Predation of nurse sharks on lobsters is rare, it was only observed once, indicating that sharks seem to enter traps for other reasons (shelter).

One effective alteration to the traps to reduce bycatch was the addition of an escape hatch to the top of the trap. This was effective in allowing a shark to escape from the trap in 60% of the trails in controlled circumstances, this alternation is now part of the licensing system for fishers using traps on the Saba Bank.

In 2015 the waters around Saba and Bonaire were declared a marine mammal and shark sanctuary, the name Yarari comes from the Taíno Indian language, meaning ‘a fine place’. In 2017 St. Eustatius joined its EEZ to Yarari, so the sanctuary covers all waters of the three islands under Dutch governance. The Dutch government committed to developing a management plan for the Yarari sanctuary together with the island administrations which is expected to come into force in 2024.

The EEZ of Sint Maarten has been a shark sanctuary since 2015, where all targeting of sharks and rays is prohibited and only catch and release fisheries for research purposes are allowed. This legislation is currently under review.

Curacao and Aruba have no specific conservation legislation or management policies for elasmobranchs.

Threats and Conservation Status

It is of concern that sharks caught in the waters of Curacao and Aruba can be (and are) landed. This poses a threat for the shark populations around these islands as local depletion of coastal sharks can

easily occur and has been well documented for the Caribbean (Simpfendorfer *et al*. 2023; Ward-Paige *et al.* 2010).

The Yarari legislation and the Sanctuary of Sint Maarten provides a strong basis for shark conservation on these islands but needs to be followed up with research and implementation effort.

In addition, all islands are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol (see chapter 3 of this report) which obliges them to protect and/or manage all species listed on annex 2 and 3 of the protocol. They are also a party to CITES and to the Convention on Migratory species (CMS).

5.3.10 Review of Shark and Ray Research for St. Kitts and Nevis

Introduction

St. Kitts and Nevis, a twin-island nation in the Wider Caribbean, has recently seen growing interest in shark and ray research. St. Kitts is elongated, measuring 37 km in length and 8 km in width, while Nevis, nearly circular and dominated by the volcano Nevis Peak, is surrounded by coral reefs. Nevis is located 3 km southeast of St. Kitts across an ocean strait called The Narrows.

Taxonomy and Diversity

Limited information is available about shark and ray populations in the waters of St Kitts and Nevis, according to FishBase there are 22 elasmobranch species, 16 sharks and 6 rays in the waters around the islands.

A photo identification study (with pictures taken by scuba divers) of white spotted eagle ray (*Aetobatus narinari*) around St Kitts identified 74 individuals of which 46 were encountered more than once (Conan, A. et.al, 2022).

In 2021 a woman was severely injured after a tiger shark bit her in the waters of Nevis, this was just one month after a woman was killed by a similar bite on Sint Maarten, this led to the suspicion that it could have been the same shark. Based on DNA analysis Clua et.al (2022) concluded that they could confirm that it was indeed the same shark with 95% certainty. The propose the method they developed as a new way to respond to shark incidents, so a more targeted response is possible instead of culling a great number of animals.

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for St. Kitts and Nevis.

Fisheries and Fisheries management

The FAO fishery profile for St. Kitts and Nevis reports that in 2014 805 people were employed as fishers and that there are two distinct fishing fleets (1) the small-scale subsistence and commercial fisheries on the reefs, slopes, and coastal ocean areas, and (2) the high seas fleet. Over 80% of the registered 260 vessels and more than 75% of the registered fishers are involved small scale fishery. This is a near shore reef fishery which utilizes traps, handlines and spear fishing as well as small scale pelagic fishing with seines, gillnets and trolling lines. There is a dive fishery for Queen conch which is mainly exported.

The high seas fleet consists of vessels flagged in St Kitts but not operating within the countries EEA. In 2010 there was one dedicated shark fisher active on Nevis, the authors could not find data on the species targeted or the level of shark bycatches for other fishers. There is a market for local consumption of shark on the islands but the size is unknown. There is no information on the catches of rays in the fisheries.

Fishing is managed through the 1984 Fisheries Act which allows for access, licensing, monitoring and enforcement as well as conservation measures, gear restrictions and prohibitions and the creation of marine reserves.

Threats and Conservation Status

The fisheries data shows there is a local market for shark meat and fishers will not discard sharks if (by)caught. This poses a threat for the shark populations around these islands as local depletion of

coastal sharks can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al.* 2023; Ward-Paige *et al*. 2010).

There appear to be no specific conservation measures to prevent over exploitation of the shark and ray populations around the islands. However, St Kitts and Nevis are member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention but have not ratified the SPAW protocol (see Chapter 3 of this report). They are also a party to CITES which regulates international trade of endangered species.

5.3.11 Review: Shark and Ray Research in Antigua and Barbuda

Introduction

The twin island state of Antigua and Barbuda, lie at the southern end of the Leeward Islands chain in the eastern Caribbean. Antigua being the larger island with an area of 280 km2 and Barbuda having an area of 160 km2.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in the waters of Antigua & Barbuda. According to FishBase there are 22 elasmobranch species, 16 sharks and 6 rays in the waters around the islands.

Habitat Preferences and Movement Patterns:

The authors found no studies on this topic for Antigua and Barbuda

Fisheries and Fisheries management

The FAO fishery profile for Antigua & Barbuda reports that in 2015 a total of 1907 worked in the fisheries sector and that the fleet was composed of 338 motorized vessels all of less than 18m length (most less than 12m). Fisheries focus on reef fish, lobster, queen conch and pelagic fish captured around Fish Aggregation Devices (FADs). There is no information available about shark (by)catches in the FAD fishery. Antigua & Barbuda report some catches of sharks to the WECAFC on an annual basis on average this is 34 metric tons live weight landed.

As part of collaborative research study between Antigua and Barbuda Fisheries Division and the Caribbean Network of Fisherfolk Organization results of 60 interviews carried out at the end of 2012 (4 from recreational fishers, 35 from commercial fishers, 11 from conch and lobster fishers, and 10 from dive operators) indicated that:

- 38.3% perceived a decline in shark abundance, while 56.67% indicated that shark abundance was stable or had increased.
- The most commonly sighted species, starting with most often sighted, were nurse shark (*Gynglimostoma cirratum*), blacktip shark (*Carcharhinus limbatus*), tiger shark (*Galeocerdo cuvieri*), lemon shark (*Negaprion brevirostris*), Caribbean reef shark (*Carcharhinus perezi*), hammerhead shark (probably *Sphyrna gilberti, S. lewini, S. mokarran, S.tiburo and S. zygaena*), bull shark (*Carcharhinus leucas*) and the sixgill shark (*Hexanchus* spp.).
- Fishers using gillnets, hook and line, vertical longlines and traps caught sharks, while no spear fisher caught sharks.
- 80% of commercial fishers caught sharks and the most commonly captured were tiger shark, nurse shark, blacktip shark, lemon shark, Caribbean reef shark, hammerhead shark, sixgill shark. Least commonly captured was the bull shark.
- Commercial fishers sold dressed shark carcasses for local consumption with prices ranging from EC$2.00 to EC$12.00, but the fins were discarded.

In 2020, Lovell *et al*. published a study on fishers' perception of species abundance based on qualitative interviews on the islands of Montserrat, Antigua and Barbuda. They found that younger fishers would not perceive species and ecosystems to have declined, despite this decline being well studied and documented, whilst older fishers were well aware of the change they had seen throughout their working life.

The fisheries are governed by a Fisheries Act from 2006, which entered into force in 2013. This makes provisions for the management and conservation of marine fisheries resources of Antigua and Barbuda, for the registration of local fishing vessels and the designation of Marine Reserves and Fishing Priority Areas and provides rules relative to aquaculture.

In addition, Barbuda has a Coastal Zoning and Management Regulations through which it has declared marine sanctuaries, no-net zones, anchoring and mooring zones and shipping areas. It empowers the Barbuda Council to amend the zones created in these Regulations or to create additional types of zones and to impose restrictions on activities in those zones. Through this regulation 33% of Barbuda's waters are now protected, including approximately one-third of each marine habitat type (Johnson *et al*. 2020).

In 2017 Antigua & Barbuda adopted a National Plan of Action for the Conservation and Management of Sharks. The plan strives to secure sharks national biodiversity conservation and manage fisheries and/or other economic activities where sharks, rays and chimeras inhabiting marine waters of the country interact, are target or by catch species. It sets out concrete actions for research, monitoring, responsible fishing practices, governance and legislation, participation and Education & communication. The plan includes a ban on shark finning.

Threats and Conservation Status

The fisheries data shows there is a local market for shark meat and fishers will not discard sharks if (by)caught. This poses a threat for the shark populations around these islands as local depletion of coastal sharks can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al.* 2023; Ward-Paige *et al*. 2010).

The National Plan of Action provides a strong basis for shark conservation in these islands but needs to be followed up with research and implementation effort for which the authors have found no evidence.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention but have not ratified the SPAW protocol (see Chapter 3 of this report). They are also a party to CITES and to the Convention on Migratory species (CMS).

5.3.12 Review of Shark and Ray Research for Montserrat

Introduction

Montserrat, an overseas territory of the United Kingdom, is a small island in the Wider Caribbean. Located approximately 43 km southwest of Antigua and about 50 km northwest of Guadeloupe. The population of Montserrat has declined over 50% over the last 20 years, from approximately 12,000 in 1995 to approximately 5,200 in 2017. This is due to prolonged volcanic activity from 1995 to 2010 that destroyed half of the island, including the former capital of Plymouth and key infrastructure, and impacted the main economic sectors of agriculture and tourism.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in Montserrat's waters, according to FishBase it has 23 elasmobranch species, 19 sharks and 4 rays in its waters. The volcanic eruptions between 1995 and 2000 deposited a lot of ash and gravel on the reefs around the island this has impacted coral reefs and marine life dependent on it.

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for the island of Montserrat.

Fisheries and Fisheries management

According to the FAO fishery profile for Montserrat the fishing sector is very small. In 2002 115 people were employed in the sector, of which 23 were full time male fishers. The island has two landing sites. The facilities available to fishers at these locations are extremely basic. Volcanic activity destroyed the larger facilities both at Plymouth and at Isles Bay. Fishing is concentrated between 0 and 2 nautical miles offshore mainly on the eastern and western sides of the island. The species groups traditionally exploited are Shallow Shelf and Reef Fish and Coastal Pelagics. There is no indication that sharks and rays are caught or consumed on the island.

In 2020, Lovell *et al*. published a study on fishers' perception of species abundance based on qualitative interviews on the islands of Montserrat, Antigua and Barbuda. They found that younger fishers would not perceive species and ecosystems to have declined, despite this decline being well studied and documented, whilst older fishers were well aware of the change they had seen throughout their working life.

The authors did not find a shark management plan or a description of fishery management for Montserrat.

Threats and Conservation Status

Assessing threats to these species is essential for conservation and should be a priority for future research. At this time, it is unknown whether which threats sharks and ray around the island face.

Montserrat has no shark conservation measures specific to its waters. They are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a member of the Cartagena Convention but have not ratified the SPAW protocol (see Chapter 3 of this report).

5.3.13 Review of Shark and Ray Research in the Guadeloupe Archipelago

Introduction

The Guadeloupe Archipelago, located in the Lesser Antilles of the eastern Caribbean Sea, is a French overseas département and region. It consists of Basse-Terre and Grande-Terre, Marie-Galante, La Désirade, and the Saintes Islands, with nearby Martinique also being a French overseas département.

Taxonomy and Population Dynamics

In 2021 Kap Natirel published an overview of the elasmobranchs of the French Antilles according to this list there are 36 elasmobranch species, 30 sharks and 6 rays, present in the waters around the archipelago.

Habitat Use and Movement Patterns

Serét (2017) indicated that the juvenile sharks are observed around in several areas in Guadeloupe on a regular basis, indicating that there are potential nursery areas around some of the islands.

From 2016 to 2022 Kap Natirel conducted an extensive BRUV study (funded by EU BESTlife) in the French Antilles. In Gaudeloupe Baited Remote Underwater Video (BRUVs) were deployed at 6 sites. At total number of 4 shark species and 2 ray species were seen with elasmobranchs observed in app 20% of deployments. Lemon shark (*Negaprion brevirostris*) and nurse shark (*Ginglymostoma cirratum*) were the most frequently observed sharks and almost all ray sightings were of Southern stingray (*Hypanus americanus*).

A follow up study from 2023 trailed the use of eDNA for shark detection in the waters of Guadeloupe, St Barths and St Martin. The preliminary conclusion of this study was that this method is not useful for detecting sharks in the waters of the French Antilles because (1) there was not enough genetic material available in the water samples collected and (2) the correct markers to detect the species present are not available yet as even species that were known to be present in the area in high numbers did not show up in the analysis.

Fishing and Fisheries management

In her study on "Characterizing Elasmobranch Species Diversity, Occurrence and Catches in Small-Scale Fisheries of the Caribbean" from 2019 Cáceres conducted in-person structured interview surveys (n=405) between June 2015 and June 2017 and deployed BRU Baited Remote Underwater Video systems (n=50 video drops/reef) at nine reefs across the islands of Guadeloupe, Martinique, and Tobago. In the study she interviewed 94 fishers on Guadeloupe, all small-scale fishers, fishing from boats of 5 to 10m length. She found that even though few fishers say they target sharks (<9%) the vast majority of them will retain any shark and ray bycatch (>80%) for sale or consumption. Fishers reported landing an average of 3.27- 4.44 elasmobranchs a year per fisher. The reported catches 10 shark species and 2 ray species, with hammerhead sharks, nurse sharks and mako sharks most frequently reported. In the BRUV-surveys far fewer elasmobranchs were observed than those reported by fishers.

Fishing in Guadeloupe predominantly occurs arounds FADs, several hundreds of these are deployed throughout the archipelago. Most are anchored more than 10 miles off shore and a privately owned by small groups of fishers. The activities and issues regarding FAD fishing in Guadeloupe, especially production data is partially monitored by Ifremer through logbooks data collection.

As a French overseas territory, Guadeloupe is part of the Outermost Regions (OMRs) of the European Union, governed by the principle of legislative identity and whose law-making power is limited to a subsidiary and regulatory power of execution. This means that for fisheries EU regulations apply, this includes the Community Plan of Action for the Conservation of Sharks (CPOA 2009).

This Action Plan has the following three specific objectives:

1. To broaden the knowledge both on shark fisheries and on shark species and their role in the ecosystem;
2. To ensure that directed fisheries for shark are sustainable and that by-catches of shark resulting from other fisheries are properly regulated;
3. To encourage a coherent approach between the internal and external Community policy for sharks.

Other EU laws that apply that are of relevance to elasmobranch conservation and management are the Common Fisheries Policy, the Technical Measures Regulation and the 2010 Shark Finning Regulation.

Threats and Conservation efforts

The fisheries data shows there is a local market for shark meat and fishers will not discard sharks if (by)caught. This poses a threat for the shark populations around these islands as local depletion of coastal sharks can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al* 2023; Ward-Paige *et al*. 2010).

The EU Community Plan of Action provides a strong basis for shark conservation in these islands but needs to be followed up with research and implementation effort for which the authors have found no evidence.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol (see Chapter 3 of this report), this gives them the obligation to protect species listed on annex 2 of the protocol and manage those on annex 3. They are also a party to CITES and to the Convention on Migratory species (CMS).

5.3.14 Review: Shark and Ray Research in Dominica

Introduction

Dominica, an independent country within the Commonwealth of the UK, is situated between the French islands of Guadeloupe and Marie-Galante to the north and Martinique to the south. It is a volcanic island with fringing reefs and steep drop offs This small island is known for its rich marine biodiversity especially for cetaceans.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in the waters of Dominica, according to FishBase 24 elasmobranch species, 20 sharks and 4 rays, can be found in the waters around the island.

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for Dominica. The study of habitat preferences and movements of sharks and rays is essential for effective conservation. Long-term studies focusing on their migration patterns and connectivity between Dominica and other Caribbean regions are lacking. Heupel *et al*. (2007) emphasize the importance of understanding shark nursery areas for species survival and effective management.

Fishing and Fisheries management

The FAO fishery profile for Dominica gives an estimated of 434 undecked multipurpose vessels, mostly motorized boats of less than 12, active in the fleet 2017 and 1195 people, of which 912 fishers, employed in the sector in a population of approximately 74000 people.

Major fish species caught are tuna (mainly yellowfin), mahi, blue marlin, wahoo, snapper and mackerels, all for local consumption. Unlike other Caribbean countries, Dominica does not harvest Queen conch or spiny lobster. There is bycatch of sharks reported in the snapper fishery but there appears to be no local consumption of sharks or rays so these are presumed to be discarded.

Fishing is managed by the Fisheries Division through a Fisheries Act which can provide for:

- Closed/open seasons and size restrictions;
- Establishment of marine reserves to protect species;
- Local and foreign fishing licenses;
- Gear size/type restrictions;
- Prohibition of certain harmful fishing practices.

As the country is part of the British commonwealth, they are party to ICCAT under the UK umbrella and work with CEFAS (UK government fisheries institute) on some fisheries monitoring for their ICATT reporting on their yellowfin tuna catches.

Threats and Conservation Status

Dominica promotes itself as the Caribbean's nature island, especially it's pristine underwater world which attracts many scuba divers. This can provide an incentive for strong environmental protection. Even though the Fisheries Act gives a strong mandate for fisheries management, the present management system is insubstantial with very few measures taken to protect vulnerable species and areas.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention but have not ratified the SPAW protocol (see Chapter 3 of this report).

5.3.15 Review: Shark and Ray Research in Martinique

Introduction

Martinique, a French Caribbean Island in the Eastern Caribbean included in the Lesser Antilles Island chain, is located between the island republics of Dominica, 35 km to the northwest, and Saint Lucia, 26 km to the south.

Taxonomy and Population Dynamics

In 2021 Kap Natirel published an overview of the elasmobranchs of the French Antilles according to this list there 22 elasmobranch species, 18 sharks and 4 rays, present in the waters around Martinique.

Habitat Use and Movement Patterns

From 2016 to 2022 Kap Natirel conducted an extensive BRUV study (funded by EU BESTlife) in the French Antilles (Beaufort, 2023). In Martinique Baited Remote Underwater Video units (BRUVs) were deployed at 2 sites. At total number of 1 shark species (nurse shark - *Ginglymostoma cirratum*) and 2 ray species (Southern stingray – *Hypanus americanus* and white spotted eagle ray - *Aetobatus narinari*) were seen during deployment.

A follow up study from 2023 (Beaufort, 2023) trailed the use of eDNA for shark detection in the waters of Guadeloupe, St Barths and St Martin. The preliminary conclusion of this study was that this method is not useful for detecting sharks in the waters of the French Antilles because (1) there was not enough genetic material available in the water samples collected and (2) the correct markers to detect the species present are not available yet as even species that were known to be present in the area in high numbers did not show up in the analysis.

Fishing and Fisheries management

In her study on "Characterizing Elasmobranch Species Diversity, Occurrence and Catches in Small-Scale Fisheries of the Caribbean" (Cáceres 2019) conducted in-person structured interview surveys (n=405) between June 2015 and June 2017 and deployed BRU Baited Remote Underwater Video systems (n=50 video drops/reef) at nine reefs across the islands of Guadeloupe, Martinique, and Tobago. In the study she interviewed 121 fishers on Martinique, all small-scale fishers, fishing from boats of 5 to 15m length. Fishers reported landing an average of 1-2 elasmobranchs a year per fisher. They reported catches 22 shark species and 2 ray species in their catches. Makos (*Isurus* spp.), hammerhead sharks (Sphyrnidae spp.), and nurse sharks (*Ginglymostoma cirratum*) were reported most frequently (Table 1). Southern stingrays (*Hypanus americanus*),and spotted eagle rays (*Aetobatus narinari*) were the reported ray species. In the BRUV-surveys far fewer elasmobranchs were observed than those reported by fishers.

As a French overseas territory, Guadeloupe is part of the Outermost Regions (OMRs) of the European Union, governed by the principle of legislative identity and whose law-making power is limited to a subsidiary and regulatory power of execution. This means that for fisheries EU regulations apply, this includes the Community Plan of Action for the Conservation of Sharks (CPOA 2009).

Threats and Conservation efforts

The fisheries data shows there is a local market for shark meat and fishers will not discard sharks if (by)caught. This poses a threat for the shark populations around these islands as local depletion of coastal sharks can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al.* 2023; Ward-Paige *et al.* 2010).

The EU Community Plan of Action provides a strong basis for shark conservation in these islands but needs to be followed up with research and implementation effort for which the authors have found no evidence.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol (see chapter 3 of this report), this gives them the obligation to protect species listed on annex 2 of the protocol and manage those on annex 3. They are also a party to CITES and to the Convention on Migratory species (CMS).

5.3.16 Review: Shark and Ray Research in St. Lucia

Includes information from interview with Makaba Felix, Monique Calderon and Charlie Prospere - Fisheries department - St Lucia (23rd August 2023)

Introduction:

Saint Lucia is the second largest of the Windward group in the Lesser Antilles and is located about 39 km south of Martinique and 34 km northeast of Saint Vincent. Saint Lucia is an island nation with a diverse range of marine resources, including various fish species and marine ecosystems. The local fisheries mainly practice artisanal fishing, with a range of techniques such as trolling and line fishing. The primary targets for fishing include species like tuna, wahoo, mahi-mahi, and dolphinfish. The artisanal fishing community plays a significant role in the local economy, with over 1700 registered fishermen in the country. However, there is no significant economic reliance on shark and ray catches, as most of the fish are consumed locally.

Fishers make use of fish aggregating devices (FADs) that are present all-around Saint Lucia, the government is working with support from Japan to move FADs further off shore to prevent damage to coral reefs around the island. Lost FADs pose issues, as they can become entangled with sharks and rays and other marine life. Saint Lucia has sea moss farming, which is used to create various products, including drinks, skincare items, and even ice cream. The government sees challenges of using plastic lines for sea moss farming and the exploration of alternative materials to reduce environmental impacts.

Taxonomy and Population Dynamics

Scientific findings have revealed a diverse assemblage of elasmobranchs, including species such as the Caribbean reef shark (*Carcharhinus perezi*), nurse shark (*Ginglymostoma cirratum*), and southern stingray (*Hypanus americanus*). FishBase records 18 shark species and 8 batoid species in the waters of St Lucia. These results highlighted the importance of St. Lucia as a habitat for various elasmobranch species.

Information on sharks in Saint Lucia is mainly obtained from reports by fishermen and dive operators. The fishermen catch sharks incidentally, and the catch data are collected by data collectors stationed at primary landing sites. There are limited reports of shark sightings from dive operators and beachgoers.

Hammerhead sharks are mentioned to be present off the East Coast, particularly around an area known for a population of hammerhead sharks by fishers. Nurse sharks are commonly seen on the West Coast of the island. There is no comprehensive stock assessment specifically for sharks and rays, making it challenging to determine trends in their abundance.

Unique Species/Areas for Sharks

Saint Lucia's marine reserves, such as the Southern Marine Management Area, contribute to the protection of marine life, although there aren't regulations specific to sharks. Rays are encountered in the waters around the island, with notable sites like Stingray City in the north-western region with high abundance of tropical stingrays and eagle rays. Rays are not heavily exploited, and there are occasional reports of rays coming closer to the shores during specific periods.

Challenges in Data Collection, Management, and Enforcement

One of the primary challenges in understanding shark populations is the reliance on sporadic reports from fishermen and limited formal monitoring. While there is a data collection system in place, it primarily focuses on targeted species and landing sites. Sharks and rays are only landed as incidental bycatch, and their data collection may not be as comprehensive as for other fish.

In a reconstruction of fisheries catches and fishing effort for the southeastern Caribbean (1940-2001) by Mohammed & Joseph (2003), St Lucia is noted as having devised a methodology for estimating total catches based on stratified sampling systems, although data were aggregated as 'marine fish nei (not elsewhere identified), making it difficult to identify data on sharks or rays (Mohammed & Joseph, 2003).

Threats and Conservation

The lack of specific regulations for sharks and rays, despite the fact that there are coastal marine reserves, also contributes to the challenge of monitoring and managing their populations effectively. In the interview, the participants discussed their efforts to expand protected areas but emphasized the need for better enforcement to effectively manage these areas. They mentioned their involvement in coral restoration and the development of monitoring plans for better conservation outcomes.

Despite the lack of comprehensive data, there is recognition of the need for increased research and conservation efforts for sharks and rays in Saint Lucia. The interviewees mention a previous biodiversity survey that collected data on various species but did not specifically focus on sharks and rays. Collaborations with organizations like the Western Central Atlantic Fishery Commission (WECAFC) and participation in international agreements such as the International Commission for the Conservation of Atlantic Tunas (ICCAT) indicate Saint Lucia's commitment to fisheries management. See also Arocha et al. (2023). Enhancing monitoring around fish aggregating devices is suggested as a possible step towards better understanding and protecting the local shark and ray populations.

Socioeconomic Importance and Stakeholder Engagement

While sharks are not targeted in local fisheries, they are occasionally caught incidentally and are then landed and consumed locally. The data collection system primarily focuses on targeted species, and there is limited information on shark and ray populations.

Conclusion

In the interview, the importance of marine reserves and collaboration with regional and international organizations is highlighted in the context of conservation and sustainable fisheries management. Moving forward, increased research efforts and comprehensive monitoring are essential to better understand and protect these species in the region.

5.3.17 Review of Shark and Ray Research for St. Vincent and the Grenadines

Introduction

St. Vincent and the Grenadines, part of the Lesser Antilles archipelago, is strategically positioned with Saint Lucia to the north and Barbados to the east. This location fosters a rich marine ecosystem, including diverse shark and ray populations. It consists of the island of Saint Vincent and the northern Grenadine Islands, which stretch southward toward Grenada. It is 30 km long and has a maximum width of 18 km. The larger islands of the Grenadines associated with Saint Vincent are Bequia, Canouan, Mayreau, Mustique, Prune (Palm) Island, Petit Saint Vincent, and Union Island. The Tobago Cays, just to the east of Mayreau, have been designated a wildlife reserve (Encylopedia Britannica, 2023). https://www.britannica.com/place/Saint-Vincent-and-the-Grenadines

Taxonomy and Population Dynamics

The waters around St. Vincent and the Grenadines are home to a variety of sharks and rays. FishBase records 18 shark species and 5 batoids, including Caribbean reef shark (*Carcharhinus perezi*), nurse shark (*Ginglymostoma cirratum*), lemon shark (*Negaprion brevirostris*), southern stingray (*Hypanus americanus*), and eagle ray (*Aetobatus narinari*).

Habitat Use and Movement Patterns

The authors found no studies on this topic for St. Vincent and the Grenadines.

Fisheries

Fishing is important in the cultural, social and economic livelihood for the people of St Vincent and the Grenadines (Shortte, 2016). There are four main categories of fishing: off-shore pelagic, in-shore pelagic, demersal and shell-fish and around 2500 traditional fishers throughout the island chain. The fisheries and species harvested in St Vincent and the Grenadines have been grouped into seven main categories including sharks, whales and turtles. Sharks are a bycatch in these fisheries, especially the offshore pelagic fishery for mahi mahi/dolphin fish (*Coryphaena hippurus*) (Shortte, 2016).

5.3.18 Review: Shark and Ray Research for Barbados

Introduction

Barbados, though not a part of the Lesser Antilles, is commonly grouped with this island chain. It is situated about 160km east of Sint Vincent and the Grenadines. Contrary to most island in the Lesser Antilles, island chain is not a volcanic island but composed entirely of sedimentary rock. Most reef cover can be found on the leeward side of the island.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in the waters of Barbados, according to FishBase there are 23 elasmobranch species, 18 sharks and 5 rays in the waters around the island.

Habitat Use and Movements

In 2015 Barbados was included in the Global Fin Print project (see page 53 of this report), they concluded that even though there was some degradation of reef shark populations around the island there is high potential for conservation if they were to invest in shark fisheries management and no-take MPAs.

Fishing and Fisheries management

Barbados has a substantial fishing fleet that mainly targets large pelagic species such as tuna, it also has a fishery for flying fish and for sea urchins both are consumed on the island. According to the FAO Fishery and Aquaculture country profile sharks and rays are mainly caught by the longline fishery as incidental catch, with a small directed fishery occurring in July – October when pelagics are scarce. The shark meat and shark oil produced are consumed and use in the island. Many longliners target tunas with billfish and shark bycatch. The reported capture production of elasmobranchs in 2013 was 10mt but it is believed that the figure is higher than this.

The most commonly caught and landed shark species. In the main primary market, the Bridgetown Fisheries Complex were the short fin mako (lion) shark (*Isurus oxyrinchus*) and the blue (peter) shark (*Prionace glauca*).

The Ministry of Agriculture, Food, Fisheries and Water Resource Management has primary responsibility for fisheries mainly through its Fisheries Division and Markets Division. The Fisheries Act (Cap 391) provides the legal authority for management and development of fisheries in Barbados and for the administration of the Fisheries Act including the Fisheries Management Plan. Under these fishing permits, technical measures, gear restrictions and closed areas and seasons are regulated. There are no specific measures for shark conservation.

In 2016 a national plan of action for sharks was drafted but this was never adopted.

Barbados is a contracting party to ICCAT and for this reason has the obligation to report on shark bycatches in its annual report to ICCAT.

A detailed investigation into the fisheries and coastal sector in Barbados underlines the importance of sustainable fishing and alternative livelihoods to mitigate negative impacts on ecosystems and local economies (UN, 2020)

Threats and Conservation status

The fisheries data shows there is a local market for shark meat and fishers will not discard sharks if (by)caught. This poses a threat for the shark populations around Barbados as local depletion of coastal

sharks can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al*. 2023; Ward-Paige *et al.* 2010), for pelagic shark species it is of particular concern that critically endangered short fin mako sharks continue to be landed.

The National Plan of Action provides would provide a strong basis for shark conservation so adoption of the plan should be a priority.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol so species listed on the annexes of SPAW should be legally protected (annex 2) or sustainably managed (annex 3) (see chapter 3 of this report). They are also a party to CITES which regulates trade in endangered species.

5.3.19 Review: Shark and Ray Research in Grenada

Introduction

Grenada, the southernmost island of the north-south arc of the Lesser Antilles in the eastern Caribbean Sea, lies approximately 160 km north of Venezuela's coast. The southern Grenadines, with Carriacou as the largest, located about 32 km northeast of Grenada, are a dependency.

Taxonomy and Population Dynamics

Surveys of shark and ray populations in Grenadian waters are sparse, but to date, 14 species of sharks and 6 batoid have been documented according to FishBase. Shark species are mostly requiem sharks (Carcharhinidae) such as the tiger shark (*Galeocerdo cuvier*) and silky shark (*Carcharhinus falciformis*); there are also two species of hammerhead, the scalloped (*Sphyrna lewini*) and great hammerhead (*S. mokarran*); and whale sharks have also been recorded. Batoids are mostly stingrays with the white spotted eagle ray (*Aetobatus narinari*), and the chola guitarfish (*Pseudobatos percellens*) also present.

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for the island of Grenada.

Conservation and Management Initiatives

According to Ward-Paige (2017) Grenada declared in 2016 that they would close their EEZs to commercial shark fishing, however, no details could be found of this policy being implemented.

Fisheries

An overview of fisheries data collection and management on Grenada states that there is no targeted fishery for sharks (Harvey, 2019. The species (primarily *Carcharhinidae*) are caught in the pelagic fishery in low numbers and are considered to be bycatch, moreover the design of longline and hooks has been adapted to minimize the capture of sharks (Harvey, 2019). There is also a small-scale fishery associated with FADs, but there is no information on elasmobranch catches or sightings (Arocha *et al.*, 2023). Research has been done on the importance of fisher knowledge in the longline fishery for large pelagic fish in Gouyave, Grenada, but again there is no specific information on elasmobranchs (Grant & Berkes, 2007).

5.3.20 Review of Shark and Ray Research for Trinidad and Tobago

Includes information from interview with Kelly Kingon, Farahnaz Solomon and Anjani Ganasse - SpeSeas Trinidad UT&T (12 July 2023) and from interview with Aljoscha Wothke and Lanja Fanovich from Environmental Research In Charlotteville – ERIC, Tobago (17 July 2023)

Introduction

Trinidad and Tobago, consists of two main islands—Trinidad and Tobago—and several smaller islands, forming the two southernmost links in the Wider Caribbean chain, lying close to the continent of South America. Trinidad is by far the larger of the two main islands, has an area of about 4,800 km2 lies just 11 km from the Venezuelan coast at its nearest point. It is separated from it by the Gulf of Paria and two narrow channels, where there are several small islands and rocks. Tobago has an area of about 300 km2 and lies 30 km to the northeast of Trinidad.

Taxonomy and Population Dynamics

Trinidad

Of the two especially Trinidad has a high diversity of shark and ray species as it has nutrient rich water coming in from the Amazon and Orinoco on the South side and clear waters from the Caribbean Sea to the North which creates a large diversity in habitats and food sources for elasmobranchs. Sharks are abundant along most coastlines of Trinidad and Tobago, except the west coast. According to FishBase 43 sharks and 23 ray species are found in the waters of Trinidad. This includes critically endangered species such as smalltooth sawfish (*Pristis pectinata*) and oceanic whitetip shark (*Carcharhinus longimanus*) as well as all 8 species of hammerhead sharks.

Tobago

Tobago has more Wider Caribbean species and higher shark numbers, likely due to feeding into the populations from Trinidad.

In 2016 ERIC collaborated with Global Fin Print (see page 56 of this report) for Baited Remote Video Analysis around the island of Tobago. The BRUV work around the island showed that there were up to six species spotted in the northeast, which is considered to be a high species richness and Tobago is considered as a 'bright spot' in the area. BRUVs were deployed around 40 m and the most common species was the nurse shark. This is also backed up by information from dive shops. Sharks were seen in 1 in 10 BRUV drops.

Historically Tobago was famous for scalloped and great hammerheads which likely swim from the open ocean to the pupping grounds in the Gulf of Paria using the northeastern islets for navigation and orientation points. Until 15 years ago you were guaranteed to see great hammerheads at these islets, but after a targeted fishery developed the species was locally fished out within one year. Due to the large numbers of shrimp as prey, the sharks became a more orange/gold color.

For the tiger shark (*Galeocerdo cuvier*) and the great hammerhead (*Sphyrna mokarran*) the waters around Tobago are considered a pupping ground. Southern stingray and spotted eagle ray were seen, especially off Charlottesville in the NE, although the latter were rare in the BRUVs. The stingrays are attracted by the scraps discarded by fishermen, and if the fishermen catch stingrays, they cut off the barb. Mobula rays are seen seasonally off Little Tobago, which is an island at the very first outcrop of northeast Tobago with the steepest drop off into the Atlantic. This is where the Guyana current hits Tobago and nutrient rich water comes up. The giant manta rays (*Mobula birostris*) came between

January and April, likely for feeding. Although this is still quite common, it's not as common as it was 20 years ago.

Shark Fisheries

Trinidad

Of the two islands Trinidad has by far the largest fishing fleet

Trinidad has a substantial targeted fishery for sharks, particularly for the dish "bake 'n shark." The fishery started in the 1980s and targets any shark species, with a preference for smaller sharks. The dedicated shark fishery mainly uses gillnets and longlines. Sharks are also wanted bycatch in tuna fisheries and exported through Trinidad. Limited species-specific data is available, primarily through the International Commission for the Conservation of Atlantic Tunas (ICCAT). There is no targeted fishery for rays but bycatch is kept and sold, with a growing market driven by consumption by Venezuelan migrants.

Fins of sharks caught on Trinidad are retained and sold separately to traders which export them to Asia.

In a paper from 1994 Christine Chang A Shing gives an overview of the shark fisheries on Trinidad and Tobago based on data from 1978 to 1991. In this study she present data that 34 species of shark are landed in Trinidad but the majority of catches are of 15 species. of which five are very common in the landings in Trinidad (small tail shark - *Carcharhinus porosus,* black tip shark – *Carcharinus limbatus,* smalleye hammerhead - *Sphyna tudes,* scalloped hammerhead - *Sphyrna lewini* and Brazilian sharpnose shark *Rhizoprionodon lalandii*). In Tobago two species are very common Caribbean sharpnose shark *Rhizoprionodon porosus* and dusky smoothhound - *Mustelus canis*. She found that hammerheads species diversity was greater around Trinidad than Tobago. Juvenile sharks of most species were found to segregate inshore within a two-mile zone around the coast, which indicates a possible nursery area.

At the time of analysis, the offshore industrial fishery was not obliged to report on shark (by)catches so the paper has insufficient data to draw any conclusion about this fishery. The bulk of shark landings from this fleet segment were are highly migratory species such as makos (*Lamnidae*), threshers (*Alopiidae* spp.) and blue shark (*Prionace glauca*).

Most sharks' meat and fins were sold fresh, with some minor sales of liver oil and cured meat in remote areas.

Tobago

There is not a big fishery on Tobago and what there is, is artisanal in coastal waters, small fishing pirogues which stay out for a day at a time and use line and hook. There are one or two people that target sharks specifically to satisfy the Trinidad holidaymaker market because there is a specialty shark and bake that Trinidad people like. This is mostly in the tourism area in southwest Tobago. Otherwise, shark is mostly bycatch. There are religious reasons for not catching sharks as some religious groups think that sharks are unclean because they don't have scales. And shark meat, contrary to Trinidad, is not as valuable for fishermen. It is sold at around 60% of the price of a grouper or snapper, for example. There could be an issue for sharks if the more expensive fish are depleted, but ERIC told us that they hope to re-direct fishing pressure (see below).

Whereas Trinidad is a shipping hub, there seems to be little attention paid to fisheries in and around Tobago, also internationally where the long-line fleet is active according to international fleet tracking

data, although it is not known under which flag. The main focus of the shark management plan is to re-direct the artisanal fishing pressure before it develops further. The moment people start to feel there's an economic interest in shark fishing, it will be much harder to change back and quid pro quo scenarios with fishermen need to be found

There are different small-scale landing sites along the coast, and many have a depot with ice machines and proper facilities for processing the fish. In some areas there are small stalls where it's literally just a stall and the fishermen with a cooler of ice when they're processing fishes. Sharks are usually the last species to be sold unless someone specifically needs the meat for shark and bake, for example. Fins are taken and although some are kept for the local market for Chinese restaurants, most are sent to Scarborough and then on to the Port of Spain for the international market.

Anecdotal evidence that the bonito and mahi mahi fishermen sometimes catch hammerhead sharks and that at the larger aggregations of bonito or mahi mahi that there are many hammerheads.

Toxicity research in Trinidad and Tobago

There have been several studies of the effect of shark meat consumption on Trinidad. Sharks are long lived predators that can accumulate toxic metals such as mercury, arsenic ad lead in their meat over time. By consuming shark meat these toxins can transfer to humans and can-do damage in their bodies, this can be especially problematic for pregnant persons. A study by Mohammed from 2017, found potentially toxic levels of mercury in samples from smalltail shark (*Carcharhinus porosus*) and scalloped hammerhead (*Sphyrna lewini*). A preliminary study by Ricketts (Ricketts 2016) looked specifically at the buildup of mercury the placentas of women after giving birth. They found elevated mercury levels for those women who consumed a lot of fish.

In Tobago ERIC carried out similar research. Tissue samples are obtained from the base of the dorsal fin from sharks at the fishing depots and analyzed for methyl mercury. The source of this is likely the run-off from gold mining in Guyana and Venezuela. Fin clips were also taken for DNA testing and these were sent to Florida International University to verify species ID and to test for methyl mercury. Most predominant species were smooth hounds and sharpnose sharks and small-tail sharks, as well as a couple of hammerhead sharks were also caught. The larger sharks, especially the hammerheads had a concentration of methyl mercury that might be of concern for consumption, depending on the quantity consumed. However, as this was opportunistic sampling and the number of samples was limited, no statistical conclusions can be made. ERIC is hoping to get more funding to carry out more robust sampling. These preliminary findings might be advantageous for sharks by reducing shark catch. It is hoped that the government might now do something about the health risk as up to now they have not been open about the effects, especially for pregnant women, which is a problem.

Fisheries Management

Trinidad

On Trinidad fisheries are managed through the Fisheries Division. It has one of the oldest Fisheries Acts in the region, stemming from 1916. This Act has been updated over the years. In 2016 a draft fisheries management policy was developed and management plans have been drafted for the trawl and hard substrate demersal fisheries.

The Fisheries Division is implementing voluntary compliance – mainly for offshore longline fleet of non-artisanal vessels to meet obligations under ICCAT management recommendations - e.g., provision of fishing data and information (trip reports); refrain from landing blue marlin, white marlin and

spearfish, whether live or dead when caught; prohibit the sale of marlins at recreational fishing tournaments.

A Shark Action Plan was developed for Trinidad in 2004 but the government lack funding for its implementation.

Data collection is challenging due to the large fisheries with six landing sites and non-specific species reporting. There are ongoing research projects for identifying nursery areas for scalloped hammerhead sharks and genetic sampling of shark catches to study population dynamics and recapture rates.

The interviewees note that training in shark identification and translation of local names into common names is necessary as well as the importance of maintaining traditional fisheries while implementing management measures was recognized. The also stressed that effort is needed to address ray conservation, including outreach and education and that engagement with the fisher community is crucial to raise awareness and share conservation information

Tobago

The Division of Fisheries of the Tobago government collects data and they report to the Tobago House of Assembly. There is also a department of Marine Resources. However, their resources are limited and the knowledge of sharks is estimated to be low by those we spoke to.

There is a new Fisheries Act which is under review and should be ready in September 2023.

Tobago has a Shark and Ray Management Plan, specifically for the north-eastern region where a planned UNESCO biosphere area will be. The plan is currently being reviewed and it is hoped that it will be ready within 6 months. There is also a management plan for the Biosphere Reserve which should be reviewed in September of 2023 and come into force in 2024.

Threats and Conservation on Trinidad and Tobago

Trinidad has one of the largest shark fisheries in the Wider Caribbean and sharks are targeted in all habitats around the island, some of which are suspected nursery areas. This poses a large threat to the local and even regional populations as nursery areas for highly migratory species like hammerheads can be essential to maintain entire regional populations. The fully unregulated emerging fishery for rays is also of grave concern.

A study by Ramjattan and Mohammed (2007) investigated the fisheries in Trinidad and Tobago, highlighting the lack of adequate regulations. The research stressed the need for improved fisheries management and conservation measures to protect these vulnerable species.

The Shark Action Plan for Trinidad provides a strong basis for shark conservation so implementation of the plan should be a priority for the near future (Shing 2004).

On Tobago shark fishing is less prevalent than on Trinidad, however, the example of the hammerhead population that was fished out within a year in the Gulf of Paria (comment ERIC) shows how vulnerable the populations around these islands are. In that sense it is a hopeful development that Tobago has a shark management plan for the UNESCO biosphere reserve on the North side of the island.

In addition, Trinidad and Tobago are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol so species listed on the annexes of SPAW should be legally protected (annex 2) or sustainably managed (annex 3) (see Chapter 3 of this report). They are also a party to CITES which regulates trade in endangered species and to the Convention on Migratory species.

Priorities for Trinidad

- The need for community-based management and integration between the Fisheries Division and fishermen was emphasized.
- Alternative livelihoods and increased education on shark conservation and the risks of heavy metals in shark meat were recommended.
- Organizing fisheries collectives and cooperatives was discussed as a potential avenue for improving fisheries management.
- The establishment of Marine Protected Areas (MPAs) in Trinidad was strongly advocated, in addition to existing MPAs in Tobago.

Priorities for Tobago

- To redirect fisheries as soon as possible so that it doesn't develop further
- Health issues with methyl mercury
- Long-term education (5-10 yrs.) on the importance of sharks with long-term funding, not project based – opportunities with Biosphere Reserve
- Understanding the species population structure
- Getting the proposed legislation in place and to declare areas and species as protected – secure funding

5.3.21 Review of Shark and Ray Research in Venezuela

Includes information from interview with Freddy Arocha Instituto Oceanográfico de Venezuela, Universidad de Oriente (12 July 2023) and interview with Rafel Tavares (Centro para la Investigación de Tiburones - CIT (18 July 2023)

Introduction

Venezuela, with its extensive coastline and diverse marine habitats, is home to numerous species of sharks and rays. This literature review aims to provide an overview of the research conducted on sharks and rays in Venezuela, highlighting key findings and gaps in knowledge.

There is a long-line fleet which targets billfish. Shark and ray species caught as bycatch are: blue shark (*Prionace glauca*), shortfin mako (*Isurus oxyrinchus*), silky shark (*Carcharhinus falciformis*), oceanic white tip (*Carcharhinus longimanus*), tiger shark (*Galeocerdo cuvier*), smooth hammerhead (*Sphyrna zygaena*), great hammerhead (*Sphyrna mokarran*), big-eye thresher (*Alopias superciliosus*), pelagic stingray (*Pteroplatytrygon violacea*) and manta rays (*Mobula* spp.). See Annex 1 below for the ICCAT statistics. There has been no reporting of catches to ICCAT since 2018.

There are two types of artisanal fisheries which are very versatile because they work with the season. There are also targeted shark fisheries as well as those for billfish, sardines and shrimp

1. Coastal artisanal which includes all types of gear and can even include trawling (La Chica), whic h was stopped in 2007. Officials turn a blind eye because this is artisanal. Because this occurs in the coastal areas this affects the nursery areas for sharks. The gear from the coastal fishery is basically bottom gillnet. That's specifically for rays and sharks. And most of the sharks are sharpnose (*Rhizoprionodon* spp.) , smoothhounds (*Mustelus* spp.), dogfish, angel sharks (*Squatina* spp.) and also batoids, including manta rays (*Mobula* spp).

2. Manual long-line offshore between 10 and 18 m; up to 1200 hooks with live bait – mostly off Margarita Island and targeting sardine; also, bottom gill net and pelagic long-line are used

Around Margarita Island a lot of rays are caught for consumption, such as eagle ray (*Myliobatis* spp.) and spotted eagle ray (*Aetobatus narinari*), elsewhere also southern stingray (*Hypanus americanus*) and longnose stingray (*Hypanus guttatus*). There are a couple of communities on Margarita Island that traditionally only fish for eagle rays and they utilize everything meat, bones, gut and skin.

For the artisanal fisheries any coastal place is a landing site, you just need a truck and ice. This makes it difficult to know what is being landed and to control and enforce.

Data on blue shark are available for ICCAT shark assessments (Arocha *et al.*, 2023), as well as shortfin mako, silky, oceanic white tip, thresher species and hammerhead species (Arocha *et al.*, 2017). Data are from the industrial longline fishery and the artisanal drift-gillnet fishery for the period 1991-2014. There are also distribution maps for the species.

Primary focus for ICCAT was billfish, but information on sharks was also collected. A back-tracking exercise was carried out to reconstruct the shark data information from 1994 to date with specific shark data capture information as well as the biological information such as size, weight (occasionally – sharks were landed without heads and fins), sex, maturity and photos of pups. See Arocha *et al.* (2017)

Taxonomy and Population Dynamics

Venezuelan waters are home to a large number of chondrichthyans due to the ambient oceanographic conditions (Taveres and Arocha, 2008). According to an update of the taxonomic list of chondrichthyans from the exclusive economic zone of Venezuela by Ehemann *et al*. (2019) there are 69 species of sharks, 50 species of batoids and 3 species of chimaera in Venezuelan waters which are contained in two subclasses, 11 orders and 36 families.

Six mobulid species are reported for the western Atlantic Ocean and the Caribbean Sea, three of which had previously been reported in Venezuela (*Mobula birostris*, *Mobula tarapacana* and *Mobula hypostoma*) (Ehemann *et al.,* 2022). The authors carried out an assessment of fishery landing data from Margarita Island (2006, 2007 and 2014) and did extensive data mining as well as using citizen science data. This led to the conclusion that there are four mobulid species in Venezuela *Mobula birostris*, *M. tarapacana M. mobular* and *M. thurstoni* and that records of *M. hypostoma* could not be verified (Ehemann *et al.*, 2022). The numbers of juvenile manta rays and pregnant *M. mobular* and *M. thurstoni* recorded in this study, leads the authors to that suggest Venezuela provides an important habitat for these species (Ehemann *et al*., 2022).

Population dynamics, habitat use and conservation status

Neonate and juvenile blacktip sharks (*Carcharhinus limbatus*) are common in several separate areas in the southern Caribbean, such as the Gulf of Venezuela, Los Roques Archipelago and in nearshore areas of Trinidad and Tobago (Arocha *et al,* 2023). This species is known to utilize coastal bays and estuaries and throughout is range and is sometimes known to occur in aggregations (Arocha *et al.*, 2023).

Many of the species recorded by Tavares and Arocha (2008) are on the IUCN Red List, including four species catalogued as Critically Endangered, six as Endangered and 17 species as Vulnerable. According to the authors, deep-sea fisheries, scientific exploration and taxonomic–genetic revisions might add future increments to the Venezuelan chondrichthyan list.

Fisheries information and management

Since 2013 there was a ban on finning sharks at sea which led to the practice of removing the heads and fins and chopping up the meat so that it was no longer possible to identify the species. The main issue at the moment is the price of fuel. Only 20-25% of the fishing vessels currently go out due to fuel shortages.

Venezuela has an extensive artisanal fishery, but there is a paucity of regional life-history data for many important species (Tagliafico *et al*., 2021) Based on port and fish market sampling at total of seven species were identified, one of which was the locally distributed blacknose shark (*Carcharhinus acronotus*) and six cosmopolitan species the spinner shark (*C. brevipinna*) the silk shark (*C. falciformis*),the blacktip shark (*C. limbatus*), the tiger shark (*Galeocerdo cuvier*),the scalloped hammerhead (*Sphyrna lewini)* and the shortfin mako (*Isurus oxyrinchus*). The catches consisted almost entirely (96%) of juveniles and neonates (Taglifico *et al*, 2021), which is unlikely to be sustainable. Species-specific seasonal patterns in parturition were identified which could inform management (Tagliofico *et al*., 2021). Historically the Brazilian sharpnose shark (*Rhizoprionodon lalandii*) was the most landed shark species and mostly juveniles are landed (Arocha *et al.,* 2023).

For the long-line fishery well-trained observers collected data until 2018 when data collection was stopped. Therefore, Venezuela does not comply with ICCAT regulations, but the enforcement is quite lax – usually a letter to improve in the next year. The sardine fishery is well-documented, but there is no control of logbooks in the rest of the artisanal fisheries. Port sampling was stopped in 2021. Catches from the long-line fishery have been well-documented (Tavares & Arocha, 2008; Arocha *et al.,* 2023).

There is report which from ICCAT on data collection in artisanal fisheries in the Wider Caribbean, which explains the fishing practice for a large number of the countries in the CAMAC scope area. This will form the basis for a future workshop by ICCAT (Arocha *et al.,* 2023).

In Venezuela everything that comes from sharks is consumed. In 2013 shark finning at sea was forbidden and the fish had to be landed with head and fins attached. Leaving the head on is very dangerous so fishermen would take off the head and chop up the rest and mix with other fish. Meat is the valuable commodity; fins are not considered valuable. In the past fins were traded. There are two traders, both in Cumana and they usually traded with Trinidad.

A shark action plan has been announced (Gazeta Official) but this is not enforced and not even official. Outreach is important. There is contact with fishermen and you need to understand each community and their idiosyncrasies and timing of the fishery. One of the hot-spots is the coastal area off the airport and fishing only takes place at new moon, not during full moon as it is too light. ICCAT is initiating projects into artisanal tuna fisheries and has carried out workshops in West Africa. The next initiative will likely be in the Caribbean (Arocha, *et al.*, 2023).

5.3.22 Review of Shark and Ray Research in Suriname

Introduction

Suriname is a small country on the northern coast of South America on the Atlantic Ocean. It is bordered by French Guiana to the east, by Brazil to the south and by Guyana to the west. 80% of the country is covered by rainforest with only the coastal area developed and populated. The coastal zone, fed by nutrient rich waters from several rivers is home to diverse marine habitats and supports a rich array of shark and ray species.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in the waters of Suriname, according to FishBase there are 51 elasmobranch species, 38 sharks and 23 rays present of the coast of Suriname. Published reports of species sightings are rare, also in comparison with sightings of other marine megafauna.

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for Suriname

Fishing and Fisheries Management:

According to the FAO Fisheries and aquaculture country profile, Suriname has quite an extensive fishery, both inshore and offshore. The inshore fishery mainly consists of smaller vessels fishing with driftnets, gillnets, lines, trawl and pots for a variety of species. The offshore fleet fishes for mackerel and snapper (trawl) and tuna (longline). There also is an industrial shrimp fishery active in Surinamese waters, fishing for deep sea shrimp, large shrimp and seabob shrimp.

Fisheries are managed by the Ministry of Agriculture and Fisheries (LVV) through the Fisheries Management Plan for Suriname 2021 -2025. The focus of the plan is on:

- Active participation of stakeholders in the implementation and monitoring of fisheries policy
- Limiting fishing effort by 'freezing' the number of permits at the level of 2020, determining provisional maximums and drawing up reduction plans
- Increased transparency in the licensing process
- Intensification of Monitoring, Control and Surveillance in collaboration with other authorities
- Reduction of ecosystem effects of fishing, including through increased implementation of TEDs (Turtle Exclusion Devices) and BRDs (Bycatch Reduction Devices)
- Improving fisheries data collection and research in order to carry out stock estimates to advise fisheries policy
- Intensive regional and international cooperation

The largest commercial seebob fleet is owned by the Dutch company Heiploeg. This company has received the Msc sustainable fisheries certificate in 2012. As part of this certification studies were carried out into the bycatch levels of elasmobranchs in this fishery and the effectiveness of bycatch mitigation measures such as Turtle Exclusion Devices (TEDs) and Bycatch Reduction Devices (BRD's) (Kris & Tomas, 2012; Willems et.al, 2013 & Willems et.al 2016). The study aimed to assess the effectiveness of bycatch measures such as the Turtle Escape Devices (TEDs) and Bycatch Reductions Devices (BRDs) in reducing bycatch of highly vulnerable rays and to provide a preliminary assessment of the ray populations in the seabob fishing zone. The results show substantial bycatch of rays (678 animals in 10 experimental hauls), most were dead or in poor condition. Species most commonly

caught were smooth butterfly ray; *Gymnura micrura* (58%), longnose stingray; *Dasyatis guttata* (18%) and smalleyed round stingray; *Urotrygon microphthalmum* (18%). Sharpsnout stingray; *Dasyatis geijskesi* and Brazilian electric ray; *Narcine brasiliensis* were caught less frequently, respectively 2 and 4% of the ray bycatch during these experimental hauls.

Adding TEDs and BRDs to the trawl nets led to an overall reduction of 36% in ray bycatch. However, this reduction was not evenly spread among the species caught, the modifications mainly reduced the capture of large rays (up to 77%) but smaller species and individuals were still captured in higher frequencies. The authors conclude that TEDs and BRDs are effective at reducing ray bycatch or large rays but that the capture of small rays was still a source of concern as this could impact the juveniles of large species as well as the entire population of small species. They also conclude that the assessment of the ray populations in Suriname's waters might benefit from a structural compilation of the Local Ecological Knowledge (LEK) of the captains and fishermen

There is resource competition between fishers in the coastal zones with both neighboring countries (Guyana and French Guiana) with many acquisitions of IUU fishing and sometimes even extreme violence. In 2023, 5 Guyanans were sentenced to death for the murder of 4 Surinamese fishers in 2016, in 2022, France threatened to get the Surinamese fishery blacklisted by the EU (making it impossible to import fish and seafood into the EU) because it found Suriname flagged vessels illegally fishing in their waters. Suriname said these were Guyanese boats fishing with a license from Suriname.

In November 2023 the Fisheries Directorate of the Ministry of LVV and the Coast Guard started a joint project with WWF Guianas to combat IUU fishing in coastal and inland waters of Suriname. The project aims to (1) improve the recording of bycatch and interactions with sea turtles, (2) increase Monitoring, Control and Surveillance (MCS) activities to combat IUU fishing, including apprehension of illegal boats and (3) the development of a national action plan to address IUU fishing.

Threats and Conservation

The fisheries data shows there is substantial bycatch of elasmobranch, in particularly rays, in the fisheries. Bycatch is landed and sold for local consumption. This poses a serious threat for the elasmobranch populations of Suriname as local depletion of coastal shark and ray populations can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al*. 2023; Ward-Paige *et al*. 2010). It is of particular concern that the seabob shrimp fishery reports high bycatches of critically endangered smalleyed round stingray as well as longnose stingray and smooth butterfly ray which are classed as near threatened by the IUCN. Reducing the bycatches of these species should be a priority in the country.

In addition, they are a member of WECAFC and so through these channels have committed to the Regional Plan of Action for Sharks. They aren't party to the Cartagena Convention. They are not a full member if ICCAT but a cooperation partner in this RFMO.

5.3.23 Review of Shark and Ray Research in Guyana

Introduction

Guyana, is located in the northeastern corner of South America, bordering Venezuela to the West, the whole coastline is a complex floodplain of different rivers and estuaries. The coastal zone, fed by nutrient rich waters from several rivers is home to diverse marine habitats and supports a rich array of shark and ray species.

Taxonomy and Population Dynamics

Limited information is available about shark and ray populations in the waters of Guyana, according to FishBase there are 53 elasmobranch species, 31 sharks and 22 rays present within the EEZ. A study from 2017 in which sharks from a Guyanan fish market were sampled revealed that all 13 species sampled belonged to the genus Carcharinidae, and included scalloped and great hammerhead (*Sphyrna mokarran* and *S. lewini*), sharpnose shark (*Rhizoprionodon* spp.) and smalltail shark (*Carcharhinus porosus*).

Habitat Preferences and Movement Patterns

The authors found no studies on this topic for Guyana.

Fisheries and Management

Bycatch of sharks and rays is not monitored but there is information of substantial impact on local shark populations. A review of the impacts of the artisanal groundfish fishery (Drugan, 2019) found that most commonly used gear types were gillnets and Chinese seines. The report frequent bycatch of Blacktip shark, *Carcharhinus limbatus* (estimated annual catch of 749 tones). Since sharks are landed with heads and fins discarded speciation is unsure and based on the genetic study mentioned above it can be assumed that fishers are landing a mix of species. Fishers try to avoid landing rays as they are perceived to be bad luck.

Similarly, to Suriname and French Guiana, Guyana has a commercial fishery for seabob shrimp which has a significant ray bycatch. As part of their MSC certification program Turtle Exclusion Devices (TEDs) were trailed in this fishery in 2018 (Garstin & Oxenford, 2018). They found a 40% decline in ray catches when using the TED, although as in the trail in Suriname they TEDs mainly excluded the larger bodied rays and had less effect on the small ones including the 'Critically Endangered' Caribbean Electric Ray (*Narcine bancroftii*).

In 2017 Guyana opened a longline fishery for yellowfin and bigeye tuna, there are no reports on shark bycatch in this fishery.

Threats and Conservation status

The fisheries data shows there is a local market for shark meat and fishers will not discard sharks if (by)caught. This poses a threat for the shark populations around Guyana as local depletion of coastal sharks can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al.* 2023; Ward-Paige *et al.,* 2010). The lack of species-specific bycatch data from the fishery and the recently opened longline fishery for tuna are of particular concern as this prevents insight into the overall population level effects.

In 2017 WWF Guianas started a new program to address threats to sharks and rays in this region. This included training workshop for fisheries officers and fishers on identifying elasmobranchs, in particular endangered, threatened and protected species.

In addition, all Guyana is a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol (see chapter 3 of this report) which obliges them to protect and/or manage all species listed on annex 2 and 3 of the protocol. They are also a party to CITES and a cooperating partner to ICCAT.

5.3.24 Review of Shark and Ray Research in French Guiana

Includes information from presentation and additional interview with Michel (Tony) Nalovic of Fishing Cleaner (04 November 2023) and personal comments from Margot Vanhoucke, scientific studies lead at EDEN-I association.

Introduction

French Guiana, located on the northeastern coast of South America, is the southernmost part of the French Caribbean. It borders Suriname to the north and Brazil to the south. The country boasts a very low population density with just over 300,000 inhabitants. Notably, French Guiana is home to a high diversity of shark and ray species. The coastal zone, fed by nutrient rich waters from several rivers is home to diverse marine habitats and supports a rich array of shark and ray species.

Taxonomy and Population Dynamics

The coastal waters of French Guiana are home to a diverse array of shark and ray species. Since 2019, the French Organizations Reserve Naturelle Isle du Grand-Connétable and GEOPOG have conducted several research and conservation projects on the shark and rays of French Guyana. They notably made an extensive study of the elasmobranchs and elasmobranch fisheries of the country (reserve-connetable, 2019). Included in the report is an updated species list for the country, based on opportunistic sightings information from fishers and analyzed the fishery for sharks and rays. The report lists 61 elasmobranch species, 33 sharks and 28 rays (Bordin, 2019). Of those species 8 are deemed to come from questionable records as they were not confirmed by photographic data or recent published information. For example, Great white shark is only confirmed through one questionable record and David's angel shark, though present in Brazil to the South of French Guiana, has no confirmed sightings (Vanhoucke, pers. comment). GEOPOG also conducted aerial surveys to study *Mobula birostris* distribution and abundance (GEOPOG, 2024) and developed field guides for species identification and best practices to release bycaught animals.

Although French Guyana still has a considerable amount of suitable habitat for the critically endangered sawfishes (*Prisits* spp.), there has been a notable decline in sawfish sightings, with up to 77% of fishers reporting sightings in 1995-2004, which dropped to only 8% in 2010-2017. These sightings are likely of either the large- or smalltooth sawfish, though the species were not further distinguished (personal communication with Michel (Tony) Nalovic, CAMAC workshop, 4th November 2023).

Habitat Preferences and Movement Patterns

In French Guyana, aerial surveys have shown that *Mobula birostris* is observed all along the coastal area, mainly between 10 and 40 m depth, and that the species' presence is maximum between July to December, with densities up to 28 +/-2 individuals per 100 km² (Girondot et al., 2015; GEPOG, 2024).

Fisheries and Management

From the 1980's to 2010 there was a targeted shark fishery in French Guyana's waters. For the most part this was operated by 4 Venezuelan longliners fishing below 30m depth who were obliges to land 50% of their catch in French Guyana. This led for example to 108,590 tons of shark and 25,054 tons of ray being landed in the year 2008. The bulk of the catch was made up of 15 species, these included *Sphyrna lewini*, *Carcharhinus limbatus*, *Carcharhinus falciformis* and *Mustelus higmani*. (reserve-connetable, 2019).

The licenses to the Venezuelans were not granted anymore from 2010 onwards which ended all targeted fishing for sharks and rays. There is still bycatch of elasmobranchs in other fisheries, particular in the shrimp fishery with small mesh nests. Very limited data is available on the bycatch levels as all of the rays and most of the sharks bycaught are discarded at sea. Some shark catches are landed for local consumption and always classed as genus *Charcarhinus*.

Michel Nalovic has also brought attention to the fact that fisheries interactions with sharks and rays are now being investigated. Projects are being implemented to control Illegal, Unreported, and Unregulated (IUU) fisheries in the region. Including efforts to stop boats from Surinamese and Guyanan fishers coming into French Guyana's coastal waters with illegal drift nets. These efforts are crucial in addressing the direct threats posed by fisheries activities to shark and ray populations.

Mr. Nalovic further informed the authors on the issues surrounding sawfish bycatch, indicating the unintentional capture of these critically endangered species. Additionally, there is significant underreporting of IUU fisheries in French Guyana. However, efforts are underway to enhance enforcement against IUU fisheries, with an emphasis on community engagement projects to facilitate these efforts.

As a French overseas territory, French Guyana is part of the Outermost Regions (OMRs) of the European Union, governed by the principle of legislative identity and whose law-making power is limited to a subsidiary and regulatory power of execution. This means that for fisheries EU regulations apply, this includes the Community Plan of Action for the Conservation of Sharks (CPOA 2009).

This Action Plan has the following three specific objectives:

1. To broaden the knowledge both on shark fisheries and on shark species and their role in the ecosystem;
2. To ensure that directed fisheries for shark are sustainable and that by-catches of shark resulting from other fisheries are properly regulated;
3. To encourage a coherent approach between the internal and external Community policy for sharks.

Other EU laws that apply that are of relevance to elasmobranch conservation and management are the Common Fisheries Policy, the Technical Measures Regulation and the 2010 Shark Finning Regulation.

Threats and Conservation efforts

Although the targeted fishery for sharks in French Guiana has ended over a decade ago the unregulated bycatch of elasmobranchs in all fisheries in the country is cause for concern. This poses a threat for the shark and ray populations around these islands as local depletion of coastal elasmobranchs can easily occur and has been well documented for the Caribbean (Simpfendorfer *et al.* 2023; Ward-Paige *et al.* 2010). As the coastal region seems one of the last areas where sawfishes are still found having conservation measures at a national level would be of great importance.

The EU Community Plan Of Action provides a strong basis for shark conservation in these islands but needs to be followed up with research and implementation effort for which the authors have found no evidence.

In addition, they are a member of WECAFC and so through this channels have committed to the Regional Plan of Action for Sharks. They are a party to the Cartagena Convention and have ratified the SPAW protocol (see chapter 3 of this report), this gives them the obligation to protect species listed on annex 2 of the protocol and manage those on annex 3. They are also a party to CITES and to the Convention on Migratory species (CMS).

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- Page 46: Oceanic manta ray – Raw pixel, no photographer credit provided.
- Page 61: Nurse shark examines BRUV – Global Fin print

Annex 1: Shark species per country

SHARKS													EEZs confirmed											
Order / family / species	Common name	IUCN Category	French Guiana	Suriname	Guyana	Venezuela	Trinidad & Tobago	French Antilles	Dutch Caribbean	Grenada	St Vincent & the Grenadines	Barbados	St Lucia	Martinique	Dominica	Guadaloupe	Montserrat	Antigua	Anguilla	BVI	Puerto Rico	Dominican Republic	Haiti	Jamaica
Carcharhiniformes																								
Carcharhinidae																								
Carcharhinus acronotus	Blacknose shark	EN	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Carcharhinus altimus	Bignose shark	NT				✓	✓																	
Carcharhinus brevipinna	Spinner shark	VU				✓	✓																	
Carcharhinus falciformis	Silky shark	VU	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Charcharhinus galapagensis	Galapagos shark	LC																		✓				
Carcharinus isodon	Finetooth shark	NT			✓		✓																	
Carcharhinus leucas	Bull shark	VU	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Carcharhinus limbatus	Blacktip shark	VU	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Carcharhinus longimanus	Oceanic whitetip shark	CR	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Carcharhinus obscurus	Dusky shark	EN	✓	✓	✓	✓	✓																	
Carcharhinus perezii	Caribbean reef sharks	EN				✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Carcharhinus plumbeus	Sandbar shark	EN				✓	✓	✓	✓															
Carcharhinus porosus	Smalltail shark	CR	✓	✓	✓	✓	✓																	
Carcharhinus signatus	Night shark	EN				✓	✓	✓																
Carcharhinus taurus	Sand tiger shark	CR						✓																
Geloocerdo cuvier	Tiger shark	NT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Isogomphodon oxyrhynchus	Daggernose shark	CR	✓	✓	✓	✓	✓																	
Negaprion brevirostris	Lemon shark	VU	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Prionace glauca	Blue shark	NT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Rhizoprionodon lalandii	Brazilian sharpnose shark	VU	✓	✓	✓	✓	✓																	
Rhizoprionodon porosus	Caribbean sharpnose shark	VU	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓						✓	✓	✓	✓
Rhizoprionodon terraenovae	Atlantic sharpnose shark	LC			✓	✓		✓																
Pentanchidae																								
Apristurus canutus	Hoary catshark	LC				✓												✓	✓					
Apristurus laurussonii	Iceland catshark	LC				✓																		
Apristurus parvipinnis	Smallfin catshark	LC	✓	✓		✓	✓														✓			
Apristurus profundorum	Deep-water catshark	LC		✓																				
Galeus antillensis	Antilles catshark	LC						✓						✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Galeus springeri	Springer's sawtail catshark	LC						✓							✓		✓	✓	✓		✓			
Apristurus riveri	Broadgill catshark	LC				✓																		
Galeus cadenati	Longfin sawtail catshark	LC				✓																		
Scyliorhinidae																								
Scyliorhinus boa	Boa catshark	LC		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
Scyliorhinus haeckelii	Freckled catshark	DD	✓	✓	✓	✓																		
Scyliorhinus hesperius	Whitesaddled catshark	LC				✓																		
Scyliorhinus retifer	Chain catshark	DD				✓																		
Ateleomycteridae																								
Schroederichthys tenuis	Slender catshark	LC		✓																				
Sphyrnidae																								
Sphyrna lewini	Scalloped hammerhead	CR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sphyrna media	Scoophead	CR	✓	✓	✓	✓	✓																	
Sphyrna mokarran	Great hammerhead	CR	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sphyrna tiburo	Bonnethead	EN	✓	✓	✓	✓	✓																	
Sphyrna tudes	Smalleye hammerhead	CR	✓	✓		✓	✓	✓	✓							✓								
Sphyrna gilberti	Carolina Hammerhead	DD																						
Sphyrna zygaena	Smooth hammerhead	VU				✓	✓	✓	✓							✓				✓	✓	✓	✓	
Triakidae																								
Mustelus canis)	Dusky smoothhound	NT	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
Mustelus higmani	Smalleye smoothhound	EN	✓	✓	✓	✓	✓																	
Mustelus minicanis	Dwarf smoothhound	EN				✓																		
Mustelus norrisi	Narrowfin smoothhound	NT				✓	✓																	
Echinorhiniformes																								
Echinorhinidae																								
Echinorhinus brucus	Bramble shark	EN				✓																		
Hexanchiformes																								
Hexanchidae																								
Heptranchias perlo	Sharpnose sevengill shark	NT	✓	✓	✓	✓	✓	✓																
Hexanchus griseus	Bluntnose sixgill shark	NT				✓		✓	✓							✓								
Hexanchus nakamurai	Bigeyed sixgill shark	NT						✓																
Hexanchus vitulus	Atlantic sixgill shark	LC			✓	✓	✓		✓															
Chlamydoselachidae																								
Chlamydoselachus anguineus	Frilled shark	LC	✓	✓	✓																			
Lamniformes																								
Mitsukurinidae																								
Mitsukurina owstoni	Goblin shark	LC	✓	✓	✓																			
Alopiidae																								
Alopias superciliosus	Big eye thresher	VU			✓	✓	✓	✓	✓							✓								
Alopias vulpinus	Common thresher	VU	✓	✓	✓	✓	✓		✓															
Cetorhinidae																								
Cetorhinus maximus	Basking shark	EN							✓															
Lamnidae																								
Carcharadon carcharias	Great white shark	VU					✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓					
Isurus oxyrinchus	Shortfin mako shark	VU	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Isurus paucus	Longfin mako shark	EN				✓																		
Odantaspididae																								
Odantaspis ferox	Smalltooth sandtiger	DD						✓																
Pseudocarchariidae																								
Pseudocarcharias kamoharai	Crocodile shark	LC				✓																		
Orectolobiformes																								
Gynglimostomatidae																								
Ginglymostoma cirratum	Nurse shark	VU	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Rhincodontidae																								
Rhincadon typus	Whale shark	EN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Squaliformes																								
Centrophoridae																								
Centrophorus granulosus	Gulper shark	EN				✓		✓																
Centrophorus squamosus	Leafscale gulper shark	EN				✓																		
Centrophorus uyato	Little gulper shark	EN				✓																		
Dalatiidae																								
Dalatias licha	Kitefin shark	VU				✓		✓								✓								
Isistius brasiliensis	Cookiecutter shark	LC				✓										✓								
Squaliolus laticaudus	Spined pygmy shark	LC		✓		✓																		
Etmopteridae																								
Etmopterus gracilispinis	Broadbanded lanternshark	LC		✓		✓																		
Etmopterus bigelow	Blurred lanternshark	LC		✓																				
Etmopterus perryi	Dwarf lanternshark	LC				✓																		
Etmopterus schultzi	Fringefin lanternshark	LC				✓																		
Etmopterus pusillus	Smooth lanternshark	LC					✓																	
Etmopterus virens	Green lanternshark	LC		✓		✓	✓	✓																
Oxynotidae																								
Oxynotus caribbaeus	Caribbean roughshark	LC				✓		✓																
Somniosidae																								
Centroscymnus owstonii	Roughskin dogfish	VU				✓																		
Portuguese dogfish	Portuguese dogfish	NT	✓																					
Zameus squamulosus	Velvet dogfish	LC	✓	✓		✓																		
Squalidae																								
Cirrhigaleus asper	Roughskin spurdog	DD				✓	✓	✓																
Squalus acanthias	Spiny dogfish	CR				✓																		
Squalus clarkae	Genie's dogfish	LC				✓ as S. mitsukurii																		
Squalus cubensis	Cuban dogfish	LC				✓	✓	✓													✓	✓	✓	
Squalus quasimodo	Humpback Western dogfish	DD				✓																		
Squatiniformes																								
Squatinidae																								
Squatina david	David's angelshark	NT		✓		✓																		
Squatina dumeril	Atlantic angel shark	LC				✓	✓													✓				✓
Total shark species	**87**																							

Annex 2: Batoid species per country

Batoids

Taxon / genus / species	Common name	IUCN Category	EEZs confirmed: Venezuela	French Guiana	Suriname	Guyana	Trinidad & tobago	French Antilles	Dutch Caribbean	Grenada	St Vincent & Gr.	Barbados	St Lucia	Martinique	Dominica	Guadaloupe	Montserrat	Antigua & Barab.	Anguilla	BVI	Dominican Republic	Haiti	Jamaica	Puerto Rico
Myliobatiformes																								
Dasyatidae																								
Bathytoshia centroura	Roughtail stingray	VU	✓					✓																
Fontitrygon geijskesi		CR	✓	✓	✓	✓	✓																	
Hypanus americanus	Southern stingray	NT	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓
Hypanus guttatus	Longnose stingray	NT	✓	✓	✓	✓	✓			✓	✓	✓	✓					✓			✓	✓	✓	✓
Hypanus say	Bluntnose stingray	NT	✓				✓	✓		✓			✓	✓			✓	✓	✓	✓	✓	✓	✓	✓
Pteroplatytrygon violacea	Pelagic stingray	LC	✓					✓																
Potamotrygonidae	Freshwater stingrays		Freshwater species, not included in the review																					
Urotrygonidae																								
Urobatis jamaicensis	Yellow stingray	LC	✓				✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Urotrygon microphthalmum	Smalleye round stingray	CR	✓	✓	✓	✓	✓																	
Urotrygon venezuelae	Venezuela round stingray	EN	✓																					
Gymnuridae																								
Gymnura altavela	Spiny butterfly ray	EN					✓																	
Gymnura micrura	Smooth butterfly	NT		✓	✓	✓	✓																	
Aetobatidaeb																								
Aetobatus narinari	Whitespotted eagle ray	EN	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Myliobatidae																								
Myliobatis freminvillei	Bullnose eagle ray	VU	✓	✓		✓	✓	✓																
Myliobatis goodei	Southern eagle ray	LC	✓	✓		✓	✓																	
Rhinopteridae																								
Rhinoptera bonasus	Cownose ray	VU	✓	✓	✓	✓	✓	✓																
Rhinoptera brasiliensis	Brazillean cownose ray	VU	✓	✓	✓	✓																		
Mobulidae																								
Mobula birostris	Gaint manta ray	EN	✓	✓	✓	✓	✓	✓	✓														✓	✓
Mobula hypostoma	Atlantic pygmy devil ray	EN	✓	✓	✓	✓	✓	✓															✓	
Mobula tarapacana	Sicklefin devil ray	EN	✓		✓																			
Rajiformes																								
Rajidae																								
Breviraja nigriventralis	Blackbelly skate	LC	✓	✓	✓	✓																		
Breviraja spinosa	Spinenose skate	LC			✓																			
Dactylobatus armatus	Skillet skate	LC	✓																					
Dactylobatus clarkii	Hookskate	LC	✓	✓	✓	✓	✓																	
Dipturus bullisi	Tortuga skate	LC	✓	✓	✓	✓	✓																	
Dipturus garricki	San Blas skate	LC	✓																					
Dipturus teevani	Caribbean skate	LC	✓		✓																			
Leucoraja garmani	Rosette skate	LC																						
Rajella fuliginea	Sooty skate	LC	✓	✓																				
Rajella purpuriventralis	Purplebelly skate	LC		✓	✓	✓																		
Rostroraja cervigoni	Finspot skate	NT	✓H				✓																	
Gurgesiellidaeb																								
Cruriraja rugosa	Rough leg skate	LC	✓																					
Cruriraja cadenati	Broadfoot pygmy skate	LC																						✓
Fenestraja plutonia	Pluto Pygmy skate	LC	✓																					
Fenestraja sinusmexicanus	Gulf of Mexico pygmy skate	LC	✓																					
Gurgesiella atlantica	Atlantic pygmy skate	LC	✓	✓	✓	✓	✓																	
Anacanthobatidae																								
Schroederobatis americana	American legskate	LC	✓	✓	✓	✓	✓																	
Springeria longirostris	Longnose leg skate	LC	✓																					
Rhinopristiformes																								
Rhinobatidae																								
Pseudobatos percellens	Chola guitarfish	EN	✓	✓	✓	✓	✓			✓		✓	✓		✓		✓	✓					✓	
Pristidae																								
Pristis pectinata	Smalltooth sawfish	CR	✓	✓	✓	✓	✓		✓														✓	
Pristis pristis	Largetooth sawfish	CR	✓	✓	✓	✓	✓																	
Torpediniformes																								
Narcinidae																								
Benthobatis marcida	Blind torpedo	LC	✓																					
Diplobatis guamachensis	Venezuelan dwarf numbfish	VU	✓																					
Diplobatis picta	Painted electric ray	VU	✓	✓	✓	✓	✓																	
Narcine bancroftii	Caribbean electric ray	LC	✓				✓	✓															✓	
Narcine brasiliensis	Brazilian electric ray	NT						✓			✓		✓										✓	
Torpedinidae																								
Tetronarce nobiliana	Atlantic torpedo ray	LC	✓	✓	✓								✓											
Tetronarce occidentalis	Western atlantic torpedo	LC																						
Total batoid species	**47**																							

These tables can be accessed digitally here:

https://docs.google.com/spreadsheets/d/1vULDH6RJmIobB2xK-2A0YcHvbo-5IVIx/edit?usp=sharing&ouid=106840848082949427223&rtpof=true&sd=true

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