

## COMPREHENSIVE STUDY OF STRATEGIC INVESTMENTS RELATED TO ARTISANAL FISHERIES DATA COLLECTION IN ICCAT FISHERIES OF THE CARIBBEAN/CENTRAL AMERICAN REGION: DRAFT FINAL REPORT

Freddy Arocha<sup>1</sup>

### SUMMARY

*In 2014, ICCAT funded a Strategic Investment Inventory for artisanal fisheries of West Africa. Using that study as a model, this present project aims to get a clear understanding of existing data collection programs and investments related to artisanal fisheries of the Caribbean/Central American region targeting ICCAT species (giving priority to those targeting billfish and shark species), in order to avoid duplication of effort and maximize the effectiveness of ICCAT's capacity building funds. The report presents the results of the study; the information and data presented represent a comprehensive view by country and the necessary information to maximize the effectiveness of ICCAT's capacity building funds.*

### RÉSUMÉ

*En 2014, l'ICCAT a financé un Inventaire des investissements stratégiques relatifs aux pêcheries artisanales dans la région de l'Afrique de l'Ouest. En se servant de cette étude comme modèle, ce projet vise à avoir une vision claire des investissements et des programmes de collecte de données existants liés aux pêcheries artisanales de la région des Caraïbes et de l'Amérique centrale ciblant les espèces de l'ICCAT (en accordant la priorité à celles qui ciblent les istiophoridés et les requins) afin d'éviter les chevauchements d'effort et de maximiser l'efficacité des fonds de renforcement des capacités de l'ICCAT. Le rapport présente les résultats de l'étude ; les informations et les données présentées offrent une vue globale par pays et les informations nécessaires pour maximiser l'efficacité des fonds de renforcement des capacités de l'ICCAT.*

### RESUMEN

*En 2014 ICCAT financió un inventario de inversión estratégica para pesquerías artesanales de África occidental. Al utilizar este estudio como modelo, este proyecto tiene como objetivo obtener una comprensión clara de las inversiones y programas de recopilación de datos existentes relacionados con pesquerías artesanales de la región del Caribe/América central que se dirigen a especies ICCAT (dando prioridad a aquellas que se dirigen a especies de istiofóridos y tiburones) con el fin de evitar la duplicación de esfuerzos y maximizar la efectividad de los fondos de creación de capacidad de ICCAT. El informe presenta los resultados del estudio, la información y los datos presentados representan una visión exhaustiva por país y la información necesaria para maximizar la eficacia de los fondos de creación de capacidad de ICCAT.*

### KEYWORDS

*Small Scale fisheries, Artisanal fisheries,  
Caribbean Region, Strategic Investment, Capacity building*

---

<sup>1</sup> 170 Ocean Lane Dr., Key Biscayne, FL 33149, USA. Instituto Oceanográfico de Venezuela, Universidad de Oriente, Cumana-Venezuela. Email: farochap@gmail.com.

## **Executive Summary**

### ***Subject of the study***

Recognizing that in many developing nations in the Caribbean/Central America region, infrastructure and resources available for research, management, and monitoring of artisanal fisheries are severely limited. Therefore, strategic investments using the funds of the ICCAT capacity building fund, the JCAP, or other funding sources can lead to much improved information sets needed to enhance the SCRS capacity for better, and more robust stock assessments. The primary objective of the study is to provide ICCAT with an understanding of existing data collection programs and investments related to artisanal fisheries of the Caribbean/Central American region targeting ICCAT species, in order to avoid duplication of effort and maximize the effectiveness of ICCAT's capacity building funds.

### ***Scope of the study***

The inventory of artisanal fisheries of the Caribbean/Central American region targeting ICCAT species include Contracting and non-Contracting Parties in the Caribbean/Central America, with a focus on those countries with substantial catches of ICCAT species in their artisanal fisheries (giving priority to those targeting billfish and shark species) and known data deficiencies. The primary countries where data collecting programs were explored included Barbados, Curaçao, Grenada, Guyana, Suriname, Trinidad and Tobago, and Venezuela. In addition, countries with limited information on large pelagic fishes caught on artisanal fisheries included Central America CPCs (Belize, Honduras, Guatemala, Nicaragua, and Panama), Colombia and Dominican Republic.

### ***Work plan of the study***

The inventory of the study was designed as a three-step process,

-Identification and communication (interview, survey) of key person in each of the countries identified in the scope of the ToRs. The primary mean of communication was a written survey distributed by the ICCAT Secretariat to the identified countries. A secondary mean of communication was direct contact between the author and key fishery officers and scientists in countries that required on-site visits. Direct contact followed to set-up on-site visits to the primary countries identified.

-The desk review consisted of a comprehensive review on the available published information that existed on the internet, including the peer review literature, in order to acquire information on the existing data collection programs, extent of their small scale (artisanal) fisheries, level of catches of large pelagic species (ICCAT species), and their limitations in fishery data collection. It also included the sources of financial support to the fishery sector to the region and/or the country of interest when available. The desk review provided the background information for the on-site visits to the primary countries of interest.

-On site visits to key countries. The primary countries required an in-depth follow up with on-site visits to the different sectors that have been identified through the desk review and personal contacts across the region. Also, support from other regional institutions, academic and other Technical and Financial Partners (TFP) were identified to be able to help in the enhancement of data collection programs for large pelagic fishes.

### ***Main conclusions and recommendations of the study***

Billfishes (blue marlin, white marlin, and sailfish) are harvested in substantial numbers mainly by artisanal/small-scale longline fleets of Barbados, Grenada, and Venezuela; followed by drift-gillnet fishery in Venezuela, and by hand-line (trolling, drop-line) fisheries around moored FADs in Dominican Republic. Of these countries, Barbados and Grenada, the billfish are part of the local's diet and all the catch is commercialized locally. In Venezuela and Dominican Republic, the billfish are targeted, and they form part of the local diet and is considered a food security issue nowadays. Other countries that catch billfish are Tobago and Curaçao using hand-lines (trolling). However, the level of the amount of billfish (by species) caught is unclear due to limited monitoring of the catch from those fisheries.

Sharks are caught as by-catch across almost all countries and all fleets. In general, sharks are likely consumed locally or traded regionally for their meat and/or other products (i.e., oil, skin, fins, cartilage, and jaws). The level of catch varies between countries, most likely due to the local traditions of consumption in countries like Trinidad, Venezuela, Guyana, Suriname, Nicaragua, Guatemala, Belize, Dominican Republic, Colombia, and to a lesser degree, Barbados, Curaçao, Grenada. The biggest issues on the shark catches is species misidentification and the part of the population caught. Considering that ICCAT has several recommendations on catch limitations or landing prohibition of specific sharks, which are likely taken by some of these countries' fleets, it is of great concern what actually is being taken from the artisanal fleets of these countries.

The species of major interest within the small tuna group of the countries within the scope of this study are dolphinfish/dorado (*Coryphaena hippurus*, recently included in ICCAT) and wahoo (*Acanthocybium solandri*), followed by blackfin tuna (*Thunnus atlanticus*). Since dolphinfish has been recently included in ICCAT, Task I data for the species is incomplete, efforts are needed to include the historical data that exists in these countries into ICCAT databases, similarly with the other species of the small tuna group. Most countries were not aware that these species catches needed to be reported to ICCAT, particularly countries that do not have industrial fisheries. Further outreach on ICCAT's part is strongly encouraged, if the SCRS wishes to further complete its knowledge of catches from these species, particularly when most of these countries do not have the level of capacity to report to ICCAT the increasing demanding data now required.

Barbados, Grenada, Venezuela, Dominican Republic, Tobago, and Curaçao have different levels of limitations on data collection and reporting of species of high concern to ICCAT (i.e., billfishes and sharks). The needs vary by country, but if those needs are not met, maintained or increased with technical support and financial aid it is likely that data reporting from these artisanal/small-scale fisheries will decrease, or disappear completely. In the rest of the countries of within the scope of this study with limited catch on ICCAT species of concern, particularly those catching sharks, the needs on data collection, species identification, and technical support are high if the SCRS wishes to advance on the knowledge of sharks caught by these fisheries.

In countries that are not ICCAT member, in particular Dominican Republic, which rely almost entirely on moored FADs to target ICCAT species; the Caribbean Billfish Project (WECAFC/The World Bank) is advancing in helping to develop a private trust fund that would contribute to manage the FAD fishery targeting billfish in the eastern part of the island. ICCAT would be in a position to offer technical assistance in the data recording and reporting aspects. Therefore, it would be in ICCAT's best interest to closely monitor the development of such endeavor.

SCRS would need to prioritize the level of investment for data enhancement programs for artisanal/small-scale fisheries within the Caribbean/Central America Region.

Countries with artisanal/small-scale fisheries in the Caribbean/Central America Region that catch species of great concern in ICCAT (e.g., billfishes and sharks) should be encouraged to declare their interest in data enhancement programs on capacity building by presenting a scientific document at any of the SCRS species group meetings next year.

Investments on capacity building on data collection and reporting, and species identification workshops caught by artisanal/small-scale fisheries for all countries within the scope of the study are required urgently considering the deficiencies in the catch matrix for several ICCAT species of interest caught by those fisheries.

The need for medium to long term data enhancement programs for artisanal/small-scale fisheries in countries with major catches of species of great concern in ICCAT (e.g., billfishes and sharks) are urgently required.

Harmonization between TFPs in the region is critical to optimize investments and results on data collection and reporting within the region. The WECAFC has a long history of promoting sustainable fisheries management within the geographically, culturally and politically complex Caribbean region. The Caribbean Billfish Project (CBP) has highlighted various opportunities through which a collaborative drive by both ICCAT and the WECAFC could improve the management of shared stocks which fall within the RFMO mandate of ICCAT. Therefore, any cooperative support that can be achieved to ensure that scaling up national successes on regional scales and beyond will benefit both ICCAT and the WECAFC, in particular for those countries that are not part of ICCAT.

## **Introduction**

In the past decade, several ICCAT documents and reports have stated that artisanal fisheries are small-scale fisheries for subsistence, local consumption, and small markets, generally using traditional fishing techniques and small boats. They occur throughout the ICCAT Convention area (particularly in developing coastal nations) and are vital to livelihoods and food security. In the ICCAT Convention area, the catches of these artisanal/small-scale fisheries can reach considerable amounts of tuna and tuna-like species, and in some cases, the estimated catch can represent a relatively large proportion of the total removals of some ICCAT species (e.g., Blue marlin from EU France-Martinique & Guadalupe; ICCAT 2012). Due to their characteristics, artisanal/small-scale fisheries are more difficult to monitor than industrialized fisheries; therefore, efforts to collect the data necessary to describe the impact and management of artisanal fisheries can be challenging.

In 2014, ICCAT funded a Strategic Investment Inventory for artisanal fisheries of West Africa (Kebe 2015). Using that study as a model, the present study aims to get a clear understanding of existing data collection programs and investments related to artisanal fisheries of the Caribbean/Central American region targeting ICCAT species (giving priority to those targeting billfish and shark species), in order to avoid duplication of effort and maximize the effectiveness of ICCAT's capacity building funds.

Over the years, ICCAT has made strategic investments to enhance data collection for a number of artisanal fisheries in the Caribbean Region. ICCAT's Enhanced Program for Billfish Research in Venezuela have been successful in improving the data available for scientific assessment, its importance and success have been acknowledged in ICCAT reports. From the review of several FAO/WECAFC, and the Caribbean Regional Fisheries Mechanism (CRFM) reports (CRFM, 2014; Singh-Renton and McIvor, 2015; FAO, 2016a,b), it was deduced that there are differences in the technical capacity within the different countries in the Caribbean Region that would not enable them to take on a detailed data collection program for species-specific large pelagic fishes (that are under ICCAT's mandate). This was one of the initial problems in Venezuela that was overcome by identifying key persons in the different sectors that would make possible the collection, reporting, and analysis of high quality data of large pelagic fishes (FAO WECAFC 2018a).

### ***Objective***

Recognizing that in many developing nations, infrastructure and resources available for research, management, and monitoring of artisanal fisheries are severely limited and strategic investments using the funds of the ICCAT capacity building fund, the JCAP, or other funding sources can lead to much improved information sets. The primary objective of the study is to provide ICCAT with an understanding of existing data collection programs and investments related to artisanal fisheries of the Caribbean/Central American region targeting ICCAT species (giving priority to those targeting billfish and shark species), in order to avoid duplication of effort and maximize the effectiveness of ICCAT's capacity building funds.

### ***Scope of the Study***

The inventory includes Contracting and non-Contracting Parties in the Caribbean/Central America, with a focus on those countries with substantial catches of ICCAT species in their artisanal fisheries (giving priority to those targeting billfish and shark species) and known data deficiencies. The primary countries where data collecting programs were explored included Barbados, Curaçao, Grenada, Guyana, Suriname, Trinidad and Tobago, and Venezuela. Countries with limited information on large pelagic fishes caught on artisanal fisheries included Central America CPCs (Belize, Honduras, Guatemala, Nicaragua, and Panama), Colombia and Dominican Republic.

### ***Work Plan of the Study***

The inventory of the study was designed as a three-step process, namely:

1. Identification and communication (interview, survey) of key person in each of the countries identified in the scope of the ToRs. The primary mean of communication was a written survey (questionnaire, **Appendix 1**) that was distributed by the ICCAT Secretariat to the countries identified. A secondary mean of communication was direct contact (via email) between the author and key fishery officers and scientists in countries that required on-site visits. Upon the response of the survey, direct interview (Skype or similar) followed to set-up on-site visits to the primary countries identified, and to expand responses to the survey.
2. The desk review consisted of a comprehensive review on the available published information that existed on the internet, including the peer review literature, in order to acquire information on the existing data collection programs, extent of their small scale (artisanal) fisheries, level of catches of large pelagic species (ICCAT species), and their limitations in fishery data collection. It also included the sources of financial support to the fishery sector to the region and/or the country of interest, as well as potential sources of financial support to those countries that are not ICCAT member. The desk review also provided the background information for the on-site visits to the primary countries of interest.
3. On site visits to key countries. The primary countries would need an in-depth follow up with on-site visits to the different sectors that have been identified through the desk review and personal contacts across the region. It is understandable that some of the primary countries may not have a strong academic background on fisheries within their territory, but support from other regional institutions like the University of West Indies that have a fishery program and several campuses across the Region or other regional programs, like the Caribbean Billfish Program (WECAFC/World Bank; FAO WECAFC 2016, 2018b) may be able to help in the enhancement of data collection programs for large pelagic fishes.

### ***Adjustments and document structure***

The results of the study findings in the present document are presented as country profiles that consisted of the information obtained from the desk review, responses to the questionnaire, and on-site visits. Each country profile included a section on harvest methods, landing data, data limitations, backed financial support, and areas of potential strategic investments.

During the course of the study, after the deadline for submitting questionnaire passed, and after consultations with regional fishery scientists of the countries of primary interest, several adjustments needed to be made. Due to the nature of the artisanal fisheries of Suriname and Guyana (see country profile), visits to those countries were suspended. However, on-site visits to other countries of primary interest, like Barbados, Curaçao, and Trinidad and Tobago, were extended because of the nature of its small scale/artisanal fisheries and upon the suggestions of country fishery officers.

Upon the review of the entities which have provided financial support to the countries of interest in the scope of the study, it was noted that most of the financial support was not disaggregated within the fishery sector of each country, but rather as a program for a group of countries, or a regional body. Therefore, the section of backed financial support within each country profile was treated separately as a whole (see Financial Support), and within the country profile only relevant and specific information was included when available.

## **Results**

### ***1. Questionnaires***

The responses to the questionnaires were very poor. The Secretariat sent explanatory communications and questionnaires in English and Spanish to all Contracting and non-Contracting Parties in the Caribbean/Central America within the Scope of the study. Only six countries (Barbados, Colombia, Curaçao, Suriname, Trinidad & Tobago, and Venezuela) responded after several communications and interaction with the author. Of those countries, only three (Barbados, Trinidad & Tobago, and Venezuela) responded the questionnaire in full the others did not respond the questionnaire because their artisanal fisheries either did not have the data, or did not target nor catch ICCAT species within the scope of the study.

A review of the responses of the questionnaires became evident that data collection programs for artisanal fisheries/small-scale are very limited, particularly in limited human resources at the data collection points, as well as limited training in species identification of ICCAT by-catch species (billfish and sharks).

The relevant information received from the countries that responded the questionnaires were included within each of the country's profiles in the appropriate sections.

### ***2. Country Profiles***

#### ***2.1 ICCAT Member countries (Contracting and Cooperating Non-Contracting Parties)***

##### ***Barbados***

Barbados became an ICCAT member country in 2000. It is the most easterly Island of the Lesser Antilles, with a narrow continental shelf, with an east coast subject to high energy waves and a sheltered west coast (**Figure 1**). Artisanal fisheries generate a larger catch volume than industrial (Mohammed *et al.* 2015), in which two species represent around 86% of the total annual catches (i.e., flying fish, *Hirundichthys affinis* and dolphinfish, *Coryphaena hippurus*-DOL). The local fishing industry comprises nine main fisheries: shallow shelf reef fishes, deep slope fishes, coastal pelagic, large pelagic, flyingfish, sea urchins, turtles (now closed), lobsters and conch; however, the flyingfish and the large pelagic fisheries are the ones currently leading the local industry (FAO 2018a). The large pelagic fishery targets dolphinfish, kingfishes, tunas, swordfish and sharks. Coastal pelagic fisheries target, among other species, small tunas.

##### **Harvest method**

Barbadian fishing vessels are classified according to length, physical structure and the gear used (FAO 2018a, Mohammed *et al.* 2015). Thus, the two smallest types (<12m) are Day-boats or “*launches*” and “*moses*” (dinghies), both of them are wooden or reinforced plastic, powered by 10-30 hp outboard engine, and equipped with trolling lines, gillnets, and hoop nets. Most carry a crew of two, and “*launches*” are equipped with

electronics; operations are mostly limited to waters close to the coast (~30 nm); the target is primarily flying-fish and large pelagic fishes (mostly small and juvenile tunas) on a daily trip basis. The other two types of fishing vessels that fish offshore (>30 nm) are the “Iceboats” and longliners. In general, “Iceboats” are similar to “launches” but usually larger (>12m), powered by inboard engines, and outfitted with ice holds giving them autonomy to fish 8-9 days. The gear and target species are similar to the “launches”; however, the species caught is are mostly flying-fish, with some large pelagic fishes/ICCAT species as part of the bycatch (mostly DOL, and WAH). The longline vessels, introduced during the 1980s, were considered industrial, outfitted similarly to the “Iceboats”, with steel hull but larger (>15 m), with a larger crew, autonomy to fish 9-28 days, and used pelagic longline gear as its primary gear. Those vessels are no longer active. Current and active longline vessels are outfitted with pelagic longline gear and gillnets, which are used to catch flying-fish when conditions demand it. However, most of the longline vessels currently operating in Barbados are 9.8 to 15.1 m LOA (ICCAT 2017a). The LL fleet target tropical tunas (YFT and BET), and most of the bycatch consists of billfish species, small tunas, and some catches of sharks and swordfish. The LL fleet operates with a 3 men crew, fishing about 8 sets with 500-700 hooks/set, using squid as bait, and in fishing grounds up to 2 days away.

#### Landing data

Barbados reported catches by species groups for the period of 1995-2016 show that after high volumes of SMT catches in the early part of the series, the catches leveled thereafter, with occasional high catches in 2008-2009 (**Figure 2A**). In contrast, the other important species group (TUN), show a sustained increasing trend since 2011. The remaining species groups remain more or less stable, expect for BIL which seem to be recuperating early catch levels in recent years. Barbados ICCAT’s average (2013-2016) reported catch of major species groups show that 88% of the reported catch consists of small tunas (SMT), and tunas (TUN); the billfish represent the third largest group with 8.2%, followed by swordfish and sharks (**Figure 2B**). The high volumes in the catch of the SMT group, consists mostly of DOL FAO reported catches (FAO 2018a) because DOL was recently included in ICCATs Small Tuna species group (ICCAT 2013), and currently it has not been reported to ICCAT by Barbados.

Billfish species specific reported catch are incomplete for 2004-2009 for BUM and WHM, and 2008-2009 for SAI (**Figure 2C**); however, Billfish unclassified catch was reported to FAO for several of the missing years in ICCAT, which could potentially be used to estimate species specific billfish catch for the missing years in ICCAT Task I database for Barbados. The unclassified shark catch shows a sustained decreasing trend, but in recent years (2015-2016) efforts have been made to report species specific catch in which the largest volume is made of BSH, followed by SMA and FAL (**Figure 2D**). The TUN group is mostly made of YFT, likely for the export market.

#### Data limitations

Barbados instituted a statistical data collection system since 1940s. According to FAO (FAO 2018a), there are approximately 30 fish landing sites around the island, categorized according to type of physical infrastructure and facilities as primary (markets), secondary (sheds) and tertiary (beaches). Landings are recorded at principal markets (Bridgetown, Oistins, Weston, and Speightstown) and secondary sites (referred as beach “sheds”) by the Fishery Division of The Ministry of Agriculture. Collection of data sometimes could be challenged owing to the existence of many secondary ports for artisanal landings.

During the on-site visit at Bridgetown Fishery Office, several clarifications were made by the Officers that helped to elucidate their harvest methods (above). In the case of the longline fishery, which is small-scale, the fleet consists of a little over 40 vessels, of which most of the fleet lands their catch at two locations (Bridgetown Fisheries Center-BFC, and Oistins). The facilities at BFC are excellent for fish processing, packing, freezing, market, and re-stocking vessels. Most of the landings of ICCAT species occur there and the data collectors record most of the information from this location. The landing port has the facilities to observe and record all species landed, however there is not enough manpower to identify the major by-catch species, like billfish and sharks. Although, very recently efforts were made to report species-specific shark catch and were reported to ICCAT. However, the continuation of this effort was stopped due to insufficient funds.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which

often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

Barbados has a data recording and reporting system for ICCAT species for their small-scale longline fishery but like in many cases throughout the region it has aged and is faltering fast because of lack of financial support, particularly for species-identification of the ICCAT by-catch species within the scope of the study. Therefore, potential investment could be directed at capacity building for species-identification of the by-catch. The focus would be on main ports where ICCAT species are landed (BFC and Oistins) by training fishery data collectors for large pelagic fish species identification (specifically ICCAT species of interest). ICCAT has Species-ID sheets in water-resistant paper that could be distributed during training courses. This practice has proven efficient in other CPCs in the region that have used them, along with periodical follow-up of the course to correct for potential errors in species identification.

#### - Curaçao

Curaçao became an ICCAT Contracting Country in 2014 after the Kingdom of the Netherlands dissolved the Netherland Antilles, reconstituting Curaçao as a new country in 2010 (**Figure 3**), along with Sint Maarten. Curaçao is located between Bonaire, Aruba, and western Venezuela. ICCAT reported catches from Curaçao after they became a new country are the result of purse seine catches in the eastern Atlantic targeting tropical tunas; within the EEZ, the fishing operations are entirely artisanal. However, several longliners conducted tests in 1999-2002 targeting swordfish and other large pelagic fishes with the EEZ, but ceased operations after 2003 (Weidner *et al.* 2001, Dilrosun 2002, Lindop *et al.* 2015). In Curaçao, the majority of the catch caught within the EEZ consists of pelagic fish; while demersal fishing represents <22% of the total catch. Within the pelagic fishes, the largest volumes are from WAH, DOL, YFT, and BLF (Lindop *et al.* 2015).

#### Harvest methods

Artisanal fisheries in Curaçao can be separated in two sectors, reef fishing for demersal species operating with a fleet of small boats (2-7 m) powered by outboard engines (15-48 hp) and principal gear are hand-lines; while the other sector is pelagic fishing operating with larger boats (7-14 m) with cabin, powered by inboard engines and trolling (hand-line dragged through the water) for pelagic species (Kraan 2017). As of 2016, the pelagic fishery had 91 vessels; however, crossover between fisheries (reef and pelagic occurs), thus the 91 vessels may be operating within the reef fishery and vice versa. Nonetheless, trolling (used to catch large pelagic species) is mostly done by larger vessels (>7m) with a cabin and an inboard motor.

A Fishery Aggregation Device (FADs) program was introduced by the island government for pelagic fisheries (van Buurt, 2002); however, there are no reports of its operations or weather if it's still operational. After the on-site visit, fishery officers indicated that they are no longer operational. However in recent times a new fishing mode using fish aggregating device commenced to be used, i.e., oil-tankers anchored off the coast waiting to load on oil from the Curaçao refinery, but no information was available on its use.

#### Landing data

The ICCAT reported Task I data for the period of 1995-2016 represented purse seine and baitboat catches from the eastern Atlantic, from operations conducted by the fleets off Senegal and Cote D'Ivoire (ICCAT 2016b, 2017c). Curaçao average ICCAT catch composition for recent years (2013-2016) reflect the purse seine catches from West African waters (**Figure 4A**). The tuna group high catches around 2000 were the product of both surface fleets, while the high catches after 2010 are from purse seine vessels only (**Figure 4B**). Billfishes, small tunas (BLF, WAH), and some major tunas (YFT, SKJ) were reported to ICCAT in 1995-2000 as being caught by unclassified gear, which may likely be from the artisanal larger vessels (>7 m) trolling lines, and the longline vessels that operated during the early 2000. According to Dilrosun (2002), all artisanal vessel of different sizes catch large pelagic fishes; however the smaller sized boats catch mostly coastal pelagic like DOL, WAH and small tunas, and the larger will catch the larger tunas, YFT, BLF, SKJ, WAH, DOL, BIL.

#### Data limitations

Curaçao fisheries laws that govern include national and island ordinances and subsidiary legislation, which predate 2010, continue to apply. The authorities created a system of management shared between the Ministry of Economic Development (MED, formerly the Ministry of Economic and Labor Affairs) and the Ministry of

Health, Environment, and Nature (GMN). MED manages high seas fishing and would manage large-scale domestic fishing in Curaçao waters if such fisheries were to exist, with the advice and consultation with the Fisheries Commission, International Fisheries Commission, and Minister of Traffic, Transportation, and Spatial Planning (VVRP). GMN's Department of Agriculture and Fisheries Management (AVB), formerly the Department of Agriculture, Animal Husbandry, and Fisheries (LVV), separately manages small-scale fishing in the Curaçao territorial sea. All of it may complicate fishery data recording and reporting when it comes to ICCAT species. In the case of industrial fisheries (surface fleets is clear, but when it comes to ICCAT species caught by artisanal fisheries, the data is not reported to the appropriate authorities, and is not shown in FAO or in ICCAT data bases.

During the on-site visit to Curaçao, talks with officers at the Department of Fisheries Agriculture and Fisheries Management (AVB) contributed to clarify the limitation on data collection and reporting of large pelagic species caught by artisanal fisheries. Although they recognized the need for it, most of their effort are directed towards managing reef fisheries. Officers indicated that they recorded data on catches of large pelagic species but were substantially impaired due to lack of financial support to monitor landings of large pelagic species, in addition to deficiencies in trained personnel for data recording and reporting on species-specific catch. The last year of available catch data from large pelagic is 2006, however is not reported to ICCAT. Officials presented a new report (yet to be published) on historical changes on fishery practices in Curaçao from 1950 to present, focusing mostly on reef fisheries, but with information on changes in large pelagic fisheries. It appears that the over-exploitation of inshore resources lead them to target costal pelagic fishes, mainly dolphinfish-DOL, and what they call blue marlin; later (recent times) when fishers became experienced and technology increased, fishers started to use oil-tankers as fish aggregating devices (oil-tanker FADs) targeting yellowfin tuna and blackfin tuna, as well as wahoo. It seems that they also catch billfishes and sharks, but due to the low price of those species in the local markets, fishers avoid them. Unfortunately, not data is consistently recorded.

Talks with Fishery officers of MED, who are responsible for reporting Task I and Task II data to ICCAT, further explained their limitations to record, collect, and report catches of ICCAT species from artisanal fisheries. Opportunities exist with aid from academic institutions and financial aid to develop a data recording program monitored by the MED Fishery officers in charge of reporting data to ICCAT.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

Curaçao has the basis for data collection but is very limited on trained personnel. Thus, capacity building in the fishery collection of data from the large pelagic artisanal fishery could prove beneficial for ICCAT. Therefore, potential investment could be directed at a data collection program on large pelagic species of interest to ICCAT. Initially, the focus would be one of the two main ports where ICCAT species are landed, by training fishery data collectors for large pelagic species (specifically ICCAT species of interest), most specifically in species ID and effort data collection, particularly in the use of oil-tankers as FADs, as well as the design of port sampling schemes for artisanal fisheries.

#### *-Grenada*

Grenada, a recent member country (2017), is the southernmost island of the eastern Caribbean island chain, also known as the Lesser Antilles. Grenada is located in an area where large pelagic fishes (tunas and tuna-like) transit to and from the Caribbean Sea and adjacent waters (**Figure 5**). Grenada's location has allowed the development of an important pelagic longline fishery that operates year-round targeting primarily yellowfin tuna for the export market, but also other large pelagic species (which include, primarily dolphinfish, sailfish, blackfin tuna, white marlin, blue marlin, wahoo, and king mackerel) as part of the bycatch that are locally commercialized (Gentner *et al.* 2018).



## Harvest methods

The commercial longline fishery in Grenada, which started in the early 1980's, can be considered a small-scale fishery with three categories of vessels (Gentner *et al.* 2018). The longline fishing method was adopted by a number of surface-trolling pirogues that were converted into operating pelagic longline gear that set about 45-50 hooks (during daylight) baited with flying fish at depths of 27-54 m. Currently, this category of longline vessels are 4.5-7 m wooden boats powered by 1 or 2 outboard engines (40 Hp) which set up to 150 hooks/set, and use a hand reel and spool to manipulate the gear. These vessels are manned by 2 fishers, mostly operating off the northwest coast. In the 1980's, Trinitarian style fiberglass pirogues (~9 m) with a small cabin top were incorporated into the longline fishery, and currently this category of vessels are powered by 2 outboard engines (40-75 Hp) and set 200-300 hooks; the 2-3 fishers on these vessels use a hand reel and spool to manipulate the gear. In the early 1990's, a new category of longline vessels was introduced, which were capable of fishing operations of over several days (4-6 days), deployment of 400-600 hooks per set, have an inboard central engine and a hydraulic spool and reel to manipulate the gear. These vessels have a capacity to fish year-round with the use of imported frozen bait (although still more commonly is the use of fresh flying fish caught at sea), electronic equipment, and the capacity to store ice. As of 2014, there are about 405 vessels of the different categories of longline vessels, of which an estimated of 75% likely belong to the lower vessel categories (1 and 2).

Grenada officially deployed five FADs in the eastern side of the Island during 2014, and these have been maintained and managed by the "Grenville FAD Fisher folk" organization. In the smaller islands of Carriacou and Petit Martinique, only two FAD continue to exist in each of the islands and are fished by private owners (Petit Martinique) and a fisher folk organization (Carriacou). The primary harvest technology is trolling around the FADs, catching mainly fish of the small tuna ICCAT category, mostly dolphinfish, blackfin tuna, wahoo, king mackerel and occasionally sailfish, marlins and small yellowfin tuna (Gentner *et al.* 2018). However, the main target is dolphinfish, which has a higher market value, in contrast to fish with darker meat (i.e., yellowfin tuna and other similar fishes). Drop lines were introduced to the Grenville FAD fishery, which has improved the fleet's capacity to harvest large pelagic fishes, including billfish; these fishers are relatively well organized and managed; in contrast to other fishers in the region that deploy very rudimental FADs that last a fraction of the time at sea before breaking.

## Landing data

Official landing data of large pelagic fishes in Grenada indicate that yellowfin tuna (*Thunnus albacares*, YFT), the main target species, has maintained an increasing trend in the landings since 2000, reaching its highest record value of 1609 t in 2016, accounting for 68% of the landed catch of the main large pelagic species for the period of 2014-2016 (**Figure 6A**). The rest of the commercial bycatch species landings show a relative even trend below 400 t (**Figure 6B**). However, three species can be considered of secondary in importance based on their landing data, which include dolphinfish (*Coryphaena spp.*, DOL), sailfish (*Istiophorus albicans*, SAI), and blackfin tuna (*Thunnus atlanticus*, BLF). This group of species represents about 21% of the landed catch between 2014 and 2016 (**Figure 6C**). The rest of the commercial bycatch species which consists of albacore tuna (*Thunnus alalunga*, ALB), blue marlin (*Makaira nigricans*, BUM), swordfish (*Xiphias gladius*, SWO), white marlin (*Tetrapturus albidus*, WHM), wahoo (*Acanthocybium solandri*, WAH), and king mackerel (*Scomberomorus cavalla*, KGM), represent the remaining 10% of the landed catch for the same period, rarely reach 100 t over the same time period.

Grenada has consistently reported official landing data of large pelagic fishes to FAO, some of the Grenada data reported to ICCAT in past years have most of the time matched those reported to FAO in several species, like the billfishes. A review of the three billfish species (SAI, BUM, WHM) reported catches to FAO and ICCAT, revealed that after 1995 both reports matched for all three billfish species until 2009, thereafter Grenada stopped reporting to ICCAT but it continued to do so to FAO (**Figure 6D**). Thus, it is recommended that until Grenada officially reports billfish Task I data to ICCAT after 2009, the ICCAT SCRS (Billfish Group) considers using the FAO reported catches as Task I data, instead of using carry-over or averaging for the missing years in the ICCAT Task I data.

## Data limitations

As stated in the National Report of Grenada in 2014, the country does not possess a Data Collection and Management Plan (CRFM 2014). The present data collection program is focused on landing sites, mostly recorded by market clerks or data clerks who are not trained as fishery data collectors. The trip-interview forms

used are likely to show, gaps, errors, and other inconsistencies. In the case of longline vessels, none are required to carry logbooks yet, although the Caribbean Billfish Project (CBP) under WECAFC management (FAO WECAFC 2016, 2018b) has produced these and expects them to be implemented in November 2018. Most of the currently reported catch is therefore done at the processors plants, and it only shows the landed catch that is purchased from each boat and not necessarily the total catch of the boat as stated by official data clerks.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

It seems that Grenada has the basis for data collection but is very limited on trained personnel, particularly to analyze and effectively use collected data to help inform fishery management decisions. Thus, capacity building in the fishery collection of data from the large pelagic fishery could prove beneficial for the country and ICCAT. Therefore, potential investment could be directed at a data collection program on large pelagic species of interest to ICCAT. Initially, the focus would be on main ports where ICCAT species are landed, by training fishery data collectors for large pelagic species (specifically ICCAT species of interest), particularly training in species ID and effort data collection, as well as the design of port sampling schemes and longline log-books for all categories of longline vessels.

Grenada is also part of a pilot study of The Caribbean Billfish Project, which currently are developing business cases for specific tasks. In the case of Grenada, there is proposal to develop a digital on-site data recording system using digital tablets, that will have the capability to report landing data in real time making it available to the Fishery Offices in order to process the landing data more efficiently. As the business case progresses, ICCAT would be in a position to coordinate with officers to harmonize data collections of ICCAT species catch and effort data. Thus, it would be beneficial that the SCRS maintain close cooperation with WECAFC to follow-up on the development of the business case to be implemented in Grenada. Linked to data improvements in Grenada, the business case of this CBP pilot nation also includes billfish harvest reductions to match incoming ICCAT quotas within a Fishery Improvement Program (FIP), and tuna quality improvements alongside incentives of access to more valuable and less price volatile markets for export tunas.

#### *-Trinidad and Tobago*

Trinidad and Tobago became an ICCAT member country in 1999. Trinidad and Tobago (T&T) is located at the southeastern end of the Caribbean; it shares maritime boundaries with Barbados and Grenada on the north and with Venezuela in the west and south, as well as with Guyana (**Figure 7**). Its location is downstream of major South American rivers and major Ocean eddies influencing the abundance of groundfish and large pelagic resources in the area. The fishing industry in Trinidad is largely artisanal, but it includes artisanal multi-gear and trawl; semi-industrial multi-gear, trawl and longliners; and industrial trawl fishery. The fisheries in Tobago are classified as artisanal multi-gear and semi-industrial multi-gear (ice-boats) (Lalla 2002, Mohamed and Lindop 2015). It is estimated that 80% of the annual national catch of marine species is made by the artisanal inshore fleet (FAO, 2000). Large pelagic fishes consisting mainly tunas, mackerels and bonitos made up over a third of the catch (37.3%), more than three times as much as the next most important taxa (Mohamed and Lindop, 2015). The same authors indicate that tunas, mackerels and bonitos (40%) were the most dominant taxa in the subsistence fishery sector.

#### Harvest methods

The large pelagic fishes in T&T are caught by the coastal pelagic and the ocean pelagic fisheries (Lalla 2002). The coastal pelagic fishery fleet comprises primarily artisanal boats called "pirogues" which are wooden, fiberglass or fiberglass-coated open boat of 7-9 m in length, powered with one or two outboard engines usually between 45-75 hp. The major fishing gears used in the coastal pelagic fishery are gillnets and lines. Artisanal gillnets are either multifilament or monofilament nets. Hand-line methods include "*a-la-vive*" (fishing with live bait), switchering (hand-line with baited hooks deployed while vessel is stationary); trolling/towing (4-6 lines are

towed from bamboo outriggers off vessel). The ocean pelagic fishery includes the industrial longliners, the semi-industrial multi-gear and recreational vessels. The semi-industrial multi-gear fleet entered the fishery in 1986. It is comprised of boats targeting pelagic resources using pelagic hand-lines as well as boats targeting demersal resources using hand-lines. ICCAT species caught by the coastal pelagic fishery artisanal multi-gear fleet include: carite (*Scomberomorus brasiliensis*, BRS), kingfish (*Scomberomorus cavalla*, KGM), wahoo (*Acanthocybium solandri*, WAH), and sharks, such as hammerhead shark (*Sphyrna tudes*), sharp nose shark (*Rhizoprionodon lalandii*), small tail shark (*Carcharhinus porosus*, CCR) and black tip shark (*Carcharhinus limbatus*, CCL) and sharks; trolling of this fleet catch KGM and WAH as main species, but they also catch dolphinfish (*Coryphaena hippurus*, DOL) and barracudas (Sphyraenidae), sharks (Carcharhinidae), bonito (*Sarda sarda*, BON) and sailfish (*Istiophorus albicans*, SAI) (Lalla 2002, Mohamed and Lindop 2015).

#### Landing data

Trinidad and Tobago's reported catch to ICCAT of large pelagic fishes show a decreasing trend in catches of small tunas and sharks; in contrast with major tunas that show a sustained increasing trend, while the rest of the major groups (BIL and SWO) appear stable (**Figure 8A**). In general, the average proportion in catch of all major species for the period of 2013-2016 resulted in almost an even split between major tunas (49%) and small tunas (42%); followed by sharks (4%) and billfish (3.8%), swordfish was negligible (**Figure 8B**).

The ICCAT species catch of T&T disaggregated by gear show two classifications: Industrial longline (LL), and unclassified (UN) gear. In the case of the industrial longline when the major tunas and billfish are disaggregated, all show an increasing sustained trend in the catches of YFT, ALB, and BET (**Figure 8C**), and uneven increasing trend in all billfish species, but with a major drop in the catches of marlins in the last year (**Figure 8D**). In the unclassified gear, the catches of small tunas and sharks represent the largest volume of the T&T reported catch, in which the decreasing trend of the small tuna group catch show that is made up of two species of *Scomberomorus* (BRS, KGM) (**Figure 8E**). The shark catches consist of 10 shark species or categories, in which the catches of unclassified hammerhead sharks (SPN) were large in recent years. Thus, it would appear that the T&T reported catch by unclassified gear would likely be from the artisanal multi-gear fleets using gillnets and hand-lines/trolling.

It should be noted that there are discrepancies in the reported catch of billfish species to FAO and ICCAT, in which the reported catch to FAO is for some species doubled than that of ICCAT task I data (FAO BUM, 1995-2000; FAO SAI, 1995-96). The SCRS (Billfish Group) may want to address this discrepancy with T&T national scientists.

#### Data limitations

In Trinidad the existing system of landings and effort data collection targets the artisanal fleet (Lalla 2002). A data collection system was initiated for semi-industrial/industrial longline fishery with technical assistance from ICCAT in 2000. However, in recent years qualified personnel in data collection have been substantially reduced which may likely affect the data recording and reporting system in some fisheries.

From the catch review, it seems that an important amount of catches (an annual average of 465 t for the period 1995-2016) are reported under general groups such as various sharks and rays (SHX and SKH). The same happens for the group TUN (Thunnini, Tunas nei), which has an average annual catch reported of 206 t. In addition, there is no dolphinfish (DOL) data available on FAO nor ICCAT during the period 1995-2011, but there is an estimated catch for this species for 1988-1999 (Thomas *et al.* 2000). However, Mohamed and Lindop (2015) pointed out that the data source and method applied to estimate DOL catches were not described.

During the on-site visit to Tobago detailed information was offered. The island has an important artisanal multi-gear fishery that catches small tunas, with juveniles of major tuna species (i.e., ALB) likely being caught, and thus proper identification of the species-specific catch appears to be a major issue. The on-site visit to Tobago, revealed that the Department of Marine Resources and Fisheries (TDMRF) conducts data collection activities throughout the landing sites which presently include 15 landing sites of the 30 existing throughout the island, with half of the man power (currently 10) to cover the data recording process.

Most of the Tobago fleet (about 600 boats) consists of fiberglass-coated open boat of 7-9 m in length, powered with one or two outboard engines usually between 45-75 hp, with a small ice-box, with the exception of about 14 larger vessels with in-board engine capable of fishing up to 7 days, while the rest fish up to 2 trips per day. The gears used are similar to those used in Trinidad but are partitioned according to the resources targeted across the

island. In the case for large pelagic species which are caught mainly by trolling, and “*a-la-vive*” (using live bait), fishing take place off the northeastern waters of Tobago, and fish are normally landed in three landing sites (Charlotteville, Parlatuvier, Castara) which are base to the largest group of vessels (about 180) in the Island, and are not being monitored by the data collectors.

In the recent past (2005), Tobago fishers have been provided with a small booklet titled “Working Boats, Fisherman’s notebook” as part of the Project for the Promotion of Sustainable Marine Fisheries Resource Utilization funded by the Japanese International Cooperation Agency in 2005. However, none of the booklets have been used for the collection of fisheries statistics by the TDMRF. The booklet was re-printed in 2015 by the TDMRF as part of a follow-up of the project to see if records were kept over the years. Although the results were positive, data sharing between fishers and data collectors do not occur.

The booklet in itself, if used by fishers, will contain basic catch statistics for day trips (species-specific catch, effort, area, time, gear). However, the guide included for species identification is limited and confusing, likely to produce errors in large pelagic species identification, as well as missing information of other large pelagic species potentially caught by fishers in the area. The booklet also indicates that FAD fishing take place, however there is no recording of such activities, nor does the TDMRF has any records as to where it takes place. Informal information indicate that fishers may use (likely bio-degradable) FADs when targeting DOL in the southeastern part of the island of Tobago. However, the number of FADs deployed per fisher and the distance from shore is unknown, nor the number of boats using FADs.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

Trinidad has a data recording and reporting system for ICCAT species for all fisheries, including artisanal fisheries, but is limited to the island of Trinidad; Tobago fisheries, which are under TDMRF, rarely reports on ICCAT species. In general, the data recording and reporting system for ICCAT has aged over the years and is faltering fast because of poor financial aid that has affected replacements of trained personnel, particularly for artisanal fisheries.

The on-site visit coincided with a FAO consultant mission to review and update of the current fisheries statistical system in Trinidad and Tobago to enable effective monitoring of the impact of climate change on fisheries in the two islands. The FAO consultancy is funded by the Global Environment Facility project, *Climate Change Adaptation in the Eastern Caribbean Fisheries Sector* (GCP/SLC/202/SCF), also known as CC4FISH. The recommendations will contribute the development of the new Fisheries Statistics and Management Information System (FiSMIS) for Trinidad and Tobago, to generate again official statistics of both islands and so improve quality of statistics produced. The development of the national FiSMIS is supported under project GCP/INT/228/JPN (Improved fisheries management for sustainable use of marine living resources in the face of changing systems).

It would be expected that Trinidad & Tobago fishery data collection and reporting will improve substantially in the coming years, pending approval and execution of the funds to do so. However, during the visit to Tobago it was noted that the implementation of the new system would take time, thus it was advisable that in specific cases opportunities for investment to implement a data collection and reporting program for a specific objective (e.g., ICCAT species of interest) should be perused. Therefore, considering that in the case for large pelagic species which are caught mainly off the northeastern waters of Tobago, where fish are landed in three landing sites (Charlotteville, Parlatuvier, Castara) not being monitored by the data collectors and are base to the largest group of boats (about 180) in the Island, a pilot data collection program for ICCAT species could supported for the main landing site, i.e., Charlotteville. If the SCRS wishes to advance on data collection from artisanal fisheries operation for ICCAT species in Tobago it would be advisable to consider this option in conjunction with Trinadanian fishery officers, as well as to follow-up on updates on the development of the new Fisheries Statistics and Management Information System (FiSMIS) for Trinidad and Tobago.

## -Venezuela

Venezuela has been an ICCAT member country since 1983, operating in the Convention area with 72 longliners, 3 purse seiners, 4 bait boats vessels in 2015 (ICCAT 2017b). The area of operation of the tuna fleets is the western central Atlantic, mostly in the central Caribbean Sea and along the northeastern South America coast on the Atlantic side (**Figure 9**). The Venezuelan continental coast extends 68% percent in the Caribbean Sea, 21% in the Atlantic Ocean, and the remaining 11% correspond to an insular region consisting of 14 archipelagos formed by over 300 islands and islets (Arocha and Mendoza, 2015). Artisanal fisheries in Venezuela started its rapid development after public investments, loans, and introduction of the outboard engine in 1950-1960. In recent times the artisanal fleets consist of about 20,000 small boats (< 10 m) and about 1,000 mid-size (14-18 m) vessels (Arocha and Mendoza, 2015). Because of its narrow continental shelf in some areas in the Caribbean Sea and the long tradition of fishing off Venezuelan coast in the Atlantic Ocean, several artisanal fisheries have directed their efforts towards ICCAT species. In some cases, this effort is directed to specific targets and in other as part of a multispecies directed catch of opportunity/seasonal of ICCAT species. Although Venezuela's artisanal catch has been reported independently of the industrial/commercial catch, it was not until 1990 when species-specific catch of ICCAT species caught by artisanal fisheries started to be recorded and later reported with the partial financial aid of ICCAT's Enhanced Program for Billfish Research (Marcano *et al.* 2000).

### Harvest methods

The large pelagic fishes exploited by Venezuelan artisanal fisheries are primarily caught by two types of fleets, one that uses small vessels ( $\leq 10$  m) and drift-gillnets, and another that uses mid-size (14-18 m) vessels and pelagic longline. The artisanal drift-gillnet fishery is a localized fishery that targets billfish and catch other large pelagic fishes (i.e., sharks, tunas, dolphinfish and small tunas). The location is a community near La Guaira, located in the central coast from which vessels go to fish to the renowned Billfish-hotspot concentrated in and around "Placer de La Guaira" (Arocha *et al.* 2009). The fleet has 35 registered wooden boats of 8-10 m powered with 2 outboard engines 48-75 hp. The fishing operation consists of daily trips with no refrigeration of the catch. The nets are fished overnight with the float line 12-15 m below the surface, and total net length range between 1,000 and 1,500 m. The fishing operation is conducted year-round only during the new moon phase (i.e., 10-15 days of effective fishing under normal weather conditions).

The artisanal off-shore fishery utilizes wooden vessels averaging in length ~15 m (range 11-18 m) and the vessels are powered by a diesel inboard engine (Arocha *et al.* 2013); a rough estimate number of vessels in the fleet are about 700, but in recent times vessels can reach 20m in length. The fleet is characterized by using four types of gear, pelagic longline (for tuna and tuna-like species), bottom longline (for snapper-grouper and small sharks), hand-line (for species of *Scomberomorus sp.*, serranids, carangids, and other mid water species), and gillnets (for species of *Scomberomorus*, and other mid water species). The artisanal off-shore fleet targeting large pelagic fishes normally operates in the Caribbean Sea around the offshore Islands off Venezuela, and in the Atlantic Ocean east of Trinidad, east of the Orinoco Delta, and east-northeast of Guyana and Suriname. On any given trip, vessels may carry 2-3 types of gear which can be used alternatively depending on the target species. However, gillnets are never combined with longlines in any given trip. This fishery is considered to be artisanal because fishing operations (gear set and haul) are done manually; some vessels have a longline spool but is also handled manually. The fleet targeting large pelagic fishes uses pelagic longline gear and it deploys between 400 and 1040 hooks per set (an average of 776 hooks/set). The bait used is live sardines or small carangids when sardines are not available. Regular average number of sets per trip is about 10-16 sets, and days at sea are in the range of 15-28 days which can vary depending on the fishing grounds of operation, the time to locate and load the bait (usually bought from other fishers on route to fishing grounds), and the condition of the bait. On occasions, when the bait dies or the price of large pelagic species drop, the vessels switch to bottom longline for snapper/grouper within the same trip.

### Landing data

Venezuela's reported catch of large pelagic fishes to ICCAT shows a decreasing trend in catches of tunas and small tunas, while the rest of the major groups appear stable (**Figure 10A**). However, considering that Venezuela has three fleets operating in the study area, the relatively stable catch trend in non-tuna groups is more an effect of scale than a real trend, mainly because of the purse seine and bait boat catches. Whereas the non-tuna groups (Billfishes, Sharks, and swordfish) are mostly caught by the longline fishery. In general, the average proportion in catch of all major species for the period of 2013-2016 resulted in 94% of tunas, and the rest is billfish and shark species, swordfish was negligible (**Figure 10B**).

The ICCAT species catch disaggregated by gear, i.e., industrial longline, artisanal drift-gillnet, and artisanal off-shore pelagic longline for billfish species show different trends than those observed from the surface fleets. The industrial longline fishery is characterized by increasing trends in the catches of YFT, ALB, BSH, and all three major billfishes (BUM, WHM, SAI), particularly in recent years. The artisanal drift-gillnet fishing in the “*Placer de La Guaira*” Billfish-hotspot, show increasing catches of BUM and SAI in recent years and stable catches of WHM (**Figure 10C**). For the other species, the catch of unclassified sharks has dropped but those from BSH and SMA seem to have recovered in the last years of the time series (**Figure 10D**); while the tuna catches mostly made of small tuna species, show an uneven trend for most of the species caught with important catches of BON, FRI, and SKJ (**Figure 10E**).

The catch of the three billfish species showed different trends between fisheries. The artisanal drift-gillnet fishery has consistently caught the largest volume of BUM (**Figure 11**); while the artisanal offshore pelagic longline fishery caught the largest volume of SAI and WHM. This comparison also shows the billfish catches by the industrial longline fishery have increased substantially since 2009.

#### Data limitations

Venezuela’s data collection from artisanal fisheries suffer from the reduced number of trained personnel for data collection and the means to record and report the data. In addition, the dispersed landing sites across the coast makes data recording an almost impossible task for some fleets. There are few exceptions, which occur when the fishery is of high value (in weight or volume; i.e., sardine, snapper/grouper, ark-shell, lobster) that landings are concentrated in specific ports or landing sites.

In the case of landings for large pelagic fishes, the artisanal drift-gillnet fishery off La Guaira that targets billfish species and other large pelagic fishes was easily monitored because it was localized and close to urban areas. However, the artisanal drift-gillnet fishery did require financial aid, capacity building, and logistic technical support to be able to record and report high quality data. The financial support from ICCAT’s EPBR made possible to maintain the flow of data from that fishery for 25 years, until the financial aid stopped. Since 2015, no data has been reported to the National Fishery Office nor ICCAT from this fishery. However, with financial support obtained from the present study it was possible to recover species-specific billfish Task I data from 2015 and 2016. However, to recover detailed data (Task II data, i.e., catch and effort, and size samples) from that fishery as well to continue monitoring the fishery would require additional financial aid that is not presently available. In addition to the mentioned issue, it appears that there are other fishing communities in the area that have started to target large pelagic species (billfish specifically) with line gear (unclear if is hand-line/trolling or longline) that have never been monitored. Thus, a full survey of the fishing communities in the area is warranted to have an inventory of the fleets/communities targeting large pelagic in the Billfish-hotspot “*Placer de La Guaira*”.

Data collection and monitoring of large pelagic landings from the artisanal off-shore fishery are more complicated. Traditionally, the fleet have used three to four known ports in eastern Venezuelan (Arocha *et al.* 2013) but in recent years, due to the current economic conditions in Venezuela, the fleet has started to land part of the catch in foreign ports, and the remaining catch is landed in Venezuela anywhere along the northeastern coast where buyers are available, and only a minimal catch is landed at the port of call. In the recent past and with financial help the JDMIP-ICCAT project, made possible to reconstruct species-specific billfish catch for this fishery from 1986 to 2013 (Arocha *et al.* 2015a). In addition, the JDMIP-ICCAT project in Venezuela to enhance monitoring of large pelagic from the artisanal off-shore longline fishery proved to be successful in recording and reporting high quality data during the time of the project (Arocha *et al.* 2015b). In some cases, the recording of species-specific catch data has prevailed in 2 of the four ports but only for billfish species. However, the recording and reporting have proven to be very inconsistent in recent years due to the lack of technical supervision and capacity building in remote areas.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

## Areas of potential strategic investment

Venezuela has a data recording and reporting system for ICCAT species for all fisheries, including artisanal fisheries, but it has aged, and is faltering very fast because of lack of financial aid, particularly for artisanal fisheries. This study demonstrated that with financial aid data recovery from the artisanal drift-gillnet fishery is still possible. However, in order to subsist in time and continue to provide the high-quality data that it did in the past 25 years, a fishery monitoring system would need to be sufficiently funded to procure the desired results. Having continuous monitoring of fisheries operating in the Billfish hotspot is important for ICCAT since that area has one of the longest time series for the billfish species in the Atlantic Ocean. In addition, this fishery is by far the one that catches the highest volume of BUM and interrupting data collection would be a great loss that may impact future billfish stock assessments.

As indicated above, the JDMIP-ICCAT project in Venezuela to enhance monitoring of large pelagic from the artisanal off-shore longline fishery proved to be successful in recording and reporting high quality data during 2012-2014. A similar monitoring program to the one developed during the JDMIP project would be required to reconstruct the billfish catch since 2013 to continue recording and reporting large pelagic catch from that fishery. In this case, capacity building would also be required in some monitoring areas, because is absent. In the case of billfish species, this fishery has become important due to the high catches of all three species, in particular WHM. Considering that the industrial longline has substantially increased its WHM catch in recent years (see **Figure 11**), it is critical that removals from this fishery can be accounted for.

## -Guyana

Guyana has been a Cooperating Non-Contracting Party of ICCAT since 2004. Guyana's marine fishing activities are directed primarily at exploiting its shrimp resources using shrimp trawlers, and its ground-fish (mainly snapper) resources using wooden vessels and a variety of gears by artisanal fishermen (MacDonald *et al.* 2015). There is limited exploitation of pelagic resources over the continental shelf and towards the continental slope (FAO 2016b), and most of the large pelagic fish caught come from the Inshore artisanal fishery, which utilizes gillnets as well as bottom longline/Caddell (Richardson 2013, 2014, ICCAT 2017c).

## Harvest methods

In Guyana, fisheries are conducted by artisanal fishers and by an industrial fishing fleet composed of trawlers and hand-liners, including some foreign flagged, licensed vessels. Most of Guyana's fishing effort occurs in the relatively shallow waters of the continental shelf (**Figure 12**). The artisanal fleet consists of 1147 boats equipped with different types of gillnets (Chinese seine/fyke net, Pin seine, Gillnet-nylon and polyethylene), there are 87 boats using Caddell/bottom longline gear (ICCAT 2017c). Artisanal boats are made of wood of 6-18 m, powered by sail, outboard, or inboard engines. The size of the boats defines the type of the gear and the target species. ICCAT species are mostly caught by the nylon and polyethylene gillnets boats. However, the Nylon-gillnet boats are smaller (7.63 to 9.15 m) in length, have no cabin, are equipped with an icebox, are powered by 48-hp outboard engines, and conduct daily fishing trips. In contrast, the Polyethylene-gillnet boats have a length range of 12.2-15.25 m, normally have a cabin and are powered by inboard engines which give these boats an autonomy of 10-21 days at sea (ICCAT 2017c, SOFRECO 2013). About 60% of the artisanal vessels use gillnets within coastal waters. The main targets of the fishery (although seasonal) are groundfish species, but sharks amount to an important by-catch product, as well as small tunas (mostly *Scomberumorus sp.*).

## Landing data

ICCAT and FAO reported catch for ICCAT species from Guyana are very similar, with the exception of 2014, when there were only reports to FAO, and in 2008 when reports on shark's catch were only made to FAO. Guyana's reported catch to ICCAT of large pelagic fishes show a decreasing trend for the two major groups (sharks and small tunas), but with a small recovery in recent years (**Figure13A**). The other species groups (SWO, TUN, BIL) show reports for the last two years of the series. In general, the average proportion in the catch of all major species groups for the period of 2013-2016 resulted in 42% of sharks, 43% of small tuna, and the rest was made of major tunas and billfish, with a negligible proportion of swordfish (**Figure13B**).

Sharks have become an important value fishery in Guyana. Most sharks are landed dressed (i.e., headless and gutted); thus, making it difficult to identify sharks to the species level. On occasions when shark species have been identified, is because they are juveniles and are landed whole. The shark species identified are small tail, (*Carcharhinus porosus*-CCR), blacktip (*Carcharhinus limbatus*-CCL), tiger (*Galeocerdo cuvier*-TIG), Atlantic sharpnose/waterbelly (*Rhizoprionodon terraenovae*-RHT), and smooth hammerhead (*Sphyrna zygaena*-SPZ).

#### Data limitations

The Fisheries Department of the Ministry of Agriculture is the government body charged with the sustainable management and regulation of the country's fisheries. It reached out to FAO and CRFM for capacity building to identify sharks caught by the artisanal fishery.

Reports of total landings for the artisanal fleet might be difficult because it has many landing sites along the coast of Guyana.

Large pelagic fishes not being part of the common landed catch in Guyana may present a challenge to data collectors to identify these to the species level, like billfishes, sharks, and maybe other small tunas.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

Considering that most of Guyana's fishing effort occurs in the relatively shallow waters of the continental shelf it is unlikely that important catches of ICCAT species occur. However, Guyana has an important interest in shark catches; however, it is not clear which species are used, nor if sharks are fully utilized. Given that ICCAT has several recommendations on sharks, it would be in its best interest to identify the species-specific catch of sharks from Guyanese artisanal fisheries in the Caribbean Sea. If the SCRS wishes to advance data collection from artisanal fisheries operation in Guyana, it would need to invest in enhancing data reports on shark species.

#### -Suriname

Suriname is a Cooperating Non-Contracting Party of ICCAT. Suriname's coast line represents 15% of the total land area, and its EEZ extends between Guyana and French Guiana 350 nm into the Atlantic Ocean (**Figure 14**). Three-quarters of the fish catch is caught by the artisanal fleet, although other fisheries are developing as tuna catches began to be reported in 2012 and reached 4700 t in 2015 (FAO 2016c). Fisheries in Suriname can be broken into three sectors: artisanal (small-scale, commercial), industrial (large-scale, commercial) and a subsistence fishery. The artisanal fishery typically occurs in near-shore coastal waters, river mouths and brackish waters (Hornby *et al.* 2015). Suriname has no high seas fishing operations targeting large pelagic fishes; however, it has a licensing system that allow foreign longline licensed vessels to land ICCAT species in the Surinamese port of Cevihis (ICCAT 2014, 2017d). The ICCAT species landed by these vessels include: yellowfin tuna (*Thunnus albacares*, YFT), albacore tuna (*T. alalunga*, ALB), bigeye tuna (*T. obesus*, BET), blue shark (*Prionace glauca*, BSH), blacktip shark (*Carcharhinus limbatus*, CCL), dolphinfish (*Coryphaena hippurus*, DOL), skipjack tuna (*Katsuwonus pelamis*, SKJ), and wahoo (*Acanthocybium solandri*, WAH) (ICCAT 2015).

#### Harvest methods

The fishing fleet in Suriname can be divided into the industrial trawl and the artisanal fleets. The industrial fleet can be subdivided into shrimp targeted and finfish targeted fisheries. Under the industrial fishery categorization, within the finfish fishery there is a hand-line fishery directed to catch snapper/mackerel, which are mostly Venezuelan artisanal off-shore type vessels (considered artisanal by Venezuelan law), licensed to fish and land part of the catch in Suriname ports. These vessels when targeting "mackerel" also catch billfishes and small tunas (DOL, WAH) (CRFM 2014). The artisanal fleet is more diverse and operates with different gears but is dominated by drift-gillnet (CRFM 2014). The coastal drift-gillnet fishery operates from two types of boats



known as Guyana type boats, open Guyana type boats, 8-14 m long, powered by 25-50 hp outboard engines and closed decked Guyana type boat 15 m long with 45-80 hp diesel inboard engines (SOFRECO 2013, Hornby *et al.* 2015). These vessels are responsible for the catch of large demersal finfish, and potentially some ICCAT species of interest (i.e., sharks).

#### Landing data

Suriname has indicated that it has no flagged vessels targeting tuna or tuna-like species, but licensed foreign flagged vessels land ICCAT species in the Suriname port of Cevihás (ICCAT 2015). ICCAT and FAO reported catch for ICCAT species from Suriname are relatively similar for reported years (2012, 2013), the rest of years for which ICCAT species are reported come from those reported to FAO. Suriname's reported large pelagic fish catch show that about a third of the ICCAT species consists of small tuna (13%), sharks (7.6%) and billfishes (5.9%) for the period of 2013-2016, and the rest of the catch is made up of major tunas (TUN) (**Figure 15A**). The reported landings were only available for two periods, 2003-2005 and 2012-2016 (**Figure 15B**). The reported landings for the first period consisted of unclassified sharks (SHK) and unclassified scombrids (KGX). During the second period (2012-2016), the largest group (TUN) consisted of YFT, ALB, BET, and SKJ; the second group (SMT) with a declining trend in recent years consists of DOL and WAH; the shark catch (SHK) is made up of BSH and CCL; and the billfish catch (BIL) is only made up of sailfish.

#### Data limitations

Ministry of Agriculture, Animal Husbandry and Fisheries collects statistical data regarding landings and other issues related to the fishery sector. The recently prepared (with FAO TCP/SUR/3301 support) sub-sector White Paper for the period 2012 -2016 noted as main issues the absence of a Fisheries Management Plan, outdated legislation, an inadequate monitoring surveillance and control system for marine resources and a low organizational level in the sector (FAO 2016c).

It appears that Surinamese artisanal fisheries do not seem to catch large volumes of ICCAT species of interests; however, it is port to foreign fleets (artisanal and industrial) that catch ICCAT species. The current monitoring system is not sufficient to record and report efficiently the catch of ICCAT species by foreign fleets. Suriname has requested aid in technical assistance to enhance its capacity to report and record in an efficient way over several consecutive years (ICCAT 2015, 2017c).

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

Surinamese artisanal fisheries do not seem to catch large volumes of ICCAT species of interests, but its port of Cevihás receives landing from licensed fleets that catch ICCAT species. Although industrial fleets are not part of the present study but considering that Suriname has requested ICCATs help to enhance their capacity to record and report landed ICCAT species in an efficient way, it may be of interest of the SCRS to follow up on this request.

#### -Belize

Belize has been an ICCAT member country since 2005, operating in the Convention area with 11 vessels >24 m in 2015 (ICCAT 2017e). The areas of operation of the tuna fleets include the southwest and northwest Atlantic, with unlikely operations within the Caribbean Sea. Along the coastline of Belize lies one of the largest barrier reefs in the world, as well as several reef areas located offshore, outside the barrier reef (Heyman and Kjerfve 2001), which is why most of the artisanal fisheries target species associated with corals reefs, like lobster (*Panulirus argus*), queen conch (*Strombus gigas*), and other invertebrates. However, finfish fisheries also exist and have predominantly supplied the local market, among these, the shark fishery has been an important fishery.

The artisanal fleet consists of about 552 boats, mostly open boats powered with outboard engines. However, most of the fishing effort is dedicated to catch lobster and queen conch. Almost all of the fishing is done in the shallow waters of the barrier reef and atolls. The targeted finfish species are those associated with the reef, the only relevant ICCAT species in the finfish catch are king mackerel (*Scomberomus cavalla*, KGM), spanish mackerel (*S. maculatus*, SSM), and wahoo (*Acanthocybium solandri*, WAH), although wahoo is also likely to be caught by the high seas fishery (FAO 2018b, FishStatJ 2018, Zeller *et al.* 2011).

There is also an artisanal shark fishery that has existed since the late 1930s, mostly for the leather trade and for fin exports. The main gears to capture sharks are longline for pelagic sharks and gillnets. The species-specific catch includes Caribbean sharpnose (*Rhizoprionodon porosus*, RHR), blacktip shark (*Carcharhinus limbatus*, CCL), great hammerhead (*Sphyrna mokarran*, SPK), scalloped hammerhead (*S. lewini*, SPL) nurse shark (*Ginglymostoma cirratum*, GNC) bonnethead (*S. tiburo*, SPJ) lemon shark (*Negaprion brevirostris*, NGB) bull shark (*Carcharhinus leucas*, CCE). Of these species, the great hammerhead (SPK) represents the highest proportion (0.35) of the shark catch (Zeller *et al.* 2011, Ylitalo-Ward 2016).

If the SCRS wishes to advance data collection from artisanal fisheries operation in Belize, it would need to invest in enhancing data reports on shark species. Given that ICCAT has several recommendations on sharks, it would be in its best interest to identify the species-specific catch of sharks from Belize artisanal fisheries in the Caribbean Sea.

#### -Guatemala

Guatemala became an ICCAT member country in 2004, operating in the Convention area with two fishing vessels targeting tropical tunas (ICCAT 2016a). Guatemala's jurisdiction area in the Atlantic (Caribbean Sea) is 31,000 km<sup>2</sup>, in which the most important city/port is Puerto Barrios.

The fishing activity that take place in the Caribbean Sea is what the official administration calls “*specialized artisanal fisheries*”, which consists of 10-13 m vessels with onboard 125 hp engine targeting shrimps likely using bottom trawl nets, and the artisanal fisheries itself with hand lines (FAO 2018e). The finfish fishery consists of about 1500 small 7 m boats with outboard 75 hp engines, targeting sharks, pompano, dolphinfish, snapper and other ground/wreck fish. Most of the small scale/artisanal finfish fishery operate on the shelf, and likely, near the break. Tuna fishing is conducted by purse seine vessels, likely operating in the open waters of the Atlantic.

Guatemala large pelagic harvest started to be reported to ICCAT (Task I) in 2003, and FAO Area 31 on 2004 (FishStatJ 2018, ICCAT 2018). The ICCAT reported landings are mostly related to major tropical tuna species (skipjack, SKJ, and bigeye tuna, BET), and albacore (ALB); the rest of the reported catch consists of small tunas, frigate (FRI) and little tunny (LTA). The reported catch for the western Atlantic indicate, that the fleet operated mostly on the eastern Atlantic, with occasional operations in the western side. FAO reported catches of large pelagic fishes show that wahoo (WAH) is the only species reported in this category, and reports are only available for the period of 2005-2011.

The operations of artisanal fin fish fishery in the Caribbean are likely under estimated due to the remote distance from the official administrative fishery offices, and likely to the lack of trained personnel to record the landed catch. In addition, landing sites may vary across the area due to the mobility of the small boats that would enable them to land where the buyer requests, making it difficult for any form of data collection.

If the SCRS wishes to advance on data collection from artisanal fisheries operation in Guatemala's Caribbean side, it would require on site visits to the landing sites to better understand how the fin fish fishery operates, and to evaluate if the landing of ICCAT species in the area warrants an investment, like training of fishery data collectors specialized in ICCAT species.

#### Nicaragua

Nicaragua became an ICCAT member country in 2004; however, there are no National Reports in the ICCAT Biennial Reports for the past four years. In its recent “*Anuario Pesquero*” (INPESCA 2015), most of the catch in the Caribbean Sea consists of demersal resources, *i.e.*, shrimp, lobster, conch, and other commercial invertebrates, most likely due to its broad and extensive continental shelf (**Figure 16**).

The Nicaraguan artisanal fleet in the Caribbean Sea consists of about 2440 boats of different sizes (8-11 m), with inboard (23 hp) and outboard (75 hp) engines, as well as sails. However, about 48% of the boats are powered. The gears commonly used are gillnets and hand lines (FAO 2018g, Haas *et al.* 2015).

There are no reports from Nicaragua in ICCAT Task I data. The only catch reported of ICCAT species is that found in FAO statistics, which consists of one species of shark (*Carcharhinus limbatus*, CCL), and two species groups, i.e., sharks and scombrid fishes. Of those two groups, the group of sharks represents over 70% of the catch of both groups combined (**Figure 17**).

If the SCRS wishes to advance data collection from artisanal fisheries operation in Nicaragua's Caribbean Sea, it would need to invest in enhancing data reports on shark species. Nicaragua has an export market of shark fins; however, it is not clear which species are used, nor if sharks are fully utilized. Given that ICCAT has several recommendations on sharks, it would be in its best interest to identify the species-specific catch of sharks from Nicaraguan artisanal fisheries in the Caribbean Sea.

#### *-Honduras*

Honduras became an ICCAT member country in 2001; however, in its latest National Reports available in the ICCAT Biennial Report, Honduras has noted that it has not operated tuna directed fisheries in the area of the Convention (ICCAT 2017f). Honduras indicated that in recent years most of the catches have been directed to non-ICCAT species, such as crustaceans and mollusks.

A recent study on Honduras's fisheries (Funes *et al.* 2015), indicated that the artisanal fishery was mostly associated to coral-reef banks and near-shore areas targeting crustaceans and mollusks, and snapper and groupers. There was no indication of fishers targeting large pelagic fishes. However, under the unclassified fish species catch, several large pelagic fishes (i.e., YFT, BLF, DOL, SAI, WAH) were reported but did not represent more than 10% of the unclassified catch.

In the context of the Comprehensive study of Strategic Investments related to Artisanal Fisheries Data Collection in ICCAT Fisheries of the Caribbean/Central American Region, Honduras currently does not target nor retain ICCAT species of interest to this study, therefore no further review is warranted at the present time.

#### *-Panamá*

Panamá became a member of ICCAT in 1998, and has a declared fleet of 3 purse seiner and 29 longline vessels over 20 m. Most of its catch in the Atlantic side consists of tropical tunas and albacore, with occasional important catches of blue shark, operating mostly outside the Caribbean Sea (ICCAT 2017g).

The artisanal fisheries operating in the Caribbean Sea represent about 5% of the artisanal fishery of Panama, the rest of the fishery occurs in the Pacific side of the country. The fleet of about 600 boats with outboard engines is dedicated to catch lobster, octopus, crabs, and snapper, in which the snapper fishery has the greatest number of boats (~400) dedicated to it. There are no reports whether this fleets occasionally targets large pelagic fishes in the Caribbean Sea (FAO 2018h; Singh-Renton and McIvor 2015). Although there is an important shark fishery (industrial and artisanal) in Panama, all is caught on the Pacific side (Harper *et al.* 2014) and there is no indication that it occurs in the Caribbean Sea. Panamá, like most Central American countries, suffer from the lack of trained fisheries officers to carry out comprehensive data collection activities, particularly of catches destined for the domestic market from the Pacific and the Caribbean, which masks the importance of fish to national food security and will compromise future estimates.

In the context of the Comprehensive study of Strategic Investments related to Artisanal Fisheries Data Collection in ICCAT Fisheries of the Caribbean/Central American Region, Panama in its Caribbean Sea region does not target nor retain ICCAT species of interest to this study, therefore no further review is warranted at the present time.

## **2.2 Non-ICCAT member countries**

#### *-Dominican Republic*

Dominican Republic occupies two-thirds of the Island of La Hispaniola, one of the Greater Antilles Islands. Dominican Republic, like most Caribbean Islands, is in an area where large pelagic fishes (e.g., yellowfin,

blackfin, albacore tunas, billfishes, dolphinfish, kingfishes, etc.) transit into the Caribbean Sea from adjacent Atlantic waters (**Figure 18**). Dominican Republic's location and narrow continental shelf allowed for the development of a small scale (artisanal) pelagic fishery using ancillary devices, like moored fish aggregating devices (FADs), that operate year-round targeting primarily dolphinfish, king mackerel, wahoo, and more recently sailfish, but also other large pelagic species (i.e., blackfin tuna, blue marlin, and yellowfin tuna) (Gentner *et al.* 2018). In recent years the numbers of FADs have increased substantially with no apparent control, and increasing effort is being placed upon billfish and other pelagics around the FADs, particularly blue marlin, since the introduction of drop lines to this fishery.

#### Harvest methods

The large pelagic fishes exploited by the Dominican Republic are primarily caught around FADs, by trolling around the FAD and by live bait fishing. "Drop lines" are also increasingly used when live bait fishing, which consist of a single hooked line attached to a floating bottle or buoy. These are either set independently drifting past the FAD in groups, before being collected and retaken up-current of the FAD, or are strung by a main line with usually no more than 20 hooked buoys within a set. The introduction of drop lines to this fishery has increased harvest capacities for large pelagics by allowing the fishers to operate more lines/hooks with live baits than could be operated from any single vessel in the past. This feature has been promoting the use of drop lines around FADs to target billfish in the DR and many other Caribbean nations since their introduction and training of use by the Japan International Cooperation Agency (JICA, 2018).

An estimate of at least 260 boats (a very conservative estimate based on three fishing areas in the southern coast of the Dominican Republic) set FADs and fish around them (Gentner *et al.* 2018). There are mainly 2 types of vessels that harvest large pelagic fish species off Dominican Republic, namely, *Yola*: a flat boat that is wooden, sometimes recovered with fiberglass, of 5-7 m and powered by a 5-25 HP outboard engine, and *Bote* or *Panga*: a modest-sized fiber glass boat with a high bow, narrow waterline beam, and a flotation bulge along the gunwale, or top edge of the hull. These are powered with different size outboard engines depending on the length of the *bote*; 15 HP for a 5m *bote*, 30 HP for a 6-7m *bote*, and 40 HP for a 7m *bote*. Each vessel carries two fishers and each handle two hooked lines, when not using drop lines. Dead bait (sardine or similar) is used to catch live bait (small jacks) that will then be used as live bait to catch large pelagic fishes when fishing on the FADs. Drop lines are also used without FADs to mostly target sailfish when they swim close to the coast, particularly in a channel near the town of Barahona.

#### Landing data

Dominican Republic's official landings data is recorded by the Consejo Dominicano de Pesca y Acuicultura (CODOPESCA) and reported to FAO (Gentner *et al.* 2018). Thus, the data recorded of large pelagic fishes follows the reporting scheme the country uses to report to FAO annually. It is likely that almost the totality of the large pelagic fishes catch in the Dominican Republic is from the FAD fishery. Official reported landings (to FAO) indicate that dolphinfish (DOL), blackfin tuna (BLF), yellowfin tuna (YFT), and king mackerel (KGM) represent the species with the highest reported landings between 2001 and 2016 (**Figure 19A**). The rest of the large pelagic fish species which include sailfish (SAI), blue marlin (BUM), albacore tuna (ALB), skipjack tuna (SKJ), other tunas (TUN, including small landings of bluefin tuna), wahoo (WAH), and cero mackerel (CER), have maintained a relatively stable trend in the landings through 2014. However, in recent years (after 2014), landings of dolphinfish, yellowfin tuna, king mackerel, sailfish, and blue marlin have shown a noticeable increase in the total landings of large pelagic fishes. Average landings in recent years (2014-2016) indicate that the group representing all tunas (TUN) account for almost half (49.4%) of the landings for that period (**Figure 19B**), followed by the group that represents landing of kingfishes (KGX); while the billfish group and dolphinfish represent equal proportions of the average landings in 2014-2016. Among the different groups of landed species, king mackerel represents the most common species (62.1%) in the kingfish (KGX) group; while yellowfin and blackfin tuna form an important proportion (64.4%) in the landings of tunas (TUN) in recent years. Billfish (BIL) landings, on the other hand, are represented by sailfish and blue marlin in almost equal proportions, in which sailfish is the highest (52.2%). Other species, like little tunny (*Euthynnus alleteratus*), frigate tuna (*Auxis thazard*), rainbow runner (*Elegatis bipinnulatus*), jacks (*Seriola sp*), and barracuda (*Sphyraena barracuda*), can be considered secondary target species that are commercialized and consumed in local communities (Herrera *et al.* 2011). A review of the billfish species (SAI, BUM) reported catches to FAO and ICCAT revealed that after 1996 both reports matched for both billfish species in the early years (1996-2003), thereafter the country stopped reporting BUM to ICCAT, but it continued to report SAI catches until 2007 (**Figure 19C**). Although SAI ICCAT reported catches from 2005 to 2007 are higher than those reported to FAO, the BUM catches were only reported to FAO from 2003 to 2016.

Similar to Grenada, Dominican Republic has consistently reported catch data to FAO and to ICCAT until 2007 for SAI and less for BUM. However, considering that BUM is officially reported to FAO, and despite the country's current limitation in data recording, it is suggested that the SCRS (Billfish Group) considers using the catch data for BUM reported to FAO by Dominican Republic as part of the total removals of BUM in the Atlantic, but with a caution notation.

#### Data limitations

As reported by CODOPESCA and personal observations in 2017, monitoring is conducted on site by *Enumeradores* or data collectors assigned to one or several landing sites on a beach or fishing community where fish are normally landed and sold to the local fish market. Each data collector records the landings, fishing operations information, operational expenses, beach activity, and general observations (like species-specific catch during a particular season). The landings data, since 2014, is being recorded by species or aggregated by species groups, like billfishes which can only be separated into sailfish and blue marlin based on the notations indicated in the observations section of the form called *Registro de Desembarco y Liquidacion Pesquera en Playas* (Registry of Landings and Fishery Liquidation on Beaches). This form is compiled in a small booklet that the data collector uses to record each landed trip. The day's work in the booklet is revised at the Regional Office by the Regional Fishery Officer and once verified, the data is sent to the central office of CODOPESCA for data entry. Although, the basic data is recorded, the quality is not, at least for large pelagic fishes. There are severe limitations, mostly associated to species ID of large pelagic fishes. For example, in the case of billfishes "aguja" is usually recorded as blue marlin, when it could likely be white marlin, or any of the other two spearfish given that these species occur in the area and have been caught by fishers. The effort information is very limited as well, mostly number of trips are recorded as a measure of effort which most of the time are daily trips. But no information on the amount of gear used nor how many FADs are deployed by a fisher or group of fishers is recorded. Interviews with fishers in several fishing communities in the southern part of the island indicated that each boat owner managed around 5-10 FADs, a very rough estimate could bring the total number of FADs to around 2500. However, due to their rudimentary nature, the number of FADs lost during the year could be substantial as well. FAD losses bear a high relative cost to these artisanal fishers but a race to fish, and therefore also a race to deploy more FADs is currently ongoing, while the lacking control of this fishery by CODOPESCA persists.

Another aspect of data limitation on large pelagic fishes caught is that most of the information recorded comes from the southern part of the island, but there are at least two communities towards the eastern side of the island where the fishing authority has no Regional offices but could be expected to record significant large pelagic fish catches. The eastern area is well known to recreational fishers who catch-and-release all billfish, and particularly target white marlin after the peak blue marlin season declines in the southeastern part of the island.. Also, no information is recorded from the northern fishing communities on whether they target or not large pelagic fishes, in fishing areas where billfishes are also known to occur as indicated by recreational fishers that target large game fishes off the northern coast.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

The data recording system for large pelagics in Dominican Republic does not meet the basic standard reporting used nowadays in fisheries, even for landings only data. There is a need for capacity building in the fishery data collection system, especially for large pelagic fishes. There is a strong need for a standardized data collection program, the development of an enumerator manual and training program that would not only record artisanal fishery data, but also the recreational fishery as well, since that fishery has an important take on billfishes regardless if that is a catch-and-release fishery.

The sporadic nature of financial support to improve data collection from these fisheries has unfortunately led to sporadic data, which needs to be more effectively collated on a broader scale and then used more effectively to inform management decisions. Something the WECAFC is trying to achieve alongside its various efforts to promote sustainable fishery management on a regional scale in the Caribbean (*R. Bealy, pers. Comm.*).

Investment for the Dominican Republic would be challenging for ICCAT, since it is not a member country. However, ICCAT could offer technical expertise to the financial entities that may be willing to invest to develop a robust large pelagic data collection program in a country in which large pelagic fishes catch (particularly billfish) seems to be growing due to its open access status. A planned follow on project from the Caribbean Billfish Project (CBP), which is a component of the GEF funded World Bank implemented “Ocean Partnerships for Sustainable Fisheries and Biodiversity – Models for Innovation and Reform”, could provide an effective way to fund an enterprise like the one recommended for the building of capacity for standardized data collection of large pelagic fishes in the country, which include all billfishes subject to be caught by the Dominican FAD fisheries (FAO/WECAFC 2018 a,b). Dominican Republic is one of the two countries (along with Grenada) selected by the CBP to conduct pilot projects under the different CBP components to generate value and conservation outcomes through innovative management. The project aims to ultimately create business plans to support pilot investments into the sustainable management and conservation of billfish. One of the business plans created include the development of a trust fund financed by the recreational fishery towards responsible billfish management off the area of Punta Cana, including pre-proposed seasonal closures in the area, and co-management with artisanal fishers of FADs deployed in DR waters. A legislative resolution has also been developed through the CBP to support these actions beyond the project timeframe. Therefore, a recommendation would be that ICCAT maintains contacts with WECAFC on the development of business cases from the CBP that would enhance data collection systems in the Caribbean region. In the event that funding becomes available for the Dominican Republic, ICCAT would be in a position to assist with technical support on what is required for data collection programs of large pelagic fishes that are managed by international bodies. Considering that in the recent BUM stock assessment a recommendation on time area closures was included, if the business case on DR legislature on seasonal area closure off Punta Cana progresses, ICCAT may be in a position to assist with available scientific information to support any seasonal closure in the area proposed.

#### *-Colombia*

Colombia has an important EEZ in the Caribbean Sea that encompasses an area of 399,380 km<sup>2</sup> (**Figure 20**) and it includes the world-renowned Sea Flower Biosphere Reserve situated in the Archipelago of San Andrés. Within Colombia’s Caribbean EEZ, like most of the Caribbean Basin, there is an area where large pelagic fishes (e.g., yellowfin, blackfin, albacore tunas, billfishes, dolphinfish, kingfishes, etc.) transit into the Gulf of Mexico or remains in the area. Colombia’s large pelagic fisheries in the Caribbean have been mainly exploited by foreign fleets since 2006 (Rodríguez *et al.* 2015), but the fleets have been reduced substantially in recent years. A small-scale artisanal fishery exists throughout the Colombian Caribbean coast and offshore islands, which operates within a limited range (3-5 nautical) off the coast and targets coastal and offshore pelagic fishes (FAO 2018c, Salas *et al.* 2011).

#### Harvest methods

The large pelagic fishes exploited by Colombia’s artisanal fisheries are primarily caught with hand-lines (Singh-Renton and McIvor 2015). An estimate of 10,000 boats operate in the small-scale fishery of Colombia in both oceans (Pacific and Atlantic Caribbean Sea); however, the artisanal fishery for large pelagic fishes in the Caribbean is considerably smaller and will likely be a smaller fraction of the overall estimate which is not clearly known due to the multispecific nature of the fishery since its operations will likely alternate with ground or reef fisheries. The artisanal fleets use the typical boat or “*panga*”, operated throughout the Caribbean Sea, constructed of wood or fiberglass of ~7-8 m and powered by 40 or 75 hp outboard engines depending on the size of the boat. Each vessel carries two fishers and each handle two hooked lines (Salas *et al.* 2011). Operations are daily, starting by catching bait, which is then used for trolling and catching large pelagic fishes; however, in the offshore Islands of San Andres, the bait is primarily meat of freshly caught juvenile blackfin tuna (BLF) (Castro *et al.* 2007).

#### Landing data

Colombia’s official landings data is reported to FAO by the Autoridad Nacional de Acuicultura y Pesca (AUNAP), Colombia’s office of fishery policy. It is likely that almost the totality of the large pelagic fishes catch in Colombian Caribbean is coming from industrial and artisanal fleets. Official reported landings (to FAO)

of large pelagic fish groups show important catches of tunas (TUN, entirely conformed of YFT) from 1995 through 2002 (~10,000 t annually), thereafter the catch dropped substantially and in recent years the catch of the three major pelagic groups (Tunas, Small Tunas-SMT, and Sharks-SHK) were almost negligible (**Figure 21A**). Average landings in recent years (2013-2016) indicate that the group representing Small Tunas (SMT), most likely consisting of BLF, WAH and DOL, represented 98% of the catch, followed by the shark group (SHK) with 2% of the catch (likely formed by BSH, FAL, TIG, SPK), and the tuna catch was almost negligible (**Figure 21B**).

A couple of studies on the artisanal fishery off San Andres Island targeting large pelagic fishes (Grandas and Castro 2004, Castro *et al.* 2007) showed that the highest proportion of the catch was BLF, followed by WAH and DOL (**Figure 21C**). The marlin catch was negligible and only blue marlins were caught.

Although, there is limited species-specific catch data, a recent exploratory longline cruise off the Colombian Caribbean coast indicated that the most common species caught throughout the Colombian offshore coast were YFT and DOL, other species like all three billfish species, several pelagic shark species (BSH, FAL, SPK, THR, TIG) were also caught (Rodriguez *et al.* 2015).

#### Data limitations

Major limitations are on species-specific landed catch, in particular the catch of ICCAT species. In the time series reviewed (1995-2016), Colombia reported to ICCAT catch data on tuna species in 1995 and 1996; thereafter, a series of years (1997-2006) reported catch of YFT appear to be a carry-over figure, likely adopted by the Tropical tuna's species group. During the years the catch was to ICCAT, the only species-specific catch data were for YFT and SKJ, the rest of the reported catch was for unclassified tuna, unclassified small tunas and unclassified sharks. In the reports to FAO, for the western central Atlantic catch, although more complete (see Figure catch), the reported groups/species catch are similar to the ones reported to ICCAT.

Colombia has the scientific technical expertise in academic institutions and in the official administration capable of designing a data collection system to record and report species specific catch from their artisanal fisheries. There are several documents in the published literature that indicates it.

It may be that the catches of ICCAT species of interest do not represent an economic value that would warrant an investment to enhance an existing data collection program to record species specific catch on large pelagic species, which would likely require training of personnel.

#### Backed financial support

There have been investments in processing plant, infrastructure and aquaculture in the WECAFC countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. However, all this type of information will be collated with the other countries and treated jointly. Mainly because the investments to the fishing sector needs to be disaggregated from other financial aid received by each of the countries reviewed.

#### Areas of potential strategic investment

The data recording system for large pelagic in Colombia, like in the Dominican Republic, does not meet the basic standard reporting used nowadays in fisheries under a tuna-RFMO management. There is a need for capacity building in the fishery data collection system, especially for large pelagic fishes. There is a strong need for a standardized data collection program in artisanal fisheries targeting large pelagic fishes. Colombian academic and official institutions likely have identified important landing ports from where large pelagic fishes are commercialized, likely those identified ports or landing sites could serve as pilot to initiate a large pelagic fish data collection program for artisanal fisheries in the Colombian Caribbean coast, along with a similar one in San Andres Islands.

Investment for Colombia would be challenging for ICCAT since is not a member country. However, like in the Dominican Republic, ICCAT could offer technical expertise to the financial entities that may be willing to invest to develop a robust large pelagic data collection program in a country in which its large pelagic fishes catch is under-reported and seem to be growing due to its open access status. Unlike Dominican Republic, where an important billfish catch is on the rise, will likely attract the attention of potential funds from the Caribbean

Billfish Project. In Colombia, does not appear to have substantial catches of billfish, it does have important catch of sharks, thus, it will likely need investment from parties interested in species specific shark catch off the Colombian coast and San Andres Island.

### 3. Financial support

There have been investments in processing plants, infrastructure, and aquaculture in the Western Central Atlantic Fishery Commission (WECAFC) countries mentioned in this document, but investment in data collection of artisanal fisheries are generally aggregated into general projects or programs financed by FAO, GEF, ICCAT, World Bank, JICA and European Union, which often include all activities related to artisanal fisheries. The aggregation makes it difficult to present a more detailed and disaggregated information on directed support towards artisanal fisheries. The information collated is the result of the desk review, it is expected that the responses to the questionnaire sent by the Secretariat to the CPCs would eventually provide a more detailed account of the backed financial support given to the artisanal fisheries of the CPCs reviewed in the present study.

#### 3.1 FAO

During the period of 2012-2014, FAO supported the countries in the Caribbean region with 37 projects, in which all contributed to fisheries and aquaculture development and management. The areas of support included, fisheries and aquaculture policy development, fisheries and aquaculture legal framework reviews and updates of legislation, fisheries statistics, small-scale aquaculture development, aquaponics, fisheries value chain development, aquatic animal health management, fisheries management, stock assessments, capacity building in application of the Ecosystem Approach to Fisheries (EAF), fisherfolk organizational strengthening, fisheries co-management, performance reviews of Regional Fishery Bodies (RFBs), and introduction and building capacity for implementation of international fisheries instruments (FAO 2014). Some of the relevant projects are described here.

##### *-The Climate Change Adaptation of the Eastern Caribbean Fisheries Sector Project (CCAFISH)*

Its objective is to increase resilience and reduce vulnerability to climate change impacts in the Eastern Caribbean fisheries sector, through introduction of adaptation measures in fisheries management and capacity building of fisherfolk and aquaculturists. Countries participating are Antigua and Barbuda, Dominica, Grenada, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. The Global Environment Facility (GEF) agency is responsible for supervision, provision of technical guidance and financial execution and operation of the project. The project's executing partners are WECAFC and the national fisheries authorities. The project will be implemented in close collaboration with the CRFM and other partners such as the University of the West Indies (UWI), The Nature Conservancy (TNC), Caribbean Natural Resources Institute (CANARI), and the Caribbean Network of Fisherfolk Organizations (CNFO). The project will also collaborate with other relevant GEF-financed regional initiatives such as the CLME+ project and REBYC-II LAC and StewardFish. Fisherfolk, aquaculturists and coastal communities are the direct beneficiaries of the project through its goals and achievements. Project status: 2016-ongoing, with a total cost of 43,152,000.00 USD. (FAO 2018g, GEF 2018a).

*-Strengthening global capacity to effectively manage areas beyond national jurisdiction (ABNJ)*. The project is executed by FAO and the Global Ocean Forum and plays a key role in building and improving cross-sectoral dialogue, engagement of high-level decision-makers, public outreach and knowledge management to improve capacity to effectively manage ABNJ. Its objective is to promote effective global and regional coordination on ABNJ, including through information exchange, capacity development, and enhanced engagement of stakeholders at global, regional and national levels in constructive policy dialogues on ABNJ. (FAO 2018h).

Other currently operational FAO projects (FAO Technical Cooperation Department 2018) (FAO 2018i):

- GCP/SLC/001/WBK Caribbean Billfish Project (CBP) - component of the GEF-funded, World Bank implemented, project P128437. Ocean Partnership for Sustainable Fisheries and Biodiversity Conservation: Models for Innovation and Reform, aka ABNJ Project. Duration: from 2014 to 2018. Total budget: 1,949,220 USD.
- GCP/SLC/012/EC: Workshop on Illegal, Unreported and Unregulated (IUU) fishing in the Western Central Atlantic Fishery Commission. Duration: from 2016 to 2018. Total budget: 97,760 USD.



- GCP/SLC/014/EC: Support to the creation of a Regional Database and associated transversal WECAFC, CRFM, OSPESCA, IFR. Duration: from 2017 to 2018. Total budget: 86,862 USD.
- GCP/SLC/015/EC: Support to the establishment of a regional fisheries management organization for the WECAFC area. Duration: from 2017 to 2019. Total budget: 111,982 USD.
- GCP/SLC/013/USA: Conservation and Management of Sharks and Rays in the Wider Caribbean Region. Duration: from 2016 to 2018. Total budget: 50,000 USD.

### 3.2 GEF

*-The UNDP/GEFCLME+ Project* is a 5-year project (2015-2020) implemented by the United Nations Development Programme (UNDP) and co-financed by the Global Environment Facility (GEF). The funds allocated for this project is 146,653,695 USD. It assists participating countries from two large marine ecosystems (LMEs: Caribbean Large Marine Ecosystem and North Brazil Shelf Large Marine Ecosystem) in improving the management of their shared Living Marine Resources through an Ecosystem-Based Management approach. The combination of those two LMEs is referred to as the CLME+ region, bordered by over 35 States and Territories: the Caribbean & North Brazil Shelf Large Marine Ecosystems. (CLM Project 2017)

*-Mainstreaming Biodiversity Conservation into the Operation of the Tourism and Fisheries Sectors in the Archipelagos of Panama.* This project integrates biodiversity conservation into fisheries, tourism and property development sectors that operate in the archipelagos of Panama (one of its archipelagos is located in the Caribbean but the other is in the Pacific). Total financed amount 4,888,636.00 USD. Approved for implementation in 2010 and closed in 2014. (GEF 2018b)

*-Developing Organizational Capacity for Ecosystem Stewardship and Livelihoods in Caribbean Small-Scale Fisheries (StewardFish).* Total financed amount is 8,939,484.00 USD. Its aim is to support the implementation of strategies 1,2,3 and sub-strategies 1.4, 1.5, 2.7, 2.8, 3.7 of the Caribbean and North Brazil Shelf (CLME+) Strategic Action Plan (SAP) in Caribbean Regional Fisheries Mechanism (CRFM) Member States by empowering fisherfolks throughout fisheries value chains, and to upkeep their engagement in resource management, decision-making and sustainable livelihoods, with strengthened institutional support at all levels. Approved for implementation in July 2017, status ongoing. Executing agencies Fisheries Division(s) of Antigua and Barbuda, Barbados, Belize, Guyana, Jamaica, Saint Lucia, St. Vincent and the Grenadines; Western Central Atlantic Fishery Commission (WECAFC); Caribbean Regional Fisheries Mechanism (CRFM); Caribbean Network of Fisherfolk Organizations (CNFO); University of the West Indies Centre for Resource Management and Environmental Studies (UWI-CERMES). (GEF 2018c)

*-Sustainable management of tuna fisheries and biodiversity conservation in the ABNJ.* It's another project with GEF financial support. Its aim is to achieve efficiency and sustainability in tuna production and biodiversity conservation in the ABNJ, through the systematic application of an ecosystem approach in tuna fisheries for: (i) supporting the use of sustainable and efficient fisheries management and fishing practices by the stakeholders of the tuna resources, (ii) reducing illegal, unreported and unregulated [IUU] fishing, and (iii) mitigating adverse impacts of bycatch on biodiversity. Total cost 178,328,036.00 USD. Approved for implementation in October 2013. Project Status ongoing. Executing agencies tuna-RFMOs (Commission for the Conservation of Southern Bluefin Tuna (CCSBT), Inter-American Tropical Tuna Commission (IATTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), and Western and Central Pacific Fisheries Commission (WCPFC) and member countries, Forum Fisheries Agency (FFA), Fisheries and Aquaculture Sector Organization of the Central American Isthmus (OSPESCA), Parties of the Nauru Agreement (PNA), Secretariat of the Pacific Community (SPC), Governments of Fiji and Ghana, National Oceanic and Atmospheric Administration (NOAA), BirdLife International (BLI), International Seafood Sustainability Foundation (ISSF), World Wildlife Fund (WWF) and Industry. (GEF 2018d)

### 3.3 ICCAT

Several special research programs have been developed by ICCAT, some of them are funded by the Commission as part of the regular budget and others co-funded by the Commission and contributions from individual Contracting Parties and other agencies. Some of these programs with relevance in the Caribbean region and to some extent to artisanal fisheries in recent years include (ICCAT 2016c):

*-Enhanced Program for Billfish Research (EPBR)*. Initiated in 1987 with funding from the Commission and other donors. The main objective is to obtain more complete detailed species-specific catch and effort statistics for billfishes, to carry out an expanded tagging program, and to carry out studies on age and growth. One of the main areas covered by this program is the Caribbean. The original plan (1986) for EPBR included the following objectives: (1) to provide more detailed catch and effort statistics, particularly for size frequency data; (2) to initiate the ICCAT tagging program for billfish; and (3) to assist in collecting data for age and growth studies. During past Billfish Species Group meetings, it was requested that the objectives of EPBR expand to evaluate adult billfish habitat use, study billfish spawning patterns and billfish population genetics. The initial project in 1986 estimated a budget of 55,000 USD, but in recent years the annual budget varied according to its needs and donor contributions from Chinese Taipei since 2009. Several countries of the Caribbean have participated in this program over the years (*i.e.*, Barbados, Grenada, Trinidad & Tobago, Venezuela, Netherland Antilles).

*-Shark Research and Data Collection Program (SRDCP)*. Aims to fill knowledge gaps on fisheries and biology issues by improving data collection, cooperation and capacity building. The SRDCP aims to provide guidance to SCRS researchers, by prioritizing those issues related to data collection and research lines on species biology/ecology, fisheries and mitigation measures of sharks captured by fisheries operating in the Convention area. In addition, the SRDCP aims to improve the quality and reduce the uncertainty of the scientific advice on sharks provided to the Commission, and to better assess the impact of management measures on shark species.

*-Small Tunas Year Program (SMTYP)*. Program duration was 2016-2017 with funding from the Commission. The objective was to recover small tuna historical data (statistical and biological data) from the main ICCAT fishing areas giving priority for the collection of historical data in the Caribbean area of Blackfin tuna (BLF), King mackerel (KGM) and Serra Spanish mackerel (BRS). The estimated budget by area for the Western Atlantic was 15,000 € to be distributed between Venezuela and Brazil, but it was never requested.

*-Atlantic Ocean Tropical Tuna Tagging Program (AOTTP)*. The AOTTP is a five-year program funded primarily by the European Union (DCI-FOOD/2015/361-161), other ICCAT CPCs, and other ICCAT funds. The project officially began on 29 June 2015. The overall objective of the AOTTP Program is to contribute to food security and economic growth of the Atlantic coastal states by ensuring sustainable management of tropical tuna resources in the Atlantic Ocean. Specifically, it will provide evidence-based scientific advice to developing Atlantic coastal states, and other ICCAT Contracting Parties, for them to adopt appropriate Conservation and Management Measures within the Framework of the International Commission for the Conservation of Atlantic Tunas (ICCAT). These objectives will be realized by improving the estimation – derived from tag-recapture data – of key parameters for stock assessment (*i.e.* growth, natural mortality, migrations and stock-structure). The Caribbean region is considered one of the areas of interest.

*-Japan Project for the Improvement of Data and Management of Tuna Fisheries (JDMIP)*. Japan initiated the five-year JDMIP in December 2009. The project (2010-2014) had a double objective which including assisting developing CPCs to effectively implement the ICCAT regulatory measures, particularly those related to the control and monitoring of fishing activities, and the improvement of collection, analysis and transmission of data. Following the conclusion of this Project (2014), Japan decided to initiate a new five-year project (Japan Capacity Assistance Project-JCAP). In its different phases, the Project has a Steering Committee comprised of the Executive Secretary, a representative from Japan, the SCRS Chair and the Convener of the SCRS Sub-Committee on Statistics. The Steering Committee meets annually to review funding priorities and project proposals and decides on the granting of funds. The total amount of JDMIP funds reserved for these projects totals €105,362.64. Belize, Venezuela, and Trinidad & Tobago have been recipients of the JDMIP funds.

### **3.4 Japan International Cooperation Agency (JICA)**

*-Caribbean Fisheries Co-Management Project (CARIFICO)*. The Caribbean Regional Fisheries Mechanism (CRFM) has been coordinating this project since 2013 in collaboration with JICA across six Organization of Eastern Caribbean States (OECS) member states. Between 2009 and 2012, CRFM and JICA worked on developing a master plan for the sustainable use of fisheries resources for coastal communities in the Caribbean. The CARIFICO project is a follow up project recommended by the master plan. One emphasis of the project was demonstrating and testing co-management approaches by promoting the development and management of Fish Aggregating Devices (FADs) for harvesting tunas and other pelagic species. In Dominica, where most of the FADs were deployed, fisheries production increased significantly. The overall goal of the project is developing and implementing fisheries co-management approaches in six pilot countries in the Eastern Caribbean and disseminating and sharing the experiences and knowledge acquired to the other Caribbean Community (CARICOM) states. The pilot project field work was done in Antigua and Barbuda, Dominica, Grenada, St Kitts and Nevis, Saint Lucia, and St Vincent and the Grenadines. (CRFM 2017)

*-Project Master Plan Study for Fisheries and Aquaculture Development and Management in the Caribbean.* The project is being implemented at the request of the CRFM located in Belize. This will serve as a baseline study involving analysis of existing market research, ecological research, studies of fish catches and experimental operations. After the study, a final master plan will be drawn up based on the results of the pilot projects. The master plan will incorporate a project to encourage the suitable management of coastal resources through the participation of poor, small-scale fishermen, as well as an aquaculture development project (JICA 2009). The project was signed in 2008, for a duration of three years.

### **3.5 World Bank**

For Latin America and the Caribbean countries, World Bank has 223 project, totaling USD\$ 23.40b in 2480 locations across 29 countries, during the period 2003-2018. Among the countries evaluated in this document, the World Bank has financed projects during the period 2003-2018 in Guyana, Grenada, Dominican Republic, Colombia, Panama, Costa Rica, Honduras, Belize, and Guatemala. Projects in those countries are related to agriculture, environment and natural resources (including the fishery sector), total investment amounts to USD\$ 169.26m. (World Bank 2018a).

*-Ocean partnerships for sustainable fisheries and biodiversity conservation: models for innovation and reform.* The project is under the World Bank coordination. This Project aims to support future pilot public and private sector investment in better managed fisheries targeting migratory stocks that straddle developing countries' coastal jurisdictions (Exclusive Economic Zones) and areas beyond national jurisdiction. The Project contributes directly to the objectives of both the ABNJ Program and the recently convened Global Partnership for Oceans (GPO). Co-financing has been made available through GPO partners and includes existing and planned World Bank IDA/IBRD4 investments. One of the regions participating in this project is the Western Central Atlantic/Caribbean region through "The Billfish Subproject", which focuses on recreational and artisanal fisheries competing to capture declining stocks of billfish species. (FAO 2018j).

*-Assessing Western Central Atlantic Blue Marlin Habitat Range and Occupancy Relative to Exposure to Fishing Operations by Pop-off Archival Satellite Tagging* (World Bank 2018b). The Project has as primary objective for this activity to define billfish habitat use and quantify risk of exploitation in cohabitation with commercial fisheries and improve models of life history necessary for assessing blue marlin in the central Western Atlantic. The project will require assessing the spatial-temporal distribution of fishing effort in recreational and commercial fisheries in addition to deploying the satellite tags, and integrating compatible satellite generated oceanographic data. The Satellite Tagging Study must be carried out in close coordination with the sub-regional Executing Agency (WECAFC/FAO) to ensure that the latter is complementary with other studies being programmed under the OPP, and that the study findings directly contribute towards the development of business cases by WECAFC/FAO. Among other important information, the satellite tagging study of Caribbean billfish will shed light on the 'key resources' on which the business case value proposition depends and will help improve the viability of the resulting investment proposal by explicitly describing the various types of risk that might otherwise prevent private capital from flowing in, including biological, regulatory and commercial risk among others.

### **3.6 European Union**

*-Project ACP (African, Caribbean, and Pacific Group of States) FISH II - Strengthening fisheries management in ACP Countries.* Sector(s): Agriculture and rural development - Economic development. Date: 06/2009 - 12/2013. Client / Beneficiary: Secretariat of the ACP Group of States. Financing Agency: 9<sup>th</sup> European Development Fund. Project Value: 8,795,680 €. ACP Fish II is a project managed by AESA (Agriconsulting Europe S.A.) that aims at strengthening fisheries sectoral policy development and implementation in ACP countries, by helping each ACP region and partner country to draw up and implement a strategy for the sustainable development of the fishery sector, and enabling ACP regions and states themselves to identify and articulate their policy objectives, decide on how they intend to achieve those objectives, ensure that there is a consistency between policy objectives and the legislation intended to deliver those objectives, and to find solutions for obstacles that stand in the way of good policy being effectively implemented. By this service contract AESA manages and implements the program through a Coordination Unit (CU) based in Brussels and six Regional Facilitation Units (RFUs) located within ACP countries. (AESA 2018). Caribbean ACP countries include: Antigua and Barbuda, Belize, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia - St. Vincent & the Grenadines, Suriname, Trinidad & Tobago.

*-Project Enhancing Regional Food Security – Fisheries, Caribbean Natural Resources Institute (CANARI).* Sector: Fisheries development, Food Security. EU Contribution: EUR 1,032,099. From January 2013, CANARI, in collaboration with the Centre for Resource Management and Environmental Studies of the University of the West Indies (UWI-CERMES), Panos Caribbean, Caribbean Network of Fisherfolk Associations (CNFO) and the Caribbean Regional Fisheries Mechanism (CFRM), has been implementing the Strengthening Caribbean Fisherfolk to Participate in Governance project, under its Coastal and Marine Livelihoods and Governance Program. The overall objective is to improve the contribution of the small-scale fisheries sector to food security in the Caribbean through building the capacity of regional and national fisherfolk organization networks to participate in governance. The four-year project is targeting the CNFO and fisherfolk organizations in the CARICOM/CFRM countries of Anguilla, Antigua and Barbuda, The Bahamas, Belize, Barbados, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Lucia, St Kitts and Nevis, St Vincent and the Grenadines, Suriname, Trinidad and Tobago and Turks and Caicos. The project is being funded by the European Union EuropeAid program and is being managed by the Delegation of the European Union to Guyana, Suriname, Trinidad and Tobago and for the Dutch Overseas Countries and Territories. The budget of the project is 1,032,099 Euros. (CANARI 2017).

### **3.7 Others**

In Guyana, the CARICOM Fisheries Resource Assessment and Management Program (CFRAMP) in collaboration with the Fisheries Department initiated a program in 1995 to strengthen the Fishery Department of Guyana capability of managing their fisheries resource. For this country, the NFMPD (1995) had an estimated investment requirement from government (through grant aid) and from private sector of USD 10.6 million and direct government expenditure of USD 62 million, which was to be recovered through fees and taxes, etc., for necessary improvement in enforcement, organization training, research and infrastructure. (FAO 2000b).

In some cases, countries have developed incentives and offered credits, based on national policies towards the fishery sector. Examples include Barbados commercial bank credit to the fisheries sector in 1998 was US\$ 1.7 million; most of it was for the construction and maintenance of fishing vessels, and for a few processing plants. Also, in the same country, public sector investment in physical infrastructure (fish markets, jetties, harbors, ice and refrigeration plants) exceeded USD 12 million in the last decade (FAO 1999).

## **Discussion**

### **Country profiles**

Country profiles were compiled in several **Tables (1, 2, 3, and 4)** to provide a summarized understanding of the inventory provided in the present study. **Table 1** summarizes the major harvest methods of ICCAT species caught as target and/or by-catch of artisanal/small-scale fisheries by country. The information indicate that the most common gear used to catch ICCAT species by artisanal/small-scale fisheries in the area is hook and line gear, either trolling or handline, and is used as the major gear or in addition to the primary gear when there is a shift in target during the fishing operation. Drift -gillnets can be seen as second most used method of catch, is mostly used by countries within their inshore waters likely over a relatively shallow platform. Longline gear is heavily used by three countries, and to some extent by other three. Artisanal/small-scale fleets from countries using longline gear as their main gear are capable of fishing operations over extended periods of time (>3-5 days), while the rest are likely day trips. **Table 2** summarizes the major groups of ICCAT species caught as target and/or by-catch by artisanal/small-scale fisheries by country. The highest groups of ICCAT species caught by these fisheries are SMT and BIL, of which four countries (Barbados, Grenada, Venezuela, and Dominican Republic) have the highest take of BIL species, the case of Trinidad and Tobago is uncertain if is high or moderate because most of the BIL catch would likely be from Tobago, and as indicated earlier Tobago reports on ICCAT species catch is very limited and uncertain. In the case of Curaçao, BIL catches are not as high as the other countries but there is indication of higher levels than recorded. Sharks species are moderately caught across all countries, mostly by those using artisanal/small-scale fisheries using drift-gillnet gear. In countries where sharks are a part of the fisher-folk diet (Guyana, Suriname, Venezuela, Trinidad, Nicaragua, Colombia), the shark catch may be higher, but due to misidentification of species is not clear how much of the shark species under ICCAT's mandate are being caught nor what fraction of the population (juveniles or adults) is being caught. High take of major tunas is from two countries (Barbados and Grenada) which have developed an important export tuna industry from the artisanal/small-scale fisheries, the rest of the countries that take major tunas are traded in local markets. Finally, the SMT that represents the most important group of ICCAT species caught by artisanal/small-scale fisheries consists of three species of great value to all countries, dolphinfish (DOL, recently included in the SMT group), king and Brazilian mackerel (KGM/SER), and blackfin tuna (BLF).

There is a high level of uncertainty (UNCERTAIN) across some species groups which come from countries (mostly Central America's CPCs) that do not show any level of ICCAT species caught by its artisanal fisheries.

**Tables 3 and 4** give indication where the limitations on data collection and reporting of ICCAT species caught as target and/or by-catch from artisanal/small-scale fisheries are present and where the strategic investment would likely be needed. In **Table 3**, only one country (Barbados) has a data collection and reporting program that meets the standard requirements for ICCAT reporting, and four countries (Curaçao, Grenada, Trinidad & Tobago, Venezuela) that show some sort of limitations in their programs, either at the data collection, at the reporting parts of their programs, or both. In the case of Trinidad & Tobago, limitations differ between islands, whereas in Venezuela the limitations are between artisanal fisheries, and in Curaçao is between artisanal and industrial fisheries. In the rest of the countries, the results indicate that the program is either poor or the limited information available deems them uncertain. On those countries with operating programs (Barbados, Curaçao, Grenada, Trinidad & Tobago, Venezuela), all have limitations of their trained personnel, either because they were reduced to a bare minimum or the lack of thereof. There are an important group of countries where the program and trained personnel is poor or at best uncertain, likely due to their low catches of ICCAT species in their artisanal fisheries. It is likely that almost all countries would require assistance in ICCAT species identification, and the levels of needs required varies among them. In the case of Barbados, its assistance would likely be directed at species identification; whereas for Trinidad & Tobago the level of needs would vary between the islands; in Venezuela the level of needs would vary between artisanal fisheries, and in Curaçao the needs would be on the artisanal fishery itself. In the case of the rest of the countries, the needs would be high because it would require support at all levels, i.e., data collection and reporting, trained personnel, and species identification. **Table 4** summarizes the areas of potential strategic investment on artisanal/small-scale fisheries that catch ICCAT species as target and/or by-catch for the countries in the scope of the study. The table indicate the major areas of strategic investments for the enhancement of data collection and reporting of ICCAT species from those fisheries, which are the program itself and capacity building of trained personnel. The level of ICCAT investment in Grenada, would be high, moderate in Curaçao, Trinidad & Tobago and Venezuela. In the case of Grenada, the needed investment although high, it would likely be reduced if the business cases advanced by the CBP/WECAFC are put in place. In the cases of Trinidad & Tobago and Venezuela, the moderate level of ICCAT investment would depend on the progress of the FAO project underway in Trinidad & Tobago, and on the continued ICCAT support on the Venezuelan artisanal fisheries. However, the level of investment in the Venezuelan case would rise to high if continued financial support continues to decline over the next coming years, as the established platform for data collection and reporting will heavily deteriorate in the next coming years. For Curaçao, the investment would depend on the need for trained personnel (likely 1-2) in data collection at the main landing port (likely 1-2). The level of ICCAT investment in Barbados would be relatively low because their main limitation is at species identification. In the case of the remaining ICCAT CPCs, the level of ICCAT investment would be high if the SCRS wishes to pursue the level of shark catches at the species level and the part of the population that is being exploited.

### **Financial support**

Similar to the West Africa Region study by Kebe (2015), there has been a considerable amount of financial resources invested in the Caribbean and Central American Region in fishery matters made by several technical and financial partners (TFP). In general terms, the investments fall with the same categorization established in the West Africa Region study (Kebe 2015), namely: a) Fishery governance, b) Improved landing facilities, c) institutional support, and d) Capacity building and improvement of data collection. The TFPs that have directed funds to enhance data collection and reporting of artisanal/small-scale fisheries include FAO and ICCAT. However, the investments have been made from specific program funds towards specific objectives within data collection and capacity building, even within ICCAT data funds. In the case of ICCAT, the Enhanced Program for Billfish Research directed funds towards data collection and capacity building of billfish species, while the JDMIP directed funds towards data collection and capacity building from artisanal fisheries targeting ICCAT species, the ideal situation, but it was limited in time and duration. Experiences from the success of the JDMIP on enhancement of data collection and capacity building of artisanal fisheries targeting ICCAT species should be explored.

FAO is the other TFP that has provided funds for improvement of data collection and capacity building in the region. However, the financial entities differ. Among these are a GEF funded project, *The Climate Change Adaptation of the Eastern Caribbean Fisheries Sector Project (CCAFISH)*, in which Trinidad & Tobago is the only country advancing on the development of a new Fisheries Statistics and Management Information System. Another partnership of financial entities which include GEF, The World Bank among others, and under WECAFC coordination is the Caribbean Billfish Project, which within its project components include the development of a regional data base for ICCAT species of interest, mainly billfish caught by ICCAT CPCs and non-ICCAT CPCs. The development of such a data base would be in the best interest of ICCAT, particularly from countries that are not part of ICCAT.

## Other issues

Artisanal fisheries using moored FADs to concentrate fish has become an issue across the region. This fishing practice in the countries within the scope of the study was not relevant, with the exception of Curaçao which uses oil-tankers as moored FADs during night time fishing for large pelagic fishes, but no detail reports of this practice exists. However, one country that is not an ICCAT member country, Dominican Republic, rely almost entirely on moored FADs to target ICCAT species. The Caribbean Billfish Project is advancing in helping to develop a private trust fund that would contribute to manage the FAD fishery targeting billfish in the eastern part of the island. ICCAT would be in a position to offer technical assistance in the data recording. Therefore, it would be in ICCAT's best interest to closely monitor the development of such endeavor.

## Conclusions

According to the level of concern that can be extracted from ICCAT's recommendations and the species stock status. The species groups of major concern which are commonly caught as target and/or as by-catch by artisanal/small-scale fisheries by countries in the scope of this study are the billfishes, followed by sharks, and the small tunas which is the group with very limited information.

Billfishes (blue marlin, white marlin, and sailfish) are harvested in substantial numbers mainly by artisanal/small-scale longline fleets of Barbados, Grenada, and Venezuela; followed by drift-gillnet fishery in Venezuela, and by hand-line (trolling, drop-line) fisheries around moored FADs in Dominican Republic. Of these countries, Barbados and Grenada, the billfish catch is a by-catch of their objective catch, i.e., tropical tunas for the export market; however, billfish are part of the local's diet and all the catch is commercialized locally. In Venezuela and Dominican Republic, the billfish are targeted they form part of their diet and is considered a food security issue nowadays. Other countries that catch billfish (likely as by-catch of small tunas, i.e., dolphinfish or wahoo) are Tobago and Curaçao using hand-lines (mostly trolling). However, the level of the amount of billfish (by species) caught is unclear due to limited monitoring of the catch from those fisheries.

Sharks are caught as by-catch across almost all countries and all fleets. In general, sharks are likely consumed locally or traded regionally for their meat and/or other products (i.e., oil, skin, fins, cartilage, and jaws). The level of catch varies between countries, most likely due to their local traditions of consumption in countries like Trinidad, Venezuela, Guyana, Suriname, Nicaragua, Guatemala, Belize, Dominican Republic, Colombia, and to a lesser degree, Barbados, Curaçao, Grenada. The biggest issues on the shark catches are the correct species identification and the knowledge of part of the population being caught. Considering that ICCAT has several recommendations on catch limitation or prohibition of specific sharks, which are likely taken by some of these countries' fleets, it is of great concern what actually is being taken from the artisanal fleets of these countries.

The species of major interest within the small tuna group of the countries with the scope this study are dolphinfish/dorado (*Coryphaena hippurus*, recently included in ICCAT) and wahoo (*Acanthocybium solandri*), followed by blackfin tuna (*Thunnus atlanticus*). Since dolphinfish has been recently included in ICCAT, Task I data for the species is incomplete, efforts are needed to include the historical data that exists in these countries into ICCAT databases, similarly with the other species of the small tuna group. Most countries were not aware that this species catches needed to be reported to ICCAT, particularly countries that do not have industrial fisheries. Further reach out would be needed, if the SCRS wishes to further complete its knowledge of catches from these species, particularly when most of these countries do not have the level of capacity to report to ICCAT the increasing demanding data now required.

Barbados, Grenada, Venezuela, Dominican Republic, Tobago, and Curaçao have different levels of limitations on data collection and reporting of species of high concern to ICCAT (i.e., billfishes and sharks). The needs vary by country, but if those needs are not met, maintained or increased with technical support and financial aid it is likely that data reporting from these fisheries will decrease, or disappear completely. In the rest of the countries of this study with limited catch on ICCAT species of concern, particularly those catching sharks, needs on data collection and species identification, and technical support are high if the SCRS wishes to advance on the knowledge of sharks caught by these fisheries.

As stated earlier, taking into consideration ICCAT species of major concern in this study, the level of ICCAT investment in Grenada, would be high, and moderate in Curaçao, Trinidad & Tobago and Venezuela. In the case of Grenada, the needed investment although high, it would likely be reduced if the business cases advanced by the CBP/WECAFC are put in place. In the cases of Trinidad & Tobago and Venezuela, the moderate level of ICCAT investment would depend on the progress of the FAO project underway in Trinidad & Tobago, and on the continued ICCAT support on the Venezuelan artisanal fisheries. However, the level of investment in the Venezuelan case would rise to high if continued financial support continues to decline over the next coming

years, as the established platform for data collection and reporting will heavily deteriorate in the next coming years. For Curaçao, the investment would depend on the need for trained personnel (likely 1-2) in data collection at the main landing port (likely 1-2). The level of ICCAT investment in Barbados would be relatively low because their main limitation is at species identification. In the case of the remaining ICCAT CPCs, the level of ICCAT investment would be high if the SCRS wishes to pursue the level of shark catches at the species level and the part of the population that is being exploited.

In countries that are not an ICCAT member, in particular Dominican Republic, which rely almost entirely on moored FADs to target ICCAT species. The Caribbean Billfish Project is advancing in helping to develop a private trust fund that would contribute to manage the FAD fishery targeting billfish in the eastern part of the island. ICCAT would be in a position to offer technical assistance in the data recording. Therefore, it would be in ICCAT's best interest to closely monitor the development of such endeavor.

In general terms, the investments fall with the same categorization established in the West Africa Region, namely: a) Fishery governance, b) Improved landing facilities, c) institutional support, and d) Capacity building and improvement of data collection. The organizations that have directed funds to enhance data collection and reporting of artisanal/small-scale fisheries include FAO and ICCAT. However, the investments have been made from specific program funds towards specific objectives within data collection and capacity building, even within ICCAT data funds. Experiences from the success from programs on enhancement of data collection and capacity building of artisanal fisheries targeting ICCAT species should be explored.

Harmonization between TFPs in the region is critical to optimize investments and results on data collection and reporting within the region. The WECAFC has a long history of promoting sustainable fisheries management within the geographically, culturally and politically complex Caribbean region. The Caribbean Billfish Project (CBP) has highlighted various opportunities through which a collaborative drive by both ICCAT and the WECAFC could improve the management of shared stocks which fall within the RFMO mandate of ICCAT. The business cases being proposed by the CBP for Grenada and the Dominican Republic, represent opportunities to address the many data issues discussed throughout this document, and to pursue the sustainable management of both FADs and longline fisheries that target tuna and tuna-like species within the WECAFC area of competence. Strategic financing of opportunities to scale up successes from these projects pilot studies, and ongoing implementations of their resultant business cases, on a regional scale will help these successes reach their ultimate goal of achieving the sustainable management of billfish species. Therefore, any cooperative support that can be achieved to ensure that scaling up national successes on regional scales and beyond will benefit both ICCAT and the WECAFC, in particular for those countries that are not part of ICCAT.

## **Recommendations**

- SCRS would need to prioritize the level of investment for data enhancement programs for artisanal/small-scale fisheries within the Caribbean/Central America Region.
- Countries with artisanal/small-scale fisheries in the Caribbean/Central America Region that catch species of great concern in ICCAT (e.g., billfishes and sharks) should be encouraged to declare their interest in data enhancement programs on capacity building by presenting a scientific document at any of the SCRS species group meetings.
- Investments on capacity building on data collection and reporting, and species identification workshops caught by artisanal/small-scale fisheries for all countries within the scope of the study are required urgently considering the deficiencies in the catch matrix for several ICCAT species of interest caught by those fisheries.
- Medium to long term data enhancement programs for artisanal/small-scale fisheries in countries with major catches of species of great concern in ICCAT (e.g., billfishes and sharks).
- Harmonization between TFPs are strongly encouraged and needed, particularly with WECAFC/FAO since all countries in the region are members of the organization and the synergy to be created between ICCAT and WECAFC will likely facilitate cooperation and enhancement in data collection of ICCAT species of concern within the region.

## Acknowledgements

The present report benefited from the support and knowledge of several friends, scientists, and key fishery officers across the region, among them are, Roy Bealey (WECAFC), Christopher Parker (Fisheries, Barbados), Joyce Leslie (Fisheries, Barbados), Louanna Martins (Fisheries, Trinidad), Lara Ferreira (Fisheries, Trinidad), Terrance Holmes (Fisheries, Tobago), Ruth Redman (Fisheries, Tobago), Aymen Charef (FAO, Rome), Pieter van Baren (WWF, Curaçao), Ramon Chong (MED, Curaçao), Stephen Mambi (MED, Curaçao), Faisal Dilrosun (GMN, Curaçao), Franklin Confesor (MED, Curaçao), Michael Suarez (MED, Curaçao), David Die (RSMAS, Miami), Papa Kebe (Senegal), and Jeremy Mendoza (WECAFC). To all of them my sincere thanks for their contributions. The ICCAT Secretariat is acknowledged for their support.

## References

- AESA. 2018. Strengthening fisheries management in ACP Countries. *In* AESA Agriconsulting Europe S.A. [online]. Updated 2018. [Cited 10 April 2018]. <http://www.agriconsultingeuropa.be/en/gallery/strengthening-fisheries-management-acp-countries-acp-fish-ii>
- Arocha, F., Ortiz, M., Barrios, M., Debrot, D. and Marcano, L. 2009. Catch rates for sailfish (*Istiophorus albicans*) from the small-scale fishery off La Guaira, Venezuela: period 1991-2007. ICCAT, Col. Vol. Sci. Pap., 64: 1844-1853.
- Arocha, F., Pazos, A., Larez, A., Marcano, J. and Gutierrez, X. 2013. Enhanced monitoring of large pelagic fishes caught by the Venezuelan artisanal off-shore fleet targeting tuna and tuna-like species in the Caribbean Sea and adjacent northwestern Atlantic waters: A preliminary analysis. ICCAT, Col. Vol. Sci. Pap., 69: 1317-1332.
- Arocha, F. and Mendoza, J. 2015. Country Review, Venezuela. *In* Singh-Renton, S. and McIvor, I. Review of current fisheries management performance and conservation measures in the WECAFC area. FAO Fisheries and Aquaculture Technical Paper No. 587, Bridgetown, Barbados, FAO, pp. 293.
- Arocha, F., Larez, A., Pazos, A., Gutiérrez, X., Marcano, L. and Silva, J. 2015a. Billfish catch in the Venezuelan artisanal off-shore pelagic longline fleet: past and present (1986-2013). ICCAT, Col. Vol. Sci. Pap. 71: 2203-2216.
- Arocha F., Pazos, A., Larez, A., Silva J., and Gutierrez, X. 2015b. Enhanced monitoring of large pelagic fishes caught by the Venezuela artisanal off-shore fleet targeting tuna and tuna-like species in the Caribbean Sea and adjacent northwestern Atlantic waters: Final analysis. ICCAT, Col. Vol. Sci. Pap. 71: 2316-2333.
- CANARI. 2017. Strengthening Caribbean fisherfolk to participate in governance. *In* CANARI Caribbean Natural Resources Institute [online]. Updated November 2015. [Cited 20 April 2018]. <http://www.canari.org/strengthening-caribbean-fisherfolk-to-participate-in-governance>
- Castro, E.R., Bent, H., Ballesteros, C. and Prada, M. 2007. Large Pelagics in the Southern Section of the Seaflower Marine Protected Area, San Andres Archipelago, Colombia: A Fishery in Expansion. *Gulf and Caribbean Research* 19 (2): 131-139.
- CLM Project. 2017. The UNDP/GEFCLME+ Project. *In* UNOPS, Caribbean and North Brazil Large Ecosystems [online]. Updated 2017. [Cited 19 April 2018]. <https://www.clmproject.org/>
- CRFM. 2014. Report of Tenth Annual CRFM Scientific Meeting – Kingstown, St. Vincent & the Grenadines, 10-17 June 2014 - National Reports. CRFM Fishery Report – 2014. Vol. 1, Suppl. 1, pp. 48.
- CRFM. 2017. Caribbean Fisheries Co-Management Project (CARIFICO). *In* CRFM Caribbean Regional Fisheries Mechanism [online] Updated 10 April 2018. [Cited 14 April 2018]. [http://www.crfm.net/index.php?option=com\\_k2&view=itemlist&layout=category&task=category&id=88&Itemid=435](http://www.crfm.net/index.php?option=com_k2&view=itemlist&layout=category&task=category&id=88&Itemid=435)



- Dilrosun, F. 2002. Progress report on Curacao fishery monitoring programme from November 2000 to July 2001. pp. 9-20. In National reports and technical papers presented at the First Meeting of the WECAFC Ad Hoc Working Group on the Development of Sustainable Moored Fish Aggregating Device Fishing in the Lesser Antilles. FAO Fisheries Report No. 683, Suppl. Rome, FAO.
- FAO. 1999. Information on fisheries management in Barbados. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 1999. [Cited 22 April 2018]. <http://www.fao.org/fi/oldsite/FCP/en/brb/body.htm>
- FAO. 2000. Information on fisheries management in Trinidad and Tobago. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2000. [Cited 22 April 2018]. <http://www.fao.org/fi/oldsite/FCP/en/tto/body.htm>
- FAO. 2000b. Information on fisheries management in the Republic of Guyana. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2000. [Cited 22 April 2018]. <http://www.fao.org/fi/oldsite/FCP/en/GUY/body.htm>
- FAO. 2014. Securing fish for the Caribbean. Subregional Office for the Caribbean. Issue Brief #10, October 2014, Barbados, pp. 4.
- FAO. 2016b. Geographic profiles, Fishery and Aquaculture country profile: The Republic of Guyana. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2000. [Cited 15 April 2018]. <http://www.fao.org/fishery/facp/GUY/en>
- FAO. 2016c. Geographic profiles, Fishery and Aquaculture country profile: The Republic of Suriname. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2000. [Cited 13 April 2018]. <http://www.fao.org/fishery/facp/SUR/en#pageSection2>
- FAO. 2018a. Fishery and Aquaculture Country Profiles: Barbados. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2016. [Cited 14 April 2018]. <http://www.fao.org/fishery/facp/BRB/en>
- FAO. 2018b. Fishery and Aquaculture Country Profiles: Belize. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2016. [Cited 14 April 2018]. <http://www.fao.org/fishery/facp/BLZ/en>
- FAO. 2018c. Fishery and Aquaculture Country Profiles: Guatemala. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2016. [Cited 14 April 2018]. <http://www.fao.org/fishery/facp/GTM/en>
- FAO. 2018d. Fishery and Aquaculture Country Profiles: Nicaragua. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2016. [Cited 14 April 2018]. <http://www.fao.org/fishery/facp/NIC/en>
- FAO. 2018e. Fishery and Aquaculture Country Profiles: Panama. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2016. [Cited 14 April 2018]. <http://www.fao.org/fishery/facp/PAN/es>
- FAO. 2018f. Fishery and Aquaculture Country Profiles: Colombia. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated December 2016. [Cited 14 April 2018]. <http://www.fao.org/fishery/facp/COL/es>
- FAO. 2018g. Climate Change Adaptation in the Eastern Caribbean Fisheries Sector. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2018. [Cited 26 April 2018] <http://www.fao.org/in-action/climate-change-adaptation-eastern-caribbean-fisheries/en/>
- FAO. 2018h. Strengthening global capacity to effectively manage ABNJ, Common Oceans - A partnership for sustainability in the ABNJ. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2018. [Cited 26 April 2018] <http://www.fao.org/in-action/commonoceans/projects/strengthening-capacity/en/>

- FAO. 2018j. Operationally Active projects for Organizational Unit, Field Programme Activities. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2018. [Cited 27 April 2018]. <https://extranet.fao.org/fpmis/FPMISReportServlet.jsp?APD=&countryId=&div=FI&fundG=&type=countryprofileopen&lng=EN&qfrs=MISC101&UF=N&typeUF=&colorder=2345&pwb=&sorttype=0>
- FAO. 2018i. Ocean partnerships for sustainable fisheries and biodiversity conservation: models for innovation and reform. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated 2018. [Cited 26 April 2018]. <http://www.fao.org/in-action/commonoceans/projects/ocean-partnerships/en/>
- FAO Western Central Atlantic Fishery Commission (WECAFC). 2018a. Report of the Third Regional Workshop on Caribbean Billfish Management and Conservation of the WECAFC/ OSPESCA/ CRFM/ CFMC Working Group on Recreational Fisheries. Bridgetown, Barbados. 4–6 April 2017. FAO Fisheries and Aquaculture Report No. 1191. Rome, Italy.
- FAO Western Central Atlantic Fishery Commission (WECAFC). 2018b. Report of the FIRMS-WECAFC regional workshop on recreational fisheries statistics in the Caribbean. Nassau, The Commonwealth of the Bahamas, 20–22 June 2017. FAO Fisheries and Aquaculture Report No. 1194. Rome, Italy.
- FishStatJ. 2018. Software for fishery statistical time series. In FAO Fisheries and Aquaculture Department [online]. Rome. Updated 21 July 2016. [Cited 13 April 2018]. <http://www.fao.org/fishery/>
- Funes, M., Zyllich, K., Divovich, E., Zeller, D., Lindop, A., Pauly, D. and Box, S. 2015. Honduras, a fish exporting country: Preliminary reconstructed marine catches in the Caribbean Sea and the Gulf of Fonseca, 1950 – 2010. Working Paper Series #2015-90. Fisheries Centre, University of British Columbia, pp. 16.
- GEF. 2018a. Climate Change Adaptation in the Eastern Caribbean Fisheries Sector. In GEF Global Environment Facility [online]. Updated 2018. [Cited 03 April 2018]. <https://www.thegef.org/project/climate-change-adaptation-eastern-caribbean-fisheries-sector>
- GEF. 2018b. Mainstreaming Biodiversity Conservation into the Operation of the Tourism and Fisheries Sectors in the Archipelagos of Panama. In GEF Global Environment Facility [online]. Updated 2018. [Cited 03 April 2018]. <https://www.thegef.org/project/mainstreaming-biodiversity-conservation-operation-tourism-and-fisheries-sectors-archipelagos>
- GEF. 2018c. Developing Organizational Capacity for Ecosystem Stewardship and Livelihoods in Caribbean Small-Scale Fisheries. In GEF Global Environment Facility [online]. Updated 2018. [Cited 03 April 2018]. <https://www.thegef.org/project/developing-organizational-capacity-ecosystem-stewardship-and-livelihoods-caribbean-small>
- GEF. 2018d. Sustainable management of tuna fisheries and biodiversity conservation in the ABNJ. In GEF Global Environment Facility [online]. Updated 2018. [Cited 03 April 2018]. <https://www.thegef.org/project/sustainable-management-tuna-fisheries-and-biodiversity-conservation-areas-beyond-national>
- Gentner, B., Arocha, F., Anderson, C. Flett, K., Obregon, P., van Anrooy, R. 2018. Fishery Performance Indicators for Grenadian and Dominican Republic Pelagic Fleets: Fishery Profiles and Summary Report, by FAO Fisheries and Aquaculture Circular No. 1162. Rome, Italy. Pp. 68.
- Grandas, Y. and Castro, E. R. 2004. Régimen de captura y esfuerzo en la pesquería artesanal de especies pelágicas en la isla de San Andrés, Caribe occidental. Proceedings of the Gulf and Caribbean Fisheries Institute 55: 223–235.
- Haas, A., Harper, S., Zyllich, K. and Zeller, D. 2015. Reconstruction of Nicaragua’s Fisheries Catches: 1950–2010. Working Paper Series #2015-23. Fisheries Centre, University of British Columbia, pp. 10.
- Harper, S., Guzman, H. M., Zyllich, K. and Zeller, D. 2014. Reconstructing Panama’s Total Fisheries Catches from 1950 to 2010: Highlighting Data Deficiencies and Management Needs. Marine Fisheries Review 76: 51–65.

- Herrera, A., Betancourt, L., Silva, M., Lamelas, P. and Melo, A. 2011. Coastal fisheries of the Dominican Republic. pp. 175–217. In Salas, S., Chuenpagdee, R., Charles, A. and Seijo, J. C. (eds.). Coastal fisheries of Latin America and the Caribbean. FAO Fisheries and Aquaculture Technical Paper No. 544. Food and Agriculture Organization of the United Nations (FAO), Rome.
- Heyman, W.D. and Kjerfve, B. 2001. The Gulf of Honduras. In Seeliger, U. and Kjerfve, B., (eds.), Coastal Marine Ecosystems of Latin America. Springer-Verlag Berlin Heidelberg, New York.
- Hornby, C., Harper, S., MacDonald, J. and Zeller, D. 2015. Reconstruction of Suriname's marine fisheries catches from 1950-2010. Working Paper Series #2015-49. Fisheries Centre, University of British Columbia, pp. 14.
- ICCAT. 2013. ICCAT Report for Biennial Period 2012-13, Part I (2012). SCRS. Vol. 2, pp. 296.
- ICCAT. 2014. Suriname National Report. In ICCAT Report for Biennial Period 2012-13, Part II (2013), Annual Reports Vol. 3:506-517.
- ICCAT. 2015. Suriname National Report. In ICCAT Report for Biennial Period 2014-15, Part I (2014), Annual Reports Vol. 3:582-590.
- ICCAT. 2016a. Guatemala National Report. In ICCAT Report for Biennial Period 2014-15, Part II (2015), Annual Reports Vol. 3: 228-236.
- ICCAT. 2016b. ICCAT Report for Biennial Period 2014-15, Part II (2015). SCRS. Vol. 2, pp. 351.
- ICCAT. 2016c. Special Research Programs. In ICCAT International Commission for Conservation of Atlantic Tunas [online]. Madrid, Spain. Updated 06 May 2016. [Cited 06 April 2018]. <https://www.iccat.int/en/ResProgs.htm>
- ICCAT. 2017. ICCAT Report for Biennial Period 2016-17, Part I (2016). SCRS. Vol. 2, pp. 428.
- ICCAT. 2017a. Barbados National Report. In ICCAT Report for Biennial Period 2016-17, Part I (2016), Annual Reports, Vol. 3: 29-39.
- ICCAT. 2017b. Venezuela National Report. In ICCAT Report for Biennial Period 2016-17, Part I (2016). SCRS. Vol. 2: 11.
- ICCAT. 2017c. Guyana National Report. In ICCAT Report for Biennial Period 2016-17, 2016-17, Part I (2016), Annual Reports Vol. 3: 584-586.
- ICCAT. 2017d. Suriname National Report. In ICCAT Report for Biennial Period 2016-17, 2016-17, Part I (2016), Annual Reports Vol. 3: 588-596.
- ICCAT. 2017e. Belize National Report. In ICCAT Report for Biennial Period 2016-17, Part I (2016), Annual Reports, Vol. 3: 40-48.
- ICCAT. 2017f. Honduras National Report. In ICCAT Report for Biennial Period 2016-17, 2016-17, Part I (2016), Annual Reports Vol. 3: 230-237.
- ICCAT. 2017g. Panama National Report. In ICCAT Report for Biennial Period 2016-17, 2016-17, Part I (2016), Annual Reports Vol. 3: 373-378.
- ICCAT. 2018. ICCAT Report for Biennial Period 2016-17, Part I (2017). SCRS. Vol.2, pp. 426.
- INPESCA 2018. Anuario Pesquero 2015. In Instituto Nicaraguense de la Pesca y Acuicultura [online]. Nicaragua. Updated 23 November 2010. [Cited 13 April 2018]. [http://www.inpesca.gob.ni/index.php?option=com\\_content&view=article&id=18&Itemid=100](http://www.inpesca.gob.ni/index.php?option=com_content&view=article&id=18&Itemid=100)
- JICA. 2018. Lineup of JICA Knowledge Co-Creation Program (Group and Region Focus). [Cited 6 September 2018]

[https://www.jica.go.jp/english/our\\_work/types\\_of\\_assistance/tech/acceptance/training/about/sector/sector14.html](https://www.jica.go.jp/english/our_work/types_of_assistance/tech/acceptance/training/about/sector/sector14.html)  
1

JICA. 2009. Activities in Belize, Major Projects. In JICA Japan International Cooperation Agency [online]. Japan. Updated December 2009. [Cited 14 April 2018].  
<https://www.jica.go.jp/belize/english/activities/activity02.html>

Kebe, P. 2015. Inventory of strategic investments related to artisanal fishery in the West Africa Region. ICCAT, Coll. Vol. Sci. Pap.,71:3085-3105.

Kraan, M. 2017. Frame Survey of Curaçao's fishing fleet. Wageningen, Wageningen Marine Research (University & Research Centre), Wageningen Marine Research report C022/17, pp. 39.

Lalla, H. 2002. National Report of Trinidad and Tobago. In FAO National Reports and Technical Papers Presented at the 1st Meeting of the WECAFC Ad Hoc Working Group on the Development of Sustainable Moored FAD Fishing in the Lesser Antilles - Le Robert, Martinique, 8-11 October 2001. FAO Fisheries Report N° 683.

Lindop, A., Bultel, E., Zylich, K. and Zeller, D. 2015. Reconstructing the former Netherland Antilles marine catches from 1950 to 2010. Fishery Centre Working Paper Series #2015-69. Fisheries Centre, University of British Columbia, pp. 22.

MacDonald, J., Harper, S., Booth, S. and Zeller, D. 2015. Guyana fisheries catches: 1950-2010. Fisheries Centre Working Paper Series #2015-21. Fisheries Centre, University of British Columbia, pp. 19.

Marcano, L. A., Arocha, F., Marcano, J., Larez, A. 2000. Actividades desarrolladas en el Programa expandido de ICCAT para peces de pico en Venezuela, período 1998-1999. ICCAT, Coll. Vol. Sci. Pap. 51: 981-992.

Mohammed, A. and Lindop, A. 2015. Trinidad and Tobago: Reconstructed fisheries catches, 1950-2010. Fisheries Centre Working Paper Series #2015-55. Fisheries Centre, University of British Columbia, pp. 28.

Mohammed, A., Lindop, A., Parker, C. and Willoughby, S. 2015. Reconstructed fisheries catches of Barbados, 1950-2010. Fisheries Centre Working Paper Series #2015-6. Fisheries Centre, University of British Columbia, pp. 28.

Richardson, S. 2013. National Report of Guyana. pp. 23-28. In CRFM. Report of Ninth Annual CRFM Scientific Meeting – Kingstown, St. Vincent & the Grenadines, 10-14 June 2013 - National Reports. CRFM Fishery Report – 2013. Volume 1, Suppl. 1.

Richardson, S. 2014. National Report of Guyana. pp. 11-17. In CRFM. Report of Tenth Annual CRFM Scientific Meeting – Kingstown, St. Vincent & the Grenadines, 10-17 June 2014 - National Reports. CRFM Fishery Report – 2014. Vol. 1, Suppl. 1.

Rodriguez, A., Rueda, M. and Escobar, F. 2015. Evaluación directa de las poblaciones de peces grandes pelágicos del Pacífico y Caribe continental de Colombia. INVEMAR y AUNAP. Serie de Publicaciones Generales de INVEMAR No. 87. Serie de Recursos Pesqueros de Colombia-AUNAP 2015. Santa Marta, Colombia, pp. 120.

Salas, S., R. Chuenpagdee, Charles, A. and Seijo, J.C. (eds). 2011. Coastal fisheries of Latin America and the Caribbean. FAO Fisheries and Aquaculture Technical Paper. No. 544. Rome, FAO, 430 pp.

Singh-Renton, S. and McIvor, I. 2015. Review of current fisheries management performance and conservation measures in the WECAFC area. FAO Fisheries and Aquaculture Technical Paper No. 587, Bridgetown, Barbados, FAO, pp. 293.

SOFRECO. 2013. Support to formulate fisheries management plans for Guyana, Suriname and Trinidad and Tobago. Final Technical Report of the ACP Fish II Project Strengthening fisheries management in ACP states. Updated December 2013. [Cited 15 April 2018]. [http://acpfish2-eu.org/uploads/projects/id146/FTR\\_new.pdf](http://acpfish2-eu.org/uploads/projects/id146/FTR_new.pdf)

- Thomas, A. D., Potts, A. C., Nichols, E. and Mukhida, F. 2000. National report of Trinidad and Tobago – Pelagic and Reef Fisheries. CFRAMP Pelagic Fisheries Assessment Workshop, Caribee Hotel, Barbados, 5 – 7 June, 2000, Department of Marine Resources and Fisheries, Division of Agriculture, Land and Marketing, Tobago, Trinidad and Tobago, pp. 19.
- van Buurt, G. 2002. Island of Curaçao FAD programme. pp. 21-26. In National reports and technical papers presented at the First Meeting of the WECAFC Ad Hoc Working Group on the Development of Sustainable Moored Fish Aggregating Device Fishing in the Lesser Antilles. FAO Fisheries Report No. 683, Suppl. Rome, FAO.
- Weidner, D. M., Laya, G. E., Folsom, W. B. and Serrano J. 2001. Caribbean Islands, Part B, Sections 1-4 in Latin America. World swordfish fisheries: An analysis of swordfish fisheries, market trends and trade patterns IV, National Marine Fisheries Service, Silver Spring, Maryland, pp. 1315.
- World Bank. 2018a. Global search Maps. In World Bank [online]. Updated 2018. [Cited 14 April 2018]. <http://maps.worldbank.org/p2e/mcmap/map.html?code=LCR&level=region&indicatorcode=0553&title=Latin%20America%20And%20Caribbean&org=ibrd>
- World Bank. 2018b. Assessing Western Central Atlantic Blue Marlin Habitat Range And Occupancy Relative To Exposure To Fishing Operations By Pop-off Archival Satellite Tagging. In World Bank [online]. Updated 2018. [Cited 14 April 2018]. [projects.worldbank.org/procurement/noticeoverview?id=OP00041556](https://projects.worldbank.org/procurement/noticeoverview?id=OP00041556)
- Ylitalo-Ward, Heather. 2016. An Introduction to Fishing Methods in Belize. Oceana, pp. 22.
- Zeller, D., Graham, R. and Harper, S. 2011. Reconstruction of total marine fisheries catches for Belize, 1950-2008. pp. 142-151. In Palomares, M. L. D. and Pauly, D. (eds.), Too Precious to Drill: the Marine Biodiversity of Belize. Fisheries Centre Research Reports 19(6). Fisheries Centre, University of British Columbia.

**Table 1.** Major harvest methods of ICCAT species caught as target and/or by-catch of artisanal/small-scale fisheries by country.

<i>Country</i>	<i>Pelagic longline (LL)</i>	<i>Drift gillnet</i>	<i>Troll/handline</i>	<i>FADs</i>
Barbados	YES	SOME	SOME	NO
Curaçao	NO	NO	YES	SOME*
Grenada	YES	NO	SOME	YES
Trinidad & Tobago	SOME	YES	YES	SOME
Venezuela	YES	YES	SOME	NO
Guyana*	NO	YES	SOME	NO
Suriname*	NO	YES	NO	NO
Belize	SOME	SOME	NO	NO
Guatemala	NO	NO	SOME	NO
Honduras	NO	NO	UNCERTAIN	NO
Nicaragua	NO	YES	YES	NO
Panama	NO	NO	UNCERTAIN	NO
Dominican Republic†	SOME	NO	YES	YES
Colombia†	NO	NO	SOME	NO

\* Cooperating Non-Contracting Party; † Non-Contracting Party; \* OIL-TANKER FADs

**Table 2.** Major ICCAT species caught as target and/or by-catch by artisanal/small-scale fisheries by country.

<i>Country</i>	<i>Major Tunas (YFT, BET, SKJ)</i>	<i>Billfish (BUM, WHM, SAI)</i>	<i>Sharks</i>	<i>Small Tunas</i>
Barbados	HIGH	HIGH	LOW	HIGH
Curaçao	MODERATE	LOW‡	LOW	HIGH
Grenada	HIGH	HIGH	LOW	HIGH
Trinidad & Tobago	LOW‡	MODERATE‡	MODERATE	HIGH
Venezuela	MODERATE	HIGH	MODERATE	HIGH
Guyana*	UNCERTAIN	UNCERTAIN	MODERATE	MODERATE
Suriname*	UNCERTAIN	UNCERTAIN	MODERATE	MODERATE
Belize	UNCERTAIN	UNCERTAIN	MODERATE	MODERATE
Guatemala	UNCERTAIN	UNCERTAIN	MODERATE	MODERATE
Honduras	UNCERTAIN	UNCERTAIN	UNCERTAIN	UNCERTAIN
Nicaragua	UNCERTAIN	UNCERTAIN	MODERATE	MODERATE
Panama	UNCERTAIN	UNCERTAIN	UNCERTAIN	UNCERTAIN
Dominican Republic†	MODERATE	HIGH	LOW	HIGH
Colombia†	UNCERTAIN	UNCERTAIN	MODERATE	MODERATE

\* Cooperating Non-Contracting Party; † Non-Contracting Party; ‡Possibly higher.

**Table 3.** Data Limitations on artisanal/small-scale fisheries that catch ICCAT species as target and/or by-catch.

<i>Country</i>	<i>Data collection and reporting Program</i>	<i>Trained personnel</i>	<i>Limitations</i>	<i>Needs</i>
Barbados	GOOD	LIMITED	Trained personnel, Species ID	LOW
Curaçao	LIMITED	LIMITED	Data recording & reporting, Trained personnel, Species ID	MODERATE
Grenada	LIMITED	LIMITED	Data recording & reporting, Trained personnel, Species ID	MODERATE
Trinidad & Tobago	TR: LIMITED; TB: POOR	LIMITED	Trained personnel, Species ID	MODERATE
Venezuela	GN: LIMITED; VAOS: POOR	LIMITED	Data recording & reporting, Trained personnel	MODERATE
Guyana*	UNCERTAIN	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Suriname*	UNCERTAIN	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Belize	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Guatemala	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Honduras	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Nicaragua	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Panama	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Dominican Republic†	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH
Colombia†	POOR	POOR	Data recording & reporting, Trained personnel, Species ID	HIGH

\* Cooperating Non-Contracting Party; † Non-Contracting Party

**Table 4.** Areas of potential strategic investment on artisanal/small-scale fisheries that catch ICCAT species as target and/or by-catch.

<b>Country</b>	<b>Data collection and reporting Program</b>	<b>Trained personnel</b>	<b>Potential Funding Source</b>	<b>Level of investment</b>
Barbados	LOW	MODERATE	ICCAT (BIL, SHK, SMT) ‡	LOW
Curaçao	MODERATE	HIGH	ICCAT (BIL, SHK, SMT)	MODERATE
Grenada	MODERATE	MODERATE	ICCAT (BIL, SHK, SMT)/CBP/WECAFC	HIGH
Trinidad & Tobago	LOW	MODERATE	ICCAT (BIL, SHK, SMT)/FAO	MODERATE
Venezuela	MODERATE	MODERATE	ICCAT (BIL, SHK, SMT)	MODERATE
Guyana*	MODERATE/UNCERTAIN	MODERATE	ICCAT (SHK)	MODERATE/LOW
Suriname*	MODERATE/UNCERTAIN	MODERATE	ICCAT (SHK)	MODERATE/LOW
Belize	HIGH	HIGH	ICCAT (SHK)	HIGH
Guatemala	NA	NA	NA	NA
Honduras	NA	NA	NA	NA
Nicaragua	HIGH	HIGH	ICCAT (SHK)	HIGH
Panama	NA	NA	NA	NA
Dominican Republic†	HIGH	HIGH	CBP/WECAFC (BIL, SHK, SMT)	HIGH
Colombia†	HIGH	HIGH	UNCERTAIN (SHK, SMT, BIL)	HIGH

\*Cooperating Non-Contracting Party; †Non-Contracting Party; ‡The ICCAT species group in parenthesis under the potential funding source column indicates the SCRS species groups that may have interest in the enhancement of data collection from those countries.

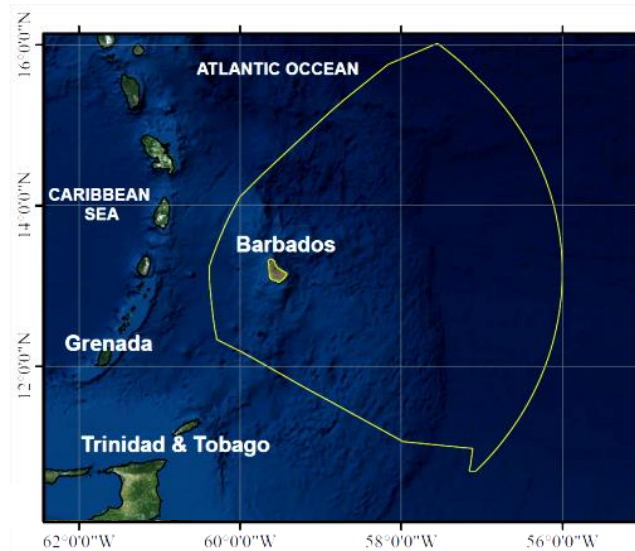


Figure 1. Exclusive Economic Zone (EEZ) of Barbados.

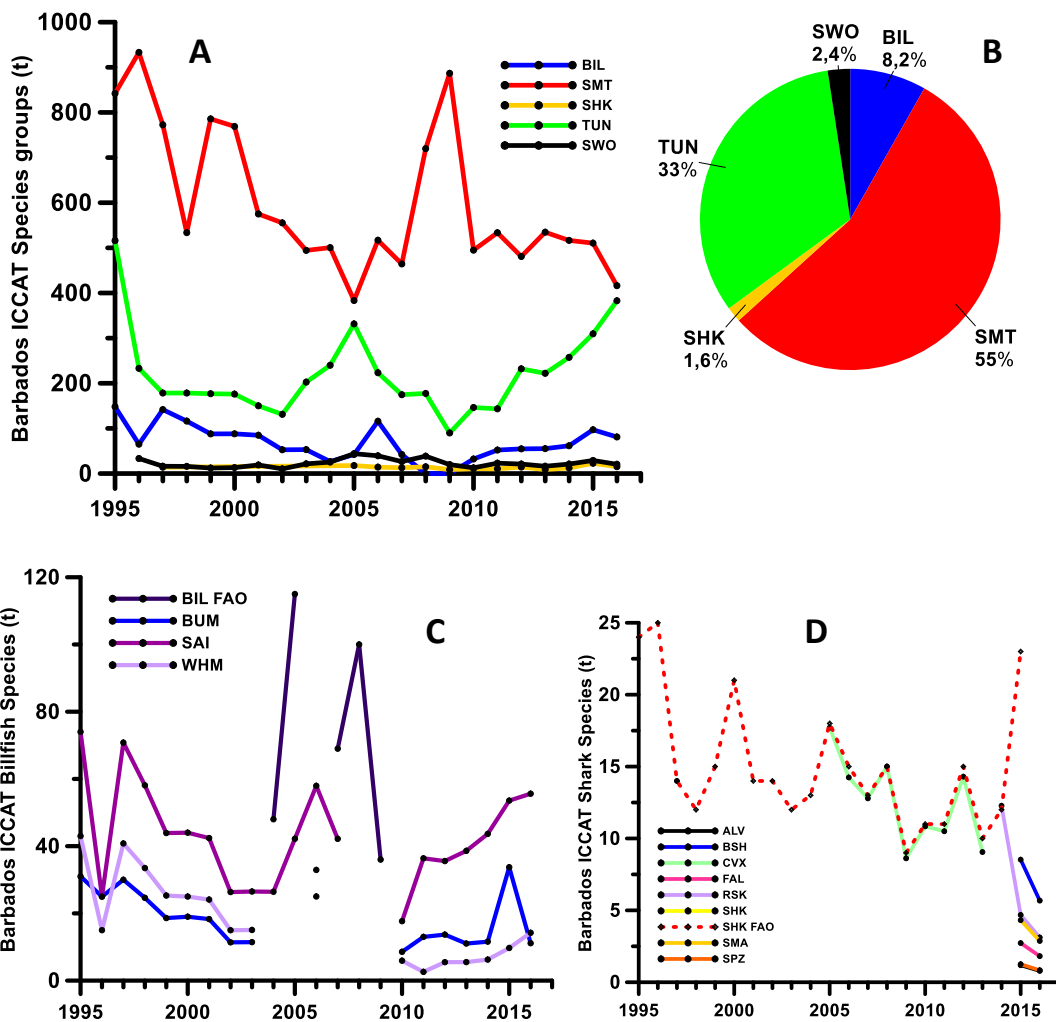


Figure 2. A) Barbados reported Task I catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016; C) Billfish species-specific reported catch to ICCAT and FAO unclassified billfish; D) Shark species-specific reported catch to ICCAT and FAO unclassified shark catch.



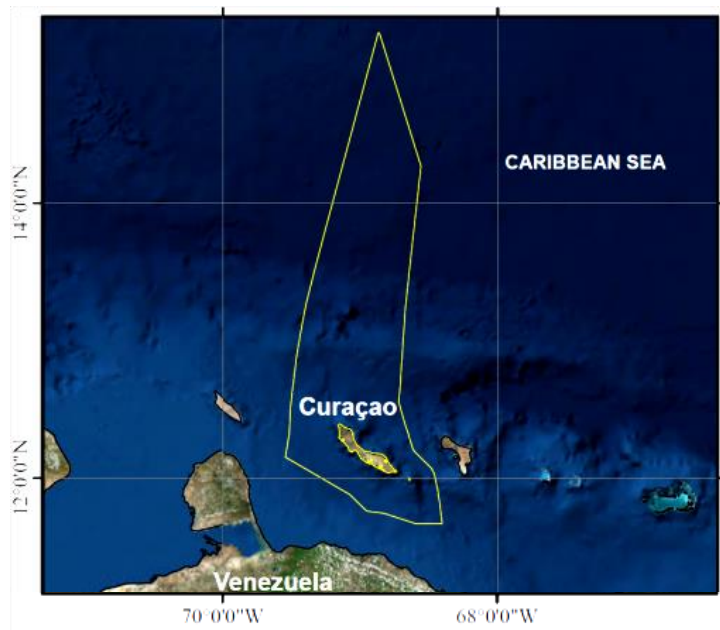


Figure 3. Exclusive Economic Zone (EEZ) of Curaçao.

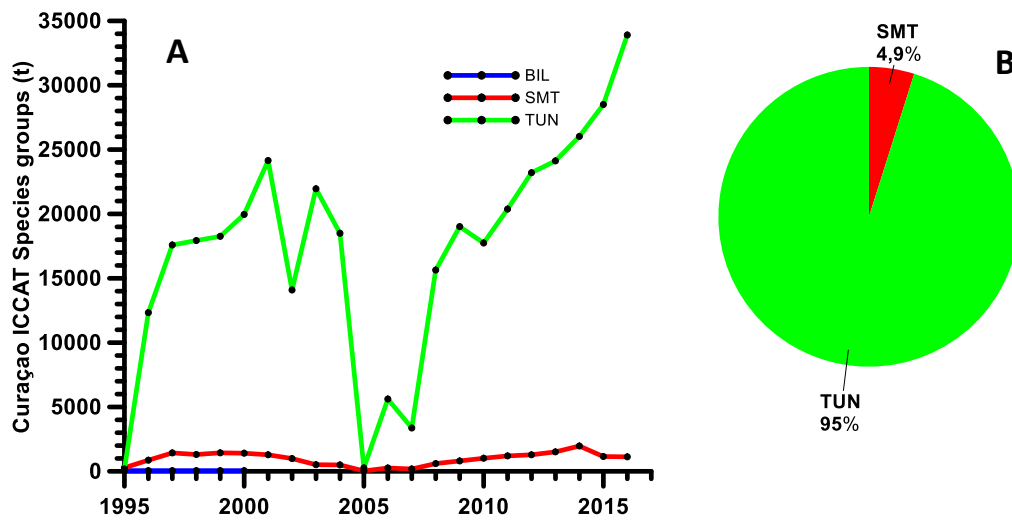


Figure 4. A) Curaçao reported Task I catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016.

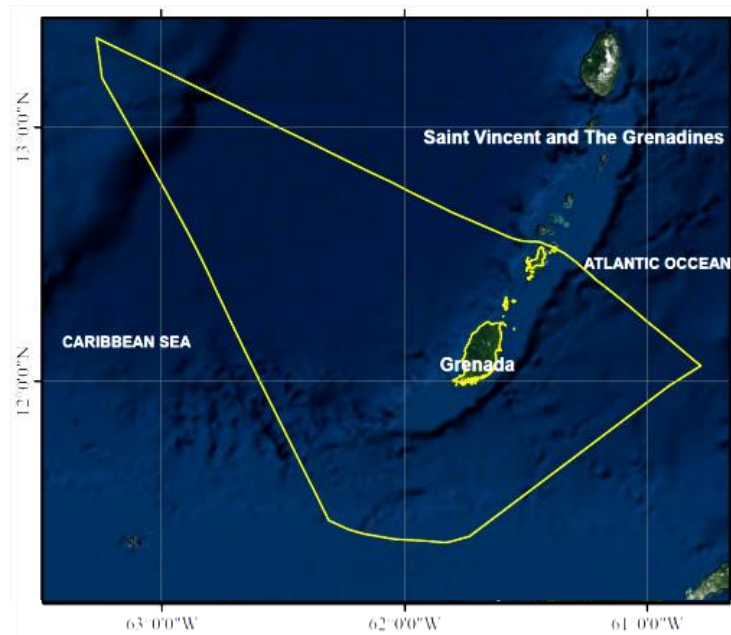


Figure 5. Exclusive Economic Zone (EEZ) of Grenada.

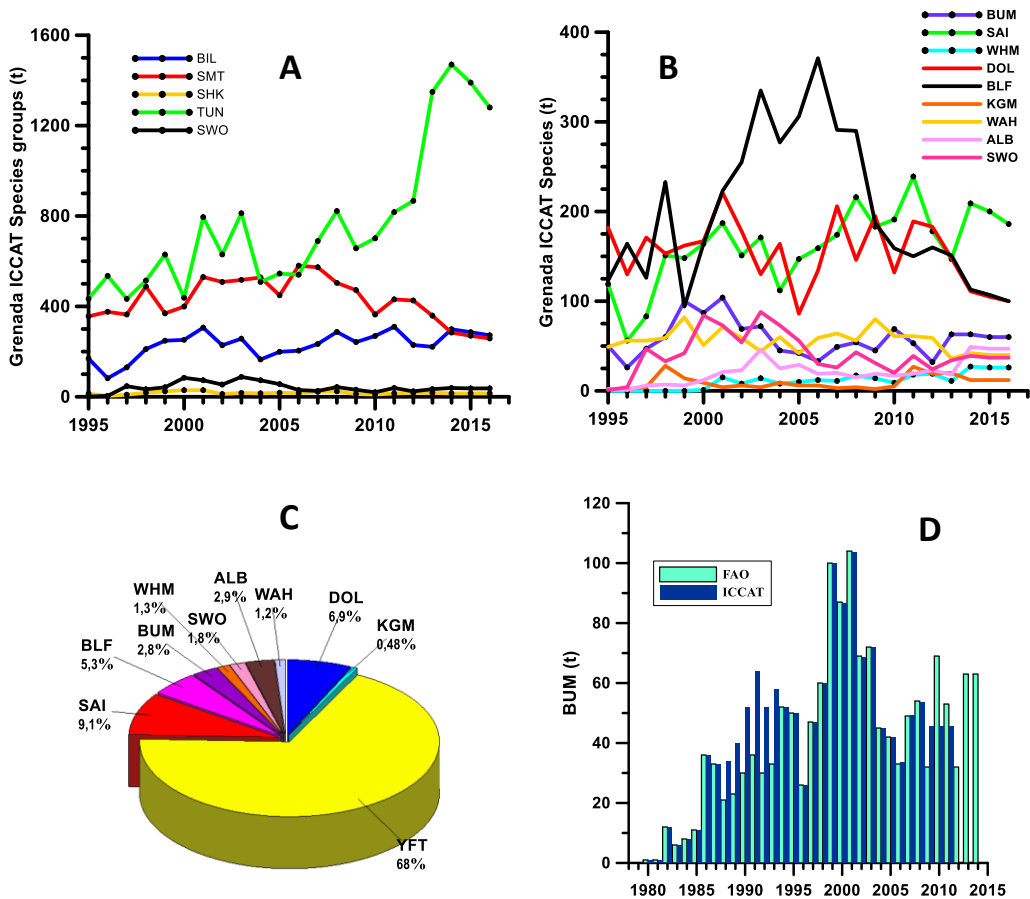
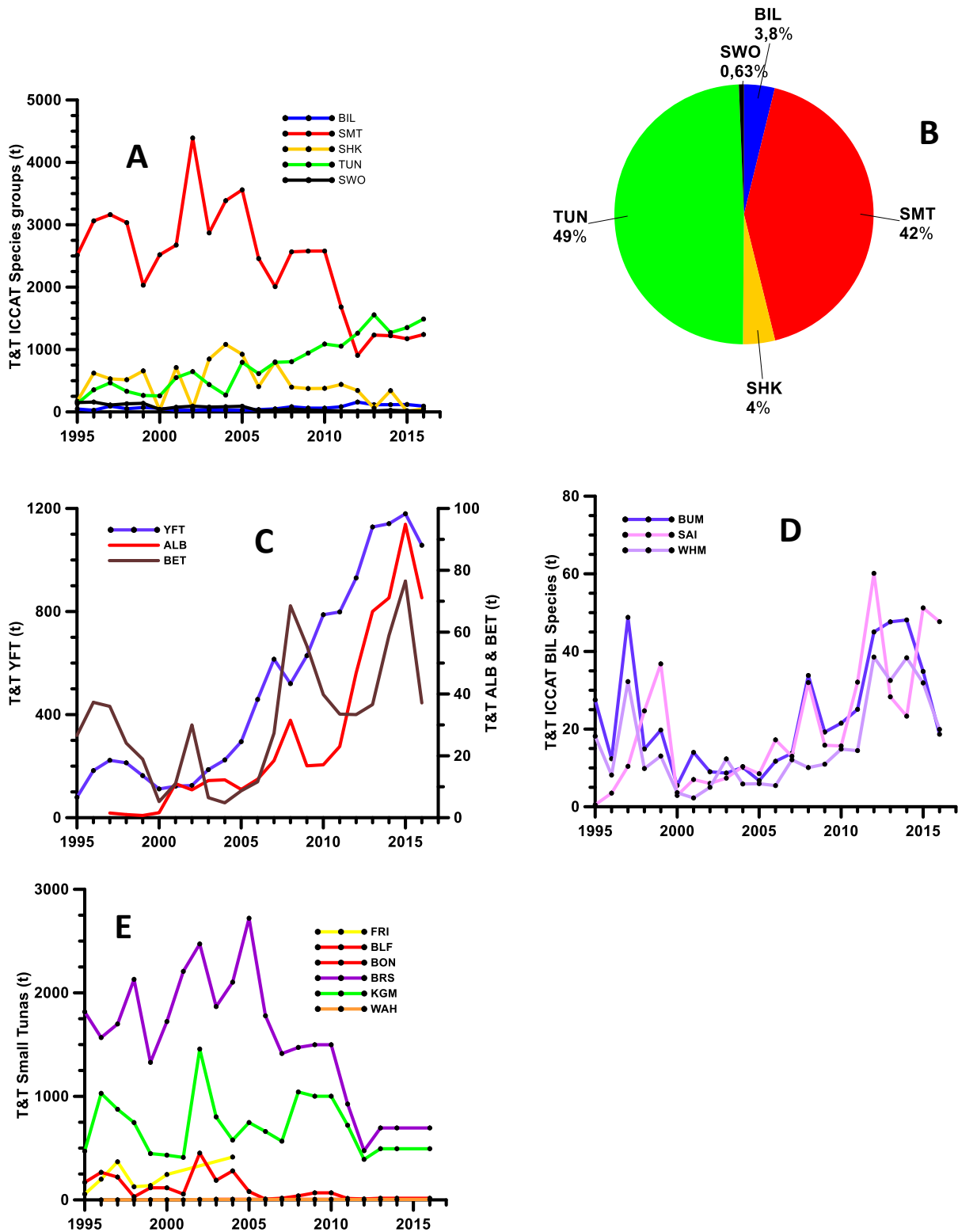


Figure 6. A) Grenada official reported catches of major large pelagic species groups; B) Major large pelagic species from the YFT-bycatch landings; C) Average proportion of major large pelagic species groups in 2013-2016; D) Comparison of blue marlin (BUM) catches from Grenada reported to FAO and ICCAT.



**Figure 7.** Exclusive Economic Zone (EEZ) of Trinidad and Tobago.



**Figure 8.** A) Trinidad and Tobago (T&T) reported Task I catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016 ; C) Reported Task I catch of major tunas; D) Billfish species-specific reported catch to ICCAT; E) Trinidad and Tobago (T&T) reported Task I catches of large pelagic species caught by artisanal fisheries.

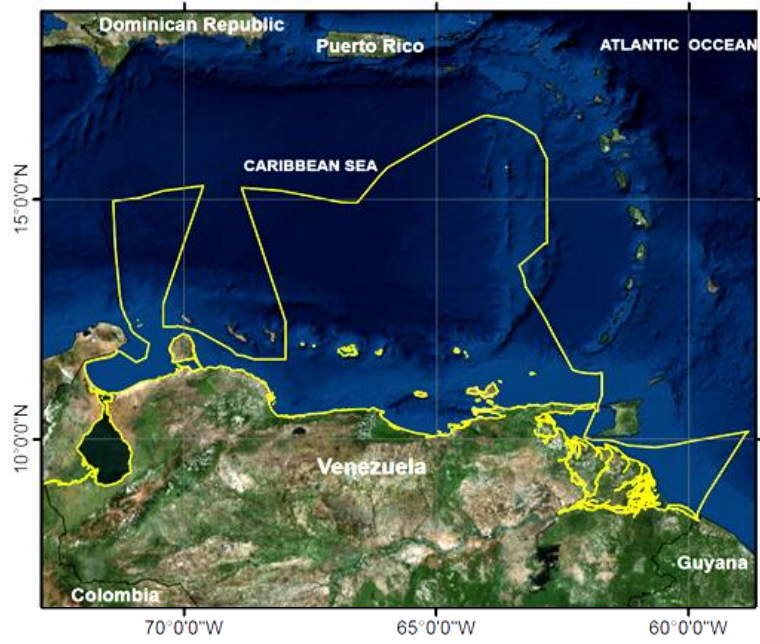
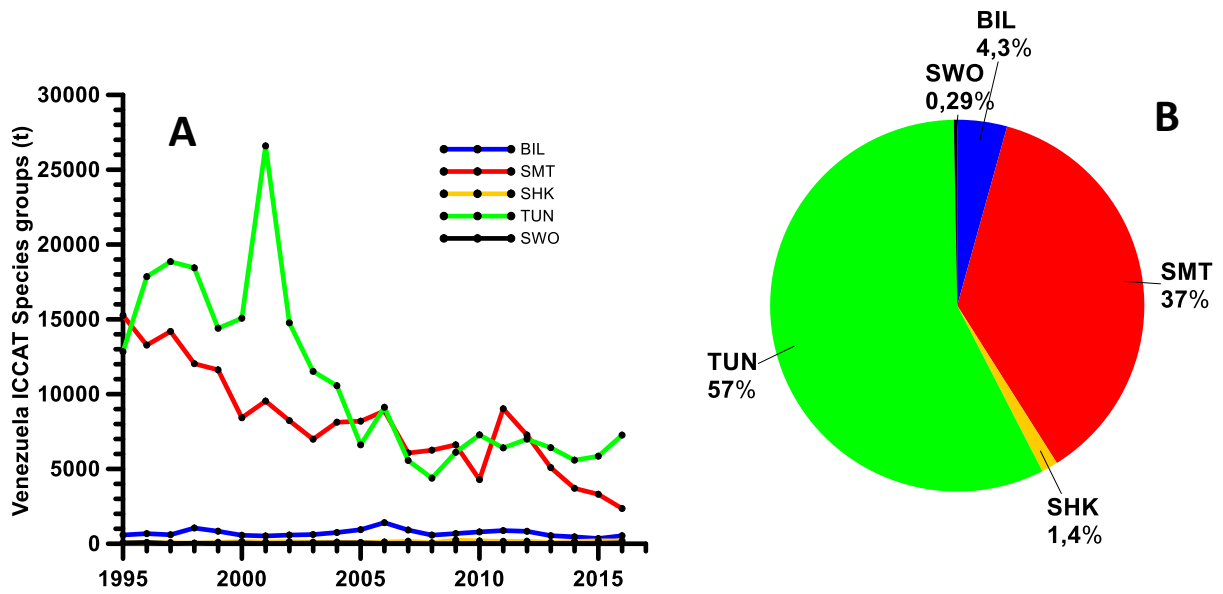
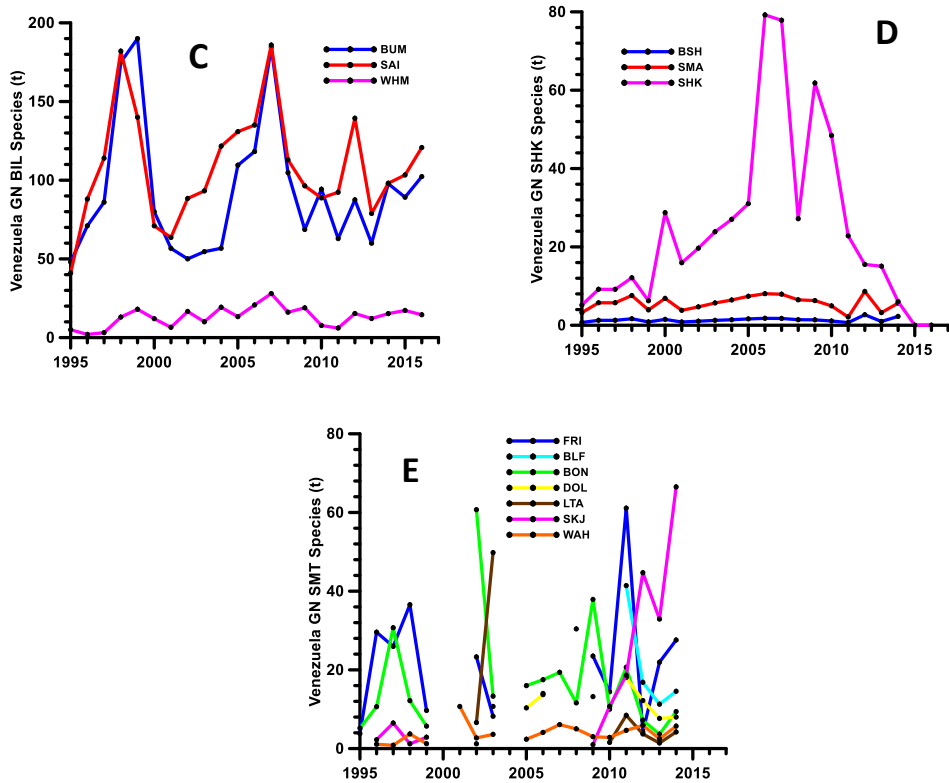
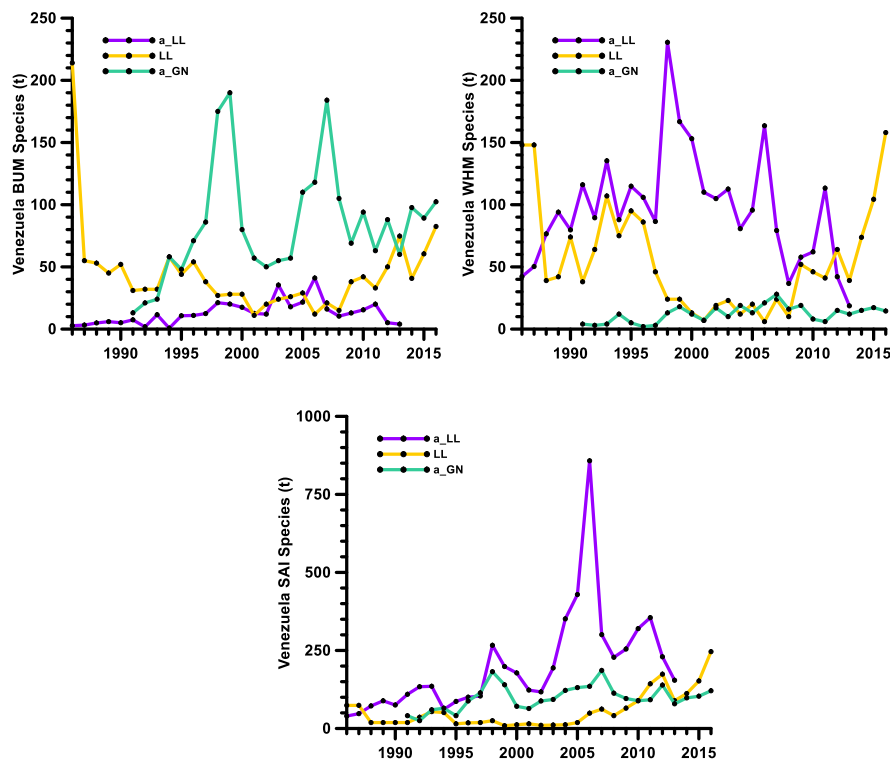


Figure 9. Exclusive Economic Zone (EEZ) of Venezuela.





**Figure 10.** A) Venezuela reported Task I catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016 ; C) Artisanal drift-gillnet fishery reported Task I catch of billfish species; D) Shark catch from the Artisanal drift-gillnet fishery; E) Tuna and small tuna catch from the Artisanal drift-gillnet fishery.



**Figure 11.** Catches of blue marlin (BUM), white marlin (WHM), and sailfish (SAI) by the different Venezuelan fisheries (artisanal LL, industrial LL, and artisanal drift-gillnet) during 1986-2016.

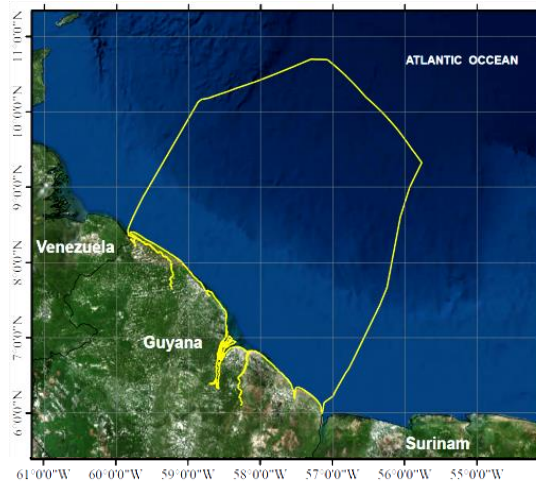


Figure 12. Exclusive Economic Zone (EEZ) of Guyana.

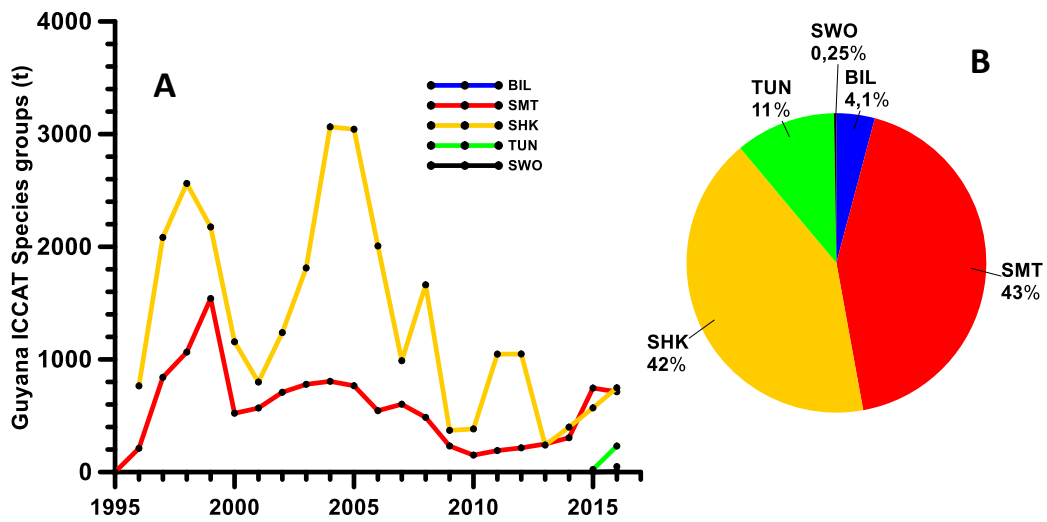


Figure 13. A) Guyana reported Task I catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016.

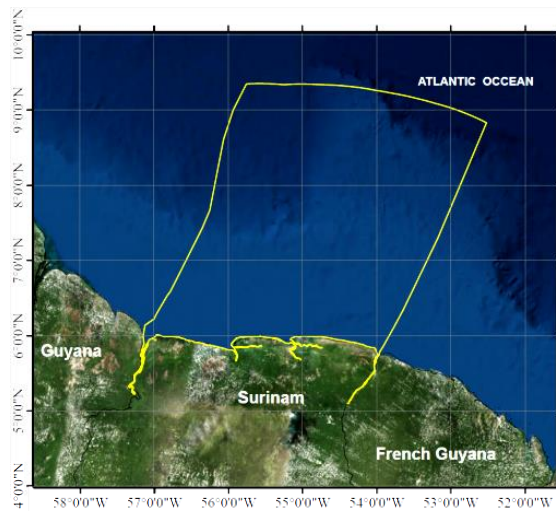
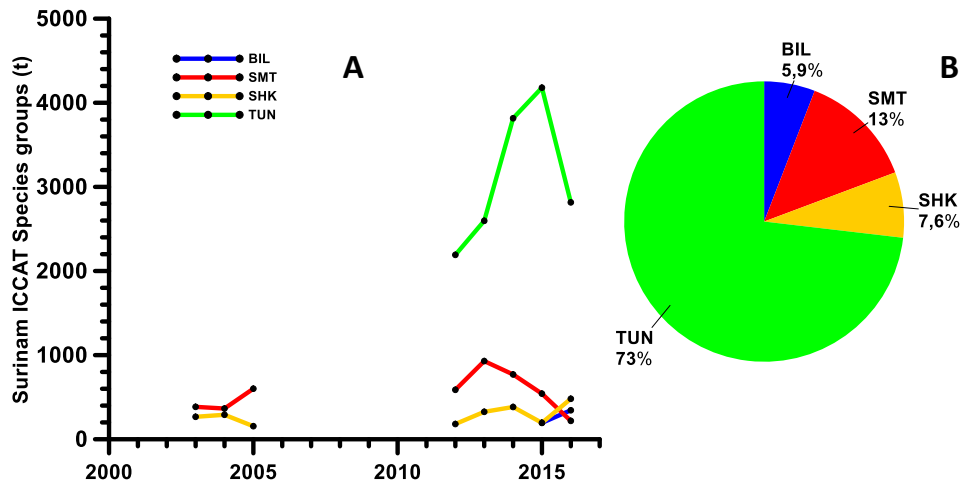
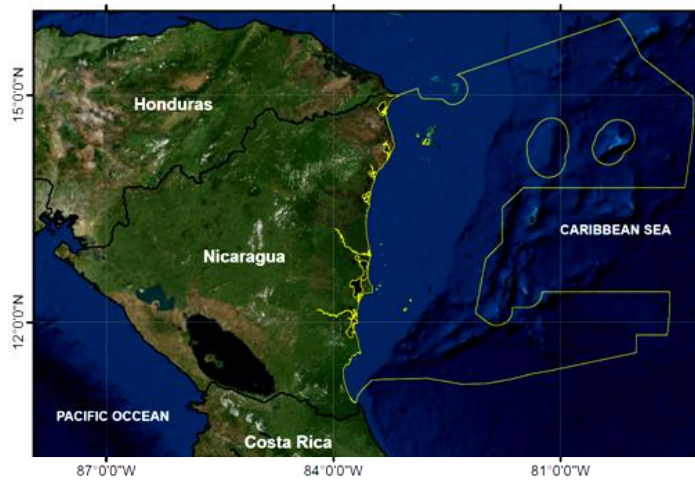


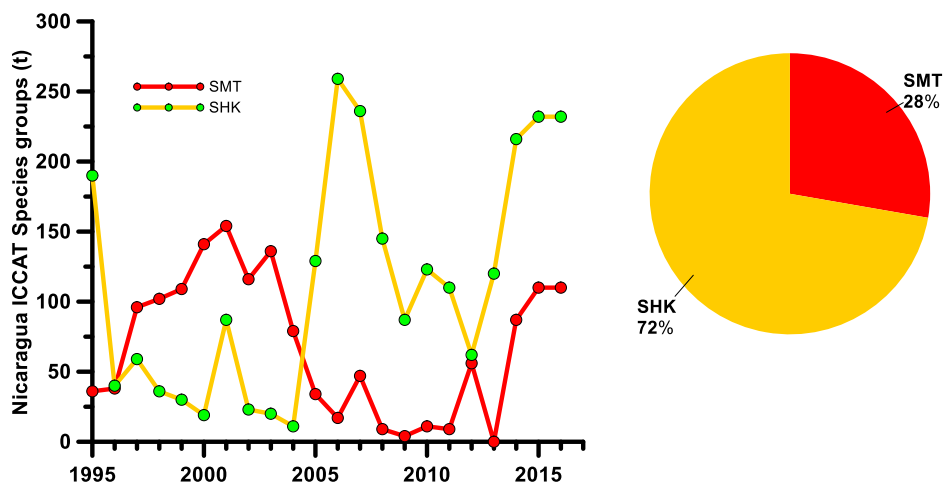
Figure 14. Exclusive Economic Zone (EEZ) of Suriname.



**Figure 15.** A) Suriname reported Task I catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016.



**Figure 16.** Exclusive Economic Zone (EEZ) of Nicaragua (Atlantic side only).



**Figure 17.** Nicaragua's FAO reported catches of major large pelagic species groups and average proportion of major large pelagic species groups in 2013-2016.



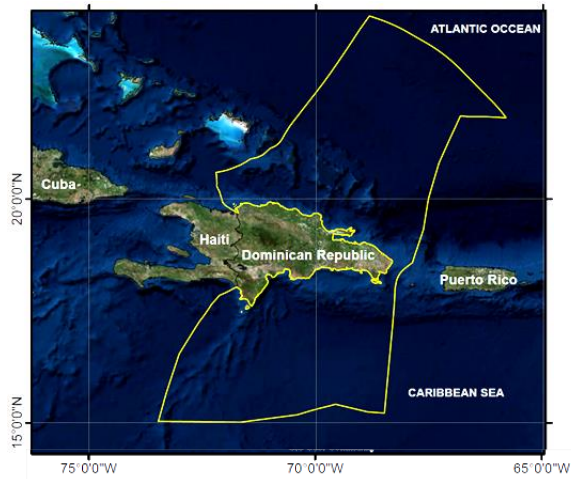


Figure 18. Exclusive Economic Zone (EEZ) of Dominican Republic.

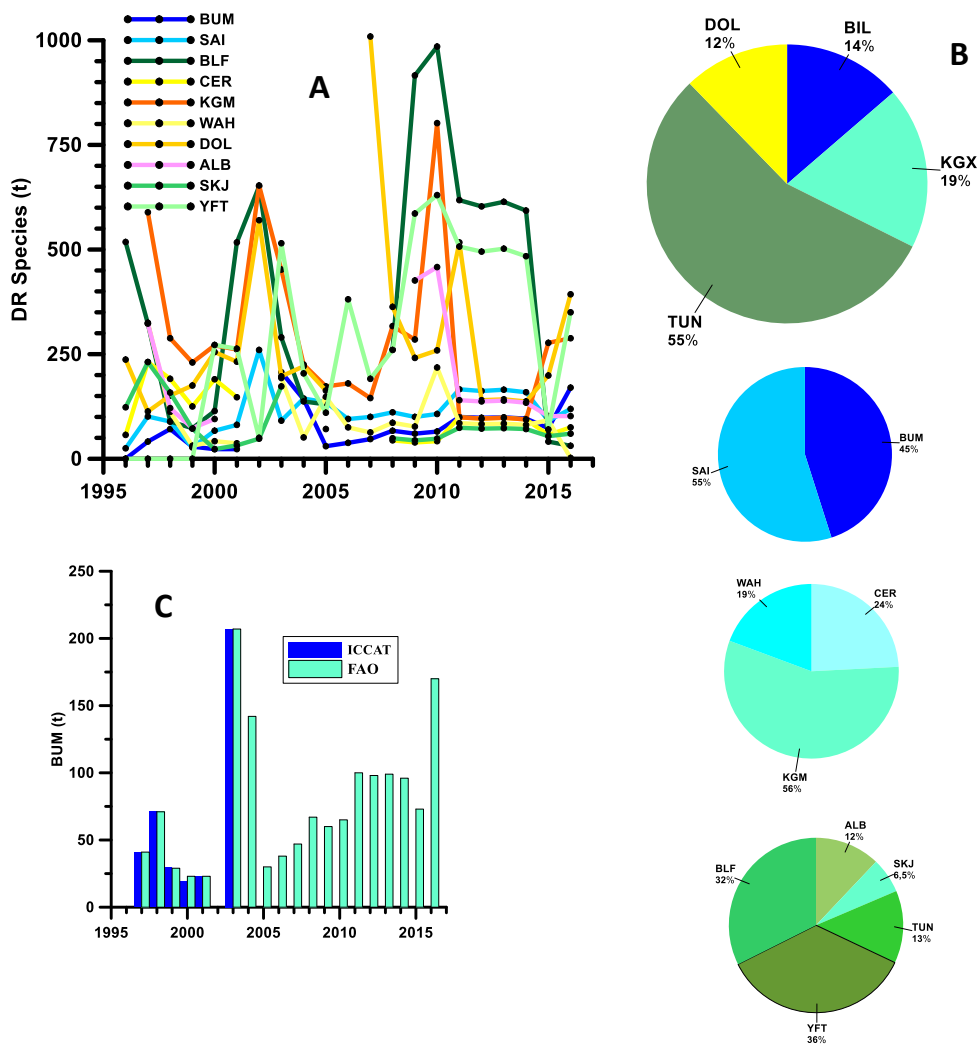


Figure 19. A) Dominican Republic (DR) official (FAO) reported catches of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016; C) Comparison of blue marlin (BUM) catches from DR reported to FAO and ICCAT.



Figure 20. Exclusive Economic Zone (EEZ) of Colombia (Atlantic side only).

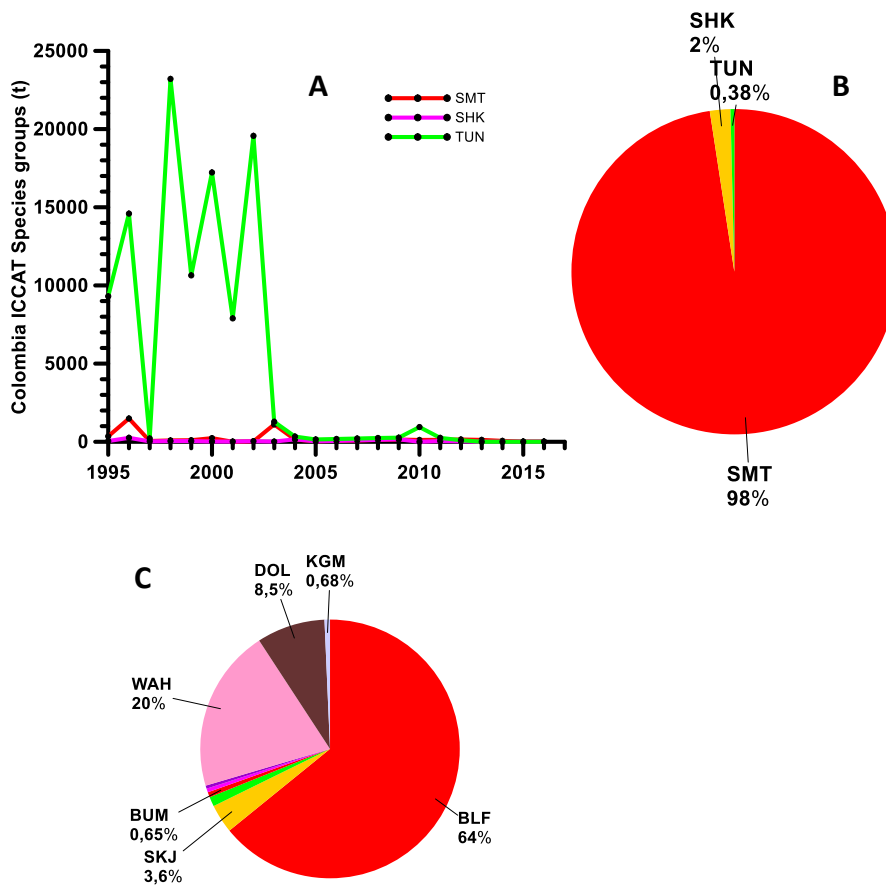


Figure 21. A) Colombia's official (FAO) reported catches for Area 31 of major large pelagic species groups; B) Average proportion of major large pelagic species groups in 2013-2016; C) Proportion of large pelagic species landed in San Andres Islands from Grandas and Castro (2004), Castro *et al.* (2007).