



The Caribbean Billfish Management and Conservation Plan



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List of Acronyms

ABNJ	Areas Beyond National Jurisdictions
BMSY	Biomass at the Maximum Sustainable Yield level
CARICOM	Caribbean Community
CBP	Caribbean Billfish Project
CBMC	Consortium on Billfish management and Conservation
CFMC	Caribbean Fisheries Management Council
CLME	Caribbean Large Marine Ecosystem
CPUE	Catch per unit of effort
CRFM	Caribbean Regional Fisheries Mechanism
dFADs	Drifting fish aggregating devices
EAF	Ecosystem approach to fisheries
EEZ	Economic exclusive zone
EPA	United States Environmental Protection Agency
FADs	Fish Aggregating Devices
FAO	Food and Agriculture Organization
mFADs	Moored fish aggregating devices
FSC	Free swimming schools
FMSY	Fishing effort at the level of the Maximum Sustainable Yield
FIRMS	Fisheries and Resources Monitoring System
GEF	Global Environment Facility
ICCAT	International Commission for the Conservation of the Atlantic Tuna
IGFA	International Game Fish Association
IUU	Illegal, Unreported and Unregulated
MCS	Monitoring, Control and Surveillance
NOAA	National Oceanic and Atmospheric Administration
OSPESCA	Central America Fisheries and Aquaculture Organization
RFB	Regional fishery body (ies)
SAP	Strategic Action Plan
SCRS	Standing Committee on Research and Statistics of the ICCAT
SICA	Central America Integration System
TAC	Total allowable catch
UNCLOS	United Nations Convention on the Law of the Sea
VMS	Vessel Monitoring System
WECAFC	Western Central Atlantic Fisheries Commission

Acknowledgments

1. Introduction

Caribbean billfishes are highly migratory fish which stocks occur in the Atlantic Ocean and which make significant contributions to Caribbean economies, livelihoods and food security. Billfish are fished commercially (industrial and small scale/ artisanal) and recreationally, by local and distant-water fleets. Main billfish species include Atlantic blue marlin (*Makaira nigricans*), white marlin (*Kajikia albida*¹), Atlantic sailfish (*Istiophorus platypterus*) and spearfish (*Tetrapturus* spp).

Declining trends due to overfishing have been recorded in most billfish species stocks across the Atlantic. This represents a threat to commercial and recreational fisheries and to the overall sustainability of their respective contributions to regional economies. Collective action by Caribbean nations to improve management and conservation of billfish resources in the region, and to influence decision-making at the International Commission for the Conservation of Atlantic Tunas (ICCAT) level, offer opportunities to reverse this trend. Currently, no regional/sub-regional management plan is in place for billfish, or any large pelagic species in the wider Caribbean region. The present document represents a chance for adoption and implementation of several activities and management measures which can contribute to address billfish conservation and management issues in the Western Central Atlantic region.

This plan is the result of the implementation of one of the activities under Component 2 “Strengthening regional billfish management and conservation planning” of the GEF/ World Bank Caribbean Billfish project GCP/SLC/001/WBK with the WECAFC/FAO as the executing agency, making use of the partnership approaches and communication structures established within the Consortium on Billfish Management and Conservation (CBMC), the WECAFC membership, and in the Interim Coordination Arrangement for Sustainable Fisheries among FAO, CRFM and OSPESCA in the Caribbean under the Caribbean Large Marine Ecosystem (CLME+) project. The Plan also considers the Strategic Action Programme (SAP) of the CLME, which was endorsed by more than 25 governments in 2013, in particular the strategy (5B) “Enhance the governance arrangements for implementing an ecosystem approach for large pelagics fisheries”.

The preparation process of the plan started in 2015 by conducting several desk and field studies, under Components 1 and 2 of the Caribbean Billfish project, which served as background information on the status of billfish resources, right based approaches and estimation of the value of commercial and recreational fisheries as well as a diagnosis of the Caribbean national legal and institutional fisheries framework. A first outline of the table of contents and a first proposal of regional management measures was presented at the 2nd Regional Workshop on Billfish Management and Conservation held in Panama in November 2015. A first draft was prepared in March 2016 which followed a consultation process with the assistance of the Consortium members and the WECAFC/ OSPESCA/ CRFM/ CFMC Working Group on Recreational Fisheries.

This management plan would be the second management plan prepared and adopted under WECAFC (the first one for queen conch *Strombus gigas*). Other Caribbean subregional managements plans adopted are the CRFM Subregional Fisheries Management Plan for Flying fish *Hirundichthys affinis*. in the Eastern Caribbean and the OSPESCA Subregional Management Plan for Caribbean Spiny Lobster *Panulirus argus* in SICA countries.

The plan is divided in 10 chapters and presents what are considered attainable actions and objectives of a management plan to be implemented in a 5-year period from its adoption. Chapter 2 presents a summary of basic fisheries legislation and organizational arrangements in the Caribbean. Chapter 3 provides an overview of billfish fisheries and resource status. Chapter 4 includes a table on problem identification describing several challenges regarding Caribbean billfish, and Chapter 5 and 6 show the principles, objectives and management measures respectively. Chapter 7 provides information on

¹ In ICCAT it is classified as *Tetrapturus albidus*

the suggested management mechanism for implementing and reviewing the management and conservation plan. This document does not present comprehensive information on the billfish biology, Caribbean fisheries or legal and institutional frameworks as there is literature on these subjects elsewhere available. A list of the literature used as background information is provided in Chapter 10.

The plan should be adaptive and is starting simple with more activities or management measures that can be added to in the future during implementation and following necessary reviews. The emphasis of this plan is on specific approaches towards billfish-related fisheries management from a regional perspective, in particular if we consider that bycatch and recreational fisheries management are not currently in place in many countries. By regional perspective, it is meant the WECAFC region even though billfishes have a wider range of distribution in the Atlantic and other Oceans.

The plan seeks to guide regional management arrangements that could benefit billfishes, their long-term sustainability, and the economic and food security contributions. The plan will assist in creating a context in which harvest reporting can be improved with the inclusion of a recreational fishery database at a regional level. The plan also expects to promote enhanced involvement and cooperation among Caribbean States, in particular under the establishment of the Interim Coordination Arrangement for Sustainable Fisheries among FAO/WECAFC, OSPESCA and CRFM under the CLME+ project, and with the International Commission for the Conservation of Atlantic Tunas (ICCAT). It is also expected that the plan will foster management and conservation alternatives to reduce by-catch and by-catch mortality, increase regional management measures and help optimize socio-economic returns.

2 Caribbean Fisheries Institutional and Legal Frameworks²

The WECAFC region includes many sub-regions, among them Brazil, the United States of America, numerous Caribbean Small Island Development States and overseas territories, and Areas beyond National Jurisdiction. As the region is a complex patchwork of countries the methods of drafting and adopting legislation may vary considerably from one country to another. Due to the nature of highly migratory species and implications for management, there are four legal international instruments to be referred to in the Caribbean region: the first is the United Nations Convention on the Law of the Sea³, followed by the UN Fish Stocks Agreement⁴, the Compliance Agreement⁵ and the Port State Measures Agreement (PSMA)⁶.

In the Caribbean there is only one regional fishery management organization: the International Commission for the Conservation of Atlantic Tunas (ICCAT⁷), with 17 contracting parties and 2 cooperating non-contracting parties from the WECAFC region. ICCAT is an inter-governmental fishery organization responsible for the conservation of tunas and tuna-like species, including billfish, in the Atlantic Ocean and its adjacent seas. The Commission compiles fishery statistics from its members and from all entities fishing for these species in the Atlantic Ocean, coordinates research, including stock assessment; develops scientific-based management advice, provides a mechanism for Contracting Parties to agree on management measures, and produces relevant publications.

Besides ICCAT, some of the countries also belong to other Regional Fishery Bodies (RFBs) such as the Caribbean Regional Fisheries Mechanisms (CRFM) of the Caribbean Community (CARICOM)

² Based on the legal and institutional framework desk study by the consultant Cristina Leria under the Caribbean Billfish Project GCP/001/SLC/WBK (Leria, 2015), and the CRFM reports by Singh-Renton and McIvar (2015), and Berry and Tietze (2013)

³ UNCLOS entered into force 16 November, 1994. More details on: <http://www.un.org/depts/los/>

⁴ Agreement for the implementation of the Provisions of the Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks in force since 11 November 2001. More details on: http://www.un.org/depts/los/convention_agreements/convention_overview_fish_stocks.htm

⁵ The FAO 1993 Agreement to promote compliance with international conservation and management measures by fishing vessels on the high seas. More details on: http://www.fao.org/fileadmin/user_upload/legal/docs/012t-e.pdf

⁶ FAO Agreement on Port States Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (adopted by the FAO Conference in 2009). More details on: <http://www.fao.org/fishery/psm/en>

⁷ <http://www.iccat.int>

and the Central America Fisheries and Aquaculture Organization (OSPESCA) of the Central America Integration System (SICA). In the case of the United States, the Caribbean Fishery Management Council (CFMC) is one of eight regional fishery management councils, which includes the Commonwealth of Puerto Rico and the United States Virgin Islands.

All countries have legislation governing fisheries, but few have provisions specific to large pelagics, billfish or sport/ recreational fisheries. Although the complexity of these laws varies from one country to another, certain broadly shared themes emerge in terms of their objectives and scope. Many of the legislation and management systems in place are based on the FAO Code of Conduct for Responsible Fisheries⁸ and include both legal and administrative frameworks, but the legal framework appears to be limited and often does not specify a formal management process with identified roles, responsibilities, information needs, and time frames for activity completion and evaluation.

All countries have an authority in charge of fisheries and aquaculture which in most of the cases is part of the Ministry of Agriculture. In a few cases, the fishery authority is independent and acts as a Ministry of Fishery. Most of the recently enacted laws provide for a Fishery Advisory Body or Committee, though in practice these appear not to be active in a number of countries. Stakeholder identification and participation in the management process is not a formal requirement in all countries, but most countries promote collaboration with stakeholders via open meetings and provision of opportunity for public comments. However, government still retained the major responsibility for management in most cases.

In general terms, specific tools that may be found to varying degrees in laws and regulations across the region for all fisheries include (i) spatial restrictions; (ii) temporal restrictions; (iii) gear restrictions (with the exception of Fish Aggregating Devices in some cases); (iv) rights and participatory restrictions; and (v) catch and size restrictions. Also, there are provisions for the development of management plans with participatory approaches (e.g. the Ecosystem Approach to Fisheries –EAF), but it is noted that not all the countries have prepared or are implementing management plans. Very few major recreational fisheries have such plans.

Regarding specific legislation for commercial billfish fisheries, recreational billfish fisheries and the use of Fish Aggregating Devices (FADs), most of the countries do not have specific legislation, and with respect to sport/recreational fisheries in general, the majority of the countries include some reference to sport fishing in their general fishery law. With regard to Fish Aggregating Devices, very few countries have specific regulations. In the Central American region, some countries include legislation that allows the capture of billfishes only for sport/recreational purposes.

At the subregional level, a management plan for moored FAD fisheries in Eastern Caribbean countries is expected to be adopted and implemented by the CRFM.

3 Fisheries

3.1 General Information on Caribbean Billfishes⁹

Billfishes (marlins, sailfish and spearfishes) belong to large pelagic fishery resources consisting of species that are oceanic, migrate over long distances and are distributed over areas that extend beyond the WECAFC region. Their classification from a taxonomic standpoint remains unsettled in terms of sub-order, genera, and species, and, according to some scholars, billfishes are genetically and morphologically distinct from tuna and tuna-like species. The species are characterized by a bill, a lateral line retained throughout life, elongate pelvic fins, a dorsal fin with a very long base that is

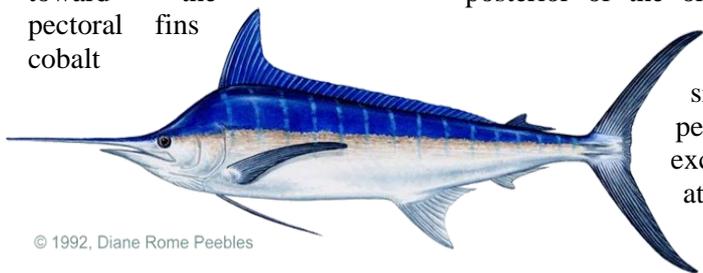
⁸ The Code can be found on: <http://www.fao.org/docrep/005/v9878e/v9878e00.htm>

⁹ Based on the desk study of Ehrhardt and Fitchett (2015) for the Caribbean Billfish project GCP/SLC/001/WBK, and the papers of Mahon and McConney (2004), Singh-Renton and Tietze (2012), the IGFA database (www.igfa.org) and ICCAT documentation (www.iccat.int)

sometimes sail-like and is depressible into a groove, and a caudal peduncle in the adult with two keels on each side. Other characteristics are scales present in the adult, jaws with teeth in the adult. The members of this family share several characteristics with the swordfish; including an elongate rostrum in adults, dorsal fin origin over back of head, pectorals low on body, and first dorsal fin lacking true spines.

The following billfish species are considered in this management and conservation plan: Atlantic blue marlin (*Makaira nigricans*), white marlin (*Kajikia albida*), Atlantic sailfish (*Istiophorus albicans*) and roundscale spearfish (*Tetrapturus spp*).

Blue Marlin (*Makaira nigricans*) – Blue Marlin is found throughout the world’s oceans in tropical, subtropical, and temperate waters. The blue marlin is notably the largest of billfish species. It is characterized by a cylindrical body shape, two dorsal fins (one with a steep slope and one smaller toward the posterior of the organism), and unlike the black marlin the pectoral fins are not rigid. They are named for their blue dorsal coloration, which fades into a silvery white. The keels on the caudal peduncle on the blue marlin make it an exceptionally strong and fast swimmer, a trait attractive to many anglers. All giant marlins are females. A male blue marlin rarely exceeds 300 lb (136 kg).

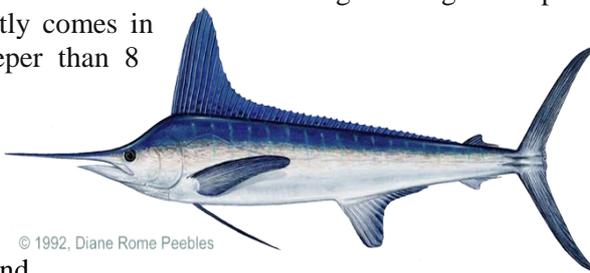


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While the blue marlin is one of the most sought-after species by recreational anglers it is not as abundant as other billfish. Primarily near-surface pelagic fishes such as mackerels, tunas, and dolphin are preyed upon by the blue marlin.

This species is found in the Atlantic Ocean from 45°N to 35°S and is less abundant in the eastern portion of this ocean. In the northern Gulf of Mexico its movements seem to be associated with the so called Loop Current, an extension of the Caribbean Current. Seasonal concentrations occur in the southwest Atlantic (5°-30°S) from January to April and in the northwest Atlantic (10°-35°N) from June to October.

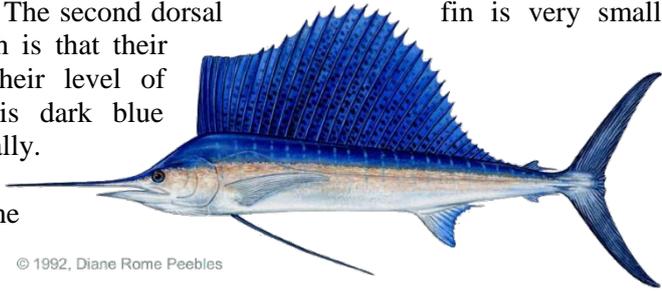
White Marlin (*Kajikia albida*) – White marlin are found in deep tropical and warm temperate waters throughout the Atlantic Ocean including the Gulf of Mexico, the Caribbean Sea, and the Western Mediterranean. Stray specimens have been recorded outside this range. Though this species is usually found in deep blue waters, it frequently comes in close to shore where waters are not much deeper than 8 fathoms.



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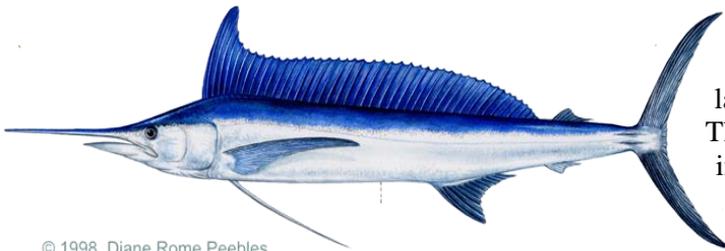
Its most characteristic feature is the rounded, rather than pointed, tips of the pectoral fins, first dorsal fin and first anal fin. Some specimens apparently vary from the norm in that the dorsal and pectoral fins may be more pointed; the anal fin is more consistently rounded than the others. The maximum height of the largest lobe on the first dorsal fin is greater than the depth of the body. The coloration of the white marlin is a dorsal dark blue fading into a silver-white with brown spots. Spots also are present on the first dorsal fin of the fish. It differs from any other marlin, in that both margins are convex. The flat, movable pectoral fins can easily be folded flush against the sides of the body. The lateral line is visible and straight.

Sailfish (*Istiophorus albicans*)– Sailfish are one of the most iconic billfish easily recognizable by its extremely large and colorful high dorsal fin. The second dorsal fin is very small. One of the unique characteristics of sailfish is that their coloration is capable of changing with their level of excitement. Typically, the sailfish body is dark blue dorsally and white with brown spots ventrally. About 20 bars, each consisting of many light blue dots, are present on each side. The fins are all generally blackish blue. The primary diet consists of various cephalopods and bony fishes such as needlefish, mackerels, tunas, and jacks.



Sailfish inhabits tropical and subtropical waters near land masses, usually in depths over 6 fathoms, but is occasionally caught in lesser depths. They appear to feed mostly in midwater along the edges of reefs or current eddies.

Spearfish (*Tetrapturus spp*) – The spearfish is found throughout the world’s oceans in tropical and subtropical deep waters. It is known to occur in the northwest Atlantic from New Jersey to Venezuela, including the Gulf of Mexico. Japanese longliners have also recorded its occurrence in the north central Atlantic, in the south Atlantic, and off South Africa. The spearfish has a dorsal fin similar to that of the sailfish but lacks the sailfish’s dorsal height and length. They feed near the surface on small fish including dolphin, flying fish, needlefish and squid. The spearfishes are cosmopolitan, but nowhere are they abundant.



3.2 Overview of Billfish fisheries and resource status

In many Caribbean countries, commercial and recreational fisheries target large pelagic fishery resources. Fishing vessels for large pelagics in CARICOM countries can be divided into five categories: a) open outboard trolling and longline boats, b) open outboard gillnetters, c) decked inboard trolling and gillnet vessels, d) medium longliners and e) large longliners. The large majority of vessels are the open outboard powered ones typical for small-scale fisheries. Larger decked vessels, mainly medium sized longliners, were introduced when regional governments and the fishing industry started developing the Caribbean region’s capacity to harvest large pelagic species. There are also foreign-flagged larger vessels, which fish for large pelagic species.

Billfish species are mostly caught as bycatch in tuna fisheries and to a much lesser scale, in directed highly localized coastal artisanal fisheries. The species are also popular in sport/recreational fisheries where a multimillion-dollar recreational fishing industry has evolved. The total landings of tuna, small tunas, and billfish by oceans reached slightly over 7 million metric tons in 2012 (Fig. 1). There appears to be a correspondence among the ranked ocean habitat compression and the production of these large pelagic species in the different oceans. Habitat compression means that large areas of cold low-oxygen water occur as distinct strata which restrict the depth distribution of tropical pelagic marlins, sailfish, and tunas by compressing the acceptable physical habitat into a narrow surface layer.

Landings of large pelagic species in the Atlantic reached only 9% of the total tuna, tuna-like species, and billfish species recorded worldwide in 2012. A slight decreasing trend in landings after 1995 is observed in the Atlantic Ocean (Fig. 1).

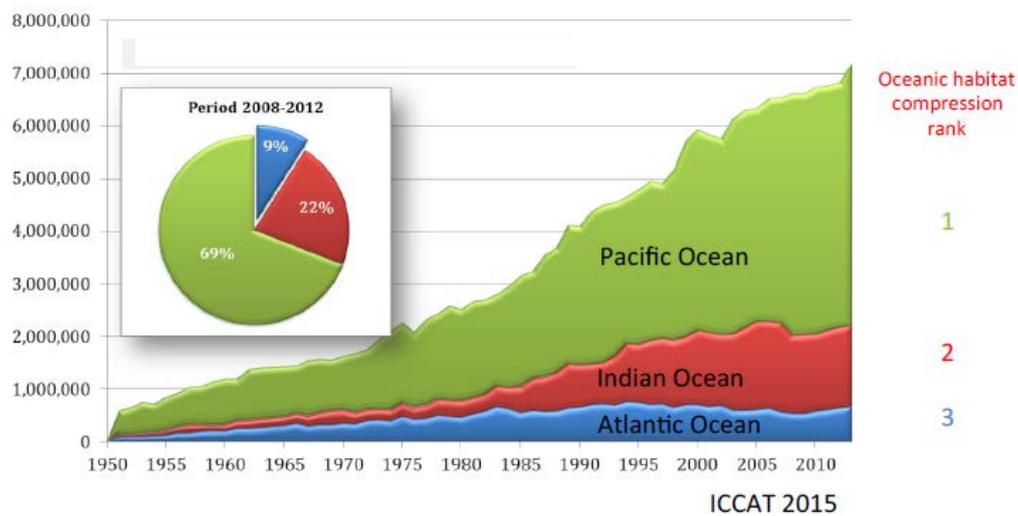


Figure 1 Landings in metric tons of tunas, small tunas and billfish

In the Atlantic, billfish landings represent 0.76% of the combined tunas, swordfish and billfish species (Fig. 2). Sailfish and white marlin are almost undetectable in the statistics and blue marlin appears as the main billfish species reported in those statistics. The fact that billfish species comprise a very low percentage as by-catch in the landings of major tuna fisheries represents a significant impediment to objectively collect billfish stock assessment data through formal fishery statistical systems. This represents a challenge to integration of billfish stock assessment data. Assessments of billfish are carried out periodically by scientists from member nations within ICCAT.

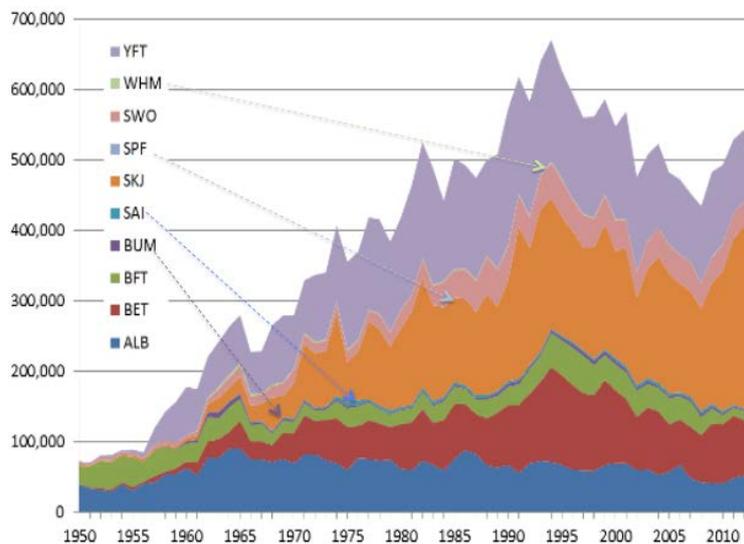


Figure 2 Landings in metric tons of major tuna species, billfishes and swordfish from the ICCAT convention area .
 YFT= yellowfin tuna, WHM= white marlin, SWO= swordfish, SPF= spearfish, SKJ= skipjack tuna, SAI= sailfish, BUM= blue marlin, BFT= Bluefin tuna, BET= bigeye tuna, ALB= albacore tuna

ICCAT has defined general areas of the Atlantic Ocean to demark managerial billfish units of stocks. There is a north and south Atlantic stock division for marlins and an east and west demarcation for sailfish and spearfish (Fig. 3). The WECAFC region comprises fractions of these areas (Fig. 3) and is the reason why the Caribbean billfish management plan only applies to this region and not the Atlantic as whole.

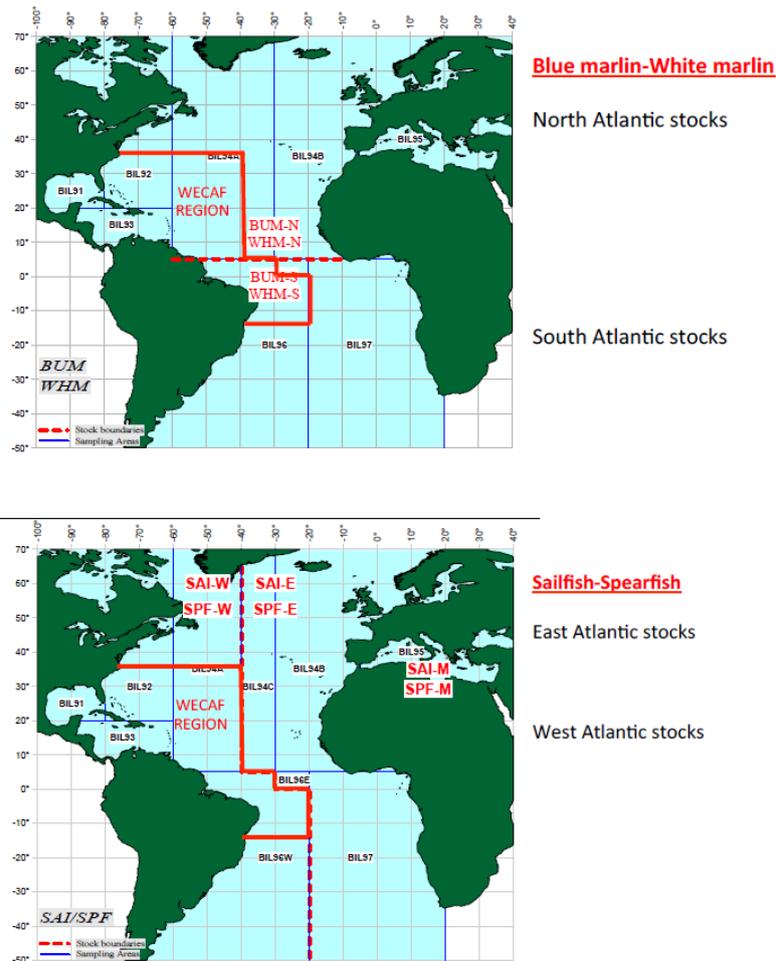


Figure 3 Boundaries for billfish stock definitions in the ICCAT Convention area showing (in red) the WECAF boundary region. BUM= blue marlin, WHM= white marlin, SAI= sailfish, SPF= spearfish. N= north, W= west, E= east, S=south, M= Mediterranean

The industrial long line fisheries for Atlantic tuna resources prominently operate over the central equatorial Atlantic, as well as in the eastern Caribbean Sea (Fig.4), followed by areas in the northern Gulf of Mexico, the southwest Atlantic off the southern Brazilian and Uruguayan coasts, and off equatorial Africa. Longline fishing effort increased steadily from the 1950s until 2000, when over 475 million hooks were operated by all fleets fishing in the Atlantic (Fig. 4). However, there has been a noticeable decrease in the amount of longline effort in the Atlantic due to removal of effort by some of the largest longline fishing countries (e.g. Japan; Taiwan, province of China, and Korea).

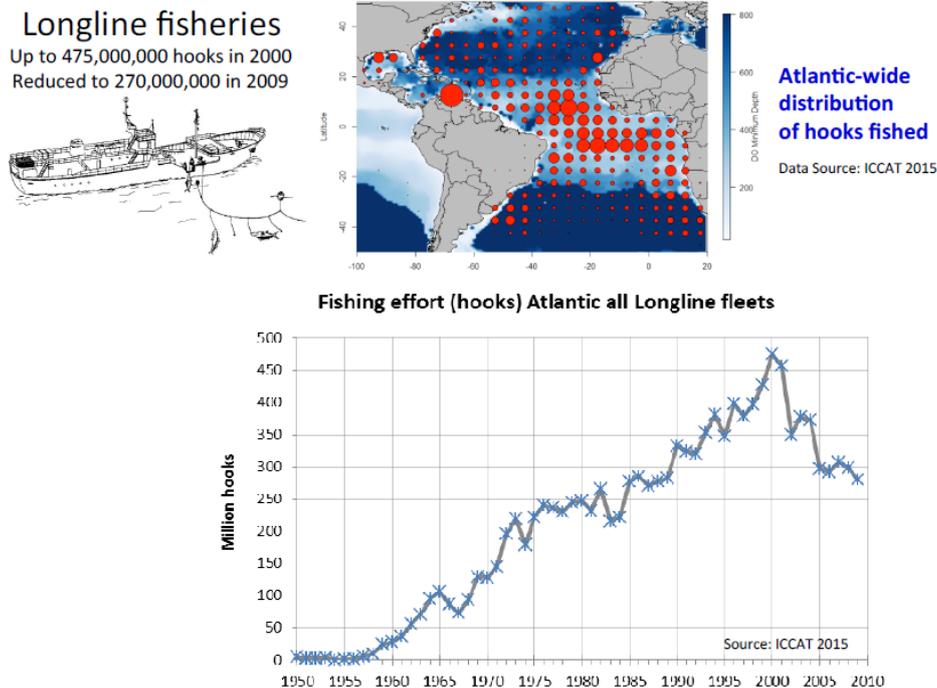


Figure 4 Longline gear operational characteristics (upper left), spatial distribution of overall longline fishing effort in the Atlantic (upper right) and historic trend of longline fishing effort in the Atlantic in millions of hooks (Lower panel)(Data sources:ICCAT)

The tuna purse seine fisheries in the Atlantic operate conspicuously in areas of West Africa, in particular the Gulf of Guinea (Fig.5). Purse seine nets may be as deep as 250-300 meters. Since the 1980's a significant development that transformed tuna purse seining was in the introduction of Fish Aggregating Devices (FADs¹⁰). There is an extensive literature on the ecological, fishing efficiency and environmental impacts caused by these FADs with results that can be summarized:

- 1) smaller size tunas occur under FADs, which are less valuable to the fishery and are significantly discarded,
- 2) increased bycatch that is mostly wasted,
- 3) increased competition for fishing grounds by artisanal/small scale and/or sport/recreational fishers,
- 4) Free FADs that drift away from tuna fishing grounds which creates issues of non-operational derelict FADs left free drifting in the ocean. They can create, for example, navigational hazards that have not been quantified,
- 5) Coastal environmental impacts are expected but not yet evaluated given the washing ashore of non-operational drifting FADs,
- 6) Massive drifting FAD densities are thought to impact in a yet unknown way the population dynamics of fishes in the large pelagic marine ecosystem,
- 7) Changes in fishing efficiency and selectivity of tuna purse seiners fishing with FAD impacted the use of catch per unit effort (CPUE) indices needed for stock assessments. This is as a result in which CPUE remains elevated, because FADs keep attracting fish, even when population abundances may be decreasing due to population exploitation. The same happens with other fishing gears used on moored FADs.

Currently, there are 107 large purse seine vessels operating in the Atlantic with a hold carrying capacity of 100,000 metric tons. Their fishing activities are concentrated in the eastern Atlantic (Fig.5) and may not have a direct impact on the fisheries in the WECAFC region. Nevertheless,

¹⁰ FADs can be moored FADs (mFADs) or drifting FADs (dFADs)

billfish by-catch, although minimal, has effects on stocks in the North Atlantic.

Purse seine fisheries

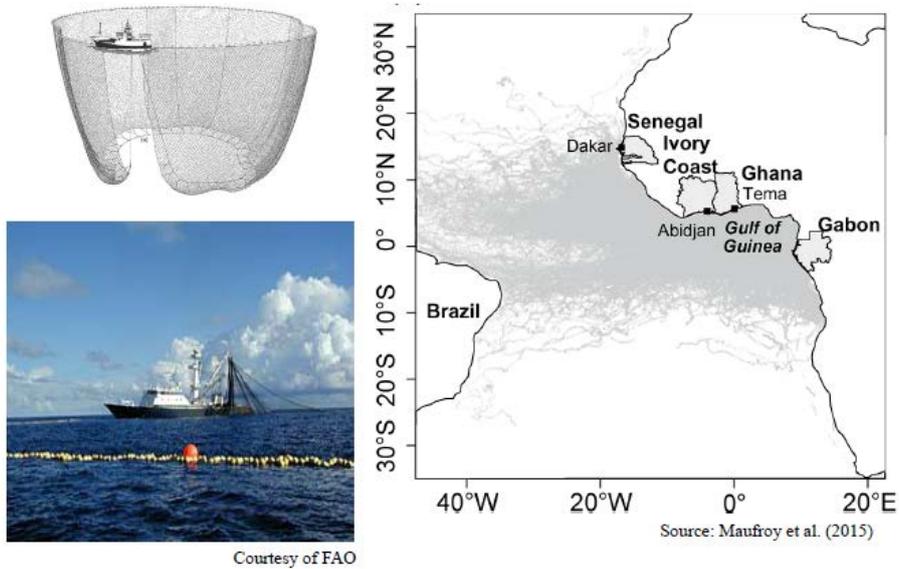
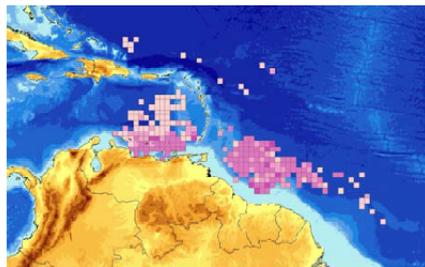


Figure 5 Atlantic purse seiners and areas of the tropical Atlantic marked by drifting FAD tracks.

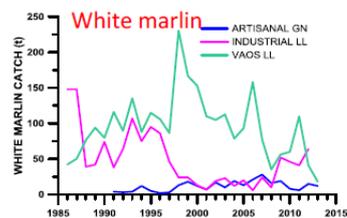
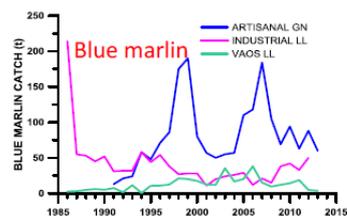
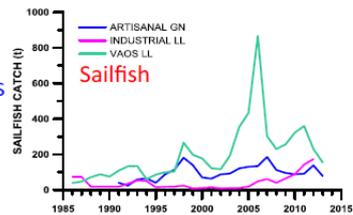
Tuna and billfish are also targeted by gillnet fleets in Venezuela, Ghana, and in the southwest Atlantic. Venezuelan gillnetters operate in the eastern Caribbean Sea as well as offshore of the Guyana-Surinam region (Fig. 6 upper left figure). Gillnetters often land blue marlin and longliners mostly land white marlin and sailfish (Fig. 6 right figures).

Venezuelan Gillnet (GN), Longline (LL) and Artisanal Off-Shore Pelagic Longline Fisheries (VAOS LL)

Sailfish CPUE distribution in Venezuelan longline and gillnet fleets



Source: Arocha et al. 2010



Source: Arocha et al. 2015

Figure 6 Area of operation and landings of Venezuelan gillnet and longline fleets.

Billfish recreational fisheries were developed in the United States during the early 1930's and have since extended in correspondence to tourism expansion throughout many WECAFC

countries/territories, in particular in small islands. The largest social and economic contributions by billfish are the tourism-based recreational fisheries tournaments, for which large registration entry fees and awards generate incentives for catching billfishes. The vast majority of tournaments are catch-and-release in nature and depend on numbers of fish caught and successfully released, verified by observers. The catch and release nature of billfish recreational fishing it is considered to contribute to the conservation of the stocks.

In 2015, more than 215 billfish tournaments took place in several localities throughout the WECAFC region (Fig. 7). In particular, in the United States, Puerto Rico, British and US Virgin Islands, and many small islands States.

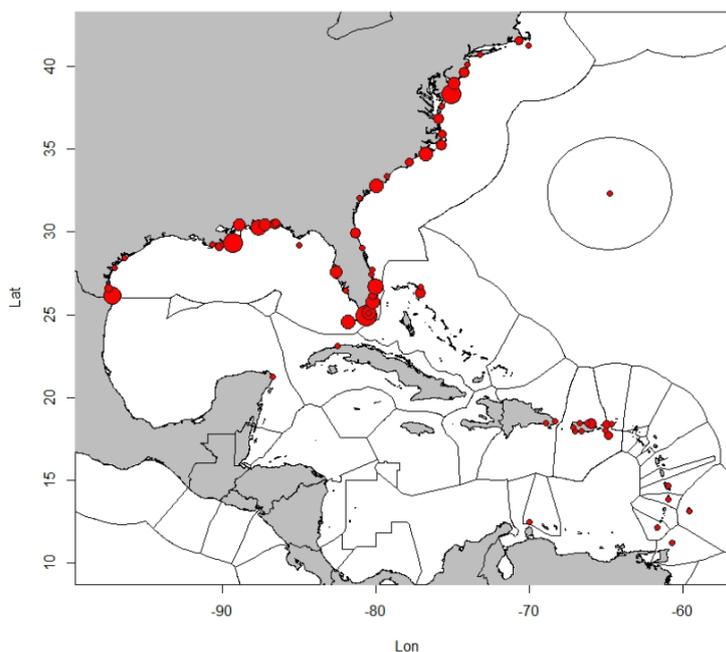


Figure 7. Distribution and density (circle size) of recreational billfish tournaments within the WECAFC region.

3.2.1 Resource status and current management

As mentioned, ICCAT is responsible for research and management of tunas and billfish in the Atlantic Ocean. It is observed that main constraints in the ICCAT stock assessment processes for billfishes have been differences of the various CPUE series together with data insufficiency on landings and on growth. The CPUE statistical problem originates from fishing power differences among fleets, regions, and seasons as billfish stocks migrate seasonally and fishing intensity (fishing effort per unit of area) changes according with the seasonal availability of targeted tuna species and not the billfish. In addition, the incidental (bycatch) nature of the billfish in tuna fisheries further complicates the implementation of more refined billfish data collection aboard vessels.

Catches obtained with the use of both drifting and moored FADs also are a challenge when quantifying CPUE as a proper index of relative billfish stock abundance status. As stated, due to the nature of FADs, they accumulate biomass independently of the status of abundance of the stock. Stock assessment scientists are aware and concerned with the difficulties in assessing tuna stocks (and by consequence billfish stocks) due to the lack of more detailed information on the nature of FAD fishing.

Several major efforts and investments to improve the billfish stock assessment database have been done by ICCAT. Billfish stock assessment results are indicative of significantly decreasing trends in abundance of the three main billfish species of the Caribbean: blue marlin, white marlin and sailfish. In 1997, the Commission made its first binding recommendation for Atlantic blue and white marlin, requiring reductions in landings and noting the need for improvements in data and monitoring. In

November 2000, ICCAT adopted a two-phased marlin rebuilding program that required, among other things, that countries reduce white marlin and blue marlin landings.

The 2011 ICCAT SCRS stock assessment indicated that the blue marlin stock is below BMSY (the stock is overfished because the current biomass is below the biomass at the maximum sustainable yield level) and that fishing mortality is above FMSY (overfishing is occurring because current fishing mortality is over the fishing mortality at the maximum sustainable yield level) and that only catch levels of 2,000 tonnes or less would prevent further stock decline. SCRS expressed concern with the significant increase in the contribution from non-industrial fisheries to the total blue marlin harvest, that landings from these fisheries are not fully accounted for in the ICCAT database, and recommended that it is imperative to develop CPUE indices for all fleets that have substantial landings of blue marlin. ICCAT also noted that the results of the 2012 white marlin assessment indicated that the stock was overfished while noting significant uncertainty associated with species composition in the historical time series of catch (white marlin vs. spearfish) and the actual magnitude of the catch due to the underreporting of discards. The Commission also acknowledged SCRS advice that, at a minimum, white marlin catches should be limited to less than 400 tonnes. Another observed signal of the bad state of the billfish stocks is the reported declining trophy size in sport fisheries over time.

In 2015, the Commission recommended an annual limit of 2,000 tonnes for blue marlin and 400 tonnes for white marlin/spearfish for these stocks, for 2016, 2017 and 2018. The current conservation and management recommendations include a mixture of total allowable catches, sharing arrangements for member countries, minimum size limits, effort controls, time / area closures, trade measures, and monitoring and inspection programmes.

4. Problem Identification

Three main billfish species are important to recreational fisheries in the WECAFC region: blue marlin, white marlin and sailfish. Two other species are less available: longbill and roundscale spearfish. As indicated earlier, the species are caught as bycatch in large Atlantic longline, gillnet and purse seine tuna fisheries; however, they represent a mere 0.76% of the tuna landings. This characteristic represents a major hurdle to objectively collect statistical data for billfish stock assessments needed to better define fishery regulations and billfish conservation policy development. Economically and socially important billfish recreational fisheries exist throughout the WECAFC region, but also artisanal fisheries, and lately, disputes with commercial fishers using the resources for human consumption have increased.

Atlantic billfish resources have been subjected to intense commercial exploitation for more than six decades, and as consequence billfish resources appear depleted, have been overfished and/or are currently being overfished. The area of the WECAFC is critically important to the habitat of the billfish in the Atlantic, and since billfish resources within the WECAFC region are only a fraction of the units of stocks in the Atlantic, the regional plan was not developed for the Atlantic as a whole. On-going commercial fishery developments target billfish and other highly migratory species mostly in the eastern Caribbean Sea, thus contributing to their already critical stock condition. Moored fish aggregating devices (mFAD) introduced in the region in the 1980's and 1990 excel billfish landings and boost competition within the commercial artisanal fishery sector and between commercial and recreational fisheries sectors.

Reduction of billfish relative abundance, and the associated decrease in billfish trophy sizes, is impacting important recreational fishing industries of the Caribbean, while adding only marginal revenues to the commercial fisheries. On the other hand, in some countries, as in particular small islands in the southern Caribbean, long line fleets are the main foreign revenue earners, only second to tourism, and the industry employs many people. The bycatch is used mostly for local consumption as

a cheap food. Lately, there are also examples of issues concerning property rights to catch fish on moored FADs, which it has an impact in the promotion of catch-and-release techniques.

Such complex resources utilization matters represent the most important conservation issue related to billfish resource utilization in the WECAFC region. Table 1 shows a summary of topics, issues and consequences for management and conservation of Caribbean billfish. The need for attention to the management of shared marine resources in the wider Caribbean region is well documented. From the early 1980s it has been a main subject for discussion by WECAFC and has continued to present days with the implementation of the CLME project and its second phase, the CLME+ project.

Table 1 Summary of topics and issues to be addressed in order to contribute to management and conservation of Caribbean billfish stocks

Topic	Issue	Consequences
Biology of the species	<ul style="list-style-type: none"> Otoliths used to determine fish growth are exceptionally small, fragile and difficult to extract from cranium. Other parts are not always suitable for age reading. Highly migratory predator species with extensive geographic range. As apex predators billfish may accumulate mercury in the body 	<ul style="list-style-type: none"> Collection of otoliths for age readings studies difficult to implement Growth data difficult to obtain Tag recapture rate is significantly low to infer growth, mortality and migrations Billfish unit stocks not well defined and that may be larger than WECAFC region Billfish meat could pose a risk to human health
Catch and bycatch	<ul style="list-style-type: none"> Transshipments may take place and data not reported or is repeated Data collection from small-scale/artisanal and recreational fisheries limited or does not exist at all Spearfish identification by species is inadequate Most of the Atlantic-wide billfish landings that are reported come from commercial industrial longline fisheries that target tuna and swordfish. Billfish is mostly a bycatch Limited data from fisheries on moored FADs 	<ul style="list-style-type: none"> Difficult to accurately document total harvest of current fisheries as well as historical billfish landings Difficult to determine sustainably harvestable biomass. Catch quotas difficult to implement in bycatch species Bycatch species are of limited interest, resulting in low research priorities
Fishing effort	<ul style="list-style-type: none"> Knowledge on spatial distribution of fishing effort is incomplete Spatial Fleet interactions (commercial and recreational) not well known Use of FADs adds an additional factor for determining spatial fishing effort distribution Fishing effort information from recreational and/ or small-scale fleets not available in many countries 	<ul style="list-style-type: none"> Difficult to standardize effort/catchability across fishing methods and over time. Number of vessels active in the fisheries are largely unknown and thus difficult to manage or to assess
FAD fisheries	<ul style="list-style-type: none"> FAD fisheries catches conceal actual biomass abundance with density. Unknown effects on migration patterns and stock abundance Unknown number of FADs operating in the region 	<ul style="list-style-type: none"> Estimates of catch per unit of effort (CPUE) cannot be considered as an index of relative abundance. Biomass can be reduced with no clear signs on the actual status of abundance of the stocks
Habitat degradation and effects from climate change	<ul style="list-style-type: none"> Increases in seawater temperatures and pH can affect billfish prey distribution and have negative and varying consequences on all life stages of the billfish 	<ul style="list-style-type: none"> Reduction of billfishes' abundance and change in habitat use and distribution or migration patterns

Topic	Issue	Consequences
Socio-economic impacts	<ul style="list-style-type: none"> • In several countries, small-scale/ artisanal fishers are dependent on billfish to generate additional family income and/ or to provide cheap food for many local communities. • Different perception of the values and use of the resource in commercial and recreational fisheries impose additional considerations for developing management strategies • Right based mechanisms not accepted nor understood • Limited application of co-management in practice • Socio-economic data collection generally deficient 	<ul style="list-style-type: none"> • Conflicts between commercial and recreational sectors due to the level of extraction and the competition for same fishing grounds and resources available. • Management requires planning and coordination with measures in place for other fisheries and close consultation and participation of stakeholders. • General reluctance to accept and implement right-based approaches. • Socio-economic situation not well analysed and documented • Incomplete knowledge of the value of commercial and recreational fisheries
Illegal, Unreported, Unregulated (IUU) fishing	<ul style="list-style-type: none"> • Illegal fishing from local and foreign fleets in national and EEZ waters • Limited regional coordination in the use of vessel monitoring systems, (VMS), or system not in place at the national level • Migratory nature of billfish and extension of the fishing areas make difficult to control IUU fishing • No specific regulations for commercial and recreational billfish fisheries in many countries • Limited regional coordination for exchange of information and use of vessel registers or no register in place at the national level 	<ul style="list-style-type: none"> • The proportion of the illegal fishing or trade remains undefined in most of the countries • Regional collaboration is needed among stakeholders if IUU fishing is to be adequately addressed • Negative economic impacts • Unreported fishing creates challenges for fishery management
Surveillance and enforcement	<ul style="list-style-type: none"> • Extension and distance of the fishing areas creates challenges for logistics and funding for surveillance at sea • Establishment of observer programs allowing the collection of good data is difficult because of need for trained personnel and sufficient funds • Satellite based VMS information is in place in some countries, however real-time data are not always available for fisheries managers and other government entities participating in surveillance and enforcement • No regional coordination agreed and in place 	<ul style="list-style-type: none"> • Enforcement can become inefficient and ineffective. • Enforcement costs are increasing, while cost recovery (through licenses, fines and confiscations) is hardly possible due to outdated/ poor fisheries legislation • Partnerships needed among different stakeholders, especially in the ABNJ • Benefits of available technology are not always maximized due to technological, administrative or political issues
Participation in the decision making process	<ul style="list-style-type: none"> • In general, low participation of artisanal fishers in fisheries planning and management decision making processes. They are not empowered to participate more actively in fisheries management. • Limited organization of commercial and recreational fishers in groups, cooperatives or associations makes it difficult for fisheries authorities to involve them in management. • Limited participation and influence in ICCAT decision-making 	<ul style="list-style-type: none"> • Fisheries co-management in the Caribbean remains at the pre-implementation phase. • Poor or non-organisation causes non-representation of fishers in important management and decision making processes in fisheries • ICCAT Regulations may have a serious impact on countries with low level of stakeholders' involvement
Management	<ul style="list-style-type: none"> • No fisheries governance arrangements for management of billfish fisheries at the WECAFC level • No national/regional/sub regional billfish 	<ul style="list-style-type: none"> • No regional cooperation and management in place, except for ICCAT regulations on quota systems and other management

Topic	Issue	Consequences
	<p>management plans in place</p> <ul style="list-style-type: none"> • Not all of WECAFC countries are members of ICCAT • Most of the billfish are part of the bycatch in commercial operations and in general, there are no bycatch management plans in the region • Lack of longer range continuity regarding government support for fishery management 	<p>measures</p> <ul style="list-style-type: none"> • Billfish fisheries in the Caribbean is not high on the agenda of ICCAT • Flag state responsibilities under international agreements are not being enforced effectively • Many populations are exploited by multinational fisheries whose regulation, from a political perspective, is exceedingly difficult. • Assessment and management is complicated and sometimes ineffective
Recreational Fisheries	<ul style="list-style-type: none"> • Recreational component of Western Atlantic billfish fisheries likely has a high total economic value • Recreational fisheries not always fall under fishery authorities' competence and responsibilities • Interaction and competition occur with other fisheries for same resources and fishing grounds 	<ul style="list-style-type: none"> • The value of recreational fisheries not addressed in ICCAT and not well studied or understood • Recreational fisheries not considered in fishery management • Conflicts with commercial fisheries

Based on the information presented, the need for a regional billfish management plan is summarized in the following points:

1. Overexploitation of billfishes
2. Lack of fishery management at the WECAFC level
3. Limited statistical and biological information objectively collected for stock assessment and reporting purposes
4. Lack of unbiased stock assessment
5. Important expansion of fish aggregating devices for pelagic fish in the WECAFC area and beyond
6. Limited national regulatory institutional frameworks in many cases, in particular regarding sport/recreational fisheries

5. Principles and Objectives

5.1 Principles

Participation. Stakeholders that contribute to fishing mortality and those involved in recreational fisheries and conservation-related activities should participate in management. All sectoral planning decisions and actions affecting communities should take into account the participation of interested and affected parties. The Consortium on Billfish Management and Conservation should play an important role to organize stakeholders to participate and have a voice in the decision making process.

Adoption of the Precautionary Approach. Because of the downward trend in landings, reduced relative abundance reported and unsustainable stock levels, successful management of billfish-related fisheries should be based on the precautionary approach.

Adoption of the Ecosystem Approach to Fisheries (EAF). Commercial and recreational fisheries exhibit numerous regional distinctions and differences such as: target and incidental species, catch and release, by-catch and by-catch mortality, geographic location, gear, season and vessel characteristics. Consequently, each fishery poses different levels of risk to billfish populations. Therefore, as it is defined by FAO, EAF strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.

Gradual application. The Plan will be gradually implemented in an adaptive process on the basis of the evaluation of progress and results of the activities and the priorities set by Governments and or Regional/Sub-regional Organizations and stakeholders.

Adaptive management. Social, economic and biological/ ecological variables need to be continuously monitored because they are dynamic and have some level of uncertainty, and adjusting actions and strategies based on new knowledge are to be taken. Therefore, the management process of modifying policies and actions in light of evaluation of the success/failure of past actions related to previously defined operational objectives should be followed.

Responsibility. The national fisheries authorities responsible for fisheries management in the WECAFC region are basically responsible for implementing the regional management and conservation plan within their national jurisdictions, and for monitoring and evaluating the status of implementation against the objectives and indicators agreed upon.

5.2 Goal

The goal of this 5-year Caribbean Regional Billfish Management and Conservation Plan is to contribute to the sustainability of billfish stocks through adaptive management and conservation actions in commercial and recreational fisheries in the Western Central Atlantic Ocean.

5.3 Specific objectives

Table 2 shows the logical framework for the plan implementation and Annex 1 shows the proposed regional specific objectives and management activities/measures timeline.

The Regional Management and Conservation Plan was developed with the following specific objectives:

1. Improve fishery catch and fishing effort data collection and reporting programs in billfish recreational and commercial fisheries.
2. Reduce, to the extent practicable, bycatch and discard mortality of Caribbean billfish in longline fisheries for large pelagics and around moored FADs.
3. Increase the coordination, collaboration and participation in current regional governance arrangements to address Caribbean billfish management and conservation.
4. Improve monitoring, control and surveillance of commercial and recreational fishing effort on billfish with harmonized management measures which contribute to combat IUU fishing.
5. Minimize adverse social and economic effects on recreational and commercial activities to the extent practicable, consistent with ensuring achievement of the other objectives of this plan.

Table 2 Logical framework for plan implementation

<i>Specific Objectives</i>	<i>Outputs</i>	<i>Activities</i>	<i>Indicators</i>	<i>Means of Verification</i>	<i>Assumptions</i>
1. Improve fisheries catch/ landings and effort data collection and reporting programs in billfish recreational and commercial fisheries	National and regional database with recreational and commercial fisheries data based on agreed protocols Commercial billfish fisheries data and statistics improved in support of management decision making processes, including negotiations for quota at ICCAT	<ul style="list-style-type: none"> • Design, test and validation of a data collection scheme for recreational fisheries • Adoption of a data collection scheme for recreational fisheries • Establishment of a Fisheries Information System at WECAFC secretariat in coordination with FAO-FIRMS • Countries start reporting sport/ recreational fisheries data to FAO and ICCAT • Capacity building in fisheries statistics 	<ul style="list-style-type: none"> • Recreational fisheries data collection system and protocols validated and adopted in at least 15 countries by year 3 • Regional Fisheries Information System in place at WECAFC secretariat by year 1 • Recreational fisheries national databases ready for regional integration in at least 15 WECAF countries by year 3 • Integration with FAO-FIRMS and ICCAT databases by year 5 	<ul style="list-style-type: none"> • Fisheries data collection system in place in the WECAFC region • Agreements and protocols agreed at the regional level • National Reports of recreational fisheries data available • FAO and ICCAT reports available 	<ul style="list-style-type: none"> • Availability of staff to collect data and keep data base with up-to-date data. • Financial resources available • Industrial and artisanal commercial fisheries catch and effort data for large pelagics in place to complement billfish recreational fisheries data
2. Reduce, to the extent practicable, bycatch and discard mortality of Caribbean billfish in longline fisheries for large pelagics and around moored FADs	Billfish by-catch and by-catch mortality addressed and reduced	<ul style="list-style-type: none"> • Awareness raising and creation of incentives for billfish bycatch reduction • Change traditional J hooks for circular hooks in selected longline fisheries operating in the WECAFC region where billfish are bycatch • Carry out training workshops on the change and use of circle hooks and billfish releasing techniques • Promotion of catch and release techniques in billfish recreational fisheries • Promotion and adoption in the WECAFC region of IGFA international 	<ul style="list-style-type: none"> • Type of incentives in place to address bycatch issues by year 3 in at least 10 WECAF countries • Number of training workshops on circle hooks by year 3 in at least 10 countries • Number of fisheries with circle hooks implemented in longline gears and recreational fisheries by year 5 in at least 10 WECAFC countries • IGFA international angling rules adopted and implemented in at least 15 WECAFC countries by year 3 • Regulations of the CRFM Management Plan for FAD fisheries adopted and implemented 	<ul style="list-style-type: none"> • Incentives created and implemented • Official documents adopting circle hooks in longline fisheries and international angling rules • Fisheries documented to be using circle hooks • Training Workshop reports • Official document adopting the management plan for FAD fisheries • Catch statistics reports from longline and recreational fisheries 	<ul style="list-style-type: none"> • Fishers are aware of the importance to protect bycatch species • Moored FADs fisheries implement the FAD management plan of the CRFM

<i>Specific Objectives</i>	<i>Outputs</i>	<i>Activities</i>	<i>Indicators</i>	<i>Means of Verification</i>	<i>Assumptions</i>
		angling rules • Adoption of the regulations established by the CRFM sub regional management plan for FAD fisheries	where needed		
3. Increase the coordination, collaboration and participation in current regional governance arrangements to address Caribbean billfish management and conservation	Harmonized and adaptive billfish regional management mechanisms with enhanced partnership between organizations and stakeholders	<ul style="list-style-type: none"> • Implementation of the Interim Management Mechanism established under the CLME+ project (WECAFC, CRFM and OSPESCA) • Sign a Memorandum of Understanding between ICCAT and WECAFC for improving participation on management and conservation measures for billfishes • Consortium on Billfish Management and Conservation (CBMC) actively participating with recommendations and advice during the implementation of the Plan • Evaluate the need to continue or not with the WECAFC recreational fisheries working group • Support the development of regionally harmonized regulations and management measures on billfish fisheries 	<ul style="list-style-type: none"> • Memorandum WECAFC-ICCAT signed by year 5 • Biannual meetings of the Consortium • Agreements of the Interim Management Mechanism • Recommendations provided by the Consortium • Increased membership and participation of Caribbean states in ICCAT • Regional regulations 	<ul style="list-style-type: none"> • Meetings' proceedings • Signed Memorandum • Signed agreements • Number of WECAFC members also member of ICCAT 	<ul style="list-style-type: none"> • Legal clearance to sign a memorandum of understanding • Consortium and Interim Mechanism in place and operating • Stakeholders interested to contribute actively to collaborative activities
4. Improve monitoring, control and surveillance of commercial and recreational	Harmonized regional management measures to monitor and control fishing effort in place	<ul style="list-style-type: none"> • Implementation of a VMS system in billfish-related industrial/artisanal and recreational fisheries 	<ul style="list-style-type: none"> • VMS system or alternate option established in billfish-related industrial and recreational fisheries in at least 	<ul style="list-style-type: none"> • VMS or alternate systems in place and operating • IUU reports • Vessel register 	<ul style="list-style-type: none"> • Human and financial resources are available • Willingness to adopt and implement

<i>Specific Objectives</i>	<i>Outputs</i>	<i>Activities</i>	<i>Indicators</i>	<i>Means of Verification</i>	<i>Assumptions</i>
<p>fishing effort on billfish with harmonized management measures which contribute to combat IUU fishing</p>		<ul style="list-style-type: none"> Find alternatives or complementary options to the use of VMS when appropriate Implementation of a billfish-related vessel register for commercial (industrial and artisanal) and recreational vessels Training on billfish identification for customs officials and other government officials 	<p>15 WECAFC countries by year 3</p> <ul style="list-style-type: none"> Alternate VMS for artisanal fisheries tested and validated by year 3 where needed and implemented by year 5 Billfish-related commercial and recreational vessels registered in at least 15 WECAFC countries by year 4 Training on billfish identification carried out in at least 10 WECAFC countries by year 3. 	<p>in place and implemented</p> <ul style="list-style-type: none"> Training reports Export reports 	<p>regional management measures</p> <ul style="list-style-type: none"> Legislative processes for issuance of national regulations in due time
<p>5. Minimize adverse social and economic effects on recreational and commercial activities to the extent practicable, consistent with ensuring achievement of the other objectives of this plan</p>	<p>Opportunities and alternatives identified and implemented for minimizing adverse social and economic effects, in particular for small scale fisheries and consumers</p>	<ul style="list-style-type: none"> Find and implement incentives and opportunities (business cases) for small scale fishers who work for conservation of billfishes, who want to move to the tourist sector or develop any alternate activity Promote and implement co-management and tenure rights where applicable Investigate mercury levels in billfish meat and their consequences for health of consumers 	<ul style="list-style-type: none"> Number of opportunities and incentives granted to artisanal fishers by year 5 in at least 10 WECAF countries Number of business cases prepared and /or implemented by year 3 in at least 10 WECAFC countries Number of compensation mechanisms in place by year 3 	<ul style="list-style-type: none"> Examples of business cases implemented Amount of money invested in business cases Amount and type of incentive mechanisms Number of fishers/ communities benefited Number of co-management or tenure rights initiatives implemented 	<ul style="list-style-type: none"> Political willingness and support Continuous active participation by stakeholders in decision making processes. Funding available

6. Regional management measures

- *Use of circle hooks in longline and hook and line commercial fisheries in the region*

Justification: The International Commission for the Conservation of Atlantic Tunas (ICCAT) has indicated that it may consider the mandatory adoption of non-offset circle hooks as terminal gear. Research on billfish caught on longline gear fitted with circle hooks reported that, depending on the species, 65-70% of billfish caught on circle hooks are alive on haul back. Released fish fitted with satellite tags indicated that post release survival ranged between 88-93%. Because billfish are caught primarily as bycatch for other species, these results indicate that circle hooks may be a viable conservation tool in longline fisheries. In addition to reduced billfish mortality, the catch rates of several of the targeted species remained unchanged or were greater than the catch rates observed with conventional J hooks.

The ICCAT Standing Committee on Research and Statistics (SCRS) reports that recent research has demonstrated that in some longline fisheries the use of non-offset circle hooks resulted in a reduction of marlin mortality, while the catch rates of several of the target species remained the same or were greater than the catch rates observed with the use of conventional J hooks or offset circle hooks. The Committee considers that this approach may be more efficient and enforceable than time-area closures and has recommended that the Commission take this approach. This measure is linked to specific objective 2.

Implementation advice: Incorporation of fisher's knowledge and perspectives into the decision making process will ensure maximal likelihood of adoption and will also identify barriers to the implementation of circle hooks, in particular in deciding whether to use non-offset circle hooks rather than offset circle hooks. Extensive promotion of the use of circle hooks in training programs for small scale and industrial fishers is needed. Lay down national and/or regional standards for circle hooks to be used.

- *Ban on exports of billfish*

Justification: An effective way for protecting species is preventing market development, in particular if the species are not a target in a fishery. Preliminary results from the studies carried out under the Billfish project indicate that the value of commercial landings of billfish in the WECAFC region is less than 1% of total fisheries production. As such, commercial harvest of billfish is probably not a significant revenue source for countries in the WECAFC region. Considering the relatively low market value of commercial billfish and economic contribution to the region, a conservation approach may be a ban on exports of billfish. Doing so might reduce incentive for commercial fishers retaining and landing billfish beyond that of the demand of local markets.

In addition, it is noted that most people are unaware that marlins have been reported to accumulate harmful levels of mercury. The United States Environmental Protection Agency (EPA) health guidelines for fish consumption indicate that any fish with a mercury level greater than 1.5 parts per million (ppm) should not be consumed in any amount. Marlins, especially large specimens, have been found to have mercury levels as high as 15 ppm. However, in many Caribbean countries local consumption is high due to traditional consumption patterns and its relatively cheap price. Therefore further studies on socioeconomic and health aspects would be needed before considering a ban on local trade and consumption. This measure is linked to specific objective 5.

Implementation advice: Regional regulation developed, adopted and implemented at national level. Carry out training on species identification for customs officials and any other government officials as required.

- *Fishing vessels for highly migratory species are required to use Vessel Monitoring Systems or similar alternate options.*

Justification: Vessel monitoring systems (VMS) are extensively used to monitor and assess the position and activity of commercial fishing vessels in particular, but can also be used in recreational fisheries. Among the benefits of using a VMS the following can be mentioned: provide important information to manage fisheries resources, improves compliance with fisheries regulations by providing regular positional information of vessel activity, provides information about the status of fish stocks and fish movement by contributing to increase accuracy and timeliness of catch and effort information, and facilitates rescue responses to emergencies at sea. This measure is linked to specific objective 4.

Implementation advice: Establishment of national VMS for fishing vessels (both commercial and recreational). In addition, the region explores ways to integrate the national systems through protocols and agreements among the countries. Development and implementation of VMS linked to monitoring, control and surveillance schemes. Of special importance is to test and validate alternate systems to be implemented in artisanal or small-scale fisheries where usual VMS shipboard equipment cannot be installed. The legal framework at national level should be developed or adapted if needed.

- *Commercial and recreational fishing fleet for highly migratory species should be officially registered to combat IUU fishing*

Justification: Licensing and registration are necessary conditions for monitoring, control and surveillance of fisheries and for implementing tenure rights approaches. They are also an important contribution to combat IUU fishing. There are already examples of national industrial fishing vessel registers linked to a sub-regional fishing fleet register in OSPESCA countries belonging to the SICA. Data could include the identification of the vessel and shipowner, and a record of performance and compliance. In a regional/sub regional context, information can be shared, under agreed procedures, among participating States in the region and decisions can be made regarding giving access to a vessel to fish in the area. As mentioned, vessel registration is an area that merits considerable attention for both monitoring, control and surveillance purposes but also for vessel safety requirements. The potential exists for this to be a credible international management tool for both flag State and port State control. This measure is linked to specific objective 4.

Implementation advice: Inclusion of all large pelagics commercial and recreational fishing vessels in the register. National vessel registers linked to a regional/sub regional register under procedures and provisions agreed by the WECAFC or sub regional fisheries bodies member States. Linked to the VMS system (see preceding bullet).

- *Catch/ landings and effort data of billfish commercial and recreational fisheries are required to be collected and reported*

Justification: Billfish catch and effort data of commercial and recreational fisheries are often incomplete but strongly needed for billfish stock assessment and provide information for decision making. In addition to national needs, the highly migratory nature of billfish stocks requires regional research and management that can only be effectively addressed through the analysis of complementary catch and effort data sets to ensure complete coverage. In some

cases, data only exist on paper or electronic data are not organized with statistical rigor and/or represent only short time periods.

Fishing effort is another key variable, particularly because most stock assessment models use catch per unit effort as an index of abundance. One particular concern regarding fishing effort is the use of FADs, many of which are not reported and recorded as part of the fishing effort as it should be. Fishery dependent data from commercial and recreational fisheries provide a direct measure of the effectiveness of management and regulations, and are of particular importance if a country is an ICCAT member. In recreational billfish fisheries there are fewer landings and are rarely reported. In general, catch/ landings and effort data collection for many fish species continues to be one of the main challenges of several fisheries departments in the Caribbean. This measure is linked to specific objective 1.

Implementation advice: Countries should invest to improve data collection from commercial and recreational fisheries as the issue of catch and fishing effort data collection has been recurrent for many other fisheries and in Caribbean regional/ subregional management plans (e.g. queen conch, flyingfish, spiny lobster). Improved coordination and cooperation among stakeholders in designing and participating in a meaningful way in data gathering can improve the quality of the data and reporting.

Due to the variety and particularities of Caribbean countries there is no one-size-fits-all solution for implementing a statistical data collection scheme. In most of the cases, statistical sampling approaches could be probably used to estimate total effort, catches, and discards. The Caribbean Billfish project will test and validate a data collection scheme for recreational fisheries which can be used. Those countries with important recreational and/or FADs fisheries will need to put in place a system for data collection which could include mandatory logbooks and fishery licences.

- **Other management measures**

In addition, there are other management measures which could be considered for further discussion in the future:

- closed areas for commercial fisheries
- closed seasons
- ban on billfish landings
- identification and conservation of critical billfish spawning areas
- billfish minimum size limits
- catch and bycatch quotas

These measures have not been included in this plan because they are not applicable in the WECAFC region under present circumstances. Nevertheless, some of them are already in place under ICCAT, e.g. minimum size limits and catch quotas, but further discussions are needed on how some of the ICCAT regulations can be adopted in the WECAFC region and implemented.

7. Adaptive management mechanisms for implementing and reviewing the management and conservation plan

This plan is a first step to establish a scheme for adaptive management and conservation of billfishes which form part of oceanic highly migratory species, and in particular for species which are mainly bycatch of large-scale tuna fisheries. The Interim Coordination Arrangement for Sustainable Fisheries developed under the CLME+ project among FAO/WECAFC, CRFM and OSPESCA seems to be a useful instrument to further the management and conservation of

billfish fisheries in the region. The Interim Coordination can assist with promotion of better fisheries management and ensure greater participation of the region in ICCAT and contributing to its objectives. The importance of large pelagic fisheries, including billfish, for the region was recognized by the countries that participated in recent years in the GEF (International Waters) funded Caribbean Large Marine Ecosystem (CLME) project. The Strategic Action Programme (SAP) of the CLME, which was endorsed by more than 25 governments in 2013, incorporated a strategy (5B) “Enhance the governance arrangements for implementing an ecosystem approach for large pelagics fisheries”. The SAP implementation will then contribute to establish and operationalize arrangements for the Caribbean billfish management plan implementation.

Figure 8 shows a proposed flowchart for the plan implementation and revision. At the national level, countries implement, review and evaluate the plan generating findings and recommendations which are then submitted to their respective subregional organizations (e.g. OSPESCA, CRFM and the CFMC). In turn, each subregional organization will follow the same process which will generate advice and recommendations to be provided to WECAFC at the regional level. In the case of countries that do not belong to any of the aforementioned organizations, then the advice is provided directly to WECAFC.

At the WECAFC secretariat level, advice and recommendations provided from the subregional level are sent for further considerations to the Consortium on Billfish Management and Conservation (CBMC) and the WECAFC/ OSPESCA/ CRFM/ CFMC recreational fisheries working group. The latter has to be evaluated in the near future whether it is going to be desirable to continue in operation or it has to be replaced by the CBMC.

At the regional level, it is also suggested by Figure 8 that a formal partnership agreement would have to be negotiated between FAO/WECAFC and ICCAT through a Memorandum of Understanding (MoU) or otherwise. It is suggested that WECAFC takes the lead in these negotiations as it has the broadest membership in the Caribbean and hence many more of its members are also ICCAT members. Furthermore, WECAFC can also seek assistance regarding the preparation of the legal instrument in consultation and cooperation with FAO headquarters and the Interim Coordination Arrangement.

The regional level decision making regarding any management plan amendments is carried out at WECAFC, and then reported back to the countries for their implementation.

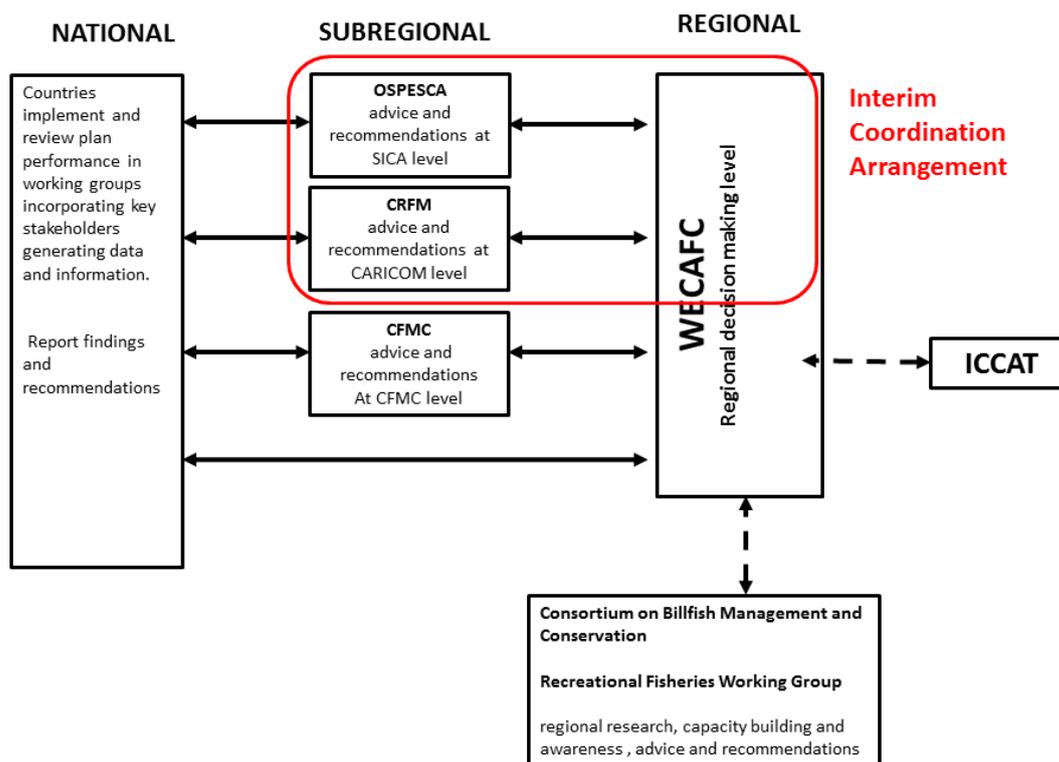


Figure 8 Proposed management plan implementation and revision mechanism

The main responsibility for monitoring and evaluating the implementation of the plan at the national level lies with the national fishery authorities in coordination with local key stakeholders. At the subregional level, RFB organizations are responsible for monitoring, in particular if we consider the existence of the Interim Coordination Arrangement agreed under the CLME+ framework. At the regional level, the overall responsibility for the coordination of all monitoring and evaluation activities lies with FAO/ WECAFC in coordination with ICCAT in case they sign the Memorandum of Understanding.

Furthermore, multi and bi-lateral development agencies, funds, financial institutions as well as government and non-government agencies, including stakeholder organizations, which will be funding and investing in the implementation of particular activities, will have to monitor and evaluate the use of their finances and the outcome of interventions and activities following their own established procedures.

Monitoring information and a review of progress with the implementation of each activity should be conducted on an annual basis. A first evaluation of the impact and outcome of each specific objective and the underlying activities should be conducted after three years and a major amendment of the plan carried out after five years and the plan renewed accordingly.

Resources will need to be mobilized for the Billfish Management and Conservation Plan to succeed. There is also a need for budget allocations and incorporation of the activities in the national plans at the country level as well as for increased private investment and credit support to develop business plans. For this to happen, the fishery sector needs to continuously demonstrate its beneficial economic and social role grounded on a transparent governance structure with full participation and involvement of all concerned stakeholders and the general

public. At a regional/ subregional level, the fishery organizations should cooperate and support the countries through projects implementation.

8. Research priorities

From the desk and field studies carried out under the Caribbean Billfish Project in 2015 and 2016, a frame of potential social, legal and biological research studies that could improve significantly the billfish conservation efforts in the WECAFC region has been identified. Research initiatives need to be carefully designed for implementation, taking into consideration the limitations in human and financial resources in the region.

The following research is required to support successful implementation of the management and conservation plan:

1. To carry out a major review and re-assessment of billfish growth to define more appropriate growth models to be incorporated in the billfish stock assessment work by ICCAT.
2. To design and implement a realistic and effective pilot program on recreational fishery statistics in the WECAFC region in support of management decision making processes.
3. To develop validated regional indices of billfish relative abundance that could be incorporated in ICCAT's stock assessment work.
4. To develop a WECAFC integrated analyses of the ecological and fishery effects of mFADs due to the fact that most mFAD supported fisheries in the region show consistently high catches of billfish.
5. To study the habitat use by the billfish resources in the WECAFC region by means of satellite tagging programs. This work will facilitate resource allocations, definition of potential protected (spawning) areas and seasonal fishing regulations, and enhancing fishing practices between fishing sectors.
6. To carry out more socioeconomic studies on commercial and recreational fisheries for highly migratory species. In particular, there is the need to have better reported prices and data on cost and earnings, more studies on billfish value generation for food security and value chain studies. The application of the Recreational Fisheries Economic Impact Assessment Manual should be promoted in as many WECAFC countries as possible.

9. Glossary

Binding

In legal terms, it refers to an agreement or resolution that cannot be legally avoided or stopped.

Biomass

The total weight of a fish species in a given area.

Bycatch

Species taken in a fishery targeting that is targeting on other species or on a different size range of the same species. That part of the by-catch no economic value is discarded and returned to the sea, usually dead or dying.

Catch per unit of fishing effort (CPUE)

Catch per unit of fishing effort (CPUE) is the total catch divided by the total amount of effort used to harvest the catch.

Comanagement

A management process (of resources) in which the government shares power with users, attributing to each of the parties specific rights and responsibilities regarding information and decision-making.

Critical habitat

Fisheries habitat necessary for the production of a given fishery resource. May be critical nursery habitat (e.g. mangroves and seagrasses) or critical spawning habitat (e.g. particular geographic location in the ocean where fish aggregate to spawn).

Discards

The components of a fish stock that are thrown back into the habitat after capture. Normally, most of the discards can be assumed not to survive.

Ecosystem

An organizational unit consisting of an aggregation of plants, animals (including humans) and microorganisms, along with the non-living components of the environment.

Exclusive economic zone (EEZ)

A zone under national jurisdiction (up to 200 nautical miles wide) declared in line with the provisions of 1982 United Nations Convention of the Law of the Sea, within which the coastal state has the right to explore and exploit, and responsibilities to conserve and manage, the living and non-living resources.

Fish Aggregating Device (FAD)

A permanent, semi-permanent or temporary structure or device made from any material and used to lure fish.

Fish stock (also fish/fishery resource)

The living resources in the community or population from which catches are taken in a fishery. Use of the term “fish stock” usually implies that the particular population is more or less isolated reproductively from other stocks of the same species and is thus self-sustaining. In a particular fishery, the fish stock may be one or several species of fish, but the definition is also intended to include commercial invertebrates and plants.

Fisheries management organizations or arrangements

The institutions responsible for fisheries management, including the formulation of the rules that govern fishing activities. The fishery management organization and its subsidiary bodies may also be responsible for all ancillary services, such as collecting information; assessing stocks; conducting monitoring, control and surveillance (MCS) and consultations with stockholders; applying and/or determining the rules access to the fishery, and for resource allocation.

Fishery

The term “fishery” can refer to the sum of all fishing activities on a given resource, for example, a shrimp fishery. It may also refer to the activities of a single type or style of fishing on a particular resource, for example a beach seine fishery or trawl fishery.

Fishing capacity

The ability to take the maximum amount of fish over a period of time (year, season) by a fishing fleet that is fully utilized, given the biomass and age structure of the fish stock and the present state of the technology.

Fishing effort

The total amount of fishing activity on the fishing grounds over a given period of time, often expressed for a specific gear type, e.g. number of hooks set per day or number of hauls of a beach seine per day. Fishing effort would frequently be measured as the product of (i) the total time spent fishing and (ii) the amount of fishing gear of a specific type used on the fishing grounds over a given unit of time.

Fishing intensity

Amount of fishing effort per area.

Fishing mortality

A technical term which refers to the proportion of the fish available being removed by fishing in a small unit of time; e.g. a fishing mortality rate of 0.2 implies that approximately 20 percent of the average population will be removed in a year due to fishing.

Fishing power

Defined as the product of the area of influence of the gear during a unit operation and the efficiency of the gear during that operation.

Fleet

The total number of units of any discrete type of fishing activity using a specific resource. Hence, for example, a fleet may be all the boats trawling for shrimps or all the fishers setting nets from the shore in a tropical multispecies fishery.

Fully exploited/fished

Term used to qualify a stock that is probably being neither overexploited nor under-exploited and is producing, on average, close to its maximum sustainable yield (MSY).

Indicator

A variable that can be monitored in a system.

Management

The art of taking measures affecting a resource and its exploitation with a view to achieving certain objectives, such as the maximization of the production of that resource. Management includes, for example, fishery regulations such as catch quotas or closed seasons. Managers are those who practice management.

Management measure

Specific controls applied in the fishery to contribute to achieving the objectives, including some or all of the technical measures (gear regulations, closed areas and time closures), input controls, output controls and user rights.

Maximum sustainable yield (MSY)

The highest theoretical equilibrium yield that can be continuously taken (on average) from a stock under existing (average) environmental conditions without significantly affecting the reproduction process.

Non-offset circle hook

A circle hook is defined as a non-offset hook with the point turned perpendicular back to the shank.

Otoliths

Calcareous deposits or bones found in chambers at the base of the skull in fish. Sectioned, these bones often show rings or layers which can be used to determine age.

Over-exploited/fished

Exploited beyond the limit believed to be sustainable in the long term and beyond which there is an undesirably high risk of stock depletion and collapse. The limit may be expressed, for example, in terms of a minimum biomass or a maximum fishing mortality, beyond which the resource would be considered to be over-exploited.

Pelagic zone

Any water in the sea that is not close to the bottom.

Pelagic fish

Fish that spend most of their life swimming and feeding in the pelagic zone, as opposed to resting on or feeding off the bottom. Examples are tuna and billfishes.

Principle

An overarching guiding concept for managing natural resources usually developed in the context of global agreements and/or legislation. Examples: ‘the precautionary approach’, ‘maintaining ecosystem integrity’.

Precautionary principle

A moral and political principle which states that if an action or policy might cause severe or irreversible harm to the public or to the environment, in the absence of a scientific consensus that harm would not ensue, the burden of proof falls on those who would advocate taking the action

Property rights

A legal right or interest in respect to a specific property. A type of resource ownership by an individual (individual right) a group (communal right), or the state (state property).

Quota

A share of the total allowable catch allocated to an operating unit such as a country, a community, a vessel, a company or an individual fisherman (individual quota) depending on the system of allocation. Quotas may or may not be transferable, inheritable and tradable. While generally used to allocate total allowable catch, quotas could be used also to allocate fishing effort or biomass.

Stakeholder

Any person or group with a legitimate interest in the conservation and management of the resources being managed. Generally speaking, the categories of interested parties will often be the same for many fisheries, and should include contrasting interests: commercial/recreational, conservation/exploitation, artisanal/ industrial, fisher/buyer-processor-trader as well as governments (local/ State/ national). The public and the consumers could also be considered as interested parties in some circumstances.

Stock

A group of individuals in a species occupying a well-defined spatial range independent of other stocks of the same species. Random dispersal and directed migrations due to seasonal or reproductive activity can occur. Such a group can be regarded as an entity for management or assessment purposes. Some species form a single stock (e.g. southern bluefin tuna) while others are composed of several stocks (e.g. albacore tuna in the Pacific Ocean comprises separate northern and southern stocks). The impact of fishing on a species cannot be fully determined without knowledge of the stock structure.

Stock assessment

The part of Fisheries Science that studies the status of a fish stock as well as the possible outcomes of different management alternatives. It tells us if the abundance of a stock is below or above a given target point and by doing so lets us know whether the stock is overexploited or not; it also tells us if a catch level will maintain or change the abundance of the stock.

Sustainable use

The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

Target species

Those species that are primarily sought by the fishermen in a particular fishery. The subject of directed fishing effort in a fishery. There may be primary as well as secondary target species.

Tenure

The rules that define how rights to land and other natural resources are assigned within societies as well as rights to use control and transfer these resources

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Annex 1 Proposed regional specific objectives and management activities/measures timeline

Specific Objectives	Outputs	Activities	Years- Expected implementation	
			1-3	3-5
1.Improve fisheries catch and effort data collection and reporting programs in billfish recreational fisheries	National and regional database with recreational fisheries data based on agreed protocols Commercial billfish fisheries data and statistics improved in support of management decision making processes, including negotiations for quota in ICCAT	Design, test and validation of a data collection scheme for recreational fisheries		
		Adoption of a data collection scheme for recreational fisheries		
		Establishment of a Fisheries Information System at WECAFC secretariat in coordination with FAO-FIRMS		
		Countries start reporting sport/ recreational fisheries data to FAO and ICCAT		
		Capacity building in fisheries statistics		
2.Reduce, to the extent practicable, bycatch and discard mortality of Caribbean billfish in longline fisheries for large pelagics and around moored FADs	Billfish by-catch and by-catch mortality addressed and reduced	Awareness raising and creation of incentives for billfish bycatch reduction		
		Change traditional J hooks for circular hooks in selected longline fisheries where billfish are bycatch operating in the WECAFC region		
		Carry out training workshops on the change and use of circle hooks and billfish releasing techniques		
		Promotion of catch and release techniques in billfish recreational fisheries		
		Promotion and adoption in the WECAFC region of IGFA international angling rules		
		Adoption and implementation of the		

<i>Specific Objectives</i>	<i>Outputs</i>	<i>Activities</i>	<i>Years- Expected implementation</i>	
			1-3	3-5
		regulations established in the CRFM sub regional management plan for FAD fisheries		
3. Increase the coordination, collaboration and participation in current regional governance arrangements to address Caribbean billfish management and conservation	Harmonized and adaptive billfish regional management mechanisms with enhanced partnership between organizations and stakeholders	Support the Implementation of the Interim Management Mechanism established under the CLME+ project (WECAFC, CRFM and OSPESCA)		
		Sign a Memorandum of Understanding between ICCAT and WECAFC for improving participation on management and conservation measures for billfishes		
		Consortium on Billfish Management and Conservation (CBMC) actively participating with recommendations and advice during the implementation of the plan		
		Adoption and Implementation of IGFA recreational fishery regulations at the WECAFC level		
		Evaluate the need to continue or not with the WECAFC recreational fisheries working group		
		Support the development of regionally harmonized regulations and management measures on billfish fisheries		
4. Improve monitoring, control and reporting of commercial and recreational fishing effort on billfish with harmonized management measures which contribute to combat IUU fishing	Harmonized regional management measures to monitor and control fishing effort in place	Implementation of a VMS system in billfish-related industrial/ artisanal and recreational fisheries		
		Find alternatives or complimentary options to the use of VMS when appropriate		
		Implementation of a billfish-related vessel register for commercial (industrial and artisanal) and recreational vessels		
		Training on billfish identification for customs officials and other government officials		
5. Minimize adverse social and economic effects on recreational and	Opportunities and alternatives identified and implemented	Find and implement incentives and opportunities (business cases) for small scale/ artisanal fishers who adopt conservation of		

<i>Specific Objectives</i>	<i>Outputs</i>	<i>Activities</i>	<i>Years- Expected implementation</i>	
			1-3	3-5
commercial activities to the extent practicable, consistent with ensuring achievement of the other objectives of this plan	for minimizing adverse social and economic effects, in particular for small scale fisheries	billfishes, want to move to the tourist sector or develop any alternate fishing activity		
		Promote and implement co-management and tenure rights		
		Investigate mercury levels in billfish meat and their consequences for health of consumers		