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Preparation of this document

The Caribbean Billfish Management and Conservation Plan was prepared by Roy Bealey and Manuel Perez Moreno, Regional Project Coordinators of the Caribbean Billfish Project of the Food and Agriculture Organization of the United Nations (FAO) in the years 2015–2018, and Raymon van Anrooy, Secretary of the Western Central Atlantic Fishery Commission (WECAFC) in the period 2011–2017, with assistance of many regional fisheries experts.

The preparation of this Plan started in 2015, through several desk and field studies conducted by the Caribbean Billfish Project which was financed by the Global Environment Facility (GEF), implemented by the World Bank, and executed by FAO/WECAFC. These studies provided background information on the status of billfish resources, potential rights based fishery management approaches, an estimation of the value of billfish species to artisanal, commercial and recreational fisheries and a diagnosis of Caribbean national legal and institutional fisheries frameworks. A primary outline of the Table of Contents and a draft proposal of regional management measures for inclusion within this Management Plan were presented at the 2nd Regional Workshop on Billfish Management and Conservation that took place in November 2015 in the Republic of Panama. A first draft was elaborated by March 2016, following a consultation process with the assistance of the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries. A second draft was reviewed and technically endorsed during the 3rd Regional Workshop on Billfish Management and Conservation held in Barbados in April 2017. Comments obtained at the 3rd Regional Workshop, as well as further comments from specialists at the World Recreational Fisheries Conference in Canada and from members of the Global Ocean Think Tank (GLOTT) were all incorporated to produce this Caribbean Billfish Management and Conservation Plan.

The Plan was reviewed and scientifically endorsed by the 8th Session of the WECAFC Scientific Advisory Group (SAG) held in Merida, Mexico in November 2017. The Plan was technically edited by Sjef van Eijs, international fisheries consultant, in the second semester of 2018 and was reviewed for layout and formatted by Marianne Guyonnet and Chorouk Benkabbour at FAO. The Plan was distributed to the WECAFC, CRFM and OSPESCA member governments in late 2018 and early 2019.

Abstract

This Caribbean Billfish Management and Conservation Plan has been prepared to reverse the trend of declining stocks of billfish species within the Western Central Atlantic Ocean and its adjacent seas, and to address unsustainable fishing practices. The Members of the Western Central Atlantic Fishery Commission (WECAFC), Caribbean Regional Fisheries Mechanism (CRFM), Central America Organization for Fishery and Aquaculture (OSPESCA) and the Caribbean Fisheries Management Council (CFMC) are concerned about the billfish stocks that are harvested in the region. Therefore, they developed together, through the Recreational Fisheries Working Group, and in close collaboration with all key stakeholders in the Consortium on Billfish Management and Conservation (CBMC) this plan in the period 2015–2018. The plan recognizes the mandate of the International Commission for the Conservation of Atlantic Tunas (ICCAT) over the billfish stocks, and supports the implementation of the ICCAT recommendations in the region.

The objective of this Plan is to outline and guide the implementation of a suite of billfish management measures over a five-year period at regional and sub-regional scales to help secure the potential future benefits that can accrue from billfish stocks in the Caribbean.

The overarching goal is to improve the management and conservation of billfish stocks. Specific objectives of the plan include:

1. Improve billfish catch, effort, biological and socio-economic data collection and reporting programs from all fisheries that target these shared stocks;
2. Reduce bycatch, discards and overall fishing mortality of billfishes in order to achieve sustainable stock levels throughout the region;
3. Increase coordination and collaboration between nations through a regional governance framework better suited to effectively address the Caribbean region billfish management and conservation issues;
4. Institute the monitoring, control and surveillance of the billfish fishing effort across all fisheries through regionally harmonized mechanisms to effectively contribute to combat illegal, unreported and unregulated (IUU) fishing operations in the Caribbean region;
5. Enhance the sustainable socio-economic performance of fisheries capturing billfishes in the WECAFC area.

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Abbreviations and acronyms

ABNJ	Areas Beyond National Jurisdiction
AIS	Automatic Identification System
BMSY	Biomass at the Maximum Sustainable Yield Level
CARICOM	Caribbean Community
CBMC	Consortium on Billfish Management and Conservation
CFMC	Caribbean Fisheries Management Council (USA)
CI	Conservation International
CLME	Caribbean Large Marine Ecosystem project
CNFO	Caribbean Network of Fisherfolk Organisations
CPC	Contracting Parties and Cooperating Non-Contracting Parties, Entities or Fishing Entities
CPUE	Catch per Unit of Effort
CRFM	Caribbean Regional Fisheries Mechanism
EAF	Ecosystem Approach to Fisheries
EEZ	exclusive economic zone
FAD	Fish Aggregating Device
mFAD	Moored Fish Aggregating Device
FAO	Food and Agriculture Organization of the United Nations
FMSY	Fishing Effort at the Level of the Maximum Sustainable Yield
FIRMS	Fisheries and Resources Monitoring System
GEF	Global Environment Facility
GLOTT	Global Ocean Think Tank of the WWF
GSI	Gonadosomatic Index
ICCAT	International Commission for the Conservation of Atlantic Tunas
IGFA	International Game Fish Association
IUU fishing	Illegal, Unreported and Unregulated fishing
IUCN	International Union for Conservation of Nature
LJFL	Lower Jaw Fork Length
MCS	Monitoring, Control and Surveillance
NOAA	National Oceanic and Atmospheric Administration
OSPESCA	Central America Fisheries and Aquaculture Organization
PSAT	Pop-up Satellite Archival Tags
PSMA	Port State Measures Agreement
RFB	Regional Fishery Body
RFMO	Regional Fisheries Management Organization
SCRS	Standing Committee on Research and Statistics of the ICCAT
SIDS	Small Island Developing States
TAC	Total Allowable Catch
tRFMO	Tuna Regional Fisheries Management Organization
UNCLOS	United Nations Convention on the Law of the Sea
VMS	Vessel Monitoring System
WECAFC	Western Central Atlantic Fishery Commission

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- Nelson Ehrhardt – for his thorough draft reviews with specific advice on how to effectively account for FAD issues and improve the management of fisheries using them.
- All participants of the national and regional meetings of the Caribbean Billfish Project, during which this document was developed, presented, discussed and refined.
- All members of the Consortium on Billfish Management and Conservation (CBMC), a great collection of passionate experts, who supported this and many other processes of the Caribbean Billfish Project.

Executive summary

The International Commission for the Conservation of Atlantic Tunas (ICCAT) is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. All Atlantic billfish species are, therefore, also of direct concern to ICCAT. The implementation of more specific and effective fisheries management measures is required to secure the sustainability of stocks of these billfish species throughout the Atlantic, with the Caribbean as a priority region for action. Although serious gaps persist in billfish catch and biological data, it is clear that reductions in billfish fishing mortalities are required to rebuild these valuable stocks, after decades of overfishing have reduced the stocks to alarming levels.

Consistent trends in declining stock abundance for billfish species within the Atlantic Ocean and its adjacent seas, mainly on account of the multiple decades of unsustainable fishing practices, are an ongoing concern.[1] This concern, based on billfish species stock assessments, alongside continuous deficiencies in billfish data reporting, suggest that the increasingly stern made by ICCAT billfish management measures and recommendations have so far been largely unsuccessful in securing stock sustainability, and in optimizing their ecological and socio-economic yield potentials.[2] Many Caribbean countries are actively implementing more directed and efficient billfish harvest approaches in order to maintain and/or enhance fishery revenues and livelihoods in response to regionally declining catch levels of reef fishes and other near shore fish stocks that have resulted from nearshore overfishing. An increase in the rate of billfish catches is particularly noticeable around Fish Aggregating Devices (FADs),[3] deployed to augment the fishing power of small nearshore commercial and recreational vessels. This phenomena clearly goes against efforts by ICCAT to reverse billfish stock declines through reducing fishing mortality to within biologically sustainable limits. These factors combined highlight the urgent need to better manage billfish capture fisheries throughout the Caribbean, both within and beyond areas of national jurisdiction (ABNJ).

Billfish species provide diverse and valuable contributions to Caribbean nations' economies and livelihoods through commercial artisanal, recreational and industrial fisheries. These fisheries provide significant socio-economic benefits to the region while they operate on different, although often overlapping, geographic scales and pursue objectives that are potentially conflictive in nature. The future of threatened billfish species rests in the ability of regional fisheries management organizations (RFMOs) and their member nations to comprehensively manage the fishing operations by these diverse fisheries harvesting the migratory billfish stocks.[4]

Measures proposed in this Caribbean Billfish Management and Conservation Plan recognize current concerns about incomplete data and overexploited stocks, and

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[1] Ehrhardt, N and M. Fitchett. 2015. Baseline desk study on the status of billfish resources and the billfish fisheries in the Western Central Atlantic. (Available at - www.fao.org/3/a-i6204e.pdf).

[2] ICCAT. 2015. Recommendation to further strengthen the plan to rebuild blue marlin and white marlin stocks. Recommendation 15-05 – (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2015-05-e.pdf).

[3] 2015 Draft Sub-Regional Management Plan for FAD Fisheries in the Eastern Caribbean (Available at - www.crfm.net/images/2015_Draft_Sub-Regional_Management_Plan_for_FAD_Fisheries_in_the_EC_Final_Draft_revised_24_Sept_2015.pdf).

[4] Leite N, Jr., Harwell H, Lessa R, Fredou FL, Oxenford HA, Serra R, Shao KT, Sumaila R, Wang SP, Watson R, Yáñez E. 2011. High Value and Long Life – Double Jeopardy for Tunas and Billfishes. Science. 333 pp 291- 292. (Available at - http://fishdb.sinica.edu.tw/pdf/896.pdf).

advocate a precautionary and ecosystem-based approach for the management of billfish stocks.

In the period 2015-2017, the WECAFC/CRFM/OSPESCA/CFMC Recreational Fisheries Working Group met three times and developed, amongst other documents, this Caribbean Billfish Management and Conservation Plan. This document underwent multiple reviews by the Consortium on Billfish Management and Conservation (CBMC) and other diverse fishery stakeholders during various meetings. The drafting process and the organization of the various stakeholder meetings was supported by the Caribbean Billfish Project, which aims to secure the sustainability of billfish stock harvests through innovative fishery management mechanisms.

The objective of this Plan is to outline and guide the implementation of a suite of billfish management measures over a five-year period, at regional and sub-regional scales, to help secure the potential future benefits that can accrue from billfish stocks in the Caribbean. The overarching goal is to improve the management and conservation of billfish stocks.

The Plan includes adaptive management actions that align with ICCAT's Atlantic-wide recommendations and secure the maximum sustainable ecological and socio-economic values for the Western Central Atlantic Ocean region's population in general, and the artisanal, commercial, industrial and recreational billfish fisheries in particular. This management plan builds upon billfish relevant fishery management recommendations of ICCAT and provides guidance for the management of billfish capturing fisheries in ICCAT member and non-member Caribbean states. It outlines primary interventions required to secure sustained economic benefits from billfishes and to contribute to food security in the Caribbean region.

Some of the proposed interventions are directed essentially at strengthening the regional billfish fisheries management framework, while others seek to directly reinforce short-term management.

This Plan's specific objectives are the following:

1. Improve billfish catch, effort, biological and socio-economic data collection and reporting programs from all fisheries that target these shared stocks, or catch them as bycatch;
2. Reduce bycatch, discards and overall fishing mortality of billfishes in order to achieve sustainable stock mortality rates throughout the region;
3. Increase coordination and collaboration between nations through a regional governance framework better suited to effectively address the Caribbean region's billfish management and conservation issues;
4. Institute the monitoring, control and surveillance of the billfish fishing effort across all fisheries through regionally harmonized mechanisms that contribute to effectively addressing illegal, unreported and unregulated (IUU) fishing operations in the Caribbean region;
5. Enhance the sustainable socio-economic performance of fisheries capturing billfishes in the Western Central Atlantic Fishery Commission (WECAFC) area.

In addition, a number of practical management actions, which can be linked to the Specific Objectives, are proposed in the Plan. There already exists a fair measure of consensus on these actions due to prior stakeholder reviews of this Plan. It can, therefore, be expected that this Plan has region-wide stakeholder support and will deliver short term direct impacts on mortality, the fishing effort and more coordinated local and regional billfish management. The practical actions include:

1. Promote the use of circle hooks and live release of billfishes among all hook and line billfish capturing fisheries in the region.
2. Limit exports, inter-island trade and consumption of billfish products.

3. Require fishing vessels that harvest shared stocks of large pelagic fish to regularly report their billfish fishing activities and harvests, and to use Vessel Monitoring Systems and/or similar systems.
4. Encourage, support and formally introduce innovative fishery management arrangements, gears, technologies and fishing methods that reduce billfish mortalities to within sustainable levels.
5. Protect identified spawning and other sites of importance to billfish species' ecological life-cycles within the Caribbean.

The present Plan requires periodical reviews on the effectiveness of implemented management interventions, which will be followed up by adjustments and/or additions of the management measures when considered necessary.

1. Introduction

This Caribbean Billfish Management and Conservation Plan is primarily intended to promote and guide the sustainable management of billfish stocks within the Caribbean Sea and the broader WECAFC area of competence (Figure 1). Many of the concepts and methodologies described are, however, also more broadly applicable to common billfish stock management issues prominent throughout the Atlantic and beyond. The term "billfish" refers to the family *Istiophoridae*, a group of predatory fishes characterized by a prominent rostrum, commonly referred to as a "bill", extending from their upper jaw.

Classified as highly migratory pelagic fishes, billfish species travel great distances within the Caribbean Sea and beyond, as their movements do extend into both the Gulf of Mexico and the broader Atlantic Ocean. Nonetheless, the Caribbean Sea is believed to encompass a large enough geographical area for improved regional management to produce beneficial results for the overall state of Atlantic billfish species stocks. This concept is reinforced by the relatively successful management and conservation of billfishes by the United States of America at the northern boundary of the Caribbean, and through the overarching support provided by WECAFC as a Regional Fishery Body (RFB), within its broader area of competence.

Billfish species within the Caribbean region covered by this management plan include Atlantic blue marlin (*Makaira nigricans*), white marlin (*Kajikia albida*), sailfish (*Istiophorus platypterus*), roundscale spearfish (*Tetrapturus georgii*) and longbill spearfish (*Tetrapturus pfluegeri*). Billfishes contribute livelihoods and food security to Caribbean nations through both extractive and non-extractive fisheries operations. Billfishes are harvested by a number of extractive fisheries, both local and international, that have different fishing methods, harvest capacities, harvest controls and resultant stock impacts. Parallel to these commercial fisheries and fleets, a typically non-extractive recreational offshore fishery has emerged within which billfishes represent the most prized, highly regarded and thus, targeted group of fishes.

Declining trends in the populations of most billfish species stocks have been recorded on a global level, with exceptions typically falling on species for which species specific data provision is insufficient to support suitably robust trend analyses. Most of these stocks continue to be subject to unsustainable overfishing while their stock biomasses have generally already fallen far below levels capable of producing Maximum Sustainable Yields (MSY).[5] The Atlantic Ocean is no exception. Assessments conducted in 2011 by the International Commission for the Conservation of Atlantic Tunas (ICCAT) for Atlantic blue marlin and in 2012 for white marlin indicated that both stocks were overfished and that overfishing is ongoing for Atlantic blue marlin. Final results of the 2018 stock assessment for blue marlin were pending at the time of writing. The 2016 stock assessment for sailfish reported that the western stock is not overfished and that this is also not likely to occur. However, in view of the fact that the results of this 2016 sailfish stock assessment were highly uncertain due to many persisting data concerns, the ICCAT Standing Committee on Research and Statistics (SCRS) recommended that western Atlantic sailfish catches should not exceed current levels.[6] Some billfish species, including Atlantic longbill and roundscale spearfish,

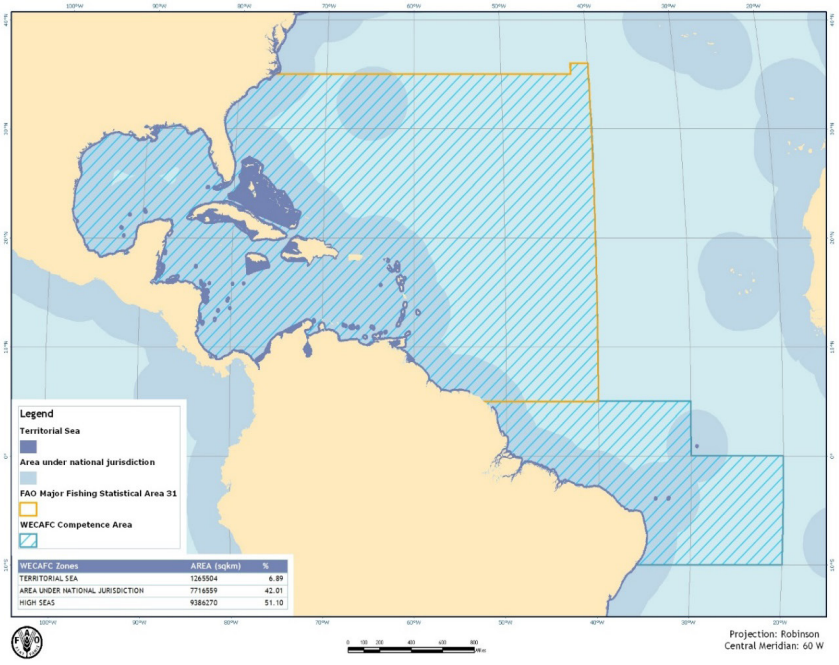
[5] Pons *et al.* 2017. Effects of biological, economic and management factors on tuna and billfish stock status. *Fish and Fisheries* 18, 1-21.

[6] www.iccat.int/Documents/Meetings/Docs/2016_SCRS_ENG.pdf

remain unassessed due to insufficient species specific data, as their catch statistics have generally been merged with those of other species.

Actions by Caribbean nations to improve the management and conservation of billfish resources, through adjusting their collective influence upon these stocks and decision-making processes at the ICCAT level, offer some opportunities to reverse billfish stock declines. Such actions simultaneously support the current ICCAT objectives of rebuilding blue and white marlin stocks, in addition to endorsing the sailfish catch level recommendation adopted in 2016.[7] Implementing such actions should take into due consideration the interests of all extractive and non-extractive fisheries targeting billfishes. Currently, no regional or sub-regional management plan is in place for billfish or any large pelagic species in the wider Caribbean region, although a number of nations in the WECAFC area are signatory to relevant overarching multilateral conventions and/or have domestic regulations in place that could impact on the harvest levels of these species.

FIGURE 1
Area of competence for the Western Central Atlantic Fishery Commission (WECAFC)



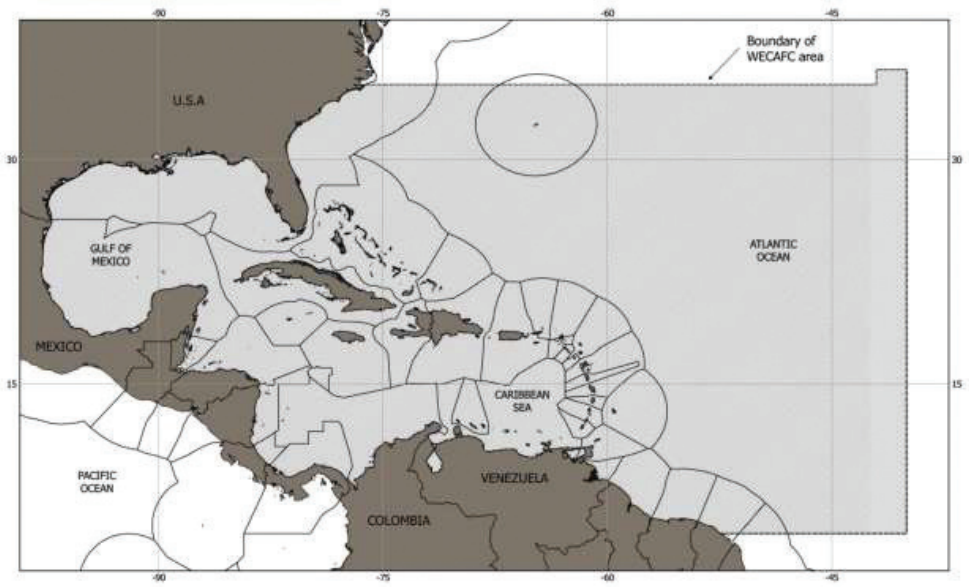
Source: FAO

In this context, it is worth noting that this is not the first regional management plan of its kind, as one specific to billfish was already developed back in 1981 for the Western Pacific.[8] That management plan highlighted the potential to accrue financial and linked societal benefits through increasing the respective Catch Per Unit Effort (CPUE) for recreational billfish fisheries, which allocate high financial and emotional values to the catching of billfish species. It also suggested that all potential social, economic and ecological benefits should be considered when determining optimal billfish yields and associated abundance thresholds, not just the volume that can sustainably be extracted from the stock according to conventional MSY methods.

[7] Recommendation by ICCAT on management measures for the conservation of Atlantic sailfish. (Available at: http://iccat.int/Documents/Recs/compendiopdf-e/2016-11-e.pdf).

[8] Shomura RS, Adams M, Amesbury S, Kawamoto P, Mendelssohn R, Wetherall J, Pflum R, Yoshida H, Yuen H. 1981. Draft Fishery Management Plan for Billfish of the Western Pacific Region. (Available at - https://books.google.com/books?id=2jw3AQAAMAAJ&printsec=frontcover#v=onepage&q&f=false).

FIGURE 2
Wider Caribbean area EEZs



Source: CRFM Sub-Regional Fisheries Management Plan for Flying Fish in the Eastern Caribbean. 2014. (Available at - www.crfm.net/images/2015_Draft_Sub-Regional_Management_Plan_for_FAD_Fisheries_in_the_EC_Final_Draft_revised_24_Sept_2015.pdf).*

This Caribbean Billfish Management and Conservation Plan describes the progressive adoption and implementation of several priority management measures and activities, which are expected to positively address billfish conservation and management issues in the Western Central Atlantic. It aims at achieving the long term sustainable exploitation of billfish resources and their associated contribution to the Caribbean nations' economies and livelihoods. This Plan results from the implementation of one of the activities mentioned under Component 2 of the GEF/World Bank funded Caribbean Billfish Project, denominated "Strengthening regional billfish management and conservation planning", for which the WECAFC/FAO is the executing agency.

The Plan also considers and aligns with the Strategic Action Programme (SAP) of the Caribbean Large Marine Ecosystem (CLME), which was endorsed by more than 25 governments in 2013, and in particular its strategy (5B) to "Enhance the governance arrangements for implementing an ecosystem approach for pelagic fisheries". This document also supports and pursues principles of the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries.[9]

The development of the Caribbean Billfish Management and Conservation Plan has benefitted from partnership approaches and communication structures established within the Consortium on Billfish Management and Conservation (CBMC), the WECAFC Working Group framework and the Interim Coordination Arrangement for Sustainable Fisheries in the Caribbean formed by FAO, CRFM and OSPESCA. The CBMC is made up of billfish fisheries experts and generates scientific advice for billfish management and conservation in the region. It is a partnership of a range of

[9] *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries. At a glance*. Document (Available at: www.fao.org/3/a-i4487e.pdf).

* Map disclaimer FAO: "The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement."

international and regional organizations like the IGFA, WECAFC/FAO, World Bank, CRFM, OSPESCA, CFMC, CNFO and CI.

The preparation process of the Caribbean Billfish Management and Conservation Plan started in 2015, through conducting several desk and field studies by the Caribbean Billfish Project. These studies provided background information on the status of billfish resources, potential rights based fishery management approaches, an estimation of the value of billfishes to artisanal, commercial and recreational fisheries and a diagnosis of Caribbean national legal and institutional fisheries frameworks.[10] A primary outline of the Table of Contents and a draft proposal of regional management measures for inclusion within this Management Plan were presented at the 2nd Regional Workshop on Billfish Management and Conservation that took place in November 2015 in the Republic of Panama. A first draft was elaborated by March 2016, following a consultation process with the assistance of Consortium members and the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries. A second draft was then reviewed and technically endorsed during the 3rd Regional Workshop on Billfish Management and Conservation held in Barbados in April 2017. Comments obtained at the 3rd Regional Workshop, as well as further comments from specialists at the World Recreational Fisheries Conference in Canada and from members of the Global Ocean Think Tank (GLOTT) were all incorporated to produce this Caribbean Billfish Management and Conservation Plan. The Plan was reviewed and scientifically endorsed by the 8th session of the WECAFC Scientific Advisory Group (SAG) held in Merida, Mexico in November 2017.

This Plan is divided into five chapters, complemented by eight annexes, describing billfish issues with the relevant context and details. Chapter 1 contains the Introduction, while Chapter 2 describes the Management Plan's principles, the overall goal and specific objectives. In Chapter 3 regional management measures, which aim to secure the sustainability of billfish stock harvests within the Caribbean, are described. Chapter 4 explains the available adaptive and precautionary management mechanisms that facilitate the implementation and evaluation of the Plan. Chapter 5 defines regional research priorities required to improve the assessment and management of billfish fisheries in the WECAFC area. A comprehensive review of the problem identification, definition of terms, the regional legal framework, a description of Caribbean billfish species and fisheries, the Terms of Reference for the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries, the Letter of Intent supporting the CBMC, a draft recommendation for billfish management and conservation in the WECAFC area can be found in Annexes 1 to 7.

As an adaptive management plan, different measures and activities can be added, eliminated or altered during implementation, according to periodic management effectiveness assessments. The latter will consider the Plan's pursuit of collectively strengthening regional management arrangements that most efficiently meet the needs of artisanal, recreational, commercial and industrial fisheries that impact on billfish stocks in the WECAFC region. Implementation of the Plan will also create a platform through which billfish data collection is improved in order to make possible more comprehensive future assessments and stock management decisions, including data inputs from recreational and artisanal fisheries into a harmonized regional database. Components of the Plan also seek to address IUU fishing in the region to help secure fishery benefits for legitimate fishers and nations that cooperate with the plan's objectives. Increasing involvement in the cooperative management by Caribbean States is also pursued, particularly through the WECAFC, OSPESCA and CRFM Interim Coordination Arrangement for Sustainable Fisheries, established with support from the CLME+ project, and with other relevant international organisations such

[10] Project publications from 2015/2016 are available at - www.igfa.org/Caribbean-Billfish-Project/

as ICCAT. The Plan's implementation is expected to bring to the fore alternative considerations for management and conservation that reduce overall mortality rates and by-catch incidence, while also strengthening regional management structures that can potentially optimize socio-economic returns from Caribbean billfish and other shared fish stocks fisheries.

The Caribbean Billfish Management and Conservation Plan sets a precedent for Caribbean billfish fisheries management that promotes regional collaboration aimed at reaching optimum and sustainable benefits from all billfish reliant fisheries. To successfully manage these shared pelagic stocks, benefits and food security issues on a regional scale must be identified and prioritized over latent, non-essential national interests. This can only be achieved through formally recognising the implications of current billfish assessments results, as well as the contra productive increases in harvesting capacity seen in various national billfish fisheries. The implementation of regionally coordinated management interventions will reduce the "free riding effect", whereby non-compliant nations, which in effect promote "race to fish" attitudes, reap benefits from the stock sustainability interventions made by compliant nations. This requires taking a regional benefit perspective across sufficiently broad spatial and temporal scales to be genuinely effective.

2. Plan principles, overall goal and specific objectives

2.1 PRINCIPLES

Participation. All stakeholders that have a stake in billfish resources should be invited to participate in its management processes. All sectoral planning decisions and actions affecting billfish fishing communities should take into account the participation of interested and affected parties and align with the FAO Voluntary guidelines for securing sustainable small-scale fisheries.[11] The Consortium on Billfish Management and Conservation, supported by the WECAFC/CRFM/OSPESCA/CFMC Recreational Fisheries Working Group, should play a pivotal guiding role in generating scientific advice and organizing and preparing stakeholders for an active participation while ensuring they have an informed voice during decision making processes.

Adoption of the Precautionary Approach. Billfish stocks should be managed for their long-term conservation and sustainable use, consistent with the FAO Code of Conduct for Responsible Fisheries.[12] For billfishes, as for many other marine resources, a more cautious approach to management is warranted when the available information is uncertain, unreliable and/or inadequate. The absence of adequate scientific information should not be used as justification for postponing or failing to take action to secure sustainability of any particular fishery resource. Because of the downward trend in landings, scientific reports on reduced relative abundance and apparent unsustainable stock levels, the precautionary approach should be applied in the management of billfish-related fisheries, resulting in more appropriate measures that provide a more realistic probability of stock recovery than those currently applied by ICCAT. A threshold abundance required to sustainably maintain the different fisheries that rely upon capturing billfishes must be maintained throughout the region and, at the very least, should be in alignment with advice of the ICCAT SCRS.

Adoption of the Ecosystem Approach to Fisheries (EAF). On a regional level, artisanal, commercial, recreational and industrial billfish fisheries exhibit numerous distinctions and differences, such as target and incidental species, gears used, seasons, vessels characteristics, catch and release considerations, by-catch species use and mortality, and data reporting frequency and accuracy. As a result, each fishery poses different threats to billfish populations, either directly or indirectly, through harvesting or through billfish trophic effects and harvesting of other species (e.g. bait fish), or influencing ecosystems of importance to billfishes. Acknowledging uncertainties associated with the management of such diverse systems, the EAF strives to consider the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions, while applying an integrated approach to fisheries within ecologically meaningful boundaries.

Gradual application. The Plan will be gradually and incrementally implemented following an adaptive process to be guided by the CBMC, based on the evaluation of progress and results of activities undertaken, incorporating available scientific

[11] FAO. 2015. *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*. FAO Fisheries and Aquaculture Department, Rome (Available at - www.fao.org/3/a-i4356e.pdf).

[12] FAO. 1995. *Code of Conduct for Responsible Fisheries*. FAO Fisheries and Aquaculture Department, Rome (Available at - www.fao.org/docrep/005/v9878e/v9878e00.htm).

knowledge on billfishes and the priorities set by governments, regional/sub-regional organizations and stakeholders.

Adaptive management. Social, economic and biological/ecological variables need to be continuously monitored because they are dynamic in nature and always have certain levels of uncertainty associated with them. Whenever practical, actions and strategies of the Plan will be modified or adapted when new knowledge from research and/or evaluations of the success/failure of past actions related to established operational objectives, becomes available.

Responsibility. The authority for implementing this regional management and conservation plan lies with the national governments in the WECAFC area. National fisheries authorities should monitor the status of its implementation within their jurisdictions, communicate and evaluate its progress in relation to agreed objectives and indicators, and seek ample cooperation on the broadest geographic scale feasible, in order to achieve optimum mutual benefits for the region's citizens and fisheries targeting these shared highly migratory stocks. Monitoring of the implementation of the Plan throughout the region is done by the WECAFC/CRFM/OSPESCA/CFMC Recreational Fisheries Working Group, which reports on a bi-annual base to the WECAFC on progress made.

2.2 GOAL

The goal of this Caribbean Billfish Management and Conservation Plan is to improve the management and conservation of billfish stocks through adaptive management actions that are aligned with the ICCAT recommendations, although more precautionary in nature. It seeks to equitably balance and secure the maximum sustainable social and economic benefits that can accrue from the exploitation of billfish stocks in the Caribbean by the artisanal, recreational, commercial and industrial fisheries operating in the Western Central Atlantic region (FAO Area 31) in particular.

2.3 SPECIFIC OBJECTIVES

Table 1 presents the logical framework for the Plan's implementation with the proposed specific regional objectives and suggested timelines for the implementation of the indicated activities.

The Caribbean Billfish Management and Conservation Plan has the following specific objectives:

1. Improve billfish catch, effort, biological and socio-economic data collection and reporting programs from all fisheries that target these shared stocks;
2. Reduce bycatch, discards and overall fishing mortality of billfishes in order to achieve sustainable stock mortality rates throughout the region;
3. Increase coordination and collaboration between nations through a regional governance framework better suited to effectively address the Caribbean region's billfish management and conservation issues;
4. Institute the monitoring, control and surveillance of the billfish fishing effort across all fisheries through regionally harmonized mechanisms that contribute to effectively addressing illegal, unreported and unregulated (IUU) fishing operations in the Caribbean region;
5. Enhance the sustainable socio-economic performance of fisheries capturing billfishes in the Western Central Atlantic Fishery Commission (WECAFC) area.

TABLE 1
Logical framework for the implementation of the Caribbean Billfish Management and Conservation Plan

Specific Objectives	Outputs	Activities	Indicators	Means of Verification	Assumptions
1. Improve billfish catch, effort, biological and socio-economic data collection and reporting programs from all fisheries that target these shared stocks.	1.1 Improved stock assessments and more comprehensive management decisions. 1.2 Sustainable harvest limits in the Caribbean, in harmony with ICCAT stock assessments and Precautionary Approach. 1.3 Effective conversion factors adjusting catch rates for FAD effects in billfish stock assessment models and allow pre- and post-FAD CPUE comparisons of stock abundance. 1.4 Stronger negotiating position of Caribbean nations for catch quotas at ICCAT meetings. 1.5 National billfish quota allocations that support sustainable harvests levels at regional level and align with ICCATs stock assessment outcomes.	1.1 Standardize as much as possible, test, validate and adopt data collection schemes which effectively report required billfish data, disaggregated by species, at national and regional levels for all fisheries that capture billfish. 1.2 Establishment of a Fisheries Information System at the WECAFC secretariat, in coordination with FAO-FIRMS, informs implemented harvest limits. 1.3 Countries start reporting billfish catch and effort data from all gear types to ICCAT and FAO with reference to catches achieved by effort with or without the use of FADs. 1.4 Regional capacity building in fisheries statistics promotes further use of data to inform national and regional management decisions. 1.5 National data recording from all fisheries informs and facilitates the equitable allocation of ICCAT quotas among Caribbean nations towards sustainable harvest quantities on a regional scale.	1.1 Regional Fisheries Information System in place at WECAFC secretariat by end of year 1 and operational for use by CBMC to assist in regional level decision making. 1.2 Socio-economic data categories and data capture methodologies determined to inform suitable harvest limitations by the end of year 1. 1.3 Fisheries data collection systems and protocols validated and adopted by at least 15 countries by the end of year 3. 1.4 National fisheries databases, harmonized with ICCAT requirements and with disaggregated billfish CPUE according to fishing methods (including FADs), are ready to be integrated regionally in at least 15 countries by the end of year 3. 1.5 Improved biological, catch and effort data collection effectively implemented by the end of year 3. 1.6 Integration with FAO-FIRMS and ICCAT databases by end of year 5. 1.7 Precautionary harvest limits determined and achieved in at least 10 countries by the end of year 5.	1.1 Effective data collection systems, based on ICCAT and WECAFC guidelines, operational in the WECAFC region and guiding billfish management. 1.2 Quota allocations / sustainable harvest limits based on more comprehensive time lines of ecological and socio-economic data. 1.3 Consensus on conversion factors for comparing pre- and post-FAD fishery billfish resource abundance. 1.4 ICCAT meeting reports reflecting improved negotiation power by Caribbean nations on relative tuna to billfish quota allocations. 1.5 Improved frequency and quality of national and regional statistical reports on fisheries in general and billfishes, in particular. 1.6 Improved accuracy for CPUE data. 1.7 Number of countries in which precautionary harvest limits are implemented for billfish species. 1.8 Increase participation of scientists from Caribbean nations and CBMC members within the ICCAT SCRS to provide advice on regional harvest potentials and sustainable quota suggestions.	1.1 Staff is made available to collect and process data, maintaining the database up-to-date to allow required analyses. 1.2 Financial resources are allocated to support the data capturing and processing systems in the short and long term. 1.3 Approach to harmonize data capturing and processing system is based on consensus among nations, including its financial commitments. 1.4 Private sector continues to be interested to provide data in support of decisions that increase resource sustainability.

Specific Objectives	Outputs	Activities	Indicators	Means of Verification	Assumptions
2. Reduce bycatch, discards and overall fishing mortality of billfishes in order to achieve sustainable stock mortality rates throughout the region	2.1 Tuna longline vessel billfish by-catch incidence rates, post release fatalities and other billfish mortality producing activities are reduced as much as practicably possible among fleets that currently produce high levels of mortality and discards. 2.2 Alternative fishing gears, technologies, fishing methods and opportunities to target different species are field tested and accordingly implemented on national and regional scales. 2.3. Precautionary harvest limits are aligned to or below ICCAT recommendations and are effectively enforced.	2.1 Raise awareness and create incentives for billfish by-catch and resultant mortality reductions. 2.2 Shift from traditional J hooks to non-offset circle hooks in selected fisheries for which billfishes are not the main target species. 2.3 Institute catch and release regulations for billfish in required fisheries to reduce mortalities and eliminate unfair competition with other billfish fisheries. 2.4 Test innovative fishing gears, technologies, methods and/or alternative species targeting to achieve sustainable billfish harvest rates among all fisheries.	2.1 Annual number of training workshops on circle hook use, billfish handling/ release techniques and other mortality reducing methods and technologies. 2.2 Number of field trials for novel gears, technologies, fishing methods and different species targeting efforts to reduce billfish mortality. 2.3 Implementation in at least ten countries of obligatory reporting requirements and implementation of ICCAT recommended sustainable gears and practices by the end of year 3. 2.4 Regulations and implementation of non-offset circle hook use by all fisheries sectors when using baits to target pelagic species in at least 10 WECAFC countries by the end of year 5. 2.5 Agreed incentives in place to address by-catch issues by the end of year 5 in at least 10 WECAF countries.	2.1 Reports on training courses on circle hook use, billfish handling/release techniques and other mortality reducing methods and technologies. 2.2 Reports on field trials for novel gears, technologies, fishing methods and other efforts, including technical publications to facilitate implementation. 2.4 Formal texts of incentive systems created for relevant fishing fleets to reduce billfish incident rate and by-catch mortality and reports on application and inscriptions by fishing vessel and company owners. 2.5 Legislations on use of non-offset circle hooks and other approved gears; documentation and technical reports to facilitate implementation. 2.6 National and regional catch statistics that confirm mortality reduction trends in artisanal, commercial and recreational fisheries.	2.1 Fishers are aware of importance of sustainable resource utilization and the need for billfish incidence rates, by-catch and overall mortality reductions. 2.2 Appropriate incentive mechanisms will allow a value adding shift towards billfish avoidance and/or release among commercial fisheries. 2.3 Comprehensive novel gear tests will be conducted objectively with active co-participation of billfish fishers. 2.4 Decision making processes will actively seek participation of all stakeholders.

Specific Objectives	Outputs	Activities	Indicators	Means of Verification	Assumptions
3. Increase coordination and collaboration between nations through a regional governance framework better suited to effectively address the Caribbean region's billfish management and conservation issues.	3.1 Harmonized and adaptive regional billfish management mechanisms implemented, with enhanced partnership between different levels of stakeholders. 3.2 Improved collective recognition and participation of Caribbean states in ICCAT decision making processes and the resultant actions that positively impact on the state of billfish resources. 3.3 Successful regional and national level co-management and tenure rights based billfish management approaches identified and tested.	3.1 Implementation of the Plan supported through the Recreational Fisheries Working Group and the Interim Arrangement for Sustainable Fisheries (WECAFC, CRFM and OSPESCA). 3.2 Negotiate Memorandum of Understanding between ICCAT and WECAFC to concretize the collaboration on billfish management and conservation issues. 3.3 The Consortium on Billfish Management and Conservation (CBMC) actively participates with recommendations and advice in the implementation of this Billfish Management and Conservation Plan and development of regionally harmonized billfish regulations and management measures. 3.4 Cost – benefit analysis and evaluation of the work of the Recreational Fisheries Working Group and the CBMC.. 3.5 Enhance technical capacities in fisheries management to strengthen Caribbean nation's effective participation and contribution to ICCAT activities. 3.6 Perform sector analyses to identify factors and variables that determine likely future co-management and tenure models and test these models.	3.1. Agreements achieved through the Interim Management Mechanism. 3.2 Meetings of the CBMC are held and provide scientific advice and recommendations. 3.3 Memorandum WECAFC-ICCAT signed by year 3 3.4 Increased membership and participation of Caribbean states in ICCAT. 3.5 Formulation, updating and adjusting of ICCAT recommendations. 3.6 Finalized draft of CRFM Management Plan for FAD Fisheries is adopted and implemented. 3.7 Decision on continuation of the WECAFC Recreational Fisheries Working Group and CBMC by year 3. 3.8 Active participation of representative groups of fishers from various billfish fisheries in co-management decision making processes. 3.9 Number of alternate management opportunities and incentives granted to commercial/artisanal fishers by the end of year 5 in at least 10 WECAFC countries.	3.1 ICCAT meetings' attendance and proceedings reports with references to inputs by Caribbean member states. 3.2 Proceedings of meetings, signed Memorandums and signed agreements. 3.4 Reports on bi-annual meetings of the CBMC. 3.5 Statistics of ICCAT membership, including fulfilment of financial obligations. 3.6 Number of amendments to ICCAT recommendations related to billfishes. 3.7 Approved CRFM Management Plan for FAD Fisheries and national level implementation. 3.8 Reports on the costs and benefits of WECAFC Recreational Fisheries Working Group and CBMC. 3.9 Number of fishers and their communities participating in co-management tests. 3.10 Reports of meetings establishing and implementing fisheries co-management approaches and training materials on fisheries co-management.	3.1 CBMC and Interim Mechanism remain in place and operating. 3.2 Stakeholders are genuinely interested in actively contributing to regional and national fishery (co-) management processes. 3.3 Stakeholders are knowledgeable about ecological benefits and hazards related to FADs and able to contribute to their management and use. 3.4 Financial and adequate staffing support is assured for implementation of regionally agreed management measures at national level. 3.5 At the national level, adequate political support is present to advance shared regional fishery resource exploitation and conservation issues. 3.6 Fishery stakeholders have sufficient interest and trust in authorities and other stakeholders to allow for a continuous active participation in decision making processes and implementation of innovative management approaches.

Specific Objectives	Outputs	Activities	Indicators	Means of Verification	Assumptions
4. Institute the monitoring, control and surveillance of the billfish fishing effort across all fisheries through regionally harmonized mechanisms that contribute to effectively addressing illegal, unreported and unregulated (IUU) fishing operations in the Caribbean region.	4.1 Harmonized collaborative regional management measures to monitor and control fishing effort in real time, backed up by comprehensive statistics. 4.2 Direct interventions through nationally and regionally coordinated MCS activities to adequately address IUU fishing of billfish.	4.1. Implementation of VMS or AIS systems in billfish related fisheries, with data sharing between stakeholders in the WECAFC region. 4.2 Implementation of WECAFC vessel marking and identification guidelines, regional vessel records and IUU vessel lists which are harmonized with ICCAT vessel lists and the Global Record. 4.3 Training on billfish identification for customs and other government officials alongside capacity building on billfish relevant regulations and persecution steps. 4.4 Regional training courses on MCS activities, enforcement, related international conventions and compliance issues.	4.1 Training course curriculums and materials for IUU related issues are prepared and available by the end of year 2. 4.2 Training courses on billfish identification, regulations and persecution are carried out in at least 10 WECAFC countries by the end of year 3. 4.3 Potential alternatives to VMS for smaller commercial and recreational fishing vessels are tested and validated, as needed, by year 3 and implemented by year 5. 4.4 Registers of commercial and recreational vessels that target billfish are operational in at least 15 WECAFC countries by the end of year 4. 4.5 Number of VMS and AIS systems or alternate options established in billfish-related fisheries with supporting data sharing systems to fight IUU fishing in at least 15 WECAFC countries by the end of year. 4.6 Formal agreements between marine/fisheries authorities to strengthen collaborative efforts to address IUU billfish fishing and trade.	4.1 VMS or alternate systems in place and operating with data sharing facilities effectively established. 4.2 IUU fishing reports on infractions, arrests and resultant persecution and convictions. 4.3 IUU fishing incidents reported to ICCAT's Compliance Committee. 4.4 Regional Vessel record established and operational. 4.5 Training reports, brochures and other materials. 4.6 Export and inter-island trade reports with correct billfish identifications. 4.7 Permits extended to install VHS and AIS systems and inscriptions into national and regional monitoring systems. 4.8 Signed formal agreements between fisheries authorities to strengthen collaborative efforts to address IUU billfish fishing and trade.	4.1 Sufficient human and financial resources available for courses and course materials. 4.2 National legislations adequate to deal swiftly and effectively with IUU infractions. 4.3 Legislative processes for issuance of national regulations will be available in due time. 4.4 Sufficient political will to effectively enforce IUU fishing related regulations on a regional scale. 4.5 Political will to unify and harmonize IUU related enforcement and compliance procedures across the region to enhance effectiveness.

Specific Objectives	Outputs	Activities	Indicators	Means of Verification	Assumptions
5. Enhance the sustainable socio-economic performance of fisheries capturing billfishes in the Western Central Atlantic Fishery Commission (WECAFC) area.	5.1 Opportunities for increasing the social and economic value of billfish fisheries identified and tested. 5.2 Contribution of billfish fisheries to the economies in the Caribbean has increased. 5.3 The consumption of billfish in the Caribbean has reduced to levels that meet health, dietary and nutrition advisories.	5.1 Develop and implement incentives and opportunities (business cases) for fishers working towards the conservation of billfishes. 5.2 Investigate mercury levels in billfish species' tissue and potential human consumption health hazards and market reactions. 5.3 Provide incentives to perform cost–benefit analysis on socio-economic and ecological impact of different billfish targeting fisheries to substantiate sectorial development plans and policies. 5.4 Improve value chain efficiencies and/or enhance commercial opportunities to compensate for billfish harvest reductions achieved among compliant fisheries.	5.1 Number of business cases prepared and/or implemented by the end of year 3. 5.2 Number of billfish harvest reduction compensation mechanisms in place and functional by the end of year 4. 5.3 Fish consumption assessments show a reduction of per capita billfish consumption in the region by year 5. 5.4 Information on the health risk associated with high levels of billfish consumption for specific groups is available in the Caribbean. 5.5 Value chain improvements result in increased profitability for private companies reducing billfish harvests.	5.1 Number and type of incentive mechanisms developed and implemented. 5.2 Comparative value adjustments achieved between fishery sectors. 5.3 Reports on successful catch and release operations and/or number of fines and value for billfish mortalities by recreational fishers. 5.4 Reports on of business cases studied, documented and/or implemented in the region. 5.5 Financial reports on functioning of business cases. 5.6 Reports with statistics on the consumption of fish show a reduction of per capita billfish consumption 5.7 Reports that indicate the health risks involved in high consumption of billfish for certain groups in society are distributed among dietary and nutrition specialists. 5.8 Reports of value chain analysis, documenting improvements with recommendations for further investments.	5.1 Political willingness to support private sector interventions in billfish conservation is available. 5.2 Availability of funding to support the inception and continuation of innovative fishery value chain investments. 5.3 Caribbean population is open to health and nutritional advice related to billfish consumption.

3. Practical measures promoting billfish stock sustainability in the region

The following practical measures have been reviewed and accepted Caribbean region wide by all key stakeholders.

3.1 PROMOTE THE USE OF CIRCLE HOOKS AND LIVE RELEASE OF BILLFISHES AMONG ALL HOOK AND LINE BILLFISH FISHERIES IN THE REGION

Justification: This Caribbean Billfish Management and Conservation Plan recognizes the fact that many Caribbean fleets actively target billfishes. It therefore, reiterates the need to reduce billfish mortality rates in the region and the broader Atlantic Ocean in view of the massive stock reductions noted by recent stock assessments for Atlantic billfish species. Few, if any, Caribbean nations are proactively nor effectively implementing the billfish quota allocated to them by ICCAT and non-compliance is prevalent. ICCAT's SCRS has suggested various billfish relevant measures for follow-up by member states.[13] Adoption of one or more of these measures, such as the use of large circle hooks, suitable drop depths for longlines and other measures deserve more proactive consideration by the Caribbean countries.

A number of ICCAT Contracting Parties already mandate and/or encourage non-offset circle hook use. The Second Independent Performance Review by ICCAT in 2016 advised that the Commission should actively encourage, or make obligatory, the use of non-offset circle hooks in longline fisheries in order to reduce the mortality of released marlins. Non-offset circle hooks can be a viable conservation tool for billfishes as recent studies have demonstrated. Research on billfish caught by longline gear fitted with non-offset circle hooks indicates that, depending on the species, 65 to 70 percent of billfishes caught are still alive on haul back.[14] Satellite tagging reports also show an 88 to 93 percent post release survival rate of catch-and-release billfishes caught with circle hooks by both commercial and recreational fishery sectors. Significant differences in mortality rates between hook types have been documented. Compared to non-offset circle hooks, the use of offset circle hooks and J-hooks has been associated with greater mortality rates on the basis of a higher incidence of deep-hooking and excessive bleeding.[15] In some longline fisheries the use of non-offset circle hooks resulted in a reduction of billfish mortality, while the catch rates of several other pelagic species remained the same or actually increased somewhat compared to the catch rates observed with the use of conventional J hooks or offset circle hooks. Some research has even shown significantly higher CPUE values for yellowfin tuna through the use of circle hooks.[16] Some regional ground truthing of these observations has also been achieved through circle hook trials conducted on Grenadian longline vessels during

[13] ICCAT 2017. *Report of the Standing Committee on Research and Statistics. Madrid, Spain, 2-6 October 2017*. (Available at: www.iccat.int/Documents/Meetings/Docs/2017_SCRS_REP_ENG.pdf).

[14] Kerstetter D.W. and Graves J.E. 2008. Post release survival of sailfish caught by commercial pelagic longline gear in the southern Gulf of Mexico. *North American Journal of Fisheries Management* 28: 1578-1586.

[15] Serafy *et al.* 2009. Can circle hook use benefit billfishes? *Fish and Fisheries* 10: 132-142.

[16] Kerstetter D.W., Graves J.E. 2006. Effects of size 16/0 circle versus size 9/0 J-style hooks on target and non-target species in a pelagic longline fishery. *Fish Res*. 80:239–250.

the Caribbean Billfish Project. Results of that year-long study indicated higher catch rates of yellowfin tuna, with increased average quality/value of the same, along-with reduced impacts on billfish species.

This practical measure contributes to the achievement of Specific Objective 2 of this Caribbean Billfish Management and Conservation Plan and is in part reliant on the effective implementation of activities under Specific Objective 4 to ensure compliance. **Implementation advice:** Transfer fishers' best practices from other locations that have successfully transitioned to circle hooks (e.g. United States of America). This will result in a shorter learning curve for its implementation and acceptance. It will also help ameliorate the extent of a potential reduction in the catch of targeted species during transition. Incorporation of fisher's knowledge and perspectives into the decision-making process will support effective adoption, identifying barriers to the implementation of circle hooks and streamlining the process of overcoming challenges. Capacity building and support may be required as well, as might information about the best rigging techniques for circle hooks. National and/or regional standards for non-offset circle hooks to be used, must be determined and effectively communicated. For the Caribbean fisheries that are currently targeting billfishes, the implementation of circle hooks must be linked with market incentives and assistance to develop values from other target or alternate stocks that are more capable of absorbing these fleets' fishing effort.

3.2 LIMIT EXPORTS, INTER-ISLAND TRADE AND CONSUMPTION OF BILLFISH PRODUCTS

Justification: These issues have been raised by fishers' representatives at multiple meetings of the WECAFC/CRFM/OSPESCA/CFMC Working Group on Recreational Fisheries, including by commercial fishers. Desisting in promoting further market growth could be an effective conservation strategy for billfishes, particularly considering that mechanisms are available to effectively discourage fishers from harvesting these species by removing the economic incentive. Other options that could lead to reduced Caribbean billfish captures include deeper set longline and drop line gears, live bait bans, deep set buoy-gears employed to specifically target swordfish, the use of green sticks to target prime quality tunas with less billfish by-catch, as well as additional measures outlined elsewhere in this Plan. Successful implementations of alternative fishing gears and methods in other regions have typically been supported by market measures.

International seafood markets appear to be encouraging excessive unsustainable billfish harvests by commercial industrial fishing fleets in the Atlantic, including within the WECAFC area. Billfish however are generally not their main revenue source. This is occurring at the same time that local small-scale commercial fisheries are continuing to develop, which rely partly on billfishes for livelihood support. In addition, there exists a growing non-extractive recreational billfish fishery that allocates high financial and emotional values to the capturing of billfishes, and that also supports sustainable ecotourism oriented livelihoods in the region. Taking into consideration that commercially harvested billfish species have relatively low market values and linked economic contributions, the ban of billfish products inter-island trade could be seen as an effective management approach. Correct implementation could retain regional economic benefits and employment, and would occur in parallel to other more sustainable fishery support and incentive developments. Doing so would reduce incentives for commercial fishers to harvest billfishes beyond that of the demand by local markets, without penalizing domestic use of these species as a source of animal protein. Eliminating the current trade of "cheap" billfish by-catch imports, which are currently entering the regional market through large and often foreign industrial fleets that operate in the Atlantic, would also have a positive impact on the national level

market prices for billfish products in the Caribbean region to the greatest benefit of local small-scale fishers.

Many people are unaware of the fact that billfishes have been reported to accumulate harmful levels of mercury, historically the highest recorded in any bony fish. The health guidelines for fish consumption of the United States Environmental Protection Agency (EPA), 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. A recent study analysed 145 billfish tissue samples collected within the Caribbean region and determined that pregnant women, or women seeking to become pregnant, should completely avoid consumption of blue marlin, because a single portion could exceed their total tolerable mercury dosage for several months. This study further suggests that weekly consumption of more than 220 g, a single international standard large portion, of blue marlin would place Caribbean citizens at a health risk by exceeding internationally suggested limits on tolerable mercury consumption rates. This result does not consider mercury accumulation from other food sources that are likely to also contribute to the individuals' weekly mercury intake during the same week in which billfish is consumed. Higher local market prices, because of limited imports and exports of billfish, along with advice for healthier consumption levels, should reduce local billfish consumption. In Caribbean countries, local consumption of billfishes can be high, due to the relatively high fish consumption in general, and the relatively low market prices of billfish products in particular.

This measure contributes to the achievement of Specific Objectives 3, 4 and 5.

Implementation advice: Regional regulations formulated through regional governance structures should be adopted for limiting trade of billfish and be implemented at national levels. Training on billfish species identification for customs officials and other pertinent government officials will be required. Regulatory authorities should be empowered through legislation that allows effective enforcement of regulations. Moreover, awareness raising on the mercury contents of billfish meat and promotion on healthy consumption levels of billfish will be necessary.

3.3 REQUIRE FISHING VESSELS THAT HARVEST SHARED STOCKS OF LARGE PELAGIC FISH TO REGULARLY REPORT THEIR BILLFISH FISHING ACTIVITIES AND HARVESTS, AND TO USE VESSEL MONITORING SYSTEMS AND/OR SIMILAR SYSTEMS

Justification: Non-reporting of data from billfish harvesting fisheries is the greatest obstacle to informed management decision taking for these species. National fisheries data capture methodologies that can be found in the region will need to be up-dated and standardized as much as possible. The WECAFC is actively promoting and developing a harmonized regional fishery database, which, through harmonization with the ICCAT databank, will provide more comprehensive information for future stock assessments. If fishers report to their fisheries authorities and these authorities report to the regional level, it will be possible to better assess the statuses of billfish species stocks and then more effectively take joint measures to secure the sustainability of the many Caribbean fisheries that rely on billfish species.

Vessel Monitoring Systems (VMS) and Automatic Identification Systems (AIS) are increasingly being used globally to monitor and assess the position and activity of fishing vessels. Potential benefits resulting from the use of VMS and/or AIS include the possibility to provide prime information to manage fisheries resources (potentially in real time, if required), to ascertain compliance with fisheries regulations through positional information and insights about vessels' activities, to increase the accuracy and timeliness of catch and effort information for determining stock status and fish movements and, last but not least, to allow the vessel owners to monitor at sea activities

and respond to emergencies at sea. The cost of these systems continues to decrease. Each year, more commercial fishing vessels in the Caribbean are already proactively installing them without mandate to do so, in pursuit of their valuable benefits. These systems can genuinely benefit fishers and fishery management authorities alike while increasing data and information availability for better management and conservation of billfishes.

This measure has links to all Specific Objectives of this Plan.

Implementation advice: Data reporting systems and authorized fishing vessel records are currently being developed within the region and should be implemented with supporting regulations. These systems need to be developed in a manner consistent with data reporting standards established by ICCAT so that these data can be used to support future billfish stock assessments. The establishment of cost effective VMS and AIS systems for fishing vessels that capture billfish, should be prioritized, while benefits to fishers must simultaneously be maximized. For example, VMS will prove hugely valuable in managing the use of FADs in Caribbean fisheries and help to address IUU fishing of pelagic stocks. The countries of the Caribbean region should explore all means available to integrate national monitoring systems into one regional system, in alignment with established data transfer protocols and agreements.

3.4 ENCOURAGE, SUPPORT AND FORMALLY INTRODUCE INNOVATIVE FISHERY MANAGEMENT ARRANGEMENTS, FISHING TECHNOLOGIES AND METHODS THAT REDUCE BILLFISH MORTALITIES TO WITHIN SUSTAINABLE LEVELS

Justification: The development and implementation of co-management structures and harvest/fishing zone use agreements in fisheries could be expedited by active implementation of the Ecosystem Approach to Fisheries (EAF). Such approaches should be encouraged in the region, particularly where genuine fishery organizations have developed effective operations and keep historical records. The use of co-management can reduce the enforcement burden placed upon national fisheries authorities. Social control and local level monitoring and enforcement will enable reduction of unreported catches and benefit billfish management and conservation.

In many fisheries in the region, subsidies and incentives still support the profitability of fishing gears and practices despite the fact that they are ecologically inadequate in the face of consistently declining stocks. This is a counterproductive, yet common modality that addresses symptoms of fundamental fisheries economics, but not the underlying causes. Current subsidies such as fuel rebates and tax exemptions are costly to society, but do not generate change for the better. Funds assigned to encourage and subsidy mechanisms should rather promote the transition to appropriate fishing gears, technologies and fishing modalities that seek to maintain the sustainability of fishery resources and optimize the long term profitability of fishery operations. Incentives could, for instance, seek to minimize the financial risks associated with fishery stakeholders' efforts to test alternative gears and methods, which enhance the long term sustainability of the ecosystems upon which the fishing industry's existence ultimately depends. Incentives for introduction of more fuel efficient vessels, safety at sea, VMS, and certain smart gears are important for sustainable adaptation of the sector to climate change. Besides circle hooks, the gear options that have proven capacities to reduce the impact on billfishes include buoy gears for swordfish, green sticks and deeper sets for longline gears.

The type of baits used also appears to have a major impact on billfish incidence rate, catch and ultimate mortality risk that a fisheries' operations imposes upon billfish species stocks. It is recommended to use squid bait only and institute a total ban on the use of live baits for tuna long-lining. In the United States of America Gulf of Mexico, the ban on live baits was the action chosen to address billfish by-catch concerns in the

large pelagic longline fishery. There, marlin were caught twice as frequently, while sailfish were captured four to five times more often when live bait was used instead of dead bait. Overall, the ban on live bait produced a 17 percent bycatch reduction across all billfish species, and a catch reduction of 29% for sailfish with aligned time/area closures.[17] Bait related regulations appear difficult to enforce throughout the Caribbean without incentives to the fishers to stimulate self-regulation, which in turn requires the need to establish co-management and/or other innovative management measures.

This measure contributes to the achievement of Specific Objectives 3 and 5.

Implementation advice: Co-management responsibilities should be developed in line with the sustainability objectives and include the development and support to fisher-folk organizations. Alternative gears, technologies and fishing methods should be field tested with the backing of supporting financial incentives. Successfully tested fisheries technologies and operations can then be actively promoted or mandated for use within relevant fisheries.

3.5 IDENTIFY AND PROTECT SPAWNING AREAS AND OTHER SITES OF IMPORTANCE TO BILLFISH SPECIES LIFE-HISTORIES WITHIN THE CARIBBEAN

Justification: Founding principles of fish stock conservation and fisheries management include ensuring sufficient protection of spawning stock biomasses to safeguard sustainable recruitment levels. For assessed Atlantic billfishes, spawning stock biomass reductions range from 70 to more than 90 percent, which implies an urgent need to protect spawning billfishes to secure future recruitment into reliant fisheries.

Some billfish spawning sites in the Caribbean are conspicuous due to the seasonal abundances and the resultant prominence of adult billfishes in catch compositions during their spawning congregations. These congregations typically have peak abundance/catch months and are often already well known to various fisheries. Some fisheries specifically target the species during the spawning season. Confirmations of billfish spawning activity have already occurred in specific areas of the region through gonad development monitoring and larval sampling. Time and area restrictions, such as closed seasons and closed areas have proven effective in producing benefits to other stocks, including those that migrate extensively.

This measure will help to achieve Specific Objectives 1 and 2.

Implementation advice: Already defined billfish species spawning sites should be initially prioritized for protection from excessive, or all, commercial harvests. Recreational catch and release fisheries must fully implement best practices to minimize effects on the spawning stocks, if they want to potentially maintain access to such sites. Harvest restrictions should be put in force during prime months of spawning aggregations and include a broad enough geographical area within which billfish spawning has been proven to occur. Restrictions can range from prohibiting billfish targeting gears (such as live baits on drop lines and longlines), to instituting size limits (maximum limits may most suitably protect spawning females), and to complete bans on fishing within known spawning sites during months of peak billfish spawning activity. Within the suggested cooperative framework of regional billfish management, nations protecting specific spawning sites within their EEZs, providing region-wide benefits through supporting fishery recruitment, could be permitted to harvest from other nations' EEZs during spawning months, or even be permitted controlled billfish imports from other nations when they are harvesting non-spawning billfishes. A regional conservation plan prioritizing the protection of spawning billfishes (sites and

[17] NOAA. 1996. Annual proportion of billfish catch in the US pelagic longline catch in 1995. In: *Description of the pelagic longline fishery for HMS*. (Available at - www.nmfs.noaa.gov/sfa/FEIS%20FINAL%206-7.htm).

large females) may be an effective way to address current needs of managing billfish stock harvests within the Caribbean.

3.6 OTHER MANAGEMENT MEASURES

There are additional management measures, which could be considered in the future. The following are examples of such measures, which will require further discussion within the WECAFC/CRFM/OSPESCA/CFMC Working Group on Recreational Fisheries, CBMC and WECAFC:

- Broader bans on billfish landings;
- Mandated release of live billfish across more fisheries;
- Formalized minimum sizes with regional catch and by-catch quotas and/or daily bag limits;
- Caps on artisanal and commercial fleet sizes with emphasis on license value and fishing efficiency for target species.

These measures are not further discussed in this Plan as they are not applicable, under present circumstances, to all countries in the WECAFC region. Nevertheless, some of them are already in place and/or suggested for implementation under ICCAT, e.g. minimum size limits and catch quotas. Some of these have also been suggested for regional implementation through the 2019 WECAFC Recommendation "on billfish management and conservation in the WECAFC area", which provides region-wide endorsement and supports implementation of this Plan.[18] Further discussions are needed towards more effective adoption of the ICCAT recommendations in the WECAFC area, also by nations that are not currently ICCAT members, to secure the regional sustainability of the many benefits currently provided by billfish stocks.

[18] FAO. 2017. *Report of the Third Regional Workshop on Billfish Management and Conservation of the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries*. (Available at - www.fao.org/3/a-bs244b.pdf).

4. Adaptive management mechanisms for implementing and reviewing the Caribbean Billfish Management and Conservation Plan

This Plan is a first step to establish a cohesive scheme for the adaptive management and conservation of billfish stocks in the Caribbean. The Interim Coordination Arrangement for Sustainable Fisheries, developed under the CLME+ project in a collaborative effort by FAO/WECAFC, CRFM and OSPESCA, appears to be a useful instrument to further the management of billfish fisheries in the region. The arrangement also contributes to an active participation of the region in ICCAT decision making processes, while also supporting its objectives. The regional importance of large pelagic fisheries, including those capturing billfish as by-catch, was recognized by the participating countries in the GEF (International Waters) funded Caribbean Large Marine Ecosystem (CLME) project. The Strategic Action Programme (SAP) of the CLME, which was endorsed in 2013 by more than 25 governments, incorporated a strategy (5B), denominated "Enhance the governance arrangements for implementing an ecosystem approach for large pelagic fisheries". The SAP implementation will consequently contribute to the establishment and implementation of the Caribbean Billfish Management and Conservation Plan.

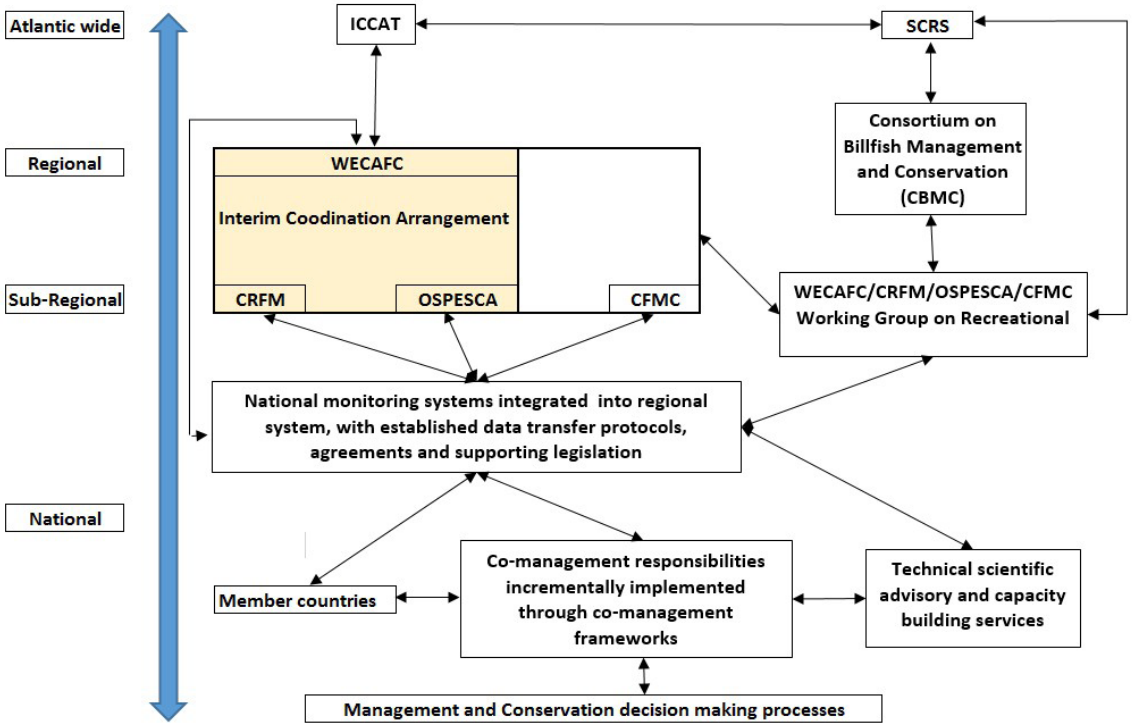
Figure 3 shows a flowchart for the proposed Plan's adaptive implementation and revision. At the national level, countries implement, review and evaluate the Plan, while generating findings and recommendations which are submitted to the respective sub-regional organizations (e.g. OSPESCA, CRFM). In turn, each sub-regional organization will follow the same procedure, which will generate advice and recommendations to be forwarded to WECAFC at the regional level. In the case of countries that do not belong to any of the aforementioned organizations, the advice will be submitted directly to WECAFC.

It is important to clearly define the current existing implementation frameworks and to provide baselines against which to track progress. At the WECAFC secretariat level, advice and recommendations received from the sub-regional levels are forwarded to the Consortium on Billfish Management and Conservation (CBMC) for further consideration. The CBMC will liaise directly with ICCAT and the WECAFC/OSPESCA/CRFM/CFMC recreational fisheries working group.

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

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

FIGURE 3
Billfish management and conservation decision making processes and revision mechanisms. (Arrows indicate information flows)



The main responsibility for monitoring and evaluating the implementation of this Plan at the national level lies with the national fishery authorities, in coordination with local key stakeholders. At the sub-regional level, Regional Fishery Body (RFB) organizations are responsible for monitoring the Plan's implementation. At the regional level, the overall responsibility for the coordination of all monitoring and evaluation activities lies with the WECAFC Secretariat, which will also report to ICCAT.

Furthermore, multi and bi-lateral development agencies, financial institutions, as well as governmental and non-governmental agencies, including stakeholder organizations, which will be funding and investing in the implementation of activities, will monitor and evaluate the use of their financial contributions and the outcome of interventions and activities, following their procedures.

A review of progress in the implementation of each activity should be conducted on an annual basis by the CBMC or Recreational Fisheries Working Group. A first evaluation of the impacts and outcomes of each specific objective and the underlying activities should be conducted after three years before a major amendment of the Plan is to be carried out after five years of implementation, with the Plan being adapted accordingly.

Resources will need to be mobilized for the Caribbean Billfish Management and Conservation Plan to succeed. The incorporation of the activities into the countries' national plans will require corresponding support budget allocations, as well as increased private investment and credit support to pursue associated business plans developed during and after the Caribbean Billfish Project; also along-with the ongoing implementation of this Plan. For this to happen, the fishery sector needs to continuously demonstrate its beneficial economic and social role founded on a transparent governance structure with full participation and involvement of all concerned stakeholders and the general public. The regional and sub-regional level will cooperate and support the member countries in the implementation of projects. Financing these projects may be attained through a combination of public and private funding avenues.

5. Research priorities

In the period 2015 to 2018, a wide range of social, economic, legal and biological research projects have been carried with support from the Caribbean Billfish Project, which contribute to billfish conservation efforts in the WECAFC region.

The below listed research initiatives, identified by the Consortium on Billfish Management and Conservation, are priority research subjects for the period 2019–2025. The limitations in terms of human and financial resources in the Caribbean region are important to recognize, but the research will support successful implementation of the Caribbean Billfish Management and Conservation Plan:

1. Conduct a major review and validation of billfish growth parameters and reproductive ecologies of billfish to fine-tune the billfish stock assessment models of ICCAT.
2. Design and implement a realistic and effective data collection and statistics program for recreational, small-scale commercial and industrial billfish fisheries in the WECAFC region, to quantitatively and qualitatively improve the availability of information to the fisheries managers of billfish harvesting fisheries. Socio-economics data will also need to be included.
3. Develop and conduct integrated and spatially suitable analyses of the ecological and fishery effects of FADs upon billfish stocks, their migration patterns and the implications within the WECAFC area. Further actionable information on fishing operation efficiencies, taking into due consideration the use of FADs, is needed to better inform management decisions relating to billfish. This would allow for improved abundance index comparisons with pre-FAD data within fisheries models.
4. Determine the horizontal and vertical habitat use patterns of billfish resources in the WECAFC region by means of satellite tagging programs. This could facilitate informed resource allocations within the region and help elucidate the geographical location of seasonal billfish congregations, which may deliver important clues about life-history events. It would also allow commercial incidence likelihood models to scientifically indicate the most practical and effective strategies of protecting prioritized sites, while having a minimal overall impact upon commercial fisheries operating in prioritized areas.
5. Conduct long term, holistic and robust socio-economic studies on the various extractive and recreational billfish fisheries in the region. Better economic data about operational costs and resultant earnings are required to improve assessments of the billfish fisheries value chain. The billfish conservation and management interventions targeting food security and livelihood support in the Caribbean are the topic of important sociological and economic studies to be conducted. Applications of the Recreational Fisheries Economic Impact Assessment Manual[19] and other valuation survey instruments developed and tested through the Caribbean Billfish Project should be promoted in all WECAFC countries.

[19] WECAFC. 2016. *Recreational Fisheries Economic Impact Assessment Manual and its Application in two Study Cases in the Caribbean: Martinique and The Commonwealth of The Bahamas.* (Available at - www.fao.org/3/a-i6148e.pdf).

Results and recommendations produced by the priority research studies described above, will be communicated annually to the ICCAT SCRS through its billfish relevant working groups and the meetings of the WECAFC/OSPESCA/CRFM/CFMC working group on recreational fisheries and the CBMC. During these events, research priorities will be re-evaluated and adapted, if required.

Glossary

Definitions of specific terms and subjects used within the content and context of this Caribbean Billfish Management and Conservation Plan:

Biomass	Or standing stock. The total weight of a group (or stock) of living organisms (e.g. fish, plankton) or of some defined fraction of it (e.g. spawners), in an area, at a particular time.
Bycatch	Part of a catch of a fishing unit taken incidentally in addition to the target species towards which fishing effort is directed. Some or all of it may be returned to the sea as discards, usually dead or dying.
Catch per unit of fishing effort (CPUE)	The amount of catch that is taken per unit of fishing effort (e.g., number of fish per longline hook-months). Nominal CPUE is often used as a measure of the economic efficiency of a type of gear. Standardized CPUE is normally used as an abundance index for "tuning" assessment models.
Co-management	A partnership arrangement in which government, the community of local resource users (fishers), external agents (non-governmental organizations, research institutions), and sometimes other fisheries and coastal resource stakeholders (boat owners, fish traders, credit agencies or money lenders, tourism industry, etc.) share the responsibility and authority for decision-making over the management of a fishery.
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	To release or return fish to the sea, dead or alive, whether or not such fish are brought fully on board a fishing vessel. Fish (or parts of fish) can be discarded for a variety of reasons such as having physical damage, being a non-target species for the trip, and compliance with management regulations like minimum size limits or quotas.
Drop line (pelagic)	A type of fishing gear used to target pelagic predators with a buoy on one end and a hook on the other end, typically with a high breaking strain line of variable length. Live baits are typically attached to the hook and drifted past FADs (see Figure A1.1).
Ecosystem	An organizational unit consisting of an aggregation of plants, animals (including humans) and microorganisms, along with the non-living components of the environment to constitute a dynamic system of complex interactions of populations between themselves and with their environment.

Ecosystem Approach to Fisheries	An approach to fisheries management and development that 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. The purpose of EAF is to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems.
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 the responsibility to conserve and manage, the living and non-living resources.
Fish Aggregating Device (FAD)	A permanent, semi-permanent or temporary object, structure or device of any material, man-made or natural, which is deployed, and/or tracked, and used to aggregate fish for subsequent capture.
Fish stock (also fish/ fishery resource)	The living resources in a 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 stakeholders; applying and/or determining the rules of access to the fishery and for resource allocations.
Fishery	Activity of catching fish, from one or more stocks of fish, that can be treated as a unit for purposes of conservation and management and that is identified on the basis of geographic, scientific, technical, recreational, social or economic characteristics, and/or method of catch. It refers to the activities involved in catching a species of fish or shellfish, or a group of species that share the same habitat.
Fishing capacity	The maximum amount of fish that could be taken in a fishery or by a single fishing unit (e.g. a fisher, community, vessel or fleet) over a period of time (e.g. season, year), given the biomass and age structure of the fish stock and the present state of the technology, in the absence of any regulated catch limitations and if the means available are fully used.
Fishing effort	The amount of fishing gear of a specific type used on the fishing grounds over a given unit of time e.g. hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day.
Fishing intensity	The fishing effort per unit area, per unit time. This is essentially equal to the effective area covered by the fishing gear per unit time as a fraction of the area occupied by the stock.

Fishing mortality	A technical term which refers to the proportion of the available fish 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	The product of the area of influence of the gear during a unit operation and the efficiency of the gear during that operation. Because absolute fishing power is difficult to measure, the concept of relative fishing power is frequently used. Relative fishing power as defined by Beverton and Holt (1957; pp. 172-173) is the "ratio of the catch per unit fishing time of a vessel to that of another taken as standard and fishing on the same density of fish on the same type ground."
Fleet	The aggregation of units of any discrete type of fishing activity utilising a specific resource. Hence, for example, a fleet may be all the purse seine vessels in a specific sardine fishery, or all the fishers setting nets from the shore in a tropical multispecies fishery.
Fully exploited/fished	The theoretical term used to qualify a stock that is 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.
Fishery Management	The integrated process of information gathering, analysis, planning, decision-making, allocation of resources and formulation and enforcement of fishery regulations by which the fishery management authority controls the present and future behaviour of interested parties in the fisheries, in order to ensure the continued productivity of the living resources.
Management measure	Specific controls applied in a fishery to contribute to the achievement of desired 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 environmental conditions without significantly affecting the reproduction process. It is estimated using surplus production models (e.g. the Schaefer model) and other methods. In practice, however, MSY and the level of effort needed to reach it are difficult to assess.
Non-offset circle hook	A circle hook is defined as a non-offset hook when the sharp point is turned inwards perpendicular to the shank.
Otoliths	Each of three small oval calcareous bodies in the inner ear of vertebrates, involved in sensing gravity and movement. Otoliths are one of various "hard structures" used to age fishes and other creatures, because they often show rings or layers of differing density, termed growth zones, which are considered to result from thermally influenced growth rates in temperate species. If the periodicity of growth zone deposition is known/validated, and consistent, then growth zone counts can accurately reflect the age of the organism under investigation.

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 stock biomass or a maximum fishing mortality, beyond which the resource would be considered to be over-exploited.
Pelagic zone	Also termed "the open ocean", this is the largest habitat component of the ocean, is vertically divided into multiple subzones and is ultimately neither close to the coast nor the ocean bottom.
Pelagic fish	Fish that spend most of their life swimming and feeding in the pelagic zone, as opposed to resting on or feeding near the bottom or shoreline. Examples are tunas and billfishes.
Principle	A fixed or predetermined policy, mode of action or an overarching guiding concept for managing natural resources that is usually developed in the context of global agreements and/or legislation. Examples: 'the precautionary approach", and "maintaining ecosystem integrity".
Precaution	An action taken in advance to protect against possible danger or failure; a safeguard. Caution practiced in advance. Forethought or circumspection.
Precautionary Approach	A set of agreed cost-effective measures and actions, including future courses of action, which ensures prudent foresight, reduces or avoids risk to the resources, the environment, and the people, to the extent possible while explicitly taking into account the existing uncertainties and the potential consequences of being wrong.
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 (TAC) allocated to an operating unit such as a country, 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 (including governmental and non-governmental institutions, traditional communities, universities, research institutions, development agencies and banks, donors, etc.) with an interest or claim (whether stated or implied) which has the potential of being impacted by or having an impact on a given project and its objectives.
Stock assessment	The process of collecting and analysing biological and statistical information to determine the changes in the abundance of fishery stocks in response to fishing, and, to the extent possible, to predict future trends of stock abundance. Stock assessments are based on resource surveys; knowledge of the habitat requirements, life history, and behaviour of the species; the use of environmental indices to determine impacts on stocks; and catch statistics. Stock assessments are used as a basis to assess and specify the present and probable future condition of a fishery.

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.
Tenure	Tenure is the relationship among people with respect to land and other natural resources. The rules of tenure determine who can use what resources of the ecosystem for how long, and under what conditions.
Uncertainty	The incompleteness of knowledge about a state or process in nature. In statistics, the estimated amount or percentage by which an observed or calculated value may differ from the true value.

ANNEX 1. Fisheries definitions applied in this Caribbean Billfish Management and Conservation Plan

This Management and Conservation Plan uses the following definitions to separate vessels that capture billfish in the Caribbean Sea and broader WECAFC area of competence, into categories:

Industrial – Any vessel in excess of 20 m in length that harvests billfishes, which are sold or traded in any form. Vessels of this size typically operate in areas beyond national jurisdiction (ABNJ) during multi-week trips.

Large-Scale Commercial – Any vessel between 10 and 20 m in length which harvests billfish that are sold or traded in any form. In the Caribbean, these vessels typically take multiple day fishing trips, have inboard engines and onboard cabins. All vessels deploying a longline with more than 500 hooks, a gill net of more than 500 m in length or using live bait to capture billfish for commercial purposes, also fall within this category, regardless of boat length.

Small-Scale Commercial – Any vessel of less than 10 m in length which harvests billfish that are sold or traded in any form. These vessels typically conduct single day fishing trips. In the Caribbean these boats are frequently of the "panga" or "pirogue" design, typically have outboard engines and are well suited to fishing around FADs or setting small longlines.

Recreational – Any vessel fishing purely for recreation or as a for-hire recreational fishing charter vessel. There is no commercial sale or other financial dealing related to the billfishes caught during these vessels' operations.

In the Caribbean, recreational fishers typically operate from motorized vessels, trolling lures to capture billfishes, although fly fishing and "pitching" dead baits are becoming increasingly popular. The economic value which the capture of a billfish represents to a recreational angler, is far greater than for any other fishery in the Caribbean.[1] Recreational anglers also typically release captured billfish to minimize the environmental impact of their fishing activities. A successful billfish release (not leading to immediate or delayed mortality), effectively multiplies the intrinsic economic value assigned to a billfish by a recreational fisher, as it represents a sustainable, non-extractive and potentially repeatable value acquisition of an individual billfish. Estimates of overall expenditures on recreational fishing for the United States of America alone have been independently reported to reach as high as USD 82 billion. US tourists, interested in recreational fishing, find the Caribbean relatively easily accessible, which is already noticeable in the valuable financial and linked employment opportunities that can be observed in many Caribbean nations. A Willingness To Pay (WTP) survey conducted during the Caribbean Billfish Project determined that recreational fishers

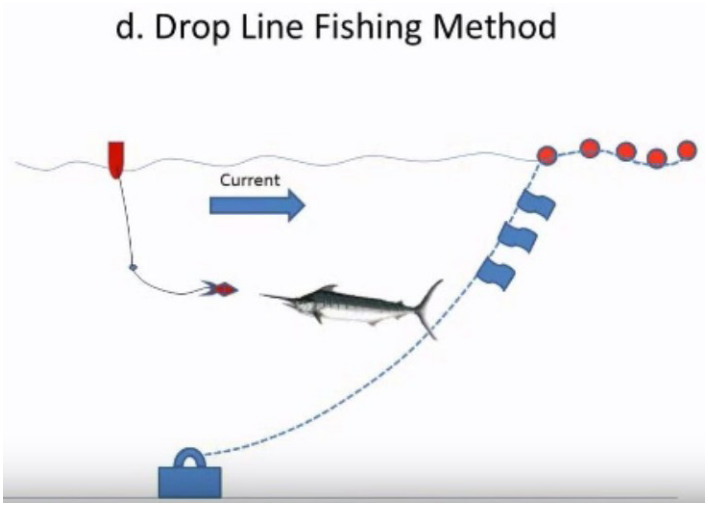
[1] Gentner B. 2016: *The value of billfish resources to both commercial and recreational sectors in the Caribbean*. (Available at - www.fao.org/3/a-i6178e.pdf).

in the Caribbean would value one more billfish caught in per day, regardless of the disposition of that catch, at USD 761, with USD 1 494 being the evaluation if that additional billfish was of trophy size. Total daily fishing expenditures by non-resident private boaters participating in this survey were USD 2 767/day and USD 1 036/day for residents, while avid billfish anglers in the Caribbean are also willing to pay around USD 439/year for a government administered billfish conservation fund. Overall, expenditures for billfish angling in the Caribbean could be as high as USD 3.5 billion, and the total that could be raised from a well enforced and used billfish license stamp could be USD 79.1 million for a government administered fund.[2]

Small-scale commercial fishers represent the greatest numerical participation among the suite of fisheries capturing billfish in the Caribbean. Ensuring the sustainability of fish stocks supporting small-scale commercial fishing operations is of paramount importance to Caribbean nations, which typically show disproportionately high reliance upon marine resources to support its citizens' livelihoods and national economies. The ongoing deployment of Fish Aggregating Devices (FADs) in the region is considered the greatest factor aiding the expansion of small-scale commercial fisheries, a matter of concern for billfish sustainability that is further discussed in Annex 4.

In the Caribbean, small-scale commercial fishers utilize a variety of gears including trolling with rod and line, drop lines, longlines and various net configurations. Drop lines (also known as buoy lines) consist of a section (5 to15 m) of high breaking strain fishing line with a hook at one end and a buoy at the other (Figure A1.1). A live bait is attached to the hook and the full setup is then released/set to drift past a FAD or through a productive channel. Multiple drop lines can be fished simultaneously, including from small vessels, and they are retrieved when a hooked fish is seen jumping in an attempt to remove the hook from its mouth, or when movements of the buoy indicate that a larger fish has consumed the (live) bait and has been hooked.

FIGURE A1.1
Illustration of the drop line fishing method used to target billfish around a moored FAD



Source: Japan International Cooperation Agency (2014). FAD training video 2 of 2 "Drop line fishing around FAD" (Available at: www.youtube.com/watch?v=_mr-eoUc59U&t=469s).

Large-scale commercial fleets also provide employment opportunities and nutrition to Caribbean nations. Many supply both local and high value export markets, whenever

[2] Gentner B & Whitehead J. 2018. *Expenditure and willingness-to-pay survey of Caribbean billfish anglers: summary report.* (Available at - www.fao.org/3/I9667EN/i9667en.pdf).

export market linkages exist. Tunas and swordfish are in constant demand for export and they are typically targeted using longlines. Billfish species are also commonly caught by these longlines and they are normally retained by these fleets, not released as bycatch in accordance with ICCAT recommendations. The larger size of vessels in this fishery clearly indicates a larger harvest capacity per vessel, but it is currently unclear how harvest rates of this fleet compare in quantity and value to other Caribbean fishing vessel categories, as a result of poor billfish catch reporting across all sectors.

Industrial fishing fleets that capture billfish in the Caribbean mostly use longlines or, less frequently, purse seine nets. The different purse seining techniques employed to target tunas, either on drifting FADs or on free-swimming schools, do have implications for billfish capture rates, but the industrial fleet's greatest source of billfish mortality is attributable to longline gear. Industrial fleets of all ICCAT member countries have been urged to take appropriate measures to reduce billfish mortality, with moderate success so far. These measures include, among others, ensuring that blue and white marlin that are alive by the time of boarding be released in a manner that maximizes their chance of survival.[3] Billfish species are considered bycatch species by overarching management authorities like ICCAT, but this is not genuinely the case for all industrial fleets. Issues related to billfish sales by industrial fishing fleets, and how they impact smaller markets in the Caribbean region, are further expanded upon in Annexes 2 and 3.

[3] 12-04 Recommendation by ICCAT to further strengthen the plan to rebuild blue marlin and white marlin stocks (Available at: www.iccat.int/Documents/Recs/compendiopdf-e/2012-04-e.pdf).

ANNEX 2. Problem identification in billfish fisheries

Fisheries management in the Western Central Atlantic and Caribbean region urgently needs to align with modern sustainable fishery practices to secure future livelihoods for millions of Caribbean citizens. Various concepts, such as the Ecosystem Approach to Fisheries (EAF), have already been technically endorsed by Caribbean nations' fishery authorities, but they generally remain poorly implemented on national scales. At the same time, regional management is constrained by not having a formal Regional Fishery Management Organization (RFMO) in place. Multiple organizations provide technical advice to the region's national fisheries authorities, but the implementation of advisory measures (including those of this Plan) remains the responsibility of each individual nation. To achieve the required cooperative management of highly migratory stocks across a broad geographical spectrum, the formalization of a more consolidated regional authority that can formulate and enforce the future management of those regionally shared fish stocks will be required. This Annex describes the main issues relevant to billfish stock management in the region, all of which will benefit from improved management on a regional scale and enhance international cooperation on multiple fronts.

A2.1. BILLFISH ISSUES WITHIN THE CARIBBEAN CONTEXT: GROWING DEMAND, STOCK HISTORIES AND ONGOING DECLINING TRENDS THREATEN FUTURE LIVELIHOODS IN THE ALREADY OVERFISHED WECAFC AREA.

The overall situation in the fishery industry, market developments and fishery management efficiency vary by country and by region. The Western Central Atlantic was the region with the highest proportion of overfished stocks in a 2009 global comparison by FAO (Figure A2.1).[1] Billfish stocks definitely form part of this worrying situation. The declining trends in billfish stocks, as demonstrated through Atlantic-wide stock assessments, indicate that overharvesting consistently jeopardizes future reaping of the diverse benefits that billfish species can contribute to many Caribbean fisheries. Caribbean states may not have been the primary drivers of historical billfish stock declines, but their domestic pelagic fishery developments are typically a reaction to overfishing of their nearshore stocks. Active targeting of billfishes by longline vessels and the rapidly developing FAD fishery are the most immediate and major causes of concern for billfish stock sustainability in the Caribbean.

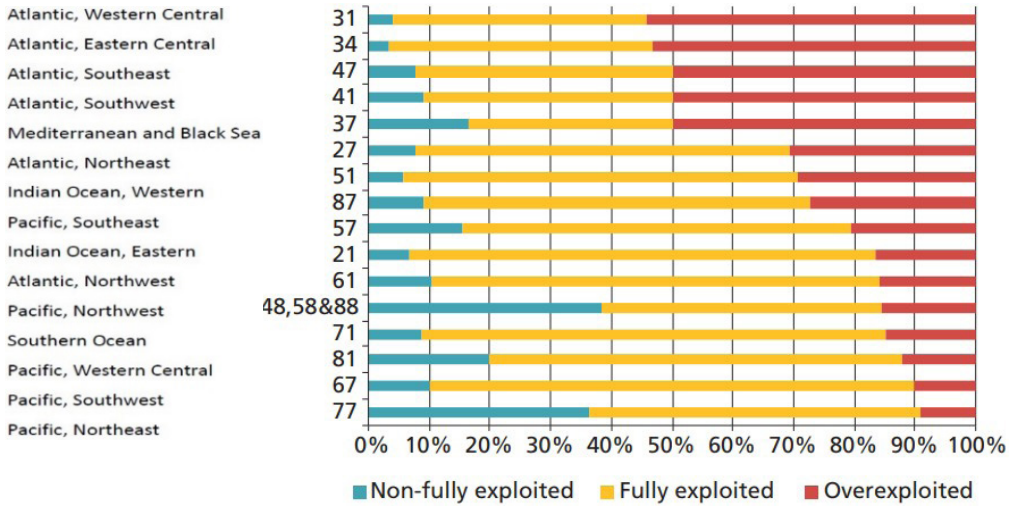
While Figure A2.1 presents a depressing picture from a global perspective, the average annual overall capture fisheries production in the WECAFC area has also shown a worrisome declining trend over the last 30 years (Figure A2.2). Again, these trends have dire implications for millions of Caribbean citizens, particularly those of small island developing states (SIDS) that already have a disproportionate reliance upon marine resources (or, alternatively, relatively expensive imports) to support their citizens' nutrition, livelihoods and national economies.

Fisheries often provide vital livelihood support to the most deprived in society and are thus frequently referred to as an "employer of last resort."[2] This perception further

[1] FAO. 2011. *Review of the state of world marine fishery resources*. FAO Fisheries and Aquaculture Technical Paper No. 569. Rome, 334 pp. (Available at - www.fao.org/docrep/015/i2389e/i2389e.pdf).

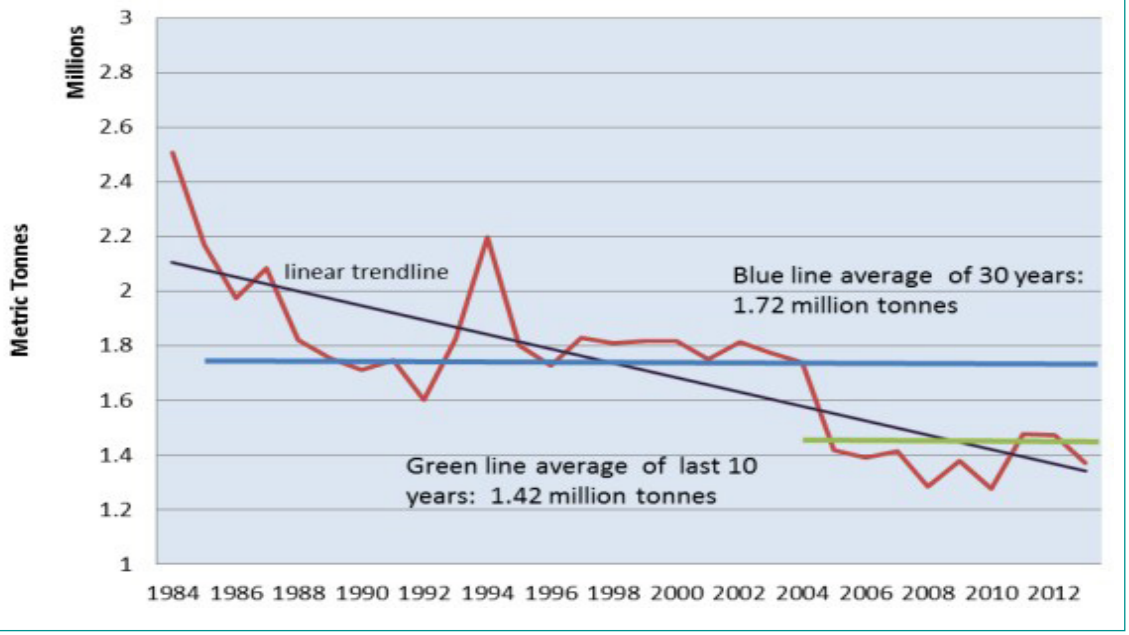
[2] Neiland E. and Bene C. 2004. Poverty and small-scale fisheries in West Africa. *Kluwer Academic Publishers*. (Available at - www.springer.com/us/book/9781402018886).

FIGURE A2.1
The percentages of fish stocks in different status by major fishing areas in 2009



Source: Hoydal K. 2016. *Findings of the independent cost-benefit assessment of the options for strategic re-orientation of WECAFC*. FAO Fisheries and Aquaculture Circular No. 1117. (Available at - www.fao.org/3/a-i6377e.pdf).
Note that area 31 – "Atlantic, Western Central" is the WECAFC area within which the Caribbean region falls.

FIGURE A2.2
Trend in total catches in Area 31 over the last 30 years (1984-2013)



Source: Hoydal K. 2016. *Findings of the independent cost-benefit assessment of the options for strategic re-orientation of WECAFC*. FAO Fisheries and Aquaculture Circular No. 1117. (Available at - www.fao.org/3/a-i6377e.pdf).

emphasizes the urgent need to secure the long-term sustainability of fishery resources in the Caribbean and broader WECAFC area. For shared migratory billfish stocks, which are already more prone to overexploitation.[3] An open access approach reinforces and promotes the inevitable consequences of lacking regulations and enforcement that currently prevail with an ultimate "race to fish" for these stocks in the Caribbean. This gives rise to the persisting "tragedy of the commons" mechanisms that form

[3] McWhinnie SF. 2009. *The tragedy of the commons in international fisheries: an empirical examination.* 57 pp 321 333 (Available at - www.sciencedirect.com/science/article/pii/S0095069608000788).

the core of the worrying state of most Caribbean fishery resources in general, and billfish resources in particular. The future nutritional demands of the region's human population in terms of seafood soon cannot be covered if fish stocks continue their current declining trends.

A2.2 CONSTRAINTS TO THE EFFECTIVE MANAGEMENT OF BILLFISH STOCKS IN THE CARIBBEAN UNDER ICCAT: DATA AVAILABILITY, CONSTRAINTS ON STOCK DECISIONS, ENFORCEMENT CAPACITY ISSUES AND THE ULTIMATE IMPLEMENTATION EFFICACY FOR MANAGEMENT RECOMMENDATIONS (BASED ON REPORTS [4, 5]).

ICCAT has undertaken many efforts to reduce billfish harvests to within sustainable levels throughout the Atlantic Ocean, and this Management and Conservation Plan recognizes that billfish stocks to date have certainly benefited from these actions. However, both the ICCAT SCRS and the Independent Performance Reviews of ICCAT state that these measures may not be sufficient for marlin stocks to recover. Recent increases in Atlantic blue marlin catches by artisanal and small-scale commercial fisheries, on both sides of the Atlantic, threaten to negate effectiveness of the marlins rebuilding plan. They, therefore, suggest the use of additional measures, particularly those that will reduce fishing mortalities by non-industrial fisheries. The second ICCAT performance review of 2016 stated that the marlin rebuilding plan was showing poor progress and that, despite better quantification, the prevailing alarming statuses of Atlantic blue marlin and white marlin stocks were considered similar to what they were in 2008. According to the SCRS, the existing conservation measures give Atlantic blue marlin only an estimated 32 percent possibility of rebuilding by 2026, while for white marlin the probability of rebuilding by 2022 is a categorically worrying 0 percent.[6] Within independent performance reviews of the commission, the broader application of time/area catch restrictions is thus encouraged in order to reduce overall fishing mortality rates for billfishes.

The SCRS has consistently expressed concern over severe underreporting of catches in the different fisheries. Some improvements have been made in recent years, but the issue remains one of grave concerns that persists, particularly for billfishes. The 2016 ICCAT performance review report suggested that poor data reporting and compliance be addressed in a systematic way. In this regard, the 2016 review panel specifically identified a number of Caribbean nations in its report, citing significant artisanal/small-scale commercial catches of billfishes, ongoing data issues and non-responsiveness to requests for catch data. There is also not enough information being provided on the proportion of caught billfishes being released alive from all fleets. These data would assist in evaluating the effectiveness of the ICCAT recommendation relating to the live release of marlins as there are plenty of indications that billfish release is currently far from being normal practice among Caribbean longline and other fisheries.

It is apparent that components of the ICCAT billfish management recommendations have been disregarded by some CPCs, particularly those components related to enhanced monitoring and management of billfish mortalities resulting from non-industrial fisheries. While prioritizing data reporting issues for marlins, the

[4] ICCAT. 2008. *Report of the independent performance review of ICCAT*. Madrid, 2009. (Available at - www.iccat.int/Documents/Other/PERFORM_%20REV_TRI_LINGUAL.pdf).

[5] Spencer J., Maguire J.J. and Molenaar E.J. 2016. *Report of the second independent performance review of the International Commission for the Conservation of Atlantic tunas (ICCAT)*, PLE-103/2016. (Available at - www.ris.uu.nl/ws/files/24571268/Second_ICCAT_Performance_Review_Report_Doc_PLE_103_2016_ENG.pdf).

[6] ICCAT. 2011. *Report of the 2011 blue marlin stock assessment and white marlin data preparatory meeting.* Madrid, Spain. (Available at - www.iccat.int/Documents/Meetings/Docs/2011_BUM_ASSESS_ENG.pdf).

review panel suggested that the Committee identify those CPC and geographic areas where the data problems are concentrated, and develop approaches to resolve these long-standing difficulties. Overall, further reductions in billfish fisheries related mortality are required to increase the likelihood of stock rebuilding success by regulating artisanal and small-scale fisheries with a concurrent broader application of time/area catch restrictions.[7]

A2.3 BILLFISH AS TARGET SPECIES SUPPORTING CARIBBEAN SEAFOOD MARKETS

Atlantic billfish stock assessment trends suggest that poor data reporting for these species conceals the true impacts on these stocks resulting from the activities of many fishing fleets operating in the Atlantic Ocean and its adjacent seas, among them the Caribbean Sea. In 2016, billfish species constituted only three percent of the total reported catch of the United States of America pelagic industrial longline fleet and, reportedly, 72 percent of billfish captured had been released alive.[8] This fleet does not retain or land billfish as its commercial retention or sale is prohibited, in compliance with ICCAT recommendations and US domestic law under the Billfish Conservation Act.[9], [10] In the United States of America, these lower billfish proportions of catch and relatively high live release percentages appear to indicate that fishery management measures effectively discourage billfish harvests by this fleet. Other longline fleets of ICCAT member states are expected to operate in a similar manner under the ongoing marlin stock rebuilding program, to ensure they don't exceed their allocated billfish quota limits.

The figures of the United States of America fleets stand in stark contrast with billfish catch compositions for Caribbean fleets. The Caribbean longline fishing effort,[11] billfish catch shares and percentages (Figure A2.3), and catch quantities have shown increases since the 1980s. For example, in 2015 the Barbados fleet reported that harvest weights for billfishes attained approximately half of that seen for tunas (Figure A4.1).[12] The number of reported billfish discards for the years 1996, 1997 and 1998 showed declines in the Caribbean region for all billfish species,[13] which may reflect either reduced catch rates resulting from overexploitation, greater retention rates to supply Caribbean billfish markets, or a combination of these two factors. The percentage of cumulative billfish landings made within the Caribbean region was greater than those

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7 Spencer J., Maguire J.J. & Molenaar E.J. 2016. *Report of the second independent performance review of the International Commission for the Conservation of Atlantic tunas (ICCAT)*, PLE-103/2016. (Available at - www.ris.uu.nl/ws/files/24571268/Second_ICCAT_Performance_Review_Report_Doc_PLE_103_2016_ENG.pdf).

8 NOAA. 2000. *Regulatory amendment 1 to the Atlantic tunas, swordfish and sharks fishery management plan: Reduction of bycatch, bycatch mortality and incidental catch in the Atlantic pelagic longline fishery.* (Available at - www.nmfs.noaa.gov/sfa/hms/related_topics/bycatch/documents/fseis_final_section_1.pdf).

9 NOAA. 2012. *Amendment to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: US Caribbean Management Measures. Final Regulatory Flexibility Analysis.* (Available at - www.nmfs.noaa.gov/sfa/hms/documents/fmp/am4/final/10-01-12_a4_final_ea.pdf).

10 Lam C.H., Galuardi B., Mendillo A., Chandler E. & Lutcavage M.E. 2016. Sailfish migrations connect productive coastal areas in the West Atlantic Ocean. *Nature Scientific Reports*. Available at - www.nature.com/articles/srep38163.pdf

11 Walcott J., Oxenford H.A. & Schuhmann P. 2008. *Current status of the longline fishery in Barbados. Proceedings of the 61st Gulf and Caribbean Fisheries Institute Conference, Guadeloupe, French West Indies*. (Available at - http://nsgl.gso.uri.edu/flsgp/flsgpw08001/data/papers/004.pdf).

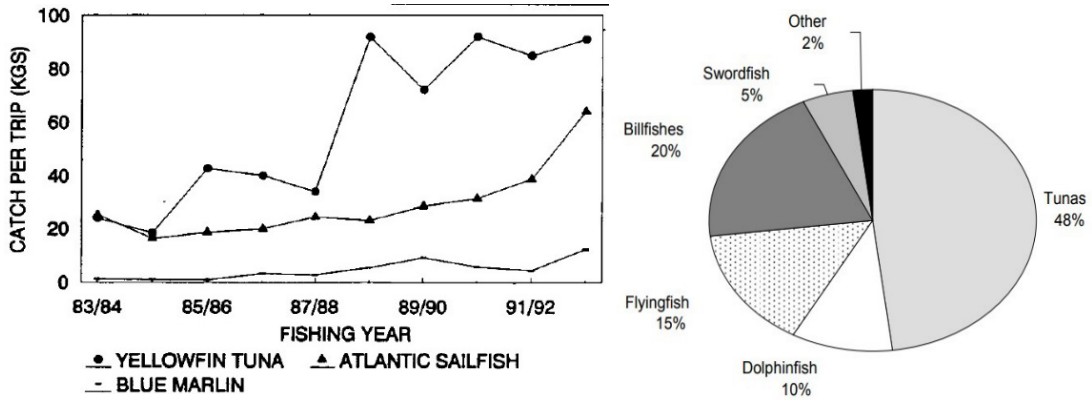
12 Schuhmann, Oxenford H.A. & Staskiewicz, Walcott J. 2010. Landings, Costs, Net Profit and Return on Investment in two contrasting fisheries. Part 1: The Longline Fishery. Centre for Resource Management and Environmental Studies (CERMES). Prepared for the Fisheries Division, Ministry of Agriculture, Government of Barbados (Available at - www.cavehill.uwi.edu/cermes/getdoc/584e4a57-65d5-4f94-84e4-81b6c3f4d560/schuhmann_et_al_2010_economic_valuation_of_barbado.aspx).

13 NOAA. *Description of the pelagic longline fishery for Atlantic Highly Migratory Species*. (Available at - www.nmfs.noaa.gov/sfa/hms/related_topics/bycatch/documents/fseis_final_section_6.pdf).

seen in the Gulf of Mexico for marlins from 1961 through 1996, and it is possible that the bulk of catches obtained from within the EEZs of CARICOM countries was never reported to ICCAT.[14]

FIGURE A2.3

Annual mean catch per trip (kg) for longline pirogues from 1983/84 to 1992/93 per target species (left)*. Mean annual longline catch composition shown by percent weight of recorded landings from 2001 to 2005 (right)**



* Sharma R, Pons M, Martin S, Kell L, Walter J, Lauretta, Schirripa M. 2017. Factors related to the decline and rebuilding of billfish stocks in the Atlantic and Indian oceans. *ICES Journal of Marine Science*. (Available at - www.researchgate.net/publication/317139389_Factors_related_to_the_decline_and_rebuilding_of_billfish_stocks_in_the_Atlantic_and_Indian_oceans).

** Walcott J, Oxenford HA, Schuhmann P. 2008. *Current status of the longline fishery in Barbados. Proceedings of the 61st Gulf and Caribbean Fisheries Institute Conference, Guadeloupe, French West Indies*. (Available at - http://nsgl.gso.uri.edu/flsgp/flsgpw08001/data/papers/004.pdf).

An industrial fishing fleet, operating from Trinidad & Tobago, exports billfishes to Barbados and other eastern Caribbean islands. These "bycatch" landings represent a relatively low economic return to this fleet, but Caribbean importers have come to rely upon these imports to supplement local landings and cover a steady demand for this low priced fish, particularly from July through November. Small fish-fry businesses that are enjoying increased popularity while attending to both locals and tourists, have become primary points of sale for billfish based dishes.[15] Such market developments illustrate a growing Caribbean demand for billfish products, which stands in contrast to the troublesome billfish stock statuses, as well as ICCAT's recommendations to achieve the sustainability of Atlantic billfish stocks. During meetings of the WECAFC Recreational Fisheries Working Group, commercial fishers from the region have repeatedly stated concerns about the competition from these low priced billfish products landed by large industrial fleets, as they can't compete with the economies of scale achieved by the industrial fleets that ultimately reduce the market value for their own catches.[16]

In the Bolivarian Republic of Venezuela, billfish had a modest commercial value until the 1980s, when economic conditions provided a boost to billfish market values and encouraged fishery operations directed at supplying local markets with fresh or

[14] Die D. *Status and assessment of large pelagic resources: In Management of large pelagic fisheries in CARICOM nations*. (Available at - ftp://ftp.fao.org/docrep/fao/007/y5308e/y5308e01.pdf).

[15] McConney P.A. *Post-harvest sector: In Management of large pelagic fisheries in CARICOM nations.* (Available at - ftp://ftp.fao.org/docrep/fao/007/y5308e/y5308e01.pdf).

[16] FAO. 2017. *Report of the third regional workshop on Caribbean billfish management and conservation of the WECAFC/ OSPESCA/ CRFM/ CFMC working group on recreational fisheries.* Fisheries and Aquaculture Report SLC/FIA 1911.

frozen billfish products in greater proportions.[17] This nation then aligned with other Caribbean fleets that actively target billfish by applying up-to-date knowledge on pro-active gears, baits and fishing methods to promote their billfish catch and supply consistently developing billfish markets.[18]

A2.4 FISH AGGREGATING DEVICES (FADS): IMPLICATIONS FOR BILLFISHES AND THEIR DEPENDENT FISHERIES IN THE CARIBBEAN

Overview

The introduction of moored or anchored fish aggregating devices (mFADs) in Caribbean waters during the 1980's and 1990's increased the capabilities of small-scale fisheries to target and harvest billfishes. This simultaneously led to an increase in conflicts between the small-scale commercial and recreational fisheries sharing the same pelagic fish resources.[19] Effective FAD fishery management mechanisms are currently lacking in the Caribbean, although a sub-regional management plan for FAD fisheries is being finalized by CRFM.[20] WECAFC and CRFM also have a joint FAD Working Group that oversees these developments and continues to inform on FAD fishery management decisions, aided by specialists of the Caribbean Billfish Project. FADs must be placed in a broader development context and should be treated as another component in the processes aimed at diversifying livelihood opportunities for fishers. However, as with other livelihood options, they bring trade-offs and risks.[21] The nationally and regionally encouraged, ongoing and often externally supported[22] deployments of mFADs within the Caribbean[23] are considered a worrisome trend for billfish stocks sustainability.

Atlantic blue marlin is among the most targeted species around Caribbean mFADs, and this is particularly the case when live baits are used on drop lines. Suggestions that drop lines are primarily employed in the region to target large tunas around FADs are not correct; marlin are often the primary target (see Figure A1.1), particularly when captured through using the small tunas that congregate around FADs as bait on drop lines. These gears are very effective at capturing Atlantic blue marlin. FADs promote "growth overfishing" of the tuna species that are used as bait, and are then sold at relatively low cost due to poor quality if the fishers are not successful in converting these smaller tuna into a larger fish. Growth overfishing occurs when fishing pressure

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[17] Alió J.J. 2013. Recreational fishery component of the Caribbean Large Marine Ecosystem; large pelagic fishery case study: Southern Caribbean area (Venezuela with notes from Colombia). CRFM Research Paper Collection 7 (Available at - www.researchgate.net/publication/258144201_RECREATIONAL_FISHERY_COMPONENT_OF_THE_CARIBBEAN_LARGE_MARINE_ECOSYSTEM_LARGE_PELAGIC_FISHERIES_CASE_STUDY_SOUTHERN_CARIBBEAN_AREA_VENEZUELA_WITH_NOTES_FROM_COLOMBIA).

[18] Samlalsingh S. Oxenford H. & Rennie J. *Proceedings of the Forty-Sixth Annual Gulf and Caribbean Fisheries Institute*. Fort Pierce, Florida. 46: pp 3-21. (Available at www.gcfi.org/proceedings/proceedings/successful-smallscale-longline-fishery-grenada).

[19] Ehrhardt N. and Fitchett M. 2015. *Baseline desk study on the status of billfish resources and the billfish fisheries in the Western Central Atlantic*. (Available at - www.fao.org/3/a-i6204e.pdf).

[20] CRFM. 2015. Draft sub-regional management plan for FAD fisheries in the Caribbean (Stakeholder Working Document). CRFM Technical and Advisory Document Number 2015/05. Available at - www.crfm.net/images/2015_Draft_Sub-Regional_Management_Plan_for_FAD_Fisheries_in_the_EC_Final_Draft_revised_24_Sept_2015.pdf).

[21] Albert J.A., Beare D., Schwartz A.M., Albert S., Warren R., Teri J., Siota F. & Andrew N.L. 2014. The contribution of nearshore fish aggregating devices (FADs) to food security and livelihoods in Solomon Islands. *PLoS ONE* 9 (Available at - http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0115386.).

[22] Sidman *et al.* 2015. T*oward a Sustainable Caribbean FAD Fishery – Introducing lures to incentivize co-management efforts.* (Available at - www.flseagrant.org/wp-content/uploads/TP_214_web.pdf).

[23] Sidman *et al.* 2014. *Toward a Sustainable Caribbean FAD Fishery – An analysis of use, profitability and shared governance*. TP 2016. (Available at - www.flseagrant.org/wp-content/uploads/TP_206_Toward_A_Sustainable_Caribbean_web.pdf).

on small individuals of a species prevents that species' stock from producing maximum poundage and resultant value, either to the harvesting fishery and/or to fisheries targeting the same species at greater age and size. Moored FADs congregate small tunas and billfish far more effectively than they congregate large tunas, as the latter can typically be found further offshore.

The use of FADs has increased catches and reduced the costs of fishing operations (e.g. lower fuel use), which has boosted billfish harvest maximizations to supply domestic markets in the Caribbean. This has driven capacity investments among the involved fisheries, especially the small-scale commercial fishery. It is clear that small-scale commercial fisheries harvest significant quantities of billfishes in the Caribbean around FADs. Consequently, there exists an urgent need to enhance data availability on the operations and catches of these fleets so that their impact can be incorporated in stock assessment models, catch allocations and other stock management decisions.

Catch composition changes with linked billfish harvest incentives and capacities

In Cuba, the catch composition of fisheries using FADs was initially dominated by spearfish, but later consisted of about 60 percent white marlin, 25 percent sailfish and only 15 percent common dolphinfish.[24] Atlantic blue marlin is the species most targeted by fishers around the FADs of Guadeloupe and of Saint Vincent and the Grenadines. This billfish species constitutes up to 18 percent and 42 percent of the seasonal harvests by FAD fishers in Guadeloupe and Martinique, respectively. Recognizing the poor condition of billfish stocks, additional harvests by FAD fisheries must be balanced by reductions in the billfish fishing mortality rates resulting from larger commercial and industrial fisheries. Beyond halting uncontrolled FAD fishery growth, this is the only way that the benefits obtained from billfishes by all fishery sectors can realistically be sustained in the long term.

The increase in marketing of billfish produce from small-scale fisheries operations have been occurring through FAD induced improvements to pelagic species catch efficiencies. Under an open access management regime, increased profits are being invested towards enlarging fishery harvest capacities, which is a prevalent and concerning trend throughout the Caribbean. These re-investments in open access regimes perpetuate a financial cycle that is practically and politically difficult or impossible to control once initiated. It is understandable that promoting fishers' abilities to commercialize the produce of their activities is generally perceived as a positive development, from the perspective of achieving a higher livelihood standard. However, the reality is that this process does not recognize the respective stock status' of various targeted billfish species, nor the lack of alternative livelihood opportunities available to such fishers when the billfish stocks inevitably collapse if current actions persist Atlantic wide. The increase in billfish products offered in the market place is also frequently the result of ineffective monitoring, management and enforcement of regulations. It is generally considered politically delicate to control these fishing fleets with their numerous and dispersed vessels, because of their importance to the livelihood support they provide to coastal communities. Open access fisheries are characterised by "race to fish" scenarios that do not promote fishery efficiency. It also places involved fishers at risk of fishing themselves out of a livelihood altogether, especially when they're targeting stocks that have already each endured at least a decade of overfishing.

[24] Report of the first meeting of the WECAFC ad hoc working group on the development of sustainable moored fish aggregating device fishing the in the Lesser Antilles. Le Robert, Martinique, 8-11 October. 2001.

Fisher congregation and linked conflicts

FADs congregate pelagic fishes and they have a natural secondary effect of also congregating fishers/vessels and their associated efforts. This also provides a potential opportunity to improve the efficiency and cost effectiveness of fisheries management, control and surveillance, an opportunity which remains largely untapped to date by fishery authorities of Caribbean nations. However, a detrimental consequence of fisher congregations in the region has been the growing competition between fisheries that are operating around FADs, with different capacities and market orientations regarding the billfishes they capture. Intensifying conflicts, both between and within the different fisheries operating around FADs, have become apparent in the Caribbean region.[25]

In the Caribbean, these intensifying conflicts, which occur both at sea and on land, are generally the result of a lack of user rights being effectively assigned to FAD fishers. Consequently, those having greater fishing capacities are harvesting more intensively than other fishers that are, therefore, losing out on opportunities to harvest for themselves within the prevailing "race to fish". Different incentives are the basis for interactions and conflicts between fishers operating in a congregated and concentrated manner around FADs. The greatest contrast is seen between commercial fishers, who pursue profits and livelihood support, and recreational fishers, who typically allocate a much higher financial and intrinsic value to a live than a dead billfish. Increased harvest rates around FADs of Atlantic blue marlin by the commercial fisheries, would appear to jeopardize the benefits that could be generated by the recreational fisheries that assigns the highest reward/value to this species.

Hyper-stability in catch rates and the implications for stock assessments

Main constraints to billfish stock assessments include differences between the various CPUE series, catch data underreporting, inconsistencies between catch and landings statistics and lacking biological data on growth and/or maturity. CPUE statistical problems originate from fishing power differences between fleets, regions and seasons as billfish stocks migrate seasonally. Fishing intensity (fishing effort per unit of area), changes in accordance with the seasonal availability of targeted tuna species and/or specifically targeted billfishes. The fact that incidental billfish catches by industrial tuna fisheries are characterized as incidental in nature, also hampers analyses. In addition, non-compliance of management measures and regulations related to billfish further complicates the implementation of billfish data collection aboard vessels. FADs create an additional data concern that is impeding informed management of billfish stocks.

The increased catch per unit of effort (CPUE), which make FADs such popular tools among various fishery sectors, compromise the use of conventional CPUE data as a proxy for abundance within stock assessment models. CPUE indices function on the theoretical premise that randomly distributed fishes would be more frequently captured by randomly distributed fishing efforts, if the stock was more abundant. If there are more fish within the fished area, then greater catch rates will be achieved by the same fishing effort. By congregating pelagic fishes, FADs allow fisheries to artificially increase (termed hyper-inflate) their catch rates within the same amount of effort (typically numerated by fishing time or number of lines or hooks deployed). The effect of FADs increasing the catch per unit effort implies within stock assessment models that the stock abundance has increased, while this is not necessarily true. The contrary appears to be the norm, as FADs don't put more fish into the ocean, but rather make them easier to harvest efficiently. The need for FAD deployments to artificially amplify catches and thus maintain pelagic fishery cost effectiveness in the short term, should thus be considered symptomatic of fishery sustainability problems

[25] Ehrhardt N. and Fitchett M. 2015. *Baseline desk study on the status of billfish resources and the billfish fisheries in the Western Central Atlantic.* Available at - www.fao.org/3/a-i6204e.pdf.

(e.g. overcapacity and ineffective management); rather than as a politically appealing short term solution that places harvested stocks at greater risk of more rapid depletions. Combining these issues makes catch rates around FADs not compatible with the stock assessment methods applied before FADs were introduced to the fishery. This means that tracking stock abundance according to historical data is no longer possible, and stock abundance models must now begin from new hypothetical (and inevitably hyper-inflated) baseline values that cannot yet accurately integrate the congregation effects induced by FADs (which will vary by species, season, and nation etc.).

Using FAD data, therefore, has the troublesome ultimate effect of suggesting that stocks have recovered and become more abundant in CPUE datasets, a feature masking stock declines and potential impending collapse signals. Congregation of pelagic species on FADs can also create a "basin effect" that nullifies the potential benefits of conducting fishery independent data collection or test fishing to develop CPUE indices that are comparable to historical datasets. While the use of FADs enhances the catch per boat when total fishing pressure is low, it ultimately increases the likelihood of fishery collapse with generally increased and more efficient fishing pressure[26] and causes dire concerns for fisheries management and the resultant sustainability of stock and livelihood support for fishers.

Summary and additional concerns

FADs are believed to impose additional and largely unknown consequences upon pelagic fish stocks, as well as population dynamics of the broader marine ecosystem. There is extensive literature on the ecological, fishing efficiency and environmental impacts caused by FADs, with a number of findings summarized below:

1. Relatively small tunas and other pelagic fishes congregate the most near moored and drifting FADs. These small fish around FADs attract larger pelagic fishes, which are in turn targeted by fishers. However, these primary congregations of small fishes can have negative implications for connected fisheries exploitation patterns. Small (and potentially juvenile) fishes are less valuable to industrial purse seine fisheries which capture them more frequently around moored FADs. Even if discarded to support sustainability, the mortality rates seen for discarded "undersized" fishes can be considerable and do negatively influence the associated stocks. The increased harvest of smaller individuals from various pelagic fish stocks by expanding small-scale commercial fisheries operations around moored FADs, may also induce growth and recruitment overfishing[27] that is detrimental to the financial and environmental efficiency of all fisheries sharing harvests from these stocks. Growth overfishing occurs when species such as yellowfin tuna, which are targeted by longline fisheries as adults, are harvested at a smaller sizes around FADs. Recruitment overfishing occurs when juvenile fishes are harvested around FADs before they have had an opportunity to reproduce, which compromises the stocks recruitment capacity. Developing small-scale commercial fisheries in the Caribbean do retain these smaller specimens as they have created a lucrative local niche market demand and/or use them as live bait to target larger fishes (especially following the introduction of drop lines). Live bait fish are not reported within the catches of these fisheries or other fisheries that use both types of FAD to increase their efficiency. This

[26] Cabral R.B., Aliño P.M. & Lim M.T. Modelling the impacts of fish aggregating devices (FADs) and fish enhancing devices (FEDs) and their implications for managing small scale fishery. *ICES Journal of Marine Science 71* pp 1750-1759. (Available at - https://academic.oup.com/icesjms/article/71/7/1750/664488/Modelling-the-impacts-of-fish-aggregating-devices).

[27] Fonteneau A., Pallares P. & Pianet R. 1999. *A worldwide review of purse seine fisheries on FADs.* IFREMER Conference Article. (Available at - http://archimer.ifremer.fr/doc/00042/15278/).

unreported live bait capture represents a hidden harvest that is not reflected in statistical models that are used to inform fishery management decisions.

2. The incidental catch of billfish by purse seine fisheries shows many relationships with the methods of fishing/setting employed. Atlantic blue marlin dominate the billfish catch in weight and numbers for purse seiners operating around FADs. Many billfishes captured by these fisheries are retained and mortality is high following capture in the purse seine net and during brailing.[28] Billfishes captured by purse seine fisheries are also typically large individuals, which accentuates the negative impact on fecundity and recruitment of these harvests, particularly upon billfish stocks that exhibit sexual dimorphism.
3. Increased competition for fishing grounds between small-scale commercial and recreational fishers occurs around FADs. An intensification of conflicts is already well documented within the Caribbean.
4. Drifting FADs that move away from the fishing grounds where they were initially deployed will contribute to pollution and can create navigational hazards. The ownership of drifting FADs and responsibilities of owners when FADs cause accidents at sea are not yet arranged either. At the same time, they continue to attract and congregate fish communities, although out of reach of the national fleets. Moored FADs which are of simple design and/or made of inferior materials will frequently break up as the ropes/chains deteriorate and/or the flotation structure collapses. The subsequent effects will be very similar to the ones described for the drifting FADs.
5. Coastal environmental impacts are likely, but not yet evaluated given the washing ashore or sinking of non-operational drifting FADs.
6. Massive drifting FAD densities are thought to impact the population dynamics of fishes in a yet unknown way, within the larger pelagic marine ecosystem. Concerns relate to predator-prey-fishery interactions, as well as potential influences upon the migratory patterns of pelagic fishes.
7. The promotion of drop line fishing using live baits around FADs are of particular concern for the sustainability of the Atlantic blue marlin. Using live baits increases the proportional catch of billfish around FADs, while species used as live baits are typically not recorded in catches. Lost drop lines also add to marine pollution, while posing a ghost fishing threat.
8. Changes to the fishing efficiency and the selectivity of fishing when using FADs has put in doubt the usefulness of CPUE) as an abundance index to carry out robust stock assessments that are comparable to historical data. This results from the hyper stability of CPUE, with this core abundance reflecting parameter potentially remaining stable or increasing because FADs continue to attract and concentrate fish beneath them, even though population abundances may be decreasing due to over-exploitation. Overall, CPUE indices from fisheries utilizing FADs are considered to provide a skewed perspective of stock abundance, due to their ongoing aggregation mechanisms promoting artificially inflated catch rates, even within biologically compromised and/or declining stocks.

A2.5 RECREATIONAL FISHERIES: BEST PRACTICES, INTER-SECTOR CONFLICTS AND POTENTIAL DRIVERS OF BILLFISH SUSTAINABILITY

While the trend of releasing all billfish captured by recreational anglers is commendable and should continue to be promoted throughout the Caribbean, some recreational

[28] Roman M. & Hall M. 2013. *Bycatch and non-tuna catch in the tropical tuna purse seine fisheries of the world*. FAO Fisheries and Aquaculture Technical Paper 568. Available at - www.fao.org/docrep/018/i2743e/i2743e.pdf.

anglers do still retain captured billfish and sell them, often illegally. Recreational anglers are now generally scorned by their peers if they harvest a billfish. The sale of recreationally captured billfishes should be formally prohibited, as directed by ICCAT, to minimize the incentive for recreational anglers to harvest billfishes. Even catch and release fishing for billfish can cause mortality. Nevertheless, studies have shown that the use of circle hooks can lead to very high post release survival rates. Efforts to maximize the survival of recreationally caught billfish should be supported with the implementation of standardized handling methods that maximize post release survival.

Recreational anglers are frequently considered competitors for fishery resources by other (commercial) fishers, particularly around FADs. When FADs are deployed by commercial fisheries in the Caribbean, some fishers within these sectors are claiming ownership of the resources congregated around these FADs. However, no legislation exist for use or tenure rights for fishing in the majority of Caribbean nations. The free access nature of marine resources lies at the basis of inter sector tensions and conflicts which can be observed in the region.[29] Recreational fishing vessels also benefit from improved catches around FADs and they often have a greater overall capacity to capture billfish and other pelagic species than typical small-scale commercial fishing vessels when using the same gears (i.e. not drop lines, nets or longlines). Many Caribbean nations have already developed a relatively large, and mostly marine oriented, angler tourism industry. The Caribbean nations appear well positioned to potentially benefit from a portion of the estimated USD 190 billion spent annually by some 220 million recreational anglers worldwide.[30]

Recreational anglers have already shown support for billfish stock protections within and outside of the Caribbean. Such efforts include lobbying for protected areas and providing financial and practical assistance to a variety of billfish research programs. Angler assessments have shown a remarkable willingness among recreational anglers to financially support actions to secure the sustainability of billfish harvests.[154] However, to date formalized and financially secure mechanisms to allow mutually beneficial outcomes for all fisheries are still lacking in the region. Apart from some recreational fisheries specifically targeting large, trophy sized billfish, the general regional emphasis upon the numbers of billfish caught and released highlights the importance of maintaining billfish in high abundance. Many recreational anglers have the financial capacity to fish in other locations if Caribbean billfish stock levels decline below certain threshold values.

A2.6 SUMMARY JUSTIFICATION FOR DEVELOPMENT AND IMPLEMENTATION OF THIS PLAN

Based on the information presented, the justification for development and implementation of a Caribbean Billfish Management and Conservation Plan is summarized in the following points:

1. Ongoing over-exploitation of billfish stocks, with fishery developments supporting targeted fishing for billfish contradicting worrisome stock statuses and trends.
2. Poor and inconsistent governance of the fisheries in the WECAFC region, which could greatly benefit from better cooperation on a regional scale, to address shared stock concerns.
3. Limited biological information is available on growth and maturity of billfish.

[29] Gentner B. 2016. *The use and design of rights and tenure-based management systems for transboundary stocks in the Caribbean*. FAO Fisheries and Aquaculture Circular No. 1126. Bridgetown Barbados. (Available at - www.fao.org/3/a-i6071e.pdf).

[30] *The hidden harvests: the global contribution of capture fisheries. 2010.* Agriculture and Rural Development Department, Sustainable Development Network. World Bank, Washington DC, USA. World Fish Center.

4. FAD deployments continue to cause severe and unresolved issues for CPUE parameters that are of pivotal importance to make accurate statistical stock assessments that can effectively inform management decisions.
5. The lack of basic data on billfish catches and discards by different fleets, and the true status of billfish resources, constitute significant constraints to developing appropriate policies on how billfishes should be managed and/or conserved.
6. Exponential and unregulated expansion of FAD fisheries in the WECAFC area and beyond represent a rapidly developing threat to billfish stocks, particularly when live baits are used on drop lines to target billfishes. These developments undermine and stand in contrast to recommendations encouraging sustainable actions among larger scale commercial and industrial fisheries.
7. Ineffective national regulatory and institutional frameworks regarding the management of commercial and recreational fisheries are allowing overfishing and constitute lost opportunities for maximization of the socio-economic benefits that could be sustainably obtained from the valuable billfish stocks in the region.
8. Persisting IUU fishing issues and limited regional collaboration are encouraging an unsustainable "race to fish", while undermining regional fishery management efforts for shared large pelagic stocks.

ANNEX 3. Fisheries institutional and legal frameworks influencing the Caribbean, the broader WECAFC area and billfish stocks throughout the Atlantic Ocean and adjacent seas: Implications for the effective management of migratory pelagic stocks

The WECAFC area of competence encompasses a large diversity of sub-regions, including national waters of Brazil, the USA, numerous Caribbean Small Island Developing States (SIDS) and overseas territories, as well as Areas Beyond National Jurisdiction (ABNJ). The Caribbean region in particular is a complex patchwork of countries and overseas territories within which the methods of drafting and adopting legislation vary considerably from one nation to another, as do the capacities for fisheries regulation enforcement and resultant efficacies. The highly migratory nature of some marine species and consequent implications for their management are recognized in a number of international legal instruments, which are also applicable in the Caribbean region. Among the most important are: the United Nations Convention on the Law of the Sea (UNCLOS III),[1] the UN Fish Stocks Agreement,[2] the FAO Compliance Agreement, ICCAT and the Port State Measures Agreement (PSMA).[3] These frameworks definitely aid and support the implementation of billfish management, but have not been effective, individually or collectively, at securing the sustainability of billfish stocks to date. Compliance with these instruments also varies greatly between the different Caribbean nations, which inequitably share harvests from the same billfish stocks.

ICCAT is currently the overarching RFMO in the Atlantic,[4] with 18 contracting parties and two cooperating non-contracting parties from the WECAFC membership of 34 countries and the European Union. ICCAT is the inter-governmental fishery organization responsible for the conservation of tunas and tuna-like species, including billfishes, in the Atlantic Ocean and its adjacent seas. ICCAT compiles fishery statistics from its members and from all entities fishing for these species in the Atlantic Ocean. It coordinates research, including stock assessments, provides science-based management advice, develops mechanisms for Contracting Parties to agree on management

[1] UNCLOS entered into force 16 November, 1994. More details available at - www.un.org/depts/los/.

[2] 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 are available at - www.un.org/depts/los/convention_agreements/convention_overview_fish_stocks.htm.

[3] FAO Agreement on Port States Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (adopted by the FAO Conference in 2009). (Available at - www.fao.org/fishery/psm/en).

[4] ICCAT website is available at - www.iccat.int.

measures and produces relevant publications. For many years, WECAFC and CRFM have both been actively encouraging and guiding increased ICCAT membership by Caribbean states, although complexities related to the process of membership and quota allocation, alongside the costs of attaining and maintaining membership as a CPC,[5] appear to represent formidable hurdles, particularly for Small Island Developing States (SIDS).

This Billfish Management and Conservation Plan builds directly upon the various ICCAT billfish stock management recommendations (see Annex 4), while providing the Caribbean region with a holistic, cooperative, standardized and cost-effective management opportunity for relevant fisheries from all nations and overseas territories, including those that are not ICCAT members but do influence regionally shared billfish stocks through their fishing activities. In addition to ICCAT, most of these countries also belong to one of Regional Fishery Bodies (RFBs), such as the Caribbean Regional Fisheries Mechanisms (CRFM) of the Caribbean Community (CARICOM), or the Central America Fisheries and Aquaculture Organization (OSPESCA) of the Central America Integration System (SICA). These RFB frameworks can also provide valuable multilateral support to the attainment of objectives set forth in this Plan.

All Caribbean nations have legislation governing fisheries, but only a few have provisions specific to large pelagic fishes, regional harvest sharing for migratory stocks, billfishes, FADs fisheries and/or 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 legislations and management systems in place are based on the FAO Code of Conduct for Responsible Fisheries[6] and include both legal and administrative frameworks. In most cases however, the legal framework is limited and often does not specify a formal management process with identified roles, responsibilities, information needs and time frames for activities' completion and evaluation.

All Caribbean countries have an authority in charge of fisheries and aquaculture, which in most cases is part of the Ministry of Agriculture. In a few cases, the fishery authority is independent and acts as a Ministry of Fisheries. Most of the recently enacted fishery laws provide for a Fishery Advisory Body or Committee, in which generally academics, private sector and fisheries managers discuss and prepare fisheries management advice. However, not all these bodies or committees are operational. Stakeholder identification and participation in the management processes is not a formal requirement in all countries, but most countries do promote co-management approaches via invitations to open meetings and the provision of opportunities for public comments, where and when feasible. Governments do, however, still retain the ultimate authority and responsibility for national fishery management.

Different governance structures, instruments and regimes may be found to varying degrees for all fisheries within laws and regulations across the region, including: (i) spatial restrictions; (ii) temporal restrictions; (iii) gear restrictions; (iv) rights and participatory restrictions; and, (v) catch and size restrictions. Not all the countries have prepared and/or are implementing fishery management plans. There are various countries that have committed to the development of management plans with a co-management component, which often contemplates the simultaneous introduction of the Ecosystem Approach to Fisheries (EAF). There exists an urgent need to formalize fishery management through the implementation of specific management plans, including this one, because of the essentially "open access" nature of many fisheries in the Caribbean. Open access fishery systems do not motivate to strive for

[5] Contracting Parties and Cooperating non-Contracting Parties, Entities or Fishing Entities (CPCs).

[6] FAO. 1995. The Code of Conduct for Responsible Fisheries. (Available at: www.fao.org/docrep/005/v9878e/v9878e00.htm).

efficiency maximizations in economic or environmental terms and do not promote effective compliance with regulations. They typically induce behaviour patterns by fishers that give way to the unsustainable "race to fish".

Very few Caribbean countries have billfish-specific regulations for recreational or commercial fisheries. In most countries, general fishery laws include some reference to sport/recreational fishing, but these tends to be limited to generic structural and formal measures to manage this activity. Some countries in Central America (e.g. Costa Rica, Guatemala and Nicaragua), the United States of America and the Commonwealth of The Bahamas do have legislation that prohibits the commercial sale and/or export of one or more billfish species, allowing the capture of billfish species only for sport/recreational purposes. This legislation is typically backed by guidelines seeking to minimize post release mortalities for these species in those nations' recreational fisheries.

The current use of Fish Aggregating Devices (FADs) is largely unregulated in the Caribbean.[7] At the sub-regional level, a management plan[8] for moored FAD fisheries in Eastern Caribbean countries is expected to be adopted and implemented soon by the CRFM. Effective implementation of that plan is hoped to counteract the current lack of legislative or policy recognition of FAD fisheries.

[7] Manual of Best Practices in Fisheries that uses Moored Fish Aggregating Devices (Available at - www.crfm.net/index.php?option=com_k2&view=item&id=501:http-crfm-int-images-fad-manual-vol-i-fad-design-construction-deployment-english-version-pdf&Itemid=244).

[8] 2015 Draft Sub-Regional Management Plan for FAD Fisheries in the Eastern Caribbean (Available at - www.crfm.net/images/2015_Draft_Sub-Regional_Management_Plan_for_FAD_Fisheries_in_the_EC_Final_Draft_revised_24_Sept_2015.pdf).

ANNEX 4. Billfish species and fisheries

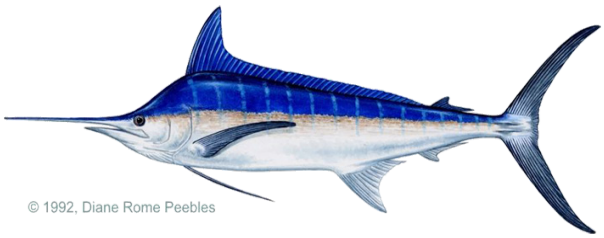
A4.1 BIOLOGICAL DESCRIPTIONS OF BILLFISH SPECIES CAPTURED IN THE CARIBBEAN

Billfish species (marlins, sailfish and spearfishes) are some of the fastest and largest marine apex predators. They are highly agile and migrate over great distances both within and beyond the WECAFC area. Their classification remains largely unsettled in terms of sub-order, genera and species. Their extended premaxillary bones which form their rostra, more commonly known as "bill", are generally believed to assist their hydrodynamics and feeding.[1]

Billfishes are characterized by having a bill, a lateral line retained throughout life, elongate pelvic fins, and a dorsal fin with a very long base that is sometimes sail-like and is depressible into a groove. Adults have a caudal peduncle with two keels on each side. Other characteristics are the presence of scales and jaws with small teeth in adults. The members of this family share several characteristics with the swordfish, including an elongated rostrum in adults, which is laterally flattened in swordfish. Because of their relatively long lifespan and large size, billfish species are at relatively high risk of over-exploitation, a vulnerability which is reflected by the high proportion of billfish species stocks considered as threatened when compared with most IUCN assessed marine bony fish.[2]

The Atlantic billfish species stocks included in this Caribbean Billfish Management and Conservation Plan consist of: blue marlin (*Makaira nigricans*), white marlin (*Kajikia albida*), sailfish (*Istiophorus platypterus*), longbill spearfish (*Tetrapturus pfluegeri*) and roundscale spearfish (*Tetrapturus georgii*).

Atlantic blue marlin (*Makaira nigricans*) – Atlantic blue marlin are found in tropical, subtropical, and temperate Atlantic waters, with a distribution ranging from 45°N to 35°S. Atlantic blue marlin movements in the northern Gulf of Mexico appear to be associated with an extension of the Caribbean Current, termed the Loop Current. Seasonal Atlantic blue marlin congregations do



[1] Habegger M.L., Dean M.N., Dunlop J.W.C., Mullins G., Stokes M., Huber D.R., Winters D. & Motta P.J. 2015. Feeding in billfishes: inferring the role of the rostrum from a biomechanical standpoint. *The Journal of Experimental Biology.* 218 pp 824-836 (Available at - http://jeb.biologists.org/content/jexbio/218/6/824.full.pdf).

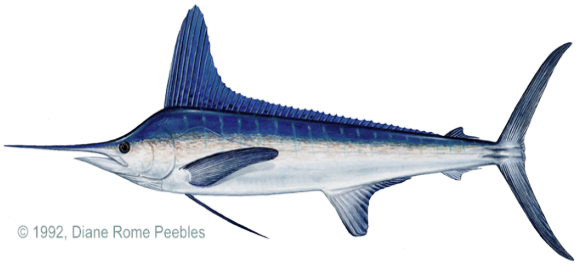
[2] Collette B.B, Carpenter K.E, Polidoro B.A, Juan-Jorda M.J., Boustany A., Die D.J., Elfes C., Fox W., Graves J., Harrison L.R., McManus R., Minte-Vera C.V., Nelson R., Restrepo V., Schratwieser J., Sun C.L., Amorim A., Brick Peres M., Canales C., Cardenas G., Chang W.C., de Oliveira Leite N., Jr., Harwell H., Lessa R., Fredou F.L., Oxenford H.A., Serra R., Shao K.T., Sumaila R., Wang S.P., Watson R. & Yáñez E. 2011. High Value and Long Life – Double Jeopardy for Tunas and Billfishes. *Science*. 333 pp 291- 292. (Available at - http://fishdb.sinica.edu.tw/pdf/896.pdf).

occur within the species extensive range, including in the southwest Atlantic (5°-30°S) from January to April and in the northwest Atlantic (10°-35°N) from June to October.

The Atlantic blue marlin is the largest billfish species captured in Caribbean waters, reaching a length of up to 450 cm (lower jaw fork length -LJFL) and a weight of 580 kg.[3] A maximum age of 27 years has been recorded for females and 18 years for males.[4] Atlantic blue marlin males are smaller than females and typically do not exceed 150 kg. At 189.9 cm (LJFL), 50 percent of the females are considered to have reached maturity according to macroscopic and microscopic assessments.[5] Atlantic blue marlin spawn in the northern Caribbean Sea during summer months, with evidence of this species spawning activity within the WECAFC area noted off the Dominican Republic (April-May),[6] The Commonwealth of The Bahamas (in July)[7] and Bermuda (in July).[8]

Atlantic blue marlin feed on a variety of fishes (at least 31 species) and cephalopods (at least 13 species), with skipjack tuna (*Katsuwonus pelamis*), dolphinfishes (*Coryphaena*) and other heavy, muscular, schooling, epipelagic fishes having the highest relative dietary importance.[9] Feeding intensity and sex ratio analyses suggest that male Atlantic blue marlin may forego feeding migrations while awaiting the arrival of females within spawning sites that hold a lower relative abundance of prey species.[10]

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 beyond this range and potential for hybridization with the similar (Indo-Pacific) striped marlin is being assessed at the time of



[3] ICCAT blue marlin species profile. (Available at - www.iccat.int/Documents/SCRS/Manual/CH2/2_1_6_BUM_ENG.pdf).

[4] Robins, C.R. and G.C. Ray. 1986. *A Field Guide to Atlantic Coast Fishes of North America. Houghton Mifflin: Boston*.

[5] Arocha, F. and Marcano L. 2006. Life history characteristics of Makaira nigricans, Tetrapturus albidus, and Istiophorus albicans from the eastern Caribbean Sea and adjacent waters. Pgs. 587-597. *In* J. Nielsen, J. Dodson, K. Friedland, T. Hamon, N. Hughes, J. Musick and E. Verspoor, Eds. *Proceedings of the Fourth World Fisheries Congress: Reconciling Fisheries with Conservation*. Amer. Fish. Soc. Symp. 49 Bethesda, Maryland. Gillnet.

[6] Prince E.D., Cowen R.K., Orbesen E.S., Luthy S.A., Llopiz J.K., Richardson D.E. & Serafy J.E. 2005. Movements and spawning of white marlin (*Tetrapturus albidus*) and blue marlin (*Makaira nigricans*) off Punta Cana, Dominican Republic. *Fisheries Bulletin*. 103 pp 659 – 669. (Available at - http://aquaticcommons.org/9022/1/prin.pdf).

[7] Serafy J.E, Cowen R.K., Paris C.B., Capo T.R. & Luthy S.A. 2003. Evidence of blue marlin, Makaira nigricans, spawning in the vicinity of Exuma Sound, Bahamas. *Marine and Freshwater Research*. 54 pp 299 – 306. (Available at - www.rsmas.miami.edu/users/cparis/archive/publication/MFR_2003.pdf).

[8] Luckhurst B.E., Prince E.D., Llopiz J.K., Snodgrass D. & Brothers E.B. 2006. Evidence of blue marlin (*Makaira nigricans*) spawning in Bermuda waters and elevated mercury levels in large specimens. *Bulletin of Marine Science*. 79 pp 691 – 704. (Available at - www.ingentaconnect.com/content/umrsmas/bullmar/2006/00000079/00000003/art00021).

[9] Vaske Jr. T., Travassos P.E., Pinheiro P.B., Hazin F.H.V, Tolotti M.T. & Barbosa M.T. 2011. Diet of the Blue Marlin (*Makaira nigricans*, Lacepède 1802) (*Perciformes: Istiophoridae*) of the southwestern equatorial Atlantic Ocean. *Braz. J. Aquat. Sci. Technol*., 15 (1) pp 65 – 70. (Available at - https://alsafi.ead.unesp.br/handle/11449/405?locale-attribute=en).

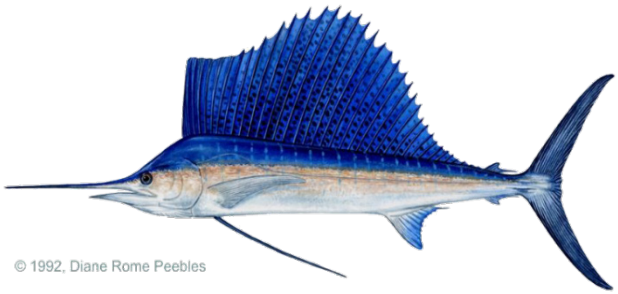
[10] Shimose T., Yokawa K., Saito H. & Tachihara K. 2012. Sexual difference in the migration pattern of blue marlin, Makaira nigricans, related to spawning and feeding activities in the western and northern Pacific Ocean. *Bulletin of Marine Science*. 88 pp 231-250. (Available at - www.ingentaconnect.com/content/umrsmas/bullmar/2012/00000088/00000002/art00004?crawler=true).

writing. This species most characteristic features are the rounded, rather than pointed, tips of the pectoral fins, first dorsal fin and first anal fin. The anal fin is more consistently rounded than in other billfish species, but is very similar to the roundscale spearfish. The maximum height of the largest lobe on the first dorsal fin is greater than the depth of the body. The colouration of the white marlin is a dorsal dark blue fading ventrally to a silver-white. Spots also are present on the first dorsal fin.[11]

This species reaches a maximum size of 280 cm total length and can exceed 82 kg. A maximum age of 13 years was calculated using anal spine structures,[12] although the longest time at liberty for a tagged fish is in excess of 15 years.[13] Like most billfish, females grow larger than males, which do not exceed 200 cm (LJFL). Half of female white marlin are sexually mature at a length of 160.46 cm (LJFL), according to 1 389 samples from the Western Central Atlantic region. Females indicating advanced stages of gonad maturity are seen northeast of Dominican Republic and north-northeast of the Puerto Rico trench form April to June,[14] with relative adult residency and larval presence noted there during April and May.[15]

For the white marlin from the western equatorial Atlantic, epipelagic fishes and cephalopods that have an average length of 10.1 cm, constitute its primary prey. These include pomfret (*Brama brama*), Atlantic bird squid (*Ornithoteuthis antillarum*) and[16] the flying gurnard (*Dactylopterus volitans*), which has the highest relative importance.[17]

Sailfish *(Istiophorus platypterus)* **–** Sailfish are easily recognizable through the presence of an extremely large and colourful dorsal fin, and are a popular target species in many recreational fisheries.



Sailfish typically have a body that 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 of the fish. Similar to other billfishes, but most evident due to the fin proportions of sailfish, the fins are all generally blackish blue when the fish is not excited or agitated, but can otherwise be electric blue in colour.

Sailfish reach a maximum length of 315 cm (LJFL) and 58 kg in weight. The estimated maximum age for sailfish is 12 years for females and 11 years for males.

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[11] Based on ICCAT species description available at - www.iccat.int/Documents/SCRS/Manual/CH2/2_1_7_WHM_ENG.pdf.

[12] Die, D. J. and Drew, K. 2008. An Atlantic-wide study of age and growth of Atlantic marlins. In *Proceedings from the Atlantic Billfish Research Program Symposium*, pp. 67-84. Ed. by D. DONALSON. Gulf States Marine Fisheries Commission, Galveston, Texas.

[13] Nakamura, I. 1985. *Billfishes of the World: an annotated and illustrated catalogue of marlins, sailfishes, spearfishes and swordfishes known to date*. FAO Species Catalogue, Vol. 5. . FAO fisheries synopsis. Rome, 125: 66pp.

[14] Arocha, F. and Bárrios, A. 2009. Sex ratios, spawning seasonality, sexual maturity, and fecundity of white marlin (Tetrapturus albidus) from the western central Atlantic. *Fisheries Research*, 95 pp 98-111.

[15] Prince E.D., Cowen R.K., Orbesen E.S., Luthy S.A., Llopiz J.K., Richardson D.E. & Serafy J.E. 2005. Movements and spawning of white marlin (*Tetrapturus albidus*) and blue marlin (*Makaira nigricans*) off Punta Cana, Dominican Republic. *Fisheries Bulletin*. 103 pp 659 – 669. (Available at - http://aquaticcommons.org/9022/1/prin.pdf).

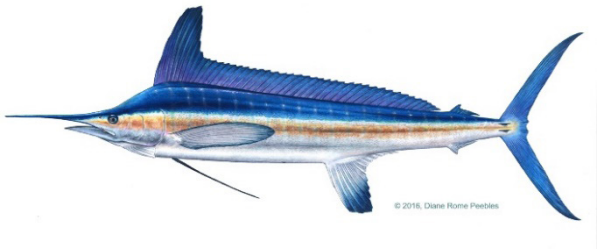
[16] Júnior, T. V., Vooren, C. M. and Lessa, R. P. 2004. Feeding habits of four species of Istiophoridae (*Pisces: Perciformes*) from northeastern Brazil. *Environmental Biology of Fishes*, 70: 293-304.

[17] Pinheiro, P., Júnior, T. V., Hazin, G. H. V., Travassos, P., Tolotti, M. T. and Barbosa, T. M. 2010. Diet of the white marlin (*Tetrapturus albidus*) from the southwestern equatorial Atlantic Ocean. *ICCAT Col. Vol. Sci. Pap*., 65: 1843-1850.

As with other billfish species, sailfish are batch spawners and although spawning areas in the Atlantic are poorly known, evidence of sailfish spawning has been noted off the Commonwealth of The Bahamas,[18] Florida, the Bolivarian Republic of Venezuela, Guyana, Suriname and off the southern coast of Brazil.[19]

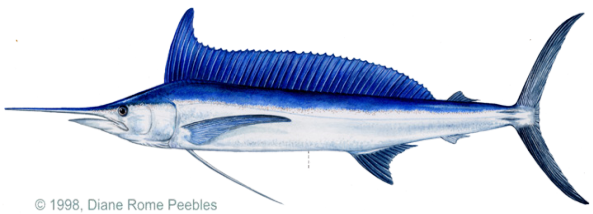
Their primary diet consists of various epipelagic schooling bony fishes (about 75% of diet), such as needlefish, mackerels, tunas, and jacks, as well as cephalopods including Atlantic bird squid (*Ornithoteuthis antillarum*) and neon flying squid (*Ommastrephes bartrami*).

Roundscale spearfish (*Tetrapturus georgii*) – Roundscale spearfish is reported to reach a maximum size of 160 cm (LJFL) – 21.5 kg for males and 150 cm (LJFL) – 23.5 kg for females. Common misidentifications do suggest that this species is more comparable in size to white marlin than these figures suggest. Feeding habits have not been reported in scientific literature, but this species is thought to feed on schooling fish and squids. This species has a very similar morphology to white marlin and has a broad distribution.



There is no information about age, growth and maturity or tagging data available specifically for roundscale spearfish. In the Western Atlantic, this species is believed to spawn from June to November, with August and September considered peak months. Spawning female concentrations have been recorded in the Venezuelan Basin of the Caribbean Sea.[20]

Longbill spearfish (*Tetrapturus pfluegeri*) – Longbill spearfish reach a maximum total length of 200 cm and a weight of 45 kg. This species is believed to be capable of exceeding seven years of age with a maximum time at liberty of a tagged specimen being five years.[21] Growth studies have not yet been conducted for this species, but there is an ongoing collaborative assessment of anal spines to improve growth data. There is also no information regarding the length or weight at which this species becomes sexually mature, although GSI values greater than 1.0 have been noted in females larger than 150 cm LJFL.



[18] Serafy J.E., Cowen R.K., Paris C.B., Capo T.R. & Luthy S.A. 2003. Evidence of blue marlin, *Makaira nigricans*, spawning in the vicinity of Exuma Sound, Bahamas. *Marine and Freshwater Research*. 54 pp 299 – 306. (Available at - www.rsmas.miami.edu/users/cparis/archive/publication/MFR_2003.pdf).

[19] Sailfish description based on ICCAT manual. (Available at - www.iccat.int/Documents/SCRS/Manual/CH2/2_1_8_1_SAI_ENG.pdf).

[20] Description based on ICCAT manual (Available at - www.iccat.int/Documents/SCRS/Manual/CH2/2_1_8_4_RSP_ENG.pdf).

[21] Oritz M., Prince E.D., Serafy J.E., Holts D.B., Davy K.B., Pepperell J.G., Lowry M.B. & Holdsworth J.C. 2003. Global overview of the major constituent-based billfish tagging programs and their results since 1954. *Marine and Freshwater Research*. 54 pp 489 – 507. (Available at - www.rsmas.miami.edu/assets/pdfs/mbf/fac/Serafy/23-Ortiz%20et%20al.%202003%20Global%20Billfish%20Tagging.pdf).

Spawning areas within the Atlantic seem to be located mostly in the western areas of both hemispheres. Macroscopic assessments of gonad development suggest that the Venezuelan Basin of the Caribbean Sea is a spawning site for this species, occurring in this region from April to August.[22] Primary prey species in the western central Atlantic include pomfret (*Brama brama*) and snake mackerel (*Gempylus serpens*).[23]

Misidentification issues hampering billfish catch reporting. Misidentification is a common problem for billfish species and causes merged datasets that ultimately invalidate species-specific stock assessments. As can be observed in Figure A4.1, white marlin and roundscale spearfish are very similar in morphology and size, so they have likely been misidentified for decades.[24] Such misidentifications can have irreversible management and conservation implications, if overfishing of either species occurs without recognition.[25]

FIGURE A4.1

A white marlin (top) and roundscale spearfish (bottom), illustrating the similarity between these species

A4.2 OVERVIEW OF RELEVANT FISHERIES AND THEIR CONTRIBUTIONS TO BILLFISH LANDINGS

Billfish stocks face a variety of anthropogenic threats, because of their broad distributions and linked highly migratory habits. This Caribbean Billfish Management and Conservation Plan recognizes that neither the Caribbean region, the WECAFC area, nor the Atlantic Ocean are isolated ecosystems. As a result, the interventions proposed by this Plan fall within the broader geographic sphere of options used to manage fisheries in the greater Atlantic Ocean, particularly those under the ICCAT mandate.

[22] Arocha, F., Barrios, A. and Lee, D. W. 2007. Spatial-temporal distribution, sex ratio at size and gonad index of white marlin (*Tetrapturus albidus*) and longbill spearfish (*Tetrapturus pfluegeri*) in the Western Central Atlantic during the period of 2002-2005. *Collective Volume of Scientific Papers. ICCAT*, 60: 1746-1756.

[23] Description based on ICCAT species description available at - www.iccat.int/Documents/SCRS/Manual/CH2/2_1_8_3_SPF_ENG.pdf.

[24] Beerkircher L., Arocha F., Barse A., Prince E., Restrepo V., Serafy J. & Shivji M. 2009. Effects of species misidentification on population assessment of overfished white marlin, *Tetrapturus albidus* and roundscale spearfish *T. georgii*. *Endangered Species Research* 9 pp 81 – 90. (Available at - http://cnso.nova.edu/ghri/forms/beerkircher_etal_esr_09.pdf).

[25] Bernard A.M., Shivji M.S., Prince E.D., Hazin F.H.V., Arocha F., Domingo A. & Feldheim K.A. 2014. Comparative population genetics and evolutionary history of two commonly misidentified billfishes of management and conservation concern. *BMC Genetics* 15 p 141. (Available at - https://bmcgenet.biomedcentral.com/articles/10.1186/s12863-014-0141-4).

The regional implementation of a holistic suite of management measures that sustainably and equitably allocate shared billfish resources must be harmonized across the various spatial scales relevant to billfish stock management in order to be genuinely effective. This Plan, therefore, supports and builds upon relevant management measures currently in place throughout the Atlantic, but its focus is unequivocally on achieving the overall sustainability of Atlantic billfish stock harvests in view of the disproportionate and increasing reliance of Caribbean SIDS on these harvests to support their economies and food security. This may encourage the Caribbean states to lead by example in the sphere of internationally/regionally coordinated billfish harvest management for sustainability.

Billfish management measures vary by species, as do the linked threats of unsustainable harvests that various fisheries impose upon each species while they migrate between areas of national jurisdictions in the Caribbean and beyond. However, an overall reduction in billfish mortality through fishing operations in the Caribbean could provide benefits throughout the broader WECAFC area and greater Atlantic Ocean. It would also promote the long term accrual of sustainable benefits these species provide within the region. Successes from the Caribbean region's implementation of this Plan may also be extended to other sites and/or regions in future.

A4.2.1 Global and Atlantic context of the various fisheries capturing billfish

The dramatic declines seen in Atlantic billfish stocks, have also been observed for billfish stocks in other oceans[26]. Fisheries targeting billfish show considerable differences in the temporal and spatial scales of operation, the levels of efficiency (according to fishing gears, technologies and methods used), harvest incentives (generally according to intended target species), overall harvest capacities, and the resultant ultimate impacts upon shared billfish resources. Some fisheries actively target billfish, while others discard them as bycatch, with no known literature available describing handling procedures for billfishes to be discarded aboard fishing vessels. Anecdotal information also suggests that meat from some billfish species is used as bait by some longline fisheries. Various scientific studies have however confirmed high post release survival rates for billfishes captured and released by both commercial and recreational fisheries.[27, 28, 29, 30] All these factors support the potential ecological effectiveness of catch and release mandates.

Industrial fishing fleet: Longline vessels

The primary overall source of billfish mortality to date results from pelagic longline fisheries targeting tunas and swordfish.[31] Historic trends of Atlantic billfish stock declines are, therefore, believed to largely reflect the influence of large industrial fishing fleets that capture billfish during their international pursuit of tunas and

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[26] *Report on the Twelfth Session of the IOTC Working Party on Billfish* (IOTC–2014–WPB12–R [E]), Yokohama, Japan (Available at - file:///C:/Users/bealey/Downloads/IOTC-2014-WPB12-RE_-_FINAL_DO_NOT_MODIFY_0.pdf).

[27] Kerstetter D.W., Luckhurst B.E., Prince E.D. and Graves J.E. 2003. Use of pop-up satellite archival tags to demonstrate survival of blue marlin (*Makaira nigricans*) released from pelagic longline gear. *Fish. Bull.* 101(4): 939-948. (Available at: www.researchgate.net/publication/249644832_Use_of_popup_satellite_archival_tags_to_demonstrate_survival_of_blue_marlin_released_from_pelagic_longline_gear).

[28] Kerstetter, D.W. and Graves J.E. 2006. Post-release survival of white marlin released from commercial pelagic longline gear in the western North Atlantic. *Fish. Bull. (*Available at: http://fishbull.noaa.gov/1043/kerstetter.pdf).

[29] Kerstetter D.W. and Graves J.E. 2007. *Post-release survival of sailfish (*Istiophorus platypterus*) captured on commercial pelagic longline gear in the southern Gulf of Mexico*. Col. Vol. Sci. Pap. ICCAT, 60(5): 1576-1581 (Available at: http://nsuworks.nova.edu/occ_facreports/58/).

[30] Ehrhardt N. and Fitchett M. 2015. *Baseline desk study on the status of billfish resources and the billfish fisheries in the Western Central Atlantic*. (Available at - www.fao.org/3/a-i6204e.pdf).

[31] Peel E., Nelson R. & Goodyear C.P. 2003. Managing Atlantic marlin as bycatch under ICCAT. The fork in the road: recovery or collapse. *Marine and Freshwater Research* 54 pp 575 – 584. (Available at - file:///C:/Users/bealey/Downloads/peel%20et.al.%202003%20management.pdf).

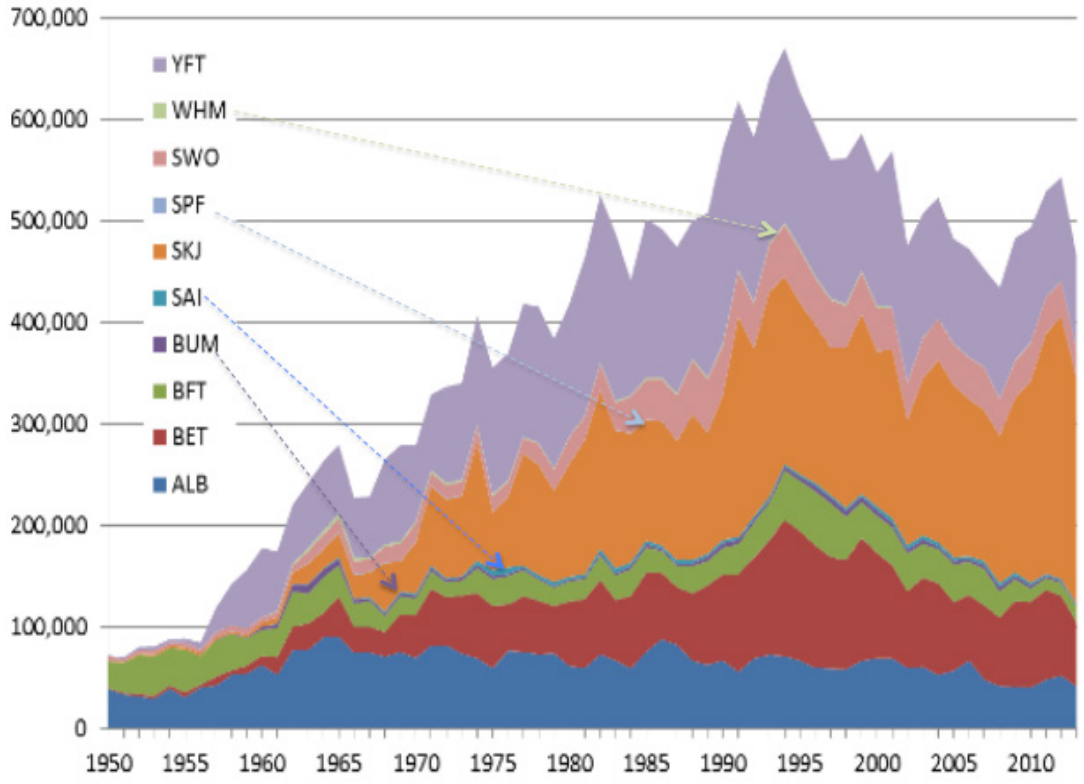
swordfish. ICCAT rules, regulations and recommendations apply particularly to industrial fishing fleets and, therefore, the industrial vessels from nations that are CPC's of ICCAT should regard billfishes as by-catch species, as they are obliged to do. Industrial fishing fleets most consistently and holistically report billfish landings to ICCAT and FAO, due to more stringent reporting requirements to obtain international fishing licenses and other factors, including a more comprehensive program of on-board observers. In the Atlantic Ocean, billfish species represent a mere 0.76 percent of the combined landings of tuna, swordfish and billfish species, reported by industrial fleets (Figure A4.2). Consequently, the capture of billfish does naturally occur at lower abundances than tunas, but underreporting of billfishes data is still considered most likely to be occurring for these and all other fleets.

While billfish stock assessments are carried out periodically by the ICCAT Standing Committee on Research and Statistics (SCRS), robust assessments are impeded by poor or absent biological and catch data. This is believed to result from billfish species being labelled as bycatch through ICCAT, and as a result not being considered a data priority for the industrial fleets.

For statistical reporting purposes, ICCAT has designated areas of the Atlantic Ocean related to billfishes. These demarcations provide a north-south Atlantic division for marlins and an east-west division for sailfish and spearfish (Figure A4.3). Importantly, while data reporting is delineated into reporting units of a North and a South Atlantic for marlin species (Atlantic blue marlin and white marlin/roundscale spearfish), they are each assessed and managed on an Atlantic-wide basis. On the other hand, sailfish are actually assessed as East and West Atlantic stocks.

FIGURE A4.2

Landings in tonnes of major tuna species, billfishes and swordfish from the ICCAT convention area. YFT= Yellowfin tuna; WHM= White marlin; SWO= Swordfish; SPF= Spearfish; SKJ= Skipjack; SAI= Sailfish; BUM= Blue marlin; BFT= Bluefin tuna; BET= Bigeye tuna; ALB= Albacore tuna



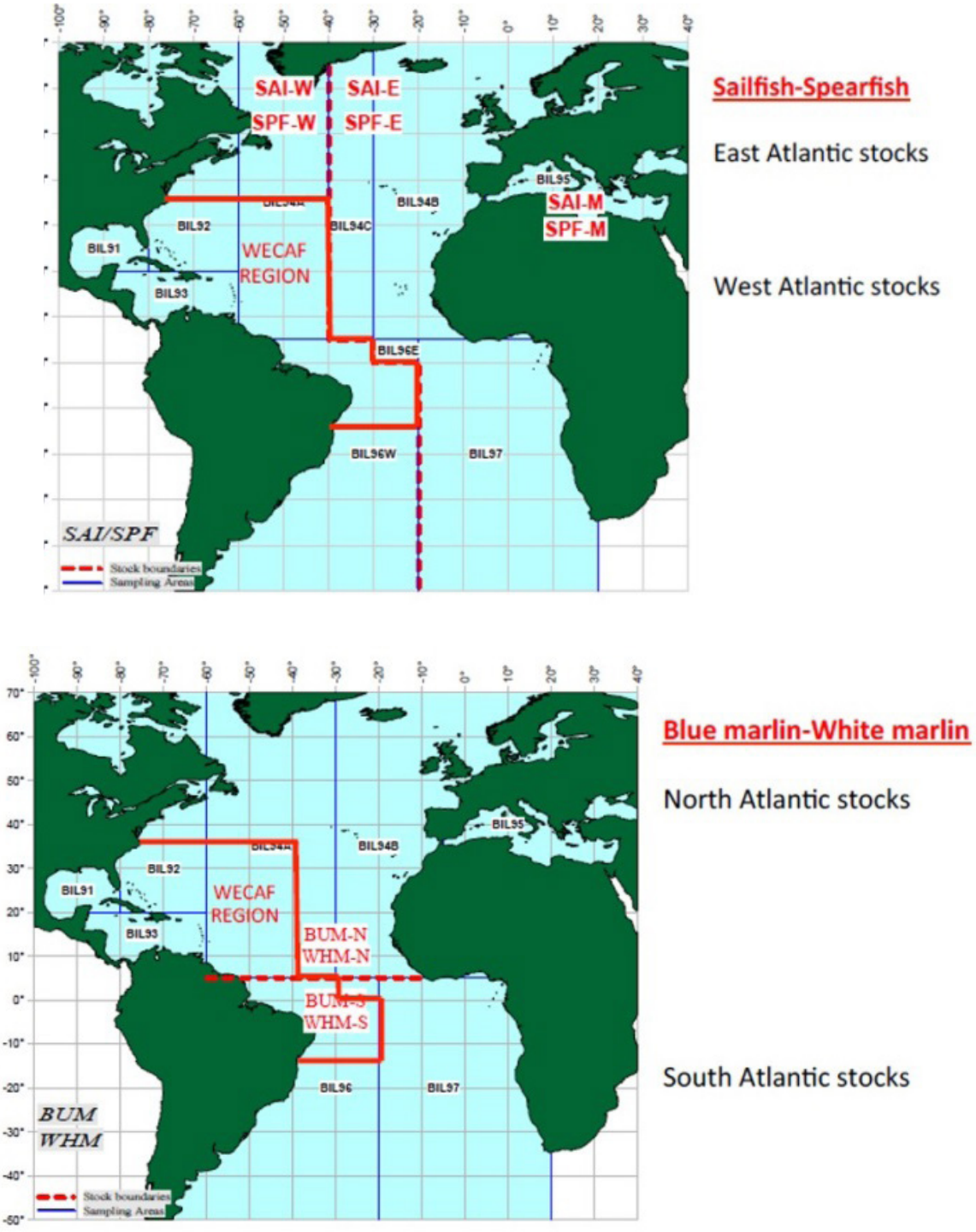
Source: NOAA. 1996. Annual proportion of billfish catch in the US pelagic longline catch in 1995. In: *Description of the pelagic longline fishery for HMS.* (Available at - www.nmfs.noaa.gov/sfa/FEIS%20FINAL%206-7.htm).

FIGURE A4.3

Boundaries defining billfish species reporting areas (blue lines); N-E or S-W stock reporting separations (dotted red line) within the ICCAT Convention Area (blue shading) and the WECAFC boundary region (solid red line).

BUM= Atlantic blue marlin; WHM= White marlin; SAI= Sailfish; SPF= Spearfish.

N= North; W= West; E= East; S=South; M= Mediterranean.

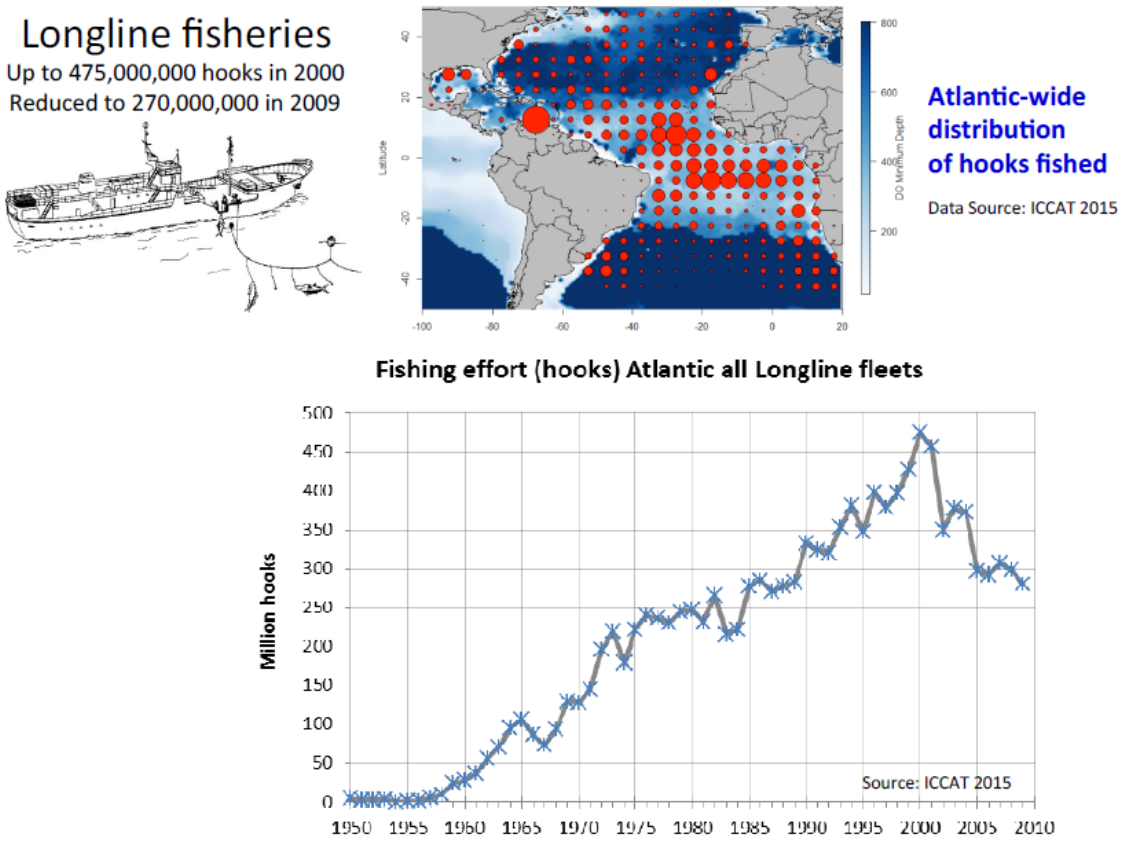


Source: ICCAT Geographical definitions: Version 2016 02 EN (Available at - www.iccat.int/Data/ICCAT_maps.pdf).

Industrial longline fisheries prominently operate in the central equatorial Atlantic, as well as in the eastern Caribbean Sea (Figure A4.4), followed by areas in the northern Gulf of Mexico, the southwest Atlantic off the southern Brazilian and Uruguayan coasts, and off equatorial Africa. These longline fishing efforts increased steadily from the 1950s until 2000, when some 475 million hooks were operated by all longline fleets operating in the Atlantic (Figure A4.4). There has been a noticeable decrease in the amount of longline effort in the Atlantic since the year 2000, due to the withdrawal of fishing effort by some of the most important longline fishing countries (e.g. Japan, South Korea and Taiwan, province of China). A threshold of 240 million hooks has more recently been suggested to avoid overfishing of billfishes in the Atlantic Ocean.[32] A section of the Caribbean Sea previously had the most hooks fished per unit area of the Atlantic (Figure A4.4). A reduced effort in the Caribbean by industrial longline fleets from outside the region may provide opportunities to increase their tuna harvest proportion for the commercial longline fleets registered in, and operating from the Caribbean. However, this Plan cautions that the management of such developments should prioritize long term sustainability of all harvested stocks.

FIGURE A4.4

Industrial tuna longline gear operational characteristics (upper left); Spatial distribution of overall longline fishing effort in the Atlantic (upper right); Historic trend of the longline fishing effort in the Atlantic in millions of hooks (lower panel)



Source: NOAA. 1996. Annual proportion of billfish catch in the US pelagic longline catch in 1995. In: *Description of the pelagic longline fishery for HMS*. (Available at - www.nmfs.noaa.gov/sfa/FEIS%20FINAL%206-7.htm).

[32] Sharma R., Pons M., Martin S., Kell L., Walter J. and Lauretta Schirripa M. 2017. Factors related to the decline and rebuilding of billfish stocks in the Atlantic and Indian oceans. *ICES Journal of Marine Science*. (Available at - www.researchgate.net/publication/317139389_Factors_related_to_the_decline_and_rebuilding_of_billfish_stocks_in_the_Atlantic_and_Indian_oceans).

Industrial fishing fleet: Purse Seine vessels

Tuna purse seine fisheries in the Atlantic operate intensively in areas off West Africa, particularly in the Gulf of Guinea (Figure A4.5).[33] The introduction of drifting FADs has transformed the tuna purse seine industry since the 1980s.[34] Purse seine nets may be as deep as 250-300 meters and capture tunas by employing various methods, like around drifting FADs, in association with other natural floating structures, around pods of marine mammals and/or on free-swimming schools. In the Atlantic, sailfish are by far the most abundant billfish captured in school sets, while Atlantic blue marlin dominate the billfish catch, in weight and numbers, for sets around FADs. Overall, the purse seine fishery has a lower billfish capture rate than longline fisheries (< ten percent of total billfish harvests currently reported), but many billfish captured by this fishery are retained and mortality is high.[35]

The billfish bycatch by the tuna purse seine fishery shows a strong relationship with the methods of fishing/setting employed. Sets associated with marine mammals (55 percent), tuna schools (29 percent) and log-sets (16 percent) have different billfish by-catch rates. The billfish captured by seine fisheries are also typically large individuals (88 percent > 150 cm).[36] This can have a disproportional effect on billfish fecundity. A temporary moratorium on FAD fishing for this fishery in the Atlantic reduced incidental marlin catches from 600-700 tonnes to 300 tonnes, but increased sailfish catches from 25 to 45 tonnes.[37] The sailfish catch increase likely reflects a change in this fleets activities with an increase in the number of purse seine sets made on free swimming tuna schools as a result of the moratorium on FADs. Sailfish target smaller prey and are therefore less strongly congregated around FADs than marlins, for which blue marlins are particularly vulnerable to congregation around FADs and linked harvest.

There are more than 100 large purse seine vessels operating in the Atlantic with a combined hold carrying capacity of some 100 000 tonnes. Purse seine fishing activities are mainly concentrated in the eastern Atlantic (Figure A4.5), but there are also a few purse seiners operating within the WECAFC area. The Bolivarian Republic of Venezuela has the largest purse seine fleet in the region. Seasonal closures covering spawning areas during peak billfish spawning periods have been suggested as a means of reducing billfish harvests by purse seine fisheries and of mitigating the negative impacts they may have upon other users of billfish stocks.[38] Such methods may also prove effective within the suite of recommendations for managing other billfish harvesting fisheries.

Small and Large-Scale Commercial Fleets

Billfishes are also captured by small-scale and large-scale commercial fisheries. These fisheries typically operate within areas of national jurisdiction, using a variety of

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[33] Ehrhardt, N and M. Fitchett. 2015. *Baseline desk study on the status of billfish resources and the billfish fisheries in the Western Central Atlantic*. (Available at - www.fao.org/3/a-i6204e.pdf).

[34] Note that drifting FADs (dFADs) are used by seine net fisheries, but discussions in this Plan not relating to seine net fisheries typically refer to moored FADs.

[35] Roman M, Hall M. 2013. *Bycatch and non-tuna catch in the tropical tuna purse seine fisheries of the world*. FAO Fisheries and Aquaculture Technical Paper 568. (Available at - www.fao.org/docrep/018/i2743e/i2743e.pdf).

[36] Vargas NE, Vaca-Rodrigues JG, López HR. 2013. S*patial-temporal analysis of the billfish incidental catch by the Venezuelan tuna purse-seine fishery in the eastern Pacific*. (Available at: www.researchgate.net/profile/Hector_Lopez16).

[37] Gaertner D, Menard F, Develter C. 2002. Bycatch of billfishes by the European tuna purse-seine fishery in the Atlantic Ocean. *Fisheries Bulletin*. 100 pp 683 – 689. (Available at - http://aquaticcommons.org/15242/1/04gaertn.pdf).

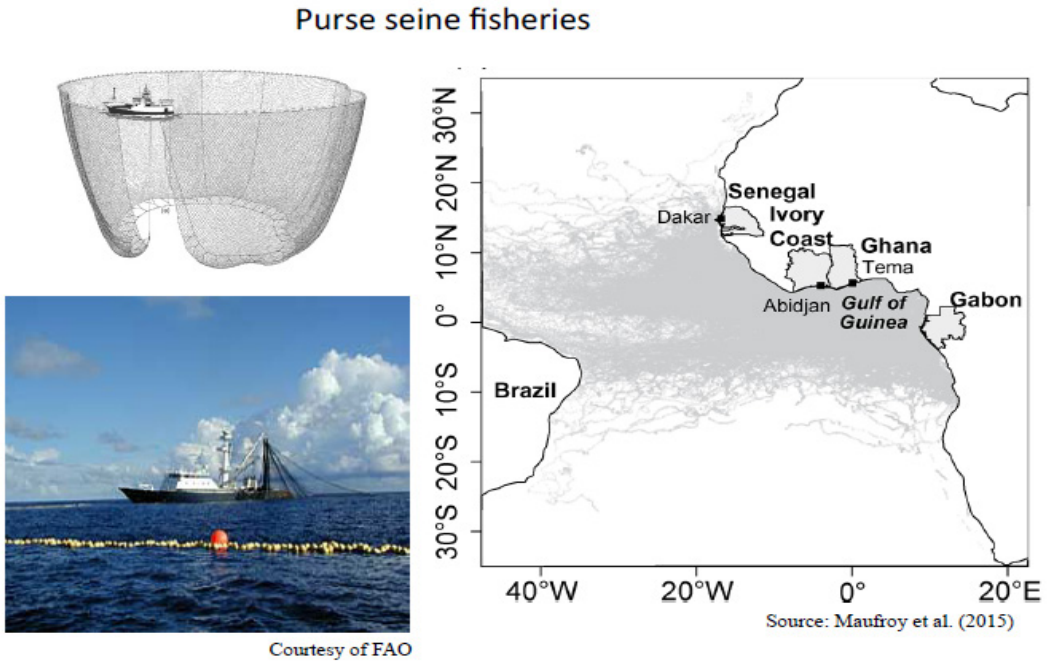
[38] Roman M, Hall M. 2013. *Bycatch and non-tuna catch in the tropical tuna purse seine fisheries of the world.* FAO Fisheries and Aquaculture Technical Paper 568. (Available at - www.fao.org/docrep/018/i2743e/i2743e.pdf).

gears (longlines, drop/buoy lines, rod & line, gillnets, hand-lines). These fleets tend to represent higher overall livelihood support to their fishers if compared to the often more efficient and lucrative industrial fleets. These local small-scale and larger-scale commercial fisheries often target multiple species for sale in domestic markets. However, the smaller commercial fishery sectors are increasingly orientating their activities towards export markets. Many of these fisheries consider billfishes as target species, rather than bycatch, and the fleets continue to rapidly increase their harvest capacities, especially when FADs are deployed. This worldwide phenomenon is particularly prevalent in developing nations and these fisheries do represent a rapidly evolving threat to the sustainability of billfish stocks. Their development does not typically recognize the greatly reduced stock status of billfish species that have already resulted from a long history (sometimes + 30 years) of unsustainable harvests by larger fleets. Various factors, including the number of boats, the geographical spread of landing sites for these smaller fishing vessels and their relative contributions to citizens' livelihoods, can make these fisheries very difficult to manage effectively.

This Plan recognizes that small- and large-scale commercial fisheries have the potential to incur significant cumulative billfish mortalities, particularly through targeted harvests. That way they do threaten to undermine any benefits that may accrue from improved management and effort reductions by the industrial fleets, mentioned above. Data on these local small- and large-scale commercial fleets' landings are typically sparse, which contributes to the lack of understanding of the impacts of these fleets on billfish stocks. The underreporting of harvests in these rapidly developing fishery sectors also largely explains the persistence of uncertainty within Atlantic billfish stock assessments. Recognizing these concerns, a precautionary approach to managing these fisheries should certainly be applied in the interim.

FIGURE A4.5

Atlantic purse seine fishery areas of operation in the tropical Atlantic as marked by drifting FAD tracks



Source: Maufroy A., Chassot E, Joo R. & Kaplan D.M. 2015. Large-scale examination of spatio-temporal patterns of Drifting Fish Aggregating Devices (dFADs) from tropical tuna fisheries of the Indian and Atlantic Oceans. *PLoS One 10*. (Available at - http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0128023)..

Recreational fisheries

Billfish are an iconic target species group for many recreational fisheries, supporting a linked tourism industry which continues to develop on a regional and global scale. A limited number of countries record recreational fishing landings data, including the comprehensive efforts by the United States of America fishery authorities to obtain data from the recreational fishers to guide the formulation of management measures.[39] However, despite the scarcity of data on recreational fishing, it is clear that billfish mortality caused by recreational fishery harvests is considerably less than that from commercial fisheries.[40]

Worldwide, recreational fisheries have been conservatively estimated to represent an annual value of some USD 190 billion; accrued from some 220 million participants.[41] This figure includes all recreational fisheries, not only those targeting billfishes, although billfishes are exceptionally highly valued by the participants in this fishery sector. The 2011 United States of America recreational fishery may represent an illustrative example of this sectors size and impact. Recreational anglers in the United States of America landed 204.9 million pounds of saltwater fish in 2011, spending USD 26.8 billion on fishing tackle, equipment and trip-related goods and services in the process. Including the multiplier effects, this spending generated USD 70.3 billion in economic output (sales), creating USD 32.5 billion in value added growth and supported 454 542 jobs with USD 20.5 billion in income. Comparatively, commercial fishery values for the same species created USD 10.6 billion in value added impacts and generated 304 611 jobs with USD 7.5 billion of income.[42] In the Caribbean nation of Puerto Rico, recreational billfish fishing trip expenditures have been estimated at USD 700 and USD 4 000 for resident and non-resident anglers, respectively. The annual economic impact of non-resident billfish anglers to the Puerto Rican economy was estimated at USD 44 million, with an annual consumer surplus of USD 11 135.[43] Such high values have again been seen in the Caribbean recreational fishery sector through the aforementioned Willingness To Pay study.

Recreational fisheries can represent much greater financial value per captured billfish[44] and contribute substantially more in terms of sustainable livelihood opportunities than commercial billfish fisheries. Many recreational fisheries advocate for and practice catch and release for billfishes, which minimizes their stock impact, effectively multiplies the value per harvested fish and supports high value charter fleets alongside linked tourist based activities. In accordance to local contexts, some recreational fisheries focus efforts on the capture and release of as many billfish as possible, while other niche recreational fisheries emphasize the capture of large "trophy sized" billfish.

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[39] NOAA Fisheries Atlantic Billfish Recreational Landings Update 1st Quarter 2017 Fishing Year. (Available at - www.nmfs.noaa.gov/sfa/hms/news/news_list/2017/5/2017_q1_billfish_landings_052517.html).

[40] Tunas, billfishes and other pelagic species in the eastern Pacific Ocean in 2015. Fishery Status Report 14. (Available at - www.iattc.org/PDFFiles2/FisheryStatusReports/FisheryStatusReport14.pdf).

[41] The hidden harvests: the global contribution of capture fisheries. 2010. Agriculture and Rural Development Department, Sustainable Development Network. World Bank, Washington DC, USA. World Fish Center.

[42] Southwick R. 2013. *Comparing NOAA's Recreational and Commercial Fishing Economic Data.* (Available at - http://asafishing.org/uploads/Comparing_Recreational_and_Commercial_Marine_Fishing_Data_Report_May_2013.pdf).

[43] Clark D.J., Ditton R.B. and Chaparro R.S. *The Economic Importance of Recreational Billfish Angling in Puerto Rico. Proceedings of the 48th Gulf and Caribbean Fisheries Institute Conference*. (Available at - http://aquaticcommons.org/12903/1/gcfi_46-3.pdf).

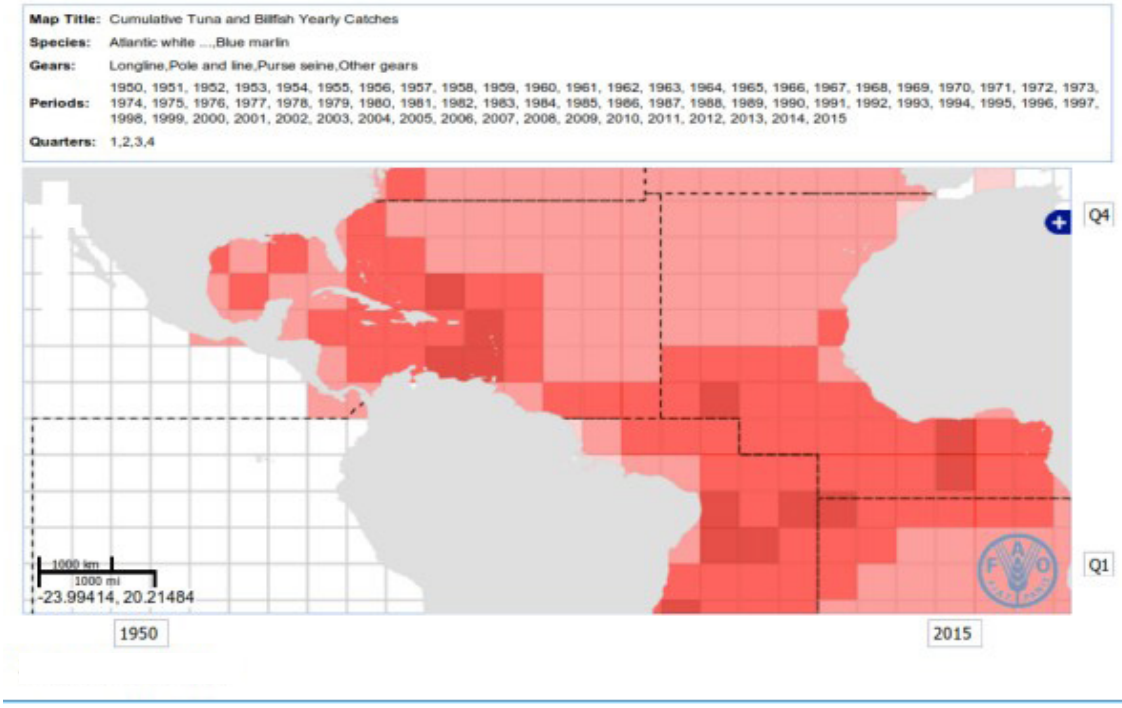
[44] Gentner B. 2016: *The value of billfish resources to both commercial and recreational sectors in the Caribbean*. (Available at - www.fao.org/3/a-i6178e.pdf).

Fishery catch rates as indicators of billfish abundance

Billfish catch rates and landings vary in time and place. This is a reflection of the different fishing efforts by a range of fisheries that take place in different locations, and is also subject to the actual reporting of billfish catches by the respective fisheries and nations. However, these data do prove useful in locating sites with high billfish abundance, which are often season specific and are well known by local fishers. Figures A4.6, A4.7 and A4.8 illustrate zones of relatively high catches for Atlantic billfishes within the WECAFC area and Caribbean Sea. Higher resolution analyses have also more specifically identified areas of high seasonal billfish abundance. Some billfish species also appear to spend most of their life within the Caribbean region. Catch rate analyses elucidate periods of high abundance (peak seasons) for these migratory stocks, which may then merit seasonal protections, particularly for spawning billfishes. Certain areas with high catch rates have already been confirmed to be spawning aggregations. This should warrant seasonal protection to promote the overall sustainability of these stocks on a regional scale, and potentially beyond if spawning events within the Caribbean region have broader recruitment implications for Atlantic billfish stocks (see Chapter 3).

FIGURE A4.6

Cumulative harvests of Atlantic blue and white marlin (darker cells indicate greater harvests)



Source: FAO. 2015. Atlas of Tuna and Billfish Catchers. Online query. (Available at www.fao.org/fishery/statistics/tuna-atlas/en).

FIGURE A4.7

Geographic distributions of total reported landings and relative contributions in the Atlantic from 2010–2014 for Atlantic blue marlin (left) and white marlin (right). Circle sizes represent the relative totals per square grid reported for each species. Dark lines denote the ICCAT data reporting separations for marlins (N-S but analyzed as Atlantic-wide stocks)

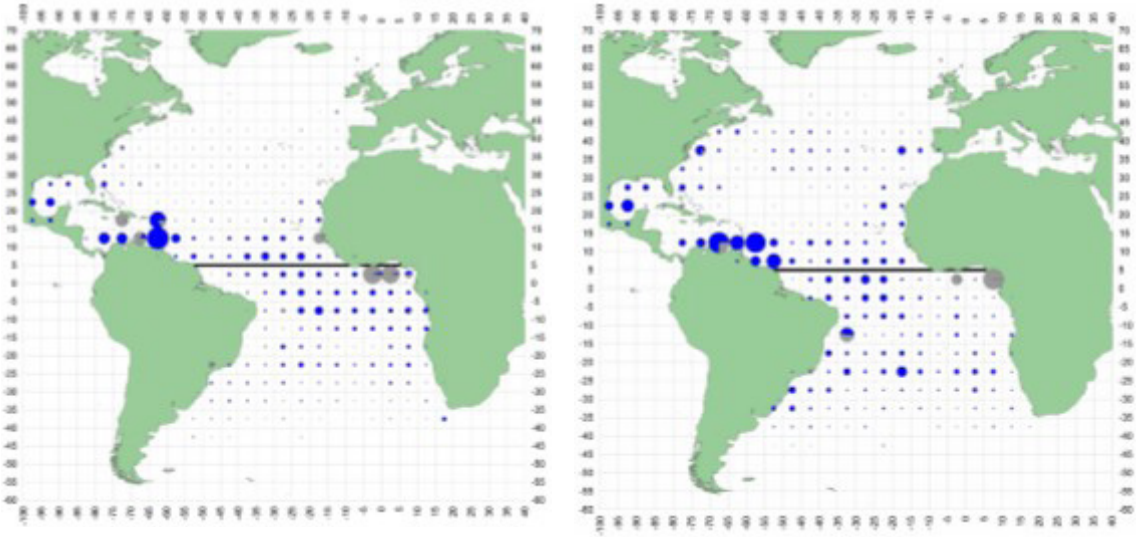
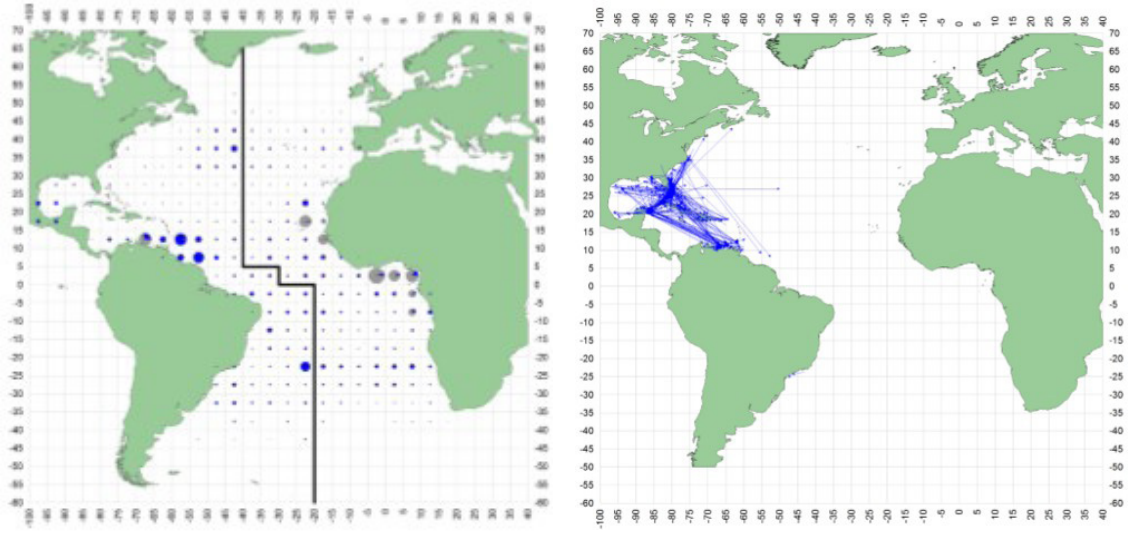


FIGURE A4.8

Geographic distributions of total reported landings and relative contributions in the Atlantic from 2010-2014 for sailfish (left); tagging data points and bearings (right). Circle sizes represent the relative totals per square grid reported for each species. Image on the right illustrates tag-recapture straight line distances and bearings obtained for sailfish in the region to date.
Dark lines denote the ICCAT data reporting separations sailfish (E-W and analyzed as such) in the Atlantic



A4.2.2 The Caribbean and WECAFC area context of fisheries and billfish catches

Caribbean fishery structures and catch compositions

Larger longline vessels were introduced to the Caribbean in 1988 by various governments aiming at increasing the harvest of large pelagic species in their national Economic Exclusive Zones (EEZs), and to improve livelihood and food security

support from these resources for their citizens. This pursuit of harvesting large pelagic species further offshore, as well as the development of FAD fisheries, has occurred in response to declining near-shore catches that resulted from the overexploitation of inshore and reef fisheries in the region.[45] In 1994, the Barbados pelagic fishing fleet comprised of approximately 275 commercial day-boats, 75 commercial ice-boats and 20 recreational fishing boats. As is the case in many other Caribbean nations, purpose-built modern longline vessels from Barbados now target billfish, swordfish and yellowfin tuna. Billfish catch rates fluctuate throughout the year (Figure A4.9), while the fishing methods and gears employed also significantly influence these catch rates. From 1987 to 1992, the total annual billfish catches in Barbados represented 1.3 percent of landings by surface hand-liners, 15 percent by deep set overnight longlines and as much as 46 percent by shallow set daylight hour's longlines.[46] Over a similar period, on the Caribbean Island of Grenada, as much as 32 percent and 17.5 percent of the catch consisted of sailfish and marlin, respectively. Also here, seasonal catch variations were again evident. For both nations, an apparent increase in billfish CPUE was suggested to reflect increasing vessel fishing powers (Figure A4.9).[47]

Large industrial fishing vessels also harvest pelagic species in the Caribbean region, with some belonging to Caribbean nations.[48] Some are foreign flagged, while others may have foreign crews and owners, but are flagged/registered to Caribbean nations. Some Caribbean nations are alleged to be receiving short term benefits by ultimately facilitating a "flag of convenience" for these fleets. This situation could be detrimental to the sustainability of many shared pelagic stocks in the region.

The foreign owned industrial fishing vessels are typically larger than those within the region's national fleets and have greater harvest capacities per vessel. Limited data on their activities in the region suggest a need to better monitor and address potential IUU fishing by these fleets. Various fisheries stakeholders have raised concerns at meetings of the CBMC and Working Group on Recreational Fisheries about unreported catches of billfishes and large quantities of small pelagic fishes, as they appear to affect the supply of these affordable species in the local markets.[49] These smaller pelagic species are used as live baits on longline hooks to target tuna, billfish and kingfish/wahoo. Flying fish, for which there is a Sub Regional Management Plan in the Eastern Caribbean,[50] are of primary concern in this regard. The possibility that landed billfishes are cut up in pieces for longline bait when smaller live-bait species are unavailable, has also been raised as a contentious issue by multiple stakeholders.

Tuna and billfish are also targeted by gillnet fleets in the Atlantic, with The Bolivarian Republic of Venezuela providing the most consistent data on the catches of this fishery within the Caribbean region. Venezuelan gillnetters operate within their EEZ in the eastern Caribbean Sea and also venture further from shore to areas off Guyana and

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[45] CRFM. 2015. CRFM Working Groups: Terms of Reference. CRFM Special Publication No. 3. 41p.

[46] Oxenford HA. 1994. *Recent billfish catch data for Barbados* (1987-1992). SCRS/1992/071 Col. Vol Sci Pap. ICCAT, 41 pp 244 – 252. Available at - www.iccat.int/Documents/CVSP/CV041_1994/CV041000244.pdf.

[47] Mahon R., Rennie J., Ryan R. & Singh-Renton S. 1994. *Billfish catch and effort data from Barbados, Grenada, St. Lucia and St. Vincent and the Grenadines*. SCRS/1992/068. Col. Vol Sci Pap. ICCAT. 41 pp 431 – 441. Available at - www.iccat.int/Documents/CVSP/CV041_1994/CV041000431.pdf.

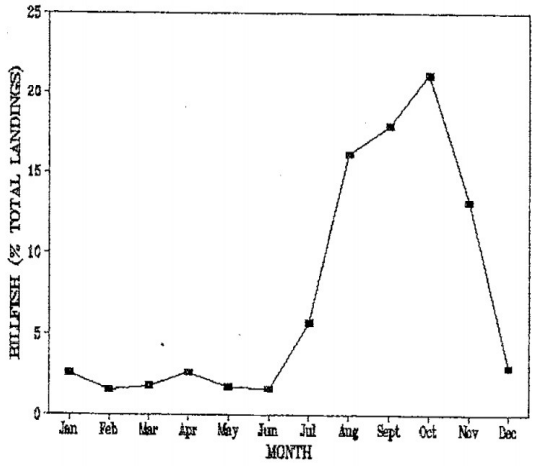
[48] Arocha *et al.* 2015. *Billfish catch in the Venezuelan artisanal off-shore pelagic longline fishery: past and present (1986 – 2013)*. SCRS/214/043 Col.Vol.Sci.Pap. ICCAT 71 2203 – 2216. Available at - www.iccat.int/Documents/CVSP/CV071_2015/n_5/CV071052203.pdf.

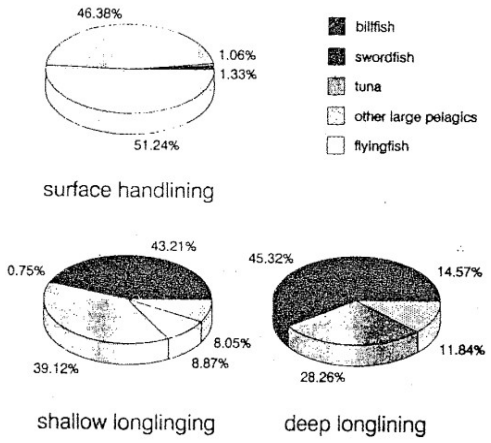
[49] CRFM. 2012. *Study on the formulation of a master plan on the sustainable use of fisheries resources for coastal community development in the Caribbean.* JICA report 12-022. Available at - http://open_jicareport.jica.go.jp/pdf/12058525.pdf.

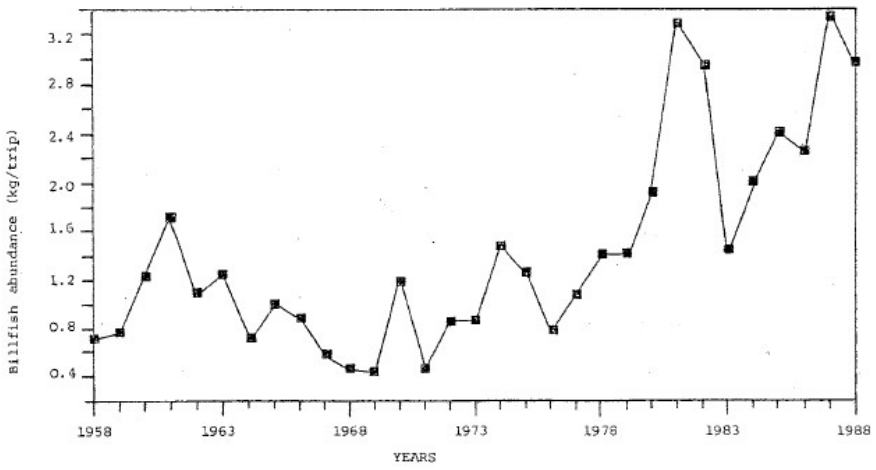
[50] CRFM, 2014. *Sub-Regional Fisheries Management Plan for Flyingfish in the Eastern Caribbean.* CRFM Special Publication No. 2. 42 p. + annexes. (Available at - www.fao.org/fi/static-media/MeetingDocuments/WECAFC16/Ref19e.pdf).

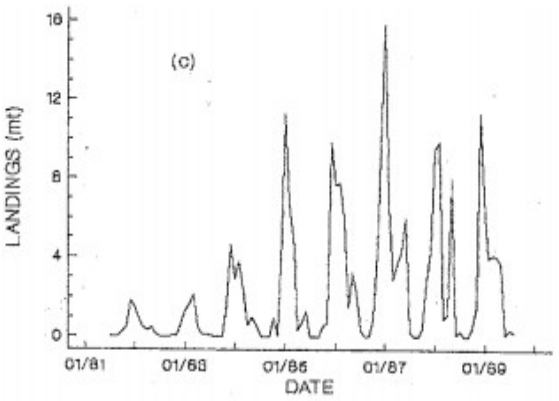
FIGURE A4.9

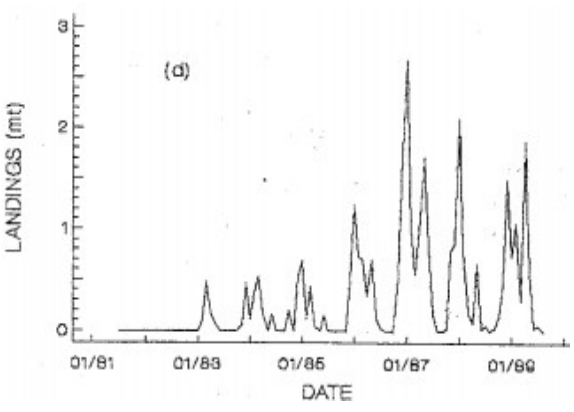
Seasonal contributions of billfishes to the total fish landings in Barbados; as 5-year monthly mean percentages of total landings (top left); Barbados fishery catch composition by fishing method (top right).* Annual catch per trip of billfishes at the main landing site (Oistins) in Barbados (middle). Total landings of sailfish (bottom left) and marlin (bottom right) at the Gouyave landing site in Grenada**











* Oxenford H.A. 1994. Recent billfish catch data for Barbados (1987-1992). *SCRS/1992/071 Col.Vol.Sci.Pap. ICCAT, 41* pp 244 – 252. Available at - www.iccat.int/Documents/CVSP/CV041_1994/CV041000244.pdf

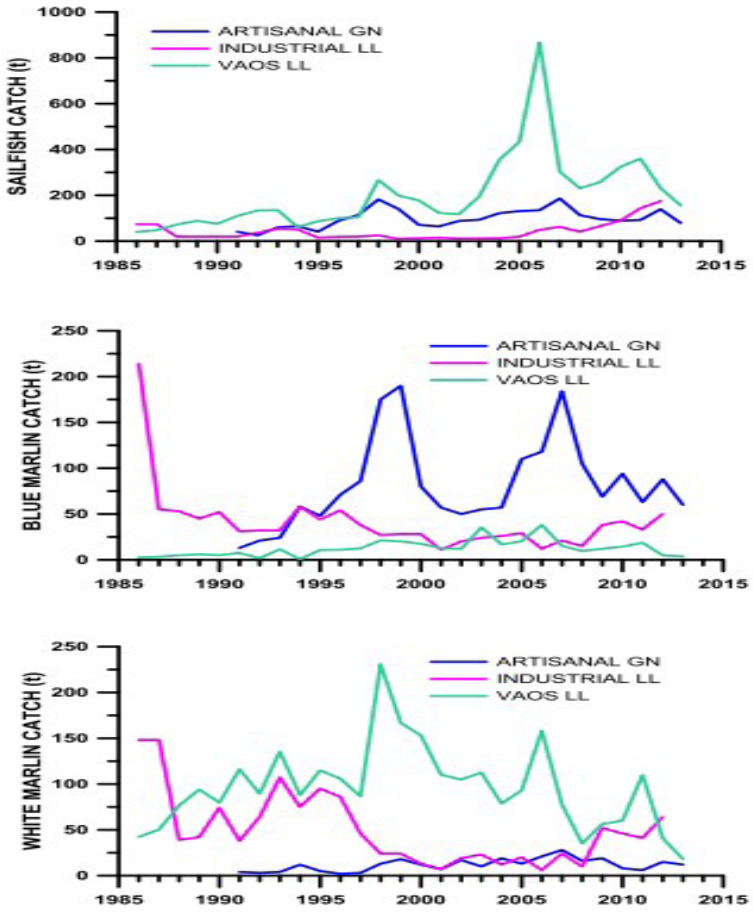
** Mahon R., Rennie J., Ryan R. & Singh-Renton S. 1994. Billfish catch and effort data from Barbados, Grenada, St. Lucia and St. Vincent and the Grenadines. *SCRS/1992/068. Col. Vol Sci Pap. ICCAT. 41* pp 431 – 441. Available at - www.iccat.int/Documents/CVSP/CV041_1994/CV041000431.pdf

Suriname. Figure A4.10 illustrates that these Venezuelan gillnetters capture Atlantic blue marlin in relative greater proportions than the Venezuelan longline fleet.

Fish Aggregating Devices (FADs) continue to increase in popularity and prevalence in the Caribbean, with small-scale commercial fishers typically obtaining the bulk of the benefits from these structures. The use of FADs impacts on the species and size composition of the associated harvests. Overall, Atlantic blue marlin are the most commonly captured billfish around FADs (Figure A4.11). At the time of writing, CRFM is finalizing a Sub-Regional Management Plan for FAD Fisheries,[51] seeking to promote sustainability within FAD fisheries of the region. That document is expected to be complimentary in addressing the sustainability and fisheries related data collection concerns noted throughout this Plan.

FIGURE A4.10

Estimated specific billfish species catch (MT) by Venezuelan fleets for the period of 1986-2013; Sailfish (top graph), Atlantic blue marlin (middle graph), and white marlin (bottom graph). Artisanal gillnet (GN), Industrial longline (LL), and Artisanal off-shore pelagic longline fishery (VAOS LL) data were obtained from the ICCAT task 1 data* and presented to the ICCAT SCRS**



* Arocha *et al.* 2010. ICCAT Col.Vol.Sci.Pap., 65(5):1633 – Available at www.iccat.int/Documents/CVSP/CV071_2015/n_5/CV071052203.pdf

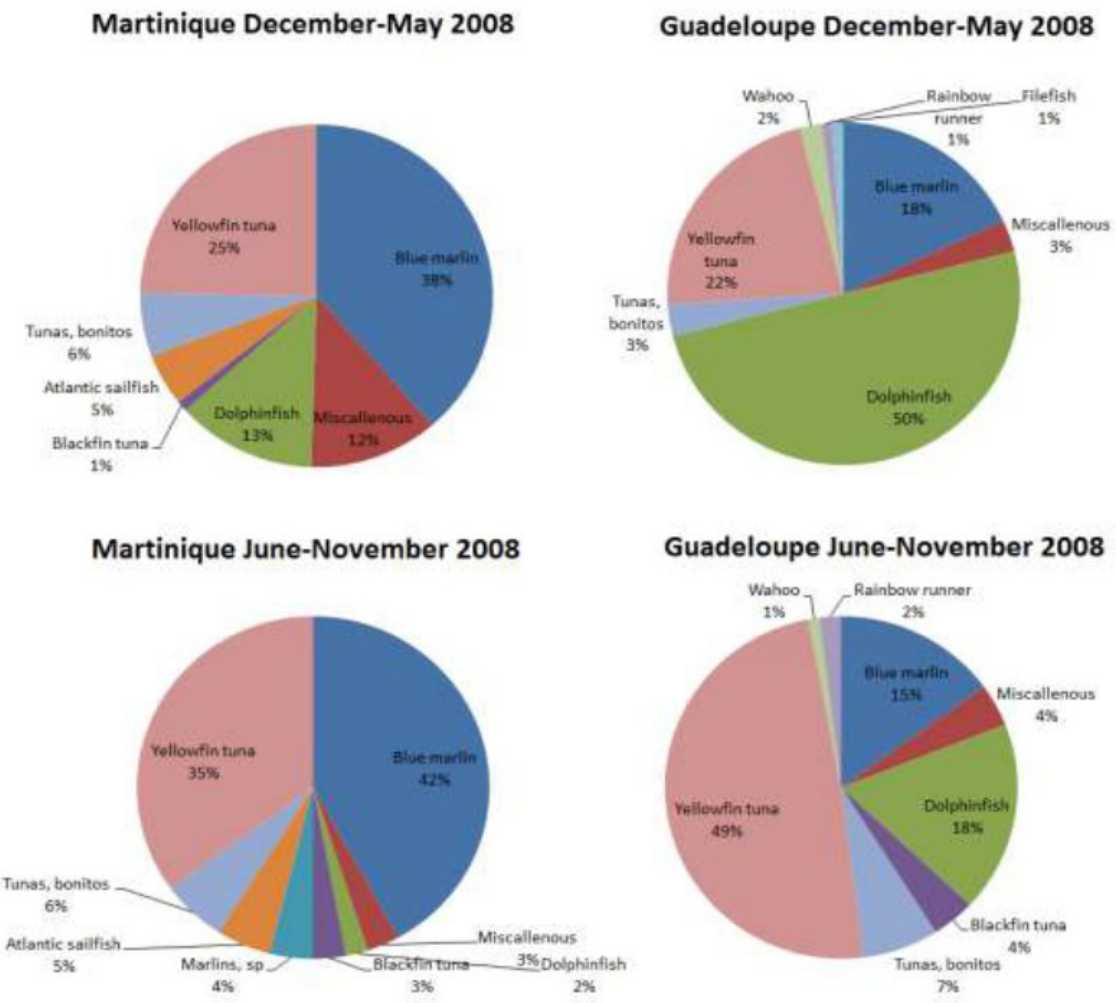
** Arocha *et al.* 2015. Billfish catch in the Venezuelan artisanal off-shore pelagic longline fishery: past and present (1986 – 2013). *SCRS/214/043 Col.Vol.Sci. Pap. ICCAT 71* 2203 – 2216. Available at - www.iccat.int/Documents/CVSP/CV071_2015/n_5/CV071052203.pdf

[51] CRFM. 2015. *Draft Sub-Regional Management Plan for FAD Fisheries in the Eastern Caribbean* (Available at - www.crfm.net/images/2015_Draft_Sub-Regional_Management_Plan_for_FAD_Fisheries_in_the_EC_Final_Draft_revised_24_Sept_2015.pdf).

FIGURE A4.11

The top five species caught around FADs at 5 locations in the Lesser Antilles over at least one year. * Indicates species which were present in the top five at all locations (top). Proportion of main target species caught on moored FADs in Guadeloupe and Martinique during December-May and June-November (pie charts)

Top species	Grenada	Saint Vincent and the Grenadines	Martinique	Dominica	Guadeloupe
1	Blackfin	Blue marlin	Blue marlin	Yellowfin*	Yellowfin*
2	Yellowfin*	Yellowfin*	Yellowfin*	Dolphinfish*	Dolphinfish*
3	Cavalli	Blackfin	Little tunny	Skipjack	Little tunny
4	Dolphinfish*	Dolphinfish*	Blackfin	Blackfin	Blue marlin
5	Rainbow runner	Skipjack	Dolphinfish*	Sharks	Rainbow runner



Source: CRFM. 2015. Draft sub-regional management plan for FAD fisheries in the Caribbean (Stakeholder Working Document). *CRFM Technical and Advisory Document* Number 2015/05. Available at - www.crfm.net/images/2015_Draft_Sub-Regional_Management_Plan_for_FAD_Fisheries_in_the_EC_Final_Draft_revised_24_Sept_2015.pdf

The use of live baits around FADs by Caribbean fishers increases their capacity to capture both marlin and tuna (Figure A4.12). These baits are often available for capture around the FADs. There are various implications to be considered with the use of live baits around FADs (Annex 2), as it promotes the targeted capture of already overfished species. Off the Caribbean islands of Dominica and Martinique, during their peak

season, blue marlins are more frequently caught on live baits around FADs than any other species. Dolphinfish, the most popular species among fishers, appears to be the most captured using large lures (Figures A4.11 & A4.12).

Recreational fisheries targeting billfish initially developed in the United States of America during the early 1930s and have since expanded throughout many nations of the Caribbean and WECAFC area. In many countries, this has evolved and created high value recreational fisheries segments. The economic contributions of recreational fisheries have been assessed in a number of Caribbean nations (Table A4.1), with recreational fisheries providing higher values and supporting greater employment levels than commercial fisheries[87] in most nations. This demonstrates a strong value proposition potential for billfish stock conservation.[52]

Recreational fishery contributions are most visible during sports fishery tournaments,

TABLE A4.1

Comparative evaluation of recreational and commercial fishery in the Commonwealth of The Bahamas for large pelagic species (top),* and other selected Caribbean nations (bottom)

Country	Commercial		Recreational Value	
	Revenue	Economic value	Expenditures	Economic value
Trinidad and Tobago	$805 000	$180 642	$479 285	$980 131
UK.Bermuda	$21 000	$4 712	$689 834	$5 864 621
Barbados	$378 000	$84 823	$2 822 071	$9 457 762
Totals	**$1 204 000**	**$270 178**	**$3 991 189**	**$16 302 514**

Activity	Recreational fishing	Commercial fishing
Number of jobs	18 875	9 300
GDP impact (USD)	US$411 241 547.06	US$80 114
Output sales	US$659 040 940.80	US$69 727 402.53[37]

Source: Description based on ICCAT manual (Available at - www.iccat.int/Documents/SCRS/Manual/CH2/2_1_8_4_RSP_ENG.pdf)

when substantial registration/entry fees and awards generate incentives among local and often international clientele for catching billfishes. In 2015, more than 215 billfish tournaments took place in several localities throughout the WECAFC region (Figure 18). Many of these are annually recurring tournaments taking place in the United States of America, Dominican Republic, Grenada, Puerto Rico, British, US Virgin Islands, Bermuda and various other small island states. Examples of states that recognize the valuable contributions of local recreational fishing fleets and, therefore, protect these marine resources, include Puerto Rico and the United States of America. Billfish are being protected by the federal fishery management plan of Puerto Rico, which, among other things, reserves four billfish species for recreational use only and prohibits the sale of these species.[53] In the United States of America a ban on the commercial harvest and sale of Atlantic billfish is in place,[54] while Guatemala also prohibits the sale of sailfish products. ICCAT also suggests billfish species minimum size limits for recreational fleets

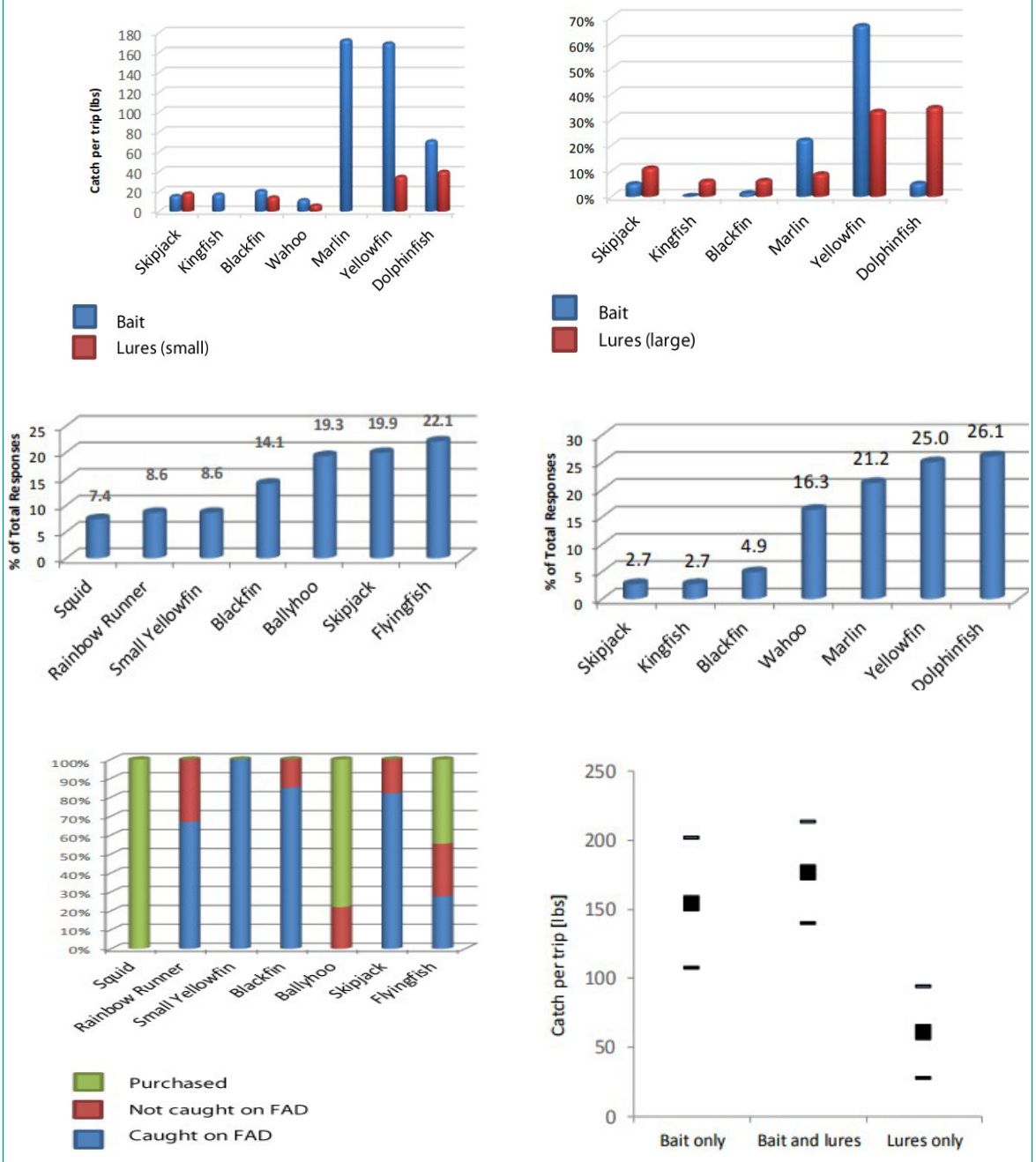
[52] Gentner B. 2016: *The value of billfish resources to both commercial and recreational sectors in the Caribbean*. Available at - www.fao.org/3/a-i6178e.pdf.

[53] Clarke D.J., Ditton R.B. and Chaparro R.S. 1994. *The Economic Importance of Recreational Billfish Angling in Puerto Rico. Proceedings of the Forty Sixth Annual Gulf and Caribbean Fisheries Institute*. 47-59pp.

[54] Clarke D.J., Ditton R.B. and Chaparro R.S.. 1994. *The Economic Importance of Recreational Billfish Angling in Puerto Rico. Proceedings of the Forty Sixth Annual Gulf and Caribbean Fisheries Institute.* 47-59pp.

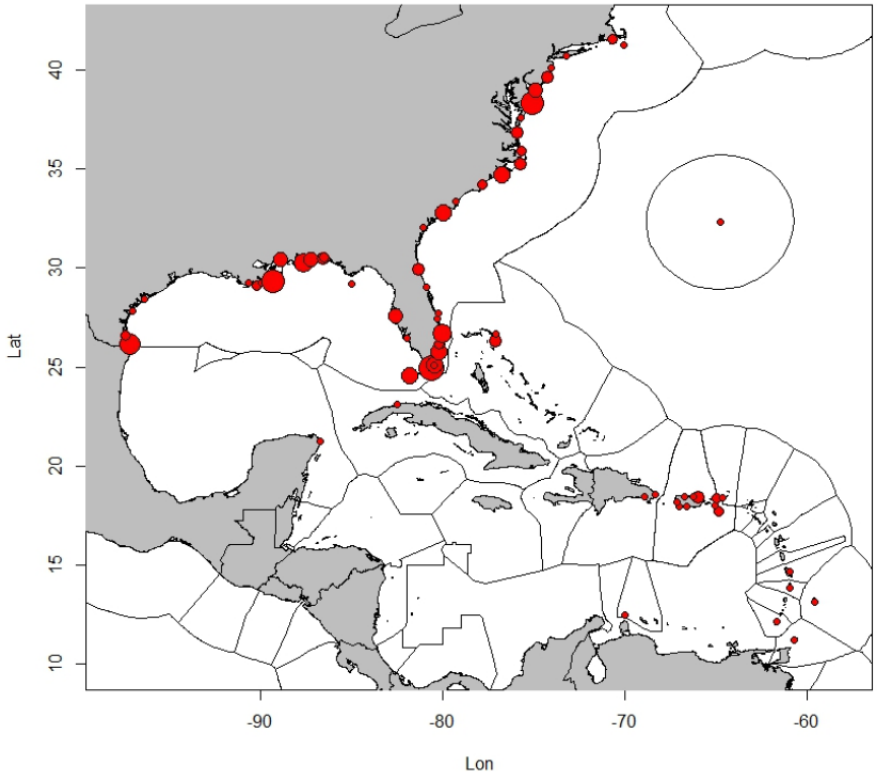
FIGURE A4.12

Dominican FAD fishers' catches per trip using bait, compared to small lures (top left) and large lures (top right); The preferred baitfish (middle left), and target species (middle right); How bait species are obtained (bottom left): Green = purchased; Red = not caught on FAD; Blue = caught on FAD; Overall average catch weights per trip (bottom right)



Source: Sidman *et al.* 2015. *Toward a Sustainable Caribbean FAD Fishery – Introducing lures to incentivize co-management efforts.* Available at - www.flseagrant.org/wp-content/uploads/TP_214_web.pdf

FIGURE A4.13
Distribution and relative abundance (circle size) of recreational billfish tournaments within the WECAFC region



Source: NOAA. 1996. Annual proportion of billfish catch in the US pelagic longline catch in 1995. In: *Description of the pelagic longline fishery for HMS*. (Available at - www.nmfs.noaa.gov/sfa/FEIS%20FINAL%206-7.htm).

and the prohibition of the sale of recreationally caught billfishes.[55] In addition, the 2012 United States of America Billfish Conservation Act (BCA) outlawed the importation and sale of billfish and billfish products in the continental United States of America, and was amended in 2018 to avoid "grey imports" from still entering mainland markets as was still occurring through a prior trade exception for the State of Hawaii.

Most recreational tournaments in the region are now catch-and-release in nature for billfish, with points allocated according to the number of billfish caught and successfully released. The catch and release nature of recreational billfish fishing encourages a non-extractive ethos within this fishery segment that also frequently promotes and advocates for the conservation of billfish species that are hugely valued by this fishery. In 1988, recreational fishers in the United States of America released 70 percent of captured billfishes.[56] This percentage is higher now and the practice has rapidly expanded among sport fisheries globally. Satellite tagging research has also documented very high post release survival rates for recreationally caught and released billfish.

[55] ICCAT. 2015. Recommendation to further strengthen the plan to rebuild blue marlin and white marlin stocks. Recommendation 15-05 - Available at: www.iccat.int/Documents/Recs/compendiopdf-e/2015-05-e.pdf.

[56] NOAA. 1988. *Atlantic billfishes (white marlin, blue marlin, sailfish and spearfish), fisheries management plan (FMP) and regulatory impact review: Environmental statement*. Northwest University. Available at - https://books.google.com/books/about/Atlantic_Billfishes_white_Marlin_Blue_Ma.html?id=Bjo3AQAAMAAJ ; NOAA. 2017. Atlantic HMS Fishery Management Plan Archive. (Available at - www.nmfs.noaa.gov/sfa/hms/documents/fmp/fmp_archive/fmp_archive.html).

A4.3 THE STATUS OF BILLFISH STOCKS COVERED UNDER THIS PLAN

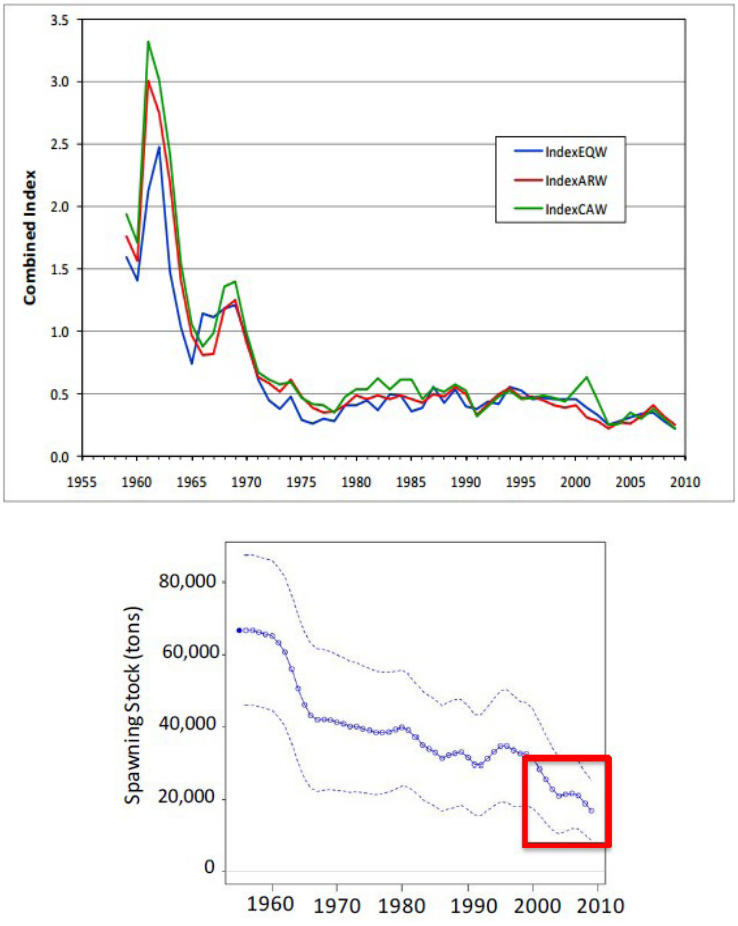
Billfishes are among the most overexploited species under international management jurisdiction in the Atlantic Ocean.[57] No regional management measures specific to billfish are currently in force within the Caribbean or broader WECAFC area. Billfish assessments are periodically conducted by ICCAT with the aim to guide its Atlantic-wide fishery management decisions. Although assessments of the ICCAT SCRS are constrained by data limitations, results from the latest assessments are presented here as the best available information on the situation of billfish stocks within the Caribbean.

Atlantic Blue Marlin

The 2011 SCRS Atlantic blue marlin stock assessment indicated that the stock was below the biomass which could produce maximum sustainable yield (B_{MSY} – i.e. the stock is overfished). The assessment also showed that fishing mortality was above the level at which the stock could produce maximum sustainable yield (F_{MSY} - i.e. overfishing is occurring) (Figure A4.14). Following results of this assessment, a total

FIGURE A4.14

Atlantic blue marlin estimated standardized combined CPUE indices using equal weighting for all CPUE series (EQW), weighting the CPUE series by area (ARW) and by catch (CAW) (top). Spawning stock biomass reductions of 70% recorded for Atlantic blue marlin (bottom)



Source: ICCAT 2017. *Report of the Standing Committee on Research and Statistics. Madrid, Spain, 2-6 October 2017.* (Available at: www.iccat.int/Documents/Meetings/Docs/2017_SCRS_REP_ENG.pdf).

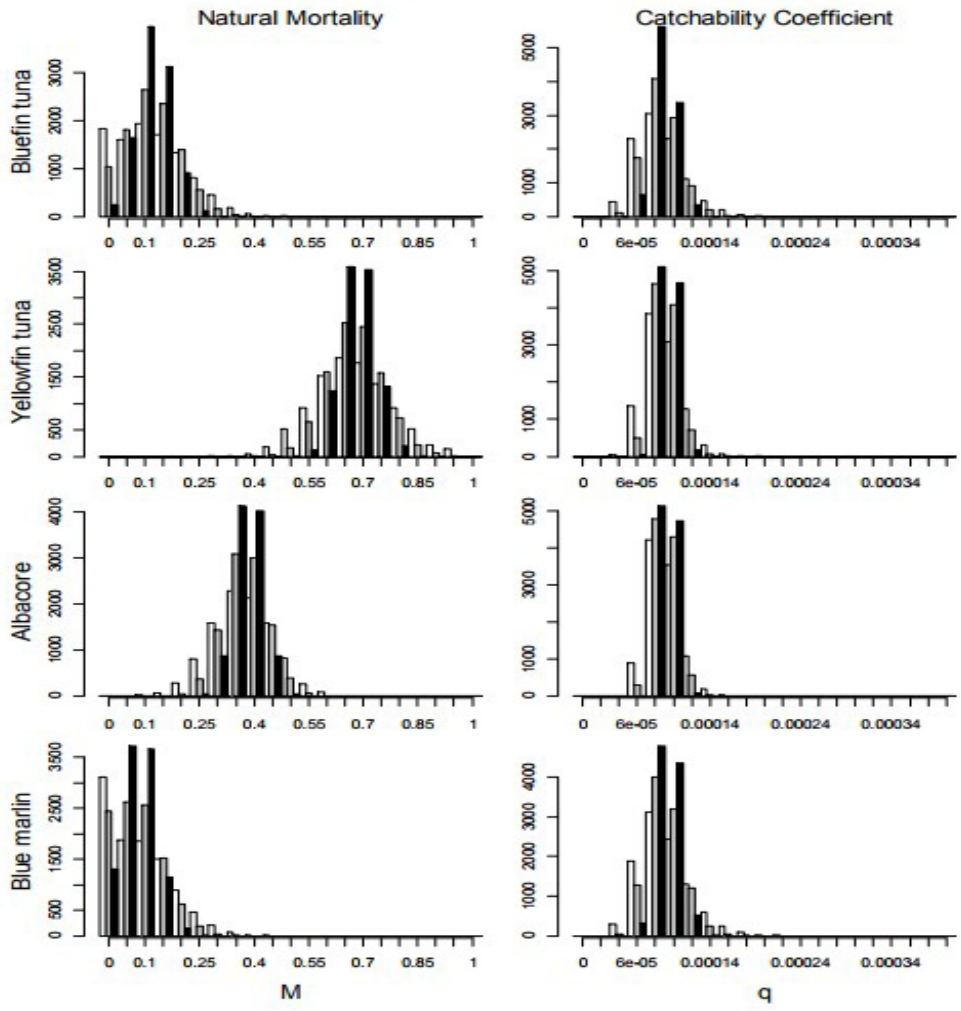
[57] Beerkircher L., Arocha F,. Barse A., Prince E., Restrepo V., Serafy J. & Shivji M. 2009. Effects of species misidentification on population assessment of overfished white marlin, Tetrapturus albidus and roundscale spearfish T. georgii. Endangered Species Research 9 pp 81 – 90. (Available at - http://cnso.nova.edu/ghri/forms/beerkircher_etal_esr_09.pdf).

allowable catch (TAC) of 2 000 tonnes or less was put in place to prevent a further decline (Figure A4.14).[58] In addition, country-specific quotas were also imposed. The SCRS expressed concern over the significant increase in Atlantic blue marlin harvest by non-industrial fisheries and that these landings were not fully accounted for. The elaboration of CPUE indices for all fleets that contribute substantially to Atlantic blue marlin landings, was therefore recommended.

Lower natural mortality (M) estimates for Atlantic blue marlin, in comparison to many tuna species targeted by longline fisheries (Figure A4.15), suggest that the life-history characteristics of Atlantic blue marlin make it more vulnerable to overfishing than most tunas. Similarly, comparing catchability coefficients between Atlantic blue marlin and tunas, using the same model, also suggests that Atlantic blue marlin stocks face greater stock risks from the same longline fishing effort, despite the fact that the hooks may be

FIGURE A4.15

Distributions of natural mortality and catchability estimates from 10 000 simulations of a capture-recapture model under low effort (white bars), medium effort (gray bars), and high effort (black bars) tagging scenarios



Source: Lauretta M.V. 2014. A simulated capture-recapture model for estimating mortality and stock mixing rates of migratory Atlantic fishes. *Collect. Vol. Sci. Pap. ICCAT 70* pp 2868-2888. (Available at - www.researchgate.net/publication/286371129_A_simulated_capture-recapture_model_for_estimating_mortality_and_stock_mixing_rates_of_migratory_Atlantic_fishes).

[58] Recommendation by ICCAT to Further Strengthen the Plan to Rebuild Blue Marlin and White Marlin Populations [Rec. 12-04]. Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2012-04-e.pdf.

aimed at targeting tuna species. This implies that Atlantic blue marlin stocks will collapse earlier than tuna stocks when faced with equal longline fishing capacities.

White Marlin and Roundscale Spearfish

Results of the 2012 Atlantic-wide white marlin assessment indicate that the stock is overfished, with ICCAT highlighting significant uncertainty associated with this species' composition in the historical catch time series (white marlin vs. spearfish), as well as with the actual magnitude of catch due to the underreporting of discards and of catches by non-industrial fleets. As a result, ICCAT implemented a maximum annual TAC of 400 MT. Country-specific quotas, similar to those for Atlantic blue marlin, were also implemented (Table A4.3).

The white marlins similarity to roundscale spearfish forms the basis for much of the uncertainty associated with the species composition in historical time-series (further discussed in Annex 4), worsened by the magnitude of under-reporting and discards. These two species statistics are combined in ICCAT stock assessments to minimize the misidentification concern. In addition, the catch limit of 400 MT for white marlin/roundscale spearfish is considered a minimum requirement which should be heeded by all billfish harvesting fisheries in the Atlantic Ocean and its adjacent seas. Figure A4.16 illustrates the temporal variability of catch reported for this species and an alarming overall stock decline. White marlin overfishing could be occurring if catches are under-reported, as is broadly expected to be occurring.[59] A reduction in spawning stock biomass of 90.3 percent is suggested by historical data time series for this/these species.

Sailfish

Sailfish is the only billfish species which is actually assessed by the SCRS according to the data "reporting units" outlined by ICCAT (i.e. not as an Atlantic wide stock). Although different scenarios provided different outcomes, the 2016 Atlantic sailfish stock assessment came to the overall conclusion that the western Atlantic sailfish stock was not overfished, nor experiencing overfishing. Nonetheless, ICCAT highlights particular concerns related to fragmented and/or lacking data for this species, and a substantial level of uncertainty about the current fishing status of this stock.15 The SCRS warns for the possibility that both eastern and western sailfish stocks may have been reduced to stock sizes below BMSY[60] (i.e. being overfished), and that there is considerable uncertainty about the level of stock reduction. Alternative assessments by the SCRS, using data limited methodologies, suggest that the western stock is overfished and experiencing overfishing, so the SCRS recommended that the results from the assessment should be interpreted with caution.[61] Due to the difficulty of determining the status for both the eastern and western Atlantic sailfish stocks, no quantitative projections were generated on future stock conditions during the last assessment.

ICCAT recommends that the total catch of either stock of Atlantic sailfish should not exceed, in any year, the level corresponding to 67 percent of the average estimate of their MSY, or, to be more precise, 1 271 tonnes for the eastern stock and 1 030 tonnes for the western stock. Contracting parties are exhorted to take or maintain appropriate measures to limit sailfish mortality, including live sailfish releases, circle hook use, other effective gear modifications, minimum size limits and/or limiting fishing days at sea. Contracting parties are also expected to enhance their efforts to collect and annually report accurate

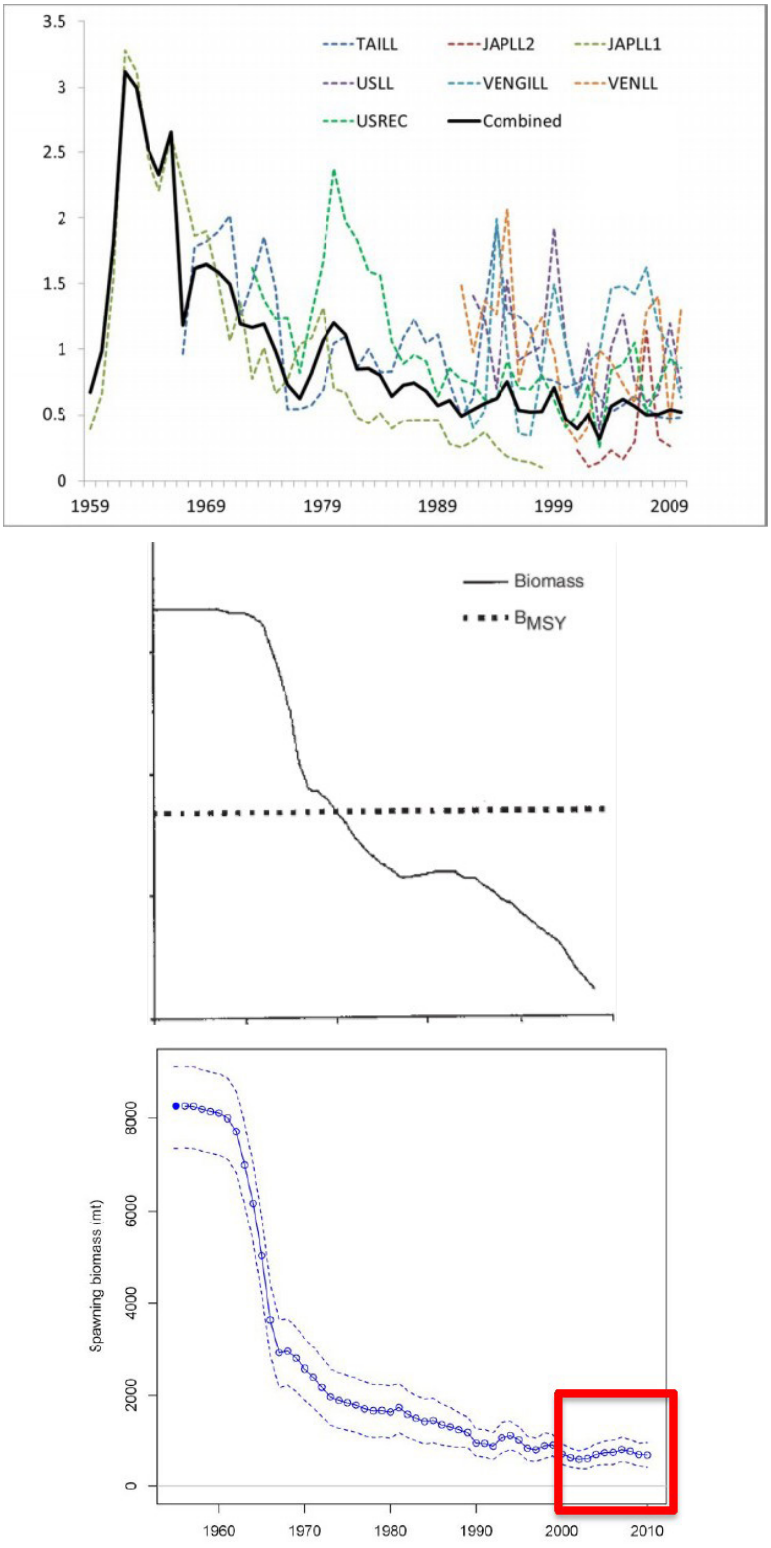
[59] ICCAT Stock Assessment website (Available at - www.iccat.int/en/Assess.htm).

[60] ICCAT. 2016. Report of the standing committee on research and statistics (SCRS). Madrid, Spain. (Available at - www.iccat.int/Documents/Meetings/Docs/2016_SCRS_ENG.pdf).

[61] ICCAT. 2016. Report of the 2016 Sailfish Stock Assessment. (Available at: www.iccat.int/Documents/Meetings/Docs/2016_SAI_REPORT_ENG.pdf).

FIGURE A4.16

White marlin indices of abundance by fishery. For graphing purposes the indices are scaled to their respective mean value for the period 2009-2010 (top graph).* Estimated biomass trajectory for white marlin (middle graph). Spawning stock biomass reduction recorded for Atlantic white marlin (bottom graph)**

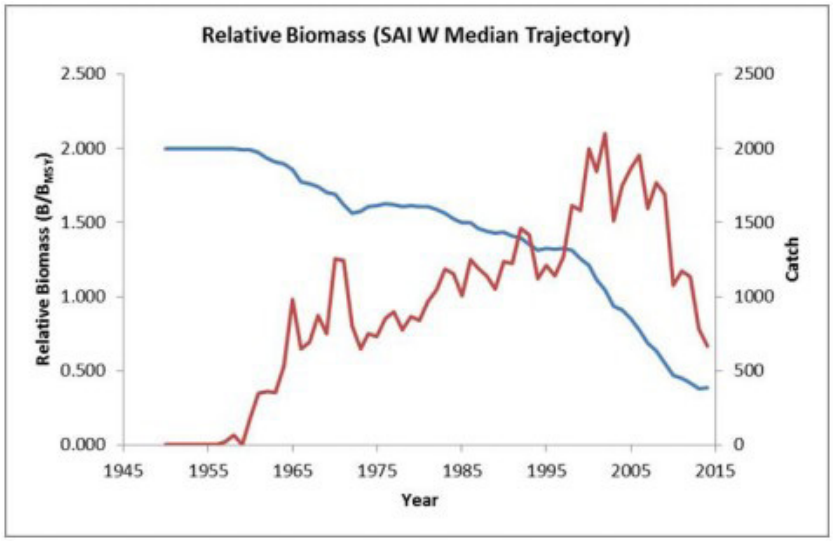


* Kerstetter D.W., Graves J.E. 2008. Post release survival of sailfish caught by commercial pelagic longline gear in the southern Gulf of Mexico. *North American Journal of Fisheries Management* 28: 1578-1586.

** Peel E., Nelson R. & Goodyear C.P. 2003. Managing Atlantic marlin as bycatch under ICCAT. The fork in the road: Recovery or collapse. *Marine and Freshwater Research* 54 pp 575 – 584. (Available at - file:///C:/Users/bealey/Downloads/peel%20et.al.%202003%20management.pdf).

data on sailfish catches, including live and dead discards.[62] Data reporting for this species is also considered incomplete because of lacking discard reporting concerns, and ICCAT acknowledges that sailfish catches are likely under-reported. Figure A4.17 shows the western sailfish stocks biomass trajectory, while Figure A4.18 illustrates overall stock abundance trends based on available CPUE data for the western Atlantic sailfish stock, for which a spawner stock biomass reduction of 95.8 percent has been reported.

FIGURE A4.17
Median biomass trajectory (in blue) and catch in metric tonnes (in red) for the western Atlantic sailfish stock



Source: ICCAT. 2016. *Report of the 2016 Sailfish Stock Assessment*. (Available at: www.iccat.int/Documents/Meetings/Docs/2016_SAI_REPORT_ENG.pdf).

Longbill spearfish

Longbill spearfish stocks were combined with sailfish in pre-2009 assessments. Longbill spearfish remain individually unassessed due to the lack of species-specific data. As a result, it is unknown if its populations are currently being sustainably fished.

Sailfish spatial habitat utilization information in relation to known spawning sites within the WECAFC area suggests a degree of regional residency (Figure A4.20). Therefore this Caribbean Billfish Management and Conservation Plan could prove to be specifically beneficial for the regional sailfish resources.

All Atlantic billfish species have experienced overfishing for at least a decade (Table A4.2). In 1964, white marlin was the first billfish species in the Atlantic to exceed the sustainable effort threshold.

When billfish data, reported to ICCAT, are applied specifically to the WECAFC area, reductions of 27.1 percent, 45.0 percent and 50.1 percent can be observed for Atlantic blue marlin, sailfish and white marlin, respectively, between 2003 and 2015 (Figure A4.21).

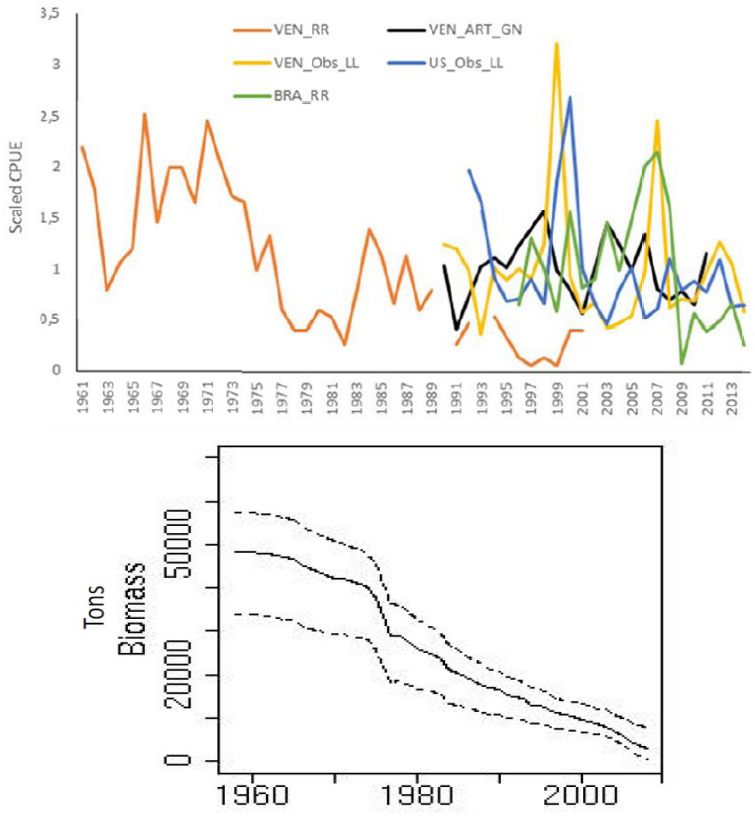
A4.3.1 Current management of the billfish stocks captured in the Caribbean

Recognizing consistent billfish abundance declines, ICCAT has made various recommendations aimed at reducing billfish fishing mortality rates. These recommendations, some updated previous ones, others new, aim at reducing the impact of fishery activities upon billfish stocks through proposed linked Total Allowable Catch (TAC) limits, gear selections and fishing methodologies. To put the management measures of this Caribbean Billfish Management and Conservation Plan in a historical context, the following timeline describes efforts by ICCAT since 1995 on ongoing issues:

[62] ICCAT Recommendation 16-11 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2016-11-e.pdf).

FIGURE A4.18

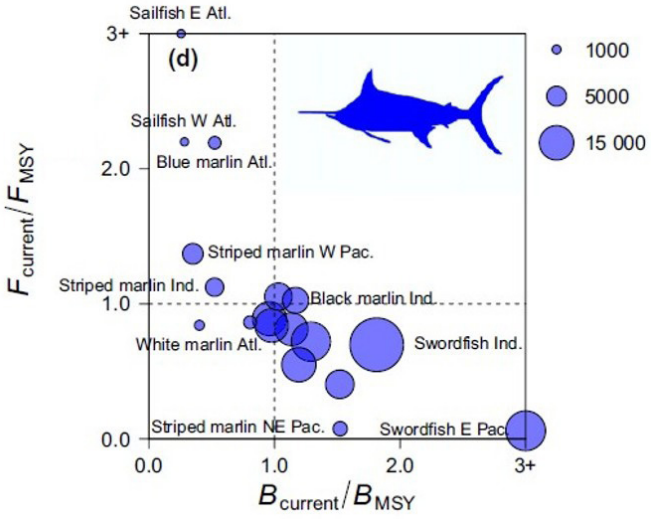
Relative abundance indices (scaled to mean for graphing) of the western Atlantic sailfish stock showing standardized data for various fleets (top) and spawning stock biomass reductions of 95.8 percent recorded for western Atlantic sailfish (bottom)



Source: ICCAT. 2015. *Sailfish Report 2014-2015* (II) (Available at - www.iccat.int/Documents/SCRS/ExecSum/SAI_ENG.pdf).

FIGURE A4.19

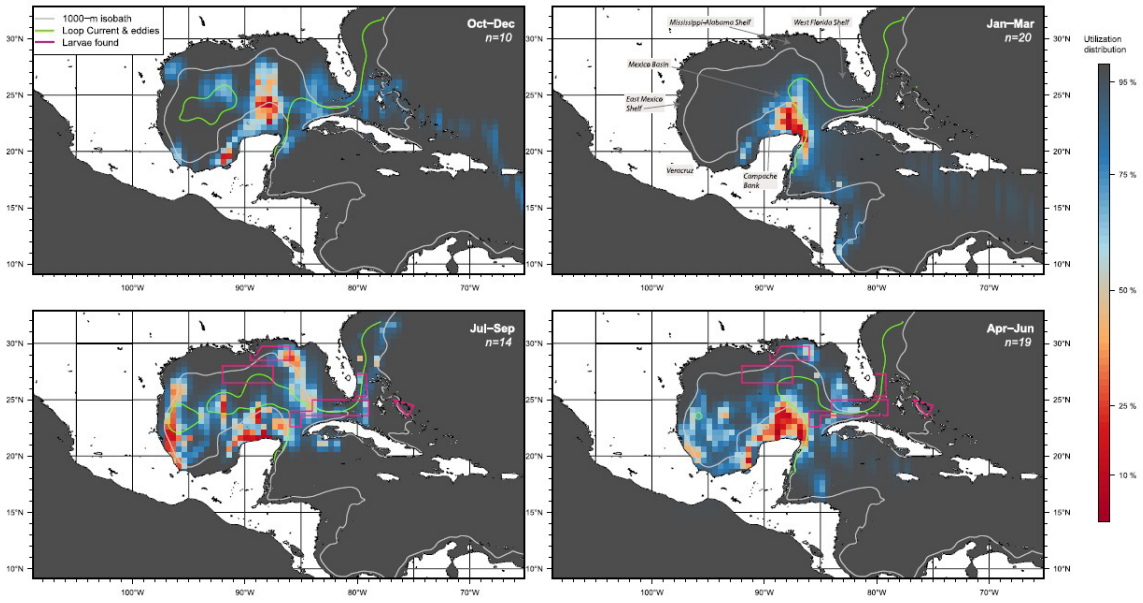
Stock status relative to target reference points (dashed lines) for fishing mortality (FMSY) and biomass (BMSY) for billfishes. Horizontal and vertical dashed lines show MSY target reference points commonly used among tRFMOs. The area of circles within each plot is proportional to MSY (MT)



Source: Pons *et al.* 2017. Effects of biological, economic and management factors on tuna and billfish stock status. *Fish and Fisheries* 18, 1-21. Available at - http://onlinelibrary.wiley.com/doi/10.1111/faf.12163/full

FIGURE A4.20

Seasonal spatial habitat use by satellite (PSAT) tagged sailfish in the Gulf of Mexico. Utilization distribution is plotted in false colour on a 0.5° grid. Spawning occurs between April and September in areas defined by magenta borders. Contour of bottom depth at 1 000 m (pink line); Seasonal average of loop current and eddies (green lines)



Source: Lam C.H., Galuardi B., Mendillo A., Chandler E. & Lutcavage M.E. 2016. Sailfish migrations connect productive coastal areas in the West Atlantic Ocean. *Nature, Scientific Reports*. Available at - www.nature.com/articles/srep38163.pdf

TABLE A4.2

Threshold effort and years when fishing mortality exceeded MSY levels for three consecutive years, in a billfish data time series.

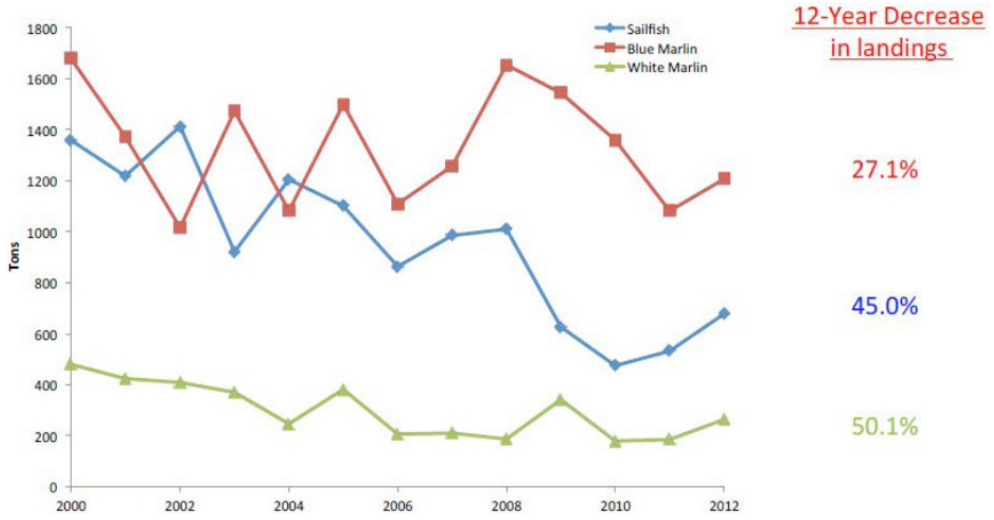
Ocean	Species	Effort threshold (*M*)	Year threshold exceeded	Years of overfishing	Year overfishing stopped
Atlantic	Blue Marlin	300	1990	23	
	Sailfish E	175	1975	38	
	Sailfish W	292	1998	10	2008
	Swordfish N	207	1987	16	2003
	Swordfish S	395	1995	16	2011
	White marlin	74	1964	15 and 30	1979 and 2012

Source: Sharma R., Pons M., Martin S., Kell L, Walter J., and Lauretta, Schirripa M. 2017. Factors related to the decline and rebuilding of billfish stocks in the Atlantic and Indian oceans. *ICES Journal of Marine Science*. (Available at - www.researchgate.net/publication/317139389_Factors_related_to_the_decline_and_rebuilding_of_billfish_stocks_in_the_Atlantic_and_Indian_oceans).

1995 – Resolution to enhance research programs for billfishes, recognizing that in 1995 the biomass for Atlantic blue and white marlin had been below the level needed to maintain MSY for more than a decade and that the Committee considered these stocks to be overexploited. Also recognizing that the biomass for sailfish in the western Atlantic was below the level needed to maintain MSY, the Committee, in 1994, concluded the stock to be at least fully exploited and perhaps even over-exploited.[63]

[63] ICCAT Resolution 95-12 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/1995-12-e.pdf).

FIGURE A4.21
Trends in the landings of selected billfish species within the WECAFC region according to ICCAT reports (Task 2 spatially-explicit statistics)



Source: Ehrhardt, N and M. Fitchett. 2015. Baseline desk study on the status of billfish resources and the billfish fisheries in the Western Central Atlantic. Available at - www.fao.org/3/a-i6204e.pdf.

1996 – Resolution to promote the use of monofilament leaders (gangions) to facilitate the live release of billfishes and assess their cost effectiveness. Improved catch statistics and information about post-release mortality of released live billfish by commercial, as well as by recreational fisheries was suggested to provide basic inputs for the formulation of a recovery program for billfish.[64]

1997 – Recommendation to reduce, starting in 1998, Atlantic blue marlin and white marlin landings by at least 25 percent, taking the 1996 landings as the base for calculations. Such reductions were expected to be accomplished by the end of 1999.[65]

1998 – Recommendation to maintain the year 2000 landings of Atlantic blue marlin and white marlin by each Contracting Party, non-contracting party, entity and fishing entity at the levels of landings for these species, as was then required to be achieved by the end of 1999.[66]

2000 – Recommendation that a two-phase program be undertaken to rebuild Atlantic blue marlin and white marlin populations to levels sufficient to support MSY. The measures put forward for Phase 1 were to commence in 2001 and apply through 2002, with re-evaluation and adjustment in 2002, for the beginning of Phase 2.[67]

2001 – Noting the stock status and immediate need for an updated evaluation of white marlin, an amendment was made to have four stock assessments be the annual norm, although no more than five should be feasibly scheduled. The recommendation by ICCAT, endorsed at the Commission meeting in 2000, to "Establish a Plan to Rebuild Atlantic Blue Marlin and White Marlin Populations", was slightly amended for Phase 1 in relation to stated years, and for Phase 2 to the tune that the SCRS conduct stock assessments for white marlin and Atlantic blue marlin in 2002 and 2003, respectively.[68]

[64] ICCAT Resolution 96-9 (Available at www.iccat.int/Documents/Recs/compendiopdf-e/1996-09-e.pdf).
[65] ICCAT Recommendation 97-9 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/1997-09-e.pdf.).
[66] ICCAT Recommendation 98-10 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/1998-10-e.pdf).
[67] ICCAT Recommendation 00-13 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2000-13-e.pdf).
[68] ICCAT Recommendation 01-10 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2001-10-e.pdf).

2002 – A further amendment was introduced and as such Phase 1 of the rebuilding plan will continue through 2005 with some specified modifications. The amendment recognized significant uncertainties in marlin stock assessments.[69]
2004 – The SCRS advised to postpone Atlantic blue and white marlin stock assessments to 2006 and for the rebuilding plan to be extended through 2006.[70]
2006 – ICCAT expressed the need to enhance billfish research (particularly age & growth), and improve data collection from commercial and recreational billfish fisheries to support the marlin stock rebuilding plan. In this year, the recommendation was launched to control, reduce and regulate the billfish mortality from artisanal fleets. At this point, the first recommendation of circle hook use was endorsed, as a means of minimizing post-release marlin mortality.[71]
2008 – An independent review panel expressed concern about the effectiveness of the TAC recommendation due to severe under-reporting of billfish catches in some fisheries, according to the SCRS. The SCRS considers that unless such non-compliance issues are properly addressed, adopted additional measures might be rendered ineffective.[72]
2010 – Terms of the 2006 Recommendation to Further Strengthen the Plan to Rebuild Atlantic Blue Marlin and White Marlin Populations [Rec. 06-09], were extended through 2011.[73]
2011 – The Atlantic blue marlin stock assessment of 2011 indicated that the stock was both overfished and experiencing overfishing. The 2006 Atlantic marlin stock rebuilding plan was, therefore, extended through 2012, while white marlin and spearfish were combined in assessments in recognition of likely misidentifications by data recorders. Adjustments to paragraph 3 of the stock rebuilding plan recognized the need for substantial catch reductions to halt stock declines for Atlantic blue marlin, and, as a result, a Total Allowable Catch (TAC) of 2000 tonnes, as proposed by the SCRS, was set for Atlantic blue marlin, to go into effect in 2012. The recommendation to reduce the total Atlantic blue and white marlin (now including spearfishes) catches, also stipulated that landings by pelagic longline and purse seine vessels must be no more than 30 percent of a CPC's highest annual landing level from 1996 to 2004 for Atlantic blue marlin and white marlin individually. The recommendation also formulated stipulations on the possibilities to carry over under-harvests to subsequent years, as well as on the release of marlins that come aboard alive.[74]

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[69] ICCAT Recommendation 02-13 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2002-13-e.pdf).
[70] ICCAT Recommendation 04-09 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2004-09-e.pdf).
[71] ICCAT Recommendation 06-09 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2006-09-e.pdf).
[72] Spencer J, Maguire JJ, Molenaar EJ. 2016. Report of the second independent performance review of the International Commission for the Conservation of Atlantic tunas (ICCAT), PLE-103/2016. (Available at - www.ris.uu.nl/ws/files/24571268/Second_ICCAT_Performance_Review_Report_Doc_PLE_103_2016_ENG.pdf).
[73] ICCAT Recommendation 10-05 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2010-05-e.pdf).
[74] ICCAT Recommendation 11-07 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2011-07-e.pdf).

2012 – The 2012 white marlin stock assessment suggested that the stock remained overfished, but overfishing was probably not occurring. The data merge with spearfishes may have influenced this outcome, as well as the significant uncertainty associated with species composition in the historical time series of catch (white marlin vs. spearfish), and the alleged volume of catch due to the underreporting of discards. Acknowledging these uncertainties, the SCRS concluded that, at a minimum, the Commission should ensure that white marlin catches do not exceed prevailing levels of approximately 400 tonnes. Results of Atlantic blue marlin stock assessments of previous years suggested that the stock remained overfished and that overfishing was continuing. The 2 000 tonnes catch limit for Atlantic blue marlin was, therefore, also reaffirmed. It was also stated that the stock would likely continue to decline unless recorded catch levels were reduced to 2 000 tonnes or less, and the Commission would manage to lower billfish mortality by non-industrial fleets. A minimum harvest lengths of 251 cm LJFL for Atlantic blue marlin and 168 cm LJFL for white marlin/spearfish, or comparable limits by weight, were stipulated for recreational fisheries. In addition, the prohibition of sale of billfish and billfish products from recreational fisheries was recommended.[75]

2015 – Annual TAC limits for Atlantic blue marlin and white marlin were recommended to be continued through 2018 and to be implemented across sixteen nations (Table A4.3). Improvements in data collection and reporting programs were suggested in accordance with the advice by SCRS, in preparation for upcoming stock assessments. The SCRS also suggested the use of circle hook, stating that "circle hooks can reduce deep hooking and, therefore, increase the post-release survival rate of marlins in many fisheries, while not negatively affecting catch rates of target species." Again, CPC were strongly encouraged to take appropriate measures to ensure that all Atlantic blue marlin and white marlin/spearfish that are alive by the time of boarding, are released in a manner that maximizes their survival, as the CPC approach their respective landing limits. It was also recommended that the United States of America limit its recreationally caught marlin landings to 250 fish per year. Established recreational size limits for Atlantic blue marlin and white marlin/spearfish and a five percent scientific observer coverage should be maintained at recreational fishing tournaments for these species.[76]

2016 – The Bolivarian Republic of Venezuela was authorized to transfer 30 tonnes of Atlantic blue marlin to the European Union during 2017.[77] Underreporting of sailfish catches was pinpointed as a main source of uncertainty in this species' stock assessments. As a result, ICCAT recommended that CPC enhance their efforts to collect data on catches of sailfish, including live and dead discards. These data should be reported annually as part of Task I and II on data submission, to support the stock assessment processes. CPC shall take or maintain appropriate measures to limit sailfish mortality. Such measures could include, among others, the release of live caught sailfish, encouraging or requiring the use of circle hooks or other effective gear modifications, implementing a minimum harvest size and/or limiting days at sea. The total catch of the West Atlantic sailfish stock should not exceed 1 030 tonnes in any year. New data collection programs need to be developed and in their Annual Reports, beginning in 2017, CPCs shall describe their data collection programs and steps taken to implement this Recommendation.[78]

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[75] ICCAT Recommendation 12-04 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2012-04-e.pdf).

[76] ICCAT Recommendation 15-05 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2015-05-e.pdf).

[77] ICCAT Recommendation 16-10 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2016-10-e.pdf).

[78] ICCAT Recommendation 16-11 (Available at - www.iccat.int/Documents/Recs/compendiopdf-e/2016-11-e.pdf).

TABLE A4.3
Breakdown of total billfish landing limits between the sixteen nations with allocated billfish quotas by ICCAT

Blue Marlin	*Landings Limit (t)*
Brazil	190
China, P.R.	45
Chinese Taipei	150
Côte d'Ivoire	150
European Union	480
Ghana	250
Japan	390
Korea Rep.	35
Mexico	70
S. Tomé & Príncipe	45
Senegal	60
Trinidad and Tobago	20
Venezuela	100
TOTAL	**1,985**

White Marlin/Spearfish	*Landings Limit (t)*
Barbados	10
Brazil	50
Canada	10
China, P.R.	10
Chinese Taipei	50
European Union	50
Côte d'Ivoire	10
Japan	35
Korea Rep.	20
Mexico	25
S. Tome & Principe	20
Trinidad and Tobago	15
Venezuela	50
TOTAL	**355**

* Note that only five nations within the WECAFC area have been allocated billfish landings quotas.

2017 – Priority was placed upon collecting species specific billfish catch data from fisheries in all CPC operating in the western Atlantic, particularly those located within the Caribbean region, where important artisanal fisheries target billfish species. The recommendation was made to launch a new data collection initiative as part of the ICCAT Enhanced Program for Billfish Research (EPBR), to overcome data gaps in billfish catching fisheries, particularly in artisanal fisheries. EPBR objectives were expanded to evaluate adult billfish habitat use, study billfish spawning patterns and billfish population genetics, as these are considered essential aspects in billfish assessments. The Committee also noted a lack of data regarding billfish catches on anchored FADs.[79]

The status of Atlantic billfish stocks would certainly be worse if it were not for the continuous efforts of ICCAT. However, implementation and enforcement of its recommendations and measures at the national level remain an ongoing challenge. Convenience overfishing, defined as the deliberate overfishing sanctioned by official bodies which seem to prefer an eventual collapse of fish stocks over potential social and

[79] ICCAT 2017. *Report of the Standing Committee on Research and Statistics. Madrid, Spain, 2-6 October 2017*. (Available at: www.iccat.int/Documents/Meetings/Docs/2017_SCRS_REP_ENG.pdf).

political conflicts,[80] may therefore be an ongoing issue for shared stocks. Few nations within the Caribbean have specific billfish regulations and management measures. WECAFC nations should urgently seek to, at least, meet the above mentioned ICCAT recommendations. This Caribbean Billfish Management and Conservation Plan provides a potential opportunity and mechanism for Caribbean alignment to ICCAT requirements. Implementation of this Plan could not only improve compliance by ICCAT members from the region, but also provide a more geographic specific approach to securing sustainable billfish stock harvests between ICCAT members and non-members alike.

[80] Froese R. 2004. Keep it simple: Three indicators to deal with overfishing. *Fish and Fisheries* 5 pp 86 – 91 (Available at -https://core.ac.uk/download/pdf/11897517.pdf).

ANNEX 5. Terms of Reference for the WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries

A5.1 ROLE OF THE WORKING GROUP

A5.1.1 Scope

The scope of the Working Group is to provide scientific and management advice for the sustainable management of recreational fisheries in the WECAFC region. In undertaking its work, the Working Group will pay due attention to Article 6.4 of the general principles of the Code of Conduct for Responsible Fisheries,[1] the principles of the Ecosystem Approach to Fisheries (EAF), the principles of the FAO Voluntary Guidelines for Securing Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, and the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security.

A5.1.2 The Goal of the Working Group

Using a multidisciplinary approach, the Working Group will contribute to the sustainable management of recreational fisheries in the WECAFC Region, by providing scientific and management advice to Members of WECAFC based on the best available knowledge. In pursuing this goal the Working Group will contribute to the fulfilment of national and regional responsibilities for the marine environment and for the management of recreational fisheries and resources, and related or interacting species, or other interacting fisheries in the WECAFC Region under the Code of Conduct for Responsible Fisheries, in line with the principles of the Ecosystem Approach to Fisheries, the Voluntary Guidelines for Securing Small-Scale Fisheries in the Context of Food Security and Poverty Eradication, the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, and in accordance with agreed, documented management goals.

A5.1.3 Terms of Reference (TORs)

Many of the fish resources captured by recreational fisheries, such as billfish, dolphin fish and tunas, are transboundary and/or highly migratory and, therefore, the Terms of Reference (TORs) may apply at the sub-regional and/or national levels, as appropriate. The Working Group, with the support of FAO and the WECAFC Secretariat, will act in an advisory capacity to guide and facilitate the sustainable management of recreational fisheries.

[1] 6.4 Conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors. States should assign priority to undertake research and data collection in order to improve scientific and technical knowledge of fisheries including their interaction with the ecosystem. In recognizing the transboundary nature of many aquatic ecosystems, States should encourage bilateral and multilateral cooperation in research, as appropriate.

Specifically, the Working Group on Recreational Fisheries will:

(a) Compile, analyse and share available biological and socio-economic data and information on recreational fisheries.
(b) Develop common monitoring and assessment methods for recreational fisheries, involving commercial fisheries (industrial and small scale) formally in data collection, wherever possible.
(c) Provide scientific and management advice to countries and regional organizations about the implementation and performance of agreed sub-regional management measures for recreational fisheries.
(d) Establish communication among members of the Working Group, between the Working Group and interested parties, including the private sector.
(e) Evaluate and make recommendations on emerging issues, including external environmental and economic drivers of change at local, national, regional or global levels. To the extent possible, address issues dealing with pollution and habitat degradation and their socio-ecological impacts in collaboration with appropriate national, sub-regional and/or regional institutions and local stakeholders.
(f) Establish links with the appropriate working groups of the Caribbean Regional Fisheries Mechanism (CRFM), the Central America Fisheries and Aquaculture Organization (OSPESCA), the Inter-American Tropical Tuna Commission (ICCAT), and the Consortium on Billfish Management and Conservation (CBMC) in order to avoid duplicating efforts and tasks while optimizing the use of technical and financial resources.
(g) Establish links with other sub-regional initiatives and projects (e.g., Caribbean Large Marine Ecosystem –CLME+, Climate Change adaptation in the Eastern Caribbean Fisheries Sector – CC4FISH, and the Sustainable Management of Bycatch in Latin America and Caribbean Trawl Fisheries –ReByC II LAC, for mutual benefit.
(h) Collaborate with other WECAFC working groups (i.e., fisheries using fish aggregating devices, flying fish and shark fisheries), in issues of mutual interest.
(i) Report to appropriate institutions at each session.
(j) Seek partnerships with other institutions that could provide assistance and recommendations about monitoring, assessment and management of recreational fisheries.
(k) Support the organization of, and provide technical expertise during, the Regional Workshop on Recreational Fisheries Data and Statistics in the Caribbean.
(l) The working group will aim to advise and support the implementation of the Caribbean Billfish Management and Conservation Plan, the CRFM Sub-Regional FAD Management Plan and the 2012 "FAO Technical Guidelines for Responsible Fisheries: Recreational Fisheries" in the WECAFC area.
(m) The working group will review and validate draft findings of the "Scenario Study on how to influence ICCAT decision making processes."
(n) Support the Project Management Unit of the Caribbean Billfish Project.
(o) Support activities of the Consortium on Billfish Management and Conservation (CBMC).
(p) Support endorsement procedures for the draft Billfish Management and Conservation Plan for the Wider Caribbean Region by WECAFC, OSPESCA, CRFM, CFMC and ICCAT in 2017-2018.
(q) Report on the 8th meeting of the WECAFC Scientific Advisory group to provide advice and recommendations.
(r) Promote closer relations with, and reporting to, the SCRS of ICCAT.
(s) Review and provide recommendations on the Business Case(s) developed through the Caribbean Billfish Project.

The implementation of many of the tasks assigned to this Working Group will be supported by the Caribbean Billfish Project, a component of the World Bank/ GEF programme on Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation – Models for Innovation and Reform.

A5.1.4 Mode of Operation

A5.1.4.1 Role of Countries

The members of the Working Group will play a leading role through the following activities and commitments:

- Participate in agreed activities of the Working Group and facilitate, to the extent practicable, participation of appropriate experts;
- Implement the tasks agreed upon in the work plan of the Working Group at national level;
- Host Working Group meetings on a rotational basis.

A5.1.4.2 Role of Convenor

The Convenor of the Working Group will play a leading role during the organization of the meetings, by coordinating inputs of the members of the Working Group:

- Call for meetings as appropriate;
- Ensure that contributions are received in a timely manner and in the appropriate format;
- Ensure that outputs are delivered as agreed during each meeting;
- Collaborate closely with FAO-WECAFC and other sub-regional and regional organizations, as appropriate.

A5.1.4.3 Role of FAO

The FAO/WECAFC Secretariat will play a supporting role in the activities of the Working Group by assisting in:

- Co-coordinating the activities of the Working Group (including facilitate procurement of funding);
- Providing a technical secretary and technical backstopping;
- Providing technical assistance and support to research;
- Facilitating training.

A5.1.4.4 Role of other organisations (e.g. CRFM, OSPESCA)

Sub-regional organisations have an important role to play in assisting their member countries to participate fully in the activities of the working group by:

- Providing technical assistance and support;
- Facilitating procurement of funding when possible;
- Facilitating the decision-making process at the Sub-regional level;
- Promoting implementation of data collection and a resultant regional database for recreational fisheries.

A5.1.5 Communication

A mechanism for ongoing communication among Working Group members (Video conference, Skype and e-mail), is essential to ensure that the work of the group is sustained between meetings. It must include all Working Group members.

The successful functioning of the Working Group also requires that each member country and organization/agency identify a national focal point through which communications will be directed. The outputs of the Working Group will be communicated through Working Group reports to WECAFC, CRFM, OSPESCA, national fishery administrations and any other organization via the WECAFC Secretariat.

A5.1.6 Working Group meetings

Working Group meetings will be organized according to the work plan and depending on resources available.

A5.2 WORKING GROUP WORK PLAN 2017–18

The Working Group intends to carry out, with support of the Caribbean Billfish Project (CBP) and the Consortium on Billfish Management and Conservation (CBMC), the following activities over the period 2017–2018:

Activity	Timeframe	Responsible
Organization of the 3rd Regional Workshop on Caribbean Billfish Management and Conservation	4–6 April 2017 Barbados	WECAFC: meeting supported by the CBP
Finalization, publication and dissemination of the Report of the 3rd Regional Workshop	June 2017	WECAFC Secretariat
Organization of the Regional workshop on Recreational Fisheries Statistics in the Caribbean	20–22 June 2017 Bahamas	WECAFC + CRFM (as convener): meeting supported by the CBP and the EU DG Mare
Finalization, publication and dissemination of the Report of the Statistics Workshop	September 2017	WECAFC Secretariat
Final round of comments on the Caribbean Billfish Fisheries Management and Conservation Plan – from Fisheries Directors/chiefs and WG members	April – June 2017	CBP PMU + WECAFC Secretariat + members
Support finalization of the CRFM Sub-Regional Management Plan for FAD Fisheries in the Eastern Caribbean	May–July 2017	CRFM + WECAFC Secretariat + WG members
Review and validation of the draft findings of the "Scenario study on how to influence decision making of ICCAT regarding tuna and billfish species in the Caribbean"	October–November 2017	WG Members
Passing of advice and recommendations generated by the 3rd Regional Workshop and on the Billfish Management and Conservation Plan (+FAD Management plan) for review/ discussion and approval within CRFM and OSPESCA	October 2017–January 2018	Interim Coordination Mechanism for Sustainable Fisheries (CLME+ supported)
Reporting to the 8th meeting of the WECAFC Scientific Advisory Group (SAG) for review of advice and recommendations	November 2017	WG Convener + WECAFC Secretariat
Reporting to the SCRS of ICCAT	March–May 2018	WG Convener + WECAFC Secretariat, supported by WG members
Presentation and endorsement of the Caribbean Billfish Management and Conservation Plan by WECAFC 17 and ICCAT	May 2018/ November 2018	WG Convener + WECAFC Secretariat, supported by WG members
Regional roll out and testing of the recreational fisheries data collection system and regional database and seek to expand to include other fisheries sectors	January 2018–onwards	WG Convener + WG members
Support the review process and provide advice on the feasibility of the various business cases developed by the CBP	January–June 2018	WG Convener + WECAFC Secretariat, supported by WG members

ANNEX 6. Draft recommendation for billfish management and conservation in the WECAFC area

Draft Recommendation WECAFC/17/2018/-

"ON BILLFISH MANAGEMENT AND CONSERVATION IN THE WECAFC AREA"

The Western Central Atlantic Fishery Commission (WECAFC):

RECALLING that the objective of the Commission is to promote the effective conservation, management and development of the living marine resources within the area of competence of the Commission, in accordance with the FAO Code of Conduct for Responsible Fisheries, and to address common problems of fisheries management and development faced by members of the Commission;

NOTING with concern the declining trends in billfish stocks in large parts of the WECAFC area and the ongoing challenges to manage billfish fisheries and conserve the stocks, while recognizing the ecosystem value of the billfish stocks, the socio-economic importance of the commercial and recreational fisheries of billfish for the WECAFC members, and the contribution to employment, tourism, food security and coastal livelihoods;

RECOGNIZING that improving billfish management and conservation in the Western Central Atlantic will have to be consistent with International Commission for the Conservation of Atlantic Tunas (ICCAT) recommendations and with the FAO International Guidelines on securing Sustainable Small-Scale Fisheries (SSF Guidelines); requires partnerships between all relevant stakeholders, small-scale fisheries, recreational fisheries, industrial fisheries, distant water fleets, tourism sector, Regional Fisheries Bodies, researchers, managers, Civil society Organizations and Non-Governmental Organizations; and that an Ecosystem Approach to Fisheries (EAF) should be applied.

NOTING that ICCAT has implemented total allowable catch (TAC) limits for blue marlin and white marlin/spearfish, (Recommendation 15-05), and has also developed a "Recommendation on management measures for the conservation of Atlantic sailfish" (Recommendation 16-11), which has the aim to keep the annual Western Atlantic sailfish landings below 1 030 tonnes;

RECOGNIZING the important technical work of the joint WECAFC/OSPESCA/CRFM/CFMC Working Group on Recreational Fisheries, which was established by WECAFC 14 in 2012 and met in Colombia (November 2012), USA (March 2013), Panama (November 2015), Barbados (April 2017) and The Bahamas (June 2017), and the support received from the Caribbean Billfish Project- Component of the GEF-funded, World Bank implemented, project P128437: Ocean Partnership for Sustainable Fisheries and Biodiversity Conservation Models for Innovation and Reform (ABNJ) Project.

FURTHER RECOGNIZING the continued efforts by the members of the Consortium on Billfish Management and Conservation (CBMC), which secretariat is hosted by the International Game Fish Association (IGFA), and aims to foster better management and conservation of the billfish resources in the Western Central Atlantic;

RECALLING that most WECAFC members have endorsed the Caribbean and North Brazil Shelf Large Marine Ecosystems (CLME+) Strategic Action Programme (SAP), including SAP Sub-strategy 5B, which aims at enhancing the governance arrangements for implementing an ecosystem approach for large pelagic fisheries;

PENDING the delivery of additional information by the Working Group, CRFM and the WECAFC Scientific Advisory Group (SAG);

ADOPTS in conformity with Article 6 of the WECAFC Revised Statutes the RECOMMENDATION that:

1. Members of WECAFC implement the "Caribbean Billfish Management and Conservation Plan", as appropriate, and report from 2020 onwards, to the CRFM, OSPESCA, WECAFC and ICCAT, on progress with the implementation of the plan.

2. The Working Group on Recreational Fisheries continues to collect, generate and share data and information on billfish resources and their fisheries on an annual basis. The Working Group will include in its work plan review of ICCAT stock assessments and management and conservation measures for the billfish species, as required, to meet the management objectives.

3. Members of WECAFC prepare (where applicable) national level billfish management and conservation plans by the end of 2020, addressing ecological, social, economic and governance issues, and put in place appropriate legislation in support of long-term sustainable stocks.

4. In alignment with ICCAT Recommendation 15-05, members of WECAFC determine and adopt minimum size limits for retention of recreational billfish catch, under domestic regulations, that meet or exceed the following: 251 cm Lower Jaw Fork Length (LJFL) for blue marlin and 168 cm LJFL for white marlin/spearfish, or comparable limits by weight.

5. Members of WECAFC work to minimize the post-release mortality of marlins/spearfish and sailfish in their fisheries.

6. Members of WECAFC prohibit the sale, or offering for sale, of any part or whole carcass of blue marlin or white marlin, spearfishes or sailfish caught in recreational fisheries.

7. Members of WECAFC that are non-contracting parties[1] to ICCAT provide their estimates of landings and of live and dead discards of blue marlin, white marlin, spearfishes and sailfish, and all other available data including observer data, annually to WECAFC, as appropriate, such that the data can be provided to ICCAT as part of their data collection, to support the stock assessment process.

[1] Non-contracting parties excludes non-contracting cooperating parties.

8. Members of WECAFC provide information about their data collection programs to WECAFC, and the WECAFC Scientific Advisory Group, in collaboration with the ICCAT Scientific Committee on Research and Statistics (SCRS), review and evaluate this information as a basis for developing recommendations and initiatives to improve or expand these programs, in particular for small scale and artisanal fisheries of developing countries, including through capacity building.

9. In alignment with ICCAT Recommendations 15-05 and 16-11, members of WECAFC take or maintain appropriate measures to limit blue marlin, white marlin, spearfishes and sailfish mortality. Such measures could include, for example: releasing live billfish, encouraging or requiring the use of circle hooks or other effective gear modifications, implementing a minimum size of retention, and/or limiting days at sea. To further contribute to this, members of WECAFC keep any billfish landed by their fleets for local consumption only, avoiding the export of billfish products, and endeavour to restrict imports of marlin, spearfish and sailfish products.

10. Members of WECAFC report on request to WECAFC on steps taken to implement the provisions of this Recommendation through domestic law or regulations, including monitoring, control and surveillance measures.

11. This Recommendation shall be reassessed after the next assessments of Atlantic blue marlin, white marlin, spearfishes and sailfish stocks conducted by the ICCAT SCRS.

ANNEX 7. Letter of Intent – On the Establishment and operations of the Consortium on Billfish Management and Conservation (CBMC) for the Western Central Atlantic

This Letter of Intent (hereinafter referred to as "LoI"), is made among the Parties listed below:

- The International Game Fish Association (IGFA)
- The Western Central Atlantic Fishery Commission (WECAFC) of the Food and Agriculture Organization of the United Nations (FAO)
- The World Bank
- The Caribbean Regional Fisheries Mechanism (CRFM)
- The Central American Fisheries and Aquaculture Organization (OSPESCA)
- The International Commission for the Conservation of Atlantic Tuna (ICCAT)
- The Caribbean Fisheries Management Council (CFMC)
- The Caribbean Network of Fisherfolk Organizations (CNFO)
- The Conservation International (CI)

Considering that since the mid-1980s the catches of billfishes in the Western Central Atlantic are showing a declining trend; That billfish stocks are under pressure and that is why the International Commission for the Conservation of Atlantic Tuna ICCAT has determined that Atlantic blue and white marlin are overfished and has set quotas for billfish landings by their contracting parties;

Recognizing the current and potential socio-economic value of the species for income generation, food security ('billfish' is the cheapest fish in many of the Caribbean Small Island Development States (SIDS) and for recreational purposes, the governments in the Wider Caribbean Region (FAO area 31) decided that action has to be taken to secure sustainable extractive use and conservation of this important species. The 14th session of the Western Central Atlantic Fishery Commission (WECAFC), held in Panama City, 6-9 February 2012, called (amongst others) for action from the Commission on recreational fisheries and particularly on this subject and requested the establishment of a dedicated working group on recreational fisheries. The session then decided to establish a joint Western Central Atlantic Fisheries Commission (WECAFC)/Central America Fisheries and Aquaculture Organization (OSPESCA), Caribbean Regional Fisheries Mechanism (CRFM) and Caribbean Fishery Management Council (CFMC) Working Group on Recreational Fisheries;

Aware that efforts towards management and conservation of Billfish resources in the Western Central Atlantic can only be sustainable if the Ecosystem Approach to Fisheries (EAF) is applied and all relevant stakeholders (including representatives

of small-scale-, recreational-, and industrial fisheries, tourism, research, investment, management and conservation bodies and organizations) are included;

Acknowledging the existing political and legal frameworks for fisheries at national and regional levels in the Wider Caribbean Region/ Western Central Atlantic, as well as commitments under various international fisheries instruments and towards Regional Fisheries Bodies (RFBs) active in the region;

Recognizing the importance of the recent establishment of the Global Partnership for Oceans (GPO) in June 2012 and the approval by the Global Environment Facility (GEF) Areas Beyond National Jurisdiction (ABNJ) Program in November 2011, which offer entry points for the Caribbean region to participate in global level initiatives;

Noting that The World Bank/Global Environment Facility (GEF) supported Caribbean Billfish Project (GCP/SLC/001/WBK) is as such instrumental in bringing private and public stakeholders together from the Caribbean and establishing links with other regions;

DECLARE their intention to:

(a) collaborate in the establishment of a proposed Consortium on Billfish Management and Conservation (CBMC) for the Western Central Atlantic;
(b) jointly agree and define the terms and conditions for the proposed Consortium, bearing in mind the privileges and immunities of a number of the Parties to this LoI, including the inapplicability of national laws;
(c) the purpose of the proposed Consortium will be, generally, to implement the World Bank/Global Environment Facility (GEF) supported Caribbean Billfish Project, and to foster better management and conservation of the billfish resources in the Western Central Atlantic;

CONFIRM their common understanding that:

(a) This Letter of Intent does not create any financial or other commitments for any of the Parties.
(b) Nothing in this Letter of Intent constitutes a waiver of the privileges and immunities that may be enjoyed by any of the Parties to this LoI.

Signed _____ in _____ original copies in English and Spanish, all texts being equally authentic.

This Caribbean Billfish Management and Conservation Plan has been prepared to reverse the trend of declining stocks of billfish species within the Western Central Atlantic Ocean and its adjacent seas, and to address unsustainable fishing practices. The Members of the Western Central Atlantic Fishery Commission (WECAFC), Caribbean Regional Fisheries Mechanism (CRFM), Central America Organization for Fishery and Aquaculture (OSPESCA) and the Caribbean Fisheries Management Council (CFMC) are concerned about the billfish stocks in the region. Therefore, they developed together, through the Recreational Fisheries Working Group, and in close collaboration with all key stakeholders in the Consortium on Billfish Management and Conservation (CBMC) this plan in the period 2015–2018. The plan recognizes the mandate of the International Commission for the Conservation of Atlantic Tunas (ICCAT) over the billfish stocks, and supports the implementation of the ICCAT recommendations in the region. The objective of this Plan is to outline and guide the implementation of a suite of billfish management measures over a five-year period at regional and sub-regional scales to help secure the potential future benefits that can accrue from billfish stocks in the Caribbean. The overarching goal is to improve the management and conservation of billfish stocks.

COPACO
Western Central Atlantic Fishery Commission

OSPESCA
Organización del Sector Pesquero y Acuícola del Istmo Centroamericano

CRFM

Caribbean Fishery Management Council
CFMC

THE WORLD BANK

THE INTERNATIONAL GAME FISH ASSOCIATION

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