October 2011

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منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Agricultura y la Alimentación

WESTERN CENTRAL ATLANTIC FISHERY COMMISSION (WECAFC)

FIFTH SESSION OF THE SCIENTIFIC ADVISORY GROUP (SAG)

Puerto Morelos, Mexico, 27- 29 October 2011

Coordination and collaboration in fisheries research in the region

1. Introduction and background

The Western Central Atlantic Fishery Commission (WECAFC) was established in 1973 by Resolution 4/61 of the FAO Council under Article VI (1) of the FAO Constitution. Its statutes were amended by the FAO Council at its Seventy-fourth Session in December 1978 and by the Hundred and Thirty-first Session of the FAO Council in November 2006 (FAO, 2010).

The work programme of the WECAFC has its activities arranged under the following themes:
- Fisheries assessment and management;
- Capacity building;
- Technology/knowledge transfer;
- Coordination and liaison (with regional and international institutions and programmes/projects).

These activities are conducted in addition to the advisory services provided by WECAFC (policy advice, provision of information, management and legal advice).

The Scientific Advisory Group (SAG) of the WECAFC acts as an advisory body to the Commission. This background paper serves as a follow-up on recommendations made by the first four SAG meetings with regards to coordination and collaboration in fisheries research in the region. It is expected to give guidance to WECAFC on the formulation and implementation of WECAFC's work programme in respect of all aspects of fisheries research, and assist in the development of the 2012-2013 workplan.

This background paper has been prepared by Ms Maren Headley of the CRFM office in St Vincent, in close collaboration with the WECAFC Secretariat. The information presented is the result of a desk study, whereby a number of regional institutions and projects have been contacted. The information presented may not be complete or not sufficiently updated. SAG members and observers are therefore invited to contribute to the information presented. Changes to this draft background paper will be incorporated in the final version, which will replace the current version on-line after the SAG meeting.

2. Research activities since 2005 in which WECAFC was involved

A list of research activities which WECAFC has been involved in since 2005 is provided below (FAO, 2009a):

Working Group on Queen Conch, *Strombus gigas*

- Regional Workshop on the Monitoring and Management of Queen conch, *Strombus gigas*, Jamaica, 2006

Working Group on Caribbean Spiny Lobster, *Panulirus argus*

- Regional Workshop on the Assessment and Management of Caribbean Spiny Lobster (*Panulirus argus*), 2006.

Working Group on sustainable use of Moored FAD Fishing in the Lesser Antilles

- The Third Meeting of WECAFC ad hoc Working Group on the Development of Sustainable Development of Moored Fish Aggregating Device (FAD) Fishing in the Lesser Antilles, 2006

Working Group on Flyingfish

- The Third Meeting of WECAFC ad hoc Flyingfish Working Group of the Eastern Caribbean, 2008.

Activities and Projects

- Study on the effects of pollution and coastal development on fisheries in the Gulf of Paria and Columbus Channel
- Regional Workshop of factors contributing to Over-exploitation and Unsustainability in fisheries in CARICOM Countries, 2006
- Increasing the Profile of Artisanal Fisheries in the National Policies of Nicaragua (FAO, FishCode STF, OSPESCA, NIC1)
- Improvement of information on status and trends of Queen conch capture fishery in the Caribbean region (FAO, FishCode STF, OSPESCA, ACT1)
- Support to the improvement of routine fisheries monitoring in Central America (FAO, FishCode STF, OSPESCA, ACT2)
- A Regional Workshop on Nassau grouper, 2007 (CFMC, NOAA, and NMFS).
- Monitoring and managing queen conch fisheries. A manual. 2008 (SIDA & UNEP)

Trust Fund Projects

- Reduction of environmental impact from tropical shrimp trawling through the introduction of By-catch Reduction Technologies (BRTs) and Change of Management, 2002 – 2007, GEF/UNEP/FAO
- Scientific Basis for Ecosystem-Based Management in the Lesser Antilles: Including Interactions with Marine Mammals and Other Top Predators 2002 - 2007
- Workshop Report FAO / OSPESCA for Development of National Plans of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU PAN) in the Central American Isthmus, 2005
- CITES and Commercially-exploited Aquatic Species Including the Evaluation of Listing Proposals, 2005–2010, GCP/INT/987/JPN
- FAO/OSPESCA/INCOPESCA- Meeting on reducing vulnerability of fishing and fish farm communities to natural disasters and climate change, 2010
- Strengthening of Interdisciplinary Fisheries Research for Responsible Fisheries in the Countries of Central America-FIINPESCA - (OSPESCA-FAO-SWEDEN)- 2005-2009

TCP Projects

- Introduction of Aquaculture and Other Integrated Production Management Practices to Rice Farmers in Suriname and Guyana, 2004–2006
- Support the management of fisheries for shrimp and institutional strengthening of Fisheries Authority, Phase II, 2006

- Improvement of the Domestic markets for seafood in the Latin American and Caribbean region, 2007-2010
- Establishment of a programme of cooperation for the sustainable management of river fisheries in the transboundary areas of the rivers Parana and Paraguay, 2010-2011

FAO TCP Facility

- Specific Project Development Alternatives in the Framework for the Implementation of the Program to Eradicate Diving in the Spiny Lobster Fishery of Caribbean Nicaragua, 2006 – 2007.
- Assessment of the Eastern Caribbean flying fish resource, 2008-2010
- Design of a project to strengthen and increase technology transfer in aquaculture and inland fisheries between the countries in South America, 2009-2011

Global Trust Fund Projects with relevance to the WECAFC region and WECAFC membership

- Development of a database on Vulnerable Marine Ecosystems of the High Seas, 2011-2014
- Promotion of sustainable fisheries: support for strengthening functions of and coordination among Regional Fishery Bodies (RFBs)/Regional Fisheries Management Organizations (RFMOs), 2008-2012
- Fisheries management and marine conservation within a changing ecosystem context, 2009-2014

3. Summary of SAG recommendations for fisheries research and collaboration in fisheries research to WECAFC

A summary of recommendations regarding cooperation and collaboration in fisheries research is provided below for each of the SAG meetings.

First SAG Meeting, 2001 (FAO, 2001)

- Provision should be made for ensuring coordinated and cooperative development and management at the WECAFC regional level for shared coastal resources.
- Consideration should be given to establishing a working group on large pelagics for the WECAFC or Antilles countries, with due consideration of the activities of the Working Group on Large Pelagics of the CARICOM Fishery Resources and Assessment Management Programme (CFRAMP), which only covers the CARICOM countries.
- Attention was drawn to the need for effective cooperation with other agencies and organizations working on marine coastal issues.
- Effective cooperation and management of the shared shrimp stocks of Panama and the Central American countries, of which the Honduras-Nicaragua shelf were most important, should be considered. The approach undertaken by the WECAFC *ad hoc* Working Group on Shrimp and Groundfish Fisheries on the Brazil-Guianas Shelf was given as an example.
- The SAG emphasized the linkages between the activities of regional projects and the activities of the WECAFC *ad hoc* working groups.
- The SAG agreed that, given the geography and characteristics of the fisheries resources in the WECAFC region, responsible fisheries management required regional and sub-regional cooperation, as the principal means for the application of the precautionary approach to fisheries in the region.

Second SAG Meeting, 2003 (FAO, 2003a)

- Technical assistance should be requested from ICCAT for the assessment of the large pelagic fish stocks that are the target of this emerging anchored FAD fishery. To this end, an ICCAT expert should be invited to the next meeting of the working group in Guadeloupe.

- As fisheries management becomes more comprehensive through ecosystem approaches and globalization, the development of innovative approaches that are appropriate to different scales and capacities requires attention to ensure cost-effectiveness and efficiency.
- Several other initiatives in the region addressing large marine ecosystems, the Meso-American barrier reef, integrated watershed to reef projects and eco-regional approaches to planning are all important examples of the trend towards ecosystem approaches, and are of relevance to the mandate and interests of WECAFC.
- The Group recognized that some problems had been experienced in implementation of the Working Groups' activities, including a lack of continuity in membership of the Working Groups for some countries, disparities in the human capacity, data availability and effectiveness of management systems between the countries, and very limited financial resources that meant the activities of the Working Groups had been largely constrained by the availability of donor funds.

Third SAG Meeting, 2005 (FAO, 2005a)

- The need to improve fisheries management in most WECAFC countries in order to ensure sustainable use of the resources. Fisheries management should be in accordance with an ecological approach. Protection and restoration, where appropriate, of critical habitats would be necessary for many resources, particularly inshore species and communities.
- Technical assistance should be requested from ICCAT for the assessment of the large pelagic fish stocks that are the target of this emerging anchored FAD fishery. An ICCAT expert should be invited to the next meeting of the working group.
- A number of other working groups established by regional fishery organizations could complement the work of WECAFC. SAG was of the view that WECAFC could take advantage of these working groups by coordinating meetings and activities so that they do not overlap and hopefully complement each other. WECAFC may consider holding ad hoc working group activities that coincide with activities of these other working groups to build synergy.
- WECAFC should consider how to strengthen its collaboration with regional academic institutions in WECAFC member countries because such institutions have a large pool of people with skills and knowledge that can contribute to WECAFC's work.

Fourth SAG Meeting, 2007 (FAO, 2007)

- SAG suggested the convening of a regional meeting by the various agencies working on MPAs in the region to share the large body of existing knowledge on the subject with fisheries managers of the region.
- Some SAG members expressed their concerns at the length of time it is taking the Working Group on moored fish aggregating devices to acquire the scientific information to provide fisheries managers with advice for the management and control of this emerging fishery. The SAG encouraged the participating countries to expedite and strengthen their involvement in the research project on promoting subregional cooperation for the development of sustainable fishing using moored FADs in the Lesser Antilles.
- SAG encouraged FAO/WECAFC and other international organizations involved in fisheries in the region to continue and establish more linkages to create more synergy.
- The Commission may wish to encourage universities and fisheries authorities in the region to pay more attention to the social science aspects of fisheries governance while retaining an interdisciplinary approach.
- It was noted that the report on intersessional activities demonstrated a fair degree of coordination, collaboration and information-sharing within WECAFC. However, there

were still many cases of work proceeding in the region without information-sharing, and this reduced the opportunities to improve fisheries science.
- A simple and brief summary of fisheries-related research activities in the region, distributed electronically monthly or bi-monthly, was suggested to bridge the existing gaps in communication.
- Initiatives such as the CLME project, which contained provision for communication, should be encouraged to test simple systems for improving information exchange and determine whether this led to improvements in project outcomes.

Follow-up on SAG recommendations from WECAFC, SAG members or partners

Since the convening of the first SAG meeting in 2001, there has been a general move towards the Ecosystem Approach to Fisheries by regional organizations, institutions and projects. As defined by FAO, 2003b, *'An ecosystem approach to fisheries (EAF) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries*.' WECAFC has recognized that coordination and collaboration of research among regional organizations, institutions and projects is necessary to achieve an EAF, as reflected in the recommendations of the past four SAG meetings. Overall collaboration and coordination has been positive, however at times it has been inadequate (FAO, 2010). It has been noted that throughout the history of WECAFC, there has not been a clear strategy of the development of linkages with regional organizations (FAO, 2010) and this deserves some attention.

The Caribbean Large Marine Ecosystem (CLME) project has provided the opportunity for collaboration/cooperation under the following case studies:
- Shrimp and groundfish resources of the Guiana-Brazil shelf; WECAFC, CANARI, CERMES, CRFM
- Eastern Caribbean flyingfish; CRFM, WECAFC, CERMES, IFREMER,
- Large pelagic fishery; CRFM, IFREMER
- Spiny lobster; OSPESCA, WECAFC, CRFM
- Reef fisheries and biodiversity; UNEP

The CRFM Resource Working Groups and annual Scientific Meetings have also provided an opportunity for collaboration and cooperation in fisheries research. Representatives from the following organizations have actively contributed to the activities of the Working Groups:
- Canada Department of Fisheries & Oceans
- CERMES
- IFREMER
- Instituto Oceanografico – Univ de Oriente-Venezuela
- NMFS-SEFSC
- Universidade Estadual-Brazil

Socio-economic aspects of fisheries have also been receiving increased attention under projects such as SOCMON, which is being led by CERMES; and a Diagnostic Study to Determine Poverty Levels in Fishing Communities in Selected CRFM Member States, which is being led by the CRFM. Further details on these projects and institutions follow in the next section.

4. Overview of main fisheries research programmes in the Caribbean

Main institutions, organizations and projects that were involved in fisheries research since 2005

An overview of the main institutions, organizations and projects that were involved in fisheries research within the WECAFC area since 2005 is provided below. This list is not intended to be

exhaustive; rather it highlights important fisheries research aspects that have been addressed at the regional and international levels.

Projects

ACP FISH II Programme for Strengthening Fisheries Management in ACP Countries (ACP Fish II), 2009-2011[1]

The overall objective of the Programme is to contribute to the sustainable and equitable management of fisheries in ACP countries, while the specific objective is to strengthen fisheries sectoral policy development and implementation in ACP Countries. The expected project outputs are:

- Improved fisheries policies and management plans at the regional and national levels;
- Reinforced control and enforcement capabilities;
- Reinforced national and regional research strategies and initiatives;
- Developed business supportive regulatory frameworks and private sector investment;
- Increased knowledge sharing on fisheries management and trade at the regional level.

Caribbean Large Marine Ecosystem Project (2009-2013)[2]

This project is aimed at the improvement of management of shared living marine resources, most of which are considered to be fully or over exploited, through an ecosystem level approach in the Wider Caribbean. A preliminary Transboundary Diagnostic Analysis (TDA) has shown that unsustainable exploitation of fish and other living resources, habitat degradation and community modification, and pollution are the three priority issues affecting the CLME. The final TDA will serve as the scientific basis for the development of a Strategic Action Programme (SAP). Pilot projects on specific transboundary fisheries will test governance models at the local, national and sub-regional levels and provide additional knowledge on the application of ecosystem based management and the socio-economic importance of fisheries.

The CRFM leads the pilot studies on the Eastern Caribbean Flyingfish Fishery and the Large Pelagic Fishery. The Reef fisheries and Biodiversity pilot project is led by the UNEP Caribbean Regional Coordinating Unit. The Shrimp & Groundfish Project is led by FAO/WECAFC, and the Spiny Lobster Project is led by OSPECA.

Moored fish Aggregating Devices in the Lesser Antilles and Haiti Project (MAGDELESA), 2010 - 2011[3]

This project is focused on the sustainable management and development of moored FADs fishing in the Lesser Antilles and in Haiti. The following activities will be undertaken:

- Improvement of FAD design to make them law compliant, optimize their operation and reduce maintenance costs;
- Research on selective fishing techniques to control the fishing of juveniles or to reduce the fishing of specific species depending on the stock status;
- Catch & effort, and biological data collection of the target species;
- Development of a statistical digest in St Lucia and Dominica for the monitoring of the various components (biological, economic, social, technical) of FAD fisheries;
- FADs counting by aircraft survey to establish a connection between the density of FADs and catches;

[1] http://acpfish2-eu.org/index.php?page=Caribbean&hl=en

[2] http://www.clme.iwlearn.org/

[3]

- Evaluation of social and economic impacts of FADs use, taking into account the countries development differences;
- Analysis and definition of FADs governance methods in the Lesser Antilles;
- Fishing products quality in accordance with storage methods and on board processing until the sale, and also in relation to the accumulated pollutants (e.g. heavy metals);
- Analysis of working and safety conditions on board the vessels.

Institutions/Organizations

Caribbean Marine Protected Areas Management Network &Forum (CaMPAM) (2004-2011)[4]

Training of Trainers for MPA Managers

This programme focuses on MPA planning, policy, management, research and monitoring, as well communication and training skills in order to facilitate the dissemination of knowledge.

Promoting sustainable fishing practices and alternative livelihoods for fishers

Pilot sites are selected for implementation of small projects under the SPAW programme and are aimed at promoting cooperation between fishers and MPA managers for the common goal of conserving and restoring fisheries resources.

Exchanging lessons between MPAs

The aim of the programme is to facilitate exchanges between countries and sites where successful sustainable fisheries practices or alternative livelihoods for fishers have been developed to allow for transfer of experiences and practices within the region.

Caribbean Fisheries Management Council (CFMC)[5]

Moving forward: A snapshot of US activities in Ecosystem-Based Fisheries Management, 2005

This study provides a snapshot in time of efforts in the United States to begin implementing ecosystem-based fisheries management (EBFM) and describes some related initiatives within the scientific community to develop tools or provide a conceptual framework for implementation.

Conch (*Strombus gigas*) Stock Assessment Manual, 2008[6]

This manual provides a framework for assessing the status of exploitation of the Caribbean Queen Conch stocks. The aim is to facilitate research work necessary to comply with the CITES requirements concerning international trade.

Caribbean Workshop: Exploring Tools for Improving Management of Data-Poor Stocks, 2011[7]

The purpose of the workshop was to provide decision-makers in the US Caribbean with an opportunity to explore the tools available for addressing data-poor stocks and to consider how the region can best move forward.

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[4] http://www.cep.unep.org/about-cep/spaw/strengthening-and-management-of-protected-areas-in-the-wider-caribbean-region/campam-network-and-forum-1

[5] *www.caribbeanfmc.com/*

[6] http://www.caribbeanfmc.com/DR%20EHRHARDT/CONCH%20MANUAL.pdf

[7] http://www.fisheriesforum.org/caribbean-workshop-exploring-tools-improving-management-data-poor-stocks

Caribbean Community Climate Change Centre (CCCCC)

Regional Framework for Achieving Development Resilient to Climate Change, 2009-2015[8]

This is a core planning document to guide organizations with regards to achieving resilience to climate change.

Caribbean Regional Fisheries Mechanism Secretariat (CRFM)[9]

Resource assessment and training is conducted under the following working groups which were established in 2005 and meet annually during the Scientific Meetings.

- Shrimp and groundfish resources
- Lobster and conch resources
- Reef and slope fish resources
- Small coastal pelagic fish resources
- Large pelagic fish resources
- Ad Hoc Methods Working Group which became the Data, Methods & Training Working Group in 2009.

Formulation of Master Plan for Fisheries and Aquaculture Development and Management in the Caribbean, 2010-2012[10]

The master plan is being developed based on the results of three pilot projects:

- Pelagic Fishery Resource Development and Management using Fish Aggregating Devices (FADs) in St. Lucia and Dominica;
- Development of Fisheries Statistical System Models in Guyana and St. Vincent and the Grenadines;
- Small-scale aquaculture training in Jamaica and low cost small-scale aquaculture development in Belize.

The expected outputs are:

- A Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean;
- Reports of Baseline and Pilot Studies
- Transfer of relevant technology to the institutions and staff of CRFM Member States and CRFM Secretariat during the course of the Study.

Diagnostic study to determine poverty levels in fishing communities in selected CRFM Member States, 2010 – 2011 [11]

The objective of the project is to determine the poverty levels in fishing communities in CRFM Member States, and its effects on the communities' quality of life and structures, in order to identify suitable models for planning and implementing alternative livelihood programs and to alleviate poverty in fishing communities. It will also identify the demographic, socio-economic, biological and environmental variables underlying the low standards of living in the fishing communities, and devise means of monitoring and evaluating them to evaluate the success of poverty alleviation programmes. The following countries were involved in the study; Barbados,

[8] http://www.gcca.eu/usr/Executive-Summary-Draft.pdf

[9] www.caricom-fisheries.com

[10] http://www.caricom-fisheries.com/Projects/MajorProjects/tabid/58/Default.aspx

[11] http://www.caricom-fisheries.com/Projects/MajorProjects/tabid/58/Default.aspx

The Bahamas, Belize, Grenada, Guyana, Jamaica, Montserrat, St. Kitts and Nevis, St. Vincent and the Grenadines and Trinidad and Tobago.

Annual technical support and advice to countries in preparation for the International Commission for the Conservation of Atlantic Tunas (ICCAT) (Singh-Renton, 2010)

Centre for Resource Management and Environmental Studies (CERMES)[12]

Marine Resource Governance in the Eastern Caribbean (MARGOV) 2007-2011

The objectives of this project are to:

- Investigate governance in the context of small scale fisheries in the eastern Caribbean primarily using cross-scale network analyses with emphasis on features that enhance resilience and adaptation;
- Increase the capacities of partners to undertake their own research and use the results by involving them in the participatory applied research;
- Facilitate through outreach and information, the incorporation of the research results into initiatives related to marine resource governance for fisheries;
- Establish applied research into marine resource governance as a new demand-driven programme.

Socio-economic Monitoring by Caribbean Fisheries authorities (SOCMON) 2007-2009[13]

This project aims to contribute towards building capacity among all fisheries stakeholders; fisheries officers, fishers, landing site personnel, planners, coastal managers, enforcement agencies, local consultants, and others in socio-economic monitoring in the Caribbean.

Strengthening Principled Ocean Governance Networks (PROGOVNET): Transferring Lessons from the Caribbean to the Wider Ocean Governance Community (2008-2010). [14]

The project goal was to understand the role networks can play in the successful implementation of a principled ocean governance regime for the Wider Caribbean and to use the lessons learned to develop a regional ocean governance framework that can be adapted by other ocean governance communities throughout the world.

The Caribbean Ocean Governance Linkages Project (COGLink), 2010 [15]

This project explored how the states in the Wider Caribbean Region relate to regional organizations and projects that deal with transboundary ocean governance issues, with regards to participation of States in their meetings.

Gulf and Caribbean Fisheries Institute (GCFI), 1949-2011[16]

This is an annual forum of marine fisheries scientists in the Wider Caribbean. A wide range of topics are covered including: Fisheries Biology, Ecology, and Assessment; Marine Invertebrates, Fish Spawning Aggregations, Management and Socio-Economics of Marine Fisheries, Science and Management of Marine Protected Areas; Pelagic and Recreational Fisheries; Essential Fish

[12] http://www.cavehill.uwi.edu/cermes/

[13] http://www.cavehill.uwi.edu/cermes/socmon_project.html

[14] http://marineaffairsprogram.dal.ca/MAP_Projects/PROGOVNET.php

[15] http://www.cavehill.uwi.edu/cermes/coglink_home.html

[16] www.gcfi.org

Habitats; Marine Aquaculture; Sustainable Fisheries; Marine Conservation in the Wider Caribbean; Climate Change; and Marine Invasive Species.

International Commission for the Conservation of Atlantic Tunas (ICCAT)[17]

ICCAT was established in 1969 and co-ordinates the management of all tunas and tuna-like species in the Atlantic Ocean and adjacent seas, including the Caribbean Sea and the Gulf of Mexico. The following activities are carried out by ICCAT:

- Monitoring and management of by catch in all Atlantic tuna fisheries, including bycatch of non-target fish species such as seabirds, turtles and whales
- Formulation and implementation of recovery and other management and conservation strategies for all species of tunas, billfishes, mackerels and sharks found in the Atlantic region.
- Maintenance of a statistical database of tuna fishing activities occurring within the ICCAT Convention Area
- Coordination of international research programmes that examine the biology, ecology and abundance of the fish populations concerned.
- Determination and adoption of appropriate resolutions and recommendations for management and conservation of the resources and fisheries concerned, including adoption and implementation of stock recovery/ rebuilding plans.

Training workshop on data collection and improvement in the Caribbean region**,** 2009 (ICCAT, 2010)

This workshop was conducted by ICCAT in collaboration with the CRFM. The topics covered included:

- A description of ICCAT species present in the region, historical catches and the spatial distribution of those catches. A summary of stock status for those stocks assessed by ICCAT was also provided;
- A description of the process of providing data to ICCAT through the various forms, including the Task I, Task II catch and effort and Task III size data;
- Exploration of features in Excel for data manipulation, data management and statistical analysis;
- A description on how to raise sample catches to total catches for simple random and stratified random surveys;
- Introduction to basic assessment models and reference points including estimation of maximum sustainable yield, yield per recruit and spawning per recruit.

International Coral Reef Initiative (ICRI)[18]

ICRI is a partnership among governments, international organizations, and non-government organizations with an interest in preservation of coral reefs and related ecosystems.

Regional Lionfish Strategy Workshop, 2010. [19]

The objectives of the workshop were to:

- Identify and refine 'best practices' for control of the invasive red lionfish (*Pterois volitans*) in the Caribbean;

[17] www.iccat.es

[18] *www.icriforum.org/*

[19] http://www.icriforum.org/sites/default/files/ICRI-Lionfish-Workshop-Summary.pdf

- Create the foundation for a regional body to work collaboratively on lionfish issues in the Wider Caribbean;
- Increase regional awareness, communication, collaboration, and capacity to assess ecological impacts and control lionfish in the Wider Caribbean;
- Achieve consensus among workshop participants on effective lionfish control strategies, action items, and future initiatives while simultaneously recognizing the unique challenges faced by each country represented at the workshop.

International Development Bank

Caribbean Regional-track Strategic Program on Climate Resilience, 2011[20]

The activities of the region-wide pilot include data management and monitoring for improving the understanding of climate risks and potential impacts.

Marine Stewardship Council (MSC)[21]

Pilot program for data limited fisheries

The MSC framework assesses fisheries against performance indicators for three main principles; the status of stocks; impacts on the ecosystem; and management conditions with economic and social considerations as an extra principle where information is available. The MSC's fishery certification program and seafood eco-label recognize and reward sustainable fishing. Latin American and Caribbean countries are significant exporters of fish and the data limited program will enable a number of the region's fisheries to explore MSC certification.

National Oceanic and Atmospheric Administration (NOAA)

SouthEast Data, Assessment, and Review (**SEDAR**) (2002-Present)[22]

SEDAR is conducted annually during three workshops:

- A data workshop where datasets are documented, analyzed, and reviewed and data for conducting assessment analyses are compiled;
- An assessment workshop where quantitative population analyses are developed and refined and population parameters are estimated;
- A review workshop where a panel of independent experts reviews the data and assessment, and recommends the most appropriate values of critical population and management quantities.

Organization of Fishing and Aquaculture in Central America (OSPESCA)[23]

Strengthening Information on Fisheries and Aquaculture in Central America as the basis for decisions 2006-2008

The project sought to harmonize statistical data collection at the national and regional levels.

[20] http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/PPCR%20Caribbean%20-%20Regional%20Track%20Program_1.pdf

[21] www.msc.org

[22] http://www.sefsc.noaa.gov/sedar/

[23] http://www.sica.int/ospesca/

Strengthening of Interdisciplinary Fisheries Research for Responsible Fisheries in the Countries of Central America - FIINPESCA - (OSPESCA-FAO-SWEDEN), 2005-2009

The project contributed to the improvement of scientific knowledge on the exploitation status of the fishery resources as well as the economic and social aspects that characterize the respective fisheries, by strengthening the fisheries research capacity based on an interdisciplinary approach.

World Wildlife Fund (WWF)

Sustainable Fisheries in Latin America: A Blueprint for Sustainable Tropical Shrimp Trawl (TST) Fisheries[24]

This study sought to (1) identify and understand the critical problems found in tropical shrimp trawl fisheries and their causes, and (2) create, based on examples of best practice and potential solutions, a "blueprint" which can support a transition of TST fisheries to more sustainable practices.

Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems: Chapter 6- Increasing the Resistance and Resilience of Tropical Marine Ecosystems to Climate Change[25]

Chapter 6 offers an introduction to the effects of climate change on tropical marine systems, as well as an overview of the types of strategies that might be adopted to increase the resistance and resilience of tropical marine protected areas. This chapter focuses mostly on coastal systems, with some information on pelagic systems.

Working for Sustainable Fishing[26]
Using the EBM framework, WWF is engaging with the fishing industry to:

- Improve fisheries management
- Reduce the impacts of fishing
- Promote sustainably caught seafood

Main fisheries research priorities of these institutions since 2005

This paper is the result of a desk top study and sought to identify fisheries research priorities of the organizations/institutions based on literature reviews and personal communication. However, given the different organizational structures and work programmes, it was difficult to identify specific research priorities. Therefore a summary of the broad fisheries research areas by organization is provided below.

CERMES

- Marine governance
- Ecosystem based management
- Socio-economic monitoring
- Climate change
- Fisheries biology and management

[24] http://www.wwfguianas.org/?201770/A-Blueprint-for-moving-toward-sustainable-tropical-shrimp-trawl-fisheries

[25] http://wwf.panda.org/about_our_earth/all_publications/?8678/BUYING-TIME-A-Users-Manual-for-Building-Resistance-and-Resilience-to-Climate-Change-in-Natural-Systems

[26] http://wwf.panda.org/what_we_do/how_we_work/conservation/marine/sustainable_fishing/

CFMC

- Data limited stock assessments
- Fisheries management plans
- Ecosystem based management

CRFM[27]

- Fisheries Statistics & Information
  - Establishment of a regional fisheries database
- Fisheries Research & Resource Assessment
  - Stock assessment
  - Ecosystem based management
- Fisheries Resource Management & Development
  - Formulation of a Master Plan on Sustainable Use of Fisheries Resources for Coastal Community Development in the Caribbean
  - Aquaculture
  - Socio-economic monitoring

ICCAT

- Fisheries statistical database
- Stock assessment
- Catch allocations
- Ecosystem based management

IFREMER [28]

- Contribute to sustainable fisheries and aquaculture
- Promote shared capacity for technological information

MSC

- Stock assessment
- Ecosystem based management
- Socio-economic considerations

NOAA/NMFS[29]

- Protect, Restore, and Manage the Use of Coastal and Ocean Resources Through an Ecosystem Approach to Management
  - Ecosystem observations
  - Ecosystem research
  - Fisheries management
  - Habitat
  - Coral reef conservation
  - Aquaculture
- Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond
  - Climate and ecosystems

[27] http://www.caricom-fisheries.com/LinkClick.aspx?fileticket=rZZDc2vXObY%3d&tabid=83

[28] http://wwz.ifremer.fr/institut_eng/The-Institute/Reference-documents/Strategic-Plan

[29] *www.nmfs.noaa.gov/mb/**strategic**/NMFS**strategicplan**200510.pdf*

OSPESCA

- Regional management of fisheries and aquaculture
- Institutional and organizational strengthening
- Central American regulation harmonization

WWF

- Sustainable fishing
  Building resilience to climate change

The observed changes in research activities from 2005-2010 as seen in the previous section have been influenced by factors such as: the extent of fishing; the development of new techniques and approaches; fisheries governance initiatives at the national, regional and international levels; and increasing awareness on the impacts of external factors on fisheries.

Initially, the focus was on biology of the target species and fishing technology, followed by an increased emphasis on fisheries management and development. Capacity building, development of resilience to external factors such as climate change and the incorporation of the social and economic factors associated with fishers and their communities are also now being considered (FAO, 2010). The development of governance frameworks and the application of the ecosystem based management are now being explored and supported by numerous projects and organizations. There is a renewed focus on the use of Marine Protected Areas (MPAs) as a fisheries management tool and the biology, ecology and effects of invasive species, such as the lionfish are also currently being investigated. The role of NGOs in conducting fisheries research is increasing as seen with the MSC and WWF and their efforts to promote sustainable fisheries.

Gaps in attention of fisheries research programmes in the region

The move towards an integrated approach to the management of living marine resources has revealed the existence of various knowledge gaps (Heileman, 2007). Even though many fisheries research areas are being addressed by various institutions and projects, the following areas have been identified as requiring additional attention (Heileman, 2007; FAO, 2010).

- Recruitment and stock issues that are not the result of over-exploitation, but the result of environmental factors and climate change;
- The anticipated impacts climate change on fisheries and other vulnerability issues;
- The need to understand and strengthen the role of the fisheries sector in building resilience;
- The fact that resource economics, a discipline which is not yet at the centre of fisheries management, needs to gain much more prominence;
- The high impact of tourism on the demand for fisheries resources, and on environmental quality and productivity;
- Recreational fisheries;
- The high degree of uncertainty in the spatial oceanic dynamics of migratory species, and a need for standardized indices of abundance, sustainable yield, and fishing effort;
- Biology and population dynamics of individual species;
- Ecological interactions within fish communities;
- Impacts of fishing and other pressures on ecosystem structure and function and threshold levels at which the ecosystem could collapse;
- The distance and direction of larvae dispersal, movement patterns during the juvenile and adult phases of important fisheries species;
- Behaviour and temporal variability of water masses in the vicinity of complex coastlines;
- Biological connectivity of marine populations, both large-scale (oceanic, via larvae or adult migration) or cross-shelf (seasonal and ontogenetic changes);

- Spatial extent and distribution of habitats (habitat mapping);
- Economic value of coastal and marine ecosystems and the ecosystem services they
- provide;
- Linkage between habitat degradation and increasing fish and coral diseases;
- Impacts of pollution on sensitive habitats, and on living marine resources.

Constraints and opportunities for addressing these gaps

Given the knowledge gaps that currently exist, the best available scientific information along with a precautionary and adaptive approach should be used to manage the fisheries in the WECAFC area. A significant investment in research is necessary to address these knowledge gaps and collaboration among fisheries institutions and organizations is critical in achieving this task (Heileman, 2007). The WECAFC area is characterized by complex and diverse ecological, linguistic, cultural, economic and political settings, which influences fisheries management capacities (FAO, 2010). This has resulted in extreme diversity in capacities and management systems which makes the promotion of effective collaboration and harmonization of management regimes among countries difficult. There has been an improvement of governance of living marine resources in many countries at the national level within recent years, however as noted by Heileman, 2008, management of resources (especially trans-boundary ones) at the national, sub-regional, and regional levels has been constrained by a number of factors including:

- Institutional and legal deficiencies;
- Limited co-ordination and collaboration among the fisheries stakeholders;
- Low level of data and information exchange among the countries;
- Gaps and overlaps in the legislative framework for coastal and marine management;
- Low level of implementation of regional and sub-regional MEAs;
- Limited participation by stakeholders in the management of living marine resources;
- Overlap of living marine resource management goals throughout the Caribbean, which could result in conflicts if these goals are incompatible with each other.

At present, it is critical for fisheries issues to be considered alongside trade, ocean governance, tourism, social reform and climate change issues. A coherent governance framework is necessary to ensure that there is collaboration amongst all these sectors. This need has prompted the development and implementation of projects such as CLME and MARGOV, which are expected to recommend solutions.

As an advisory body, WECAFC provides the opportunity for institutions and persons to cooperate and collaborate on these issues through the:

- Sessions of the Commission;
- Activities of the Ad hoc Working groups;
- Workshops and expert consultations;
- Projects implemented, directly or indirectly, under the auspices of WECAFC.

However, WECAFC is currently facing a number of difficulties including; reduced inter-sessional activities of the Working Groups; lack of financial resources; reduced budgets and insufficient funding (FAO, 2010). The wide membership of WECAFC provides an excellent opportunity for collaboration/cooperation on fisheries research and a cost-effective way to support improvements in fisheries management.

5. Priority fisheries research issues for WECAFC for the period 2012-2013

The following five areas have been identified as priority areas for WECAFC for the period 2012-2013: (i) comprehensive fisheries assessment; (ii) building capacity for fishery data collection, assessment and management; (iii) incorporating social, economic and livelihood considerations; (iv) Fisheries and aquaculture development and management; and (v) impact of climate change on fisheries. The first three areas have also been identified by (Chuenpagdee *et al*., 2011)

1.) Comprehensive Fisheries Assessment

The fisheries in the WECAFC region are multi-gear and multi-species in nature with complex fleet interactions. Traditionally, the focus of assessments has been mainly biological, however the need for integrated assessments which can produce multidimensional advice with a broader perspective has been recognized (García *et al*., 2008). Collection of landings data is common for the target species, however in many instances these data are not representative for the whole stocks and most assessments are based on single species and given the diversity of the fisheries, this is inappropriate. Fishers also change their areas of operation on a seasonal and spatial basis, especially when targeting sedentary resources with a heterogenous distribution. Therefore, in addition to analyzing landings data, spatial distribution of the resources, spatial catch and effort trends, fishing strategies and fleet dynamics also need to be considered in order to achieve an integrated assessment (Caddy and Defeo, 2003; Caddy and Seijo, 2005). The development and implementation of appropriate approaches for fisheries (stock) assessment requires improved technical and financial support for research on a permanent basis and should be considered by WECAFC.

2.) Building Capacity

Given the wide range in financial resources and capacity, which exist in the WECAFC region, an integrated approach to fisheries assessments requires increased capacity of personnel and institutions at the national, and regional levels. This can be achieved through project development and training for:

- Selection and/or design of appropriate assessment approaches;
- Design of data collection systems to address fisheries management questions, which take the ecosystem into account;
- Decision making which takes into account the uncertainty and incomplete knowledge of the fishery and the ecosystem in which it operates;
- Developing an understanding of ecosystem functions among fishers and fishing communities, and their roles in achieving effective fisheries management;
- Increasing local capacity of fishers and fishing communities for self-regulation and self-organization to effectively participate in fisheries management;
- Community based management.

3.) Aquaculture Development and Management

Aquaculture continues to be the fastest growing animal food-producing sector and it is expected to surpass capture fisheries as a source of food fish (FAO, 2009b). Aquaculture in the Wider Caribbean region production accounts for less than one percent of the world's aquaculture and culture efforts are directed mainly towards non-native species such as tilapia (FAO, 2011) as well as shrimp which rely on imported seed. The main factors responsible for the slow development in aquaculture have been the lack of technical expertise, infrastructure, capital investment and human resources (FAO, 2011). In 2010, a workshop was held to assess the feasibility and sustainability of establishing a regional shellfish hatchery for the Wider Caribbean.

The recommended native shellfish species for the hatchery included the: mangrove cupped oyster; Lion's paw scallop; pearl oyster; West Indian top shell; sea egg; and four-sided sea cucumber. Sea-cucumbers are considered to be threatened, due to overexploitation and lack of harvest

regulations and the release of juvenile sea cucumbers produced in the hatchery would assist in rebuilding wild stocks (FAO, 2011). A steering group comprising the FAO Fisheries and Aquaculture Department, the Caribbean Regional Fisheries Mechanism (CRFM) and aquaculturists, was formed to: i) promote the concept of the regional hatchery at the ministerial level; and ii) coordinate efforts of individual countries to work towards a regional goal. The group will also be responsible for producing a business proposal to submit for donor funding. It is recommended that WECAFC participates in the Steering Group and provide assistance to the countries in exploring the full potential of aquaculture.

4.) Incorporating social, economic and livelihood considerations

In the WECAFC, fisheries contribute to food security and are a major source of employment and income for coastal communities. Many of these fisheries are small-scale and characterized by: seasonal fishing supplemented with other economic activities; low levels of capital investment and the use of labour intensive harvesting, processing and distribution methods; and reduced ability to influence the market due to their limited capital investment (Salas *et al*., 2007). As a result, many fisheries management issues are socio-economic in nature and include aspects of the entire coastal economy (Staples *et al*., 2004; Salas *et al*., 2007a; García *et al*., 2008). It is therefore necessary to understand the characteristics and functioning of fishing communities, the dynamics of fishing operations, fishers response to management and regulation, as well as the way fishers cope with vulnerability (Chuenpagdee *et al*., 2004; Salas and Gaertner, 2004; De Young *et al*., 2007). This would facilitate the establishment of appropriate programmes and initiatives geared towards developing sustainable fishers and fishing communities.

5.) Impact of Climate Change on Fisheries

It is expected that climate change will affect fisheries through habitat alteration and loss; reduced abundance and diversity; and shifts in distribution induced by changes in ocean currents (Nurse, 2008). Extreme weather events are also projected to become more frequent and/ or intense in the future. Exposure and sensitivity of small-scale fisheries within the WECAFC area to climate change are considered be high, whereas the adaptive capacity is low (FAO 2005b, Salas *et al.*, 2007). The reasons for inclusion of this subject among the regional research priorities are:

- Observed and projected negative impacts (direct and indirect) on the sector, e.g. through habitat and ecosystem damage, e.g. bleaching of corals, additional stress on mangroves and seagrasses;
- Linkage between ocean warming as a triggering mechanism in the proliferation of harmful algal blooms and various diseases;
- Dependence of fisher folk on sector for employment, revenue generation and human well-being;
- Housing and fishing operations located in low-lying coastal areas which are vulnerable to climate-related events such as hurricanes, storm surge and sea-level rise;
- Lack of consistent governmental, access to capital on reasonable terms, and weak fisher folk organizations;
- Lack of insurance and other institutional support to enable the sector to rebound in the aftermath of extreme events.

It is therefore important that the appropriate response strategies are developed and effectively implemented.

6. Potential partner institutions for WECAFC in terms of its work on above research priorities

Table 1: Potential Partners Institutions

Organization/ Project	Comprehensive stock assessment	Building capacity	Aquaculture management and development	Incorporating social, economic and livelihood considerations	Impact of climate change on fisheries
ACP Fish II	X	X	X	X	
CaMPAM		X		X	
CCCCC					X
CERMES		X	X	X	X
CFMC	X	X			
CLME	X	X	X	X	X
CRFM	X	X	X	X	X
GCFI	X	X	X	X	X
ICCAT	X	X	X		X
ICRI	X				X
IDB					X
MAGDELESA	X	X	X	X	
MSC	X	X	X		
NOAA	X	X	X	X	X
OSPESCA		X	X	X	X
WWF	X	X		X	X

7. Summary of conclusions and recommendations

The five research priorities identified in the preceding section are pivotal in achieving effective fisheries management and addressing the existing knowledge gaps. As discussed by the past four SAG meetings, this paper highlights the fact that collaboration/cooperation amongst the various organizations with fisheries research interests is necessary to avoid research overlap and ensure the best use of limited financial and human resources.

It is therefore recommended that WECAFC partner organizations and members further contribute to the preparation of this document, by sharing their current fisheries research priorities, activities and outputs. This would serve as a useful reference document and allow areas of overlaps/gaps to be easily identified.

The SAG is requested to:

1) Review, discuss and agree on the research priorities for WECAFC, in collaboration with partners;
2) Identify under which components of the 2012-2013 work plan the research priorities will be addressed;
3) Advise on the establishment of an information exchange mechanism to strengthen the research linkages with partner organizations/institutions.

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