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FIFTH MEETING OF THE WORKING GROUP TO PROMOTE SUSTAINABLE AQUACULTURE DEVELOPMENT

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**Report of the Fifth Meeting of the Working Group to Promote
Sustainable Aquaculture Development (Electronic), 11 September 2024**

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	-	African, Caribbean and Pacific states
CARICOM	-	Caribbean Community
CARIFORUM	-	Caribbean Forum of African, Caribbean and Pacific States
Cefas	-	Centre for Environment, Fisheries and Aquaculture Science of the United Kingdom
CITES	-	Convention on International Trade in Endangered Species of Wild Fauna and Flora (also known as the Washington Convention)
COTED	-	Council of Trade and Economic Development of the Caribbean Community
CPSO	-	CARICOM Private Sector Organisation
CRFM	-	Caribbean Regional Fisheries Mechanism
FAO	-	Food and Agriculture Organization of the United Nations
FISHCOM	-	Fisheries and Aquaculture Priority Commodity
GDP	-	Gross domestic product
IMTA	-	Integrated multi-trophic aquaculture
MDCs	-	More Developed Countries (of CARICOM)
SLC	-	Subregional Office for the Caribbean
SME	-	Small and Medium-sized Enterprises
SPS	-	Sanitary and Phyto-sanitary
TCDC	-	Technical Cooperation between Developing Countries
ToRs	-	Terms of Reference
UNCLOS	-	United Nations Convention on the Law of the Sea
UWI	-	University of the West Indies
WGA	-	Working Group to Promote Sustainable Aquaculture Development

SUMMARY REPORT

The primary aims of this Fifth Working Group Meeting are to: consider the summary and update since the 4th Meeting of the CRFM Working Group to Promote Sustainable Aquaculture (WGA) held on 30 June 2022; elements of the enabling environment for promoting aquaculture development; and other considerations for the further implementation of the 5-year Work Plan for Aquaculture Development. The deliberations and recommendations of the Working Group will be brought to the attention, as appropriate, of the CRFM Executive Committee, Caribbean Fisheries Forum, and/or Ministerial Council for further consideration.

The Working Group includes government officers from the main aquaculture-producing CARICOM States, private sector representatives, and experts from partner educational institutions. The list of attendees (50% female) at the Fifth meeting is attached.

Fisheries Officers, Scientists aquaculture focal points, and private sector representatives from CRFM Member States attended the Meeting, which was held electronically via Microsoft Teams. The Meeting was chaired by Avery Smikle, Director, Aquaculture Branch, National Fisheries Authority of Jamaica. In attendance were Dr. Maren Headley, Programme Manager, Fisheries Management and Development, CRFM Secretariat; other staff of the CRFM Secretariat; Dr. Yvette Diei Ouadi, Fishery and Aquaculture Officer, Food and Agriculture Organisation of the United Nations (FAO); and other staff of FAO..

Call to order

The Meeting was called to order at 08:35am Belize time (09:35am Jamaica time and 10:35am Eastern Caribbean time) by the Convener, Mr. Peter A. Murray, Advisor, Fisheries Management and Development of the CRFM Secretariat. Mr. Murray gave welcoming remarks in the unavoidable absence of Dr. Sandra Grant, Deputy Executive Director of the CRFM Secretariat.

Mr Murray noted that there remains concern that SIDs have been left behind in aquaculture development with larger countries making more rapid progress. Special attention needs to be paid to the challenges faced by CRFM Members to ensure that we can overcome the many challenges. There is a need for targeted solutions and investments. The actions and support that we require need to be clearly defined and enunciated. These need to be given higher priority than is currently the case and require long-term commitment and support to obtaining funding, technical assistance, and assistance in creating the necessary policy environment for aquaculture, including, mariculture to flourish.

It is important to promote small-scale aquaculture and in so doing recognize that integrated multitrophic aquaculture is an important and useful means to support ecosystem-based management efforts. There is need for the development and implementation of more prominent actions, including global, regional, and national initiatives toward the improvement of gender equality and the empowerment of women in aquaculture; mindful that socio-cultural expectations, socio-economic dynamics, and power dynamics contribute to the roles that men and women have in the sub-sector.

CRFM States should be encouraged to put in place the relevant policies to boost the sector's growth. Saint Lucia has made great strides while in Belize we have seen a nexus develop between gender involvement and seaweed mariculture that provides a useful case that could be emulated.

Market-related challenges, including eating habits and food product development, as well as issues related to SPS and other non-tariff barriers, constrain the growth of seaweed aquaculture, however, FAO can assist with creating awareness of the benefits of seaweed consumption, notwithstanding that capacity building and specific training development along the entire seaweed value chain is required. It is necessary for development partners to provide guidance to Members to access market-based mechanisms that incentivize aquaculture activities such as seaweed farming and which provide ecosystem services, maintain healthy local marine ecosystem functioning, and contribute to addressing climate change impacts. Sanitary and phyto-sanitary (SPS) issues and other non-tariff barriers can pose challenges to exportation of aquaculture products. It is in that context that we are hosting this meeting today

After Mr. Murray's remarks, the provisional Agenda was tabled and was accepted by the Meeting with no amendments (see *Appendix 1*) having been moved by the participant from the Bahamas and seconded by the participant from Jamaica.

Introduction of participants, review of the ToRs of the Working Group and election of Chair

Participants introduced themselves (see *Appendix 2* for the list of participants)

Participants were asked to consider who should chair the current meeting. While the representative of the Turks and Caicos Islands, which currently chairs the Caribbean Fisheries Forum and Ministerial Council, appeared unwilling to chair the meeting, Ms. Avery Smikle of Jamaica was asked to the chair and graciously accepted.

The Convener presented the current Terms of Reference (ToRs). The objective of the working group is to promote sustainable aquaculture development at the national and regional levels for purposes of, among other things, increasing food production security, improving rural income and employment, diversifying farm production, and increasing foreign exchange earnings and savings, and to advise the Caribbean Fisheries Forum on policies, programmes, and projects to promote the development of aquaculture. The 15 of them listed terms of reference were taken as read.

Discussion

Consideration was given to making explicit mention of adding the production of statistics to the terms of reference, in particular the role for the working group in standardizing how aquaculture statistics are reported from the region. There are currently gaps in the collection and compilation of aquaculture statistics. Data on hydroponics and the growing of ornamental fish were given as examples of data gaps, which the Working Group can play a role in helping to obviate. It was also suggested that the terms of reference might consider intersectoral linkages between aquaculture value chains and sectors such as tourism or agriculture.

It was noted that a previous meeting of the WGA had been asked to consider the revision of its membership to more include mention of representatives of the private sector and academia: such that "the membership of the group would be comprised of Member States and agencies which are interested in collaborating and cooperating in the promotion of aquaculture development at the national and regional levels, including, *inter alia*, participants from the private sector and academia, as appropriate." This was done to ensure more fulsome perspectives being brought to the discussions and have the advantage of allowing for better buy-in to the recommendations emanating from the working group. The recommendations for revising the terms of reference of the Working Group have been incorporated into the attached Terms of Reference (*Appendix 3*)

Action

The Working Group:

Noted the participants at the meeting

Appointed Ms. Avery Smikle of Jamaica to chair the current meeting

Noted the current Terms of Reference of the Working Group to promote sustainable aquaculture development

Agreed to the revision of the terms of reference to include reference to improvement of statistics on aquaculture and consideration of a role for the working group in providing guidance with regard to intersectoral linkages

Summary on status of aquaculture in the CRFM Member States and update since the 3rd Meeting of the CRFM Working Group to Promote Sustainable Aquaculture

Summary of WGA4

The Fourth Meeting of the Working Group to Promote Sustainable Aquaculture Development had been held virtually on 20 November 2019, under the chairmanship of Mr. Kris Isaacs, of St. Vincent and the Grenadines. The summary report of the meeting had been circulated as a reference document - Summary Report of Fourth Meeting of the CRFM Working Group to Promote Sustainable Aquaculture, CRFM Technical & Advisory Document Number 2022/04, and was taken as read

Update since WGA3

CRFM Secretariat has done little with regard to aquaculture since the 4th meeting of this working group, primarily since it was envisaged that the survey on Five-year Work Plan for aquaculture development in the Caribbean would have provided some direction in this regard.

Notwithstanding, CFF 21 had recognised that the CARICOM approach to aquaculture development is still seen as being multifaceted to address the range of available natural land and fresh-water resources in the region while incorporating the commercial elements. The Forum also acknowledged that because of the limited potential growth of wild catches in the Caribbean region, sustainable expansion and intensification of fish production through responsible aquaculture development should remain a major objective for countries in the region.

Following this, the Seventeenth Meeting of the Ministerial Council of the Caribbean Regional Fisheries Mechanism (April 2023) acknowledged the urgent need to promote the development of aquaculture in the region in a sustainable manner, to enhance its contribution to food and nutrition security, job creation, trade, and blue economic growth, and reducing pressure on nearshore fisheries. Further to that the Council requested the CRFM Secretariat to continue development of project proposals for implementation of the 5-year Work Plan for Aquaculture Development; and, reiterated its request to the CRFM Secretariat to facilitate discussions with the government of China regarding support for the development of Integrated Multi-Trophic Aquaculture in the region.

The Eighteenth Meeting of the Ministerial Council of the Caribbean Regional Fisheries Mechanism (April 2024) repeated these requests

After WGA3, CRFM had developed a concept note for a project which is geared toward demonstrating the feasibility of integrated multi-trophic aquaculture (ITMA) systems to improve sustainable production, and speaks to the preparation of a detailed activity implementation plan for the development of ITMA, with practical recommendations for short and medium-term objectives; based on information and understanding gained from industry analyses, economic valuations, feasibility assessments and research, as well as capacity building and support for investment in ITMA. This draft concept note is being presented at this current WGA meeting at *Agenda item 9*.

CRFM has begun to network with the Yellow Sea Fisheries Research Institute of China, which had been planning to send a mission to the region in 2020. However, this mission had not been carried out due to the COVID-19 pandemic and arrangements have since been on hold. It was noted that the Yellow Sea Fisheries Research Institute is willing to help promote aquaculture and specifically multitrophic aquaculture. The work done by China in the Yellow Sea area on lower trophic species mariculture in the coastal, marine environment is most relevant, since it is the area of greatest potential for most CRFM Member States vis-à-vis inland aquaculture. CRFM Secretariat will continue to reach out to the Yellow Sea Fisheries Research Institute to explore areas of cooperation

Overview of aquaculture

An overview of CRFM Member States' aquaculture (as at August 2022) had been circulated. It was noted that, in general, the aquaculture sector is not well developed in the CARICOM region. Most CARICOM States have limited land and freshwater resources; in fact, this was the rationale for the decision by the OECS members of CARICOM, in the mid-1990s, that land-based aquaculture would not be the focus of their fisheries development thrust, except as a subsistence activity for small farmers. Notwithstanding, the 1999 OECS Fisheries Management Strategy and Implementation plan speaks to the conduct of applied research on aquaculture/mariculture in support of the stated aim to create a diversified and sustainable production base.

This has prompted OECS countries, as well as Jamaica, to see the potential for aquaculture as part of their fisheries development paradigm. Aquaculture production by CARICOM Member States, has been mainly due to only a few of the countries and a few species.

Because of the limited potential growth of wild catches in the Caribbean region, sustainable expansion and intensification of fish production through responsible aquaculture development should be a major objective for countries in the region. In keeping with this, aquaculture development policy formulation was identified as one of the areas to be addressed under the CRFM/JICA Master Plan Study (2009-2011).

The CRFM had identified aquaculture as a priority since 2002; in 2011, it was announced that the CARICOM development strategy for 2013-2020 includes plans to develop the sector by adopting an ecosystem approach to aquaculture. Recognizing the need to put in place a mechanism to promote and provide support for the development of aquaculture in the region, the CRFM Secretariat also established the Working Group to Promote Sustainable Aquaculture Development (WGA) at the national and regional levels, mainly for the purposes of: increasing food production and security; improving rural income and employment; diversifying farm production; and increasing foreign exchange earnings and savings as well as advising the Caribbean Fisheries Forum on policies, programmes and projects to promote the development of aquaculture.

In the Caribbean Community Common Fisheries Policy (CCCFP), objective (a) of section 4.3 is aimed at promoting the sustainable development of fishing and aquaculture industries in the Caribbean Region as a means of, *inter alia*, increasing trade and export earnings, protecting food and nutrition security, assuring supply to Caribbean markets and improving income and employment opportunities. *Section 10-Fisheries Sector Development*, of the CCCFP, states that Participating Parties, to the extent of their capabilities, will endeavor to promote and adopt measures to enhance the development of the fisheries and aquaculture sectors. Against the backdrop of recent experiences of the aquaculture sector of Belize, there is recognition of the need to improve disease management in general, including through the development and implementation of disease management strategies that are tailored to the specific needs of the region. This can include developing and implementing biosecurity measures to prevent the introduction and spread of diseases; developing appropriate treatment and control measures for diseases that do occur; implementing mandatory inspection programme; and strengthening governance related to anti-microbial resistance

The CRFM Ministerial Council has agreed that economic models for varying scales and types of aquaculture operations (including multi-trophic aquaculture and aquaponics) should be promoted among Member States.

In the case of *Antigua and Barbuda*, aquaculture production of mainly freshwater *Tilapia* spp. continues to grow exponentially. This growth was abated in 2020 due to reduced demand as a result of the COVID-19 pandemic. A *Feasibility Study on Climate Smart Aquaculture in Antigua and Barbuda*, was completed in 2019 under the FAO/GEF-funded Project for Climate Change Adaptation of the Eastern Caribbean Fisheries Sector (CC4FISH). However, the focus was on mainly addressing issues pertaining to freshwater culture on land and in the context of the following objectives:

- sustainably increase aquaculture productivity and the incomes of aquaculture producers,

- strengthen the capacities of aquaculture communities to adapt to the impacts of climate change and, where possible,
- reduce and/or remove greenhouse gas emissions.

In 2021, one local enterprise, Sea Springs Aquafarm, launched the country's first freshwater prawns and crayfish farm using *Macrobrachium* spp and *Cherax quadricarinatus*. The company aims to satisfy local demand while reducing the import bill; in 2019, 111 metric tons of frozen shrimp and prawns were imported into Antigua and Barbuda.

In terms of mariculture, critical issues affecting its development included:

- Susceptibility to natural disasters mainly tropical storms; according to the Centre for Research on the Epidemiology of Disasters, Antigua and Barbuda was one of the most highly exposed countries in the world to natural disasters, ranking among the top four countries by land area and population affected by disasters from 1970 through 2002 (International Monetary Fund, 2004).
- Absence of or inadequate insurance; market failure existed for this type of venture due to the fact that it is an “emerging” enterprise.
- Accessing financial resources was difficult; similar to the insurance companies, lending institutions perceived capital investment in coastal or open ocean facilities as being high risk.
- Availability of suitable coastal areas for mariculture; most of the prime areas were already utilised by tourism and port infrastructures.
- User conflict with other maritime-related sectors such as tourism, transport, water (desalination), and tours and recreation.
- The *Sargassum* phenomena; its unpredictability and its impact on water quality have made culturing in certain traditional areas untenable.
- Incomplete legislative framework for aquaculture; statutory instruments related to areas such as environmental assessment and monitoring, limits set on stocking density, use of drugs and chemicals, fish health management, etc., need to be developed and enacted.
- Impact of non-indigenous marine species on ecosystems and biosecurity (i.e., the possibility of species becoming invasive and/or introduce new diseases).
- Producing a competitive-priced product in an environment where most of the inputs (feed, equipment, etc.) were imported.

Based on the aforementioned challenges, a Strategic Action Plan is needed to address all of the issues.

The Bahamas also considered the feasibility of sponge aquaculture as a sustainable low-cost industry. The culture of the mangrove oyster (*Crassostrea* spp.) had been considered in Saint Lucia in the early 1980's and a culture project was set up in Jamaica in 1997 for this oyster. A study published in 2003 suggested that prospects for farming the Caribbean Spiny Lobster, *Panulirus argus*, were worthy of consideration. Because of the limited potential growth of wild catches in the Caribbean region, sustainable expansion and intensification of fish production through responsible aquaculture development should be a major objective for countries in the region. However, there is evidence of detrimental effects on coastal environments thus suggesting that farming spiny lobster may be an unsustainable venture, based on current practices. This is partially due to management strategies that do not consider the paucity of knowledge about the nutritional and cultural considerations related to tropical lobsters.

As part of a collaborative seafood farming plan, between Guyana and **Barbados**, to start farming of fresh water prawns to supply the Barbados tourism industry and Barbados households but also those (countries) in the eastern and southern Caribbean that are now importing millions of dollars in frozen shrimp and frozen prawns; it has been determined that once the country is able to secure the larvae, farming can begin in six months and consequently, Barbados has considered several areas where it may be possible to establish ponds for seafood production.

For **Belize**, mariculture is highlighted as an overarching guiding principle within the Cabinet-approved Fisheries Policy and Strategy, which serves as a pathway to regulate and manage the development of the sector across various entities; and is identified as a key marine-based sector under the Blue Economy scoping & diagnostic analysis, which will be properly integrated into the national Blue Economy Strategy for Belize.

For some years, the Department has been working in collaboration with The Nature Conservancy, Turneffe Atoll Sustainability Association, and Beltraide to properly understand and develop the seaweed mariculture sub-sector.¹ Ongoing research has led to a greater understanding of the enabling environment needed for commercial seaweed production through continuous monitoring of 5 seaweed farms. Four farms are located in the Turneffe area and one in the Placencia area. Their performance varies depending on the site, season, and maintenance applied, but have indicated optimal growth on the eastern side of the Turneffe Atoll and near Ray Caye in Placencia.

A training curriculum was developed jointly by TNC and the Placencia Cooperatives and utilized to train many fishers, groups, and interested persons in seaweed cultivation. Training material including training videos, training manual, and the seaweed best practice management guidelines have been developed to support capacity building. Many of the Department's marine reserve staff have also been trained.

Recently, under a regional project, *Integracion de la cadena de valor en la pesca y acuicultura* (INCAVPESCA - Fisheries and Aquaculture Value Chain Integration project) being implemented by OSPECA, opportunities were afforded to one beneficiary from each country to train and assist in developing a small-scale seaweed farm.

For Aquaculture, there have been specific cooperation and developments for tilapia and snapper. Under the INCAVPESCA project, Belize (Aquaculture Unit) had developed an aquaponics system, which was being monitored for performance.

It is expected that over the short term, the Governance framework for mariculture will be developed to foster and facilitate the sustainable development of the mariculture sector which is much needed to jumpstart what we recognize as an attractive and promising industry. In this regard, draft regulations are being prepared to address mariculture development. To complement the development of this governance structure, awareness and outreach is required to properly sensitize current and interested stakeholders on the impending regulations and other development opportunities; to allow for greater understanding of the sector and promote cooperation with the Government of Belize and partners. Data acquisition is critical in assessing the performance of the sector and is used to identify areas that may require improvements and management interventions.

In **Dominica** the Aquaculture sector has seen a major revamp after the rehabilitation of the Belfast prawn farm hatchery under the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector project (CC4FISH). After destruction by Hurricane Maria and Tropical Storm Erika, production levels in aquaculture dropped to zero. However, this rehabilitation has assisted in the hatching of over three hundred thirty thousand (330,000) post larvae between 2021- 2023 serving ten farmers across the island.

Further support was provided under the Mexican government and the Food and Agriculture Organization (FAO) project (AMEXCID). This project was implemented with the aim of increasing the contribution of aquaculture to food security, nutrition, and livelihoods.

Under this project, the following were achieved:

1. Expansion of the state-owned hatchery to include strengthening of existing ponds and covering.
2. Procurement and supply of inputs to aquaculture farmers (aquaculture feed, coolers, nets).
3. Excavation of ponds and inputs to farmers such as pond liners.

¹ In Belize, there is a native species that is prized commercially, and locally known as Eucheuma, since 2019 has been called *Eucheumatopsis Isiformis*.

As it relates to mariculture, in collaboration with The Food and Agriculture Organization (FAO) and the Ministry of Agriculture, an initiative was undertaken to enhance the seamoss value chain in Dominica as part of the project “Sustainable Development of Resilient Value Chains - Implementation of CARICOM COVID-19 Agri-Food Recovery Plan.” The project’s goal was to augment institutional knowledge, technical proficiency, and experience at the national level to effectively spearhead and execute risk-responsive food systems approaches.

The primary challenge in the seamoss value chain was the lack of a fast-growing seamoss species to satisfy local agro-processors’ demand. To address this, the project introduced the *Eucheuma cottonii*² species from St. Lucia, known for its rapid growth, with the aim of meeting local demand. This new species of seamoss was introduced to three pilot groups (Calibishie, Woodfordhill, and Grandbay), where they received technical training and inputs for seamoss cultivation.

With regard to Haiti, for the last twenty years, the Haitian government considered the sector of Aquaculture as one of two major priorities. In Haiti there are three different types of Aquaculture: land-based (earthen ponds) with production 2,400 Tonnes; interior water (natural and artificial bodies of water- lakes, micro barrages) with production 4,000 Tonnes; and, marine Based Aquaculture / mariculture : cages and close system with Cyclone pens, where production has apparently not been quantified. Haiti has a lot of potentialities for the development of aquaculture with lots of private investors (Haitian and Foreigners: diaspora) being interested in investing. However, since March 2019 with the COVID-19 pandemic (and some political instability) activities have been slow, but recently appear to be restarting.

In **Jamaica**, the National Fisheries Authority has identified the development of aquaculture as a strategic priority. This is established as a goal in the Strategic Business Plan 2024/2025 “to increase and diversify fish production, through aquaculture to increase food and nutritional security and economic growth.”

Policy and Regulatory Framework

As part of the policy and regulatory framework the Fisheries Act, 2018 was promulgated June 1, 2019. This Act created a regulatory framework for aquaculture and mandates that persons and facilities involved in aquaculture should be licensed. The Act also facilitates the transition of the Fisheries Division to the National Fisheries Authority. This has resulted in the upgrading of the Aquaculture Branch to the Aquaculture Division with the requisite capacity to facilitate planning, management, and provision of services to the aquaculture sub-sector through extension, research, and the provision of seed stock from its farms. There also exists a draft National Fisheries and Aquaculture Policy which outlines the goals, objectives and strategies for aquaculture development in Jamaica, as well as a Land and Water Use Development Strategy for Aquaculture. Both documents are currently being updated and will be used to determine aquaculture development zones and management plans as outlined in the Fisheries Act, 2018. Jamaica also passed an Act to deal with the sanitary and phytosanitary standards for fish and fishery products produced in Jamaica (The Aquaculture, Inland and Marine Products and By-Products (Inspection, Licensing and Export, 1999). This Act was amended in 2013 to facilitate a broader reach of the act in terms of standards established for the national production of fish and fishery products, the import and export of fish and fishery products and by-products into and from Jamaica. Overall, the Act establishes a regulatory framework for the sanitary and phytosanitary standards for both the local and international markets are in keeping with internationally accepted standards. This Act is administered by the Veterinary Services Division of the Ministry of Agriculture, Fisheries and Mining.

Initiatives in Aquaculture

National Fisheries Authority is seeking to revitalise aquaculture in Jamaica. This is being facilitated through several initiatives which have been facilitated with funding from the Government of Jamaica as well as multi-lateral funding partners. Through the Promoting Community-Based Climate Resilience in the Fisheries Sector Project (a project funded through the CIF-PPCR) several investments have been made. These include the development of a tilapia broodstock development programme and the construction of a

² The scientific name of species has changed; the accepted name is now *Kappaphycus alvarezii*. It is worth noting that there is some concern in certain parts of the Caribbean (not all) about *K. alvarezii* exhibiting invasive behavior (it is non-native to the Caribbean).

bio-secure tilapia hatchery which will assist the National Fisheries Authority in increasing its seedstock production capacity. The project has also facilitated capacity building of small-scale fish farmers through the development of facilities to prepare fish feed using locally available material, the strengthening training in aquaculture (tilapia) production through partnership with the HEART-Trust Ebony Park Agriculture Training Institution. The project has also facilitated the diversification of aquaculture through the culture of oysters and irish moss and facilitating the organization and improvement in production of ornamental fish. Other initiatives utilising funds from the Government of Jamaica include the re-introduction of tilapia/*Macrobrachium* sp. polyculture and the expansion of aquaculture production through the development of aquaparks. These are land developed for aquaculture with the requisite infrastructure to support aquaculture production. Duty concessions have been afforded for the importation of fish feed for aquaculture production.

Saint Lucia has seen a dramatic increase in the export of *Eucheuma Cottonii* to Europe and North America fairly recently. At the end of September 2021, a total 141,037.86 kg of seamoss was exported, valued at USD\$3,580,170 which represents a 20% increase over the entire total for the previous year 2020. This has demonstrated the potential for seamoss production to create employment and generate income in coastal communities. In recognition of this, the Department of Fisheries has held numerous stakeholder consultations and is in the process of implementing management strategies to ensure the economic and environmental sustainability of seamoss production on the island. Some of these activities include mapping of existing production sites, implementing governance structures to manage activities and reduce user conflict in areas where seamoss is cultivated, experimentation with environmentally friendly production methods, and the development, implementation of quality standards and best practices for the industry. Climate smart aquaculture is being promoted through aquaponics and in April 2021 an aquaponics system was constructed to be used for training under the CC4FISH project. So far, approximately 27 individuals have been trained in introductory aquaponics. A National Vocational Qualification (NVQ) Standard has also been developed by the Ministry of Education with support from the Department of Fisheries and other stakeholders in Aquaponics Level I and II, which will be used for training and certification of farmers and other interested individuals.

With the National Fisheries and Aquaculture Policy (2018), ***St. Vincent and the Grenadines (SVG)*** has begun preparations for the expansion of the aquaculture sector. Seamoss (*Eucheuma cottonii*, *Gracilaria* spp. and *Kappaphycus alvarezii*) production has been identified as a priority given the increase in exports to North American markets which saw over 99% increase in export value between 2017 and 2020. Provided lasting market demands, the upscaling of production and marketing of seamoss is foreseen as a valuable avenue for poverty alleviation and alternative livelihoods. Support for such expansion is being provided through the “SVG Seamoss Project” implemented by The Nature Conservancy (TNC) in partnership with the Fisheries Division of the Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry and Labour and a Non-Governmental Organization Sustainable Grenadines Inc. (SusGren). Through the project, the most suitable locations for the establishment of seamoss farming sites will be determined and modelled against competing uses of SVG’s marine space and appropriate licensing systems will be recommended for approval by the Government. Assessments of the seamoss industry have also been made by Georgetown University through the “Blue Economy: Opportunity for Sea Moss Production” project which identified SVG as having great potential for competitive positioning in the global market, however, there is a need for regulation to formalize the sector and establish adequate phytosanitary standards and quality control which will enable access to more profitable markets.

Acknowledging the early developmental stages of the industry, the Ministry of Agriculture, Forestry, Fisheries, Rural Transformation, Industry, and Labour had identified conch and lobster as potential candidates for the development of hatchery technologies given their importance in export markets, the heavy exploitation rate and unknown status of the local stock. With the streaming of the OECS Blue BioTrade pilot project, support will be provided through the strengthening of existing knowledge of the queen conch value chain and CITES compliance, stock assessments, and enhanced data collection, as well

as exploring restorative aquaculture through the establishment of conch nurseries. There are also plans in the “Unleashing the Blue Economy of the Caribbean Program (UBEC) project” to visit other Caribbean countries with the aim of learning best practices and strategies for the expansion of the aquaculture sector. Species identified for project are seamoss species, queen conch, and lobster. The culmination of this project will see the development of a Strategic Action Plan for fisheries and aquaculture to implement the Fisheries and Aquaculture Policy and the establishment of an aquaculture facility, the nature of which is yet to be determined.

Despite these early steps, there is still a marked need for human resources specialized in aquacultural development, as staff of the Fisheries Division involved in the subject are primarily Biologists. Foreign investment and national prioritization are yet another major caveat to the development of aquaculture as current investment interest lies in the local private sector.

The policy in Suriname is to encourage the development of extensive culture of endemic species by small scale farmers and the semi-intensive culture of *Tilapia spp* by medium-sized entrepreneurs. Within the current 4 years development plan, farmers who have land available will be supported with financing for the construction and preparation of grow-out ponds. The policy will also focus on support to research centers for the development of feed based on local resources and hatcheries.

Focusing on *Tilapia spp.*, Cascadura (*Hoplosternum littorale*), Black River conch (*Pomacea urceus*), and Pacu (*Colossoma macropomum*) Trinidad and Tobago has identified approximately 16 major elements as being critical in the creation of the enabling environment to encourage interest and investment in aquaculture, of which 14 have been implemented. This includes increasing staffing complement to deal with aquaculture: this was implemented but ended in 2015 when the administration changed and all contractual agreements ended. Presently the Aquaculture Unit of the Fisheries Division under the Ministry of Agriculture, Land and Fisheries has a technical staff complement of two officers who serve as extension officers for farmers and potential farmers, import and export of live fish inspections, as well as carry out everyday duties to ensure optimal functioning of office. Support staff includes on-the-job trainees (persons on 2 year contracts) hired under the Ministry of Labour, assigned to the Aquaculture Unit with no prior experience or knowledge in Aquaculture. and the preparation of a national aquaculture policy A strategic plan was developed but has not been implemented. A programme of aquaculture incentives aimed at encouraging increased interest and investment in the aquaculture sector has also been identified. The Agriculture Incentive Program (AIP) is active; however, funds are not released in a timely manner to assist or encourage farmers to expand facilities or invest. Also, meetings were held in 2018-2019 to update the AIP list to include equipment and materials deemed necessary for Aquaculture and Aquaponics and to date there has been no official feedback on the updated list. There are aquaculture farmers awaiting payments for incentives processed by the Fisheries Division since 2014.

The Turks and Caicos Islands had a Queen conch (*Lobatus gigas*) mariculture fishery on the island of Providenciales. Unfortunately, in 2012, the production of the facility was no longer feasible with issues ranging from available food sources, surrounding development environmental issues, to legal matters. However, there is still the continued interest in mariculture in the marine waters (offshore) to land-based systems. Currently, the Department of Fisheries and Marine Resources Management and the Department of Agriculture (both housed under the Ministry of Tourism, Agriculture, Fisheries, Culture, Religious Affairs, and the Environment) have been in discussions of developing proper legislation under the Department of Agriculture that could guide potential mariculture applications as to the appropriate species to be farmed, with location, maintenance and monitoring. With the development of this legislation, small to medium sized entrepreneurs would be able to develop a business that could assist with food safety and sustainability.

Given the conviction that the CARICOM approach to aquaculture development will have to be multifaceted to address the range of available natural land and freshwater resources in the region, while incorporating the commercial elements, the Sixteenth Meeting of the Ministerial Council of the Caribbean Regional Fisheries Mechanism has acknowledged an urgent need to promote the development of aquaculture in the

region in a sustainable manner, to enhance its contribution to food and nutrition security, job creation, trade and blue economic growth, and reducing pressure on nearshore fisheries. In this context the Council has requested the CRFM Secretariat to continue development of project proposals for implementation of the 5-year Work Plan for Aquaculture Development and called on development partners and international donors to support initiatives for implementing this work plan.

Global aquaculture production continued its increasing trend in 2020, 2021, and 2022, undisrupted by the COVID-19 pandemic. Growth patterns differed between regions, countries, and territories, with important disparities in the scale of production, distribution, farming technologies, performance, and management.

World aquaculture production in 2022 achieved an all-time record of 130.9 million tonnes, up by 8.1 million tonnes from 122.8 million tonnes in 2020. Its estimated farm-gate value was USD 312.8 billion in 2022, an increase of USD 34.2 billion from USD 278.5 billion in 2020. It comprised 94.4 million tonnes (live weight equivalent; worth USD 295.7 billion) of aquatic animals and 36.5 million tonnes (wet weight; worth USD 17 billion) of algae (seaweed and micro-algae), plus a further 2 700 tonnes (worth USD 138.5 million) of shells and pearls.

The year 2022 was the first time in history that global aquaculture production of animal species surpassed capture production estimated at 91 million tonnes. In fact, the 2022 figure of 94.4 million tonnes of farmed aquatic animals was higher than the annual capture production for every year since 1950 – with the sole exception of 2018, when 96.5 million tonnes of aquatic animals were caught from the wild. The production of farmed animal species increased in 2022 by 6.7 million tonnes (7.6 percent) from 2020. This net increase was due mainly to Asia, whose contribution (5.9 million tonnes, 87.9 percent) was far higher than that of Latin America and the Caribbean (448,300 tonnes, 7.3 percent), Europe (232,100 tonnes, 3.5 percent), Africa (50,500 tonnes, 0.8 percent), Northern America (26,500 tonnes, 0.4 percent) and Oceania (10,100 tonnes, 0.2 percent). By species group, the net increase was mainly attributed to finfish (3.9 million tonnes, 58.1 percent), followed by crustaceans (1.6 million tonnes, 24.6 percent), molluscs (1 million tonnes, 15.6 percent) and other aquatic animal species (121 800 tonnes, 1.8 percent).

Global production of farmed algae reached 36.5 million tonnes in 2022, an increase of 1.4 million tonnes (4.1 percent) from the 2020 production of 35.1 million tonnes. This increase was the result of production expansions led by China, followed by Malaysia, the Philippines, the United Republic of Tanzania, the Russian Federation and a few others, unfortunately offset by drops (in descending order of reduction in output) in Indonesia, the Republic of Korea, Japan and a few other smaller producers.

Total world aquaculture production in 2022 grew by 87.9 million tonnes from 43 million tonnes in 2000, an increase of 204 percent (average yearly growth rate of 5.2 percent). In the same period, farming of aquatic animals expanded by 62 million tonnes from 32.4 million tonnes, a 191 percent increase (average yearly growth rate of 5 percent). The production of cultivated algae more than tripled in the same period.

Different regions show huge differences in the scale of aquaculture production and its growth pattern. Within each region, the scale and annual variation pattern differ from country to country. The figure above illustrates the trend in annual variation during the period 2001–2022 in six regions.

Mariculture – or marine aquaculture – takes place in the sea and may last the entire production cycle or only the grow-out phase. Mariculture lasting the full cycle is for species dependent on wild seeds from the sea, for example, sea mussels. On the other hand, mariculture lasting only the grow-out phase is for species produced in a land-based hatchery and sometimes even in freshwater, as is the case with Atlantic salmon.

Coastal aquaculture, typically practised in constructed ponds onshore or in intertidal zones, plays an important role by providing livelihoods and employment, facilitating economic development among coastal communities in many countries, particularly in Asia and Latin America.

Global production of marine and coastal aquaculture reached 71.1 million tonnes in 2022, including 35.3 million tonnes of aquatic animals and 36.4 million tonnes of algae. Separating the production of mariculture

from coastal brackish water is traditionally difficult, as the two are often aggregated in national production data, particularly from countries farming finfish in both environments.

On a global scale, seaweed farming and mollusc culture are overwhelmingly dominated by production in the sea, while crustaceans are primarily raised in coastal brackish water ponds and tanks. According to the available information, cage culture in the sea contributes around 65 percent of the total world production of finfish farmed in marine and coastal aquaculture combined.

The production of fed aquaculture continued to outpace that of non-fed aquaculture in 2021–2022. Globally, the share of non-fed aquaculture in total farmed animal species production fell from 39.7 percent in 2000 to 27.6 percent in 2020 and to 26.9 percent in 2022 (Figure 12). However, in inland or coastal multispecies polyculture systems, the separation between fed and non-fed species is not easily defined, as feeds intended for fed species benefit also filter-feeding species, especially when using powder feeds or pellet feed with low water stability that dissolve quickly. In some areas in Asia, for example, bivalve species such as hard clams and constricted razor clams grown in coastal ponds are intentionally fed with specially prepared feed in fine particle form at the final stage of culture for “fattening” purposes.

FAO’s global aquaculture production statistics dataset 1950–2022 released in March 2024 reports 731 statistical units technically known as “species items” – an increase from the 652 reported in 2022. They comprise 564 aquatic species identified at species level and 7 interspecific hybrids of finfish, 99 species groups identified at genus level, and 61 groups of species identified at family or higher levels. The 564 farmed species taxonomically recognized in the world comprise 368 species of finfish grouped in more than 200 genera, 88 species of molluscs, 62 species of crustaceans, 32 species of algae, 2 species of cyanobacteria, 7 species of marine invertebrates, 3 species of frogs, and 2 species of aquatic turtles.

Despite this great diversity of aquatic species farmed worldwide, a relatively small number of “staple” species dominate total aquaculture production globally, regionally and nationally.

Discussion

It was acknowledged that aquaculture within the region is either under-reported or there is a need for greater involvement at the regional level as it relates to aquaculture development. Appreciation was expressed for the fact that the CRFM Secretariat has investigated looking at integrated multi-trophic aquaculture (IMTA) and that, the Yellow Seas Fisheries Research Institute of China is still interested in providing assistance in that regard. It was noted that Jamaica and Belize would want to be a part of such an initiative as they have been for some time given consideration to mariculture development. At present, Jamaica is doing oyster culture, Irish moss, or sea moss, and hopefully they will be looking at mariculture of fish species fish. It was opined that to really have value from such approaches and to ensure that we are using sound ecosystem practices, adopting the approach as a region would be more beneficial to Member States.

Action

The Working Group:

Noted the Summary report of the Fourth meeting of the CRFM Working Group to Promote Sustainable Aquaculture

Noted also the updates provided by the Secretariat regarding the activities/outcomes since the Fourth meeting of the CRFM Working Group to Promote Sustainable Aquaculture

Noted further the overview of the global state of aquaculture and the overview of CRFM Member States' aquaculture as at August 2024 updated based on submissions from aquaculture focal points

Acknowledged that adoption of IMTA at the regional level would probably be more beneficial to Member States

Survey on Five-year Work Plan for aquaculture development in the Caribbean - Current status of Member State implementation

Between June of 2023 and July 2024, the CRFM Secretariat endeavoured to carry out a survey on the current status of Member State implementation of the Five-year Work Plan for aquaculture development in the Caribbean. The survey sought to capture all that countries are doing on aquaculture, both government-led and non-government-led activities, including identifying all activities that are supported by donors, private sector and / or NGOs. By this means, the CRFM hoped to determine if and which elements of the 5-year action plan for aquaculture development are being advanced satisfactorily, as well as areas of continuing weaknesses. Only eight (Antigua and Barbuda, Barbados, Jamaica, Saint Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Turks and Caicos Islands) of the seventeen CRFM Member States responded to the survey with timeliness that would allow for the data to be analyzed meaningfully; this is unacceptable as a sample size to be able to draw any conclusions that could guide future action. To have had responses from at least 12 member countries would have been workable.

Discussion

It was noted that the survey instrument is a simple one to give the opportunity for people to just see and note their progress in implementing the action plan's activities. However, so much has passed since the submissions which were received that we would be well advised if those countries would send a more up-to-date response to the survey because of the period of time that has passed.

It was suggested that if aquaculture is not prominent in non-responding countries, then perhaps sample stratification could assist in prioritizing respondents; though it was noted that all countries have indicated some sort of interest in aquaculture, whether primarily at the subsistence level or at a higher, more commercial, level.

It was pointed out that there are some activities (such as financing, regional trade shows, Training, attachments, and secondments) that individual countries may not necessarily be able to do on their own and so may not really be considered a priority or they may not be as effective at a country level as they would be at a regional level. However, it was suggested that where a country feels that a particular activity is something that will be best done in partnership they could indicate that under the "partners" heading in the instrument; and where a country felt that this is a particular thing that didn't quite relate to them because of the challenge of national versus regional then they could indicate that in the challenges column.

It was agreed that all countries should endeavour to complete the survey instrument. The Secretariat will endeavour to revise it mindful of the current discussion and circulate it to participants in addition to sending it through the official channels, which is normally permanent secretary copied to Chief Fisheries officers, by the end of the first week of October 2024. It was acknowledged that partner agencies and technical experts who may be able to provide information from their own knowledge could also be sent the survey instrument. Respondents should then submit their survey responses to the Secretariat by the 13th of December 2024. This would allow time for the responses to be analysed in time for presentation of the results at the next meeting of the Caribbean Fisheries Forum. It was noted that perhaps a more direct approach of calling contacts and impressing upon member countries the importance of the survey and how it will benefit them could be helpful.

Action

The Working Group:

Noted that the number of responses received from Member States was unacceptable as a sample size to be able to draw any conclusions on the status of implementation of the Five-year Work Plan for Aquaculture development in the Caribbean; that could guide future action.

Agreed that the CRFM Secretariat would endeavour to revise the survey instrument mindful of the current discussion and circulate by the fourth of October 2024.

Agreed also that all Member States would endeavour to complete the survey instrument and submit to the Secretariat no later than the 13th of December 2024 to allow time for the responses to be analysed in time for presentation of the results at the next meeting of the Caribbean Fisheries Forum.

Discussion on future directions for aquaculture development and elements of the enabling environment for promoting aquaculture development.

Scope for multitrophic aquaculture (mariculture) in CRFM Member States

Aquaculture efforts in the region have utilised a variety of approaches to the development of the sub-sector ranging from addressing issues pertaining to freshwater culture on-land, the development of aqua-parks and incorporation of aquaculture in the legislative framework, creating an enabling environment to encourage interest and investment in aquaculture, highlighting mariculture as a pathway to regulate and manage the development of the sector across various entities, implementing management strategies to ensure the economic and environmental sustainability of seamoss production, and encouraging the development of extensive culture of endemic species by small scale farmers and the semi-intensive culture of *Tilapia spp* by medium sized entrepreneurs

At its 14th Meeting, the CRFM Ministerial Council discussed the issue of aquaculture development and accepted that there are several challenges that hamper aquaculture production in the CARICOM region; mindful that it requires investment, as well as the policy, legal, and regulatory frameworks, capacity building, the identification of the species with potential and ensuring good supplies of brood stocks, setting up good health systems and addressing the constraints, such as high input costs, feed and land availability, cost of credit, water systems, and the technical expertise required to conduct the operations in a systematic and proper manner. Additionally, other critical elements include extension support, research and development, skills training (including at the basic farm level), addressing climate change and disaster risks, including problems that may arise due to flooding. Following on extensive discussions on the issue the Council *agreed* that economic models for varying scales and types of aquaculture operations (including integrated multi-trophic aquaculture (IMTA) and aquaponics) should be promoted among Member States

The commercial feasibility of mariculture needs to be reviewed; given that, for some species hatchery technology may be a major constraint, while for others, problems may occur in the nursery or “grow-out” phases of production. While there may be candidate species for which the culture technology is well developed, market prices may be too low to allow for profitable production in the region. Expansion of Caribbean aquaculture is critically dependent on the identification of species with the highest commercial potential; and, IMTA may enable farmers to diversify their output by replacing purchased inputs with byproducts from lower trophic levels, without new sites; leading to increased profits and reduced financial risks due to weather, disease and market fluctuations. In general, integrated multi-trophic aquaculture (IMTA) provides the byproducts, including waste, from one aquatic species as inputs (fertilizers, food) for another. Farmers combine fed aquaculture (e.g., fish, shrimp) with inorganic extractive (e.g., seaweed) and organic extractive (e.g., shellfish) aquaculture to create balanced systems for environment remediation (biomitigation), economic stability (improved output, lower cost, product diversification and risk reduction) and social acceptability (better management practices).

During a visit to China in 2019, the Chinese had expressed interest in working with the region, but the exchange did not go as planned due to the COVID pandemic. In this context, the Sixteenth meeting of the CRFM Ministerial Council had supported the continued interest in collaborating with the Yellow Sea Fisheries Research Institute of China for knowledge and technology transfer, capacity building, research, and investment in sustainable aquaculture development in the region using, *inter alia*, the principles of

integrated multi-trophic aquaculture (IMTA), to increase the sustainability of aquaculture systems while enhancing environmental health, using an ecosystem-based approach to aquaculture development

Council had therefore authorized the CRFM Secretariat to follow-up on the mission of fisheries and aquaculture experts from the Yellow Sea Fisheries Research Institute of China that had to be postponed due to the COVID-19 pandemic, and to take action to renew collaboration with partners in China for knowledge and technology transfer, research and capacity building, and potential investments in the development of integrated multi-trophic aquaculture in the region

The Seventeenth Meeting of the CRFM Ministerial Council reiterated the request to the CRFM Secretariat to facilitate discussions with the Government of China regarding support for the development of integrated multi-trophic aquaculture in the region; and the Eighteenth meeting requested that the CRFM Secretariat advance the development of project proposals for the implementation of the 5-year CRFM Work Plan for Aquaculture Development.

In support of this, the Working Group will in a subsequent agenda item, be presented with a preliminary draft concept on “Development of Integrated Multi-Trophic Aquaculture in CARICOM States for Climate-Smart Sustainable and Resilient Aquatic Food System” for submission to potential donors, including the Government of China, for funding.

Discussion

In response to a question, it was confirmed that the concept that will be presented for discussion under a subsequent agenda item is specifically for integrated Multitrophic agriculture/mariculture. It was noted that countries were actually considering aquaculture of different species which may have a bearing on the direction taken in further development of the project proposal.

It was mooted that one of the things that will be very important for the countries that would participate in marine spatial planning; there is some work that is being done regionally to look at this area. Both marine spatial planning and consideration of the policy and regulatory framework to accommodate these kinds of activities in the marine space might be included in the project concept, in addition to the types of technology that would be used. The meeting was reminded that there are current initiatives, including, for example, the BE-CLME+ project, which is looking at aspects of marine spatial planning, however, we would want to build these areas into any concept, especially as it contributes to the enabling environment, especially where you're talking about nearshore species.

It was noted that one of the reasons why CAEIH was asked to be a part of the working group is that one of the basic tenets is to try to develop skill sets and build capacity in the region, given that there are people who have already had some training. This also has a bearing on issues related to the policy science interface. It was emphasized that one of the main constraints to aquaculture development in the region was the question of the inadequacy of (primarily human) capacities. The issue of competition for space to carry out aquaculture activities, whether on land or in the near shore, was also raised. In some of the countries on the leeward side, the near shore is actually fairly deep and may not facilitate some types of aquaculture we may have in mind, while on the windward side of some of these countries, because they're fairly high energy, they also pose challenges for certain types of mariculture. In fact, it was opined that because of priorities for the use of marine space, especially the near shore spaces, marine spatial planning is an important consideration for the enabling environment. It has also been found that extreme weather events, such as hurricanes, are also a consideration when seeking to further develop aquaculture. The example was made of the Bahamas where successful experimental offshore cage culture growing cobia was impacted by storms that didn't quite make it to hurricane intensity, causing the cage to move around and then the researchers had to go to retrieve it, thus setting back the work accomplished. The vagaries of climate including and not limited to climate change and climate variability and water resources limitations are also things that need to be considered.

Action

The Working Group:

Noted the summary on the scope for multitrophic aquaculture (mariculture) in CRFM Member States.

Noted also that a project concept for “Development of Integrated Multi-Trophic Aquaculture in CARICOM States for Climate-Smart Sustainable and Resilient Aquatic Food System” for submission to potential donors for funding will be discussed at a subsequent agenda item

Aquaponics as a mechanism for promoting aquaculture development

Aquaponics is the cultivation of plants and aquatic animals in recirculating environment. It is a synergy between fish and plants and the term stems from the two words Aquaculture (the growing of fish in a closed environment) and Hydroponics (the growing of plants usually in a soil-less environment).

Aquaponics systems can provide healthy foods (fish/herbs/vegetables) with high yields using minimal water, which can contribute to food and nutrition security, as well as being a successful commercial venture, appropriate to developing as well as developed countries.

Recognizing the need for public-private collaborative efforts, the Government of Antigua and Barbuda made the development of the aquaponics sector a priority and, in the mid-2010s, sought technical assistance to grow and advance the sector from FAO. FAO responded through the Blue Revolution Project, which supports the sustainable development and management of aquaculture

A technical training workshop on advancing aquaponics was held in Saint John’s, Antigua and Barbuda, in the period 14–18 August 2017. Fourteen international participants were present from five countries (Antigua and Barbuda, the Commonwealth of the Bahamas, Barbados, Grenada, Saint Kitts and Nevis). The workshop was an activity organized under the Technical Cooperation Project (TCP/SLC/3601) Towards a Caribbean Blue Revolution in response to the request from the Governments of Antigua and Barbuda, the Commonwealth of the Bahamas, Barbados, Saint Kitts and Nevis.

Another technical training workshop on advancing aquaponics was held in Christ Church, Barbados, in December 2018, supported under the UN FAO-funded projects: Towards a Caribbean Blue Revolution as well as the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH).

Since then, the Caribbean Aquaproducers Association has been formed. It is a non-profit association for advancing Aquaculture, Aquaponics & Hydroponics in the Caribbean region; based in Barbados, its stated mission is “to promote partnerships across aqua producer businesses, academic institutions, and associated operations that advance safe, secure and sustainable aquaculture development within the Caribbean Basin.”

A presentation was made by Ms. Mia Avril on *aquaponics as a mechanism for promoting aquaculture development*. She noted that aquaponics can support aquaculture development through impacting sustainability with regard to efficient use of water in that aquaponics uses 90% less water than traditional aquaculture and agriculture; and waste management because it converts fish waste into valuable plant nutrients, reducing environmental degradation. In terms of scalability, small to large-scale systems for aquaponics can be implemented at various scales, from backyard systems to commercial operations. Aquaponics contributes to Economic Viability through diversified income streams such as the sale of both fish and vegetables; and local job creation: through Opportunities in system design, maintenance, and product sales. Aquaponics contributes to Climate Resilience by being less vulnerable to the impacts of climate change and extreme weather conditions, which often disrupt traditional farming systems in the Caribbean and can be set up in controlled environments, reducing the risk of crop failures due to hurricanes or droughts. It also provides economic opportunities through new revenue streams from small-scale farming, tourism

Aquaponics contributes to the Sustainable Developments Goals: SDG 2: Zero Hunger, by contributing to food security; SDG 6: Clean Water and Sanitation through efficient water use and reduced pollution; and

SDG 12: Responsible Consumption and Production as it promotes sustainable agricultural practices (eco-farming tours), and job creation as well as supporting the blue economy by integrating aquaculture in a sustainable manner.

A number of successful implementation of aquaponic activities were also presented: urban aquaponics farms in the Nassau, The Bahamas (Blue Fields Farm) providing local communities with fresh produce-available in supermarkets; aquaponics as a teaching tool- modern agriculture in schools; Value-added products made from aquaponics produce (teas, soaps, etc.) sold to high-end markets such as “Naturally Bahamian; and aquaponics as a response to natural disasters to help rehabilitate rural communities.

The presentation spoke to Challenges and Considerations such as: Initial investment costs where capital is required for setup and potential ROI- especially if climate resilience is to be considered; technical knowledge in the need for understanding of both aquaculture and hydroponics- technical expertise and training required; and maintenance and management in regular monitoring of water quality, fish health, and plant growth.

What aquaponics could look like for us in the region, or how we could develop it further is to look into ways to integrate technology more into the system. That is done a lot, and in a lot of developed places where they use a lot of IOTs, try to connect the systems and make it all operable from phones, for instance, and using AIs and automation to make the system work better. Another thing that can be done is the support from government in terms of policy, as well as means of attracting funding, basically just to build some kind of framework that would incentivize it. Some places already have tax exemptions, but for the tax benefits and grants and subsidies and things like that, that could make one, the inputs more accessible to people, and then, yeah, I guess just make it a more accessible tool. We should recognize the potential there for tourism and eco-friendly initiatives where you could integrate aquaponics into various sectors beyond just food production. Recognizing the importance of partnerships then with international organizations, like we mentioned FAO, and how helpful they have been over the years with providing a lot of technical and financial support to some islands to help with developing aquaponics.

The call now is for us to explore further how we could develop aquaponics in all of our islands and recognize that it can very much be done with marine species. There are some places, not so much in the region, like in Florida where they have already started doing aquaponics farming with conch, actually, and some marine algae, it's also possible to grow sea moss in aquaponics settings. We should explore the fact that the resources that we have can be used. While space is limited in the region, aquaponics deals with that because of its scalability and the fact that it can be done pretty much anywhere, so space is less of a concern. Aquaponics really does help us address a lot of the main concerns that aquaculture is facing in the region. In summary, aquaponics represents a nice solution to promoting aquaculture. It offers pathways to sustainable food production and we need some strategic investment and training and support to make it the mechanism that it could be.

Discussion

A few countries have experimented with aquaponics, and most of them may have been NGO-led. There are really two schools of thought with respect to aquaponics: there's a school of thought that says it's economically viable And then there is another one which says it's not so viable economically, especially depending on how the system may be set up. This may be associated with a high level of energy consumption.

With respect to the economic viability of aquaponics in the region it was opined that a lot of the aquaponic systems that we have seen in the region tend to be not very successful, but it had a lot to do with how it is set up: it's not that it requires so much energy, but it requires consistent energy and that could be a problem in many places. There is, however, the potential to integrate renewable energy options like solar. There are instances of aquaponics farms that was set up very large scale, but with minimal inputs: these ones would not have had much success. It all comes back to the fact that you do require that heavy initial investment in

order to set it up well enough that it does become profitable. Smaller scale systems would be a lot more successful in the sense that they are easier to operate, but then the output would be a lot less.

There was a general consensus that the region lacks skilled persons in aquaculture and if the region is interested in developing these different aspects of aquaculture, through the CRFM, we could perhaps consider training opportunities for countries that are interested in learning more about these technologies. If we don't have sufficiently trained persons then being able to scale up from project to a commercial operation, can be problematic. It was acknowledged that the Caribbean Aquaculture Education and Innovation Hub (CAEIH) can play a significant role in supporting such capacity building. While right now CAEIH is a bit restricted by funding, the whole concept behind this network is to try to build a group of skilled people who could then go out and conduct further training and get people in all islands well trained. CAEIH is encouraging getting aquaculture into our school system: they are currently working with Jamaica for sure, but potentially in other islands, getting teachers trained up, getting curricula developed just to try to get aquaculture into the school system. In this way already we're cultivating a generation of people that are already trained enough to start doing something and then the funding would just be the next thing to get them going.

It was noted that aquaponics provides an opportunity to broaden where we can get our essential amino acids from. Not in all situations can we grow the complete required suite of proteins that you can get from eggs and poultry and terrestrial: for some situations, the best option might be to just grow fish, complete proteins and aquaponics has the added benefit of growing plants along with it; so all in one contained system, you get all of the key nutrients that you need. From that perspective, there is reason to support aquaponics development.

The meeting was informed that in the case of Antigua and Barbuda, the Fisheries Division has been working with the Ministry of Education, particularly the agricultural science teachers, looking at how we could actually incorporate it into the curriculum, however, from the Ministry of Education viewpoint, a lot of the teachers, they're not that comfortable, for instance, dealing with the issue of aquaponics and actually how it can be incorporated into their training programmes. There are certain guidelines within the more recent CSEC syllabus for agricultural science, but this means that there needs to be a greater level of collaboration if we're going to have enough capacity to actually have individuals can actually branch off and go on.

It was suggested that when most people enter the sector, it tends to be a trial-and-error type based on what they picked up from a short course. That has been a challenge even from Antigua and Barbuda's fisheries department in terms of providing extension services, even to the Ministry of Education, with the various systems that they may have in school and how they maintain them and in addition not just to the teachers but also to the auxiliary staff that actually maintain the systems during summer holidays. Antigua and Barbuda has for the most part now, when it comes to funding for overseas training, whether it be China or elsewhere, sent agriculture science teachers because that was seen as the best means of actually fostering the development of the sector.

With regard to getting aquaponics into the school system, the meeting was advised that in December 2023, CAEIH carried out a survey and contacted a few teachers in Jamaica, especially the ones that teach the sciences. Traditionally, aquaculture has been seen as part of the agriculture sector, one of the things that needs to be done is to change the cultural perception of aquaculture and what it can entail. When CAEIH contacted some teachers who had done the O-level curricula, most of them did not understand what aquaculture was: for many persons, the terminology is quite ambiguous. Based on what was garnered from the teachers, CAEIH did a webinar to introduce mariculture to teachers. One hundred persons (of the 300 that had signed up) attended. A number of institutions from around the Caribbean that are actually doing research, participated and showed what other concepts of aquaculture existed; based on that, it was realized that aquaculture needs to be introduced into the curriculum to change the concept. While it's difficult to change the O-level curriculum, just introducing the sixth and seventh grades to basic concepts of mariculture and facilitating visits to different systems can be a useful beginning to changing the existing perspective of what aquaculture actually is; thus, providing a basis move on to tertiary education.

It was suggested that when teachers themselves don't have confidence about certain subjects, they don't see that they can put it into the curriculum. Notwithstanding there may appear to be strict rules for curriculum development, but confidence leads to them being imaginative and they find ways of doing it. It was also posited that CERMES has always been very good at taking on board and recognizing the needs of our countries and we should look into how they can be supportive of it in their curriculum, if we can build a cadre of people at that level that can filter down and encourage teachers at the other levels, that may also be a mechanism that would be useful.

Action

The Working Group:

Noted the presentation on aquaponics as a mechanism for promoting aquaculture development.

Acknowledged the general consensus that the region lacks skilled persons in aquaculture and **posited** that if the region is interested in developing these different aspects of aquaculture, through the CRFM, training opportunities should be considered for countries that are interested in learning more about these technologies.

Acknowledged also that there is a need to change the cultural perception of aquaculture and what it can entail.

Suggested that aquaculture really needs to be introduced into school curricula to change the current perception and while it is difficult to change the O-level curriculum, just introducing the sixth and seventh grades to basic concepts of mariculture and facilitating visits to different systems can be a useful beginning to changing the existing perspective of what aquaculture actually is; thus providing a basis move on to tertiary education.

Posited that since CERMES has always been very good at taking on board and recognizing the needs of countries, we should look into how they can be supportive of aquaculture in their curriculum to assist in building a cadre of people at that level who can in turn encourage teachers at the other levels.

Science-Policy interface for aquaculture Development in CRFM Member States

Integral to any fully functioning policy cycle in governance is the communication of marine science data and information, through the stages of the policy cycle, ultimately for use in decision-making. The networks of ties between science and policy constitute science-policy interface). The networks of ties between science and policy constitute science-policy interfaces. The process and product of an interview investigation of the marine science-policy interface in the WCR has been investigated.³ It found that policy discussions that used marine science extensively were infrequent. Constraints on the use of science included low capacity, science not being provided in policy-relevant format, not having easy access to databases, and low policy demand for science.²⁰

Science-policy interfaces are as important for governance of fisheries resources as in any other area of natural resource governance and may be more challenging than most. Perceptions of the quality of science, and hence its credibility, depend in part on the credibility of the source of the information as well as the information itself. Interestingly, CRFM, The University of the West Indies (UWI), Western Central Atlantic Fishery Commission (WECAFC), and OSPESCA are seen as the top four organizations most credible as regional sources of marine scientific information.²⁰

There can be many reasons for the failure of policy processes to use the “best available scientific information,” a principle reflected in most of the multilateral environmental agreements to which Caribbean states are party. These reflect several issues such as considerations of the structure of the science-policy interface, access to information, the relevance of the information to policy questions, the credibility of the

³ McConney, P., L. Fanning, R. Mahon and B. Simmons, 2016. A First Look at the Science-Policy Interface for Ocean Governance in the Wider Caribbean Region. *Front. Mar. Sci.*, 05 January 2016. Accessed 14 August 2024 at < <https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2015.00119/full>>

research, the way the information is formulated for uptake by policy makers, receptiveness to science among decision-makers, and the role of agents in bridging science-policy gaps.²⁰

It is advantageous for the region's policy making and advising delegates to have access to international actors and to be exposed to international factors that shape the science-policy interface at the global level. The science-policy interface at the regional level should not be strengthened in ways that may simultaneously weaken or disconnect external international interfaces. Interfaces should be supported or strengthened by more meaningful regional engagement that fits regional marine affairs into the global environment.²⁰ There are opportunities for learning about successful arrangements at international science-policy interfaces. Preparing science products to be actively used in policy is prominent at the international level and problematic in the region. Regional organizations should design decision support systems to incorporate international best practices not only from science and technology perspectives, but also for suitable advocacy, information management and communication research.²⁰

Limited engagement of citizens resulted in poor knowledge of their perceptions of marine science and policy at the regional level. Engaged and informed citizens will demand mechanisms for even greater input, such as via civil society organizations, into marine policy. They will be better equipped to provide public opinion at the regional level on which to base policy decision-making.²⁰ The challenges related to the Science Policy Interface in marine resources management can be seen as also relating to aquaculture and mariculture, and so a presentation will be made on Science Policy Interface for Aquaculture Development in CRFM Member States

A presentation was made by Dr. Juli-Anne Russo, the founder of the Caribbean Aquaculture Education and Innovation Hub looking at how science influences policy decisions and how policy shapes the scientific research agenda. She reminded participants that as of 2022 statistics, global aquaculture is increasing, and surpassed captured fisheries, however, Caribbean SIDS showed less than one percent of this global growth.

Aquaculture in the Caribbean

Globally aquaculture is increasing at an average APR of 5.59% per year, compared to 0.15%/ yr for capture fisheries (FAO, 2020)

The Caribbean SIDS < 1% of the global growth

FOOD SECURITY

- Seafood consumption is high
- Importation is 20x the volume of exports
- Captured fisheries contribute <2% GDP
- Captured fisheries provide employment & food security
- Seafood is highly nutritious, protein, minerals, omega 3

MARINE CONSERVATION & SUSTAINABILITY

- Caribbean sea overfished > 70% loss in biodiversity
- Increase in warm waters, hurricanes, storms
- Conch, coral reef, lobster, marine fish

LIVELIHOOD

- Ornamental species

Challenges to growth of aquaculture include the cultural perception, that most persons think that aquaculture is only about tilapia and using large inland ponds, which requires a lot of land space and water inputs, the high feed costs, energy costs, and high investments.

However, the whole process: the value-added products, whether there's a need for more processing centers, passes up best management practices leaving even biosecurity needs to be looked at. Other challenges

include regulation and policies that are not in place, like marine spatial planning as well as a lack of skilled technicians, extension agents, and research scientists. With all systems and investments in place if we don't have the skilled persons aquaculture definitely cannot grow. This is the case for our technicians but also our research scientists. Our countries need to get up to date with the age of science, Research and Development (R &D), and innovation.

Most Caribbean islands have a very high literacy rate, but we have a “brain-drain”. Most persons that go abroad to study, can't really come back because the jobs are not there to use their studies that they did overseas; so there is a huge void also in the secondary and tertiary aquaculture sciences. There, at the moment, are no tertiary institutions offering aquaculture as a science, and consequently, there is a gap in aquatic animal health, nutritionists, geneticists, phycologists. The region needs to have more persons with an understanding of seaweed: this is a growing industry, but it's still very young and we need to understand about species selection and mariculture specialists. Mariculture is not something that is practiced a lot throughout the islands, other than the culture of seaweed. We need to have specialists that are looking at lobster or conch. There is also a need for scientists that will make the policies for marine spatial planning.

"Necessity is the mother of Invention"

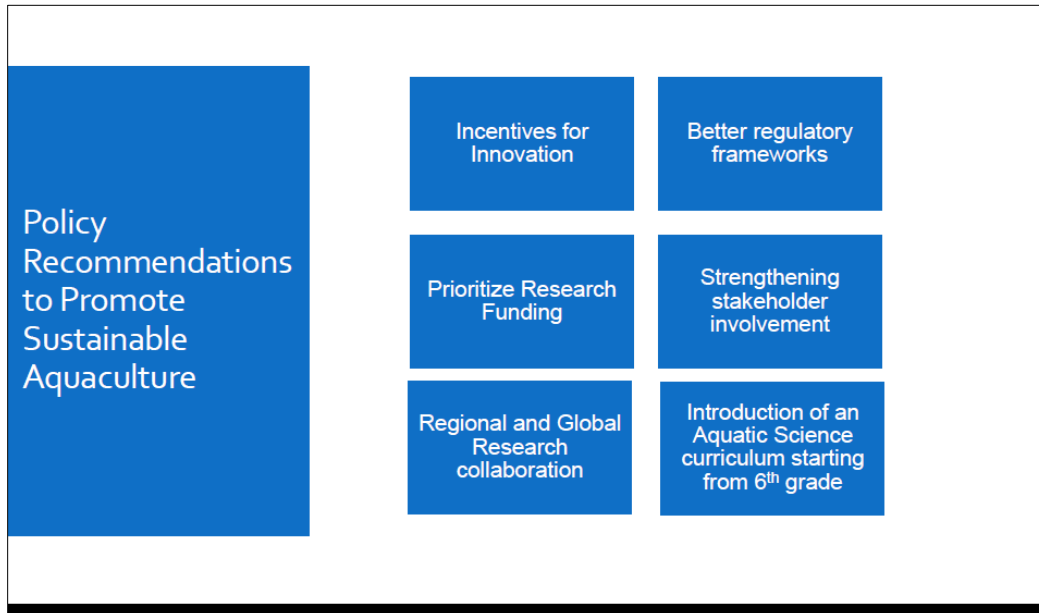
The Role of Scientists in Aquaculture Development

Innovation & Technology Development	Improving Productivity & Resource Efficiency	Environmental Impact Assessment
<ul style="list-style-type: none"> • Breeding Techniques • Disease management • Sustainable feed alternatives • Sargassum invasion • Restorative aquaculture • Aquaponics • Indoor aquaculture • Climate resilient structures • ITMA systems • AI, apps, Digitize 	<ul style="list-style-type: none"> • Sustainable aquaculture practices • Informs BPM • Optimization of resources- water, feed & energy • Improve growth rates • Feed conversion ratios • HACCP • Quality Control • Biosecurity measures 	<ul style="list-style-type: none"> • Mitigates environmental impacts-water pollution, habitat disruption, & biodiversity loss • Ensures sustainable & eco-friendly practices • Marine spatial planning • Policy makers

We need to give consideration to the kind of structures that can be developed and built for this era of climate change. There is a need to rethink how we are actually doing aquaculture. We need to consider whether we are going to continue to focus our aquaculture on large ponds or can we create inland structures that are inside and are hurricane or flooding-resistant. If we're going to increase aquaculture, we need to consider who is there to look at the diseases that are coming in: we don't have any trained aquatic animal health scientists and veterinarians. We need to look at improving productivity and resource efficiency. For example, by optimization of water, feed, and energy. Scientists are needed to deal with HACCP and quality control measures, biosecurity measures, and environmental impact assessments.

There are a number of opportunities for R&D and innovation that we are missing out on such as ecotourism. We have to consider the potential for seaweed value-added products. The cosmetic industry is a multi-million-dollar industry that we may be able to take advantage of. There are many missed opportunities for growth and innovation that can really drive and create, and open, different discussions about what aquaculture really can look like and can be like in the Caribbean. This includes having more private partnerships. We don't need to reinvent the wheel. Through CAEIH, we have started connecting with institutions that are actually working in the Caribbean doing many different projects, such as Issa Caribbean

in Puerto Rico, the Island School in the Bahamas, Dr. Megan Davis who is working on conch with Harbor Branch, Dr. Benetti who is looking at the different marine species and aquaponics through Adams Farms. We just need to start collaborating with the work that is already being done in our region and this can help to bridge the gap between the complex scientific data and practical decisions. Some of the policy recommendations to promote sustainable aquaculture as shown in the figure.



It was reiterated that in order for us to actually take advantage of the opportunities that we are missing, the region needs to invest in changing the culture of what aquaculture is: putting it into our school system, not only in agricultural schools but within our traditional schools where it's a STEM subject as a STEM science, because that's exactly what it is. We need to start focusing on the aspect of it as a science as well as the business of aquaculture. The tertiary institutions need to start introducing it. Right now we have a cohort of graduates that have nowhere to go to learn this information. CAEIH is trying to create an information source for students who are graduating with a science degree, including marine biology, who want to learn more about aquaculture.

Discussion

Participants were informed of Europe's Erasmus Mundus program: a joint master's degree in aquaculture, environment, and society with, for example, semesters in different countries, Scotland, then Greece, then France and now the Netherlands because there's an additional university that came on board. There is an environmental impact assessment component, also learning about fish health, et cetera. While it was a very good program with regards to exposure, there appeared to be a shortfall with regards to tropical species. Having said that, it was certainly a good program to be exposed to.

Action

The Working Group:

Noted the presentation on Science Policy Interface for Aquaculture Development in CRFM Member States.

Noted also the potential challenges envisaged in seeking to improve the Science Policy Interface for Aquaculture Development

Recognised that it is advantageous for the region's policy making and advising delegates to have access to international actors and to be exposed to international factors that shape the science-policy interface at the global level.

Accepted that the science-policy interface at the regional level should not be strengthened in ways that may simultaneously weaken or disconnect external international interfaces.

Acknowledged that interfaces should be supported or strengthened by more meaningful regional engagement that fits regional marine affairs into the global environment.

Considered the need to rethink how CRFM Member Countries actually doing aquaculture with the current focus on large ponds or whether to create inland structures that are inside and are hurricane or flooding-resistant.

Reiterated that in order for Member Countries to actually take advantage of the opportunities that we are missing, the region needs to invest in changing the culture of what aquaculture is: putting it into our school system, not only in agricultural schools but within our traditional schools as a STEM science as well as the business of aquaculture.

Opined that regional tertiary-level educational institutions need to start introducing aquaculture into their curricula

Updates on FAO aquaculture initiatives in the CARICOM Region

The working group received updates on two FAO aquaculture initiatives in the Region

Digitised library of public and private aquaculture farms in the CARICOM Region

The Food and Agriculture Organization of the United Nations Sub-regional Office for the Caribbean (FAO-SLC) had sought the assistance of the Caribbean Regional Fisheries Mechanism in providing the relevant support for the establishment of a digitized regional technical library of aquaculture farms, practitioners (technicians/expertise) and institutions in the CARICOM region. This was expected to create opportunities for the continued sustainable development of aquaculture in the CARICOM region, through assessing current regional efforts and creating a digitized library.

The expected deliverables were:

- An interactive digital technical library of aquaculture farms, practitioners (technicians/expertise), and institutions in the CARICOM region; this includes pilot-scale operations demonstrating proof of concept
- Policy briefs on aquaculture gaps in the region and opportunities for further development.
- A webinar with private and public sector aquaculture farm representatives and relevant institutions (including but not limited to academic/vocational entities, regional fisheries bodies, and development banks) to discuss best practices on how to develop and sustain small-scale and large-scale farms in the region.
- A meeting on the development of best practices guidance document for Member States.

The meeting received a presentation from Ms. June Masters, Statistics and Information Analyst of the CRFM Secretariat, supported by an intervention from Dr. Yvette DieiOuadi of FAO's regional office in the Caribbean and a presentation from Ms. Tamsin Vicary also of FAO (NFISI).

In Ms. Masters' presentation, she advised that The CRFM/FAO WECAFC Digital Aquaculture Library is an online tool that provides information on the aquaculture sector in the Caribbean. The CRFM and FAO/WECAFC had recognized that there was a gap in the availability of information on the Caribbean's aquaculture sector, and the tool is a solution to that problem.

The Initiative began in 2021, to develop tools and resources to improve networking and sharing of aquaculture knowledge and best practices in the aquaculture sector. After extensive data collection and development work, the CRFM and the FAO unveiled the Digital Aquaculture Library in June 2023. The library is now accessible for public use via the Tools tab on the CRFM's website (<https://crfm.int/>). Submissions can be made by entities wishing to be included in the Registry. The submissions are subject to review and verification by the CRFM Secretariat.

The access to the registry is under the CRFM website, while the access to the open ASFA Aquaculture Publication is under FAO website. But both are accessed via the "Tools" tab on the CRFM website. On the CRFM Website (<https://crfm.int/>) or https://crfm.int/index.php?option=com_content&view=article&id=46&Itemid=488.

The Digital Aquaculture Library consists of two parts: A [registry](#) of individuals and/or hubs for each Member State involved in, inter alia, the financial, technical, research, managerial, regulatory, and/or practical aspect of aquaculture, and A Digital Library for [aquaculture publications](#) for the region, managed on OpenASFA.

The participants were given a demonstration of how to navigate through the library. It was emphasized that there is a role for everyone in sustaining the tool and keeping it relevant and alive. The updating of the Registry involves the updating of country contacts by each nominated country official, who transfers this information for collation to CRFM. CRFM will then update the populated CARICOM Excel sheet and submit it to the FAO NFISI contact for updating the downloadable pdf made accessible through relevant websites in the CARICOM. The updating of the Aquaculture Publications on OpenASFA involves: the listing of new publications by nominated contacts in the Region; the compilation of these listings by CRFM; submission to FAO's OpenASFA contact for uploading. The WG was asked to make suggestions regarding the resources to support the update mechanism. Members can suggest materials to be added to the library, or sources of funding or other resources that can assist this work in any way, or changes that would make the tool better etc.

CRFM, as the custodian of the library will become an ASFA partner, which will provide the benefit of access to the full ASFA database on ProQuest and the ability to upload new publications directly.

In her intervention, Dr. DieiOuadi noted that this initiative informs a wider scale initiative, which is a registry of experts and resource persons in species and thematic areas in the wider Caribbean. This CARICOM initiative for an aquaculture registry has actually triggered further talk from WECAFC members and now we are developing this wider scale registry of experts and resource persons. Appreciation was extended to CRFM Secretariat for committing to sustain this important tool and keeping it alive and updated. It was suggested that while collecting the information to update the fisheries and aquaculture status within CARICOM for the CRFM's Statistics and Information report, the opportunity could be seized to update the information regarding the registry.

Tamsin Vicary of FAO introduced the Aquatic Sciences and Fisheries Abstracts (ASFA) as being one of FAO's longest-standing partnerships established for over 50 years. The goal of ASFA is to share and promote fisheries and aquaculture research, which FAO seeks to do with its partners. There are over 100 institutions that are active in ASFA and each of those partners shares their research on OpenASFA, making it available on the full ASFA database on ProQuest and also on the FAO website.⁴ Asfa has undergone a rapid period of transformation and hence FAO is launching new terms of reference that each partner would sign up to. The full details of those terms of reference can be shared for CFM to consider. There is a regional network for Latin America and the Caribbean region, however, only Cuba is active in the Caribbean. It was noted that the benefit of joining ASFA is that research is accessible, and shared across multiple platforms, thus increasing its reach in that it's available on different databases and through Google. The detailed indexing that ASFA involves means a reader is likely to find it using different search techniques. Each

⁴ <https://www.fao.org/asfa/en>

partner receives free access to the ASFA database, ProQuest, which is otherwise only available at cost to subscribers and each partner has the opportunity to participate in different projects, attend training, and steer ASFA's direction in terms of meeting information and knowledge management needs that are specific to them and their network. So ASFA can respond to information needs that partners may have.

The CARICOM collection has been shared; a publication list has already been created on ASFA with some 86 records that are freely searchable on the FAO website. FAO would really like to build and maintain this collection and if CRFM could join ASFA that would be the best way for securing long-term contributions to this collection, ensuring that it grows and adequately covers aquaculture research being produced in the region. FAO would provide full training to anybody who is willing to create ASFA records. This is a really simple process, you can create a record in five minutes and an advantage is that you can also store the full text, so unpublished materials, research you may just wish to share without publishing through an academic journal can be stored on OpenASFA, in addition to conference papers, dissertations, and other kind “gray” literature. The next step would be for CRFM to review the terms of reference if they wish to join ASFA formally, and which can be happily shared with the CRFM Secretariat and any other interested parties. It would be important to first have a discussion on what content would be shared on OpenASFA and how manage in a sustainable and long-term way. Then finally on becoming an ASFA partner to nominate a focal point who would handle communications between CRFM and ASFA.

Action

The Working Group:

Recalled the FAO initiative to develop a digitised library of public and private farms in the CARICOM Region

Noted the update on the status of the digitised library of public and private farms in the CARICOM Region

Proposed that while collecting the information to update the fisheries and aquaculture statistics within CARICOM for the CRFM's Statistics and Information report, the opportunity should be seized to update the information regarding the digitised library of public and private farms

Noted also the advantages and processes for partnering with FAO in the Aquatic Sciences and Fisheries Abstracts

Considered that the CRFM Secretariat should look into such a partnership

Sub-regional mariculture TCP

FAO has been approved for a sub-regional mariculture Technical Cooperation Programme (TCP) broken up into two outputs: (a) developing a marine shrimp (*Penaeus vannamei*) sub-regional hatchery model in St Lucia producing post larvae that will be grown out domestically and in St Kitts and Nevis and (b) implementing a red snapper (*Lutjanus campechanus*) cage mariculture pilot in Jamaica, importing juveniles through a collaboration with the University of Miami.

Mohamed Diop, FAO Fisheries and Aquaculture Officer, explained the outputs and overview of the project, for the working group to provide input and analysis of the initiative. Recognising that food security is a chronic issue within the Caribbean and this is not the exception for seafood, where it is estimated that more than one-third of fish consumed in the curriculum is imported. Finfish and crustacean mariculture represent a potential solution for food insecurity for the Caribbean, promoting local seafood production while also having the potential to create livelihoods along the fisheries value chain. Mariculture is especially relevant for Caribbean states, which although being freshwater stressed, many small island developing states do have access to high-quality marine waters that are free from aquatic pathogens that will stifle mariculture development, representing untapped potential for aquaculture production. FAO has recognized this untapped potential as far as mariculture development and has launched a sub-regional mariculture TCP with the goal of reducing food imports and promoting the mariculture production of marine shrimp and finfish in the Caribbean.

The project is divided into two parts. The first part is we're trying to develop a shrimp hatchery hub in St. Lucia that will be producing *Penaeus vannamei* shrimp post larvae for local grub in St. Lucia, but also in St. Kitts and Nevis. The idea is that FAO is trying to prove this concept of a hatchery hub whereby a single focal point within a subregion is able to produce aquaculture inputs to benefit the wider subregion of the small island developing states. The ramifications of what is being done are twofold: In the Eastern Caribbean right now shrimp mariculture is negligible; hopefully through this pilot we'll be able to provide seed and promote the shrimp mariculture within St. Kitts and St. Lucia, then maybe expand to other countries thus hopefully providing some kind import substitution and then also incentivize smallholder farmers to get involved in shrimp mariculture, because we're going to be providing examples.

The second part, the more wider idea is that hopefully, this hatchery hub will provide a framework for future mariculture development for the subregion, whereby we can invest in specific institutions or infrastructure that could provide seed and feed for wider subregions.

When we talk about aquacultural development, it can be seen as a wider effort rather than every country having to develop feed or seed infrastructure for themselves; so outputs of this project include upgrading the infrastructure of the prawn hatchery in St. Lucia for marine shrimp production. At the prawn hatchery now in St. Lucia, they produce a *Macrobrachium rosenbergii* freshwater prawn, but Mr. Diop and another HQ technical officer will be visiting St. Lucia towards the end of September, and evaluating the space for potential for *Penaeus vannamei* production. The idea is that the existing hatchery will be upgraded with the potential to produce *Penaeus vannamei* for St. Lucia, as well as to be transported to St. Kitts.

The second output is growing technical capacity amongst stakeholders in shrimp mariculture seed production and grow out through in-person and virtual workshops. FAO will be hiring a shrimp consultant, from Asia, who will be in person in St. Lucia and St. Kitts for the hatchery upgrading and the grow out of the marine shrimp. One of the consultant's outputs will also be to have webinars for the wider CARICOM for people to learn about shrimp mariculture, some of the strategies that have been used in Southeast Asia and how they can be applied to the Caribbean context, and provide a forum for discussion in the mariculture development.

The third output is developing models of shrimp mariculture grow out in St. Lucia and St. Kitts, so during the travels at the end of September Mr. Diop and the HQ technical officer are going to be evaluating sites and seeing the potential for this grow-out. Another output is developing published protocols for seed production in finfish slash shrimp mariculture production within the Caribbean context. The idea is that hopefully when this project is ended, we'll have collateral materials that people can build upon and revert back to when they want to continue, whether it be shrimp or finfish mariculture.

The final, umbrella, output of this part of the project is to prove the concept of a sub-regional hatchery hub, hopefully providing a framework or a foundation for future mariculture development.

The second part of the project is the Finfish Mariculture Grow-out Pilot. This project will also be developing a Red Snapper Caged Grow-out Pilot in Jamaica through a letter of agreement (LOA) with the University of Miami in collaboration with the National Fisheries Authority of Jamaica. Through the LOA with the University of Miami, their outputs will be basically providing technical capacity building for stakeholders in Jamaica in the wider CARICOM for virtual seminars, while also providing Red Snapper juveniles that will be sent to Jamaica. The idea is that normally those juveniles are sent to Jamaica, they have to be housed in a marine lab for one to two months, and then those juveniles would move out into the marine mariculture cages. The cages themselves will be constructed by a consultant FAO will hire from Rome, whose primary responsibility will be to come to Jamaica and construct two cages utilizing local materials, while also engaging local stakeholders and teaching them how to make cages for themselves because FAO really wants to promote the idea of mariculture within the context of the Caribbean and how it can be sustainable even after the project is finished. The goal of this activity is to demonstrate mariculture cage feasibility and build the technical capacity of stakeholders.

The second output is a cage grow-out of the red snapper finfish in Jamaica. The implementation team will be between FAO, the National Fisheries Authority, the University of Miami who has the technical expertise to lead such a project, and also private sector entrants who are eager to be a part of this example for future finfish development.

The third output is in-person and online workshops building stakeholder mariculture technical capacity. In-person workshops of that are teaching people how to produce finfish and crustaceans. There will also be online webinars that FAO is trying to organize with the University of Miami and other experts that will be diffusing some of the technical capacity of finfish production across the Caribbean to enable a first technical capacity experience as to how to go from egg to harvest of finfish mariculture.

The final output is developing published protocols similar to what was said about the crustaceans, developing published protocols for seed production in finfish mariculture within the Caribbean context.

It is important to note the subregional context of this TCP: although implementation will be within Jamaica, St. Kitts, and St. Lucia, the goal is really to provide a catalyzing effect for the wider Caribbean region. The plan is for this project to provide an example that will support our mariculture development across the subregion by inviting fisheries officers interested in the pilots and seeing examples of how finfish and crustacean mariculture can be done utilizing the FAO-established models. As indicated previously, webinars for the subregion will be held so people can get firsthand experience while these pilots and on-going. and learn to see how it can be adapted within their own countries. Finally, the goal of the pilot, once successful and established, is to develop recommendations and concept notes for subregional expansion initiatives as well. The idea is through government or through international organizations like the FAO as well as through the private sector, the impact of these pilots will catalyze interest and then further investment to push forward multicultural development for the Caribbean sub region.

Discussion

The question was asked whether, in the the finfish initiative, there is a role for UWI, with regard to scaling up at the larger regional level. The question was also posed how were the species selected for the FAO mariculture pilots? With regard to the first question, FAO is developing frameworks of collaboration with the University of the West Indies. They are still evaluating, because there's some upgrading that's going to need to be done to be able to house the juveniles that are going to be imported from the University of Miami.

When it comes to the species selected, FAO just wanted to have diversified examples of how mariculture could be developed within the Caribbean context, so one way was through marine shrimp. FAO saw that the production of marine shrimp was negligible within the Eastern Caribbean, and they have been importing it, so FAO decided on marine shrimp for the Eastern Caribbean. Finfish, particularly red snapper, is something that is very much in high demand and it is a species of fish that people know. A lot of times people try to develop a mariculture species that people don't necessarily know and so there's another level of marketing and promotion that has to happen: FAO decided on the red snapper because it's a iconic species of the Caribbean. This is not to say that red snapper is the only, I guess, future of finfish mariculture for the Caribbean but it is believed that it would be an exciting pilot demonstration of how finfish mariculture could be done in Jamaica and the wider subregion. A lot of the same protocols and technical capacity that's going to be done towards the red snapper are going to be applicable to other species of fish so it's really just given an example.

Action

The Working Group:

Noted that FAO has been approved for a sub-regional mariculture TCP

Noted also that the two main outputs of the TCP were (a) developing a marine shrimp (*Penaeus vannamei*) sub-regional hatchery model in St Lucia producing PL that will be grown out domestically and

in St Kitts and Nevis and (b) implementing a red snapper (*Lutjanus campechanus*) cage mariculture pilot in Jamaica, importing juveniles through a collaboration with the University of Miami

Acknowledged that these initiatives could provide a framework or a foundation for future mariculture development, catalyzing interest and then further investment to push forward multicultural development for the Caribbean subregion.

Considerations for the further implementation of the 5-year Work Plan for Aquaculture Development

Informed by the previous agenda items of the meeting, the Convener was to initiate discussion on issues that would require consideration for furthering the implementation of the 5-year Work Plan for Aquaculture Development in CRFM. To the extent possible specifics related to the implementation of activities were to be discussed. The working group was of the view that this topic had been extensively covered in the discussions under the earlier agenda items. Given the fact of where we are with the survey and that we have set out as a timeline for the survey, which really and truly we had seen as feeding into this agenda item.

The thinking was that we could actually wait until we've done the analysis of the implementation of the plan before really addressing this agenda item. Against the backdrop of what was discussed, participants would want to look at the draft meeting report and provide feedback on agenda item nine by the 26th of September.

In terms of agenda item 10, we have a number of things that have come up there and based on the discussions we had and mindful of the feedback that we may get between now and the 26th.

Action

The Working Group:

Agreed that this topic had been extensively covered in the discussions under the earlier agenda items

Emphasised that the need for capacity building and research and development had been a recurring concern throughout the meeting

Summary of recommendations & proposals for development of aquaculture

Action

The Working Group:

Noted the wealth of discussion and recommendations from the preceding agenda items,

Agreed that the Secretariat should compile a summary of recommendations to be circulated to participants, to allow for the acceptance of said recommendations.⁵

Also agreed that, as appropriate, the recommendations would be submitted to upcoming meetings of the CRFM Executive Committee, the Caribbean Fisheries Forum and/or the CRFM Ministerial Council, as appropriate.

Any other business

There was no other business proposed for discussion

⁵ see appendix 4

Place and date of next meeting

Action

The Working Group:

Agreed that the Sixth Meeting of the Working Group would be electronic

Charged the Secretariat with determining the appropriate date for the Sixth Meeting of the Working Group; which, to the extent practicable, should be no later than the end of the second quarter of 2025.

Adjournment

The Chair thanked Member States for participating and opined that this fifth Meeting of the Working Group to Promote Sustainable Aquaculture Development had been fruitful. She thanked the participants for giving her the opportunity to chair the meeting. She expressed confidence that a way forward has now been discerned for aquaculture development in the region.

The FAO subregional Officer, Dr. Yvette DieiOuadi thanked the CRFM Secretariat for inviting FAO to participate in the meeting.

Dr. Julian Walcott expressed his pleasure in participating on behalf of UWI/CERMES and pledged support for the further work of the Working Group

The Meeting was adjourned at 12:25 pm Belize time (1:25 pm Jamaica time; 2:25 pm Eastern Caribbean time; 3:25 pm Suriname time)

Appendix 1 – Annotated Agenda

Fourth Meeting of the Working Group to Promote Sustainable Aquaculture Development (Electronic)

11 September 2024

Item #	Agenda Item
1	Call to order and opening <ul style="list-style-type: none">• <i>The Meeting Convener will call the meeting to order and opening remarks will be made by DED</i>
2	Adoption of the Agenda <ul style="list-style-type: none">• <i>The meeting will adopt the agenda including any other items of business brought to the attention of the WGA that are of relevance to its ToRs, not elsewhere considered</i>
3	Introduction of participants and review of the ToRs of the WG and election of Chairperson <ul style="list-style-type: none">• <i>Participants will introduce themselves</i>• <i>The WGA will agree on a country representative to chair the current meeting.</i>• <i>The Convener will briefly present the Working Group ToRs. The WGA will propose any revision to the ToRs that may be deemed appropriate.</i>
4	Summary on status of aquaculture globally and in the CRFM Member States and update since the 4th Meeting of the CRFM Working Group to Promote Sustainable Aquaculture (WGA) <ul style="list-style-type: none">• <i>The Meeting Convener will provide a summary of the state of aquaculture globally and in the region, the report of the 4th meeting of the WGA and an update of activities since then.</i>
5	Survey on Five-year Work Plan for aquaculture development in the Caribbean - Current status of Member State implementation. <i>The Meeting Convener will present the results of a Survey on the Five-year Work Plan for aquaculture development in the Caribbean outlining the current status of Member State implementation</i>
6	Discussion on future directions for aquaculture development and elements of the enabling environment for promoting aquaculture development. <i>Presentations will be received on</i> <ul style="list-style-type: none">• <i>Scope for multitrophic aquaculture (mariculture) in CRFM Member States</i>• <i>Aquaponics as a mechanism for promoting aquaculture development</i>• <i>Science-Policy interface for aquaculture Development in CRFM Member States</i>
7	Update on the FAO aquaculture initiatives CARICOM Region. <ul style="list-style-type: none">• <i>FAO had initiated action to develop a digitised library of public and private aquaculture farms in the CARICOM Region. The Working Group will be provided with an update on the status of this action.</i> <i>FAO has been approved for a sub-regional mariculture TCP broken up into two outputs: (a) developing a marine shrimp (Penaeus vannamei) sub-regional hatchery model in St Lucia producing PL that will be grown out domestically and in St Kitts and Nevis and (b) implementing a red snapper (Lutjanus campechanus) cage mariculture pilot in Jamaica, importing juveniles through a collaboration with the University of Miami. The Working Group will be provided with an update on this TCP</i>

- | Item # | Agenda Item |
|---------------|---|
| 8 | <p>Considerations for the further revision, updating and implementation of the 5-year Work Plan for Aquaculture Development</p> <ul style="list-style-type: none"> • <i>Based on the preceding agenda items, the WGA will have open discussion on considerations for revision, update and implementation of the 5-year Work Plan for Aquaculture Development in CRFM.</i> <ul style="list-style-type: none"> ○ <i>Issues related to the implementation of activities will be discussed, including on how aquaculture can contribute to food security and nutrition</i> |
| 9 | <p>Review of Regional Project Concept for “Development of Integrated Multi-Trophic Aquaculture in CARICOM States for Climate-Smart Sustainable and Resilient Aquatic Food System” for submission to potential donors for funding</p> <ul style="list-style-type: none"> • <i>The meeting will consider a preliminary draft concept note on Development of Integrated Multi-Trophic Aquaculture in CARICOM States for Climate-Smart Sustainable and Resilient Aquatic Food System and propose how it could be revised/improved/updated for submission for donor funding</i> |
| 10 | <p>Summary of recommendations and proposals for sustainable development of aquaculture for submission to the Exec Comm, Forum and/or Ministerial Council for adoption.</p> <ul style="list-style-type: none"> • <i>As appropriate, the WGA will consider and agree on any recommendations that it may wish to make to upcoming meetings of the CRFM Executive Committee, the Caribbean Fisheries Forum and/or the CRFM Ministerial Council</i> |
| 11 | <p>Any other business</p> <ul style="list-style-type: none"> • <i>The WGA will consider any other business brought to its attention of relevance to its ToRs, not elsewhere considered</i> |
| 12 | <p>Place and date of next meeting.</p> <ul style="list-style-type: none"> • <i>The WGA will propose a place and date for its 5th meeting</i> |
| 13 | <p>Closing remarks and Adjournment</p> <ul style="list-style-type: none"> • <i>After an exchange of the usual pleasantries, the meeting will be adjourned)</i> |

Appendix 2 - Attendees at the Fifth meeting of the Working Group to Promote Sustainable Aquaculture Development

11 September 2024 (via GoToMeeting)

<i>Name and Designation</i>	Address	Email Contact
Dr. Patrick McConney	Senior Lecturer Centre for Resource Management and Environmental Studies University of the West Indies Cave Hill BARBADOS	patrick.mcconney@cavehill.uwi.edu
Dr. Carolyn Henri	Working group Member Private Sector Punta Gorda, Toledo District Belize Tel: +501-634-1016	henri98203@comcast.net henri98203@comcast.net
Dr. Julian Walcott	Lecturer in Tropical coastal and marine resource management Centre for Resource Management and Environmental Studies University of the West Indies Cave Hill BARBADOS Tel: 246-417-4316	julian.walcott@cavehill.uwi.edu
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Dr. Neveen Gray	Veterinary Officer Ministry of Agriculture Regent and Vlissengen Bourda Georgetown GUYANA Tel: 592-220-6556	nevandigrayce@gmail.com
Dr. Yvette Diei Ouadi	FAO Fishery and Aquaculture Officer FAO Subregional Office for the Caribbean	Yvette.DieiOuadi@fao.org

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Mr. Brandon Dookie		
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Mr. Dorian Stanford		
Mr. Eustace Phillip		
Mr. Ian Horsford	Chief Fisheries Officer (ag.) Fisheries Division Point Wharf Fisheries Complex Lower North Street St. John's ANTIGUA and BARBUDA Tel: 001-268-462-1372	fisheriesantigua@gmail.com ian.horsford@ab.gov.ag
Mr. Lester Gittens	Senior Fisheries Officer Department of Marine Resources P.O. Box N 3028 Nassau THE BAHAMAS TEL: 242-393-1777	LESTERGITTENS@bahamas.gov.bs
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Mr. Mohamed Diop FAO-SLC	Fisheries and Aquaculture Officer Food and Agriculture Organization of the United Nations (FAO) 2nd Floor United Nations House Balmoral Gap, Marine Gardens Christ Church BARBADOS	Mohamed.Diop@fao.org
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	Belize City BELIZE Tel: 501-223-4443	
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Mrs. Artie Tedjoe	Ministry of agriculture, livestock and fisheries Cornelis Jongbowstraat #50 Paramaribo SURINAME Tel: 597-476-741	Visserijdienst@gmail.com
Mrs. Avery Smikle	Director Aquaculture Division National Fisheries Authority Ministry of Agriculture & Fisheries 2C Newport East Kingston 11 JAMAICA Tel: 876-967-1601 876-948-9014	Avery.Smikle@nfa.gov.jm
Ms. Allena Joseph	Marine Spatial Planning Specialist, BE: CLME+ Project CRFM Secretariat Princess Margaret Drive Belize City BELIZE Tel: 501-223-4443	Allena.joseph@crfm.int
Ms. June Masters	Statistics and Information Analyst CRFM Secretariat Old Montrose Kingstown St. Vincent and the Grenadines Tel: 784-458-4269	June.masters@crfm.int
Ms. Kathy Lockhart	Ms. Kathy Lockhart	klockhart@gov.tc

	<p>Director of Fisheries (Ag.) Department of Fisheries and Marine Resources Management Ministry of Tourism, Environment, Fisheries, Maritime Affairs, Culture and Heritage, Agriculture, Religious Affairs and Gaming Lower Bight Road Providenciales TURKS and CAICOS ISLANDS Tel: 649-331-4545</p>	
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Ms. Nadia Ramphal	<p>Fisheries Officer Fisheries Division Ministry of Agriculture, Land and Fisheries #35 Cipriani Boulevard Newtown Port of Spain TRINIDAD AND TOBAGO Tel: 868-623-8525/6028</p>	<p>nadiaramphal@hotmail.com</p>
Ms. Risha Alleyne	<p>Aquaculturist Women in Caribbean Aquaculture United States of America Tel: 784-498-4522 (m)</p>	<p>risha_alleyne@msn.com</p>
Ms. Sanya Compton	<p>Research Graduate CRFM Secretariat Old Montrose Kingstown ST. VINCENT and the GRENADINES Tel: 784-458-4269</p>	<p>sanya.compton@crfm.int</p>
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Appendix 3 - Revised (11 September 2024) Terms of Reference of the CRFM Working Group to Promote Sustainable Aquaculture Development

Background and Rationale

According to the FAO State of World Fisheries and Aquaculture Report 2010, aquaculture continues to be the fastest-growing animal-food-producing sector and to outpace population growth, with the per capita supply from aquaculture increasing from 0.7 kg in 1970 to 7.8 kg in 2008, an average annual growth rate of 6.6 percent.

Aquaculture accounted for 45.7 percent of the world's fish food production for human consumption in 2008, up from 42.6 percent in 2006. It is set to overtake capture fisheries as a source of food fish. While aquaculture production (excluding aquatic plants) was less than 1 million tonnes per year in the early 1950s, production in 2008 was 52.5 million tonnes, with a value of US\$98.4 billion.

The majority of fishers and aquaculturists are in developing countries, mainly in Asia, which has experienced the largest increases in recent decades, reflecting in particular the rapid expansion of aquaculture activities. In 2008, 2.9 percent of fishers and fish farmers were in Latin America and the Caribbean.

The aquaculture sector is not well developed in the CARICOM region, with significant development limited to countries like Jamaica and Belize. Other countries like Guyana, Suriname and Trinidad and Tobago have begun to put more emphasis on aquaculture as an area for development. The practices mainly involve the use of ponds to culture such species as penaeid shrimp (*Penaeus* spp.), tilapia (*Oreochromis* spp.), carp (*Ctenopharyngodon idellus*, *Hypophthalmichthys nobilis*, *Hypophthalmichthys molitrix*) and cachama (*Colossoma macropomum*). Also, there is long line culture for algae (*Eucheuma* spp. and *Gracelaria* spp.) in St. Lucia and the mangrove oyster (*Crassostrea rhizophorae*) in Jamaica.

Most CARICOM states have limited land and freshwater resources, however some, like Suriname, Guyana and Belize, do have ample supplies. On the other hand, most states have larger expanses of marine space than land mass, which offers the potential for the promotion and development of mariculture. As such the approach to aquaculture development will have to be multifaceted in its focus, design and implementation in order to address the needs of those with ample land and fresh water resources and those with less of these resource endowments, while incorporating the commercial elements of aquaculture. The CRFM has identified the promotion and development of aquaculture as one of the programme areas within its 2002 Strategic Plan and CRFM First Medium-Term Plan (2004 – 2007) and CRFM Second Medium Term Plan (2008 - 2011). With this in mind, it identified aquaculture development policy formulation as one of the areas to be addressed under the CRFM / JICA Master Plan Study (2009 2011), which included the delivery of two Regional Aquaculture Development Planning Workshops in March and August 2011 involving Belize, Guyana, Haiti, Jamaica, Suriname and Trinidad and Tobago. Some of the common issues identified at the March 2011 Regional Workshop were in the areas of aquaculture policy, legislation, institutional capacity to conduct research, development and provide extension services, technology, feed production and marketing.

In relation to the recently approved Draft Agreement Establishing the Caribbean Community Common Fisheries Policy, objective (a) of section 4.3 is aimed at promoting the sustainable development of fishing and aquaculture industries in the Caribbean Region as a means of, *inter alia*, increasing trade and export earnings, protecting food and nutrition security, assuring supply to Caribbean markets and improving income and employment opportunities, while section 10 Fisheries Sector Development states that Participating Parties, to the extent of their capabilities, will endeavor to promote and adopt measures to enhance the development of the fisheries and aquaculture sectors and to improve the welfare and socio-economic conditions of fishers and fishing communities, including, *inter alia*, by:

- (a) improving the business, financial and insurance environment;
- (b) promoting and facilitating joint ventures;
- (c) promoting access to training;

- (d) supporting capital investment; and
- (e) promoting the involvement of stakeholders, in particular in planning and management activities, including by supporting the formation and strengthening of fisherfolk organisations. The Policy document in section 20 also recognizes the need to develop a protocol on aquaculture.

With the above in mind and recognizing the need to put in place a mechanism to promote and provide support for the development of aquaculture in the region, the Secretariat, in keeping with Article 11 (Sub-Committees of the Forum) of the CRFM Agreement, is proposing that a working group for the promotion of aquaculture development be established.

Objectives

The objective of the working group would be to:

1. Promote sustainable aquaculture development at the national and regional levels, mainly for the purposes of:
 - increasing food production and security;
 - improving rural income and employment;
 - diversifying farm production; and
 - increasing foreign exchange earnings and savings.
2. Advise the Forum on policies, programmes and projects to promote the development of aquaculture.

Terms of Reference

The terms of reference for the establishment of a CRFM Working Group to Promote Aquaculture Development, are as follows:

1. Assist member States in conducting feasibility studies, socio-economic analyses, policy, planning and project formulation;
2. Promote interdisciplinary research on selected aqua-farming systems for adaptation or improvement of technologies, and for the development of new technologies that are environmentally suitable/appropriate and utilizing renewable energy sources;
3. Promote market and value-added product research to facilitate improved marketing and trade of fish and fish products from the aquaculture sector;
4. Provide support to the improvement of statistics on aquaculture
5. Provide assistance to train and upgrade the core personnel needed for national aquaculture planning, research, training, extension and development;
6. Keep under review the policy and legal frameworks for sustainable aquaculture development in the region including the gaps and weakness, and propose recommendations to the Forum for their improvement;
7. Provide guidance on management and development responses to the positive and negative links between aquaculture and other socio-economic sectors
8. Develop guidelines for the introduction of alien/exotic/non-indigenous fish species into aquaculture operations and the avoidance of invasive species and pathogens in such operations;
9. Provide guidance for the adoption and implementation of credible aquaculture certification schemes;
10. Identify bottlenecks and constraints to aquaculture development and make proposals to the Forum to address them;
11. Monitor scientific and technological developments in aquaculture and keep the Forum updated;
12. Promote the establishment of a regional information system to address common priorities that may be identified with respect to information and knowledge exchange, including through the improvement of data collection methods;

13. Assist member states in strengthening their national aquaculture agencies/organizations;
14. Assist the national agencies/organizations in testing and adapting existing technologies to local requirements and in the training of technicians, extension workers and farmers;
15. Promote the transfer of appropriate aquaculture technologies and techniques developed at the national and regional levels;
16. Facilitate the exchange of national experts, technical know-how and information within the framework of TCDC;
17. Advise on and support activities geared towards sustainable feed development for aquaculture; and
18. Assist in the development of programmes for the promotion of the participation of women and youth in the aquaculture industry/sector at all levels.

Mode of Operation

The CRFM Secretariat will be responsible for coordinating the activities of the Working Group.

The Working Group, through the CRFM, should work closely with staff of national and regional aquaculture and related institutions, and of regional organizations such as the FAO Commission for Inland Fisheries and Aquaculture of Latin America and the Caribbean (COPESCAALC), FAO Aquaculture Network for the Americas (RAA) and the Network of Aquaculture Centres in Asia-Pacific (NACA) in order to make full use of available technical expertise.

Membership of the Working Group and Participation

The membership of the group would be comprised of Member States and agencies which are interested in collaborating and cooperating in the promotion of aquaculture development at the national and regional levels, including, *inter alia*, participants from the private sector and academia, as appropriate.

Working Group Meetings

The Working Group will meet by way of regular electronic meetings and an annual on-site meeting subject to the availability of funding.

Appendix 4 - Recommendations of WGA4 for consideration and/or approval of the CRFM's governance hierarchy

Adoption of integrated multi-trophic aquaculture (IMTA) as an agreed regional direction for aquaculture development should be encouraged as being more beneficial to Member States

CRFM Member Countries need to consider changing the current focus on land-based aquaculture in large ponds to the creation of inland structures that are hurricane or flooding resistant.

All Member States should endeavour to complete the survey instrument on the implementation of the 5-year action plan for aquaculture in a timely enough manner to allow time for the appropriate meeting of the CRFM governance hierarchy meeting of the Caribbean Fisheries Forum.

Efforts should be made to ensure that aquaculture is introduced into school curricula of our traditional schools (not just agricultural schools) as a STEM science, including through introducing the sixth and seventh grades to basic concepts of mariculture as well as the business of aquaculture; to engender change in the current perception of aquaculture and also providing a basis for it to be included in curricula of tertiary education facilities.

Investigations should be carried out into how CERMES and other regional tertiary level educational institutions can be supportive of aquaculture in their curricula to assist in building a cadre of people at that level, who can in turn encourage teachers at the other levels.

While collecting the information to update the fisheries and aquaculture statistics within CARICOM for the CRFM's Statistics and Information report, the opportunity should be seized to update the information regarding the digitised library of public and private farms

CRFM Secretariat should seek to partner with FAO in the Aquatic Sciences and Fisheries Abstracts

CRFM

The CRFM is an inter-governmental organisation whose mission is to “Promote and facilitate the responsible utilisation of the region’s fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region”. The CRFM consists of three bodies – the Ministerial Council, the Caribbean Fisheries Forum and the CRFM Secretariat.

CRFM members are Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, Saint Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago and the Turks and Caicos Islands.

