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SUMMARY REPORT

FOURTH MEETING OF THE WORKING GROUP TO PROMOTE SUSTAINABLE AQUACULTURE DEVELOPMENT

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Summary Report of the Fourth Meeting of the Working Group to Promote Sustainable Aquaculture Development (Electronic), 30 June 2022

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CONTENTS

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
SME	-	Small and Medium-sized Enterprises
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 Fourth Working Group Meeting are to: consider the summary and update since the 3rd Meeting of the CRFM Working Group to Promote Sustainable Aquaculture (WGA) held on 20 November 2020; elements of the enabling environment for promoting aquaculture development; competition as a potential hinderance to 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 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 at the Fourth 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 the Kris Isaacs, Senior Fisheries Officer, St. Vincent and the Grenadines. In attendance were Dr. Sandra Grant, Deputy Executive Director, CRFM Secretariat; and Dr. Maren Headley, Programme Manager, Fisheries Management and Development, CRFM Secretariat, and Dr. Yvette Diei Ouadi, Fishery and Aquaculture Officer, Food and Agriculture Organisation of the United Nations (FAO). This was a joint meeting between the CRFM Working Group on Aquaculture and the FAO Subregional Office for the Caribbean, incorporating elements of FAO webinar on a Digital Library for aquaculture in CARICOM.

Call to order

The Meeting was called to order at 08:45am Belize time (09:45am Jamaica time and 10:45am Eastern Caribbean time) by the Convener, Mr. Peter A. Murray. After welcoming remarks by Dr. Yvette Diei Ouadi and Dr. Sandra Grant, the provisional Agenda was tabled and was accepted by the Meeting with no amendments (see ***Appendix 1***).

INTRODUCTION OF PARTICIPANTS, REVIEW OF THE TORS OF THE WORKING GROUP and ELECTION OF CHAIR

The convener invited participants to introduce themselves (see ***Appendix 2***).

Participants were asked to consider who should chair the current meeting, noting that usually the representative of the country that currently chairs the Caribbean Fisheries Forum and Ministerial Council, chairs the meeting. In the absence, at the time, of a representative from Suriname, Mr. Kris Isaacs of St. Vincent and the Grenadines was nominated to the chair by Jamaica and accepted by acclamation.

The Convener presented the current Terms of Reference (ToRs), which was accepted without amendments. It was noted that the 3rd meeting of the WGA had been asked to consider the revision of its membership to include 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, however, was not given consideration at the 3rd meeting and, thus, was revisited. It was opined that the current, limited representation at the working group resulted in a lot of core information being missed from its deliberations. Broadening of the participation in the working group would 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. Given this, the Working Group agreed to expand the stated membership and the amended Terms of Reference are shown at ***Appendix 3***

ACTION

The Working Group:

Noted the participants at the meeting

Elected Mr. Kris Isaacs of St. Vincent and the Grenadines 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 its membership to be more inclusive of representatives of the private sector and academia.

Also agreed that the section of the Terms of Reference on membership should be amended to read: "*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*."

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 WGA3

The Third Meeting of the Working Group to Promote Sustainable Aquaculture Development had been held virtually on 20 November 2019, under the chairmanship of the Convener, Mr. Peter A. Murray, CRFM Advisor, Fisheries Management and Development. The summary report of the meeting had been circulated as a reference document - Summary Report of Third Meeting of the CRFM Working Group to Promote Sustainable Aquaculture, CRFM Technical & Advisory Document Number 2020 /12, and was taken as read.

Update since WGA3

Consequent upon the COVID-19 pandemic, there has been no meeting of the WGA since its meeting of November 2020. The 19th meeting of the Caribbean Fisheries Forum had considered the main substantive development trends/issues in aquaculture and noted the priorities/concepts/proposals in furtherance of implementing the 5-year Work Plan for Aquaculture Development. The Forum has also endorsed the report of the Third Meeting of the WGA; as well as a project concept note for demonstrating the feasibility of integrated multi-trophic aquaculture system(s) to improve sustainable production. The Forum has also asked the CRFM Secretariat and its donor partners to give attention to supporting the project proposals aimed at addressing the recommendations of CRFM Ministerial Council and the CRFM/CARICOM Fisheries and Aquaculture Priority Commodity (FISHCOM) Working Group, which has COTED's mandate for fisheries commodity development

The 20th meeting of the Forum was reminded that the government of China expressed a willingness to support the development of Integrated Multi-Trophic Aquaculture in the region. Subsequently, the Ministerial Council at its 16th meeting requested that the CRFM Secretariat and regional and international development partners give priority to developing bankable proposals and to secure the necessary funding from private investors and donors to invest in the development of sustainable aquaculture, including mariculture. Council also supported collaborating with 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). Consequently, Council authorised the CRFM Secretariat to follow-up on the mission of fisheries and aquaculture experts from China 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.

OVERVIEW OF AQUACULTURE

An updated overview of CRFM Member States' aquaculture (as at April 2022) had been circulated (see **Appendix** 4).

While the global community has recognised and reiterated the crucial role of aquaculture for food security and nutrition and in providing for the livelihoods of the world's people, the aquaculture sector is not well developed in the CARICOM region. 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. More specifically, expansion of Caribbean mariculture is critically dependent upon the identification of species with highest commercial potential. Integrated Multi-trophic Aquaculture is currently being considered to 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. An overview of aquaculture in CRFM Member States was presented.

In 2020, the CRFM Secretariat had carried out a survey to determine the status of implementation and achievements to date with regard to the 5-year Work Plan on Aquaculture. The Survey sought to capture all which countries are doing on aquaculture, both government-led and non-government-led activities, to determine if and which elements of the 5-year action plan for aquaculture development were being advanced satisfactorily; and areas of continuing weaknesses. A number of factors have been suggested with regard to the current status of implementing the 5-year action plan. Most notable among these remain (1) the inadequacy of the human capacity, including for business planning and implementation; whether by way of numbers of persons or areas of study, within national fisheries agencies to lead and support aquaculture development. (2) The limitations in availability of land and water resources, in a majority of Caribbean SIDS, limits development of aquaculture to the extent required to substitute/replace demand for marine capture species, whether for local consumption or export. Additionally, (3) persons interested in pursuing aquaculture often have challenges acquiring the start-up capital for their ventures.

Notwithstanding the abovementioned, aquaculture efforts in the region have utilised a variety of approaches to development of the sub-sector (see Reference Document previously circulated) 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

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 region. Expansion of

Caribbean aquaculture is critically dependent on the identification of species with highest commercial potential; and Integrated Multitrophic Aquaculture (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.

It is still the view that the CARICOM approach to aquaculture development will have to be multifaceted to address the range of available natural land and fresh-water resources in the region, while incorporating the commercial elements. Because of the limited potential growth of wild catches in the Caribbean region, sustainable expansion and intensification of fish production through responsible aquaculture development remains a major objective for countries in the region, as such, sanitary controls specifically for aquaculture need to be addressed; this notwithstanding that such requirements have to be viewed in the wider context of the economies in which they might develop.

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 (***Resolution No. MC 16 (19) of 2022***) 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.

There is need to monitor implementation of the 5-year Action Plan. Given the biennial planning cycle for CRFM, it had been considered best to carry out a similar survey (utilising the same survey instrument) to the one carried out in 2020, six months before the end of the biennium. This would have allowed two months for circulation and responses and one month for analysis, such that the results would be ready to "feed" into the preparation of the 2022-2023 biennial work plan, at that time this would have begun in April 2022. Thus, the next survey to monitor implementation of the current action plan should have commenced circa October 2021, such that the results would be ready by December of that year, to be incorporated into the 2022 - 2024 Biennial work plan. While this was not possible due to challenges consequent upon the COVID-19 pandemic and given that *ad interim* the Ministerial Council has decided that the planning/financial cycle for the CRFM should begin in January as from 2022, the CRFM Secretariat expects to carry out this survey in the latter part of 2022 to allow the results to inform any necessary "half-term" revision of the current 2022-2024 work plan.

FAO Current state of aquaculture in CARICOM survey

A presentation on the results of a short survey sent to CARICOM countries was made by Dr. Samia Sarkis, FAO consultant. The objective of the survey was to obtain a current overview on the species commercially produced, their contribution to GDP or food security, and the limitations and interests in expanding aquaculture by the region. Of the 15 CARICOM countries, 11 responded to the survey questions.

Tilapia species dominate aquaculture in CARICOM countries (mostly Nile Tilapia- *Oreochromis niloticus*), and 9 of 11 countries reported culture of this finfish commercially. Five species of other finfish, 4 species of crustaceans (shrimps/prawns), 3 species of seaweed, and 1 species of bivalve are also cultured at commercial scale. Most aquaculture in CARICOM relies on exotic species (70% including Tilapia; 38% excluding Tilapia; native species constitute 29% of commercial culture). The Private sector dominates commercial aquaculture, and of the 11 CARICOM countries which responded, there is one government supported commercial operation of Tilapia (where the government entity produces Tilapia fingerlings for farmers to grow-out) and seven public/private partnership.

With regards to the contribution of aquacultured species to GDP, there are 3 Exotic species and 4 Native species. Most of the contribution to GDP by exotics refers to Tilapia (reported by 54% of countries which responded), while 33% of countries report exotic species other than Tilapia; the contribution to GDP by natives was reported by 36% of countries; and 2 countries reported no contribution of aquaculture to GDP, despite ongoing commercial aquaculture operations. Tilapia was also reported as the top species contributing to food security by 54% of countries; exotic species in general (including Tilapia) constitute the top species for food security, reported by 72% of countries; whereas native species consisted of the top cultured species for food security by 27% of the countries which responded.

Other Species of Interest for Aquaculture in CARICOM included 8 native species and 5 exotic species. Of these, 5 species are lower trophic species (also referred to as 'unfed') which are known to have a lesser environmental impact (and there are known techniques/operational culture in the CARICOM region for 6 of the species of interest.

In terms of prioritised Needs by Country for Growth of Aquaculture Sector, 5 of 11 countries report lack of investment and reliable seed supply as equally being the most limiting factors, 7 of 11 countries reported lack of appropriate skill set, number of people, etc. as the 2nd most limiting factor, whereas 5 of 11 countries report technical knowledge as the 2nd most limiting factor.

Additional constraints and challenges to expanding and diversifying aquaculture in CARICOM

Legislative and Regulatory Development and Enactment	Capacity Environmental and Physical plants	Operational Decrease reliance on imported supplies Regional information sharing/training
• Zoning • Licensing • Statutory instruments- environmental monitoring, fish health management, use of drugs • Aquaculture policy • Aquaculture regulation Act • Inclusion of Aquaculture into existing national programmes • Government support/subsidies to private sector • Standardisation of production techniques (Best practice adoption) • Protection against larceny • Government support for research and development	• Land availability • Freshwater availability (seamoss processing • Sanitary and processing facilities • Hatchery facility for seed supply • Resilience to climate change factors (droughts and floods)	Supply of high-quality feed (local production) Seed supply Reduce feed cost Training for skilled human resources (Fish nutrition, breeding and larval culture, disease identification, new species

Dr. Sarkis suggested that part of the solution to address the recognized limitations could include:

- Technical Knowledge exchange between existing practitioners, experts and new interests. For e.g. Pacific white shrimp, Queen conch (Puerto Rico), Spiny lobster (British Virgin Islands)
- The establishment of the digital aquaculture library providing an expert database, documentation of techniques, and possibly mapping of farms- assists in developing operations, zoning, licensing, regulatory framework
- Improving contribution to GDP and Food Security through the development/strengthening of Government and private partnerships, pooling national technical resources (such as government supported farms through fingerling production) and national government budget allocations to aquaculture.

- Regional pooling of resources for feed production facility, or seed supply (as discussed in FAO Regional proceedings 2011).

Discussion

There was agreement that IMTA could provide a way forward for aquaculture in the region; noting that there was also need for discussions on aquaculture beyond simply production for consumption but also with regard to its use to restock wild populations. It is important to identify appropriate species for culture and the potential for diversification as well as appropriate changes to legislation to contribute to the enabling environment for aquaculture. It was noted that Tilapia is so pervasive in a number of countries that it is often not recognised as an exotic (some might say invasive) species.

It was pointed out that a lot of knowledge related to development of aquaculture resides in Jamaica and Belize. Particular mention was made of shrimp aquaculture in Belize, noting that this country can provide many lessons, especially with regard to technology transfer.

It was thought that creating a natural ecosystem/nursery for spiny lobster and other fish needs to be researched as a possible sustainable solution.

There was discussion on culture of Cobia using submerged cages, as done in Panama: this ensued consequent upon clarification that the finfish referred to in Dr. Sarkis' presentation as being cultured by Suriname is Cobia or Black acar (*Ciclasoma bimmaculatum*), a freshwater native species.

The issue of financing was touched on as an important consideration as was the need for information regarding sources of seedlings. The meeting was reminded that attention should be paid to making use of the competitive advantages of the region, for mariculture, such as the amount and quality of sunlight, the temperature and the clarity and relatively pristine nature of the marine environment.

ACTION

The Working Group is invited to:

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

Noted also the update provided by the Secretariat regarding the outcomes following the report.

Noted further the Overview of CRFM Member States' aquaculture as at April 2022 and **agreed** that the CRFM Secretariat would again circulate the overview document for input/updating by Member States who would return the updated documents by 15 July 2022.

Noted the results of a recent prioritisation survey carried out by FAO.

Agreed that Integrated Multi-trophic aquaculture (IMTA) could provide a way forward for aquaculture in the region.

Noted that the CRFM Secretariat expects to repeat its 2020 survey on implementation of the 5-year Action Plan, post-June 2022 to allow the results to inform "half-term" revision of the current 2022-2024 work plan, if necessary.

Noted that there is need for discussions on aquaculture with regard to its use to restock wild populations.

Noted also that it is important to identify appropriate species for culture and the potential for diversification as well as appropriate changes to legislation to contribute to the enabling environment for aquaculture.

Was reminded of the region's competitive advantages for mariculture, such as the amount and quality of sunlight, the temperature and the clarity and relatively pristine nature of the marine environment; noting that every advantage should be taken of these in furtherance of aquaculture development in the region.

KEY CONSTRAINTS TO AQUACULTURE DEVELOPMENT AND ÉLÉMENTS OF THE ENABLING ENVIRONMENT FOR PROMOTING AQUACULTURE DEVELOPMENT STATES

A presentation on best practices related to exotic and native species with emphasis on opportunities and impacts was made by Dr. Ryan S. Mohammed. He noted that insular states within had issues related to Water availability (too much vs too little), water quality issues and natural ecosystem issues, while the mainland states had challenges related to coastal saltwater intrusion and water quality or riverine systems/downstream effects.

Points of note with regard to aquaculture species as compared to aquatic alien invasive species (AIS) were that

i. It should be able to withstand the climate of the region in which it will be raised.
ii. Its rate of growth must be sufficiently high.
iii. It must be able to reproduce successfully under culture conditions.
iv. It must accept and thrive on abundant and cheap artificial food.
v. It must be acceptable to the consumer.
vi. It should support a high population density in ponds or tanks.
vii. It must be disease-resistant.

Dr. Mohammed proposed some ooptional fish species considered suitable for the Caribbean culture

Common Name	Scientific Name	Environment	Source Status
Grey mullet	*Mugil cephalus*	F, B, S	Native
American eel	*Anguilla rostrata*	F	Native
Grey snapper	*Lutjanus gresius*	B, S	Native
Dog snapper	*Lutjanus jocu*	B, S	Native
Tilapia	*Oreochromis mossambicus*	F. S	Introduced
	O. nilotica	F, S	Introduced
	O. aureus	F	Introduced
	O. mossambicus x O. niloticus	F	Introduced
Red tilapia hybrid	*O. niloticus x O. aureus*	F, B, S	Introduced
"Tri tri"	*Sicydium sp.*	F, B	Native
Crucian carp	*Carassius carassius*	F	Exotic
Atipa, Cascaura, hassar	*Hoplesternum littorale*	F	Native
Pacu	*Piaractus sp.*	F	Exotic

He also proposed optional crustacean species

Common Name	Scientific Name	Environment	Source/status
Malaysian prawn	*Macrobrachium rosenbergii*	F, B	Introduced
Common river prawn	*Macrobrachium crenulatum*	F, B	Native
White leg shrimp	*Litopenaeus vannamei, formerly Penaeus vannamei*	S	Introduced
Giant tiger prawn, Asian tiger shrimp, Black tiger shrimp,	*Penaeus monodon*	S	Introduced

Common Name	Scientific Name	Environment	Source/status
Australian Red Claw Crayfish	*Cherax quadricarinatus*	F	Introduced

In addition to other species worth considering

Common Name	Scientific Name	Environment
Black river conch	*Pomacea urceus*	F
Atlantic oyster	*Crassostrea virginica*	S
Caribbean mangrove oyster	*Crassostrea rhizophorae*	B, S
Spectacled caiman	*Caiman crocodilus*	F, B

With regard to aquaculture opportunities, Dr. Mohammed posited Caribbean food sovereignty, reduced pressures on wild populations, potential to service the local tourism sector, and contribution towards the Blue-green Economy. He suggested the existence of both positive and negative impacts.

Positive Impacts	Negative Impacts
Alternative protein source	Concerns with farmed vs wild caught
Alternative jobs	Re-training needed
Potential to earn foreign revenue	High start up cost

Mr. Harnarine Lalla of Trinidad and Tobago shared experiences in determining the important elements of the enabling environment which need to be addressed in promoting aquaculture development. Between 2010 and 2011, the issue of National Food Security was a major priority for the country. With the global economic collapse in 2009, countries suffered is various ways.

In Trinidad and Tobago, a number of basic food commodities were selected for focused attention and development; as part of the Tilapia Action Plan to concentrate on promotion and development meetings were held with the Minister of Agriculture at the time and aquaculture stakeholders, both agency and private sector. Stakeholders sought to identify problems and suggest possible solutions. Several groups were formed to deal with what were presumed to be problem areas; and 15 issues were identified as critical to the success of sustainable aquaculture development. These can be distilled down to:

- Identification of items, procedure, and process to qualify for import concessions.
- Improving human capacity.
- Determine optimal requirements for establishing aquaculture operations.
- Enable minimization of costs and maximization of availability of inputs into aquaculture operations.
- Prepare a National Aquaculture Policy.
- Improve knowledge management and access to information and training material related to aquaculture.
- Improve access to financing.

Dealing with these issues, it was felt, would result in an enabling environment for the private sector to become interested, involved and to invest in aquaculture.

Discussion

Brief mention was made with regard to transiting fishers to aquaculture and it was pointed out that socio-culturally, it has been observed that person that fish at sea appear not to have the mindset that allows him/her to be land-based in terrestrial aquaculture or even mariculture.
There was some discussion on potential for aquaculture species becoming invasive and, in that regard, mention was made of *Crassostrea gigas* culture. In the French experience *C. gigas* was introduced to culture for economic reasons. While this was very successful it proliferated naturally and overtook the habitat of native flat oyster (Ostrea). It is uncertain if *C. virginica* has same impact, however, *C. virginica* is known to transport species which become invasive when introduced to non-native sites. Caution is necessary to avoid any loss of native oyster species (mangrove oyster, *C. rhizophorae* and flat oyster, *Isognomon alatus*). Use of triploid stock that are sterile so there is no potential of spread was noted as a best practice option. There are mixed results with culturing triploid larvae; some farmers have not had good results raising these larvae and setting up tetraploid broodstock requires a high skill set and investment. It was suggested that if for trials spats are purchased that are triploid and growth rates look at then once production bugs are worked out investment into tripoid hatcheries could be made.

It was emphasised that political will was important in moving the enabling environment forward; and, noted that aquaculture can help reduce the region's import bill, ease pressure on wild population and support the tourism industry.

ACTION

The Working Group:

Noted the presentation on best practices related to exotic and native species.

Also noted the presentation on elements of the enabling environment for promoting aquaculture development.

Recognised that a number of the potential challenges and ways forward, envisaged in implementing the recommendations of these presentations had been considered as part of the discussions of the previous presentations and would be furthered in subsequent presentations.

COMPETITION AS A POTENTIAL HINDERANCE TO AQUACULTURE DEVELOPMENT

The item as briefly introduced by the Convener. In reviewing the status and trends in aquaculture in the CRFM States, the Third meeting of the WGA had been pointed to the fact that competition among aquaculturists could militate against successes as they have been known to compete with each other in a manner that appeared to be detrimental to all their interests; and hence, there may be a need to consider "private / private" partnerships as well as the often-touted public / private partnerships. This issue was seen as being linked to the Working Group's Term of Reference to "provide guidance for the adoption and implementation of credible aquaculture certification schemes" and should therefore be an item for discussion at this meeting of this Working Group.
Businesses that are new to the market always pose a threat to existing businesses. Five forces that will make the market or market segment attractive in the long-term have been identified.[1] These five powers are direct competitors in the sector (industry rivals), potential new entrants, threat of substitute products, bargaining power of buyers and bargaining power of suppliers. The strength and determination of competition in any sector depend on the competition between existing businesses, the threat of new businesses that may enter the market, the threat of the businesses producing the products in the market, the bargaining power of the

[1] Porter, M. E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. New York, USA, The Free Press. (cited in Uzmanoğlu, M. S., & Arslan, F. M. (2020))

buyers and the bargaining power of the suppliers.[2] While the businesses can directly predict the threats of existing competitors, businesses in other sectors are not expected to enter the market and thus encountering such a situation poses a threat to the business. If the competition between businesses operating in an industry is low, businesses have the opportunity to increase prices and make more profits. In other words, strong competition between businesses active in a sector poses an important threat to profitability.[3] Competition is normally expected to be high in sectors where potential competitors can easily enter; thus, there may be an increase in competition in the sectors that do not have any entry barriers. Additionally, the aquaculture sector has become more and more aware that for an aquaculture enterprise to remain viable and profitable, it must be environmentally sound and able to monitor its performance.[4] In a paper looking at increased competition for aquaculture from fisheries, it was found that improved fisheries management reduces the growth potential of global aquaculture in markets where wild fisheries constitute a large share of total supply.[5] It has also been suggested[6] that enterprises that are reaching higher levels in technical knowledge on aquaculture face fierce competition with each other. In the marine aquaculture industry, selling prices of products, quick delivery of products to the market, and financial power are the most important dynamics of competition.

With the increase in production, competition among businesses is also increasing. The competition among the existing businesses is intensely felt due to the reasons of having a greater number of businesses in the aquaculture sector, the supply-demand balance cannot string out to the whole year, low market growth rate on the consumer side and the fact that the products produced are relatively standard and there is no differentiation in the subjects of a brand, etc.[6]

Against this backdrop, a presentation was made by Mr. Sandifor Ruel Edwards of the CARICOM Public Sector Organisation (CPSO) on the issue of competition among and with aquaculturists as potentially hindering aquaculture development and the consequential need to consider "private / private" partnerships will be discussed. He noted that CARICOM imports US $184 million (2017-2020) worth of fish and crustaceans, molluscs and other aquatic invertebrates and exports and Exports US 293 million (2017:2020). This begs the question of whether regional aquaculture and mariculture can support '25% by 2025' directive from CARICOM Heads of Government. Aquaculture is the fastest-growing food-producing sector and account for 45.7% of the world's fish food production for human consumption[7]. Just under 3% of fishers and fish farmers were in Latin America and the Caribbean there is aquaculture infrastructure in some CARICOM Member States (Belize, Guyana, Jamaica, Suriname & Trinidad and Tobago). The main regional cultures are exotic species, mainly salmonids (trout and other fish); marine shrimp and tilapia.

Mr. Edwards suggested that the combination of aquaculture on the large landmasses such as the MDCs and Belize, together with mariculture in States with large Exclusive Economic Zones such as those of the OECS, provide an attractive industry setting for the private sector. From the private sector perspective key influencers on industry competitiveness and sustainability are:

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[2] Arslan, F. (2012). *Endüstriyel Pazarlama: Rekabetsel Yaklaşım*, İstanbul: Beta Yayınları. (cited in Uzmanoğlu, M. S., & Arslan, F. M. (2020))

[3] Aktan, C. C., & Vural, İ. Y. (2004). *Rekabet Gücü ve Rekabet Stratejileri, Türkiye İşveren Sendikaları Konfederasyonu*. Rekabet Dizisi: 3. (cited in Uzmanoğlu, M. S., & Arslan, F. M. (2020))

[4] https://thefishsite.com/articles/trying-to-increase-the-competitiveness-of-your-aquaculture-business <accessed 29 June 2022>

5 Frank Jensen, Max Nielsen and Rasmus Nielsen, 2014. Increased competition for aquaculture from fisheries: Does improved fisheries management limit aquaculture growth? Fisheries Research. Volume 159, November 2014, Pages 25-33

[6] Uzmanoğlu, M. S., & Arslan, F. M. (2020). Dynamics of competition in the marine aquaculture industry: A research on Turkey. Acta Aquatica Turcica, 16(2), 158-169. https://doi.org/10.22392/actaquatr.619093

[7] The latest figure from the FAO 2022 SOFIA is 49.2% (in 2020)

Environmental
•Natural Disasters (storms, volcanoes…) •Sargassum, water pollution (effluent, e-waste, agriculture etc) •Destruction of coastal marine coastlines including corals.
Financial Ecosystem
•Specialized Financing (cost of capital and access to capital) •Insurance •Market Failure Risk "Emerging Industry" in the Region •Availability of Credible Investment Business Cases
Quality Infrastructure
•Food safety •Standards and Certification •Traceability
Technology
•Data capture, analytics and dissemination •Adoption and adaptation

Mr. Edwards opined that competition is a potential hindrance to aquaculture development, but there are opportunities for 'Private-Private' & 'Public –Private' Partnerships. Private – private partnerships could be downstream investments such as feed production, shared processing, other shared infrastructure like storage facilities and cold chain investment, public policy advocacy and to improve capitalization. public –private partnerships could take the form of standards and quality infrastructure development, training, certification and other capacity building, export market promotion / trade agreement negotiations/ economic cooperation agreements expansion (Belize-Republic of Chain on Taiwan Agreement), Trading Infrastructure (CITES requirements – Grenada, traceability systems)

Approaches to Advancing the Region's Aquaculture Industry could include:

- Enhanced regulatory and trading environment (CITES requirements, UNCLOS obligations).
- Partnering with the public and private sectors in terms of policy investment regimes and capacity-building.
- 'Information precedes the Trade' - Statistics and Information ('Value Chain' and 'Value Shop').
- Need to be efficient producers of low-cost, high-quality aquaculture products incl. value added, and producers of more 'knowledge-intensive' aquaculture services.
- Development of innovative financing instruments to support the diversity of firms along the value chain.
- Recognition of small-scale producers as commercial partners and facilitation of their integration into the mainstream economy and financial system.

In this, CPSO envisages its role/advantages as:

- Advocating for mariculture development at the Community Level
- Support the further building out of the Caribbean Network of Fisherfolk Organization
- Contributing to statistics and technical research
- Collaboration for greater harmonisation of laws and regulations for the sector
- Joint development of proposals for financing
- Education and Awareness on the role of mariculture in achieving the full implementation of the CARICOM Single Market and Economy (CSME)
- Identification of export opportunities and member-to-member exchanges

Discussion

It was pointed out that given the levels of competition existent in and or related to aquaculture, the region might be better placed focusing aquaculture outputs/products on exports, in this instance the competition within the external market could be partially obviated by joint/regional approaches, including but not limited to the use of single brands for exports.
The importance of thoroughly considering environmental impacts of aquaculture and these should be prior to starting a commercial operation, especially where exotic species are utilised, to avoid irreversible changes in native species populations and ecosystem function.

It was noted that there is need for countries to mandate budgetary allocations specifically for aquaculture development

ACTION

The Working Group:

Discussed the issue of competition as a potential hinderance to aquaculture development.

Advise on potential challenges, consequent upon existing, observed levels of competition.

Emphasized the importance of thoroughly considering environmental impacts of aquaculture and addressing them prior to starting a commercial operation, especially where exotic species are utilised, to avoid irreversible changes in native species populations and ecosystem function.

Noted that the discussions of the previous presentations addressed a number of the issues that could be furthered in the context of this agenda item.

Noted and **endorsed** the CPSO's proposed approaches to advancing the region's aquaculture industry.

Proposed that consideration be given to focusing aquaculture outputs/products on exports, with potential competition within these markets being partially obviated by joint/regional approaches, such as the use of single brands for exports.

Called for CARICOM countries to mandate budgetary allocations specifically for aquaculture development.

UPDATE ON THE FAO INITIATIVE TO DEVELOP A DIGITIZED LIBRARY OF PUBLIC AND PRIVATE FARMS IN THE CARICOM REGION

As a follow up to the needs identified in the regional review of the aquaculture sector in the Latin America and the Caribbean conducted in 2020[8], the FAO-SLC contracted a service provider (Living Reefs Foundation, specialized in lower trophic level aquaculture research, development and commercialization spearheaded by Dr. Samia Sarkis) to engage with 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 would 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 are:

8 Regional Review of Aquaculture in Latin America and the Caribbean

- 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 brief 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.[9]
- A meeting on the development of best practices guidance document for Member States.

A joint presentation was made by Dr. Yvette Diei Ouadi, FAO subregional Fishery and Aquaculture Officer, and Dr. Samia Sarkis, Consultant to FAO. Dr. Diei Ouadi began by pointing to the motivation behind this initiative. In 2018 Aquaculture production in CARICOM of 34,313 tonnes represented 0.04% of global production and 1% production in Latin America and the Caribbean (LAC). That in CARICOM was the smallest proportion within the LAC region. Aquaculture development within the region is disparate and significant development is limited to countries like Jamaica and Belize. Other countries like Guyana, Suriname, and Trinidad and Tobago have started casting more and more interest in this sector as an important development stream. While key policy windows exist to leverage support by foreign aid and/or start-up companies, there has been no comprehensive assessment of the needs and capacities within the region to harness emerging opportunities
A digital library was seen as supporting the creation of opportunities for the continued sustainable development of aquaculture in the CARICOM region and would entail compiling a list of public and private aquaculture farms, knowledge hubs and documents in the CARICOM region; providing a current state of aquaculture in the CARICOM region; and, creating a digitized regional technical library of aquaculture farms, practitioners (technicians/expertise) and institutions in the CARICOM region.

On-going activities include:
- Finalising a CARICOM State of Aquaculture report
- Finalising a listing of experts, practitioners and knowledge hubs of resource persons
- Finalising a listing of aquaculture publications for the Region
- A joint FAO-CRFM meeting bringing together private and public sector aquaculture to gather information and learn from best practices, set priorities; and produce a document on aquaculture gaps and opportunities in the region for development
- Finalization of process to digitize information in an interactive aquaculture library

Final outputs of the project would be:
1) A CARICOM State of Aquaculture Overview that includes a summary of current aquaculture operations, limiting factors, and funding opportunities (investment and grant)
2) Online library of current aquaculture experts, practitioners and knowledge hubs
3) Online library of CARICOM aquaculture publications and those relevant to the region
4) Recommendations for maintaining yearly updates of experts and documents for digitized library
5) Policy brief on aquaculture gaps in the region and opportunities for development

Dr. Sarkis Dr. Sarkis described the objectives, process and proposed methods to achieve and maintain a digital aquaculture library. The overarching objective is to enable communication between and among public and private sector entities which facilitates, improves, develops and expands commercial aquaculture activities in the CARICOM Region. Proposed content would be a list of current practitioners and expertise both public and private and a list of relevant documents, including technical guides, fact sheets, applied research. The logistics of establishing and maintaining a current CARICOM digital library entails:

[9] This Fourth meeting of the CRFM Working Group on Aquaculture replaces the proposed webinar as participants for the proposed FAO meetings were the same as for this one

1) Establishing process: Simple and effective use of resources.

- Integrate list of experts/practitioners into existing similar digital databases in other regions

2) Routine updating: Who, what, when?

Identify organization(s) in CARICOM with capacity to update

- Option for documents: Libraries of the University of West Indies- information update under the umbrella of OpenASFA partnership/network
- Option for list of experts: Yearly validation of contact details by countries, updated by an identified Regional organisation

3) Visual mapping of aquaculture operations

- Additional option to record aquaculture sites
- Applicable to zoning and marine spatial planning projects

The digital aquaculture library would include the following data:

A. **Online Expertise library:**

- Restricted Fields published online which include such data as an Institution ID, name, type, mission with a street address and keywords describing its mission.
- This online library excludes personal information such as cell phone numbers/facebook messaging

Please note that: To facilitate information exchange between FAO and the CARICOM aquaculturists, the FAO Sub-Regional Office of the Caribbean proposes in addition to maintain an internal list of all public and private aquaculture experts and practitioners, which would include such data as personal cell phone numbers, alternative emails subject to the consent of each individual:

1) Online Expertise Library Format: The format can resemble similar to existing web-based platforms, and several options are explored: 1) The listing of experts is institution-based or individual-based,

2) A short biography on expert/knowledge hub can be added to the database list above, as is done for the Network of Aquaculture Centres in Asia and Pacific.

B. Online Aquaculture Document Library

Existing databases can also be relied upon to incorporate CARICOM aquaculture documents. One such database is the existing FAO Aquatic Sciences and Fisheries Abstracts (ASFA). A sample process has already been initiated with 15 documents uploaded to date. Uploading will continue unless CARICOM countries disagree.

To finalise the process for data collection and transfer to a web platform, the FAO Sub-Regional office is calling for:

- the validation by each country of information document previously sent for accurate representation of aquaculture activities in each country,
- obtaining contact details for additional experts (public and private) and knowledge hubs,
- making a decision on listing option as to whether it should be institution-based or individual-based, and
- obtaining the consent for details to be published, from institution and/or individual.

The matter of maintaining accurate information of both the expert database and the document library was raised. Simple and cost-effective suggestions were made.

With respect to the expert database, yearly updates are strongly recommended to maintain the aquaculture library current. To achieve this:

a) A yearly update of aquaculture experts and practitioners will be needed by each country and sent to the identified Regional organization for uploading online.
b) With respect to the document library, the ongoing posting in ASFA by FAO staff requires the support of countries to upload the details of new documents. This requires the identification of assistance (e.g. regional libraries) to provide new materials. This information is sent to an identified regional organisation, which in turn would forward to ASFA editors. This is a suggestion and if agreed by CARICOM countries can be pursued by contacting regional libraries.

Lastly, the possibility of mapping aquaculture farms was presented. This can also be done using FAO support, but requires the input of CARICOM practitioners to provide exact street address or latitude and longitude of land-based aquaculture farm, a call for latitude and longitude of farm in aquatic environment, and information regarding the species farmed at each area.

Dr. Sarkis provided an estimated timeline on finalizing the digital library and noted a call to countries during August 2022 to compile the remaining information and consent as mentioned above.

Discussion

The presentation was well received. Participants' consensus was seen in the view that a digital library for this region is long overdue, given that such already existed for other regions of the world. It was suggested that one way of moving forward could be by way of countries updating existing databases; starting with existing initiatives/platforms was also preferred. It was also mooted that the CRFM Secretariat could play a role in this regard; noting that this would require more discussion.

It was emphasised that this is a CARICOM Digitized Library which FAO had initiated based on an assessment of needs; as such, its use and sustainability rest upon participants/Member States.

In response to a query, it was noted that the idea of a geo-referenced map of aquaculture facilities as part of the digital library is simply considered as an addition to the library information. Geo-referenced location information of aquaculture facilities helps address issues related to health and food safety issues that are currently being considered as being incorporated into model CARICOM aquatic health and food safety legislation. Additionally, for development institutions, having easy access to experts and experienced resource persons is important for engagement in projects, seeking information on specific issues, etc. This Library would be consulted to identify the suitable resource persons or farms for south-south cooperation, exchanges of experience. It was pointed out that any apparent concern lies with the potential consequences of information being made public, including increased praedial larceny of aquaculture facilities. A need for aquaculture mapping along the whole value chain was indicated.

Recognising potential for area-related conflicts the concept of licencing was put forward. It was also noted that a mechanism to prevent "take-overs" by foreign investors/extra-regional entrepreneurs after the hard/ground-work had been done by locals, should be part of the enabling environment for aquaculture development.

There was no stated objection with the proposed next steps.

ACTION

The Working Group:

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

Discussed the issues related to development of a digitised library of public and private farms in the CARICOM Region

Called on Member States to provide the information requested and relevant to the further implementation of the digital library initiative

Accepted that a mechanism to prevent "take-overs" by foreign investors/extra-regional entrepreneurs, after the all the necessary preparatory work had been done by locals, should be built into the enabling environment for aquaculture development

Agreed that further discussion would be necessary regarding the operationalization and sustainability of the digitized library, and the discussion regarding the hosting, day-to-day maintenance/management of the library should be held so that any agreed action could be reflected in the final report of the project

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, including how aquaculture can contribute to food security and nutrition and achievement of the goal of reducing food import bill by 25% by 2025. The working group considered that this topic had been extensively covered in the discussions under the earlier agenda items

Discussion

It was indicated that the issue of the need for capacity building and research and development had been a recurring concern throughout the meeting. Participants lamented the inadequacy of industry-driven research and development conducted by academia. It was felt that there is need to determine the aquaculture potential on a species-by-species basis and in this context engage universities within the region.

Participants were of the view that the CRFM's collaboration with the University of Florida in capacity building should be expanded to other educational institutions within and outside the region.

The meeting was reminded that university research and development is often driven by funding availability and funders' priorities. In this regard, it was suggested that there is need to get aquaculture on the agenda of international funding institutions

The CRFM Secretariat was asked to set up a WhatsApp group of participants of the Working Group

ACTION

The Working Group:

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

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

Expressed the view that the CRFM's collaboration with the University of Florida in capacity building should be expanded to other educational institutions within and outside the region.

Noted that university research and development is often driven by funding availability and funders' priorities.

Suggested that every effort should be made to get aquaculture on the agenda of the donor community
Asked the CRFM Secretariat to set up and administer a WhatsApp group on Aquaculture comprising, in the first instance, attendees at the WGA4

Summary of recommendations & proposals for development of aquaculture and elements of a Draft Ministerial Resolution on sustainable 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 (see appendix 5) to be circulated to participants, by 15 July 2022, to allow for the acceptance of said recommendations.

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.

ANY OTHER BUSINESS

There was no other business proposed for discussion

PLACE and DATE OF NEXT MEETING

ACTION

The Working Group:

Agreed that the Fifth Meeting of the Working Group would be electronic.

Charged the Secretariat with determining the appropriate date for the Fifth Meeting of the Working Group, which, to the extent practicable, should be in the first quarter of 2023.

ADJOURNMENT

The Chairman thanked Member States for participating and opined that this fourth Meeting of the Working Group to Promote Sustainable Aquaculture Development had been fruitful. He thanked the participants for giving him the opportunity to chair the meeting. He noted that a way forward has now been discerned for aquaculture development in the region.

The FAO subregional Officer, Dr. Yvette Diei Ouadi thanked the participants. She noted that the meeting was interesting, productive and fruitful. A lot was exchanged and learned: it is now necessary to take follow-up action. Dr. Diei Ouadi opined that aquaculture development is a priority for both FAO and CRFM and expressed satisfaction with the multi-sectoral nature of the participation, which needs to be sustained. She

cited the meeting as providing a framework for moving forward and the expectation that the recommendations and follow-up will be taken as tasks to be carried out by the CRFM and FAO. In thanking the participants, she highlighted the excellent job done by the chair. Expressing her thanks to the CRFM Secretariat she looked forward to continued collaboration.

The Deputy Executive Director thanked the Chair for taking on that responsibility and the excellent way in which he handled the meeting. She felt that it had been a very fruitful and informative day and thanked the attendees for their active participation which ensured that a number of important issues were addressed. She welcomed the concept of a digital library for aquaculture and expressed satisfaction at the involvement of the private sector in the working group, assuring all that contact will be made before the next meeting since the CRFM Secretariat wishes to provide necessary support to all that require it. Dr. Grant thanked FAO for suggesting the hosting of this joint meeting and looked forward meeting all at the next meeting.

The Meeting was adjourned at 2:00pm Belize time (3:00pm Jamaica time; 4:00pm Eastern Caribbean time)

Appendix 1 – Annotated Agenda

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

30 June 2022

1. Call to order
   The Meeting Convener will call the meeting to order
2. Adoption of the Agenda
   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
3. Introduction of participants and review of the ToRs of the WG and election of Chairperson
   Participants will introduce themselves. The Convener will briefly present the Working Group ToRs. The WGA will propose any revision to the ToRs that may be deemed appropriate. The WGA will agree on a country representative to chair the current meeting.
4. 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 (WGA)
   The Meeting Convener will provide a summary of state of aquaculture, the report of the 3rd meeting of the WGA and an update of activities since then. FAO will present the results of a recent prioritisation survey
5. Discussion on key Constraints to aquaculture development and elements of the enabling environment for promoting aquaculture development
   Presentations will be received on the state of aquaponics in the region; best practices related to exotic and native species with emphasis on opportunities and impacts; and experiences of Trinidad and Tobago in determining the important elements of the enabling environment which need to be addressed in promoting aquaculture development, for the consideration of the WGA
6. Competition as a potential hinderance to aquaculture development
   The issue of competition among aquaculturists as potentially hindering aquaculture development and the consequential need to consider "private / private" partnerships will be discussed
7. Update on the FAO initiative to develop a digitised library of public and private farms in the CARICOM Region.
   FAO recently 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 and make proposals for the way forward with this initiative.
8. Considerations for the further implementation of the 5-year Work Plan for Aquaculture Development
   The WGA will receive a presentation on potential investments and opportunities for aquaculture in the region. Based on this and the preceding agenda items, the WGA will have open discussion on considerations for implementation of the 5-year Work Plan for Aquaculture Development in CRFM. Issues related to the implementation of activities will be discussed, including on how aquaculture can contribute to food security and nutrition and achievement of the goal of reducing food import bill by 25% by 2025
9. Summary of recommendations & proposals for development aquaculture and elements of a Draft Ministerial Resolution for sustainable development of aquaculture for submission to the Exec Comm, Forum and Ministerial Council for adoption in October 2022.
   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 the CRFM Ministerial Council
10. Any other business

The WGA will consider any other business brought to its attention of relevance to its ToRs, not elsewhere considered

11. Place and date of next meeting
    The WGA will propose a place and date for its 5th meeting
12. Closing remarks and Adjournment
    After an exchange of the usual pleasantries, the meeting will be adjourned

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

30 June 2022 (via Microsoft Teams)

ANTIGUA AND BARBUDA Mr. Ian Horsford Chief Fisheries Officer (Ag) Fisheries Division Point Wharf Fisheries Complex Lower North Street St. John's Tel: 268-462-1372 268-462-6106 268-562-4309 Cell: 268-770-6061 Fax: 268-462-1372 Email: fisheriesantigua@gmail.com ian.horsford@ab.gov.ag ihorsford@gmail.com	**ANTIGUA AND BARBUDA** Mr. Kevin Alexander Sea Springs Aquafarm Sea View Farm Main Road St. John's Antigua Cell: 268-724-9211 Email: seaspringsaquafarm@gmail.com
THE BAHAMAS Ms. Candice Webb Assistant Fisheries Officer Department of Marine Resources Email: candicewebb@bahamas.gov.bs	**BARBADOS** Mr. Colvin Taylor Principal Fisheries Assistant (Ag) Fisheries Division Cell: 264-230-6909 Email: Colvin.Taylor@barbados.gov.bb
BARBADOS Ms. Kristina Adams Aquaculturalist Adams Aquafarm Email: adamsaquafarm@gmail.com	**BELIZE** Mr. Miguel Manuel Sosa Aquaculture Supervisor Department of Agriculture Central Farm Belize Email: miguel.sosa@agriculture.gov.bz
BELIZE Mr. Alvin Henderson Chairman Shrimp Growers Association and owner Belize Shrimp Growers Association Email: alvin@royalmayanshrimp.com	**BELIZE** Ms. Denise Swan-Murrillo Ministry of Foreign Trade Email: daswan024@gmail.com denise.swan@mft.gov.bz
BELIZE Mr. Gilbert Andrews Belize Coastal Zone Management Authority and Institute (CZMAI) Princess Margaret Drive	**DOMINICA** Ms. Wynnona Joseph Senior Fisheries Officer Fisheries Division

Belize City Tel: 501-223-0719 Email: waterquality@coastalzonebelize.org	Ministry of Blue and Green Economy, Agriculture and National Food Security 2nd Floor, Government Headquarters Roseau Tel: 767-266-5291 767-266-5263 Fax: 767-448-0140 Email: fisheriesdivisiondom@gmail.com wynnonaj@gmail.com
GUYANA Dr. Neveen Gray Fisheries Department Ministry of Agriculture Cell: 592-698-1380 Email: nevandigrayce@gmail.com	**GUYANA** Ms. Nakita Dookie Principal Fisheries Officer Fisheries Department Regent and Vlissengen Road Bourda Georgetown Cell: 592-682-9316 Email: nakita.dookie@gmail.com
JAMAICA Mrs. Avery Smikle Director - Aquaculture Branch National Fisheries Authority – Aquaculture Division Ministry of Agriculture and Fisheries 2C Newport East Kingston 11 **JAMAICA** Tel: 876-984-9343 876-984-9444 Fax: 876-984-5194 Email: avery.smikle@moa.gov.jm fisheries@moa.gov.jm	**JAMAICA** Ms. Kerrone Fairclough Regional Extension Officer National Fisheries Authority Aquaculture Division Ministry of Agriculture and Fisheries 2C Newport East Kingston 11 **JAMAICA** Tel: 876-984-9343 876-984-9444 Fax: 876-984-5194 Email: kerrone.fairclough@moa.gov.jm fisheries@moa.gov.jm
JAMAICA Mr. Noel Thompson Public and Private Sector Cell: 876-371-1981 Email: tonyt215@hotmail.com	**MONTSERRAT** Mr. Alwyn Ponteen Chief Fisheries and Ocean Governance Officer Fisheries Unit Ministry of Agriculture, Trade, Lands, Housing and the Environment P.O. Box 272 Brades Tel: 664-491-2075 Fax: 664-491-9275 Email: ponteena@gov.ms up669929@myport.ac.uk

ST. KITTS AND NEVIS Dr. Marc Williams Director of Marine Resources Department of Marine Resources Ministry of Agriculture and Marine Resources Church Street Basseterre Tel: 869-465-8045 869-465-4045 Cell: 869-668-1188 Fax: 869-466-7254 Email: marcwill3@aol.com dmrskn@gmail.com Skype: marc.t.x.williams	**SAINT LUCIA** Mr. Ezechiel Joseph Jr. Aquaculture Focal Point Fisheries Assistant Department of Fisheries Castries Tel: 758-468-4135 758-468-4143 Fax: 758-452-3853 Email: ezechiel.joseph@govt.lc deptfish@govt.lc
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ST. VINCENT AND THE GRENADINES Dr. Ashley John Private Sector Cell: 874-492-0908 Email: caribbeanstar54@gmail.com	**SURINAME** Mrs. Aartie Tedjoe Aquaculture Extension Officer Fisheries Department P.O. Box 1807 Cornelis Jongbawstraat 50 Paramaribo Tel: 597-472-233 597-476-741 Fax: 597-424-441 Email: tedjoe_an@yahoo.com
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TRINIDAD AND TOBAGO Dr. Ryan S. Mohammed Aquaculture Association of Trinidad and Tobago Email: ryansmohammed2020@gmail.com	**CARICOM PRIVATE SECTOR ORGANIZATION (CPSO)** Mr. Sandiford Ruel Edwards MA, MBA Technical Expert CARICOM Private Sector Organization #1 Murray Street Woodbrook Port of Spain TRINIDAD and TOBAGO Tel: 868-273 5826 Email: sedwards@thecpso.org
FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS Dr. Yvette Diei Ouadi Fishery and Aquaculture Officer FAO Secretary of WECAFC 2nd Floor United Nations House Balmoral Gap Marine Gardens Christ Church **BARBADOS** Tel: 246-426-7110 Fax: 246-427-6075 Email: Yvette.DieiOuadi@fao.org	**FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS** Ms. Samia Sarkis FAO Consultant Email: ssarkis@livingreefs.org
CARIBBEAN REGIONAL FISHERIES MECHANISM (CRFM) SECRETARIAT	
Dr. Sandra Grant Deputy Executive Director CRFM Secretariat P.O. Box 642 Princess Margaret Drive Belize City **BELIZE** Tel: 501-223-4443 Cell: 501-675-5465 Email: sandra.grant@crfm.int Skype: linegrant	Dr. Maren Headley Programme Manager, Fisheries Management and Development CRFM Secretariat First Floor TEKA Building Arnos Vale Kingstown **ST. VINCENT AND THE GRENADINES** Tel: 784-458-4269 Email: maren.headley@crfm.int Skype: maren.headley1
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Appendix 3 - Revised (30 June 2022) Terms of Reference of the CRFM Working Group to Promote Sustainable Aquaculture Development (WGA)

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 assistance to train and upgrade the core personnel needed for national aquaculture planning, research, training, extension and development;
5. 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;
6. 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;
7. Provide guidance for the adoption and implementation of credible aquaculture certification schemes;
8. Identify bottlenecks and constraints to aquaculture development and make proposals to the Forum to address them;
9. Monitor scientific and technological developments in aquaculture and keep the Forum updated;
10. Promote the establishment of a regional information system to address common priorities that may be identified with respect to information and knowledge exchange;
11. Assist member states in strengthening their national aquaculture agencies/organizations;
12. Assist the national agencies/organizations in testing and adapting existing technologies to local requirements and in the training of technicians, extension workers and farmers;

13. Promote the transfer of appropriate aquaculture technologies and techniques developed at the national and regional levels;
14. Facilitate the exchange of national experts, technical know-how and information within the framework of TCDC;
15. Advise on and support activities geared towards sustainable feed development for aquaculture; and
16. 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 - Overview of CRFM Member States' aquaculture (as at April 2022)

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.

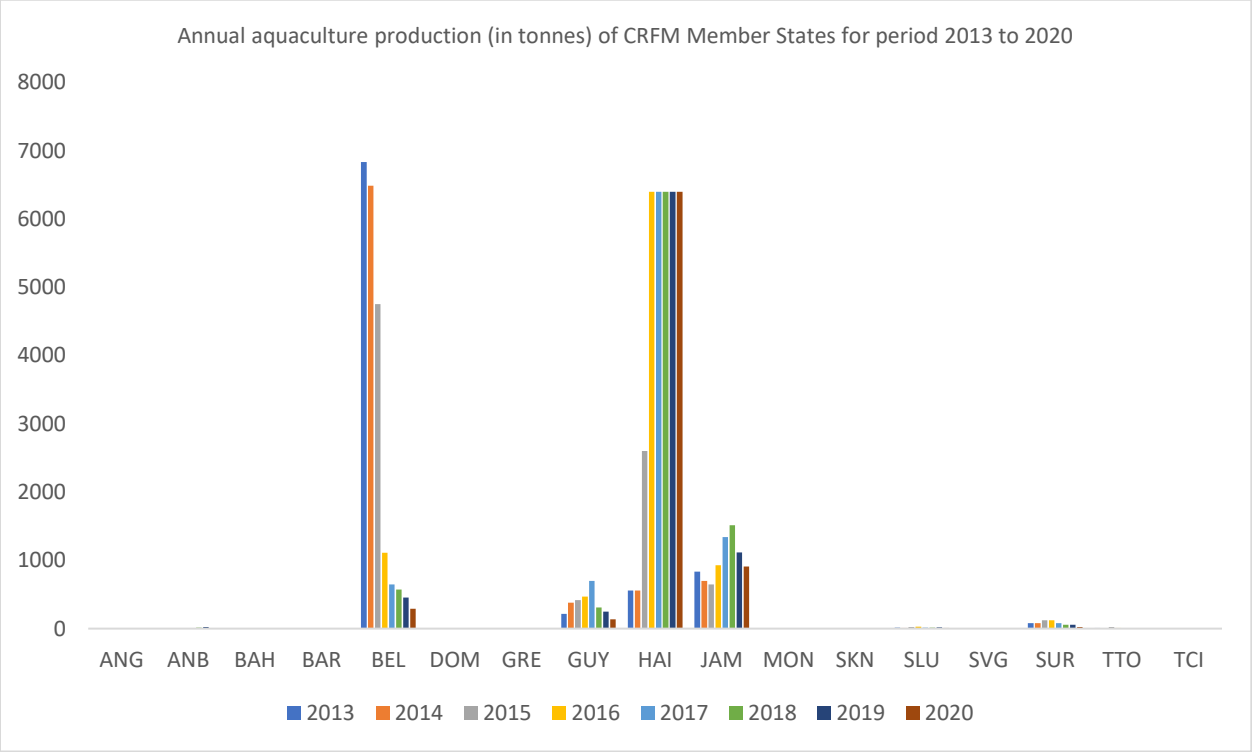


Figure 1 Trend in aquaculture production among CRFM Member States from 2013 to 2020

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).

It is recognised that many Caribbean nations have seen the potential of mariculture to help meet local demand for fish and other marine products and to relieve pressure on capture fisheries. Governments and investors are especially interested in culturing species that are traditionally associated with the Caribbean, such as the spiny lobster, queen conch, and Nassau grouper. Most States have large expanses of marine space, which offers the potential for development of marine-based aquaculture or "mariculture". In 1980 a "Case paper for the establishment of a mariculture system in the Commonwealth Caribbean" was presented to the Caribbean Development Bank; it recommended rapid expansion of mariculture systems in the region. In the early 1980s, the French Departments experimented with cage culture of some snapper

species and it was thought that these methodologies had the potential to be utilized in other Eastern Caribbean islands provided that the preferred geographic and physical characteristics were accessible. Consideration should be given to the fact that in some of our countries it may be difficult to implement Mariculture due to conflicts with other stakeholders such as fishers as well as security concerns.

The CRFM had identified aquaculture as a priority since 2002; in that year, 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 a 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.

The inaugural meeting of the WGA considered a report on the potential for fish farming in the Caribbean. The Report set out a five-year action plan for aquaculture development, which was subsequently approved by the CRFM's Ministerial Council. Towards these goals, the WGA has taken on board the major challenges identified for aquaculture development in the Caribbean, which include: availability of freshwater, technology transfer; feed access and availability10; small-scale farmers – "new" technical assistance; governance and political willingness; and, application of the Ecosystem Approach to Aquaculture. The Working Group, coordinated by the CRFM Secretariat, seeks to work closely with staff of national and regional aquaculture and related institutions, and of regional organizations such as the Commission for Inland Fisheries and Aquaculture of Latin America and the Caribbean (COPESCALC), 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.

In 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. 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. In this regard, it should be noted that sanitary controls specifically for aquaculture remain an unaddressed area of strategic SPS weakness in the region.

Against this backdrop, the CRFM Ministerial Council agreed that economic models for varying scales and types of aquaculture operations (including multi-trophic aquaculture and aquaponics) should be promoted among Member States

At the country level

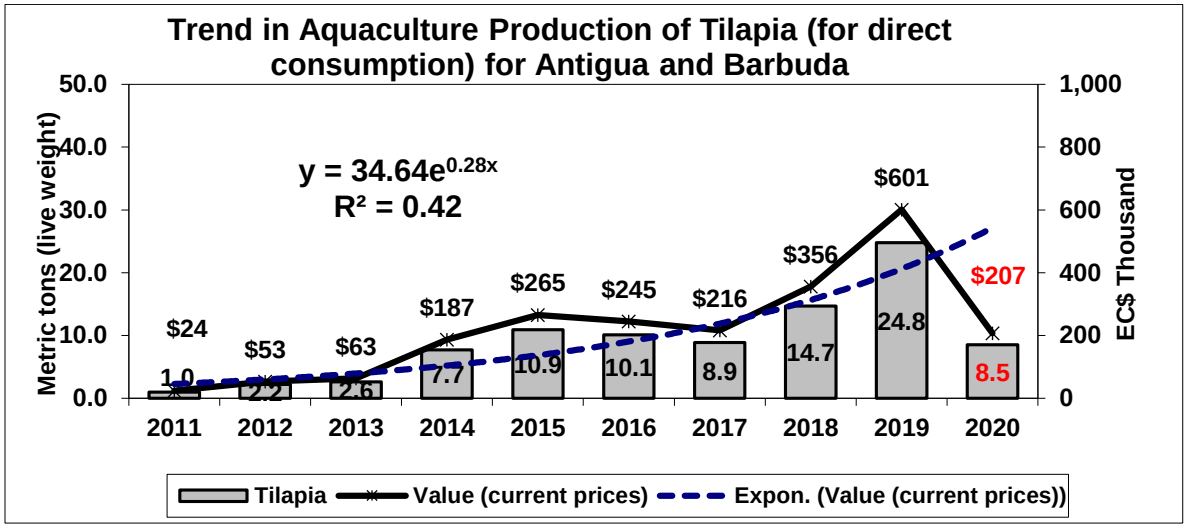
In the case of ***Antigua and Barbuda***, aquaculture production of mainly freshwater *Tilapia* spp. continues to grow exponentially. This growth was abated in 2020 due to reduced demand as a result of the COVID-19 pandemic.

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,

[10] By way of example, local and regional farmers still depend heavily on imported feeds, however, there have been no assistance granted to reduce the import costs; notwithstanding that there have been discussions with the local feed mill in Trinidad on improvement of the quality of feed as well as start production of the feed with nutrient requirements to cater for all stages of fish production were not accepted by management

- 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., 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. 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 of spiny lobster may be an unsustainable venture, based on current practices. This is partially due to management strategies that skip the many lacks in knowledge about nutritional and culture requirements of tropical lobsters.

For ***Barbados,*** the FAO started producing statistics on inland freshwater aquaculture in 2006, with the production of red tilapia and red claw crayfish for local consumption. Since then in its regional review on the status and trends in aquaculture development in Latin America and the Caribbean in 2020, production has steadily increased from 2 tonnes in 2010 to 26 tonnes in 2018.

As part of a new 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 who are now importing millions of dollars in frozen shrimp and frozen prawns. 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 the seafood production.

For ***Belize***, mariculture is highlighted as an overarching guiding principle within the Cabinet-approved Fisheries Policy and Strategy, which will serve 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. Ongoing research has led to 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 included 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 Belize, a farm will be established in the Turneffe area since on-going scientific research revealed optimal and conducive environment for seaweed growth. Training material developed under this project includes updated training videos, reprint of training manual, and script / tools required to develop a seaweed farm.

For Aquaculture, there have been specific cooperation and developments for tilapia and snapper. Under the INCAVPESCA project, Belize (Aquaculture Unit) has recently developed an aquaponics system, which is presently being monitored for performance. The Project also produced two Production Packages (in Spanish) for the farming of 'Snapper' (*Lutjanus guttatus*) and 'Tilapia' (Oreochromis, Tilapia spp.), where

members of the OSPESCA Aquaculture Working Group (GRUTAC) also met recently to approve the packages and to discuss ongoing activities.

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. 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. This will allow for greater understanding of the sector and promote cooperation with the Government of Belize and partners. Lastly, data management is at times overlooked as a priority due to its intensive nature. Nevertheless, data acquisition is critical in assessing the performance of the sector and used to identify areas that may require improvements and management interventions. This support is pending approval under the Compete Caribbean Project being implemented by Beltrade.

Under the INCAVPESCA Project, a seaweed mariculture training workshop scheduled to be held in May 2022, where officials from OSPESCA countries will visit Turneffe and be trained by TNC. Country officials are then expected to return and replicate the development and deployment of a small-scale seaweed mariculture farm.

Under the INCAVPESCA Project, tilapia fingerlings are being prepared for import to Belize and will be stored at the Central Farm Aquaculture Facility for safekeeping.

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 fens, 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.

Between 1976 to 1983, ***Jamaica*** successfully implemented the Inland Fisheries Project a GOJ/USAID Project which introduced to Jamaica the commercial production of tilapia, through the production of the red hybrid tilapia. This is the variety which is predominant in Jamaican production systems today. During this time, the culture of mangrove oysters was developed through a project that was jointly implemented by the Fisheries Division, the University of the West Indies (UWI), with support from the International Development Research Centre of Canada (IDRC).

Freshwater aquaculture diversified to include Oreochromis sp. varying species of carps, Giant Freshwater Prawn (*Macrobrachium rosenbergii*), Australian Red Claw (*Cherax quadricarinatus*), Basa (*Pangasius* sp.). In terms of mariculture, the two main species cultured include the mangrove oyster (Crassostrea rhizophorae) and the white leg shrimp (Penaeus vannamei). The Jamaican aquaculture is classified into two sub-sectors – food fish and ornamental fish production. The ornamental fish sub-sector produces a variety of live bearers and egg layers.

Jamaica has many attributes which make it favourable for inland freshwater aquaculture as well as mariculture. As a result of this Jamaica has been exploring both the development and expansion of freshwater and marine aquaculture production systems. Jamaica has developed a policy framework from as early as 1983 through the assistance of the FAO a Policy for the Development of Aquaculture in Jamaica was developed. Since then policy framework has catapulted to include a draft Policy for Fisheries and Aquaculture, the promulgation of the Fisheries Act 2018, which both of which provide a governance and regulatory framework for aquaculture development in Jamaica. The passage of the Fisheries Act in 2018, requires that all persons and facilities involved in commercial aquaculture activities are licensed. It provides a mechanism for the development of aquaculture management plans and the development and implementation of aquaculture management areas and zones both on land and in water. There currently

exists an Aquaculture Development Plan as well as an Aquaculture Land and Water Use Development Plan for Jamaica both documents support the policy and regulatory framework for aquaculture development in Jamaica. In order to provide support for mariculture development a comprehensive review of of the possibilities for marine cage fish-culture and other alternative technologies was prepared with assistance from the Food and Agriculture Organization (FAO). The document provided an indication of species suitable for mariculture as well as areas that could be suitable for coastal mariculture development.

Currently, production is comprised primarily of small-scale fish farmers. It is estimated there are approximately 104 tilapia farmers and 60 ornamental fish farmers. At the end of 2021 it was estimated that the quantity of tilapia harvested was 869.2MT valued at US$4.65M. It is estimated that the number of active acres during the past year was 701.5 acres. Initiatives undertaken by the Ministry of Agriculture and Fisheries to support aquaculture production have included exploring the implementation of aquaculture parks, reduction/elimination of duty concessions on productive inputs, licensing and registration of fish farmers and aquaculture facilities.

Saint Lucia has seen a dramatic increase in the export of *Eucheuma Cottonii* to Europe and North America over the past two years. 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 recently implemented 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 over the last four years 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 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 has 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 development of feed based on local resources and hatcheries.

The ***Turks and Caicos Islands*** did have 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 for available food sources, surrounding development environmental issues, to legal matters. However, there is still the continued interest in mariculture both 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.

Looking ahead

Against all this, commercial feasibility of mariculture needs to be reviewed. It has been suggested that in some cases, the hatchery technology may be a major constraint, while in other species 'problems may exist in the nursery or grow-out phases of production. There are also candidate species for which the culture technology is well developed, but market prices are too low to allow for profitable production in the Caribbean. Expansion of Caribbean mariculture is critically dependent upon the identification of species with highest commercial potential.

Integrated Multitrophic Aquaculture (IMTA) is currently being considered as the basis for an ecosystem approach to the mariculture paradigm that can 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.

It is still the view that the CARICOM approach to aquaculture development will have to be multifaceted to address the range of available natural land and fresh-water resources in the region, while incorporating the commercial elements. Because of the limited potential growth of wild catches in the Caribbean region, sustainable expansion and intensification of fish production through responsible aquaculture development remains a major objective for countries in the region, as such, sanitary controls specifically for aquaculture need to be addressed; this notwithstanding that such requirements have to be viewed in the wider context of the economies in which they might develop.

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.

There is need to monitor implementation of the 5-year Action Plan. Given the biennial planning cycle for CRFM, it was considered best to carry out a similar survey (utilising the same survey instrument) to the one carried out in 2020, six months before the end of the biennium. This would have allowed two months for circulation and responses and one month for analysis, such that the results would be ready to "feed" into the preparation of the 2022-2024 biennial work plan, at that time this would have begun in April 2022. Thus, the next survey to monitor implementation of the current action plan should have commenced circa October 2021, such that the results would be ready by December of that year, to be incorporated into the 2022 - 2024 Biennial work plan. While this was not possible due to challenges consequent upon the COVID-19 pandemic and given that *ad interim* the Ministerial Council has decided that the planning/financial cycle for the CRFM should begin in January as from 2022, the CRFM Secretariat expects to carry out this survey post-June 2022 to allow the results to inform "half-term" revision of the current 2022-2024 work plan.

Appendix 5 - Recommendations of WGA4 for consideration and/or approval of the CRFM's governance hierarchy

- The working group's Terms of Reference on membership should be amended to read: "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."
- Integrated Multi-trophic aquaculture (IMTA)[11] should be utilised to provide a way forward for aquaculture in the region
- Environmental impacts of aquaculture should be thoroughly considered and addressed prior to starting a commercial operation, especially where exotic species are utilised, to avoid irreversible changes in native species populations and ecosystem function
- Consideration should be given to the use of aquaculture to restock wild populations
- The region's competitive advantages for mariculture, such as the amount and quality of sunlight, the temperature and the clarity and relatively pristine nature of the marine environment should be utilised in furtherance of aquaculture development in the region
- Approaches to Advancing the Region's Aquaculture Industry could include
    - Enhanced regulatory and trading environment (CITES requirements, UNCLOS obligations).
    - Partnering with the public and private sectors in terms of policy investment regimes and capacity-building.
    - The concept of 'Information precedes the Trade', providing Statistics and Information ('Value Chain' and 'Value Shop') should be utilised to the extent possible; where appropriate.
    - Development of low-cost, high-quality aquaculture products including value added,
    - Production of more 'knowledge-intensive' aquaculture services.
    - Development of innovative financing instruments to support the diversity of firms along the value chain.
    - Recognition of small-scale producers as commercial partners and facilitation of their integration into the mainstream economy and financial system.
- The region should focus its aquaculture outputs/products on exports
- Potential competition within export markets should be partially obviated by joint/regional approaches, such as the use of single brands for exports
- CARICOM countries should mandate budgetary allocations specifically for aquaculture development
- Member States should provide the information requested and relevant to the further implementation of FAO's Caribbean digital library for aquaculture initiative
- The enabling environment for aquaculture development should be built to include mechanisms that would obviate "take-overs" by foreign investors/extra-regional **entrepreneurs,** after the all the necessary preparatory work had been done by locals
- CRFM's collaboration with the University of Florida in capacity building should be expanded to other educational institutions within and without the region
- Every effort should be made to get aquaculture on the research and development; capacity building; and financing agendas of the donor community

[11] In IMTA, multiple aquatic species from different trophic levels are farmed in an integrated fashion to improve efficiency, reduce waste, and provide ecosystem services, such as bio-remediation. Species at the lower trophic level (usually plants or invertebrates) use waste products such as feces and uneaten feed from the higher trophic species (typically finfish), as nutrients. The lower trophic species can then be harvested in addition to the fish to give the farmer more revenue, or even to be fed back to the fish.

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.