CONTRIBUTION 3.2

Analysis of Trends in Production, Fleet, Trade and Economic Contribution of the Fisheries and Aquaculture in CRFM Member States

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Abstract

The mission of the Caribbean Regional Fisheries Mechanism is "to promote and facilitate the responsible utilization 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 sector's aim is to provide employment and food security for the people of the region. Analysis and validation of the trends based on data in the CRFM Statistics and Information Reports for 2002 to 2022 was conducted. A technical and stakeholder assessment was carried out to investigate the trends observed. The data revealed that the marine capture production, since 2018, has steadily declined, while only eight CRFM Member States were actively involved in aquaculture production. Regarding trade in fish, imports have steadily increased both in value and weight; and exports have not kept up with imports. Many aspects of the fisheries have changed, by issues such as overfishing, climate change, ghost fishing, irresponsible fish farming, habitat destruction, land-based pollution and IUU fishing. However, the fisheries and aquaculture sectors in the region continue to provide food and nutrition security for small-scale fishers and the people of the Caribbean region.

KEYWORDS: Fisheries trends, CRFM/CARICOM, aquaculture, imports, fishers

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1. INTRODUCTION

The importance of the fisheries and aquaculture to the world's nutrition and food security is becoming more widely acknowledged. To achieve sustainable, inclusive, and equitable global fisheries and aquaculture production, the scaling up of revolutionary reforms in policy, management, innovation, and investment is necessary. There was an all-time high of 214 million tonnes produced worldwide from fisheries and aquaculture in the year 2020, which included 36 million tonnes of algae and 178 million tonnes of aquatic animals (FAO, 2022). With an estimated value of USD 141 billion, the global capture fisheries production (excluding algae) in 2020 was 90.3 million tonnes, of which 78.8 million came from marine waters and 11.5 million from inland waters. This represents a 4.0 percent decrease from the average of the three years prior. A record-breaking 122.6 million tonnes of aquaculture were produced worldwide in the year 2020, comprising 87.5 million tonnes of aquatic animals valued at USD 264.8 billion and 35.1 million tonnes of algae valued at USD 16.5 billion. Approximately 68.1 million tonnes came from marine and coastal aquaculture, whereas 54.4 million tonnes were from inland aquaculture (FAO, 2022).

Caribbean Regional Fisheries Mechanism (CRFM) promotes and facilitates responsible and sustainable use of the region's fisheries and other living aquatic resources for improved food security, livelihood, and welfare of the people of the region (CRFM, 2023).. The CRFM Member States have a combined total coastline of approximately 9314 km, EEZ area of 2060721 km2 and 200750 km2 of inshore fishing area in its 17 member states (CRFM Statistics and Information Report, 2021). The fisheries and aquaculture sector is facing multidimensional pressure including climate change which is adversely affecting fish production (March et al., 2023). One of the major challenges is climate change and according to Tandon (2012) the impacts of climate change on SIDS will be maximum (Tandon, 2012).

Despite the great species diversity, the effects of climate change on reef fish, molluscs, spiny lobsters, and crabs are by far the most severe among the commercially significant fisheries groups in the wider Caribbean region. Their unique vulnerability stems from the following: 1) the majority of species are heavily dependent on vital coastal habitats (coral reefs, mangroves, estuaries), which are already severely degraded owing to anthropogenic activities (e.g., over-harvesting, sewage and agricultural runoff, coastal development), in addition to stressors associated with climate change. 2) They have biphasic life histories, meaning that after settling in a particular benthic nursery habitat, they must develop into juvenile and adult stages. 3) A large number of these stocks in the wider Caribbean region are already severely impacted by overfishing, which lowers their genetic diversity, productivity, and consequently their resilience to additional environmental changes (Oxenford et al., 2018).

The increasing population throughout the world has created a huge pressure on the natural resources for food production (Devaux et al., 2020). Fish is an important source of animal protein with omega-3 and omega-6 fatty acids and many essential nutrients (Maulu et al., 2021). The marine resources can produce up to Maximum Sustainable yield for different species, if the requirement is more than the MSY level then those requirements have to be met from aquaculture or else the marine resources will be depleted if exploited more than the MSY level (FAO, 2023). There is also an effort by CARICOM to reduce the food import bill by 25% by 2025 in the CARICOM region (CARICOM, 2022). So, it is important to study the trend of fish production from marine and aquaculture sector and the trends in fish import in the CRFM member states to understand the present situation to address reducing the import bill. With this objective the fish catch data of member states were analyzed and the trend analysis was carried out for marine fish production, aquaculture production, import of fish and other animal products (beef and meat) and export of fishery products. The import of other animal products like beef and chicken were compared with fish imports to understand the preferences of animal protein by the people of the Caribbean region.

2. METHODS

The fish production information was collected from CRFM statistical reports (20xx – 2022) and the FAO database. The yearly total of the Member State is live weights and includes the high seas production, The totals from the FAO database were used for this calculation The Export and import dataset were collected from the online database; Market Analysis and Research, International Trade Centre (ITC) The data set were used to calculate the growth rates using the formula mentioned below.

$$Growth\ rate\ of\ fish\ production\ = \frac{(production\ of\ present\ year - production\ of\ Lap\ year)}{Production\ of\ lap\ year} \times 100$$

$$Growth\ rate\ of\ aquaculture\ production\ = \frac{(production\ of\ present\ year - production\ of\ Lap\ year)}{Production\ of\ lap\ year} \times 100$$

$$Growth\ rate\ of\ fish\ import\ = \frac{(Import\ of\ fish\ in\ present\ year - import\ of\ fish\ in\ Lap\ year)}{import\ of\ fish\ in\ Lap\ year} \times 100$$

For the analysis of trends, the last 20 years data on marine capture fisheries production were taken into account and for import and export last 20 years data were taken. The import and export were analysed based on the quantity and value. The fish import and export were also compared with the import of beef and poultry to understand the sectoral situation of animal protein import in the region, and also to compare the preferences for the animal protein in the region.

To determine the possible reasons for the observed trends in marine capture fisheries, a survey was conducted to gather information on the possible reasons for the trend observed in the production of the marine capture fishery of the CRFM Member States over the past 20 years (2002-2021), in July 2023. The past 20 years were divided into four groups (2002-2006; 2007-2011; 2012-2016; and 2017-2021). The survey was customized to each Member State (MS). Out of the 17 MS invited to respond to the questionnaire, only 8 member states responded to the survey. Eight member states representing the different categories of CRFM Member States returned responses to the questionnaires as follows. Based on the geographical location three groups were formed. Group-1 - countries to the north; Jamaica, Bahamas, Turks and Caicos Islands. Group-2 - countries of the central Caribbean - Antigua and Barbuda, St. Lucia, St. Vincent and the Grenadines. Group-3 – Countries of Central America – Suriname and Guyana. Each member state was asked to suggest possible reasons for the observed trend over the 20-year period (the overall trend was separated into five-year intervals). The responses provided by respondents may not be considered as the statement of the country rather it is considered as the personal views of the respondents based on their experience in the sector.

3. RESULTS

Trends in marine fish production (2002-2021)

The trend of marine fish production for the CRFM member States is presented in *Figure 1*. It shows that the fish production in the CRFM member states has increased in 2021 in comparison to 2000. However, the marine production in the last five year is sightly declining though stagnant in last two years. (*Figure 1*) The rate of growth in marine production was calculated in comparison to the previous year fish production, in most of the year the graphs show a negative growth, except in few selected years during 210 to 2012 (*Figure 2*).

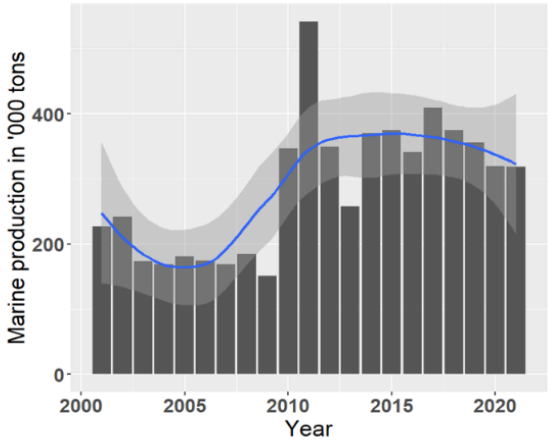

Figure 1. Trend in marine capture fisheries production from 2002 - 2021

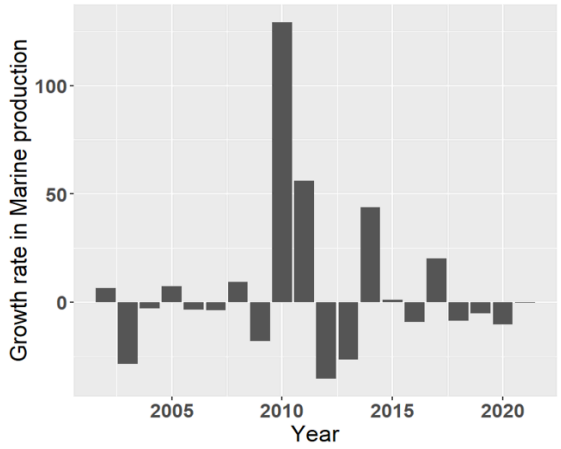

Figure 2. Rate of growth in marine production from 2002 - 2021

Country-level production trend analysis

Fish production was analyzed for CRFM Member States for the period of 2002 to 2021. Barbados, TCI and Guyana showed a significant decline in fish production trends. However, the countries like Anguilla, Antigua- Barbuda showed a positive fish production trend (Fig. 3) during 2001 to 2021. Some of countries showed an initial increment and then a declining trend (Grenada, Bahamas, Jamaica)

The country–level growth rate was estimated to determine the performance of marine production by different member countries during the last two decades (Fig. 4). Most of the countries showed a negative growth rate during the last 5 years (2017-2021). However, TCI showed a positive growth rate during the last two years. A small incremental growth was also observed in Montserrat, Bahamas and Suriname during 2021 in comparison to 2020.

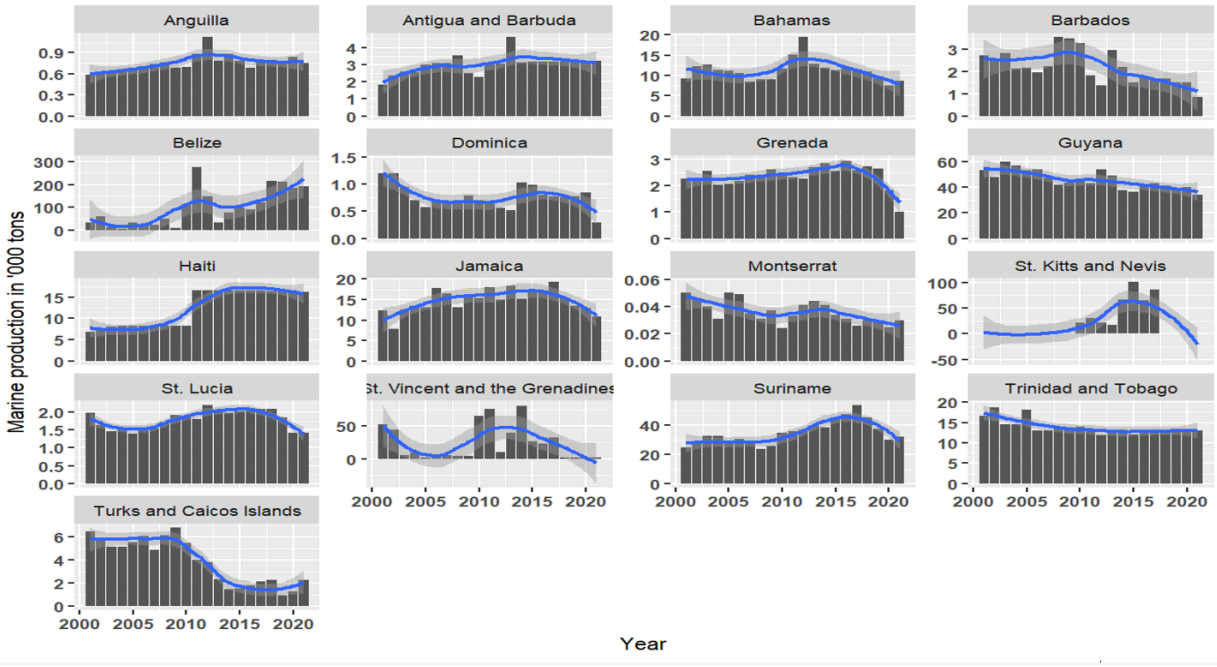

Figure 3. Country-level trend in marine capture fisheries production from 2002 – 2021

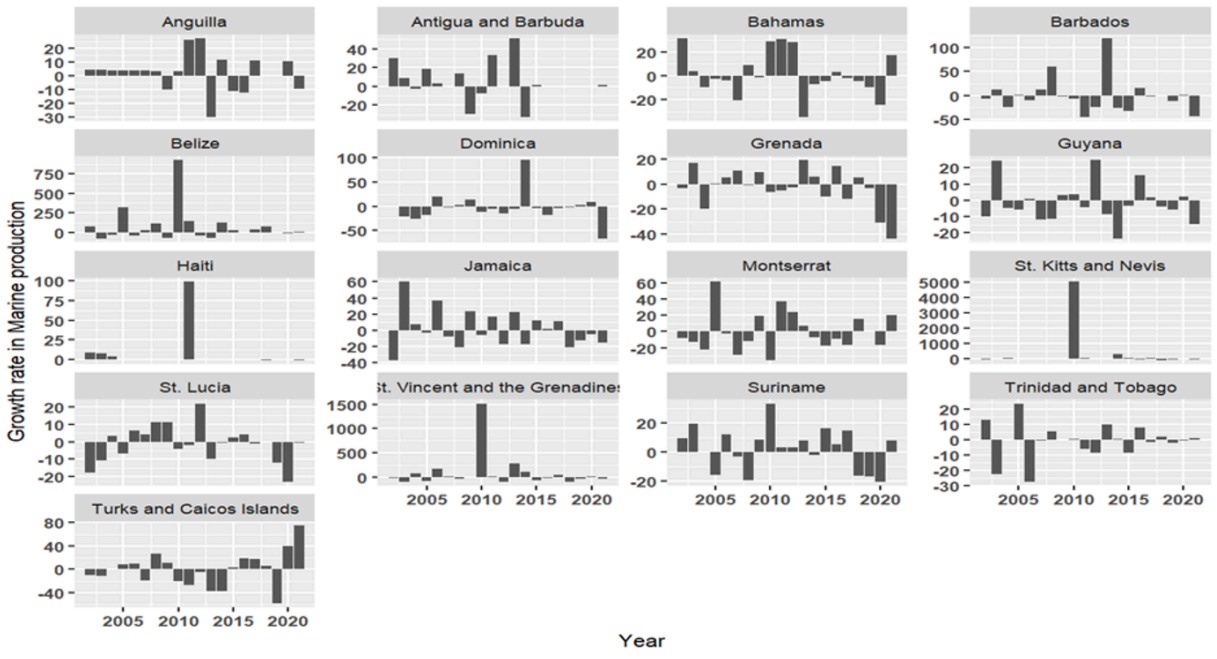

Figure 4. Country-level rate of growth in marine production from 2002 - 2021

4. SURVEY FINDINGS

Over the four five-year periods (2002-2006; 2007-2011; 2012-2016; and 2017-2021) Increasing trend in marine fish production per Member State was noted a total of 14 times. Of the 14 times that an increasing trend was noted 10 times it was opined that increased fishing effort might have been the reason for the increase in production, two events were tentatively attributed to the introduction of FAD fishing, one event was attributed to recovery after a hurricane and another event, to spill-off effects of a closed season (*Figure 5* and *Figure 6*).

The time period where most Member States observed an increasing trend in production was 2012- 2016. During this period five of the eight member states that responded to the survey, experienced an increasing trend in fish production. Possible reasons suggested for the increase were; increase in fishing effort (3 Member States), introduction of FADs (1 Member State) and recovery after a hurricane (1 Member States)

Decreasing trends in production were observed 13 times. Member States suggested the following reasons for the decline; Because of weather phenomena/hurricanes/ La Nina (5 Member States); Decline in fishing effort (3 Member States); Climate Change /influx of sargassum (4 member States); Inadequate data collection system (1 Member State); three Member States also pointed to COVID 19 restrictions as possible cause for the observed decline in fish production during 2017-2021 (*Figure 6*).

The five-year period with the highest cases of declining marine fish production was 2017-2021. Five of the eight Member States had a declining trend in fish production. The reasons suggested were: COVID 19 restrictions (3 Member States); Sargassum (2 Member States); Unfavorable environmental conditions/ extreme weather patterns and climate change (2 Member States); and a rigidly enforced Conch Quota (1 Member State).

Steady-states were observed five times over the four 5-year periods. The reasons suggested for this include restriction of effort (1 Member State); effects of a Hurricane (1 Member State) and inadequate data collection system (1).

The survey demonstrated that the fisheries managers (eight out of 17 Member States) of the region were seeing increased fishing effort as the main factor influencing increased fish production. Also, that in their estimation decreasing trends in production were as a result of; bad weather phenomena/hurricanes/ La Nina (5 Member States); decline in fishing effort (3 Member States); Climate Change /influx of Sargassum (4 Member States); Inadequate data collection system (1 Member State); three Member States also pointed to COVID 19 restrictions as possible cause for the observed decline in fish production during 2017-2021. It is interesting, however, that pollution was not directly pointed to by any of the respondents.

	Production 2002-2006	
Groups 1	Trend	Reason
Jamaica	Increasing	Increase fishing effort
Bahamas	Decrease	Bad weather
TCI	Steady	Restriction on effort
Group 2		
Antigua and Barbuda	Increasing	Increase fishing effort
St Lucia	Steady	Don't know why
St. Vincent and the Grenadin	Steady	Don't know why
Group 3		
Suriname	Increasing	Increase fishing effort
Guyana	Decrease	Climate change/sagassum influx

	Production 2007-2011	
Groups 1	Trend	Reason
Jamaica	Increasing	Increase in fishing effort
Bahamas	Increasing	Because of increase in effort
TCI	Decreasing	Because of weather phenomena Two major
Group 2		
Antigua and Barbuda	Decreassing	Decreass fishing Effort (The Great Recession)
St Lucia	Increasing	The introduction and use of FAD fishing
St. Vincent and the Grenadines	Decreasing	Because of weather phenomena (hurricane 'Omar')
Group 3		
Suriname	increasing	1) Increase in effective fishing effort, 2) Increased landing of
Guyana	Decreasing	Climate change/sagassum influx

Figure 5. Responses of different groups from 2002 to 2011

	Production 2012-2016	
Groups 1	Trend	Reason
Jamaica	Steady	Hurricane Sandy and aid to replace vessels and gear
Bahamas	Decreasing	Conch Quota was rigidly
TCI	Increasing	Recovery after the huricanes
Group 2		
Antigua and Barbuda	Increasing	General improvement in the global economy (more fish demanded)
St Lucia	Increasing	The introduction and use of FAD fishing
St. Vincent and the Grenadines	Steady to slightly increasing	Because of increase in effort/technology/gear (bigger or more or better boats.
Group 3		
Suriname	Increasing	Increase foshing effort
Guyana	Decreasing	Because of inadequate data collection or data management.

	Production 2017-2021	
Groups 1	Trend	Reason
Jamaica	Decreasing	Measures to stem the spread of COVID-19. Influx of Sargassum cause fish to die.
Bahamas	Decreasing	Conch Quota was rigidly enforced during
TCI	Steady	Because of inadequate data collection or data managemen
Group 2		
Antigua and Barbuda	Increasing	Better able to control fishing effort have resulted in long-term benefits
St Lucia	Decreasing	There was an influx of Sargassum seaweed, The effect of Covid-19 pandemic
St. Vincent and the Grenadines	Increasing	Because of increase in effort/technology/gear.The introduction of FADS and the improvement of vessels
Group 3		
Suriname	Decreasing	2018 with unfavourable environmental conditions (La Nina cycle).
Guyana	Decreasing	Eextreme weather patterns and climate change and Because of the effects of COVID -19 restrictions

Figure 6. Responses of different groups from 2012 to 2021

Trend in aquaculture production

The aquaculture production from CRFM member countries showed a positive trend in the initial years (from 2000 till 2006), however after 2006 the production shows a declining trend (*Figure 7*). The present total aquaculture production from CRFM member countries is moving around 3500 tonnes per year over the last five years.

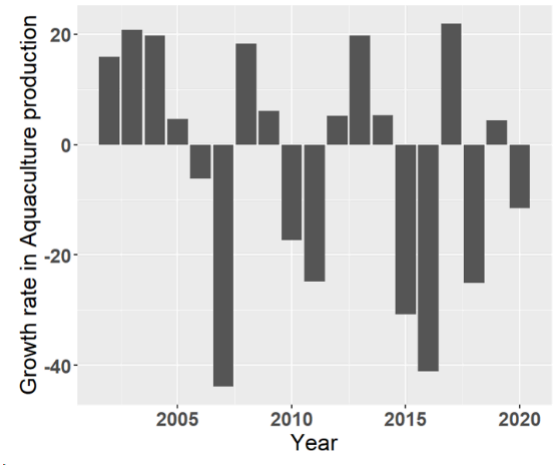

Figure 7. Trend in aquaculture production in CRFM region

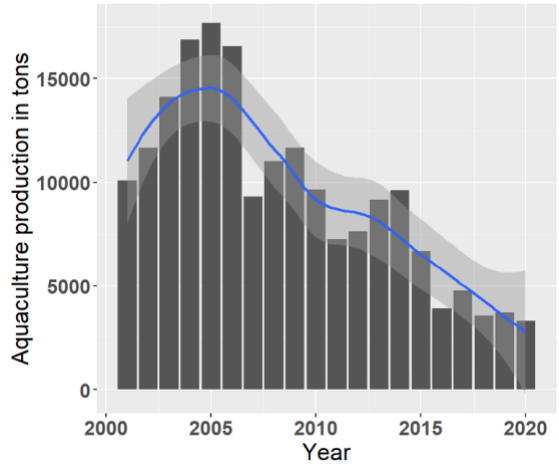

Figure 8. Rate of growth in aquaculture production

The rate of growth in aquaculture production shows 11 years increasing production to the previous years and in 8 years there is a decrease in growth rate in comparison to the previous year's production. The decreasing growth rate is higher than the increasing growth rate. Overall, there was a decreasing trend in aquaculture production in the year 2020 in comparison to 2005-06 (*Figure 8*).

Trend in import of fishery product

The trend in the import of fish products shows a positive growth in the last two decades. The value of imports has increased 3.5 times in the last two decades from around US$100 million in 2002 to US$350 million in 2022 (*Figure 9*), while the product weight of imports has almost doubled, from 50,000 tons in 2002 to 90,000 tons in 2022 (*Figure 10*). The data show the continuous increase in the import of fishery products in the CRFM region. The increase in import might be the reason for high demand for the fish product in the region.

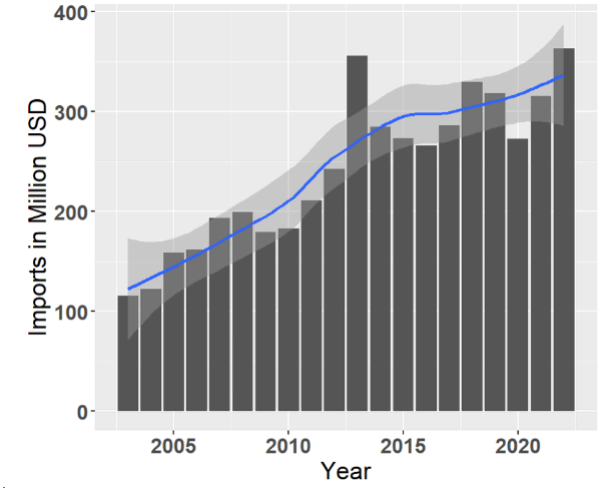

Figure 9. Trend in import of fishery product (value)

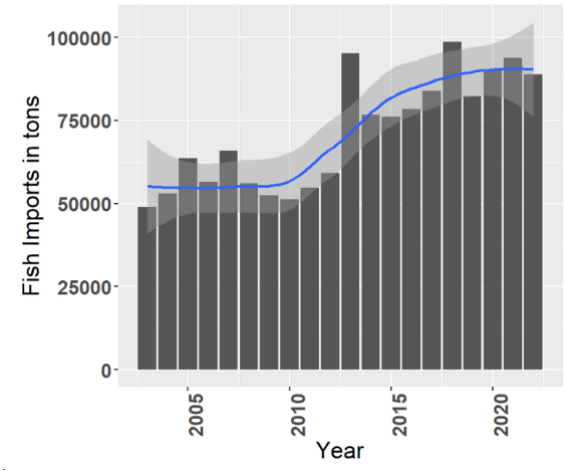

Figure 10. Trend in import of fishery product by weight

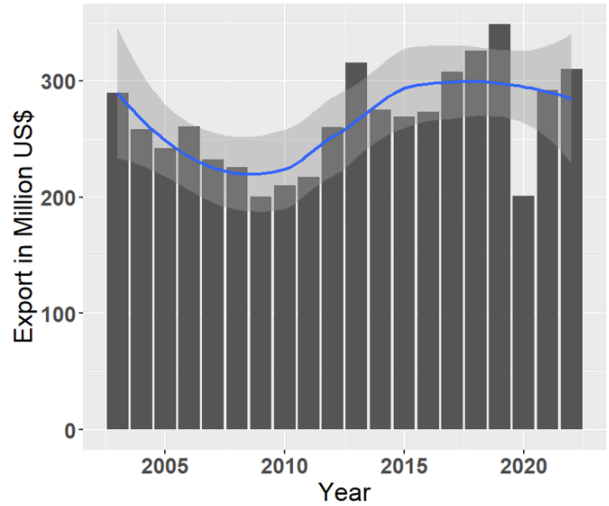

Figure 11. Trend in export of fishery product

Trend in export of fishery product

The trend in fish product export is almost stagnant, the values move around 250 million USD to 300 million USD. Though in the initial years it showed a declining trend, after 2012 the value of export is around 300 million USD. Owing to the COVID-19 pandemic, there is low export in the year 2020 (*Figure 11*).

Trend in import-export of fishery products in the region

The trend in the difference of the values of imports and exports has been increasing in the last two decades. The trend was negative until 2012 and the difference in imports to exports is increasing towards the positive side. It is indicating the value of imports are more compared to that of exports in million US$. In the year 2002 the import-export difference was around -180 million US$, which indicates higher exports than imports. However, the difference increased during the year 2022 to around 50 million US$, indicating higher imports of fishery products in comparison to exports (*Figure 12*). During the 2012 to 2017 the value of fishery product export and import are almost equal.

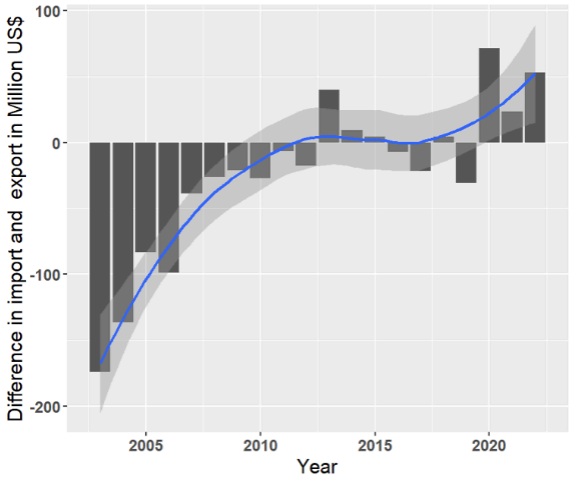

Figure12. Difference of Import-export of fishery product in million US$ in the region

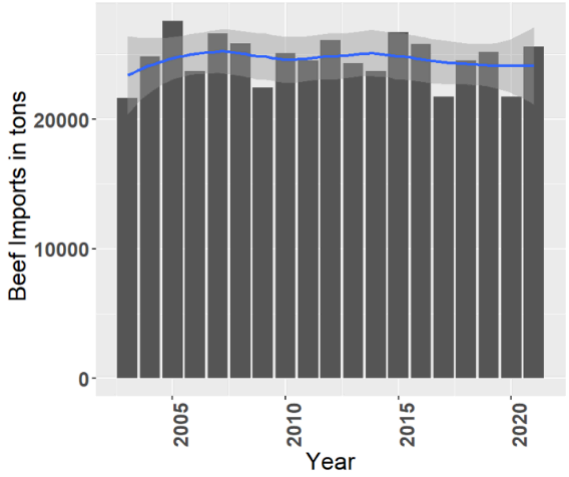

Figure 13. Trend in import of beef in the region

Trend in import of beef

The trend in beef import has not increased much in the last two decades. The trend is showing almost a straight line. The total weight of imports is around 22000 tons (*Figure 13*). Which means the demand for beef consumption has not increased much.

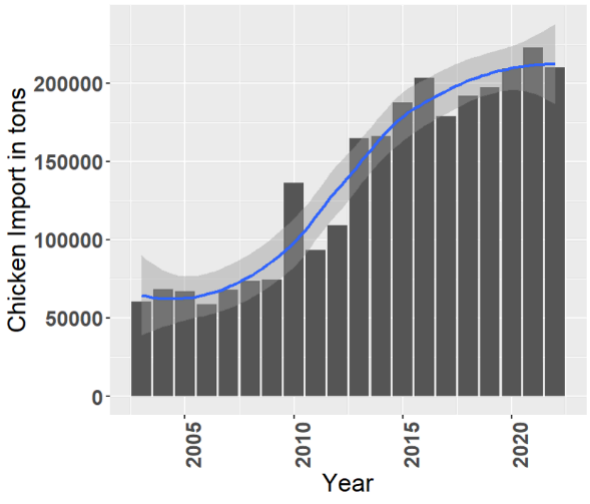

Figure 14. Trend in import of chicken in the region

The trend in imports of Chicken

Chicken imports have increased 4 times between 2002 and 2022. Regarding the weight of the chicken, imports have increased from 50,000 (2002) tons to 200,000 tons (2022), almost 4 times. The rate has increased since 2010. The slope of growth is quite high after 2012. Until 2012 the value was less than 100,000 tons. In the last three years the chicken imports were almost stagnant.

5. DISCUSSION

Fish production has been almost stagnant over the last few years. It is difficult to predict the movement of fish production, as we are unsure from the data anlysed whether the catch for the respective species remains the same or whether it varies. Also there is always an improvement in the fish catching methods, whether the use of boats with higher engine capacity or better gear, or increase in gear length, or an increase in fishing boats has produced similar catch. The catch analyses based on species and size will provide better information about the status of the fish stock. From the survey it is also evident that there is an increase in fishing pressure in the region and fish aggregating devices (FADs) might have contributed to maintaining the production, At the same time, there have been multiple stressors that impacted fish production like hurricanes, COVID-19, Sargassum and climate change.

Total aquaculture production is showing a decreasing trend. In this regard, the region faces a lot of challenges like limited expertise, high production cost and limited seed supplies apart from other aquaculture challenges (Wurmann et al., 2020). The decrease in aquaculture production needs to be urgently addressed. Jeffs and Davis have done an assessment of the aquaculture potential of spiny lobster in the Caribbean in the year 2003. New aquaculture candidate species

(Alvarez-Lajonchère and Ibarra-Castro, 2013) need to be identified and biosecurity measures need to be improved (Subasinghe et al., 2023) for better production from aquaculture.

The value of fish imports has increased 3.5 times and the weight of fish product import has increased to 1.8 times in the last two decades. The increase in poultry import to the region is quite high, 4 times increase in 2022 in comparison to 2002, the reason might be the consumer preference for chicken. However, the beef imports were almost stagnant in the last two decades. This suggests that there is less preference for beef. Greater awareness on the negative impact of red meat on human health might be the reason for the stagnant beef imports. Chicken and fish imports have increased in the last two decades indicating the high preference of chicken and fish as animal meat protein intake in CRFM member countries.

As the marine fish production is almost stagnant with not much scope to increase the capture production, only the aquaculture (both marine and freshwater) sector has the potential to meet demand of fish requirement in the region. In aquaculture, an integrated multi trophic aquaculture system, and aquaponics, are some of the more likely interventions to increase aquaculture production in the region. Technical support and guidance through extension services are required for the farmers to adopt the new technologies and to increase fish production from the region (Stankus, 2019).

6. CONCLUSION

In the present analysis the authors have only considered the total production from the member states, not the species wise fish production. In the total production the production of some species might have increased and some might have decreased, while some of the species catch might be stagnant. Some new species might have exploited, some of the species might have significantly depleted from the region. It is very difficult to say how the stocks have behaved from this analysis, however the total marine production is almost stagnant. To provide further recommendations one needs to analyze the species wise production trend and then provide species wise management strategies and or production enhancement strategies. However, the stagnant fish production and the high demand for fish and fishery products evident from import is putting a pressure on the fishery sector to increase the fish production by targeting the non-exploited resources (if any) or the production enhancement strategies from aquaculture either from marine or from inland.

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