TRENDS IN FISHERIES, AQUACULTURE AND CONSUMPTION IN NIGERIA

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ABSTRACT
The production and consumption trends of fish in Nigeria were examined in this study. The study used secondary data from the Food and Agriculture Organization Statistics (FAOSTAT) and World Bank statistics for the period of 1971–2021. The data was analyzed using the growth and Auto-Regressive Integrated Moving Average (ARIMA) models. The study's findings showed that the annual average growth rate of total fish production from 1971 to 2021 was 3.01%, aquaculture was 8.84%, capture 2.444% while imports stood at 4.3%. The annual average growth rate for the years 2022 to 2025 was forecasted to be 2.9% for total fish production, 4.7% for aquaculture, 2.5% for capture and 3.8% for imports. The study revealed a significant degree of concentration in the importation of foreign fishing resources. The Nigerian fish importers have implemented backward integration into commercial aquaculture in an effort to lower the country's import costs. Fish import growth rate accelerated, however, fish production growth rate slowed down. To achieve a balanced trade of Nigerian fisheries, the report recommends allocating additional resources to the export sector of the country's fisheries and implementing counter-dumping regulations in the import sector.

Keywords: Fisheries performance; Time - series, Forecasting Models, global growth rate.

INTRODUCTION

Fish, mollusks, crustaceans, and aquatic plants can all be farmed through the process known as aquaculture. Aquaculture output that is intended for final harvest for human use is referred to as aquaculture production. Fisheries is a significant economic industry that employs over 8.6 million people directly and an additional 19.6 million indirectly, with women making up 70% of the workforce (Worldfish, 2021). At the moment, Nigeria produces just over 1 million metric tons of fish, leaving an annual import imbalance of over 800,000 metric tons (Worldfish, 2021). Although these industries are not the main agricultural operations in Nigeria, aquaculture and fishing are significant food additions (Amosu *et al.*, 2017). Nigeria is currently the second-largest fish producer in Africa, behind Egypt, the influence that aquaculture and fisheries has on the country's Gross Domestic Product (GDP) cannot be overlooked because they account for 1.09% of the country's agricultural GDP (NBS, 2020). Fish is a nutrient-rich food with a wide range of culinary and medicinal applications. The demand for fishery products has increased both nationally and internationally in recent years as more people have become aware of the health benefits of eating fish.

This tendency is anticipated to continue in the ensuing decades as well, according to the growing population and the unavoidable requirement to address the food problem. The development of fish-based companies requires an increase in fish production and progress in the fishing industry (Garcia and Rosenberg, 2010).

In spite of Nigeria's abundance of natural water resources, the freshwater ecosystems have not yet reached their full potential. Even while fish farming offers tremendous potential for boosting the country's economy, there are several obstacles standing in the way of its success. In order to encourage economic and scientific developments in the aquaculture and fishing industry, these challenges must be seriously addressed. These challenges include reducing the country's reliance on oil, diversifying the economy, addressing the lack of infrastructure, creating strong institutions, and enhancing governance, public financial management systems, as well as human development indicators (Federal Ministry of Finance, 2020).

A thorough examination of the current state of affairs and developmental tendencies can be used to anticipate the possibilities for fisheries and aquaculture in the future (Pauly *et al*, 2003). Therefore, this article focuses on examining these patterns to provide a thorough picture of the current situation of the aquaculture and fisheries industry in Nigeria. Doing so may aid researchers in proposing the most appropriate strategies for the sector's development. It will assist decision-makers and other interested parties in identifying intervention areas and developing suitable programs, plans, and policies for the growth of Nigeria's aquaculture and fisheries industry. It also makes an effort to highlight

the pressing concerns surrounding the industries of fish production, marketing, and commerce.

MATERIALS AND METHODS

Study Area

The investigation was carried out in Nigeria, a sub-Saharan country on the Gulf of Guinea. Over 218.5 million people were reportedly living in Nigeria as of 2022 (World Data, 2022), which has a total land area of 923,770 km^2 (FAO, 2020b). Nigeria is bounded by the Gulf of Guinea to the south, Benin to the west, Niger to the north, Cameroon and Chad to the east, and longitudes 2° 49'E and 14° 37'E and latitudes 4° 16'N and 13° 52' North of the Equator.

There are 923,768 km^2 of land in all, and 37,934 km^2 make up the continental shelf. According to the FAO (2020b), its coastline is 853 km long and has a 210,900 km-long Exclusive Economic Zone. About 11,666,000 hectares are thought to be the total area and distribution of the main inland water system (lakes and rivers).

Data Sources

The investigation of the paper, which covered the years 1971 through 2021, utilised secondary data. Several sources, including the Federal Department of Fisheries (FDF), the Food and Agriculture Organization Statistics (FAOSTAT), and World Bank statistics, were used to compile the data.

Methods

Based on annual growth rates, the average annual growth rate shows how quickly an economy has changed on average throughout time. An annual growth rate's geometric mean is what we refer to as the average annual growth rate.

Determine the average yearly growth rate $= \frac{Yt}{Yt-1}$ $\wedge {}^{1}/_{(n-1)} \times 100$ The global growth rate multiplied by ${}^{1}/_{(n-1)}$, where n is the number of years, equates to the average annual growth rate. A variety of techniques are employed to investigate time series data and projections. It can be divided into groups of theoretical models, a group of linear and non-linear models, partial equilibrium, and general equilibrium based on their typology.

Box-Jenkins 'Method

The study of the numerical time series to project trends using the ARIMA model one of the categories of models called ARIMA attempts to calculate each value of the series in relation to the values that came before it $y_t = {}_f(yt-1, yt-2\, yt, yt-n)$. A theoretical model is the name given to it. Box and Jenkins (1976) popularized and codified this group of models.

To be clear, autoregressive processes presume that each point may be anticipated by the weighted sum of a set of prior points plus a random error factor. The integration procedure presupposes that there is a constant difference between each point and the one before it. Moving average methods assume that each point is a combination of its own error and the errors of the points that came before it. In the class of statistical models used to examine and project time-series in agriculture and rural development, ARIMA is a potent tool. Numerous organizations (FAO, USAID, IITA, etc.). The fish production figures from 2022 to 2025 are forecast using the Auto-Regressive Integrated Moving Average (ARIMA,1,1,3) model, it is frequently used when analyzing projections in situations like these, with user interface of the E-Views 9.0 software.

RESULTS

Aquaculture production in Nigeria has increased by 8.84 percent a year over the past 52 years (in contrast to the global average of 8%), rising from just over 3993 metric tons in 1971 to about 275,845 metric tons in 2021 (Figure 1). Capture fish has increased from 241,303 in 1971 to 805,210 metrics tons in 2021 about 2.44% increase per year. Nigerian aquaculture mostly focuses on freshwater fish, with catfish species producing 64% of the nation's aquaculture in 2015. Catfish, typically grown in ponds and tanks, is the most farmed species in Nigeria, constituting about176,540.8 metric tons in 2021.

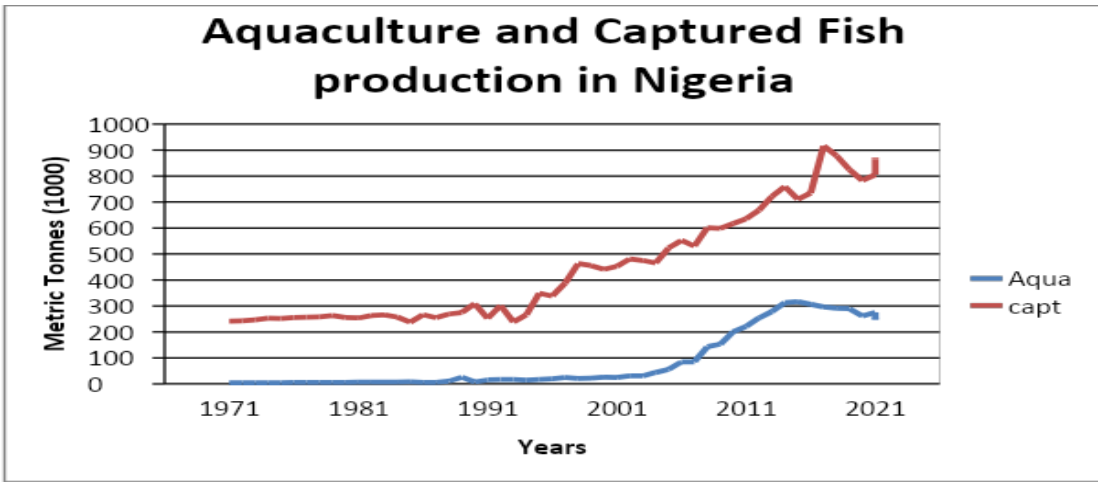

Fig 1: Trends of aquaculture and captured fish production in Nigeria 1971- 2025

The fish consumption increased yearly by3.31% from 1971 to 2021, and between 1980 and 2013, Nigeria's apparent total fish consumption increased by 55% due to an increase in fish output; the remaining 45% was covered by an increase in net fish imports (i.e., imports less exports). Between 2000 and 2011, the fish trade imbalance expanded from 350,000 metric tons to almost 2 million metric tons before dropping to 860,000 metric tons in 2013 (Figure 2) as a result of a sharp rise in local fish production. It was increased to about 1.07 million metric tons in 2014 and marginal increase to 1.08 metric tons in 2021.

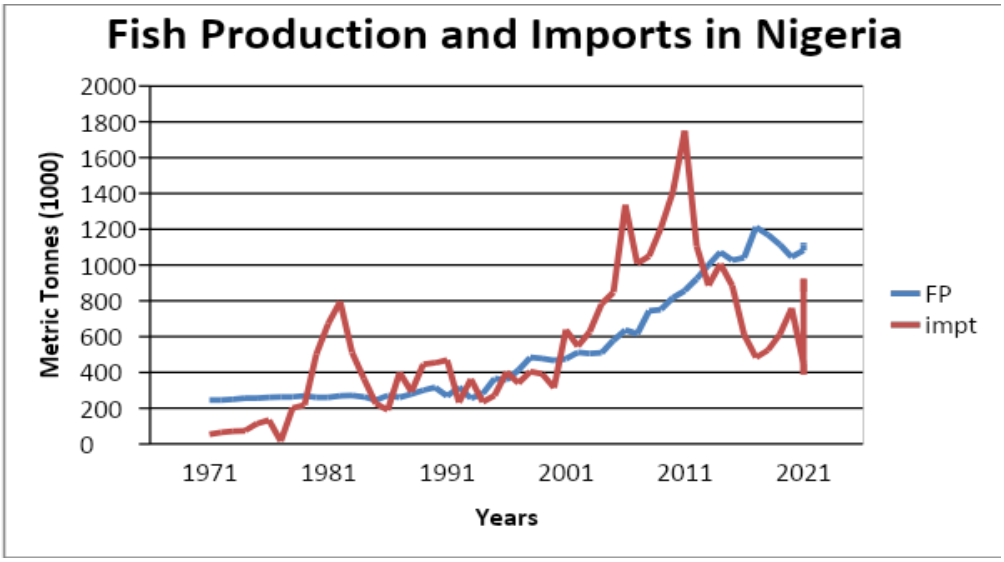

Fig 2: Trends of fish consumption in Nigeria 1971- 2025

Nigeria imported N265.4 billion worth of fish in 2021, up 41.5 percent from N187.6 billion in 2020. The country's fishing industry expanded by 3.33 percent in 2019, 0.26 percent in 2020, and only slightly (1.16 percent) in 2021 (Table 1). However, the decrease in imports allowed for an improvement in the fish self-sufficiency rate (Figure 4), which ranged from 26% to 70% of demand between 2012 and 2025.

Table 1: Fish Production and Consumption in Nigeria 1971 -2025

year	Fish production	Aquaculture	capture	imported	Consumption
1971	245296	3993	241303	54416	299712
1980	258633.3	5096.444	253536.9	155584.4	414217.8
1990	274011.7	8937.1	265074.6	435397.6	709409.3
2000	368659.8	19289.3	349370.5	342372.6	711032.4
2010	614834.5	85224.6	529609.9	945334.1	1560169
2011	856614	221128	635486	1749785	2606399
2012	922652	253898	668754	1106355	2029007
2013	1000061	278706	721355	885596	1885657
2014	1073059	313231	759828	1006263	2079322
2015	1027058	316727	710331	884723	1911781
2016	1041498	306767	734731	610648	1652146
2017	1212475	296191	916284	483047	1695522
2018	1169478	291323	878155	524024	1693502
2019	1114556	289543	825013	611978.6	1726535
2020	1044813	261711	783102	759625.2	1804438
2021	1080855	275645	805210	446941.3	1527796
Growth %	**3.01**	**8.84**	**2.44**	**4.3**	**3.31**
2022	1040363	199443.6	840919.9	732100.6	1772464
2023	1070731	208971.7	861759	768689.2	1839420
2024	1101984	218869.7	883114.5	807106.5	1909091
2025	1134150	229150.8	904999.3	847443.8	1981594
Growth %	**2.9189**	**4.7371**	**2.4781**	**4.9978**	**3.7876**

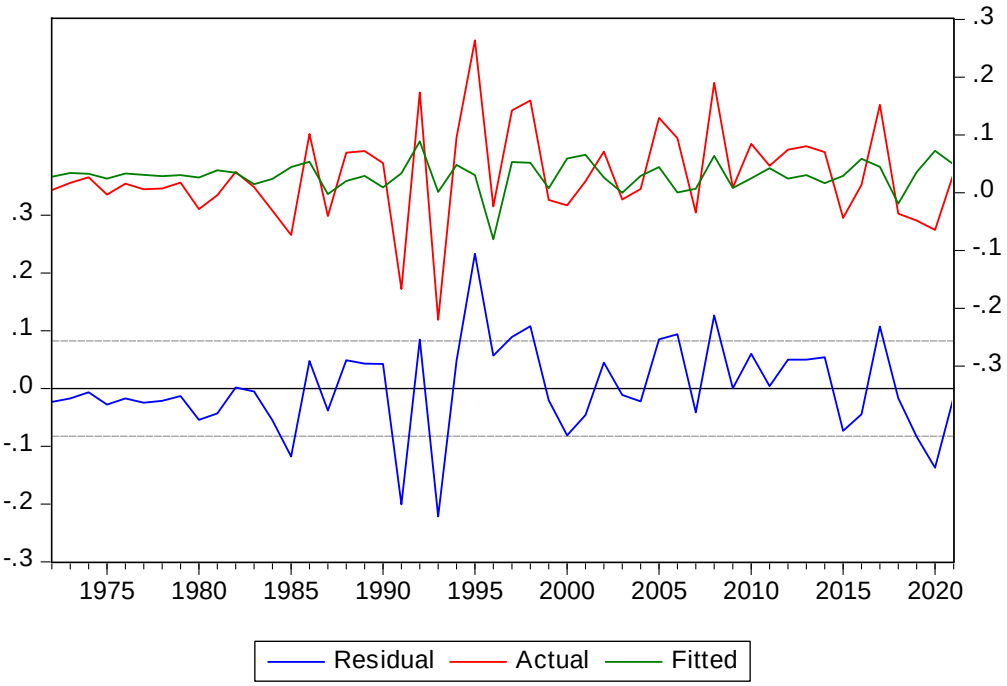

Figure 3: Actual series, fitted series and residual series of the DLFP sequence

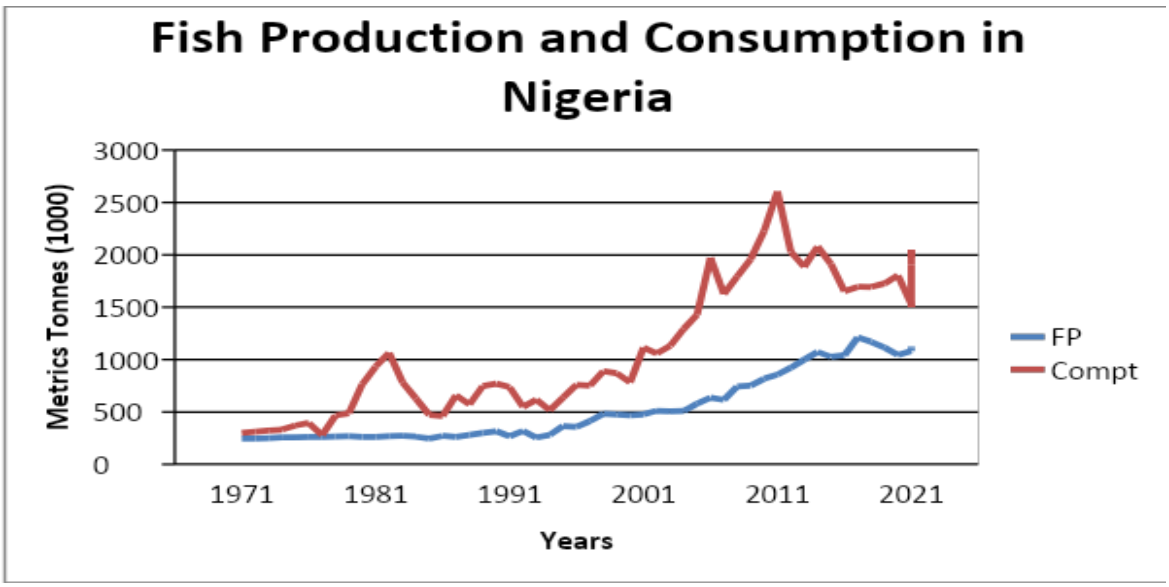

Fig 4: Fish Production and Consumption in Nigeria 1970 -2021

DISCUSSION

With an annual growth rate of 3.01 percent compared to the global increase of 3.3 percent, total fisheries and aquaculture production have increased significantly over the past five decades, rising from 245,296 metric tonnes (Live weight equivalent) in 1970 to an all-time high of about 1.08 million tonnes in 2020. After then, production fell in 2019 (a decrease of 4.9% from 2017), before rising by 3.3% to reach 1.08 million tonnes in 2021. The two-year standstill is largely attributable to a fall in captured fisheries, which fell by 6.4 percent in 2019 compared to their peak of 878,155 metric tonnes in 2018 and then by a further 2.4 percent in 2021.

The drop was caused by a number of elements, such as shifting pelagic species captures, national insecurity, and the effects of COVID-19 on the industry in 2020. Additionally, aquaculture production—the primary factor in the increase in total production since the late 1980s—has continued to rise, albeit at a slower rate in the last three years: -0.61% in 2018–2019, compared to a global average

of 3.3%, -9.6% in 2019–2020, compared to a global average of 2.6%, and 5.52% in 2020–2021, as opposed to an average annual growth rate of 7.9% between 2010–2018 (FAO, 2020a).The only option that would result in a decrease in the expected actual pricing of low-value food fish is faster aquaculture expansion, albeit this scenario would also result in a considerable increase in the price of fishmeal (Christopher *et al*., 2020).

The impact of policy changes in Nigeria focused on electoral policies at the expense of economic development and various issues linked to Covid-19 in 2020 that not only impacted production for exports but also reduced availability of workers, supplies and inputs (including feed, and fingerlings and ice) while disrupting transportation and marketing, as well as sanitary measures are some of the causes of these lower growth rates in the fisheries sub-sectors (FAO,2020b).

Aquaculture's contribution to overall fisheries and aquaculture production has further expanded as it has developed more quickly than capture fisheries over the past two decades. A total of 1.08 million tonnes were produced in 2021, with capture fisheries contributing 74% (805,210 metric tonnes) and aquaculture contributing 36% (275,645 metric tonnes). This represents a significant shift from the aquaculture share of 4.6% in the 1970s, 23% in the 1980s, 23.6% in the 2010s, and 7.07% in the 2020s. Despite the expansion, the primary source of production remains the catch fisheries.

Fish demand in the country is 3.6 million metric tonnes, but total domestic production from all sources is only 1 080,855 metric tonnes annually, leaving a demand-supply gap of approximately 2.52 million metric tonnes in 2021. If the government does not make a concerted effort to increase domestic fish productivity, fish imports will continue to fill the gap between local supply and demand, sapping significant amounts of foreign currency (Subasinghe *et al*., 2021).

The predicting relative errors for fish production are 0.19% and 1.51%, respectively, for the years 2022 to 2025. Since the forecast are based on ARIMA model that has been fitted to the complete set of data, the root-mean-square error (RMSE) from the residuals is reduced as would be expected. It provides insightful information about how well our forecasting model is performing.

CONCLUSION

Nigeria has enormous potential for fisheries and aquaculture output. With its promising status and constantly changing development patterns, Nigeria's aquaculture and fisheries sector has improved satisfactorily in recent years, mostly because of initiatives like Nigerian National Fisheries Policy. The production situation is still in a precarious state because the relevant parties haven't fully investigated the enormous prospects given by these sectors and their unquestionably bright future. The abundance of natural water resources and the diversity of the aquatic ecosystem are a benefit to the Nigerian economy, which has the potential to generate enormous earnings from the aquaculture and fishing industries. The goal of boosting production that satisfies domestic demand and, ideally, increases export opportunities might be aided by the abundance of human resources, particularly in rural areas. With a long-term sustainable plan, scientific and technological study on native fish species, proper hygiene management, and enhanced disease control, Nigeria's current aquaculture situation may be improved.

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