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TREND IN FISH PRODUCTION PARAMETERS IN NIGERIA AND ITS TOTAL ESTIMATED DEMAND: EMPIRICAL EVIDENCE FROM FISH PRODUCTION

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ABSTRACT

This study examined the trend in fish production parameters in Nigeria and its total estimated demand from 1970-2014. Data were analyzed using descriptive and inferential statistics. Data for the study were sourced from secondary sources. The total domestic production (TDP), artisanal fishery production (AFP) and aquaculture (AQU) per annum were about 42%, 37% and 5% respectively of total estimated demand (ESD). The coefficient of variability for ESD, TDP, AFP and AQU stood at 0.54; 0.37; 0.39 and 0.93 respectively. The result shows that estimated demand for fish grow faster than change in local fish production. Self-sufficiency varies from 98.99% in 1970 to 19.3% in 2014 and shows that fish demand was inversely proportional to local production both from artisanal fisheries and aquaculture. There was a strong positive correlation between the ECG and ESD or TDP which was statistically significant either at 1% or 10%. The study also revealed that an increase in production of fish to meet ESD could bring about improved economic growth, *ceteris paribus.* Adequate institutional framework such as training through extension services should be put in place for both artisanal fisherfolks and fish farmers to encourage sustainable fish production. Therefore, the capital budgetary allocations to the agricultural sector in Nigeria should followed stipulated 25% FAO standard, or at least 10% Maputo agreement by Africa leaders (African Malabo Declaration, 2014) for livestock sub sector to improve fish self-sufficiency and promote overall fishery development and productivity.

Keywords: Fish production, estimated demand, deficit, Nigeria.

INTRODUCTION

Fish Production in Nigeria

Nigeria is a typical coastal country endowed with coastline of about 800 km, a continental shelf of about 256,000 km^2; exclusive economic zone area of 210,900 km^2 and marine area of 46,000 km^2 which can partly be used for fishing. The country is also blessed with over 14 million ha of reservoirs, lakes, ponds, and major rivers capable of producing over 980,000 metric tonnes of fish annually (Oladimeji *et al.*, 2013a). Above all, the country has rich vegetation and abundant water resource capable of supporting a large population of livestock and fishes, with about 214 billion m^3 of surface water (Oladimeji *et al.*, 2016) and 87 km^3 of ground water (Oladimeji *et al.*, 2014) both of which can be used partly for aquaculture and artisanal fishing. Therefore, it can be concluded that Nigeria is endowed with abundant fishery resources to produce enough fish and fish products not only for domestic consumption but also for export

Fisheries are an integral part of Agriculture sector in Nigeria which maintains a steady contribution of 3.5 to 4% to total GDP in 2008 to 2012. This translates to about 10% of agricultural GDP, which itself contributed between 35 and 40 percent within the same period

(Oladimeji *et al.*, 2013b). However, Nigeria's abundant fisheries resources notwithstanding, the country is still largely a protein deficient nation. Total protein consumption is below the UN/FAO'S estimated minimum of 75 gm. of daily per capita intake. The findings from Federal Department of Fisheries (FDF) and Food and Agriculture Organisation (FAO) records also show that Nigeria's self-sufficiency ratio in fish production was as high as 98.8% in 1983 but dwindled between 40% and 19.2% in 2005 and 2014 with an annual average of about 49% and standard deviation of 19.1. Statistical surveys (FAO, 2012, Oladimeji *et al.*, 2013b) have shown that the current fish demand in Nigeria put at over 1.5 metric tonnes has not been met which led to annual fish importation of about US$ 400 million annually. As of 2009, the Nigeria foreign exchange expenditure on total expenditure on food import was valued at $3 billion while proportions of fish import alone amount to about $1.3 billion or 43.33% (USDA, 2009).

The water system of Nigeria is dominated by two great river systems, the Niger-Benue and the Chad systems. With the exception of a few rivers that empty directly into the Atlantic Ocean such as Cross River, Ogun, Oshun, Imo, Qua Iboe and a few others, all other flowing waters ultimately find their way into the Chad Basin or down the lower Niger to the sea. The approximate extent and distribution of the major inland water system (rivers and lake) is estimated at about 11,666,000 hectares make up about 12.0% of the total surface area of Nigeria which is estimated to be approximately 98,300,000 hectares (Fig. 1). The demand for fish like all other animal proteins in Nigeria has surpassed the supplies leaving the general populace in sub-optimal protein consumption. To solve the country's high demand for fish, Nigeria must explore her artisanal fisheries and aquaculture resources which have been found to be under-utilized.

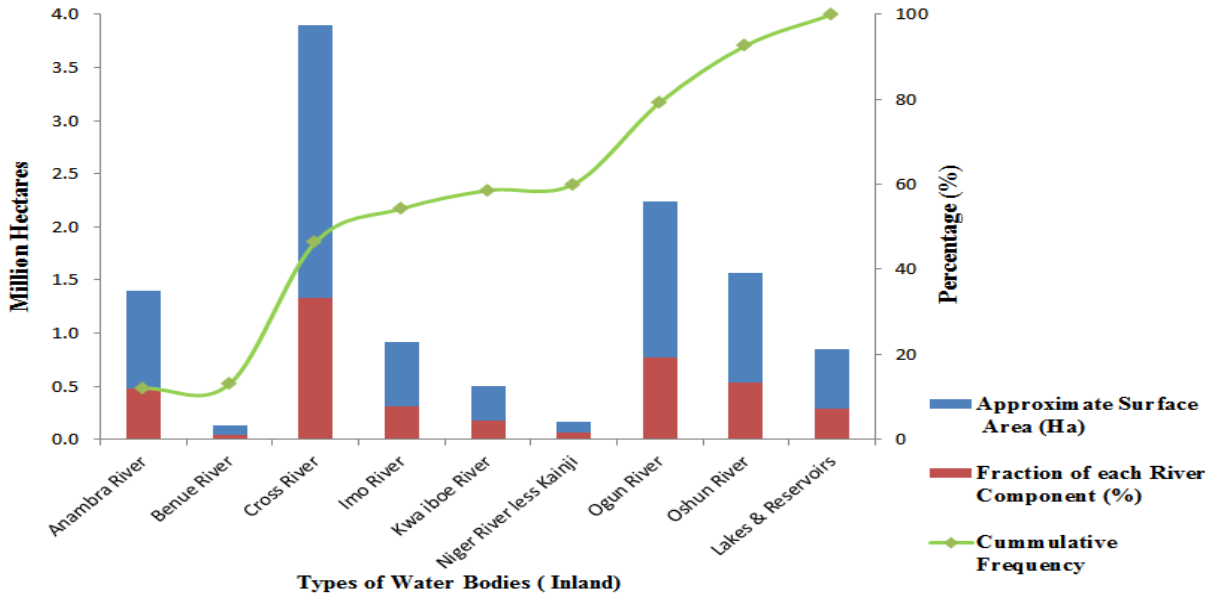

Fig. 1: Major inland water resources of Nigeria
Source: Ita, (1985); Oladimeji, (1999); Oladimeji and Abdulsalam, 2014

The objective of this study was to examine the trend in fish production parameters in Nigeria and its estimated demand and remarks on long run possible effects of continuous importation of fish to the Nigeria economy in which the country has comparative advantages.

MATERIALS AND METHODS

Study Area

The study was conducted in Nigeria; the country is situated on the Gulf of Guinea, in sub-Saharan Africa. Nigeria lies between Longitudes 2° 49'E and 14° 37'E and Latitudes 4° 16'N and 13° 52' North of the Equator. It has a total land area of 923,770 km^2 (FAO, 2013) and an estimated population of over 160 million as of 2016 (NPC, 2006, 2016). The climate is tropical, characterized by high temperatures and humidity as well as marked wet and dry seasons, though there are variations between the South and North. Total rainfall decreases from the coast northwards. The South (below Latitude 8°N) has an annual rainfall ranging between 1,500 and 4,000 mm and the extreme North between 500 and 1000 mm. Nigeria is blessed with a vast expanse of inland freshwater and brackish ecosystems. Their full extent cannot be accurately stated as it varies with season depending on rainfall (Oladimeji and Abdulsalam, 2014).

Data Sources and Analytical Techniques

Data for the study include secondary data on Nigeria fishery production, fish importation, their deficit and estimated demand, and self-sufficiency ratio of fish consumption/demand from 1970 to 2014. The data were sourced from the publications of Central Bank of Nigeria (CBN) statistical bulletins, economics and financial review; Food and Agriculture Organization (FAO); Federal Office of Statistics (FOS)/National Bureau of Statistics (NBS), Federal Ministry of Agriculture and Rural Development (FMARD) and other national and international relevant sources.

Three types of aggregate fishery data were used to analyze the trend of the parameters considered: total Artisanal Fishery Production (AFP); total Aquaculture production (AQU) and total estimated demand (ESD) of the country throughout the sample period expressed in million metric tonnes. Data covered the period 1970 to 2014. Descriptive statistics: ranges, graphs and correlation analysis were used to find out the relationship among the fish variables considered.

RESULTS AND DISCUSSION

Descriptive Analysis of Fish Production Parameters

The descriptive statistics for fishery performance indicators and gross domestic products: total and agricultural GDP as well as its output used in the analyses is shown in Table 1. The total domestic production (TDP), artisanal fishery production (AFP) and aquaculture (AQU) per annum were about 42%, 37% and 5% respectively of total estimated demand (ESD). Also, the coefficient of variability for ESD, TDP, AFP and AQU stood at 0.54; 0.37; 0.39 and 0.93 respectively. The average TDP per annum from 1960 - 2014 was about 334,531.6 metric tonnes while that of AFP was 300,987.2 metric tonnes and about 806,355.6 metric tonnes for ESD. In addition, ESD in Nigeria varied from a maximum of 1,500,000 metric tonnes (2010-2014) to a minimum of 153, 000 metric tonnes (1960-1969). Both AFP and AQU increased from average of 138, 000 and 1, 200 metric tonnes in 1960-1969 to 542, 496 and 101000 metric tonnes in 2010-2014 respectively. The result indicated that self-sufficiency varies from 98.99% in 1970s to

19.3% in 2014. This suggests that change in estimated demand of fish grow faster than change in local fish production (Fig. 2).

Table 1: Summary statistic of variables used in trend analysis

Description	Mean	Minimum	Max.	STDEV	CV
ESD (metric tonnes)	806355.6	153000	1500000	438360.4	0.54
TDP (metric tonnes)	334531.6 (41.5)	140200	562972	122349.3	0.37
AFP (metric tonnes)	300987.2 (37.3)	138000	542496	116940.3	0.39
AQU (metric tonnes)	33537.8 (4.2)	1200	101000	31013.8	0.93
Self -sufficiency ratio %	55.0	19.3	98.99	28.0	0.51
Nigeria GDP (₦'000M)	319712.4	1900	999690	278902.6	0.87
Agric. GDP (₦'M)	731060.7	5281.1	38965000	11822953	1.62
Agric. Output (metric t)	2389278	2576.4	10992400	3731218	1.56

Note: Max. Denote maximum; STDEV- Standard deviation & CV- Covariance

Trend Analyses of Fish Production and Fish Importation (1960-2015)

Figure 2 indicates relationship between estimated demands (ESD), total fish imported (TFI) and total domestic production (TDP) in 1970-2014.

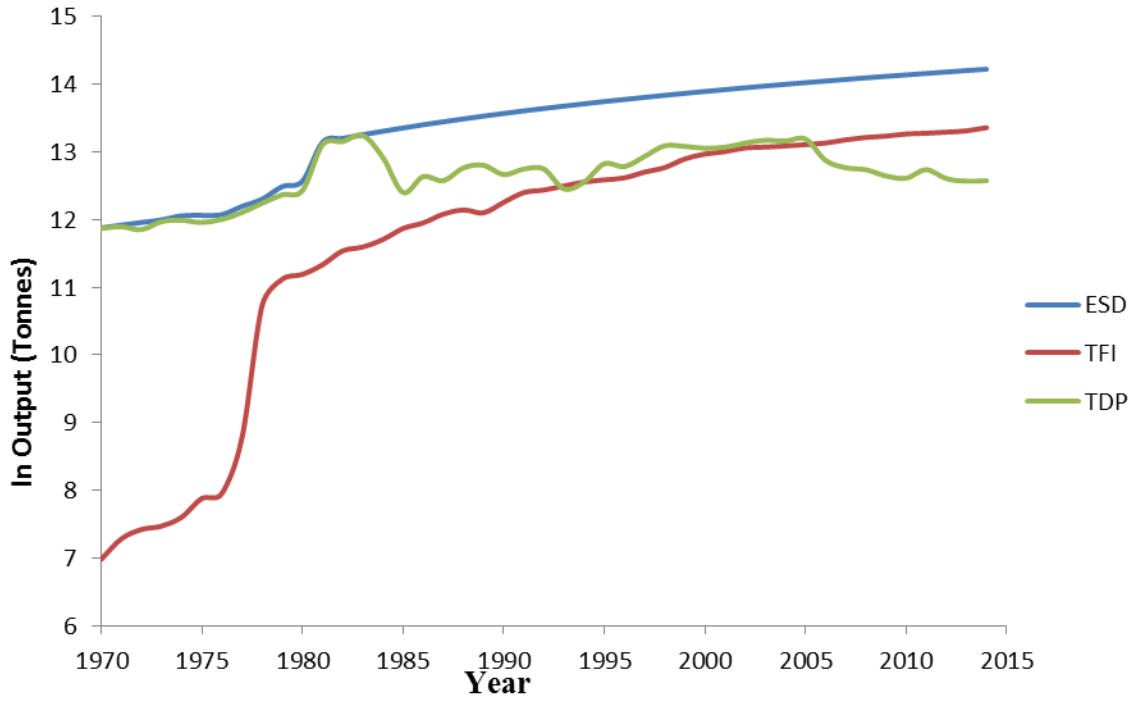

Fig. 2: Nigeria Estimated Demand (ESD), Total Domestic Production (TDP) and Total Fish Imported (TFI) IN 1970-204

Source: Computation and graph by Author; Data source: C.B.N. and N.P.C. records

Although the expected local fish production both artisanal and aquaculture fluctuates both upward and downward from 1970 to 2014, total fish imported rose from 1970 to 2014 and

surpassed the local demand between 1990 and 1995 and thereafter rose linearly till 2014. Despite the augments of local demand by importation, estimated demand continuous rising created a deficit in fish demand in Nigeria.

Figure 3 also indicates relationship between estimated demand (ESD), artisanal fisheries production (AFP) and aquaculture (AQU). Although the expected local fish production both artisanal and aquaculture fluctuates both upward and downward from 1970 to 2014, estimated demand (ESD) overlapped the local demand between 1980 and 1985 and thereafter rose sporadically and linearly since the 1980s to 2014. This connotes that fish demanded increases at increasing rate in the period 1960 to 2014 which was in consonance with the studies of Etim *et al.* (2007), Kudi *et al.* (2008), Oladimeji *et al.* (2013b) that affirmed a deficit in fish demand-supply gaps with annual fish importation of about US$ 400 million annually. On the contrary, the growth rate in total domestic production of fish despite relatively high growth rate in aquaculture is slow and most time dwindling, hence creating fish demand-supply gap deficit which does not commiserate with increasing demand and sometimes exhibit a downward slope. This led to annual fish importation of about US$ 400 million annually.

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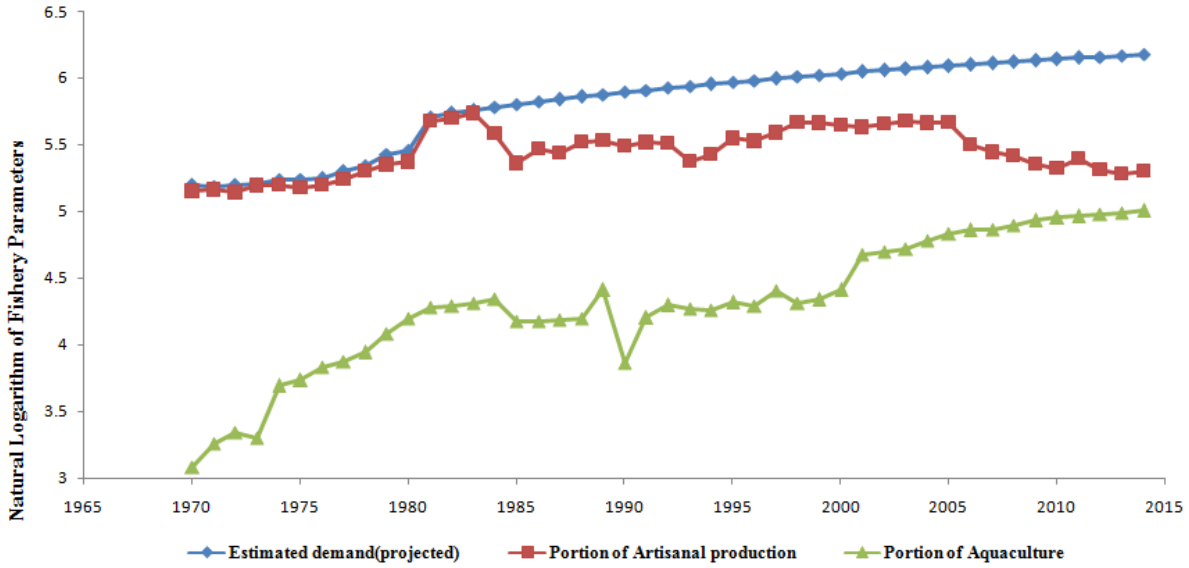

Fig. 3: Trend analyses in ESD, AFP, and AQU Production in Nigeria (1970-2014)
Source: Computation and graph by Author; Data source: C.B.N. and N.P.C. records

The result also indicates the trend of self -sufficiency in fish demand from 1970-2014 illustrated in Fig. 4. The trend in estimated demand of fish shows that the variable have a direct and steady relationship with time that is, estimated demand increases each successful year in Nigeria. This connotes that, fish demand increase at increasing rate in the period 1970 to 2014. On the contrary, fish production from artisanal fishery exhibit a downward slope while aquaculture sub sector though increasing but does not commiserate with increasing demand. The result implies that estimated fish demand have positive relationship with time and positive exponential growth rates. The growth rate in artisanal dwindled while that of aquaculture is slower hence creating a demand-supply gap deficit. This also implies that fish production in Nigeria increase does not commiserate with increased demand. This shows that there is wide gap between supply and

demand of animal protein with attendance rising cost of animal protein, fish food insecurity and malnutrition as observed by Akegbejo-Samson, (1997), Etim *et al.* (2007), Kudi *et al.* (2008) and Oladimeji *et al.* (2013b).

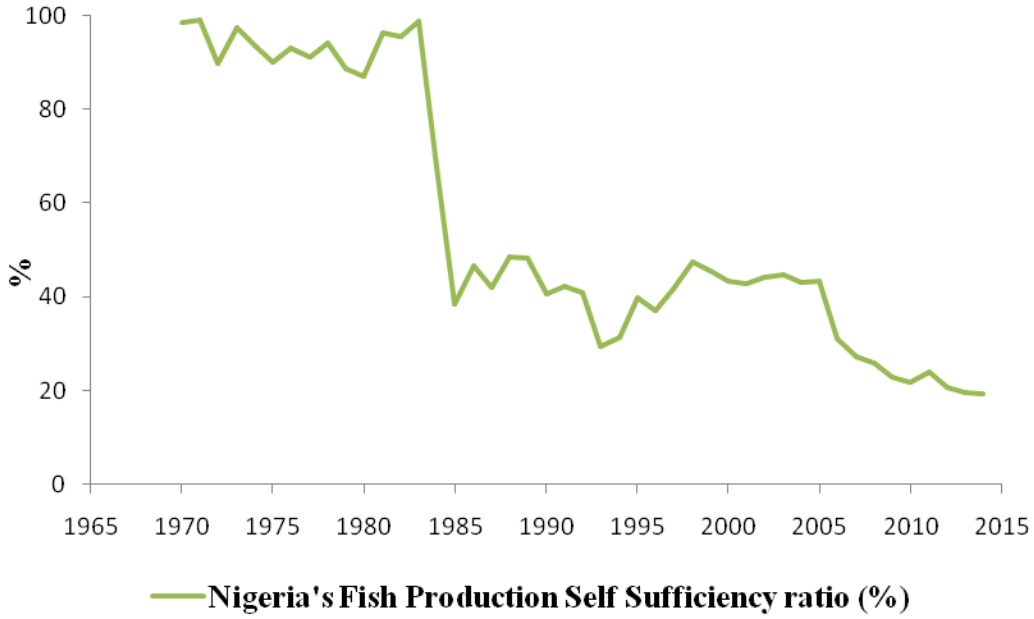

Fig. 4: The trend of self -sufficiency in fish demand from 1970-2014

Ironically, both national and agricultural GDP exhibit an upward trend in 1970-2014 (Fig. 5), but national GDP demonstrate higher and consistency increase compare to agricultural GDP which increase sharply in 1970s and 80s but continue to dwindle from 2000s to date. CBN (2007) observed that on the average fishery sub sector contributed only 1.6% to national GDP while crop sub sector contributed about 32% to total GDP and 80% to agricultural GDP from 1992 to 2006. This implies that both total GDP and Agric. GDP has been driven by the contribution of other sub sectors such as petroleum, manufacturing and services as well as other sectors of the economy.

Fishery production parameters and economic growth

The result of the correlation matrix of the log function in GDP and fishery production parameters (1970-2014) is shown in Table 2. It could be observed that the fishery parameter is positively correlated with the GDP. The result shows that there is a strong positive correlation between the Economic Growth (EC) and Estimated Fish Demand (ESD) which was statistically significant at 1%. This implies that Economic growth has linear and symmetric associations with AFP AQU and ESD in Nigeria. This is the *a priori* expectation which is consistent with the postulates of economic theory: that an increase in production of each of these parameters would bring about economic growth, *ceteris paribus.*

Trend in fish production parameters

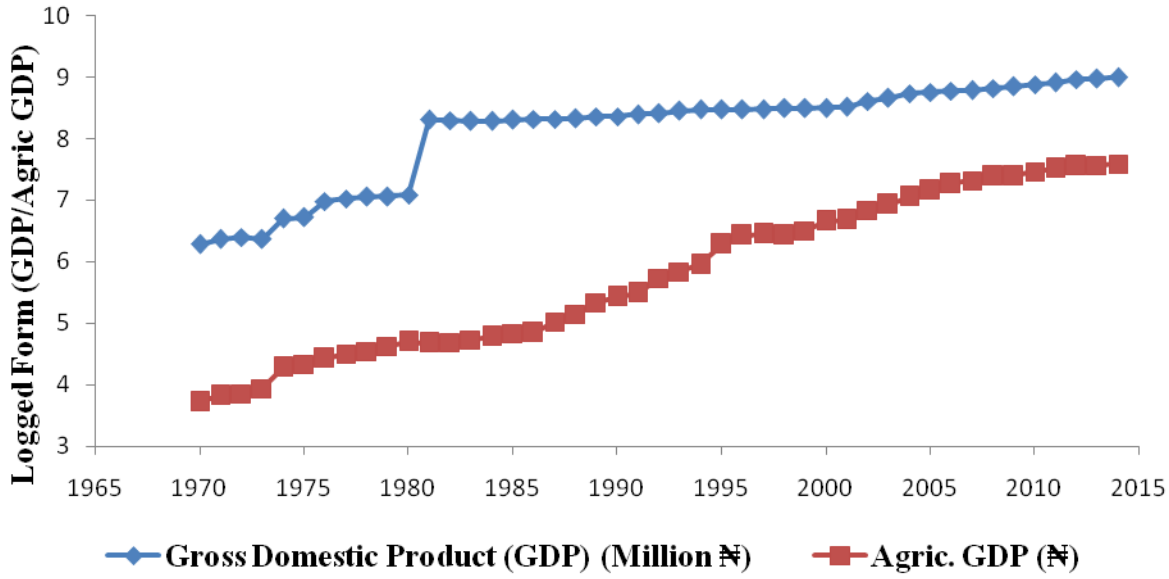

Fig. 5: Trend of Agric. GDP and National GDP

Table 2: Pearson correlation matrix of ECG and rice production parameters (1960 - 2015)

Pearson correlation	ECG	LRP	TRI	ESD
ECG	1.00			
LRP	0.563*	1.00		
TRI	-0.532	-0.467	1.00	
ESD	0.891***	0.751*	0.472	1.00

***, * denote significant at 1% & 10% respectively

Implications of trend analysis of fish parameters and estimated demand

Nigeria is endowed with abundant fishery resources to produce enough fish not only for domestic consumption but also for export. If the potential of fishery resources is harnessed, the observed estimated demand (ESD) could be overwhelm realized. This implies that fish production would significantly influence agricultural GDP and therefore have influence on economic growth (ECG) in Nigeria.

Conclusion and Recommendations

The trend analysis for fish production and importation in Nigeria shows that both estimated demand and fish importation increased exponentially while local fish production fluctuates. Although expected local fish production (LFP) which comprises of aquaculture and artisanal fluctuated upward and downward from 1970 to 2014, but estimated demand (ESD) rose sporadically and linearly since 1980s to 2014. Nigeria's importation of fish like other food products is also growing astronomically. The study also revealed that an increase in production of fish locally to meet estimated demand could bring about reduction in total fish imported hence, improve economic growth, *ceteris paribus.*

Based on the findings of this study, the following recommendations were made:

i. Adequate institutional framework such as training through extension services should be put in place for both artisanal fisherfolks and fish farmers to encourage sustainable fish production since such engagement could increase fish self-sufficiency and promote overall fishery development and productivity.
ii. Adequate and timely funding of relevant research institutes such as Nigerian Institute for Oceanography and Marine Research (NIOMR), the Lake Chad Research Institute (LCRI), National Institute for Freshwater Fisheries Research, New Bussa and the Fisheries Departments in some tertiary institutions in the country to carry out investigations and studies that could enhance fish production in the country.
iii. Establishment of fish feed mills and building of fish ponds and reservoir as well as encouraging production of quality and affordable inputs such as such fish feed, modern fishing technology and fish pond locally could spurs more people to invest in fish farming and reduce cost of production.
iv. Therefore, if Nigerian agricultural resources are managed sustainably and transparently and if capital budgetary allocations to the agricultural sector in Nigeria which is put at an average of about 3% between 1990-2001 and less than 3% as of 2014 followed stipulated 25% FAO standard or at least 10% Maputo agreement by Africa leaders (African Malabo Declaration, 2014), the livestock sub sector particularly, fish will support inclusive economic and human development of Nigeria government at all levels.

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