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**Obasi EU**

Nigerian Institute for  
Oceanography and Marine  
Research, Victoria Island, Lagos,  
Nigeria

**Adeoye RL**

Nigerian Institute for  
Oceanography and Marine  
Research, Victoria Island, Lagos,  
Nigeria

**Corresponding Author:**

**Obasi EU**

Nigerian Institute for  
Oceanography and Marine  
Research, Victoria Island, Lagos,  
Nigeria

## Empirical study of capture and aquaculture fish production in Nigeria

**Obasi EU and Adeoye RL**

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### Abstract

This work studied the development of fish production in Nigeria looking at the contributions of capture and aquaculture fish production in Nigeria to the total Domestic annual fish production; the trend and balance in annual fish demand and domestic production in Nigeria. The growth accounting framework and time series data from 2006 to 2019 to project the viability of Nigeria domestic fishery sector. The study shows that the capture fishery maintained the highest contributor to the domestic fish production in Nigeria for the study period. It contributed over 75.00% of the total domestic fish production while Aquaculture subsector gained the highest growth rate among the subsectors. Its annual growth rate stood at 12.53% while the capture sector was seen to be declining in its contribution to the domestic fish production in Nigeria.

**Keywords:** Fish production, capture, aquaculture, trend, GDP, Nigeria

### Introduction

Nigeria is located in West Africa and East Central Atlantic bordering the Gulf of Guinea between Benin and Cameroon. It is a coastal state with a coastline of 853km, a continental shelf of about 256,000km<sup>2</sup> and a 200 nautical miles Exclusive Economic Zone (EEZ) area of 210,900 km<sup>2</sup> and marine area of 46,000 km<sup>2</sup>, in which it has exclusive rights to the fish and other natural resources. The country is also blessed with inland water resources; over 14 million of reservoirs, Lakes, ponds, and major Rivers capable of producing over 980,000 metric tons of fish annually (Oladimeji *et al.*, 2013a) <sup>[12]</sup>. The approximate extent and distribution of the major inland water system (Rivers and Lakes) 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.

Fisheries is an integral part of Agriculture sector in Nigeria which maintains a steady contribution of 3.5% to 4% of 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) <sup>[12]</sup>. Studies have shown that fisheries sector in Nigeria is a viable sector which has the capacity to provide jobs for 8.632 million people in the primary sector and 19.55 million people in the secondary sector (FDF, 2015).

Fishing industry in Nigeria comprises of three major subsectors – namely; the artisanal, industrial and aquaculture. According to Aliu and Atolagbe (1998), Nigeria's annual production of fish is about 0.7 million. Over the years, studies have shown that a greater percent of the 0.7 million metric tons produced locally is from the captured fisheries (coastal and inland). The capture fisheries is dominated by the artisanal fish farmers (coastal and inland) and a significantly low contribution from industrial vessels and trawlers which basically are coastal fishers. The offshore tuna fisheries, coastal demersal fish and shrimp fisheries grouped into marine industrial fisheries. They usually operate between the country's territorial limit (30 nautical miles) and the exclusive economic zone (EEZ) (200 nautical miles) with tuna and shrimps as their target fish species. The coastal, brackish water or estuarine and artisanal pelagic fish bonga shad and *Sardinella* fishers grouped into marine artisanal fisheries, they usually operate within the 5 nautical miles non trawling zone. The main fish species are small pelagic, *Sardinella* spp. and *Ethmalosa* spp. such as croakers (*Pseudotolithus* spp.), grunts (*Brachydeuterus* spp.), various soles, catfish (*Arius* spp.), and shrimps (*Penaeus* spp.). Sciaenidae (Croakers) Ariidae (Catfish): *Arius latiscutatus* (Günther),

Haemulidae (Grunters), Cynoglossidae (Tongue Sole); Polynemidae (Threadfins); Carangidae (Jack fish); Sphyrnidae (Barracudas): Sphyrnabarracuda, Sphyrna afro, Sphyrna guachancho, Clupeidae: *Sardinella* spp. Among others.

Nigeria Inland capture fisheries is artisanal nominated fisheries. The fish production is usually carried within the inland resources (Freshwater and brackish) which are contained within 320 nautical miles (667km). The inland water resources is categorized into 11 River Basin Development Authorities (RBDAs); Sokoto-Rima Basin, Hadejia-Jema' are Basin, Lake Chad Basin, Upper Benue Basin, Lower Benue Basin, Cross River Basin, Anambra-Imo Basin, Niger Basin, Niger Delta Basin, Benin-Owena Basin and Ogun-Oshun Basin (FAO publication, 1982). Their targeted fish species are Alestidae (*Alestes baremoze*), Alestidae *Alestes* (*dentex*), Nothobranchiidae (*Aphyosemion bitaeniatum*); Poeciliidae (*Aplocheilichthys normani*); Poeciliidae (*Aplocheilichthys normani*); Cichlidae (*Astatotilapia bloyeti*); Carcharhinidae (*Carcharhinus leucas*); Citharinidae (*Citharinus citharus citharus*); Among others.

In recent times, Nigeria aquaculture has experience a considerable growth; from small pond subsistent to commercialize and improved technologies such as water recirculating system (WRS). Aquaculture in Nigeria through research is gradually moving from fresh water aquaculture to adopting aquaculture in salt and brackish water (marine culture) for the purpose of fish production. Aquaculture has the fastest growth rate among the sectors contributing the total domestic fish production in Nigeria which rose from 6% in 2003 to 20% in 2014. *Clarias* and *Heterobranchus* spp. (catfish), *Tilapia* spp. (*Tilapia*), *Cyprinus* demand for fish *carpio* (Common carp), *Heterotis niloticus* (Slap water) the most commonly cultured species of fish are mostly cultured in Nigeria. (Omeje, Sule, & Aguihe, 2020). 25 Aug 2020.

Despite the huge aquatic resources in Nigeria, the country has over the years suffered huge deficit in supplying of fish and fish produce to the tune of 2.5million metric tons of fish deficit annually, hence relying on importation to bridge this gap. This in turn has had severe drain on our foreign reserve

as about 1.2 billion dollars is spent on importation annually. Consequently, achieving and sustaining the recommended daily protein intake of 75gm for Nigerians as recommended by UN/FAO pose a serious challenge. In order to maintain steady and adequate supply of protein in Nigeria, there is need to mitigate all possible factors limiting the optimum production of fish in Nigeria. This study is to evaluate the significance and performance of capture and aquaculture fisheries as key contributing sector to the total domestic fish production in Nigeria for proper policies and programs implementation to bridge the gap between demand and supply of fish in Nigeria.

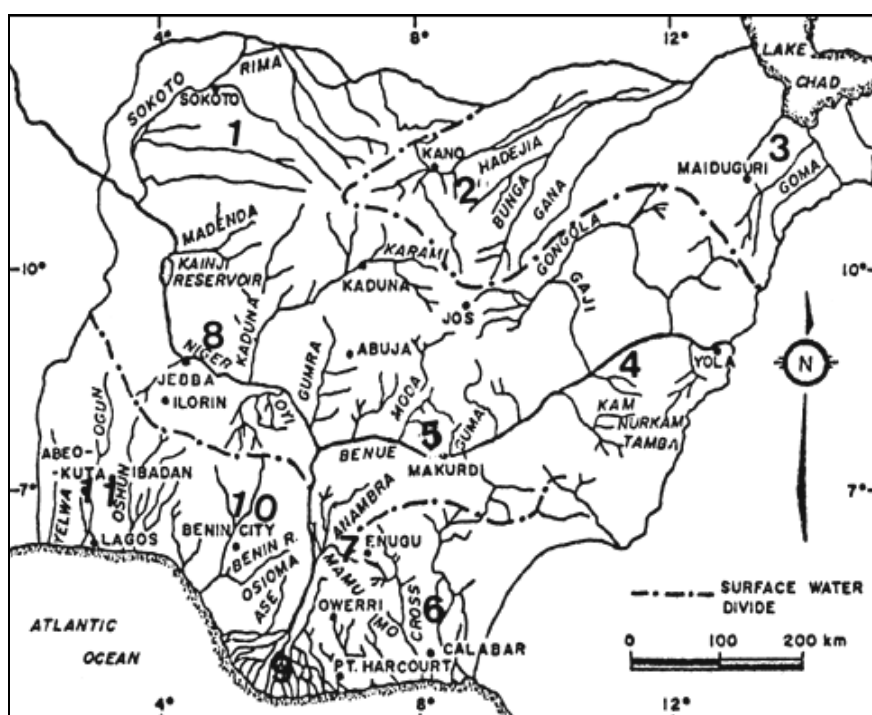
## Methodology

### Study Area

The study was conducted in Nigeria; Nigeria is situated on the Gulf of Guinea, in sub-Saharan Africa. Nigeria has a total land area of 923,770 km<sup>2</sup> (FAO, 2015) with 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 located between Longitudes 2° 49'E and 14° 37'E and Latitudes 4° 16'N and 13° 52' North of the Equator and is bordered by the Gulf of Guinea to the south, Benin to the West, Niger to the North and Cameroon and Chad to the East. It has a total land area of 923,768km<sup>2</sup> and a Continental Shelf Area 37,934 km<sup>2</sup>. The length of its coastline stands at 853 km and an Exclusive Economic Zone of 210,900 km (FAO, 2015). The approximate extent and distribution of the major inland water system (rivers and lake) is estimated at about 11,666,000 hectares. Nigeria has an estimated population of about 198 million (NPC, 2020)

The approximate extent and distribution of the major inland water system (rivers and lake) is estimated at about 11,666,000 hectares.



Source: FAO publication, 1982).

Fig 1: Map of Nigeria

**Data Sources and Analytical Techniques**

Secondary data on Nigeria fish importation (FI), estimated fish demand (EFD), capture fishery (CF), aquaculture fishery (AQF), total domestic fish production (TDFP) and projected population (PP) from 2006 to 2019 were sourced from the publications of Central Bank of Nigeria (CBN) statistical bulletins, economics and financial review, Food and Agriculture Organization Stat (FAOSTAT), Federal Office of

Statistics (FOS)/National Bureau of Statistics (NBS) and other articles and journals. The data obtained was used to compute fish production deficiency, self-sufficiency for fish in Nigeria and other parameters used for the study. Descriptive statistics and correlation analysis were used to find out the relationship among the fish variables considered and to describe the trends of the distribution. Tables and graphs represents results from the study.

**Result and discussion**

Table 1: Fish production in Nigeria from 2006 to 2019 (tones)

Year	Aquaculture Fishery (AQF) (tones)	Capture Fishery (CF) (tones)	Total Domestic Production (TDP) (tones)	Percentage Contribution of Aquaculture Fishery (PCAQF) (%)	Percentage contribution of Capture Fishery contribution (PCFC) %	Diff. in Contribution of Capture & Aquaculture Fisheries	Nigeria GDP (current Billion US\$)	Agric GDP (Current Billion US\$)
2006	84,578	552,323	636,901	13	87	73	236.1	35.2
2007	85,087	530,420	615,507	14	86	72	275.6	35.5
2008	143,207	601,368	744,575	19	81	62	337.0	37.1
2009	152,796	598,210	751,006	20	80	59	291.9	46.0
2010	200,535	616,981	817,516	25	75	51	361.5	58.4
2011	221,128	635,486	856,614	26	74	48	405.0	68.0
2012	253,898	668,754	922,652	28	72	45	455.5	85.2
2013	278,706	721,355	1,000,061	28	72	44	508.7	78.0
2014	313,231	759,828	1,073,059	29	71	42	546.7	86.3
2015	316,727	710,331	1,027,058	31	69	38	486.8	90.0
2016	306,767	734,731	1,041,498	29	71	41	404.7	99.5
2017	296,191	916,283	1,212,474	24	76	51	375.7	105.6
2018	291,323	878,155	1,169,478	25	75	50	397.2	109.3
2019	289,543	825,013	1,114,556	26	74	48	448.1	100.4

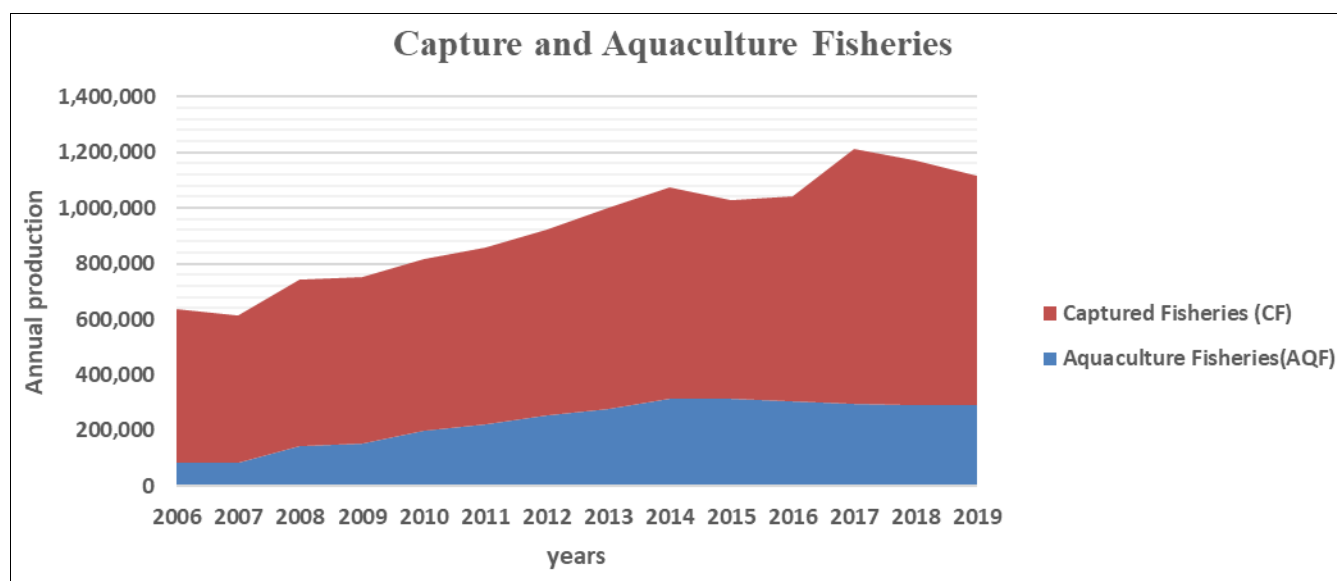


Fig 1: Trend capture fish production and aquaculture fish production (2006-2019)

Figure 1 indicates the distribution pattern between fish production in capture fishery (CF) and aquaculture fishery (AQF) from 2006 to 2019.

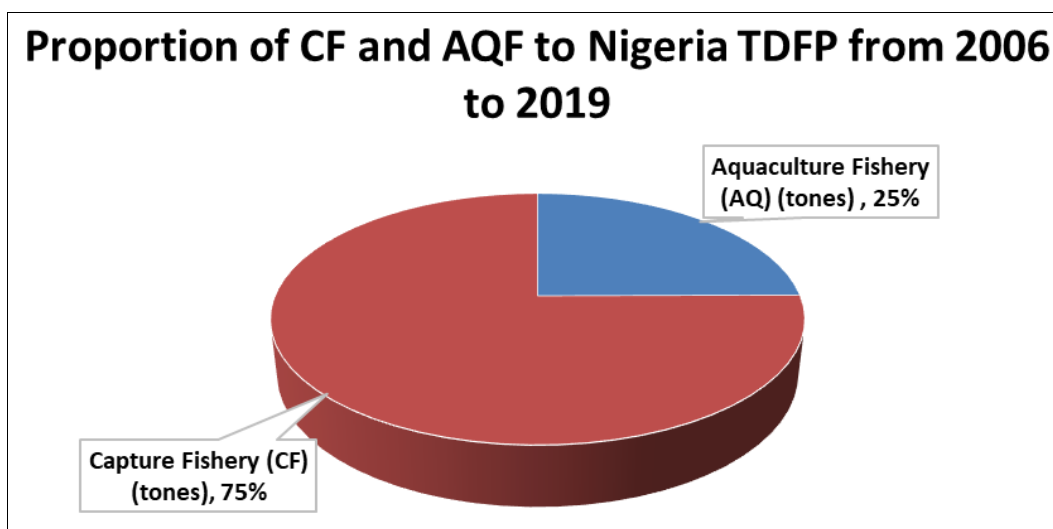
**Descriptive Analysis of Fish Production Parameters**

The descriptive statistics for fishery performance indicators showed that for the study period, a total of 12, 982, 955 metric tons of fish were produced locally. Capture fishery account for 75% (97, 49, 238 Mt) and aquaculture fishery contributed the other 25% (32, 33,717 mt) - Table 2 and fig 1. From the statistics derived in table 2, it shows that the distribution of aquaculture production with mean of 230,

979.80 and coefficient of variation 0.36, was not as precise as that of capture fisheries with mean of 696374.10 and coefficient of variation of 0.17. This signifies that the distribution of capture fisheries is relatively uniform while that of aquaculture had significant level of variation. Result from the table also explained the contrast in the nation’s Gross Domestic Product (GDP) from agricultural sector. It shows that the nation’s GDP with mean of 395.04 and coefficient of variation of 0.23, maintained more uniform distribution than GDP from agricultural sector whose mean value was 73.89 and coefficient of variation was 0.37

**Table 2:** Summary Statistic of AQF, CF, TDFP, Gross National GDP and Agric GDP from 2006 to 2019

	Mean	Std. Error	Std. Deviation	Min	Max	Sum	Coefficient Of Variation (C/V)
Aquaculture Fisheries (AQF) (tones)	230979.80	22427.78	83917.06	84578.00	316727.00	3233717	0.36
Capture Fisheries (CF) (mt)	696374.10	31622.43	118320.30	530420.00	916283.00	9749238	0.17
Total Domestic Fish Production (TDFP) (tones)	927353.90	2039.66	193680.30	615507.00	1212474.00	12982955	0.21
NIGERIA GDP (Current Billion US\$)	395.04	24.13794	90.32	236.10	546.70	5530.5	0.23
AGRIC GDP (Current Billion US\$)	73.89	7.244964	27.11	35.20	109.30	1034.5	0.37

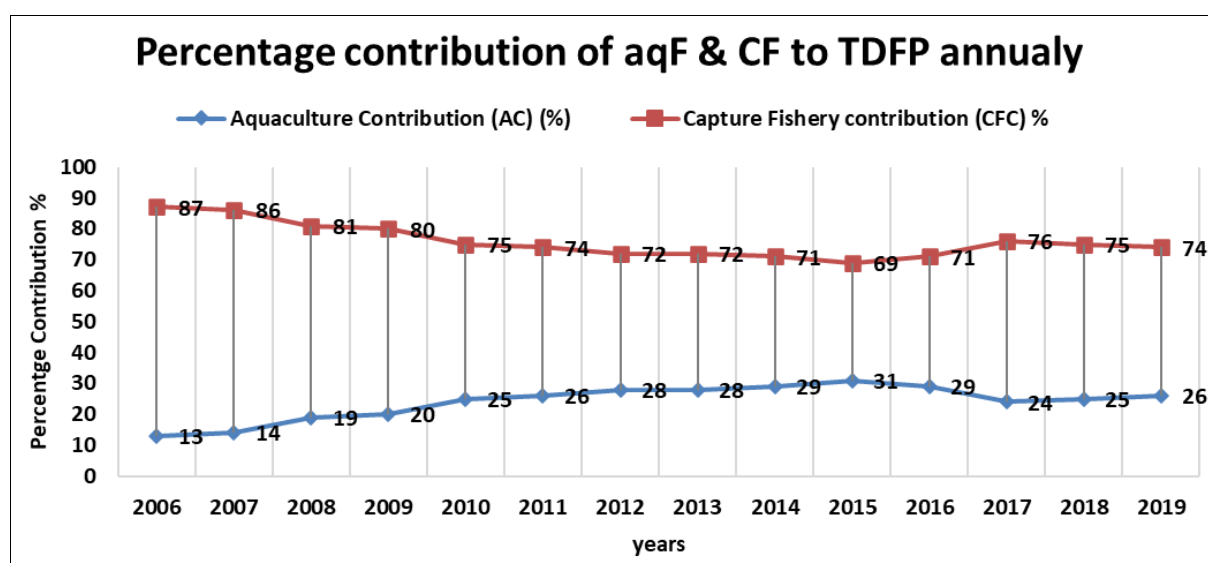


**Fig 2:** Total proportion of capture and aquaculture contribution to nigerian domestic fish production from 2006 to 2019

Fig 2: Trend of Percentage Contribution of Capture and Aquaculture fishery to Total Domestic Fish Production from 2006 to 2019

Fig 2 revealed that from 2006 to 2015, there was a steady decline in the ratio of fish output from the capture fisheries with output ratio of 87% to 69% respectively, thereafter witness a slight increment in contribution. However, the Aquaculture fishery output ratio to local product presented a different phenomenon; it's proportion in local fish production rose significantly from 13% in 2006 to 31% in 2015. This consistent growth of increasing performance to fish production declined in 2016 and 2017 contributing 29% and 24% for the respective years, it later rose to 25% in 2018 and

26% in 2019. Considering the trend obtained from fig 2, in fig 3 looking at the difference between output ration by aquaculture and Capture fisheries, it was seen that in 2006 the margin in percentage contribution was 73% which stands as the highest recorded with the period studied. In subsequent years up to 2016 there was a significant reduction 38% in output ratio by both sectors. Thereafter from 2015 to 2018 their margin widened to about 51% in 2018 and reduced to 50% in 2019. Given the pattern presented in figs 3, it is presumed that by 2023, the gap between the difference in the ratio of fish produced by aquaculture fishery and capture fishery will be about 40%.



**Fig 3:** Trend in the gap between contribution of aquaculture (AQF) and capture (CF) to Total Domestic Fish Production (TDFP)

**Conclusion and Recommendations**

Fish production in Nigeria plays significant role in the nation's economy. The adverse variance between production

and consumption in this paper implies high growth potential in fish production.

Domestic fish production in Nigeria is yet to meet its demand.

In order to strengthen the fish production in Nigeria, primacy attention should be given to all sectors contributing to the Nigeria fish domestic production.

For capture fisheries, there should be more empirical studies to adequately draw out potential fishing ground in Nigeria waters. Government should also provide public infrastructures in rural fishing communities to encourage the teaming youth from these communities to adopt fishing as means of livelihood.

For aquaculture, there should be enhancement in technology and resources use, development of additional area for aquaculture. Aquaculture trainings and promoting programs like Anchor from government should be encouraged. Fish farmers should be sensitized and organized into cooperative groups in order to easily access loans and credit facilities. More coordinated fish farm settlements should be built by government or cooperate organizations. This will help to centralize fish farmers for easy access for intervention purposes. Storage and processing industries should be settled to add to the value-chain in fish farming.

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