

DEMAND ANALYSIS FOR NIGERIAN FISHERIES

by

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ABSTRACT

This paper reviews available past fisheries statistics data and examines the basis of derivation of the estimates and concludes that much needs to be done to establish reliable fisheries data based on well defined methodology.

Subsequently, fish consumption data for the ten year period 1971 - 1979 were related to the yearly population that consumes the fish. Parameters of the resulting regression equation were tested for significance to ensure the suitability of the equation for future prediction.

The suitable equation was used to provide fish demand projections for the period 1980 - 2000 to meet the needs of fisheries planners, researchers and administrators.

INTRODUCTION

In Nigeria numerous estimates for fish production and fish demand have been provided by many authors including non fisheries people. The authenticity of these estimates is a matter of concern to fisheries planners, researchers and administrators. Some of these estimates due to their over ambitious expectation, tended to show the performance of the fishery sector as retrogressing. Existing information however, does not lend support to such conclusion.

The objective of this paper therefore, is to review the existing fisheries data, establish demand equation for the fisheries and to provide demand projections up to the year two thousands on a well defined basis, to serve future needs of planners, researchers and administrators.

DATA REVIEW

In the second National Development Plan (1970-1974)⁽¹⁾ the volume of fish available to Nigerians from all sources was estimated at 270,500 metric tonnes. Of this figure, imports of stock fish together with landings of chartered vessels accounted for 190,000 metric tonnes.

A high demand for fish in future was anticipated and an optimistic demand target of one million metric tonnes was set to be achieved by the end of the plan. In order to meet this objective, capital investment allocation to the fisheries sector by the Federal and State Governments for the plan period was ₦11,598 million. This investment represented 22.65% of total capital allocation to live-stock, forestry and fishery.

At end of the plan not even as much as 56% of the ambitious demand target of one million metric tonnes was achieved.

In a seminar held at Ibadan in 1972⁽²⁾ Dr. B.N. Okigbo presented a valuable paper on "Problems and Prospects of increasing food production in Nigeria". Mr. E.O. Bayagbona then Director of Federal Department of Fisheries commenting on the fisheries aspect of the paper and utilising the production data for 1970 projected a demand

for 1985 as between 1.3 - 1.6 million tonnes and expected that production would rise to 1.2 million tonnes in the same year.

Olayide et.al (3) estimated desirable demand for fish as 1.356 million metric tonnes for 1975, 1.775 million metric tonnes for 1980 and 2.337 million metric tonnes was projected for 1985.

In the third National Development Plan (1975-1980) (4) in response to changes in policies in favour of the fisheries the volume of fish production was estimated as 644,300 metric tonnes and a demand projection of 1.5 million metric tonnes was set against the end of the plan (1980).

In the light of this, total capital investment allocation to the fisheries was ₦101.554 million, accounting for 18.23% of total investment on livestock, forestry and fisheries.

In terms of quantitative achievement using data from Federal Fisheries (5) less than 50% of the planned target was achieved by 1980. The picture painted by this analysis is that the future of the fishery is gloomy and the erroneous conclusion would be that the fishery sector has been performing below expectation. The truth is that the fishery sector has been progressing well from one period to another as could be seen from increases in the number of fishing trawlers, increase in fish production, increase in the number of motorised and non motorised fishing canoes and improvement in craft and gear (Table 1).

The misleading conclusion usually arises during plan review when comparison of achievements with over ambitious set targets yield a picture of poor performance. It was therefore, not surprising that even Progress Reports submitted on the Development Plan later diverted from comparison of physical achievements to comparison of financial expenditure with monetary set targets.

It has therefore, become essential to examine the whole process of projecting demand for the fisheries which will take into account the realities of the situation. In this light two aspects will be considered, formulating demand equations and establishing basis for demand projections.

Table 1 - State of the fisheries 1971 - 1979

Year	Number of Trawlers	Number of Canoes		Fish Production from all sources (Metric Tonnes)
		Motorized	Non-Motorized	
1971	39	4204	90923	400537
1972	55	5364	90523	439971
1973	57	6224	91732	465075
1974	72	7850	10632	473220
1975	63	8240	20381	466236
1976	59	11704	122633	494766
1977	79	12187	125256	504014
1978	87	10118	128129	518567
1979	92	12510	121218	535435

DEMAND EQUATION FOR FISH

Planning for the future is a very difficult task especially when reliable and sufficient data are not readily available, to provide the basis for projections. However, it is very essential that targets must be set for the future and it is equally expected that such targets should be realistic in order to obtain reasonable allocation of the Nations limited resources. It is obvious from past trend that the quantity of fish demanded in Nigeria is continuously increasing. This may be explained by growth in human population and increased level of income of Nigerians that has arisen from oil boom income.

In estimating demand for fish in Nigeria therefore, cognizance is taken of the above factors in addition to the influence of prices of other competing commodities such as meat, beef, pork, chicken and others. However, the influences of these other substitutes are reflected in their contribution to consumer price index. And rather than estimate the quantity of fish per se, the quantity of fish in relation to the population that consume the fish is considered as the dependent variable (6). Similarly, income level is represented by per capita income deflated by consumer price index. With all these considerations the most suitable demand equation was defined as a relationship between fish consumption per capita and price of fish subject to a given level of income. Symbolically, this is given by:-

$$C/N = a + b \log \left(\frac{P}{CPI} \right) + c \log \left(\frac{Y/CPI}{N} \right) \dots \dots (1)$$

Where

C = Volume of fish consumed at a given time (C = Production + Import of Chartered Vessels)

N = Human Population (or estimation population) at the given time.

P = Retail price of fish per kilogram at the given time.

CPI = Consumer price index at the given time.

Y = National income (GDP at current factor cost) at the given time.

For ease of exposition the following variables are defined:-

g_i = Any point on the regression line for predicting C/N

$$P_i = \frac{P}{CPI}$$

$$Y_i = \frac{Y/CPI}{N}$$

S = Sum of squares of vertical deviations from the regression line.

Thus $s^{(7)}$ is given by

$$S = \sum (q_i - a - b \log p_i - c \log y_i)^2 \dots \dots (2)$$

Taking partial derivatives of s with respect to a, b, c and setting each to zero, yield:-

$$\frac{d s}{d a} = -2 \sum (q_i - a - b \log p_i - c \log y_i) = 0 \dots \dots (3)$$

$$\frac{d}{d} \frac{s}{b} = -2 \log p_i \sum (q_i - a - b \log p_i - c \log y_i) = 0 \dots (4)$$

$$\frac{d}{d} \frac{s}{c} = -2 \log y_i \sum (q_i - a - b \log p_i - c \log y_i) = 0 \dots (5)$$

Thus the following normal equations resulting from 3 - 5 are required for the solution of equation(1)

$$\sum q_i = a n + b \sum \log p_i + c \sum \log y_i \dots (6)$$

$$\sum q_i \log p_i = a \sum \log p_i + b \sum (\log p_i)^2 + c \sum (\log p_i \log y_i) \dots (7)$$

$$\sum q \log y = a \sum \log y_i + b \sum (\log p_i \log y_i) + c \sum (\log y_i)^2 + \dots (8)$$

The period 1973 - 1977 was used and data on consumption, C, were obtained from Federal Department of Fisheries, data on Price and Composite consumer price index and income were obtained from Federal Office of Statistics Publications (8) while data on population were obtained from National Population Bureau.

The analysis yielded the following values:-

$$\text{for } a = - .63, \quad b = -.18 \quad \text{and } c = 1.23$$

$$\begin{aligned} \text{Thus} \\ C/N = - 0.63 - 0.18 \log \left(\frac{P}{CPI} \right) \\ + 1.23 \log \left(\frac{Y/CPI}{N} \right) \dots (9) \end{aligned}$$

DEMAND PROJECTIONS

The ultimate aim of demand analysis is to be able to provide demand projections. In order to achieve this objective, a much more simpler function with practical application is needed. While equation (1) provides estimates of price and income elasticities (b and c) respectively, prediction of per capita consumption depends on estimates of fish price, composite consumer price index, National Income (GDP) and human population. Estimates for these parameters are not readily available, thereby making future provision of consumption per capita very difficult.

Alternative function was therefore considered by examining the trend in consumption over the past years. And for this analysis the period 1971 - 1979 was used (Table 2). The trend exhibited was appropriately fitted using least squares method with a linear equation given by

$$C/N = a + bx \dots (10)$$

Where C and N were as earlier defined, and X represents any given year (see graph). The resulting analysis yielded the values

$$a = 6.69 \text{ and } b = 0.26 \text{ and hence}$$

$$C/N = 6.69 + 0.26 x \dots (11)$$

The computed coefficient of determination. R^2 being a measure of total variation in C/N's which is accounted for by linear regression of C/N on year (X) is found to be 0.96 (or $100R^2 = 96\%$) suggesting

a very good fit and hence the fitted line is very useful for predicting C/N. Furthermore the coefficient of X is not significantly different from zero even at 5% level.

This simple equation enables per capita consumption to be predicted more readily by using the graph or computing C/N for given values of X.

With data of estimated human population available, the task of predicting future fish demand became easy. Table 3 shows projected demand for fish for the period 1980 - 2000. A very important factor to observe about these projections is that both growth in fish consumption and human population are built in them. Again unlike previous projections by different people, fish consumption per capita for any year is based on analysis which recognised growth in fish consumption and not arbitrarily assumed.

Table 2 - Population and fish consumption in Nigeria
1971 - 1979

Year	Projected Human Population Million	Total Fish Consumption Metric Tonnes	Per Caput Consumption Kg.
1971	66.365	463953	6.99
1972	68.356	503034	7.36
1973	70.406	536485	7.62
1974	72.834	548125	7.53
1975	74.693	580422	7.77
1976	76.699	628743	8.20
1977	78.557	668463	8.51
1978	80.563	720775	8.95
1979	82.621	753435	9.12

- Sources: 1 - Population estimates adopted from Olayide et.al Food Production in Nigeria. Report of Agricultural Statistics Task Force 1979. pp.165 - 166
- 2 - Consumption data adopted from Table 1, Fisheries Statistics of Nigeria, 1st Edition 1980, Federal Department of Fisheries, Lagos.

Table 3 - Projected fish demand for Nigeria
1980 - 2000

Year	Projected Human Population (Million)	Projected per Caput Consumption (kg).	Projected Fish Demand (Million Tonnes)
1980	84.732	9.29	0.787
1981	86.897	9.55	0.830
1982	89.118	9.81	0.874
1983	91.395	10.07	0.920
1984	93.732	10.33	0.968
1985	96.128	10.59	1.018
1986	98.586	10.85	1.070
1987	101.107	11.11	1.123
1988	103.693	11.37	1.179
1989	106.345	11.63	1.237
1990	109.067	11.89	1.297
1991	111.858	12.15	1.359
1992	114.720	12.41	1.424
1993	117.657	12.67	1.491
1994	120.669	12.93	1.560
1995	123.759	13.19	1.632
1996	126.929	13.45	1.707
1997	130.180	13.71	1.785
1998	133.516	13.97	1.865
1999	136.933	14.23	1.949
2000	140.446	14.49	2.035

Source - Projected human population adopted from Mid-Year Population Projection, 1963 - 2000, National Population Bureau, Demographic Division, Lagos.

Projected per caput consumption computed from the function shown on the graph.

SUMMARY AND CONCLUSIONS

This paper has considered two different methods to the problem of obtaining reliable fisheries demand data. The first method based on relationship between fish consumption per caput and prices of fish, National income, consumer price index and human population was academically sound but difficult to derive in practice.

The second method based on regression of fish consumption per caput on year of consumption yielded a simple suitable function for predicting per caput fish consumption each year. This enabled future fish demand projections to be derived on a well defined method.

The latter method is recommended for use and it was utilized to obtain fish demand projections for the period 1980 - 2000 as shown in the paper.

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DISCUSSION

N.I. Azeza: The paper should have considered the FAO per caput consumption in the projection to the year 2000.

V.O. Sagua: Data used for the analysis were sampled between 1975 to 1977. Is this representative of trends from now to 2000 i.e. Will it remain linear?

M.O. Okpanefe: Consumption information given by FAO originated from Nigeria. Data for 1975-77 was used for price calculation. It is not possible to forecast the nature of the curve between now and year 2000.

E.O.E. Odiong: Is there any colaboration between FDF and NIOMR?

M.O. Okpanefe: The author is a member of the Fisheries Statistics Committee of the National Fisheries Development Committee which handles statistics.

Y.L. Fabiyi: The population figures and per capita income employed is questionable. There is also specification error because the structural equation does not include error term and the result contains no standard error.

M.O. Okpanefe: I employed official figures of population and per capita income. I considered specification error un-important.

O.O. Ladipo: Remarked that error term must be specified to be sure of the validity of the work otherwise ordinary least square (OLS) cannot be validly applied.

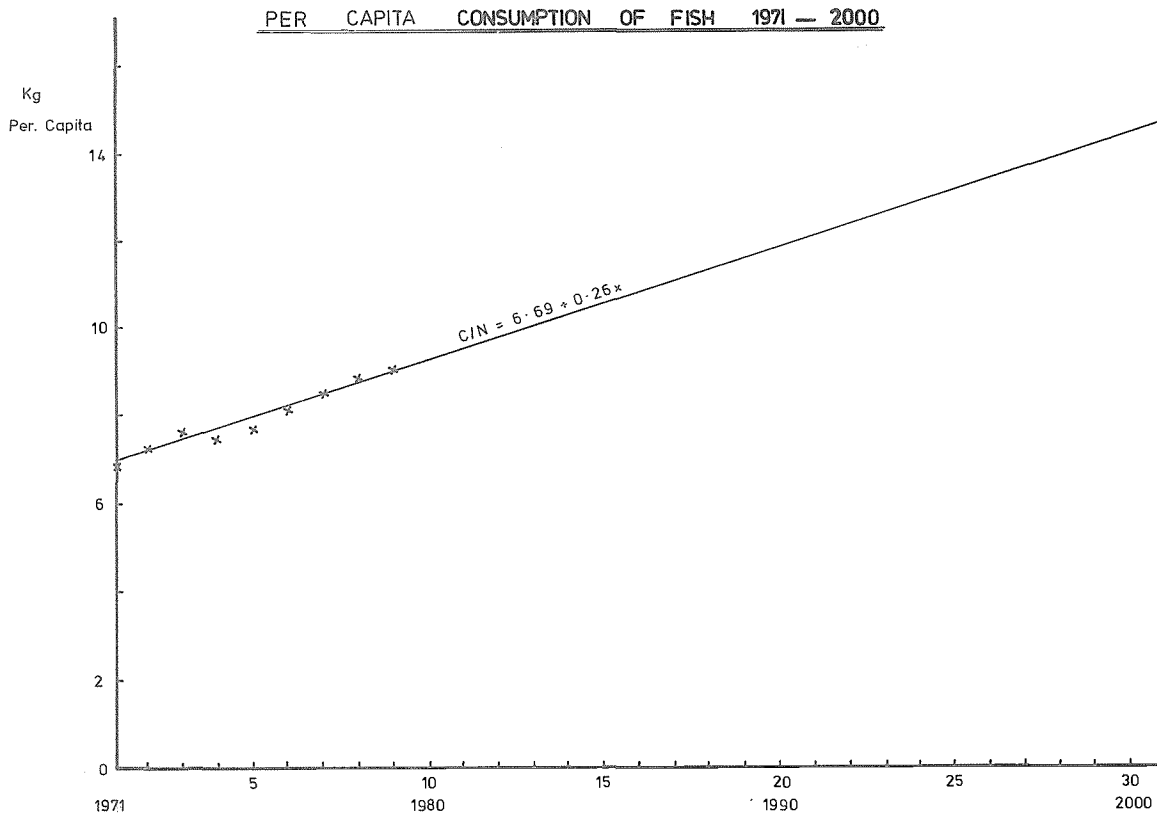


Figure I.