ECONOMIC EFFICIENCY OF FISHING AMONG MARINE AND LAGOON ARTISANAL FISHERFOLKS IN LAGOS STATE, NIGERIA

BY

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ABSTRACT

Fishing is a major source of livelihood for rural and peri-urban communities along coastal waters. The operation of artisanal fisherfolks is threatened by increasing overfishing of inshore waters, inadequate credit facilities, insufficient fishing input subsidies and inadequate extension services. These had negative implications on their efficiency hence their well-being. In order to enhance their performance, the efficiency of the fisherfolks, profitability and challenges were examined, as empirical information on these was scanty.

A multistage sampling technique was used. Thirty-six communities comprising of eighteen marine and eighteen lagoon communities were selected from 110 communities containing 3,621 fisherfolks farm families in the village listing survey reports of Lagos State Agricultural Development Authority. Ten fishing households were randomly selected per community. Data were collected through the use of structured questionnaire on fishers' socio-economic characteristics, input and output (Technical Efficiency TE), their prices (Allocative Efficiency AE). Economic Efficiency (EE) was measured as a product of AE and TE. Data were analysed using Descriptive statistics, Gross margin analysis Income-Expenditure ratio, stochastic production and cost frontier model at p = 0.05.

Male fishermen dominated the Marine and Lagoon marine and lagoon operations (100%, 93.9%) respectively. The average household for the marine (6-9) was higher than that of the lagoon (2-5). The mean age of fisherfolks was 43.0 ± 8.18 years; with 7.2% and 20.0% of marine and lagoon fisherfolks within the age range of 30-40 years respectively.

Constrains experienced by marine and lagoon fisherfolks include stormy weather (75.0%, 80,8%), severe water turbulence (76.0%, 90.0%) capsizing of canoe (91.0%, 58.0%), high cost of input (65.0%, 84.0%), lack of credit (34.6%, 88.8%) and high interest rate (38.2%, 86.3%) respectively. Gross Margin for the marine household (₦61,000.77±9,35U9) was significantly higher than lagoon (N27,973.01±2,563.14). Benefit-cost ratio was 3.2 for marine and 2.5 for lagoon. Coefficients of: labour (1.71), size of canoe (0.33), distance covered, (0.90), and capacity of outboard engine, (0.16) significantly increased the quantity of fish caught. However, none of the variables was significant for lagoon frontier model. Technical Efficiency indices ranged from 56.0% - 83.0% for marine and 51.0% - 83.0% for lagoon. The mean T.E for marine (0.73) was greater than that of lagoon (0.68). Allocative efficiency indices ranged from 38.6% - 86.0% and EE indices ranged from 4.0% - 72.0% among the fisherfolks. Among marine and lagoon operations, coefficients of age (-0.25, -0.18), secondary income (-0.01, -0.01), were negatively related and significantly reduced technical inefficiency while coefficient of canoe type (-0.19, -0.16), and gear type (-0.18, -0.09) were negative and significantly reduced Allocative and Economic inefficiency respectively.

Marine fisherfolks operation was more efficient than lagoon. However, involvement of aged fishermen in fishing, engagement of most fishermen in secondary occupation decreased efficiency. Capacity of outboard engine, distance covered and size of labour influenced quantity of fish caught by marine fisherfolks.

Keywords: Artisanal Fisheries, Lagoon and marine Fisherfolks, Fishing Efficiency. Word Count: 456

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DEDICATION

I dedicate this Thesis to God Almighty, the author and finisher of our faith, to my family members and to all those who made this Thesis, a reality.

CERTIFICATION

I certify that this work was carried out by Ogunsola Adeyeni Folake in the Department of Aquaculture and Fisheries Management, Faculty of Agriculture and Forestry University of Ibadan, Nigeria.

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TABLE OF CONTENTS

CHAPTER FOUR

CHAPTER FIVE

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

ABBREVIATION

DFID	-	Department for International Development
EEZ	-	Exclusive Economic Zone
FACU	-	Federal Agricultural Coordinating Unit
FAO	-	Food and Agricultural Organization
FDF	-	Federal Department of Fisheries
FEPA	-	Federal Environmental Protection Agency
HUFA	-	Highly Unsaturated Fatty acids
ICLARM	-	International Centre for Living Aquatic Resources Management
OBE	-	Out Board Engine
LSADA	-	Lagos State Agricultural Development Authority
NIOMR	-	Nigerian Institute for Oceanography and Marine Research
PUFA	-	Poly Unsaturated Fatty Acids
SFLP	-	Sustainable Fisheries, Livelihood Programme
SPFS	-	Special Programme on Food Security
UNDP	-	United Nations Development Programme

CHAPTER ONE

INTRODUCTION

1.1 Background of study

Nigeria has a coast line of approximately 960km with inshore water covering a distance of 853 kilometers from the cast to the west. It has a continental shelf of 923,768 square kilometers and territorial waters of 370,400 kilometers which include an Exclusive Economic Zone (EEZ) of 200 nautical miles, located in the central gulf of guinea. The territorial waters, a distance of 20 nautical miles non-traveling zone is exclusively reserved for marine small scale fisheries [UNCLOS (1983); Ita (1994)]. The Nigerian coast line inshore water is rich in both non-renewable and renewable natural resources such as coal, gravel, sand and shell, pelagic, demersal fishes respectively. Some of the pelagic fishes are *Ethmalosa finbriata*, (Bonga), Illisha *africana*, *Sardinella maderensis* (sardine) while demersal fishes include shrimps, crabs, *P. senegalensis* (croakers), *Sphyraena quachancho* (Baracuda) among several others [Adekoya (1991); F.D.F (1983)]. Apart from marine waters, Nigeria is also blessed with inland water bodies that are located on the land ward side of the base line from which the breath of the territorial sea is measured. The inland water bodies with an estimated total area of 19,958,000 hectares (Table 1) are made up of numerous rivers such as, Niger, Benue, Ogun, Osun and their tributaries; lakes such as Chad, Kanji, Tiga, Bakolore. These water bodies including reservoirs and flood plains support a good variety of fishes. (Ita, 1993). Along the Nigerian coast line are eight maritime states, which are Akwa Ibom, Rivers, Cross Rivers, Bayelsa, Delta, Ogun, Ondo and Lagos State. Lagos State is situated in the south west of Nigeria, occupy 180km of Nigerian coast line of the Atlantic Ocean and has an inshore water that extended 50km inwards. (FDF, 1997).

1.2 Artisanal Fisheries

An artisanal fishery is an activity carried out by fisherfolks on private and family basis, in water bodies. Fishing inputs used include fishing craft and simple fishing gears such as fishing nets, hooks and lines, traps and to some extent, out board engines (FAO, 1987). The success or failure of operation depends on a number of extraneous factors such as skill of fisherfolks, environmental or financial factors.

Artisanal fisheries which is usually associated with Rural and semi-urban communities is an economic activity Gitinger (1992) defined economics as the science of analyzing the use of limited resources to achieve the desired ends while practical economy helps people to obtain more food, services and a higher level of living. Onuoha and Nnadi (1991), on the other hand, stated that rural people can only be understood and appreciated by having knowledge of their attitude, problems, needs, interest, motivation, aspiration and capabilities. This type of information when derived from research studies, may help in policy formulation which will enhance the development and progress of the rural populace. Artisanal fisheries can be categorized as marine, brackish and inland water artisanal fisheries. Fisheries as observed by Lambert and Abraham (2001) involves a lot of other activities apart from using boat to catch fish. These other activities are handling, netting in inshore areas, collecting shell fish and other marine life from reef and mangroves, preservation of seafood, processing and marketing.

Artisanal fisheries represents 89% of local fish production in Nigeria. It is the major source of employment and livelihood for 80% of the people living in the riverine and coastal areas of the country (F.D.F, 1997).

1.3 Importance of Fisheries/Fish Sources on Nigeria Economy

The fisheries subsector in Nigeria comprises of industrial (commercial trawlers), artisanal and aquaculture (fish farming). All over Nigeria, fishing activities are abundant in areas with naturally available water bodies. Therefore, fish as a source of protein is readily available and relatively cheap when compared with meat (Eyo, 2001). 40% of dietary animal protein consumed by Nigerians is from fish [Eyo (2001); Dada (2003); FDF (2007)].

Fisheries play significant role in Nigerian economy in terms of dietary animal protein supply, employment generation and income generation. This is because a large number of families are gainfully engaged in fish production (capture and rearing) processing, marketing, repair and maintenance of input, fisheries consultancy and those that render ancillary services to the fisheries subsectors (Ikporukpo, 2005). Fish as a source of animal protein, provide digestible energy, is a rich source of omega-3 poly unsaturated fatty-acids (PUFAS) that aids in the prevention of cardiovascular diseases, breast and colon cancer [Kaushik (2000);

Tacon (2001)]. The marine fish oil contains highly unsaturated fatty-acids (HUFAS) that is beneficial in the prevention of inflammatory disorders and ischaemic heart diseases (Sargent, 1992). Small and big size fish are known to contain high amount of minerals and vitamins. In developing countries where certain categories of the population do not discriminate against small and big size fish, everyone has access to these nutrients irrespective of income or size consumed (Akpanileaku *et al.*, 2005). Fish is also known to contain micronutrients, water soluble vitamins complex and fat soluble vitamins (A and D) that affect human health positively [Hassan (2001); Tacon (2001)].

1.4 Statement of the Problem

Artisanal fishing activity provides the major source of livelihood, for the rural and peri-urban communities along the entire coast, estuaries and rivers. [Moffat *et al* (1998); Linden and Lundin (1996); Coughanowr *et al* (1995)]. Six major groups of this activity exist in communities, namely, small scale fishermen, fish processors, fish mongers/ marketers, net fabricators, boat builders and out board engine mechanics.

Artisanal fisheries is made up of several fishing units that are operated along 5 nautical miles, open coast from the beach, in brackish waters, rivers, lakes and reservoirs. A fishing unit is made up of a fishing craft, fishing gear and fisherfolk who carries out fishing operations. FAO (2002) estimated that 4 million people in Nigeria engage in direct and indirect artisanal fisheries operations, contributed about 88%, on the average, to domestic fish production over the period 2001 to 2005 (FDF, 2007). However, its contribution to export product remains insignificant as majority of the fish caught are consumed locally CBN, (2002). The domestic fish supply which is only 0.62 million metric tonnes is heavily subsidized by massive importation of 0.74 million metric tonnes of fish per annum. In the realization of the need to improve domestic fish supply, several regimes have recognized the importance of the fisheries sub-sector and made attempts to boost production through various programmes and institutional reforms, such as creation of Federal Department of Fisheries (F.D.F) and the Nigerian Institute of Oceanography and Marine Research (NIOMR) from former Federal Fisheries Services, to the creation of “Green Revolution programme in 1980. [Mabawonku, (1986), Jinadu, (1991), FDF (2007)]. After these, the 4th National Development Plan Programme was launched which proposed three projects to increase artisanal fisheries production and therefore improve the lots of artisanal fisherfolks, F.D.F (1994). Some of the projects set in motion were the National Accelerated Fish Production Project, Artisanal and Inshore Fisheries Development project. Under the Artisanal and inshore fisheries Developmental project, FAO experts were brought in, new crafts e.g. Glass-reinforced plastic fibre boats were introduced; Members of Cooperative societies were given highly subsidized inputs like nets, floats, sinkers, OBE, Cold Rooms, etc; Facilities for training were also provided. This project was successful but unsustainable. Unfortunately at the end of the project, the fisherfolks were unable to maintain the facilities provided, due to lack of credit facilities, inadequate extension training, drastic reduction of fishing input subsidies. With degenerating facilities, there was increasing overfishing of inshore waters, leading to poor rate of capital formation, and declining efficiency. Consequently, fisherfolks wellbeing was negatively affected

The above stated problems affect fisheries operations, the socio-economic development of the fishers and their resources use pattern. It has therefore become necessary to seek for means of enhancing the artisanal fisheries subsector for growth and employment. One of the often suggested strategies for increasing agricultural productivity is either a combination of measure designed to increase the level of farm resource or an efficient use of the resource already committed. Johannes *et al* (1993) and Lamberts and Abraham (2001) supported the view that people who use the resources (Fisherfolks) must be studied in order to learn more about rules governing access to and distribution of catch and how changing values modify traditional resource use pattern. Small holder farmers such as artisanal fisherfolks are known to be employer of labour as well as equitable distributor of wealth. In order to enhance productivity, it is essential to determine their efficiency level (Bravo-Ureta and Evenson, 1994).

1.5 Broad Objective

The broad objective is to examine the efficiency levels of artisanal fisheries and its determinants in Lagos State.

The specific Objectives are to:

1) Examine the socioeconomic characteristic of fisher folks

2) Determine profitability of artisanal fisheries in marine and Lagos communities.

3) To determine the efficiency levels (technical, allocative and economic) of fisherfolks in both marine and Lagoon communities.

4) To identify the socio-economics factors influencing the level of inefficiency

1.6 Hypotheses

The working hypotheses for this study are:

H_0: efficiency indices of fisherfolks are not affected by their socioeconomic characteristics

H_1: efficiency indices of fisherfolks are affected by their socioeconomic characteristics

1.7 Justification

The demand for fish outstripped the domestic supply in Nigeria, as 0.74 million metric tonnes of fish is imported annually to supplement the domestic fish supply of 0.62 million metric tones. (F.D.F. 2007). In an attempt to boost domestic demand as a result of ever increasing population, several regimes in Nigeria had introduced various programmes and institutional reforms which were successful to some extent but unsustainable due to lack of continuity (FDF, 2007). Literature on fisheries abound on such government interventions where level of success was small with resultant dependence of fishersfolks on government intervention, leading to endemic poverty and poor infrastructure in fishing communities [Lawson (1984); Ishak (1994)] as quoted by Dale Square *et al.* (2003). A strategy for increase agricultural production is, by considering a combination of measures designed to increase the level of farm resource or an efficient use of the resource already committed [Johnnes *et al* (1993); Lambert and Abraham (2001)]. Various studies have used the stochastic frontier models to analyse technical efficiency using data set on crops, livestock and fisheries [Ajibefun and Daramola (2000); Amaze and Olayemi (2000); Squares *et al*, (2003); Fousekis and Klonaris (2003); Sesabo and Tol (2005)].

However, studies on efficiency level of artisanal fisheries, is scanty in Nigeria. Lagos State, with 22.5% of Nigeria's coast line, on the Atlantic ocean, has the features associated with coastal artisanal fisheries communitiese. The State is endowed with six major fisheries groups associated with rural and peri-urban communities [Cougharows *et al.* (1995); Linden and Lundin (1996)]. In order to discourage rural-urban drift, improve the lot of artisanal fisherfolks and sustain level of fisheries resources, it is important to carry out efficiency levels studies of artisanal fisheries in Lagos State. Consolidation of existing resource and more efficient use of resources within the technological frame work become paramount. Study of the efficiency level will provide information on the resource use efficiency of artisanal fisherfolks in Lagos State. The information derived from the study will help in policy formulation by Government, towards increase production performance, sustainability of fisheries resources and the profession.

Table 1. Approximate Surface Area of Inland Waters in Nigeria

Inland Water Bodies	Area (ha)
Fresh water bodies (basins and flood plains excluding lakes and reservoirs	3,221,550
Major rivers	10,812,400
Major lakes and reservoir (excluding Lakes Chad all estuaries)	853,606
Deltas and estuaries	858,000
Minor reservoirs	98,900
Miscellaneous wetlands	4,108,100
Fish pond	5,500
Total	**19,958,000**

Source: Ita (1994)

CHAPTER TWO

THEORETICAL CONCEPT AND LITERATURE REVIEW

This chapter reviews the relevant literature on the study. It discusses the concept of efficiency measurement and production frontiers and the relevance of fisheries and fisheries subsectors in Nigeria.

2.1 Theoretical concept of efficiency measurement and production frontiers

Ferguson (1966) defined production function as the "maximum possible" output that can be produced from given quantity of a set of inputs. There is cost function and also profit function. "For each function, frontier can be applied, as the function sets a limit to the range of possible observation".

Efficiency of individual production unit can be accessed through frontier production function for an enterprise. That is, measuring the distance from the individual units to the production frontier [Broack *et al*. (1980); Forsund *et al.* (1980)]. The amount by which an enterprise lies below its production and profit frontiers and the amount, by which it lies above its cost frontier, is a measure of the enterprise inefficiency. Agricultural production efficiency can be measured in terms of technical (or production) efficiency, allocative (or price) efficiency, and economic efficiency. Economic efficiency is the gross product of technical and allocative efficiency, while allocative efficiency reflects the ability of a firm to use inputs in optimal proportion given their respective prices [Ali and Chandhry (1990); Ajibefun and Daramola (1999)].

2.1.2 Approaches to Measurement of Efficiency Indices

Farrell (1957) started the frontier and efficiency measurement by discarding the conventional production function approach, which measured average level of efficiency for a deterministic approach. Here, a cost frontier was estimated using linear programming, which required all observations to lie on or above the frontier. Other workers that have improved on Farrell's approach are [(Farrell and Feldhouse, (1962); Todd, (1971), Afriat, (1972), Hanoch and Rothchild (1972), Dugger, (1974), Meller, (1976), Charnes *et al*, (1994)].

In developing economy where resources are scarce and chances of acquiring improved technology is slim, efficiency study as a factor of production is essential (Ali and Chandhry, 1990). The measurement of efficiency indicates the level to which output could be increased without changing inputs (output increasing efficiency) or the level to which input can be decreased without changing output) input saving efficiency). Efficiency can be measured using the Non-parametric programming approach and the parametric or statistical production frontier approach [Charnes *et al* (1994); Coelli (1994)]. Stochastic frontier method (a parametric approach) is preferred to data development analysis (a non-parametric approach).The non-parametric approach was criticized on the basis that the maximum output represents the usage of marginal data only without utilizing all observed data. The approach is only feasible when a farmer produces multiple outputs while the stochastic frontier model was favoured because of its ability to deal with stochastic noise.

Farrell's approach was translated into a statistical or production frontier by Aigner and Chu, 1968. In this approach, neutral-shift and non-neutral shift frontiers were employed. The major pitfall in this approach is that it cannot be used to provide estimate for the technical and allocative efficiencies for farmers that engage in multiple crops production. In 1971, Timmer used a probalistic frontier function. Aigner *et al*, (1977), Meeusen and Van den Broock, (1997) suggested stochastic frontier models (composed error model). The deterministic or probabilistic approach yields coefficients that are non-negative while stochastic approach may give negative coefficients (Ali and Chaudhry, 1990).

2.1.3 Stochastic production Frontier Model

Stochastic production frontier model estimates can be obtained by either maximum likelihood or corrected ordinary least square methods. Various workers such as Ajibefun and Daramola (1999), Amaza and Olayemi, (2000), Rahji (2003) have used stochastic frontier models to analyse a variety of data sets on crops, and livestock production.

Obwona, (2000) observed that application of efficiency measurement in research work differ between developing and developed countries. In developed countries, the application is confined to the industrial sector of the economy whereas, in the developing countries, the emphasis is on the agricultural production aspect. Agricultural production efficiency measurement comes in useful, in situation with limited resources and dwindling opportunities for adoption of better technology as a result of inflation especially in developing countries (Ali and Chaudhry, 1990). Agricultural production efficiencies can be measured in terms of technical (productive), allocative (prices) and economic efficiencies. Technical efficiency refers to the achievement of maximum possible output with available resources while allocative efficiency deals with the allocation of resources in line with the price of factors. Economic efficiency, compasses both technical and allocative efficiencies [Kelly (1977); Farrell and field-house (1962); Ali and Chaudhry (1990) Sharma et al (1999), Ajibefun and Daramola (1999), Ajibefun et al (2000)]. Studies on the efficiency indices of artisanal fisheries is scarce but a few researchers have carried out studies on technical efficiencies of gill net artisanal fisheries in Malaysia, technical efficiencies of mechanical and non-mechanized canoes in Lagos State; the efficiency of artisanal fish catch technologies in Lagos state, technical efficiency and small scale fishing households in Tanzania, [Dales *et al.* (2007); Jinadu (1999); Akanni, and Akinwumi (2007); Sesabo and Tol (2007)]. [Dawang N. C. et al (2012)]

2.2 Literature Review

2.2.1 Relevance of Fisheries to the Nigerian Populace

Fisheries play a major role in the economy of most developing countries like Nigeria and contributes significantly to the supply of nutritional food as well as employment and foreign exchange earnings. Thompson (1983) observed that the fisheries of developing countries have large artisanal section when compared with industrialized countries. These large sections posed social and economic problems. It is also of concern that years of pressure of commercial fleet on artisanal fishing ground may have resulted in over exploitation and drastic resources failure. F.D.F (2007), reported that 89% of total fish production in Nigeria from 1998 to 2007 is accounted for by artisanal subsector, (Table 2).

This sector being grassroot oriented employs more people than industrial sector (Faturoti, 1999). The people that are gainfully engaged in relation to fisher Mumen are fish-mongers, processors, gear fabricators/menders, canoe builders, crew members and out board engine (OBE) mechanics. [Malberg-calvo (1994), Wokoma (1991), McGoddwin, (1994), Okpanefe (1997)]. These set of people form the fishery livelihood groups in fishing communities. Artisanal fisheries contribute directly to the provision of protein for human beings. The bulk of protein consumed by Nigerians come from fish and fish products. It was estimated by Olaniyi (1998) that 55% of Nigerian animal protein intake is fish and that it is cheaper than livestock products Adekoya (1993) was also of the view that fish products accounted for 60% of non plant protein consumed in Nigeria.

2.2.2 Fisheries Subsectors in Nigeria

The domestic fisheries subsectors in Nigeria comprises of the industrial (commercial trawlers) aquaculture and artisanal (Table 2 and 3)

The Industrial Subsector

The industrial sector which is made up of inshore and off shore (EEZ) fisheries is highly mechanized and capital intensive. It makes use of trawling vessels for fishing and shrimping since the water is rich in shellfish resources in commercial quantities. The industrial fisheries supply fish to both local and export markets. Its contribution to the domestic fish production between 1998 to 2007 was 6.2% to 4.4% (Table 2). It is characterized by high profit and post harvest dumping of trash and small size fish at sea (Dada, 2005). This fishery has access to demersal, pelagic and shellfish stocks in commercial quantities. Nigeria also has potential for 10,000 metric tonnes annually of untapped tuna resources (F.D.F, 2007).

The demersal resources is being exploited by about 193 Nigerian flagged registered fishing vessels. In the last ten years, the Nigerian government made export earnings from shrimps, other fisheries and licensing fees as shown in (Table 4 and 5).

Aquaculture Subsector

Aquaculture sector involves culturing of different fish spp. Between 1998 to 2007, aquaculture contribution in Nigeria to domestic fish production rose steadily from 4.2% 1998 to 13.8% in 2007 (FDF 2007). Nigeria is blessed with 1.75 million hectares of suitable sites for fish farming. According to Dada (2005), only 25,000

Table 2. Nigeria Fish Production by sub-sectors (1998-2007) Tonnes

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Coastal & Brackish Water	219,073	239,228	236,801	239,311	253,063	214,823	227,523	259,831	269,878	260,099
Inland; Rivers & Lakes	213,996	187,558	181,268	194,226	197,902	204,360	207,307	230,763	288,659	244,128
Aquaculture fish production	20,458	21,738	25,720	24,398	30,664	30,677	43,950	56,355	84,533	85,087
Aquaculture (fish farm)	433,069	426,786	418,069.4	433,537	450,203	446,203	434,830	490,594	518,536	504,227
Artisanal and industrial sectors	29,954.6	31,139.4	23,308.3	28,373	30,091	33.882	30,421	32,595	33,778	36,193
Artisanal	433,069	426,786	418,069.4	433,537	450,965	446,203	434,830	490,594	518,536	504,227
Industrial (commercial trawlers	20,458	21,738	25,720	24,398	30,664	30,677	43,950	56,355	84,533	85,087
Industrial(commercial)	29,954.6	31,139.4	23,308.3	28,373	30,091	33,882	30,421	32,595	33,778	26,193

Sources: Federal Ministry of Agriculture and Water Resources, Fisheries Department, (Abuja, 2007)

Table 3. Percentage contribution of each sub-sector to domestic fish production (1999-2007)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Sub-sector/year	433,070	426,069	418,069	433,537	450,985	446,203	434,830	490,594	518,537	504,227
Artisanal	89.6	89	89.5	89.1	87.4	85.4	84.7	81.7	81.4	81.9
%	20,458	21,737.60	257,201	24,398	30,664.00	30,677	43,950	56,355	84,533	85,087
Aquaculture	4.2	4.5	5.5	5	6	6	8.6	9.7	13.3	13.8
%	29,954.58	31,139.40	23.308.3	28,378	30,091	33,882	30,421	32,595	33,778	26,193
Industrial	29,954.58	31,139.40	23,308.30	28,378	30,091	33,882	30,421	32,595	33,778	26,193
%	6.2	6.5	5	5.8	5.9	6.6	6	5.6	5.3	4.3
Grand-total	483,482.30	479,663	486,313	511,720	510,762	509,201	579,544	636,544	636,848	615,507

Source: Federal Ministry of Agriculture and Water Resources, Fisheries Department (2007)

Table 4. Number of Artisanal Fishermen by category (1998-2007)

Year	Industrial	Artisanal	Aquaculture	Total
1998	650,864	475,280	23,857	1,150,001
1999	647,478	472,807	23,732	1,144,017
2000	666,320	486,566	24,003	1,177,308
2001	654,887	478,217	24,003	1,157,107
2002	656,228	479,196	24,052	1,159,476
2003	655,155	478,413	24,013	1,157,581
2005	718,887	516,917	23,236	1,259,040
2006	922,332	663,204	29,811	1,66115,347
2007	948,434	681,973	30,655	1,661,062

Source: Federal Ministry of Agriculture and Water Resources (2007)

Table 5. Registered/operated number crafts (1998-2007)

Year	Fishing		Shrimping		Eez	
	Registered	Operated	Registered	Operated	Registered	Operation
1998	62	36	187	162	1	1
1999	31	23	210	187	1	1
2000	39	34	177	173	1	1
2001	34	33	221	184	3	3
2002	30	30	212	212	1	1
2003	48	48	204	204	8	8
2004	37	37	182	182	2	2
2005	35	35	203	203	1	1
2006	32	32	176	176	2	2
2007	28	28	163	161	2	2

Source: Federal Ministry of Agriculture and Water Resources, Fisheries Department (2007)

tonnes of fish are produced annually. Aquaculture is practiced at four levels of intensity in Nigeria.

- **i.** Subsistence Ponds: Have size range of $5m^2$ to $15m^2$. They have low yield as a result of flooding, predation and poaching.
- **ii.** Homestead Fish Ponds: have size range of $30m^2$ to $50m^2$: They are built of concrete blocks or bricks. They were first introduced by the Directorate of Foods Roads and Rural Infrastructure.
- **iii.** Commercial fish Farms: These are made up of several ponds. Over 80% of aquaculture production in Nigeria came from them. Majority of these farms are poorly managed and lack well trained managers.
- **iv.** Intensive Recirculatory Fish Production System: Is becoming very popular in Nigeria. The few in existence are privately owned and are housed in warehouses. They are built at very high cost and operate at high cost too. This production system is based on high technology and high degree of management control. It yields more output from a given production unit. Each production system can produce about 2 tonnes of catfish fingerlings per week and 200,000 to 250,00 fingerlings per month. The system operates at higher stocking densities with manufactured floating feed and regular chemical prophylaxis.

Artisanal Subsector

The contribution of artisanal fisheries to domestic fish production between 1998 to 2007 is shown in (Table 7). Dugout and plank canoes which may be paddled or motorized are used in artisanal fisheries and coverage is limited. The artisanal canoe fleet in Nigeria exploits marine water and vast networks of brackish waters of the Niger Delta and other major rivers as well as inland lakes. Being a low technology and labour intensive fishery, it is characterized by low operational cost and profits, with high post harvest loses. Artisanal fisheries is very important as it is a major source of livelihood for rural communities along the entire coast and the expansive estuaries. It is estimated that about 4.0 million people are engaged in direct and indirect artisanal fisheries operations in Nigeria (DFID, 2000). The inland capture fisheries which exploits major rivers, their tributaries, natural lakes and various reservoir, is artisanal too (Table1). The catch from inland fishery is dominated by

Lates niloticus, Synodontis nigrita Clarias gariepinus, and Chrysichthys nigrodigitatus.

2.2.3 The Definition of Artisanal Fisheries

In 1977, welcome and Henderson described artisanal fisheries as an activity carried out in an aquatic environment containing fish, shrimp, mollusk, etc. The activity was regarded as economic in nature since it was characterized by a great dependence on environment as well as socio-economic conditions such as inadequate or non-existing infrastructure, variation in prices of inputs, inefficient extension service and inadequate cooperative society's activities. Ajayi *et al.* (1992) perceived artisanal fisheries as being synonymous with small dugout canoes paddled by one or two people or wooden plank canoe propelled by outboard engines with ten or more people on board and using active or passive gears. The fisheries explored are inland water, lagoon and marine pelagic and demersal fishes. Moses (1983) categories as industrial and small-scale fisheries. The small-scale fisheries were further classified into subsistence and artisanal fisheries. The classification was not distinct as subsistence was described as catch for person consumption and in small quantity while catch is higher in artisanal with left over for sales after removal of personal consumption. Berkes (1990) noted the difficulty in defining the term subsistence and artisanal. Tredten and Hersoug (1992) examined small scale fisheries in Africa, using Smith's classical definition of artisanal fisheries as small-scale and subsistence, as basis. Haakonsen (1992) on the other hand, asserted that it was difficult to separate professional fisherfolks from part time fisherfolks in West Africa as majority of fisherfolks have other economic activities. His own view of part time fisherfolks was those with low cost craft of one to three men crew, with relatively low capital investment gears. But he considered cross border migrant fishermen such as Krumen of Liberia and Ghanians who rely on fishing as the only economic activity as professionals. The difficult of separating professionals from part time fisherfolks, however arose when other cross border migrant fishers such as Serer and Nyomka from Senegal with large motorized canoes and higher investment gears, are known to be involved in rice cultivation in Sine-saloum (Senegal). The conclusion, however, was that a man's status can only be affirmed as a fisherfolk by considering the fishing income. Demuynck (1994) being aware of the fact that international agencies such as

FAO recognized artisanal fisheries, referred to it as "small-scale fisheries involved in a diverse continuum of activities". Nielsen *et al.* (1996) in their own contribution, explained the term as "lower technology fishing with limited fishing ranges, often, but not always for subsistence needs while industrial was explained as higher technology fishing with greater fishing ranges, predominantly for commercial purposes". Dalzellet *et al.* (1996) observed that 80% of annual inshore fisheries production in the Pacific Island countries was accounted for by subsistence fishery. FAO (2002), also noted that Nigeria is one of those nations with large number of artisanal fishermen scattered all over communities in the marine, lagoon, flood plains, lakes, rivers and wetlands. Most of the fishing is conducted within 12 miles of land while some traveled more miles from their communities. They experienced peak fishing season and non-fishing or slack periods. During the productive months, fishing operation normally covers a period of 12 to 14 days/per month.

2.2.4 Artisanal Fisheries as Object of National and International Consideration

The term, artisanal fisheries, also forms object of national and international considerations as the term varies from country. The FAO glossary (2002) took into consideration the different socioeconomic dimensions and views of people from different walks of life, such as the fisheries politicians, administrators, legal officers, biologists, economics, sociologists, engineers, NGOS and the media to arrive at a definition which refers to artisanal fisheries as "traditional fisheries involving fishing households (as opposed to commercial companies) using relatively small amount of capital, energy, small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumptions". In developing and developed countries, the term may accommodate one man canoe or more than 20 metre length trawlers, seiners or longlines respectively. The Anglophones sometimes use small-scale fisher to represent a fisher with small size vessel, low-level technology with low capital investment. In the U.S., a 9 metre fibre lobster fishing boat with inboard diesel motor, radio; social and emergency immersion suits with inflammable life raft will be referred to as small scale. A 7-meter wooden row boat with gillnet and lower capital investment is also small scale though, it fits the description of artisanal fisher. In French and Spanish speaking countries, artisanal fisheries means low-level technology coupled with low organization and industrialization levels.

2.2.5 Food and Agricultural Organization Glossary Description of Artisanal Fisheries (2002)

An artisanal fishery is a fish catching operation, usually carried out with canoe and simple fishing gears. It is made up of several fishing units which are operated along 5 nautical miles, open coast from the beach, in brackish waters, rivers, lakes and reservoirs. A fishing unit is made up of a fishing craft, fishing gear and fisherfolk who carry out fishing operations. According to FAO (2002), Artisanal fisheries is commercial in operation but cannot be considered as an industrial fishery because of the following factors:

1) The gears are simple and hand operated.
2) It is labour intensive and of very low capital investment
3) The craft used is also simple and traditional i.e dugout wood or plank canoe.
4) Storage and processing plants are not available either on deck or at the jetty or when available, are poorly developed.
5) Fishing units are highly scattered in remote and inaccessible villages which made evacuation and distribution of product rather difficult.
6) Fishery is not well organized and in some cases lack record keeping attribute.
7) Fishery lacks credit backing from banks and other recognized financial institutions.

2.2.6 Nigeria Category of Artisanal Fisherfolks

F.D.F (2002) recognized the presence of part-time, full-time and occasional fisherfolks as contributing to the Nigerian fish production figure. (Table 6) highlights the number recorded for 1998-2007. Full-time fishermen are very proficient and usually do not engage in any other profession though some inherited coconut plantations (plate 1). They are to be found mostly along the beaches, on lagoons and inland waters. They are highly mobile and follow fish movement about in water bodies. They are not gainfully employed throughout the year because of the seasonality of the fishery and the slack period experienced during July and September, however, during the fishing season, their catch is always in excess of local marketing demand and processing ability of the women, to the extent that extensive spoilage of the bumper catch results.

Plate 1. Coconut Plantation at Moba Sea Beach

Plate 2. Plank canoe with OBE at Agbowa Ikosi

Part-time fisherfolks are men who depend partly on fishing but have other means of livelihood such as farming, tailoring, trading, artisans etc However, due to their proficiency and availability of relevant gears and crafts they catch enough fish for home and for marketing purposes. (Table 6)

The occasional fisherfolks include men, women and small boys who capitalize on seasonal abundance of fish/shrimp using baskets, palm fronds, mats hooks and line, traps, to catch fish or shrimp for subsistence living and rarely enough for sales on regularly basis.

2.2.7 The Craft Used by Artisanal Fisherfolks in Lagos

The craft, used in transportation to and from fishing ground by the fisher folks is well documented by Jinadu (1991). The crafts are referred to as canoe or boats depending on the sizes and type of gears to be used. In the marine and the inland waters, crafts are wood plank canoe (7-10m) length and large size Ghana canoe 12-20m (Plates 2 and 3,) length. Glass reinforced plastic (GRP) boat are not so common because of the prohibitive cost (plate 4). The dugout canoes are of two varieties – Ghana dugout canoes with plank free boards and the smaller dugout canoe (NIOMR 1990). The large crescent shaped Ghana dugout canoes, with length over all (LOA) of 8-12m, midship beam of 1.2 – 1.9m and midship depth of 0.4m are common in beach seine fishery practiced in Yovoyan and Ibese of Badagry and Ojo Local Government Areas respectively (Plates 2 & 3). The dug out and plank canoes are also used along Orimedu, Lekki axis in Ibeju-Lekki Local Government Area in the *Sardinella maderensis* encircling net fishery. The small dug out and plank canoes with LOA of 3.1m are used in the estuaries, Lagoons and creeks (Udolisa and Solarin, 1979).

The wooden materials used in the construction of the big Ghana dugout canoe are samba tree species (*Triplochiton seleroxylon*). It is selected for its light weight and buoyancy while the small dugout canoe is built from the trunk of silk cotton tree species *(Eriodendron afractuosum*) and iron wood (*Lophiria alata*). For all the plank canoes, plank of white or black Afara trees *(Terminalia superba)* or Mahogany (*Khaya ivorensis*) or silk cotton trees are used.

The means of propelling the crafts are bamboo poles, paddles, wind sails and out board engines. Some fishermen in the lagoons, estuaries, creeks and rivers still use

Table 6. Shrimp/Prawn export and value (1998-2007)

Year	Value('000$)	Export(tones)
1998	31,163.78	8,028.157
1999	46,485.49	7,418.739
2000	39,495.89	6,303.250
2001	48,820.47	6,694.207
2002	54,053.12	7,372.540
2003	48,215.03	6,900.000
2004	52,706.37	7,316.160
2005	53,379.75	7,179.269
2007	38,311.32	5,136.672

Source: Federal Ministry of Agriculture and Water Resources, Fisheries Department (2007)

Plate 3. Ghana Boat with Beach Seine Net and Accessories (Floats and Sinkers) at Sakpo Beach

Plate 4. Glass Reinforced Plastic Fibre Boat (GRP) at Igbologun

bamboo poles, wooden paddles, and windsails (occasionally) while some have embraced the use of OBE. Marine Artisanal fisheries, use OBE with horse power ranging between 25 and 45HP. In the inland artisanal fisheries, 5 and 8 HP are common, while 15 horse power OBE is common to both fisheries depending, however, on the size of the canoe (NIOMR, 1990). Several models OBE, some archaic, some recent, can be found with fishermen. These are Archimedes, Johnson, Mercury, Evinrude, Yamaha and Suzuki. Yamaha and Suzuki are prevalent in recent times (Plate5).

2.2.8 Gear Used by Artisanal Fisherfolks in Lagos State

The gears used by artisanal fisherfolks in capturing fish and shell fishes at sea, and inland waters are:

i. Beach seine nets (Plates 6)
ii. Encircling nets (semi-gill nets)
iii. Gill nets (Plates 7 and 8)
iv. Cast nets (Plate 9)
v. Hooks and line
vi. Traps

In the western and far eastern marine zone of Lagos state, beach seine nets of 200-800 metres long with codends (bags) are common. (Udolisa and Solarin 1979). A crew of 12-18 men set the net at sea within an hour, and as many as 30 to 50 men are needed to drag the net to beach within two hours period. In the inland waters of western zone (Badagry Creek) and eastern zone lagoon (Oreta), the inland beach seine nets used are of the dimensions 50-90 metres long and 300-400 metre long respectively. The encircling or semi-gill nets, prevalent around Orimedu, in the far eastern zone are 300-800 metres long and 10-45 metre deep (NIORM, 1990). They were introduced and operated by the immigrant Ghanaian (Fante) fisherfolks. A crew of 7 to 22 men operates it. It is used in enclosing and gilling school of pelagic fish such as sawa (*Sardinella maderensis)* at sea. The technique is to frighten and stampede the school of fish into their net. The gillnet are fabricated according to their functions. The classification are surface gillnets, bottom set gill nets (NIOMR, 1990).

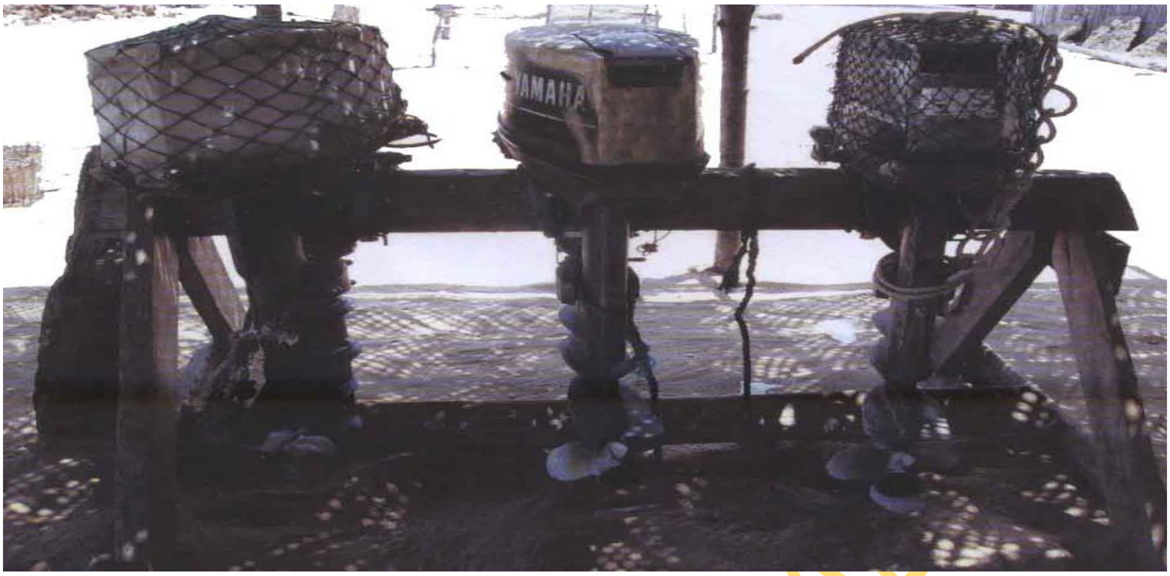


Plate 5. Different Models of OBE.

Plate 6. Beach Seine net at the Beach with two extreme edge poles

Plate 7. Gill Nets Hung for Drying at Ajido

Plate 8. Gillnet Hung near Jetty at Ibeshe Lagoon

The surface/mid water gillnet make use of more floats compared to lead sinkers to provide surface positive buoyancy. It is usually 1-2.5 metres deep, 50-800 metre long. It is fabricated from single knot, twisted nylon and polyethylene netting materials. It targets the pelagic school such as *Sardinella maderensis and Ilisha Africana* (Shad). The bottom set gill net, contains more lead sinkers than floats. Its target is the grey demersal fish, the sciaenid family i.e croakers, barracuda, shiny nose and catfish (*arius)* at sea. Bottom set gill net are set at dusk and removed at dawn. In inland waters, gill nets of 1.2-1.4 metre deep and 35-300 meters long ae used in targeting *Sardinella spp, Chrysichths nigrodigitatus, Clarias gariepinus, and Polydactylus quadrifilis.*

Cast nets, also known as falling gears, are conical in shape (plate 8). It is made from monofilament or multifilament nylon netting material. It is used throughout the years by fisherfolks in shallow lagoons, creeks, rivers streams and lakes. They are thrown from shore or from a canoe on citing school of fish such as *Pomadasy Jubelini*, *Mugil sp, Ethmalosa fimbriata.* The cone height of a cast net is between 3 to 6 metres while the retrieving line attached to the apical portion is 4.10 metres long. Lead is attached to the inner side of the cone at intervals to form pockets for trapping fish.

Hooks and line comes in various forms as handlines, pole and line, set long lines and drifting long line. Hooks and line are used by children of fisherfolks and part time fisherfolks at beaches, jetties, bridges, rivers, lagoons, estuaries and in canoes. The basic design is a main line on which some short secondary lines referred to as (snoods) are attached at intervals. Each snood terminates in a hook. The hook may be baited or unbaited. In the marine states, 200-600 hooks of 1.5-3.0mm diameter may be used at once. Silver fish *(Trichiurus lepturus), Illisha Africana*, bonga, shrimp or cut pieces of eel may be used as baits. The specie of fish caught varies from catfishes, croakers, grunters and shark to *Synodontis sp*, Gymnnarchus niloticus. [FAO (1994); NIOMR (1994)].

Traps come in various forms as clay pots, basket, fences and cages. They are devices for catching shell fishes and fishes. They are made of clay, wire and fibre nettings, bamboo, wood or metal rods, Majority have incorporation of non-return values for trapping fish. Majority does not have bait and are set at the bottom of water body or mouth of an estuary. Fish species caught includes *Chrysichthys nigrodigitatus*, shrimps, crabs among several others.

2.2.9 Fishery Livelihood Groups in Fishing Communities

Fishing can b e regarded as an important activity that forms the basis of livelihood of households living along the coast [UN, 1992; Coughanowr, *et al.* (1995); Moffat, *et al.* (1998); Linden and Lundin (1996)]. A fishery can be divided into three phases such as fish harvesting, processing and marketing. All these when merged into some other essential aspects form fishery, livelihood (SFLP/DFID/FAO, 2002a), Allison and Ellis, 2001.

Most fishing communities depend on fisheries and aquatic resources for their livelihood. In most communities, six major groups exist. The groups are small-scale fishermen (artisanal fisherfolks); fish processors, fish mongers/marketers, net fabricators, boat builders and OBE mechanics. Majority (80%) of the groups are engaged primarily in fishing. They all depend on fishing or fish related activities to acquire assets such as shelter, boats, nets engines, fishing gears and for other financial requirements.

Artisanal fishers are mostly men. Few women fish mainly in the creek and rivers. A few women employ labour for fishing activities in the high sea. In Nigerian marine communities, women are involved in preserving processing and marketing fish. Occasionally, they are involved in net making and mending. Boat building and Outboard engine mechanics involvement only (SFLP/DFID/FAO 2002b).

2.2.10 Fisheries Development programme

The Federal Department of Fisheries (F.D.F) was saddled with policy formulation, fisheries laws and regulations. Since 1970, there had been various national development plans with policies leading to trade liberalization with subsequent reduction of import duties on fishing equipments and 50% subsidy granted on fishing inputs. Federal Government policies also tend towards conservation of scarce foreign exchange with the resultant harsh import regulation and duties (Mabawonku 1993). The following policies were enacted:

Green Revolution

In 1980, a National Committee on green revolution was established with aim of boosting fish production nation wide. The committee was saddled with the responsibility of providing essential fishing input packages to artisanal fisherfolks. The package contained:

i. Improved modern fishing crafts (GRP), (plate 9), nets, accessories for large scale fishing operations.
ii. Construction of basic infrastructures such as: jetties, workshop, fuel depot, net lofts and general utilities.
iii. Ice making plants, chill or cold rooms, fish stores, smoking kilns, processing and marketing plants, fish carriers etc. (NIORM, 1990

Fourth National Development Plan

The 4th National Development plan proposed three projects to increase artisanal fisheries production and improve the living standards of the artisanal fisherfolk (F.D.F, 1994). The three projects were:

i. National Accelerated fish production project (NAFPP).
ii. Inshore fishing projects.
iii. UNDP/FAO artisanal and inshore fisheries project.

The National accelerated fish production project (NAFPP) entailed supply of fishing inputs such as OBE and spare parts, improve modern fishing canoes (Glass Reinforced Plastic Boats), fishing nets, and accessories such as hooks, indicator buoys, etc all at 50% subsidy, supplied in a package through cooperative societies under the auspices of the State Ministry of Agriculture, Fisheries department. The inshore fishing projects involved training of Nigerians and supply of experts to upgrade indigenous artisanal fishermen from level of non-mechanized canoe operation to modern inshore trawling through cooperative societies. The third project, which is the UNDP/FAO Artisanal inshore fisheries project involved establishment of viable community fishing centers, with in-built essential social amenities, improved maintenance and repair workshop for fishing crafts and gears (FDP, 1994). In 2002, the Federal Government through the States Ministry of Agriculture parastatals, (the Agricultural Development projects) established a Special Programme on Food

Security (SPFS). (FACU, 2003). FAO designed the programme to help farmers produce food and at the same time, improve their well being. The Federal Government as the main financier was expected to deposit money with FAO on yearly basis. All cooperative societies in a senatorial district are brought together to form an apex body through which loan input and fund was disbursed to farmers by the ADPS. The trial programme which started in 2000 from the Northern part of the Nigeria is now nation wide, with Lagos and Bornu State as main beneficiaries of the fisheries aspect apart from crop and irrigation. The inputs being supplied are fishing nets, hooks and accessories (i.e twine, rope, floats, buoys etc), smoking kiln for processors and fund to purchase other requirements.

2.2.11 Fisheries Regulation as a guide Against Overfishing or Over Exploitation

In order to protect fishery resources from over exploitation, the Federal Government of Nigeria and other maritime countries agreed calve out Exclusive Economic Zone (EEZ) from the territorial waters during the United Nation Conference on Law of the sea (UNCLOS, 1983). Fisheries regulations and laws are to protect fishery resources. These laws were put in place to protect and control fish harvesting so that fishers do not go into extinction. Before this, there was Fisheries Decree of 1971 that stipulated acquisition of fishing license from licensing officer before operation of fishing boat or vessel. Penalty to this offence is a heavy fine or six months imprisonment. This was reviewed in 1991, and it extended the Non-Trawling Zone for Artisanal fishermen from two nautical miles to five nautical miles seawards. Thus, extending area of operation of artisanal fishermen. Others rules and regulation enforced by Federal Department of Fisheries and State fisheries offices are:

i. The 1992 Sea Fisherman Decree
ii. The 1992 Sea Fishermen Regulations
iii. FEPA (Federal Environmental Protection Agency) guidelines on water pollution.
iv. Inland Water Decree 1992.

All these rules and regulation address the following:

v. Prevention of trawlers from operating within five nautical miles of territorial water.
vi. Mesh size regulation to exclude small size fish i.e young fishes from being caught.

vii. Ban on discharge of pollutants in Nigeria water.

viii. Ban on use of poisonous substances on water for purpose of fish catching.

ix. Regulation of number of fishing trawlers issued with fishing permits or licenses and the size of their trawlers to prevent over-fishing.

x. Fish must not be transferred by a vessel to another vessel and not be dumped into the sea by a vessel within Nigerian maritime waters.

xi. Only Nigerian owned locally registered fishing vessel and carrying Nigerian flag could operate within the territorial water.

Overfishing is believed to be an economic problem with social and biological implications. Several workers have considered the term, over exploitation or over fishing. Hardin (1968) referred to this stage, "as the tragedy of the commons". That is, the stage when fishermen will leave the fishery. Some highlighted it as one of the problems of Artisanal fisheries emanating from open access of water while some referred to overfishing as the "turning point" when management intervention is required. Gullard, (1979); Norbeck. (1974); Firth, (1966) Pauly (1990); FAO, (2002) noted that overfishing is caused by trawlers, industrial fisheries and foreign fleets fishing under fisheries access agreements and joint ventures by Governments. Suspected cases of over fishing in inshore waters in Nigeria were reported by Tobor (1983), Elliot (1993) and Kusemiju (1993) in their attempt to determine the economic sustainable yield of the marine small scale fisheries in Lagos State through data collection and analysis using cost route method, impact of seasonality, and outboard engine mechanization respectively.

2.2.12 Role of State Government in Fisheries Policy Formulation

Lagos State since inception in 1967 has not been left out of policy formulation for fisherfolks, which has been 1,2,3, patterned after F.D.F policy guidelines and regulations. The policy of Lagos State Government has been the promotion of fishing sector as a major occupation in the state with the realization that fishing is the traditional pre-occupation among her rural and semi-urban people. In the past, Lagos state was involved in organizing local fishermen into cooperative societies and has assisted them materially and financially with a view to improving their productivity and general welfare. A vocational fishermen training school was established at

Yovoyan (Badagry) in March 1980 and also the now defunct Lagos State Fish Board (Lagos, 1985). (Plate 10).

The training school was established to train the children of fisherfolks in modern fishing technique to replace the ageing generation of fisherfolks. The Fish Board was charged with the responsibility of granting loans in cash or in kind in terms of input to all registered fishermen cooperative societies; assisted in collection, preservation, transportation and marketing of fish for fisherfolks belonging to cooperative societies. Cold rooms were established in Major fishing villages of Orimedu, (Ibeju Lekki L.G.A), Yovoyan (Badagry L.G.A.). Some of the activities of the State Governments formerly handled by the fishers department of the ministry have been handed over to Lagos State Agricultural Development Authority since 1987 (NIOMR, 1990).

2.2.13 Cooperative Societies in Relation to Artisanal Fisheries

Major development agencies such as FAO have advocated the use of Cooperatives as an institutional focus for development programmes. Cooperative society is defined as a group of individuals working together for the benefit of all members. It is also a special type of business enterprise which aims at promoting or improving the economic interest of its members.

Cooperative can also serve as channels through which resource management decisions can be implemented as well as decision on regulations to stop the rapid depletion of fishery resources (McGoodwin, 1992). Fishery cooperative can also help to sustain development in rural areas (Poggie, *et al.*, 1988).

Jazairy *et al.* (1992) observed that small scale fishing communities who did not belong to cooperation societies in the Philippines, as elsewhere in the world, are vulnerable to exploitation due to poverty and uncertainty of their occupation. Inspite of their huge number, fisherfolks represent the under privilege and politically weak group. They live in remote areas and do not readily get technical assistance needed to improve their efficiency. Majority lack adequate housing, clean water supply and basic social services.

Fishermen cooperative society serves the following roles:

i. Improving the lot of its members and their families
ii. Raising social and political status of fisherfolks and
iii. Improving condition of work.

Plate 9. Fisherman with Cast Net at Oreta

Plate 10. Dilapidated Abandoned Fisherfolks Fisheries Training School at Yovoyon

Plate 11. Net Repair Shops at Sakpo Sea beach in Lagos

Plate 12. Net Fabrication in progress at Yovoyon

Plate 13. Fisherman's House with harvested Coconut at Yovoyon

Plate 14. Fisherman's House at Agorin

Plate 15. Fisherman removing Landing at Topo

The importance of cooperative society in the scheme of management is recognized by the Government of Nigeria, hence the incorporation of Department of Cooperatives in the Ministry of Agriculture. The objective of the government in establishing cooperative offices to provide ready avenue for communication and interaction. It is also to make input and credit facilities readily available to farmers.

2.2.14 Activities of Extension Services

An area of intervention by the Federal Government is the servicing of artisanal fisherfolks through institution such as Agricultural Development Programs and Research Institutes by provision of continuous extension services to farmers and fisherfolks. Extension education is the type of information derived from research work emanating from research institutes which are designed primarily for adults to help them in their life settings, to improve their physical, biological, economic and social qualities. According to Adebayo, (1997) the role of extension is the dissemination of useful knowledge and techniques and out of school training to rural adults. Makun (1992) in his own contribution, stated that extension services is one of the major organs that can boost agricultural efficiency. In Lagos State, LSADA, a parastatal of Lagos State Ministry of Agriculture and Cooperatives is saddled with the responsibility of carrying out extension services to fisherfolks and nuclear families through linkage with NIOMR.

The ADP system is a collaborative effort of the World Bank, the Federal Government and State Governments. It was established in Lagos State in 1987 with the main objective of raising the standard of living of small scale fisherfolks and farmers through the dissemination of relevant modern technology obtained from research institution such as Lake Chad Research Institute, Nigerian Fresh Water Research Institute (NIFRI) and NIOMR.

ADP systems area of intervention for artisanal fisherfolks are maintenance, preservation, processing and modern fishing techniques. In financing, ADP links fisherfolks with financiers such as banks and Non Government Organizations. ADP encourages farmers/fisherfolks through their extension network, to form groups registrable with the State Ministry of Agriculture and Cooperative. Credit facilities are easily granted to functional and registered groups than individual fisherfolks. ADPs also encourage all rural folks (artisanal fisherfolks) to be gainfully engaged throughout the year, slack period inclusive, by their fort-nightly trainings and visits to the field.

2.2.15 Non-Governmental Organization (NGO) Involvement with Artisanal Fisheries

Non-Government organization is a voluntary, non-profit making entity established by a group of individuals who are genuinely interested in the advancement of the human race NGO focuses, on health, economic, social or environmental aspect. There are several N.G.Os but some of those that are well established and who had been working for the advancement of fisherfolks, farmers and rural marine dwellers are: (a) Out-Reach Foundation, (b) Country Women Association of Nigeria (COWAN) and (c) Clean up Nigeria.

The first two named NGOs are in close collaboration with the Rural Institution Development component of LSADA. They have external funding and have been granting small scale loan in the range of N5,000 to ₦50,000 with simple interest rate of 5% to individuals members of a group. The interest charged in used as running cost and provision of stationary such as passbook, registration notebooks etc. Outreach Foundation caters for both male and female fisherfolks. COWAN on the other hand, deals with women only. Type of loan granted to the women is capital to start small scale activity such as fish processing, mat weaving, coconut purchase and processing, purchase of net for fish and shrimps capture etc.

Clean up Nigeria does not deal with credit facility provision nor does with ADP. It liaises with Federal Government, and deals directly with rural marine populace. It is also a Nigerian based N.G.O. It plays an active role in the Integrated Marine Areas Management (IMAM), a sub-regional entity organized by International Ocean Institute (IOI) which has it Western African operational center (WAOC) for Institute for NIOMR Victoria Island, Lagos. The roles of clean-up Nigeria include:

1. Compilation of marine resources data at community levels.
2. Ensure working alliance with relevant government Agencies to promote and enforce regulations that encourage marine sustainable development.
3. Initiation of campaigns against environmental pollution.
4. Encouraging tree planning in marine areas to check degradation and protection of biodiversity of the areas.

5. Promote responsible waste management of marine debrise in ICAM.
6. To consolidate promotion of public awareness campaign for marine dwellers in sustainable resources management.
7. To carry out regular beach cleaning up exercise.

2.2.16 Import-Exports Sector and the gap between Demand and Supply of Fish in Nigeria

The artisanal fisheries has no significant contribution to exports-imports sector as majority of the resource caught are consumed fresh and smoked locally. According to the report of CBN (2002), fisheries exports accounted for 0.2% of total national export revenue. Shrimp accounted for 94% by volume and value while fresh fish accounted for 7% of the revenue meanwhile statistic of fish importation nation wide indicated that 800,000 metric tonnes per year of frozen fish is imported. While the country produces 650,000 metric tonnes per year. (Business Day, 2011). The total demand for fish is 2.66 million metric tonnes while the domestic production is only 0.62 million metric tonnes. (F.D.F, 2007).

2.2.17 Gender Issue in Artisanal Fisheries

Fishing is a high risk and strenuous occupation. In most society, it is considered to be a males activity. A group of scientists noted that there is gender difference in fish harvesting. Women and children harvest smaller size fish, shell fish, crustaceans, and seaweed on inshore reefs, in mangroves areas and rivers while men with the aid of the boats, harvest fish on the outer edge of reefs and in open waters like sea and lagoons. (lambeth, 2000; Lambeth & Abraham 2001).

Women play significant role in fish distribution, as intermediaries at wholesale or retail level or as wives of fishermen. Garhardson (1997) observed that traders and fish processors are women who buy fish in baskets with varying prices according to specie and sizes.

Wokoma (1991), observed that women of Erua fish fishing community in Akwa Ibom State of Nigeria, however, cast net, set net as their male counter parts. Whereas in River State, women handled post harvest activities such as fish handing and processing like majority of their Lagos counter parts. Okpanefe, (1977) observed that in Lagos State, women are mostly employed in the secondary sector of processing and distribution. Their involvement in fish catching is not so pronounced. Fishing communities in Lagos State as in other marine states serve as production and processing centers where each member of the family plays a specific role. Majority of fishermen marry more than one wife. After landing, the women take over the extraction of fish from net, sorting the units for wet and fresh sales. Left over are processed in their backyards.

In addition to their traditional supportive role as wives and mothers, a few rich ones who are financially independent, provide credits for their men folk. Some rich elderly fishermen also give credit to purchase inputs and the men deliver their catch to the men and women financiers on agreed terms or on monthly repayment basis (Wokoma, 1991). He also observed that some women, engage in operation of a variety of gears, principally hand nets and traps in inland water. They land and market live shrimps, crabs and oysters which are low in volume but high in quality and premium.

Ijff (1990) observed that in Nigeria, women in rural economy still occupy a lower socio-economic status compared to their male counter parts despite their changing gender role as wives and mothers, which now include wage and income earners to the families. He noted that numerous government development projects aimed at promoting their socio-economic opportunities are virtually absent as the programmes are welfare oriented. As a result, the women are deprived of the direct socio-economic benefits. Williams (2002) considered the socio-economic potentials of women in riverine small scale fisheries in Nigeria, and highlighted the underestimation of the women's socio-economic contribution to the food security problems in Nigeria due to their neglect of women' to the well being of their families.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

Lagos state is one of the maritime states, situated in the south west of Nigeria (Figure 1). It was created on the 27th of May, 1967 out of the Old Western State of Nigeria. It lies within longitude $2^{0}45$ east to $4^{0}20$ east and from Latitude $6^{0}20$ North to $6^{0}43$ North in the tropics (Udo and Mammam, 1993; Arowomole, 2000). The State has boundary with Ogun State on its Northern and Eastern sides and on its western side, the Republic of Benin. The southern side stretches for 180 kilometers along the Guinea coast of the Bight of Benin, on the Atlantic Ocean. About 787km^2 is made up of lagoon, creeks and rivers (Lagos ADA, 1997). The State is blessed with 22.5% of Nigeria's coastline. The majority of the fishing communities are remotely located in rural areas. Lagos State is made up of twenty-seven local Government areas including the development areas.

The State has two distinct seasons namely, the wet season (April-October) and the dry season (November to March). It has annual rainfall of 12000mm to 15000mm while the atmospheric temperature ranges between 23^{0}C to 34^{0}C (Pliya, 1980). The artisanal fishermen are not affected by the upwelling experienced between June and August. The 784km^2 portion of the total land surface areas of Lagos State is covered by three types of water bodies, with varying degrees of salinities. These are fresh water (0<0.05ppm) and brackish water (>0.05ppm) and marine (>5ppm). (Figure 2). The marine water is variously named around beaches villages as Victoria or Bar beach., Alfa beach, Eleko, Orimedu, Magbon Alade, Magbo Segun, Lekki etc; while the lagoons are variously named as Ologe, Lagos, Lekki lagoons and Badagry creeks. (Figure 1). The lagoons empty fresh water received from numerous rivers such as Yewa, Imede, Ogun, Osun into the sea through the Lagos harbour entrance. Lekki lagoon has no link with the sea so its water is fresh. Badagry creek used to be brackish but since Benin Republic shut down its channel, the sea water inflow had been reduced to trickles, making it somewhat fresh water (NOMR, 1989).

3.2 Source of data

Primary and secondary data were gathered for this study. Primary data were collected by means of structured questionnaire administered to respondents from fishing communities. Secondary data were sourced from government establishments such as FDF NIOMR and LSADA. Data were collected on personal data of respondents comprising of sex, marital status, age, family size, educational status primary and secondary occupation; annual income range, membership of social or organized interest group; fishing practice fish landing information, government assistance, fishing input purchased and fishing operation constraints.

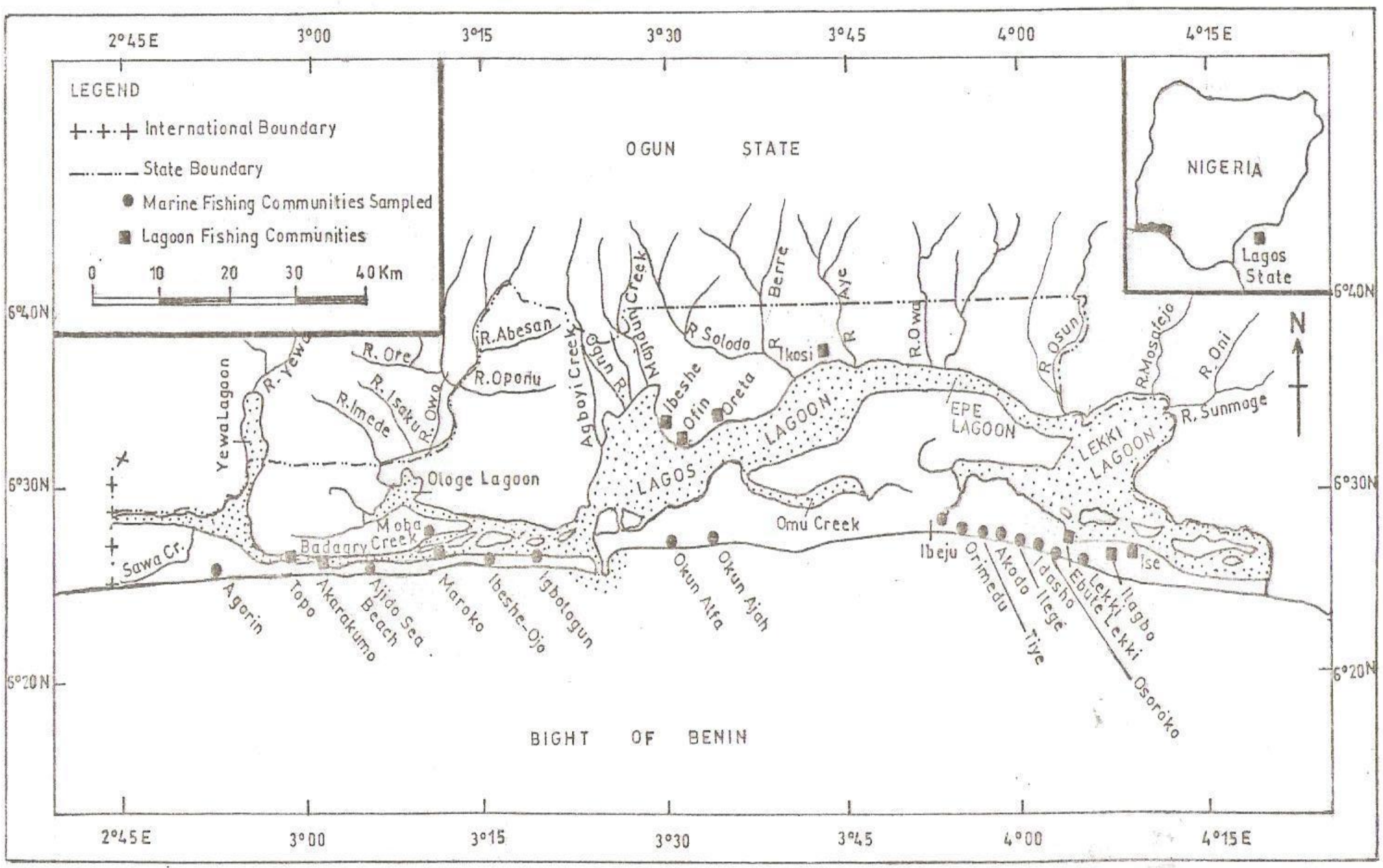
3.2.1 Sampling procedure and sample size

LSADA, an extension implementing parastatal of the Ministry of Agriculture and Cooperatives covers the entire Lagos State. Under the LSADA administrative structure, Lagos State is divided into three operational zones. The Western, Eastern and Far Easterner Zones (Figure 2).

The Western Zone extends from Lagos Mainland axis (Ebute metta, Apapa, Ikeja, Ojo) and ends in Badagry at the Seme border of Benin. The Eastern Zone starts from Oworonshoki axis (around the foot of the third Mainland bridge) spanning the whole of the old Ikorodu division while the Far Eastern covers Lagos Island, Eti-Osa, Epe and Ibeju Lekki

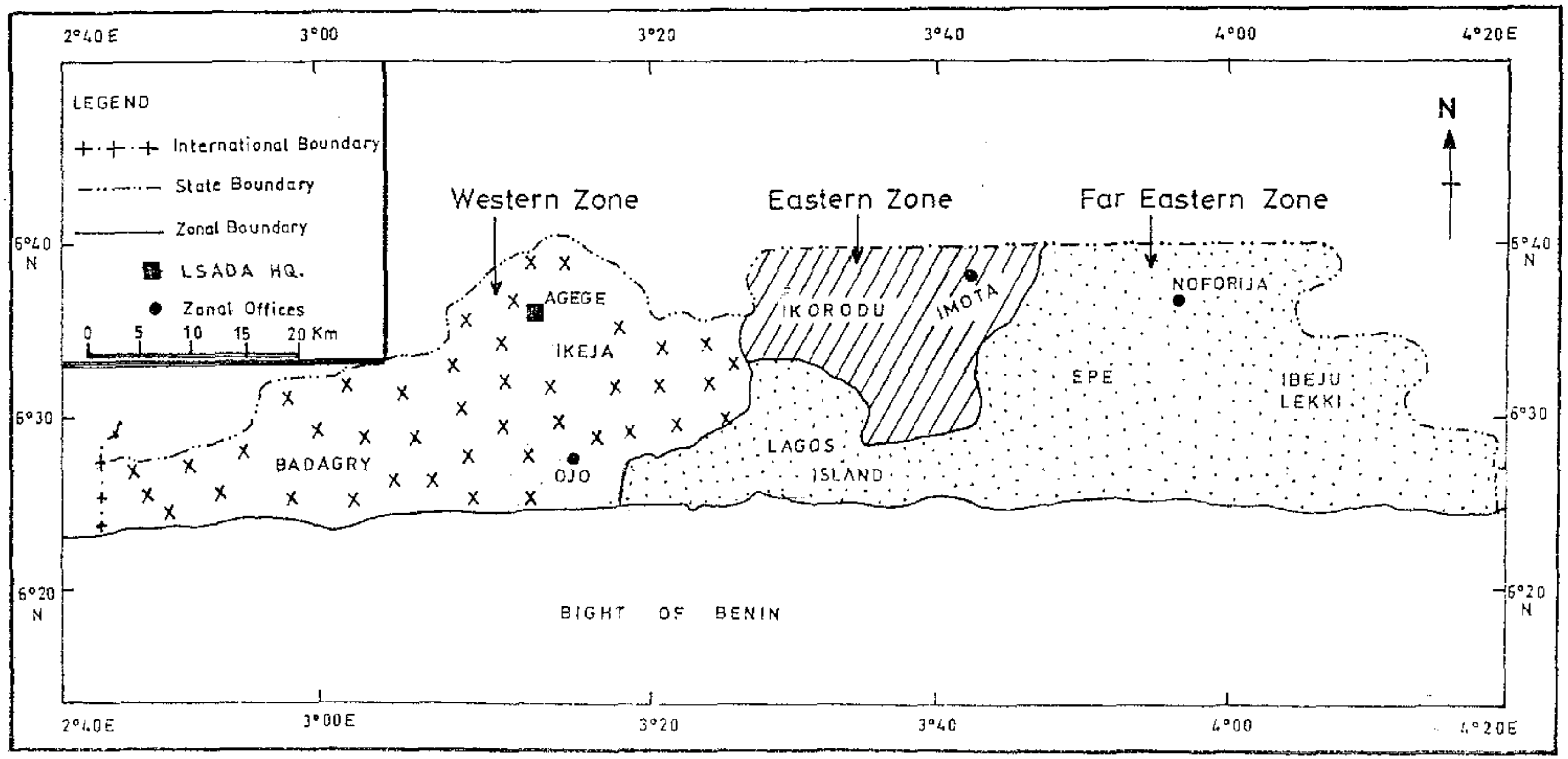
Based on LSADA operational divisions, the Western and Far Eastern zone contain Lagoon, marine and riverine communities, where fishing activities are more prominent especially in the lagoon and Marine water bodies than in the rivers. The sampling methods took this into consideration.

A multi-stage sampling technique was used in this study. Based on the village listing survey report of Lagos State Agricultural Development Authority (LSADA), thirty six (36) communities comprising of eighteen (18) marine and eighteen (18) lagoon communities were randomly selected out of the 110 fishing communities visited by the extension agents (as shown in Table 7). Consequently, random selection of ten fishing households from each community through oral interview conducted at fishing



Source : Field Survey, 2006.

Figure 1a: Relative coverage of water bodies in Lagos State.
b: Insert: Map of Nigeria showing Lagos State.



Source: Field Survey 2006.

Figure 2. Map of Lagos State showing the three operational zones of LSADA Oko Oba Agege

landing sites, beach or jetties was done. A total of three hundred and sixty (360) respondents were thus obtained. However, three hundred and forty six (346) questionnaires were used for data analysis because fourteen (14) questionnaires were rejected due to inconsistencies in information provided.

3.2.2 Methods used for the different data Collection

(a) The indices used to measure the socio-economic characteristics in the questionnaire were age, gender, marital status, household size, educational status, secondary occupation distribution pattern, fishing experience of respondents; and also physical and financial constraints associated with fishing operations. The physical factors considered were problems such as trawler menace, climatic and vegetative growth on water bodies that hampered the smooth operation of fishing trips. The financial factors considered included (i) ready availability of fund, (ii) interest rates on loans, (iii) high cost of inputs and sub-standard inputs.

(b) The indices used to measure the technical efficiency in the questionnaire were (i) labour used during fishing trips and sorting of fish, (ii) canoe length as proxy for volume, (iii) engine capacity of out board engine, (iv) hours spent on each trip; (v) age of fisherfolks; and (vi) membership of cooperative societies.

(c) The profitability indices used were cost of inputs and return on out puts to fisherfolks in Naira, fixed and variable cost and revenue from fish landing. The administration of questionnaire and data collection was done in (August 2005 – July 2006.

3.3 Method of Data Analysis

A number of analytical techniques were used to analysed the data collected:

(a) Descriptive statistics such as means, cumulative frequency, percentage, were used,

(b) Fishing budget analysis was carried out to estimate costs and returns to artisanal fishing.

(c) Stochastic frontier production function was specified to determine technical efficiencies of fisher folks.

Table 7. Sampled Areas: Marine and Lagoon Fishing Communities

Sampled Marine Fishing Communities	Sampled lagoon fishing communities
Akarakumo Sea beach	Makoko
Aivoji	Ibeshe-Ojo
Ajido Sea Beach	Ajido
Agorin	Igbologun
Ibeshe	Topo
Yovoyan	Akarakumo
Sakpo	Owode-Ibeshe
Ashipa	Ipakodo
Apese	Offin
Okun Alfa	Oreta
Okun Ajah	Ebuta Iga
Orimedu	Agbowa Ikosi
Ilege Idaso	Ebute-Erepoto
Idaso	Ilagbo
Akodo	Ibeju Agbe
Tiye	Ebute Afuye
Osoroko	Ise

Source: 2006 Field Survey

3.1.1 Cost and Return Analysis (Gross Margin and Net fishing income)

To determine the profitability of artisanal fishing, cost and return analysis, was carried out. The mathematical notation for the analysis is presented below:

(i) Total Fixed Cost (TFC): Total fixed cost monthly depreciated value of fishing net, O.B.E, Canoe etc). Straight-line depreciation method was used for the analysis

(ii) Total Variable Cost (TVC) included cost of item such as fuel, oil, canoe, net repair and labour.

(iii) Revenue (R) calculated from (fish landing in kg and price per kilogram)

(iv) Monthly Total Cost (MTC) = TFC + TVC

(v) Revenue: quantity of fish landed per trip x price of fish per kilogram.

The gross margin and net fishing income of fisher folks in the selected communities was calculated using the mathematic notation presented below:

(vi) Gross Margin (GM) = MTR – MTVC

(vii) Net Fish Income (NFI) = MTR – MTC

3.3.2 Efficiency Estimation

Stochastic frontier production function was used to determine the effect of socioeconomic variables on the technical efficiency and level of inefficiency of fisherfolks. The analytical framework is presented as follows:

3.3.3 Stochastic Frontier Production

Following Aigner *et al.*, (1977) and Meeusen and Van de Broeck (1977) method of estimating a stochastic frontier production function in which the disturbance term (E) is composed of two parts, a systematic term (v) and one-sided component (D), a Cobb-Douglas production function of the following form was specified:

$Q = g(X_{aj}\ \beta)$ ………………………………………………… Equation 1

Where Q is the quantity of agricultural output, Xa is vector of input quantities and β is a vector of parameters

Σj = (error term) is defined as

$\Sigma j = vj + uj$ J=1,2………..n fisherfolks ……………. Equation 2

On the assumption that U_j and Vj are independent, the parameters of the production frontier (equations 1 & 2) were estimated using maximum likelihood estimation method by an econometric software called FRONTIER Version 4.1 (Coelli, 1988). The farm specific technical efficiency (TE_n) of the nth fisherfolk was estimated by using the expectation of Uj conditional on the random variable E_j as shown by Battesse and Coelli (1996), That is,

TEj =exp (-Uj) ……………………………………………….Equation 3

So that Q: STE_j :…………………………………………….Equation 4

To empirically measure efficiency, the first step is to estimate a stochastic production frontier and then use the approach introduced by Jondrow et al. (1982) to separate the deviations from the frontier into random and an efficient component

(Q = f(Xa;β) +Σ. ……………………………………………………….Equation 5

Where Σ = v – u ………………………………………………….. Equation 6

Where Q is the firm's observed output adjusted for the Q = f(Xa;β) – u = Q – v statistical noise captured by v. The use of the single-equation model depicted in equation (8) is justified by assuming that farmers maximize expected profits, as is commonly done in studies of this type (Zellner, *et al.* 1966; Kopp and Smith, 19980; Care and Barton, 1990; Bravo-Yreka and Evenson, 1994; Awotide, 2004; Awotide *et al.*, 2005).

Q = f(X_{aj}β) – u = Q-v ……………………………………………………..Equation 7

If the functional form of the production frontier is self- dual, for example Cobb-Douglas, then the corresponding cost frontier can be derived analytically and written in general from as:

$C = h(Q; \gamma) + \in_j$ ………………………………………..Equation 8

Where C is the minimum cost associated with the production of Q, and γ is a vector of parameters.

$\in_j$=(error term) is defined as

$\in_j = v_j + u_j$ j = 1,2,……….. n fisherfolks

Allocative efficiency of farm j (AE_j) is given by:

$AE_j = exp(+u_j)$ …………………………………………………Equation 9

The efficiency estimates from the cost function, exp(+U) must be > 1 because U > 0, by construction. AE_j obtained in equation 14 were inverted so that $0 \leq AE_j \leq 1$ (Awotide, 2004).

In this cost function, the non-negative random variable u_j which are assumed to account for the cost of inefficiency defines how the farm operates above the cost frontier. If allocative efficiency is assumed (Coelli, 1996), the non-negative random variable u_j is closely related to the cost of technical inefficiency.

Following Farrell (1957), equations 7 and 8 can be combined to obtain the economic efficiency (EE) index:

EE = (AE) * (TE) ……………………………………………………………Equation 10

For the purpose of this study, the specific model estimated as adopted by Coelli (1996) are:

1. A Cobb Douglas production frontier

$\text{In } Q = \beta_0 + \beta_1 1_n X_1 + \beta_2 1_n + X_2 + \beta_3 1_n X_3 + \beta_4 1_n X_4 + \beta_5 1_n X_5 (V_1\text{-}U_1)$ Equation11

Where

Q = Annual total fish output (kg)

X_1 = labour input in man hours

X_2 = Length of canoe

X_3 = Outboard engine capacity in horse power

X_5 = Number of hours per trip in hours

β_1 = Parameter to be estimated (I = O, 1,2,3,4,5)

U_t = is the two-sided, normally distributed random error

U_1 = is the one-sided efficiency component with a half-normal distribution

2. A Cobb-Douglas cost frontier

$\text{In } (C_i) = \delta_0 + \delta_1 \text{ In } Q_i + (v_i + u_I)$……………………….. Equation 12

Where

C = Cost incurred in fish production (₦)

Q = Output of fish in Kg

δ = parameters to be estimated (i = 0, 1, 2)

v = is the two-sided, normally distributed random error.

u	=	is the one-sided efficiency component with a half-normal distribution

3.3.4 Inefficiency model

Multiple regression analysis was used to investigate the association between efficiency indices and six socioeconomic characteristics. The level of efficiency, which is the dependent variable, lies between 0 and 1; the model is specified as:

In EI = $\beta_0 + \beta_1\ 1_n\ X_1 + \beta_2\ 1_n + X_2 + \beta_3\ 1_n\ X4 + \beta_4\ 1_n\ X_4$ ....$\beta_6\ 1_n\ X_6 + e$ .... Equation 13

EI	=	levels of efficiency
X_1	=	age of the fisherfolk in years
X_2	=	fishing experience in years
X_3	=	Amount of secondary income in Naira
X_4	=	Type of fishing gear
X_5	=	membership of cooperatives society (1-yes, 0=no)
X_6	=	Type of canoe
β	=	parameters to be estimated (i=0, 1, 2, 3, 4,5)
e	=	Error term

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results and discussion of the (i) socio-economic characteristics of the fisherfolks, (ii) profitability structure of artisanal fishing, (iii) efficiency of fisherfolks, (iv) factors affecting efficiency levels of fisherfolks and (v) the constraints to artisanal fishing in Lagos State.

4.1 Socio-Economic Characteristics of Artisanal Fisherfolks

The section presents the results and discussion of the socio-economic characteristics of the fisherfolks. There are age, educational level, sex, household sizes, marital status, occupational distribution etc.

4.1.1 Sex of Respondents

The distribution of respondents by sex shows that 96.8% were male and 3.2% were females (Table 8), however the general distribution of respondents by gender based on water bodies shows that 100% male were found in the marine communities while 93.9% males and 6.1% females were found in the lagoon communities. The finding showed that more males are involved in active fishing in the two water bodies than females. This is similar to the findings by Wokoma (1991a) and Adekoya *et al.* (2000) that fishing trips at sea and landing at the beach involve a lot of physical exertion which is considered to be beyond the female capabilities. The few women, who were sampled in the lagoon communities, were those who set traps and handnets for crabs, shrimps at the lagoon back waters. Majority (75%) of females deal exclusively with processing, preservation, storage and marketing of fish (Adekoya *et al* 1993; Fregene, 2002; Williams 2002).

4.1.2 Marital Status of Respondents

The marital status of the respondents is presented in Table 9, the general distribution of the marital status shows that 3.2% are divorced, 93.4% are married, 1.2 are single while 2.0% are widowed. In the marine communities, 4.8% are divorced, 94.6% are married and 1.0% is widowed while no bachelor respondent was interviewed. In the lagoon communities, 1.7% are divorced, 92.8% are married and 3.3% are widowed while 2.2% are single respondents.

4.1.3 Age Distribution of Respondents

Table 10 shows the number of fisherfolks in each age range and the percentage represented by each range. The age distribution ranges between 30 and 70 years plus, with majority (54.3%) falling within 41-50 years age bracket. The age groups 30-40 years, 51-60 years, 61-70 years and above 70 years had percentage frequency of 13.9%, 26.3%, 4.6% and 0.9% respectively. In the marine and lagoon communities, the highest percentage frequencies of 69.3% and 40.6% respectively were recorded for age group 41-50 years. The age group 30-40 years had 7.2% and 20% respectively for marine and lagoon respondents. In the 51-60 + years age range, marine respondents had 21.7% while lagoon had 30.6%. The lowest percentage frequency of 1.8% (marine) and 7.2% (lagoon) were recorded for age range of 61-70 years. Marine respondent was recorded for above 70 years while 1.7% only was recorded for lagoon respondents. The distribution of 7.2% and 20% respectively recorded for marine and lagoon age range 30-40 years is indicative of the dearth of able bodies young men in artisanal fishing and this can be attributed to rural-urban drift. If viewed from the aspect of capital requirement, the lagoon respondents appear to be more than those of marine due to the fact that investment capital required or marine artisanal establishment is considerably higher for someone starting out in life without subsidy or credit facilities to fall back on. This view is in line with the observation of Omitoyin (2009) who asserted that the age of an individual has implications on the experience and decision making ability. Younger individuals are less trusted by some micro-credit provider and would prefer to give credit to older men. In the marine communities, the age range of 61-70 years and above 70 years had 1.8% and no respondent respectively. This trend is reflective of the stress and energy sapping exercise involved in going far into the sea and landing afterward, which may be rather too much for the elderly. In the lagoon communities, the age range distribution of 61-70 years and above 70 years had 7.2% and 1.7% respectively. The implication of this distribution is that a healthy elderly man can still go fishing in the lagoon, setting gillnets and traps, which is not as stressful and energy sapping as the sea operations.

Table 8. Sex Distribution of Respondents

	Marine		Lagoon		Combined	
Gender	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Male	166	100	169	93.9	335	96.8
Female	-	-	11	6.1	1'1	3.2
Total	**166**	**100**	**180**	**100**	**346**	**100.0**

Source: Field Survey, 2006

Table 9. Distribution of Marital Status of Respondents

Marital	Marine		Lagoon		Combined	
Status	Freq.	%	Freq.	%	Freq.	%
Divorced	8	4.8	3	1.7	11	3.2
Married	157	94.6	167	92.8	324	93.4
Single	-	-	4	2.2	4	1.2
Widow	1	0.6	6	3.3	7	2.0
Total	**166**	**100**	**180**	**100**	**346**	**100.0**

Source: Field Survey, 2006

Table 10. Age Distribution of Respondents

Age Range (years)	Marine		Lagoon		Combined	
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**
30 – 40	12	7.2	36	20.0	48	13.9
41-50	115	69.3	73	40.6	188	54.3
51-60	36	21.7	55	30.6	91	26.3
61-70	3	1.8	13	7.2	16	4.6
Above 70	-	-	3	1.7	3	0.9
Total	**166**	**100**	**180**	**100**	**346**	**100.0**

Source: Field Survey 2006

4.1.4 Household Size

Table 11 shows the distribution trend of the household size of respondents. The household size range of 6-9 represented the highest frequency of 45.1%. This is closely followed by household size range 2-5 with 43.4%. the respondents with household size range of 10 and above has the least frequency of 11.6%. the average household size range of 6-9 in the marine has the highest frequency of 51.2% while the average for lagoon is 2-5 with frequency of 48.9%. In the marine and lagoon, 11.4% and 11.7% respectively had 10 and above household size range. As the household size range increases the frequency distribution of respondents' decreases. The average household size for marine (6-9) is higher than that of lagoon (2-5). Majority of fisherfolks, especially the marine, are known to have more than one wife and therefore large family size. For the household range of two and less than five, the family may be in early stage of their marital life. The large family size may also have economic undertone especially when there are males (Sesabo, *et al*, 2005).

4.1.5 Educational Status of the Respondents

The respondents that had primary, secondary vocational and quoranic education in the marine and lagoon communities were regarded as being literate while those without were considered as illiterate. Table 12 shows that a large percentage (45.4%) attended primary school, followed by secondary school (27.4%) while 19.1% are illiterates. The high level of literacy may be as a result of existence of free primary education in the old western region of Nigeria which included Lagos State, in the early sixties. The finding implied that the level of literacy is relatively high among the sampled fisherfolks and could have implication for artisanal fishing in the study area. According to Azha (1991), education affects productivity in two distinct ways, via choice of better inputs and out output (allocative efficiency effects), and better utilization of existing inputs (technical efficiency aspects). The high level of literacy observed in this study corresponds with Horemans' (2006) findings that in Uganda, Nigeria and Gambia, level of school attendance in fishing communities is very high (60-80%) but fisherfolks do not have enough functional skills to access resources and to understand official documents. He

Table 11. Household Size

Household Size	Marine Freq.	Marine %	Lagoon Freq.	Lagoon %	Combined Freq.	Combined %
2 – 5	62	37.5	88	48.9	150	43.4
6 – 9	85	51.2	71	39.4	156	45.1
10 and above	19	11.4	21	11.7	40	11.6
Total	**166**	**100**	**180**	**100**	**346**	**100.0**

Source: Field Survey, 2006

Table 12. Educational Status of Respondents

Education	Marine		Lagoon		Combined	
Status	Freq.	%	Freq.	%	Freq.	%
None	31	18.7	35	19.4	66	19.1
Primary	93	56.0	64	35.6	157	45.4
Quoranic	-	-	5	2.8	5	1.4
Secondary	34	20.5	20.5	33.3	94	27.4
Vocational	8	4.8	4.8	8.9	24	6.9
Total	**166**	**100**	**180**	**100**	**346**	**100.0**

Source: Field Survey, 2006

opined that literacy and education are crucial for fisheries management, environment conservation and livelihoods diversification. Hence education provider should concentrate more on appropriate functional literacy such as being able to deal with satellite navigation, use of new information and digital technologies such as Global System for Mobile Communication (GSM) and internet usage rather than formal schooling. Pigozzi (2003), supported the above view by stating that a quality education understands the past, is relevant to the present, and has a view to the future. According to Wilson (2008), one promising vehicle for social capital development is service learning especially among the youth where community service work is combined with literacy and or workmanship development.

4.1.6 Secondary Occupation of Respondents

Among the artisanal fisherfolks, it was observed that farming was the most popular secondary occupation apart from their main pre-occupation. Table 13 shows that farming was 43.6%, while those who claimed not to have any form of secondary occupation was 23.1%. 18.2% were involved in trading, 15% representing others were boat builders/repairer OBE mechanics, net repairer/fabricator, (plate 11) carpenters, processors, fish farmers etc. In the marine communities, farming was 51.8% with trading (15.8%), and other types (13.3%). In the lagoon communities, the secondary occupation with the highest frequency is farming, 36.1% while trading and other types was 20.6% and 16.5% respectively. In the marine communities, apart from subsistence farming, majority of those who claimed to be farmers had inherited ageing coconut plantations which they harvested frequently for sales while those in the lagoon-rural communities, may be into subsistence crops and vegetable farming. (Plate 1). Those respondents in the marine communities who claimed not to have any form of secondary occupation might be migrating fishermen or fulltime fishermen who followed fish movement. In the case of lagoon respondents who do not have secondary occupation majority of them are preoccupied throughout the day using different gears such as cast net, set gill nets, and traps. (Plates 7, 9). Alongside regular fishing, some are also into another form of fishing from the wild, referred to as Acadja (a form of cage culture). Majority of those involved in trading in their spare time, are into fishing input sales such as net bundles, ropes,

Table 13. Secondary Occupation Distribution Pattern

Secondary	Marine		Lagoon		Combined	
Occupation	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
None	32	19.3	48	26.7	80	23.1
Farming	86	51.8	65	36.1	151	43.6
Others	22	13.3	30	16.7	52	15.0
Trading	26	15.7	37	20.6	63	18.2
Total	**166**	**100**	**180**	**100**	**346**	**100.0**

Source: Field Survey, 2006

twines, OBE spare parts and other fishing accessories. The diversification into different secondary occupations as observed in this study is similar to findings by many fisheries researchers. [Fregene, (2002); Akanni *et al*, (2007); Berach, (2003); SOFI (2000)]. This study by Anosike and Coughenour (1990) cited by Awoyemi 1999; Akanni *et al*, 2007; Berachi, 2003; SOFI 2000), corroborated their findings that artisanal fishermen also engaged in other economic activities to supplement their low fishing incomes. These activities included subsistence farming, trading, hunting, livestock, repairing, labour, artisanal and tailoring etc. A fisheries study in Tanzania, asserted that increase in agricultural income might reduce the financial constraint, particularly for the resource poor small-scale fishing households and enable them to invest in fishing households ad enable them to invest in fishing input such as fishing boats, thereby increasing productivity (Sesabo and Tal 2005).

4.1.7 Fishing Experience of Respondents

Fishing activities revolve round the type of water bodies, the experience of the operator, and the means of operation. Fisherfolks carry out their fishing activities in the marine, lagoon, rivers, lakes and swampy environments. They operate both at night and in the daytime using their crafts and gears. Therefore, skill in handling of tools and mode of operation can partially determine quantity of fish captured. In the absence of formal training, such skills are acquired over years. This categorization of fishing experience is shown in Table 14. Among respondents interviewed, the percentage frequency distribution with fishing experience of 16 to 20 and above 20yers is very close, 33.2% and 33.5% respectively. In the category of 6-10 and 11-15 years, the percentage frequency is very close too, 11.3% and 10.4% respectively while those respondents with less than five years of experience have the least percentage frequency of 9.5%.

In the marine communities, respondents with fishing experience in the 16-20yers category are in the majority, 45.8%, followed by those above 20 years, 23.5%. The percentage distribution in the below 5 years, 6-10 years and 11-15 years are not clearly defined as they are 10.2%, 9.6% and 10.8% respectively. In the lagoon communities, above 20 years of experience has the highest frequency of 46.7%, followed by 16-20 years, with frequency of 21.7%. Below 5 years of experience, in the lagoon has the least frequency distribution 8.9%. In the marine, above 20 years of experience, the percentage distribution decreased nearly by 50%. Whereas at above 20years in the lagoon communities the percentage distribution increased aversely. The above observations confirmed the trend of early retirement of most artisanal fisherfolks in the marine communities when compared with lagoon fisherfolks, (Table 14). The result further affirmed the strenuous nature of marine fishing operations and consequently less people stay on in the enterprise beyond 20 years compared to lagoon fishing. In a fisheries study conducted in Tanzania Coastal villages, Sesabo and Tol (2007) affirmed that fishing household's head, which represent the human capital, has a positive impact on efficiency, in that it enables heads of households to have information on fishing grounds, where fish go and spawn, and water currents. Their findings also confirmed the finding in this study, with their average fishing experience of crew members as 17.8 years.

4.1.8 Monthly Fishing Income of Respondents

The frequency distribution of the monthly fishing income of the respondents in the study area are presented in Table 15 and 16 while summary statistics are presented in Table 17, Table 15 revealed that majority of respondents in the marine communities (33%) have monthly income in the range of ₦70,001 to ₦80,000 while in the lagoon communities majority of respondents (49%) have monthly income in the range of ₦20,000 to ₦30,000 (Table 16), Table 17 shows the mean monthly income for marine respondents as ₦76,711.0 while that of lagoon was ₦30,538.00. Table 17 which shows the t-test for equality of means of monthly fishing income of marine and lagoon water bodies revealed that the average monthly fishing income of marine (₦76,711.0) was significantly different ($p<0.01$) from lagoon (₦30,538). Further analysis revealed that the net fishing income for marine (₦51,359) was significantly different ($p<0.01$) from lagoon (₦13,746).

Chi-square test of monthly fishing income and some socio-economic characteristics across water bodies revealed that for lagoon, there was significant difference ($p<0.05$) in monthly fishing income across gender as presented in table 19. In addition, there was significant difference ($p<0.01$) and $p<0.05$) in monthly fishing income across age groups in marine and lagoon respectively as presented in Table 20. Finally, there was also significant difference in the fishing income for fisherfolks who were members of co-operation societies as presented in Table 21.

Table 14. Fishing Experience of Respondents

Experience in Years	Marine		Lagoon		Combined	
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**
<5 years	17	10.2	16	8.9	3.3	9.5
6 – 10	16	9.6	23	12.8	39	11.3
11 – 15	18	10.8	18	10	36	10.4
16 – 20	76	45.8	39	21.7	115	33.2
> 20	39	23.5	84	46.7	123	33.5
Total	**166**	**100**	**180**	**100**	**346**	**100**

Source: Field Survey, 2006

Table 15. Frequency distribution of monthly fishing income of marine respondents

Income Category	Frequency	Percentage
6000 ≤ 70000	51	30
700001 ≤ 80000	54	32.53
80000 ≤ 90000	53	31.93
> 90000	8	4.82
Total	**166**	**100**

Source: Field Survey, 2006

Table 16. Frequency distribution of monthly Percentage income of lagoon respondents.

Income Category	**Frequency**	**Percentage**
< 20000	28	15.56
20000 ≤ 30000	89	49.44
300001 ≤ 40000	44	24.45
400001≤ 50000	13	7.22
< 50000	6	3.33
Total	**166**	**100**

Source: Field Survey, 2006

Table 17. Summary Statistics of Monthly Fishing Income

Water Body		Monthly Fishing Income (Naira)
Marine	Mean	76,711.00
	Number	166
	Std. Deviation	9493.90
Lagoon	Mean	30,538.00
	Number	180
	Std. Deviation	2,1204.43
Pooled data	Mean	52,690.00
	Number	346
	Std. deviation	2,846.13

Source: Field Survey, 2006

Table 18. t-test for equality of means of monthly fishing income of marine and lagoon water bodies

	F	Sig.	T	df	Sig. (2-tailed)
Equal variances assumed	3.414	0.066	25.772	344	0.000
Equal variances not assumed			26.478	252.342	0.000

Sources: Field Survey, 2006

Table 19. Chi-square test of Monthly Fishing Income by Sex by Water Bodies

Water body		Value	Df	Asymp. Sig. (2-sided)
Marine	Pearson Chi-square	“		
	N of Valid Cases	166		
Lagoon	Pearson chi-square	68.5844[b]	39	0.002
	Likelihood Ratio	37.305	39	0.547
	Linear-by-Linear Association	2.299	1	0.129
	N of Valid Cases	180		

Source: Field Survey, 2006

Note

a. No statistics are computed because sex is a constant

b. 72 cells (90.0%) have expected count less than ‘5. The minimum expected count is. 06.

Table 20. Chi-Square Test of Monthly Fishing Income By Age By Water Bodies

Water body		**Value**	**df**	**Asymp. Sig. (2-sided)**
Marine	Pearson Chi-square	5.638E2[a]	368	
	Likelihood Ratio	348.637	368	0.759
	Linear-by-Linear			
	Association	0.046	1	0.829
	N of Valid Cases	166		
Lagoon	Pearson Chi-Square	1.4653[b]	1365	0.030
	Likelihood Ratio	476.599	1365	1.000
	Linear –by-Linear			
	Association	0.212	1	0.646
	N of Valid Cases	180		

Source: Field Survey, 2006

Note

a. 408 cells (100.0%) have expected count less than 5. The minimum expected count is .01.

b. 1440 cells (100.0%) have expected count less than 5. The minimum expected count is. 01.

Table 21. Chi-Square test of Monthly Fishing Income by Membership of Cooperative Society by Water Bodies

Water body		Value	df	Asymp. Sig. (2-sided)
Marine	Pearson Chi-square	48.796[a]	16	0.000
	Likelihood Ratio	63.681	16	0.000
	Linear-by-Linear Association	10.128	1	0.001
	N of Valid Cases	166		
Lagoon	Pearson Chi-Square	26.894[b]	39	0.566
	Likelihood Ratio	44.425	39	0.254
	Linear –by-Linear Association	0.012	1	0.912
	N of Valid Cases	180		

Source: Field Survey, 2006

Note

a. 24 cells (70.6%) have expected count less than 5. The minimum expected count .49.

b. 71 cells (88.8%) have expected count less than 5. The minimum expected count is.24.

4.2 Respondents Fishing Gear Types

The fishing gear types as presented in Table 22 revealed that majority of lagoon respondents (90%) used cast net while 5.6% and 3.9 used gillnet and traps respectively. Majority of respondents in the marine (51.8%) used hooks and line (in different forms) while 31.9% and 9.0% used surrounding nets and beach seine nets respectively. Appropriate gears relevant to the water terrain and the fish species sought, were applied. For instance, long lines (a type of hook and lines) are used by fisherfolks looking for *Arius gigas* on rocky bottom sea portion whereas traps are set in relatively calm portion of lagoon streams, Creeks, swamps, having shallow depths. Cast nets and gill nets are used in lagoon for schools of fish.

4.3 Fishing Operations Constraints

The problems faced by fisherfolks during fishing operations fall into different categories. These are basically physical and financial problems. Physical problems include stormy weather, turbulence, water hyacinth, trawler menace, capsizing of canoe and loss of (OBE). Financial, problems identified were lack of fund, high cost of inputs, lack of credit facilities, high interest rate on loans and inconsistent government policies. These two major problems go a long way to determine the rate of operation or lack of operation by fisherfolks.

4.3.1 Physical Constraints

A few of the problems encountered during fishing operations by fisherfolks were trawler Menace, stormy weather, turbulence, loss of outboard engine, capsizing of canoes and water hyacinth (*Eichornia crassipes).* (Table 23)

Table 22. Respondents Fishing Gear Types

	Marine		Lagoon		Combined	
	Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**
No response	12	7.2	1	0.6	13	3.8
Cast net	-	-	160	90.0	160	46.8
Gill net	-	-	10	5.6	10	2.9
Traps	-	-	7	3.9	7	2.0
Hooks and line	86	51.8	-	-	86	24.9
Beach seine net	15	9.0	-	-	15	4.3
Surrounding net	53	31.9	-	-	53	15.3

Source: Field Survey 2000

4.3.2 Trawler Menace

The number of respondents that experienced trawler menace or who had witnessed its occurrence are shown in Table 23 (section A). In the marine communities, 77.7% of the respondents had at one time or the other suffered from trawler menace while 22.3% had never encountered the problem. In the lagoon communities, 71.7% of respondents never experienced trawler menace but 28.3% of respondents had witnessed its occurrence or had relations that were affected. Trawlers have their limits in the territorial waters. They are not expected to move close to shore beyond a distance of 5 nautical miles from the shore line. From the beach, to 5 nautical miles is the area earmarked for artisanal fisheries activities.

However, these trawlers cruised closer as near as 4 to 3 nautical mile to the beach, especially in the western zone of Lagos State, thereby constituting menace to fishing gears (set nets) and sometimes crafts (canoes). Furthermore, 71.7% of the respondents from the lagoon communities and 22.3% from the marine communities who never experienced trawler menace are those who are remotely located from the trawlers path. The lagoon communities are not affected because trawlers do not traverse their water ways.

4.3.3 Stormy Weather-In Association with other physical Constraints

Table 23 shows physical constraints along with stormy weather. Rainfall a natural phenomenon, does not cause any havoc but at the height of rainy season, when unfavourable weather condition prevails, such as heavy rainfall, accompanied by strong winds and severe turbulence, it is suicidal to attempt to go fishing. Under such condition fisherfolks may experience operational constraints such as turbulent wave actions, loss of OBE capsizing of canoe. In the marine communities the percentage frequency of respondents that have experienced stormy weather, trubulent wave action, loss of OBE and capsizing of canoe are 70.5%, 75.9%, 89.2%, 91% while in the lagoon communities, the % frequency are 80%, 90%, 46.7%, 58.3% respectively. The respondents further volunteered information in respect of loss of OBE and capsizing of canoes, with the fact that damage engine mount or some loose screws may further aggravate accidents due to stormy weather actions. In the case of capsizing of canoes or loss of canoes, the situation may also be as a result of leaking or damaged canoes or an encounter with speed boat. The low percentage frequency of 46.7% and 58.3% respectively recorded for lagoon respondents may be due to adherence or off-season faming activities instead of fishing.

4.3.4 Water Hyacinth (*Eichhornia crassipes)*

Water hyacinth (*E. crassipes)* are water weeds with wide succulent leaves and interwoven thick roots. The leaves are adorned with beautiful purple flowers. It multiplies rapidly on fresh water bodies forming a thick impassable carpet. Table 23 shows that 88.9% of the respondents from the lagoon communities suffered from the effect of water hyacinth invasion while about 21.1% of the respondents from marine communities, close to lagoon, suffered from dried up leaves and roots. Majority of respondents (78.9%) from marine communities were not affected. At the height of rainy season, fresh water from rivers empty into the lagoon turning some brackish water in the lagoons into fresh water. The water hyacinth blossomed and became a hindrance. The weed does not affect fishing operation in the sea or marine communities, as a result of saline sea water which dries off any stray ones. It is a major problem in the lagoon communities, as the leaves and roots form thick interwoven mesh that prevents movement of canoes, casting of nets, or setting of gill nets and traps. Occasionally, it marooned fisherfolks boat during fishing trips, making it impossible for them to go outside their villages or come in from fishing trips. It accounts for one of the factors determining non-fishing periods.

Table 23. Fisherfolks Physical Operational Constraints

	Marine Respondent Frequencies				Lagoon Respondent Frequencies			
	Affected		Not affected		Affected		Not affected	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Trawler menace	129	77.7	37	22.3	51	28.3	129	71.7
Stormy weather	117	70.5	49	29.5	144	80.0	36	20.0
Turbulence wave action	126	75.9	40	24.1	162	90	18	10
Loss of OBE	148	89.2	16	9.6	84	46.7	89	46.7
Capsizing of canoe	151	91	15	9	105	58.3	75	41.7
Water Hyacinth	35	21.1	131	78.9	160	88.9	2	1.1

Source: Field Survey 2006

4.4 Factors Determining Off-Season (Non-Fishing) Period

Fisherfolks do not fish round the year because they experience periods of low catch when it may be dangerous or may not be profitable to go fishing. During this period which is sometimes around August and between September and October, majority of fisherfolks concentrate on their secondary occupations or construction and repair of gears and crafts. New nets and canoe/boat construction are embarked upon. Leaking canoes/boat are mended. Table 24 shows the response from fisherfolks on what they considered as reasons for non-fishing period. It shows that off-season period may be necessitated by stormy weather, turbulent wave action, water hyacinth and low catches, although water hyacinth does not affect majority of marine water communities. Low fish catch is identified by 91% marine and 80.6% lagoon respondents as a problem. Also, turbulent wave action was identified by 75.9% marine and 90% lagoon respondents as problem. In the marine communities, 70.5% of respondents and 80% of lagoon communities agreed that stormy weather is a factor for consideration. Turbulent wave action as a result of strong wind and stormy weather experienced at height of rainy season may be a hindrance to fishing expedition as fatal accidents may occur. Water hyacinths mostly affect lagoon communities (95%) while only a few marine communities respondents (6.5%) were affected as far as water hyacinth is concerned NIOMR (1992). Although some fisheries studies had mentioned that off-season in fishing business as being determined by low fish catch which is due to factors such as violent waves, rate of flow of water and flooding, none had come up with socio-economic implications of this constraint on artisanal fisheries (NIOMR 1992). From the study, physical constraints and low fish catch resulting in off-season in fishing business will affect the income of fisherfolks during this period, extension services may have to be involved in training those that do not engage in income generating or income enhancement activity, ways of generating income to augment the reduced income at this period.

Table 24. Factors Determining Non-Fishing Periods (Off-season)

	Marine Respondent Frequencies				Lagoon Respondent Frequencies			
	Affected		**Not affected**		**Affected**		**Not affected**	
REASONS	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Low fish catch	161	97	5	3.0	145	80.5	-	15.5
Turbulent wave action	126	75.9	40	24.1	162	90	18	10
Water hyacinth	11	6.5	155	934	171	95	9	5
Stormy weather	117	70.5	49	29.5	144	80	360	20

Source: Field Survey 2006

4.5 Financial Constraints of Fisherfolks

The financial constraints directly or indirectly affecting artisanal fisheries operation in the study area include:

i) Lack of fund

ii) Lack of credit facilities

iii) High interest rates on loans

iv) High cost of inputs (out board engine)

v) Cheap hooks and slipping net knots

Table 25 shows that 77.7% and 65.7% marine respondents respectively opined that lack of fund or lack of credit facilities is a big constraint in artisanal fisheries operation while 81.1% and 87.2% lagoon respondents respectively opined that lack of fund or credit facilities did not pose much constraint on their activities. The amount needed for lagoon artisanal operation is not quite much compared with marine artisanal operation. Funding opportunities in the past were directed at marine fisherfolks as they were the beneficiaries of many credit facilities and it was easier to form them into cooperatives as they work mostly in groups. (FAO, 1992; FDF 1994) The investment profile needed for marine artisanal fishing is quite high when compared with lagoon fishing. So, with inadequate funding or unavailable credit facilities, their operation is negatively affected. Along with high interest rate, and high cost of fishing inputs are changing government policies which affect fishing operations negatively. When subsidies are removed or embargo placed on importation, prices of goods increase and sometimes, goods and services needed by fisherfolks cannot be easily accessed. These factors place limitation on their fishing income as they may not be able to purchase the required gears, crafts and outboard engines. Due to harsh economic situation, cases abound of fisherfolks purchasing cheap but substandard goods which are inferior in quality and do not last long. Fisherfolks complain regularly of substandard hooks which get rusty easily and slipping net knots through which fish caught escapes. All these constraints result in economic loss to artisanal fisherfolks.

Table 25. Financial Constraints of Fisherfolks

	Marine Respondent Frequencies				Lagoon Respondent Frequencies			
	Affected		Not affected		Affected		Not affected	
Reasons	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Lack of Fund	126	77.7	37	22.3	33	18.3	146	81.1
Lack of Credit Facilities	10	65.7	54	32.5	21	11.7	157	87.2
High Interest Rate on Loans	108	65.1	58	34.9	29	16.1	29	16.1
High Cost of Inputs	108	65.1	58	34.9	151	83.9	151	83.9
Substandard Inputs	129	77.7	37	22.3	51	28.3	128	71.5

Source: Field Survey 2006

4.6 Road network and Transportation

Table 26 shows the opinions of respondents towards the socio-economic effect of unmotorable roads on artisanal fisheries. Among the marine communities, 68% of respondents agreed that unmotorable road was a constraint to their fishing operations. However, only 26.7% respondents felt the same way among lagoon communities respondents. Field observation revealed that the marine and lagoon respondents who considered unmotorable roads as a constraint were those in remote village with sandy and sometimes marshy terrain that can only be accessed by 4-wheel drive vehicles. Besides, fisherfolks, middlemen and fish mongers also suffered the effect of bad roads. Indirectly, bad roads affected fisherfolks incomes, in that they are at the mercy of the few buyers who managed to get to their communities. Fish spoilage is also experienced during period of bumper harvest or glut resulting from few buyers. More money or increased income should have accrued to artisanal fisherfolks during this period but the reverse is the case, most often. If the roads were motorable, middlemen and fishmongers would easily cart away bumper landings, with resultant increase income.

4.7 Costs and Returns Analysis of Fishing Operation

Gross margin analysis is presented in this section to determine the profitability of artisanal fishing operation in Lagos state. The gross margin per fish landing, defined as the difference between gross revenue and total variable costs is shown in Table 27. It is usually referred to as returns over variable cost and it serves as a proxy measure of profitability. Determination of gross margin from fish production calls for the knowledge of both the revenue and the cost of various inputs. Generally, inputs cost were valued at prices paid by the fisher folks or local market prices as appropriate. Labour was valued at wage rate paid by fisher folks for the operations in the study area. The fish landing information for marine and lagoon respondents are shown on Table 26. It included weekly fish landing in kilogram, number of weeks per month; and price of fish per kilogram. The product of the above factors gave the gross monthly revenue for lagoon and marine respondents respectively. In computing monthly cost of fishing operation, the cost of fixed inputs (such as canoe, nets and OBE) were depreciated using straight-line

Table 26. Road network and Transportation

Constraints	Marine		Lagoon		Combined	
Bad Roads	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Agreed	113	68.1	48	26.7	161	46.5
Disagreed	49	39.5	122	67.8	171	48.4
No response	4	2.4	10	5.6	14	4.0
Total	**116**	**100**	**180**	**100**	**346**	**100**

Source: Computed from 2006 Field Survey

Table 27. Monthly Cost and Returns of Artisanal Fishing Operations

Revenue	Lagoon	Marine	Pool
Fish landing per wk (kg) (a)	36.31	80.28	75.64
No of fish landing weeks (b)	3.45	3.43	3.44
Fish price (N/kg) ©	332.94	296.69	314.76
Fish landing revenue (R=a*b*c*)	41740.36	81644.14	62421.56
Depreciated monthly cost of fixed inputs			
Canoe	288.36	335.56	311.00
Net	74.12	66.98	70.70
Float	6.07	32.00	18.51
Sink	4.38	5.45	4.89
Paddle	4.60	5.55	5.06
Pole	2.02	2.38	2.06
Trap	6.92	5.95	4.46
Rope	4.14	4.67	4.40
Hook	4.21	3.88	4.05
Engine	4.21	3.88	4.05
Total fixed cost (d)	2646.30	4283.56	3431.81
Cost of variable inputs			
Engine maintenance	16.68	37.20	26.53
Petrol	904.39	2132.08	1493.40
Oil	351.11	379.52	364.74
OBE repairs	711.11	533.13	625.84
Canoe repair	290.44	239.16	265.84
Net repair	332.50	225.90	281.36
Monthly labour cost	11,161.11	17,096.39	14,008.67
Total variable cost (e)	13,767.35	20,643.37	17,066.25
Total cost (TC=d+e)	16,808.47	25,389.37	20,925.31
Gross margin (GM=R-e)	27,973.01	61,00.77	45,355.31
Net Farm Income (NFI=R-TC)	24,931.90	56,254.77	41,496.24
Cost Benefit Ratio (CBR=R/TC)	2.50	3.20	3.00

Source: 2006 Field Survey

depreciation method. Cost of variable inputs used, include cost of petrol, net and labour in both communities.

Revenue per month was ₦81,644 for marine while ₦41,740 was for lagoon. Gross margin for marine was ₦61.000 and ₦27,973 for lagoon. Net fishing income was obtained by deducting monthly total cost from revenue. The higher monthly revenue obtained in marine could be due to the level of investment and distance covered by marine fisherfolks. Among the fixed cost items, OBE accounted for 89% and 87% in the marine and lagoon community respectively. Labour cost accounted for 85% of the variable cost item in both the marine and lagoon total cost respectively.

Another profitability index used in the study is the Cost Benefit Ratio. For the fisherfolks in the study areas, the Cost Benefit Ratio is 2.50 for lagoon and 3.20 for marine. The ratio showed that for every ₦1.00 invested in artisanal fish production in lagoon, ₦1.50 kobo would be realized. Similarly, for every ₦1.00 invested in marine yields ₦2.20 kobo suggest may that artisanal fishing in Lagos state was profitable.

4.8 Efficiency Determination of Fisherfolks in Marine and Lagoon Communities

Technical efficiency determination

Frontier production function is a function of fishing efforts and stocks abundance (Hannesson, 1983). In this study, the variables used for frontier production functions are labour (manpower used during fishing trips and sorting), canoe length (as proxy for volume), distance covered during the trip, engine capacity, and hours spent per trip. The results of the stochastic frontier model are presented in Tables 29 and 30 for marine and lagoon respondents respectively. From the maximum likelihood (ML) estimates for the production frontier for the marine fisherfolks, the estimate of λ (0.0429) and (0.376) were significantly different from zero at 1%, indicating a good fit and the correctness of the specified distribution assumption. In the marine artisanal fishing (Table 28), the significant variables were labour, canoe length, distance covered and engine capacity. The coefficient of labour (1.714) was statistically significant at ($P<0.01$) and has expected positive sign, which conform to a priori expectation. The positive sign shows that increasing labour input leads to an increase in artisanal fish output and vice versa.

The estimated coefficient shows that fish output is elastic to changes in labour input. A unit change in labour input result in a more than proportionate change in artisanal fish output. This suggests that labour was significantly associated with changes in fish output in marine fishing. The coefficient of length of canoe (0.334) was statistically significant ($p<0.01$) and has expected positive sign, which conforms to a prior expectation. The positive sign shows that increasing canoe size or fishing with bigger canoes leads to an increase in artisanal fish output and vice versa. One possible explanation is that a bigger size canoe with a higher engine capacity will enable the fisher folk go further and faster into the sea. The estimated coefficient shows that fish output was inelastic to changes in canoe size. A unit change in canoe size will result in a less than proportionate change in artisanal fish output. A 10% increase in canoe size will bring about 3.34% increase in fish output. This also suggests that canoe size was significantly associated with changes in fish output in marine fishing.

The coefficient of distance covered (0.0903) was statistically significant ($p<0.01$) and has expected positive sign, which conforms to a prior expectation (Akanni *et al*, 2007). The farther distance covered, the higher the chances of getting more fish, as the open water competition reduced as well as the number of fisherfolks. The positive sign shows that covering long distance leads to an increase in artisanal fish output and vice versa. The estimated coefficient shows that fish output was inelastic to changes in changes in distance covered. A unit change in distance covered will result in a less than proportionate change in artisanal fish output. A 10% increase in distance covered will bring about 0.9% increase in fish output.

The coefficient of outboard engine capacity (0.162) was statistically significant ($p<0.05$) and has expected positive sign, which conforms to a prior expectation. The positive sign shows that the higher the engine capacity the more the level of artisanal fish output and vice versa. In like manner, a bigger size canoe with a higher engine capacity will enable the fisherfolks go further and faster into the sea. This is important because the nearby coastal waters are usually over exploited and therefore depleted (Akanni *et al*, 2007). The estimated coefficient shows that fish output was inelastic to change in OBE capacity. A unit change in outboard engine capacity will result in a less than proportionate change in

Table 28. Frontier production Function Estimate for Marine Respondents

S/N	Variables	Coefficient	T-Ratio
0.	Constant	1.5113	0.169
1.	Labour (days per month)	01.714	2.144*
2.	Length of Canoe (meter)	0.3344	5.0685*
3.	Distance covered (nautical miles)	0.9031	2.217*
4.	OBE Capacity (horse power)	0.1621	1.800*
5.	Hours Per Trip	-0.02351	-0.316
	Variable parameter		
	Sigma-squared	0.0429	9.319*
	Gamma	0.0376	3.309*
	Log likelihood	25.58	
	Mean efficiency	0.73	
	Observations	164	

Source: 2006 Field Survey

artisanal fish output. A 10% increase in engine capacity will bring about 1.62% increase in fish output. However, for lagoon, none of the coefficients listed above were significant. This suggested that the variables included in the stochastic frontier analysis for the lagoon did not significantly determine the level of artisanal fishing output in the study area (Table 29).

Allocative efficiency determination

Tables 30, 31, and 32 present the results of the Stochastic Cost Frontier for the lagoon, marine and both water bodies respectively. In Tables 30 and 31, the coefficients of output was not significant for the lagoon and marine stochastic cost frontier model. However, for the results presented in Table 31, estimate of λ(1.870) and σ(0.401) are large and significantly different from zero at one percent, indicating a good fit and the correctness of the specified distribution assumption. The coefficient of output (0.1466) is statistically significant at one percent level and has expected positive sign. The coefficient is highly significant and has a positive correlation with the cost of production. This suggested that farmers whose output were high had increased gross margins which may be ploughed back into production, sufficing to say that farmers with higher output have better capacity to employ improved farm input with the associated cost which are usually higher.

4.8.1 Sources of Inefficiency

Studies have shown that socioeconomic, demographic factors, farm characteristics, environment factors and non-physical factors are likely to be sources of inefficiency in crop production and dairy farms (Ali and Chaudhary, 1990; Kumbhakar *et al.*, 1991). Results of the inefficiency model from the stochastic frontier regression analysis are summarized in Tables 33, 34 and 35 in the marine, lagoon and both water bodies. In the marine environment, age, fishing experience, secondary occupation and cooperative membership were the socioeconomic factors that significantly affected the technical efficiency of the fisherfolks. While in the lagoon environment, age, secondary income and membership of cooperative societies were the socioeconomic factors that significantly affected the technical efficiency of the fisherfolks.

Table 29. Frontier Production Function Estimates for Lagoon Respondents.

S/N	Variables	Coefficient	T-Ratio
0.	Constant	2.1724	0.072
1..	Labour (days per month)	0.2374	1.467
2.	Length of canoe (meter)	0.3436	1.026
3.	Distance covered (nautical miles)	0.032	0.432
4.	Hours per trip	-0.0739	-1.114
	Variance parameter		
	Sigma-squared	0.0949	9.347*
	Gamma	0.0229	0.001
	Log likelihood	-40.7115	
	Mean efficiency	0.68	
	Observation	169	

Source: 2006 Field Survey

Table 30. Frontier Cost Function Estimates for Lagoon Respondents.

Variable	Mean	Stochastic Frontier	
	(SD)	OLS	ML
Constant	-	9.6545	9.6347
		(76.311)***	(1.424)
Output (Q)	9.6969	0.00901	0.0090
	(0.25258)	(0.338)	(0.319)
Lambda λ		-	0.098***
			(0.003)
Sigma σ		-	0.2525
			(0.474)
Log likelihood		-	-7.128

Source: Results from data analysis 2006

The numbers in parenthesis are t-values   ***Significant at 1%

Table 31. Frontier Cost Function Estimates for Marine Respondents.

Variable	Mean	Stochastic Frontier	
	(SD)	OLS	ML
Constant	-	10.077	10.137
		(78.458)***	(23.329)***
Output (Q)	10.123	0.0081	0.0082
	(0.18757)	(0.357)	(0.411)
Lambda λ		-	0.413
			(0.138)
Sigma σ		-	0.1963
			(1.577)
Log likelihood		-	42.842

Source: Results from data analysis 2006

The numbers in parenthesis are t-values   ***Significant at 1%

Table 32. Frontier Cost Function Estimates for pooled data.

Variable	Mean	Stochastic Frontier	
	(SD)	OLS	ML
Constant	-	9.1340	9.4342
		(92.703)***	(82.850)***
Output (Q)	9.9014	0.1500	0.1466
	(0.3088)	(7.885)***	(6.962)***
Lambda λ		-	1.870
			(4.211)***
Sigma σ		-	0.401
			(12.492)***
Log likelihood		-	-51.417

Source: Results from data analysis 2006

The numbers in parenthesis are t-values ***Significant at 1%

In the marine water bodies, there was a negative relationship between age and technical inefficiency of the fisherfolks in the study area and the coefficient was significant. ($p<0.05$). This implies that younger fisherfolks were more efficient that the older fisherfolks. The coefficient of fishing experience was negatively but significantly related to technical inefficiency. The implication is that fisherfolks with more years of fishing experience tend to be more efficient in fishing operation in the study area. This, presumably, may be due to their enhanced ability to acquire technical knowledge over time, which makes them closer to the frontier output. The fisherfolks learn from experience good location and signs of fish abundance and this experience certainly enhance the efficiency of the fisherfolks.

Secondary income was negatively related to technical efficiency and the negative relationship was significant at ($p<0.05$) indicating that fisherfolks without secondary income were more efficient than fisherfolks with secondary income. One possible explanation is that substantial part of the secondary income may be used to over employ labour and to purchase excess production inputs. Membership of association operates at lower efficiency level than their counterparts. This is not in line with the general belief that farmers learn from interaction with other farmers.

In the lagoon water bodies, there was also a negative relationship between age and technical inefficiency of the fisherfolks in the study area and the coefficient was significant ($P<0.05$). This implies that younger fisherfolks were more efficient than older fisherfolk. Secondary income was significant $p<0.05$) indicating that fisherfolks without secondary income were more efficient than fisherfolks with secondary income. One possible explanation is that secondary income is diversionary and may result in reduced effort being put into primary income acquisition. Membership of association had a positive and significant effect on technical inefficiency p(<0.05) which suggests that, on average, members of association operate at lower efficiency level than their counterparts. This is not in line with the general belief that farmers learn from interaction with other farmer.

Table 33. Socio-Economic Factors Affecting Technical Inefficiency among the Marine Respondents

Variables	Coefficient	T-Ratio
Constant	1.5130	0.169
Age	-0.251	-1.923*
Fishing experience	-0.061	-2.203**
Secondary income	-0.00588	2.150**
Type of gear	-0.1259	1.880*
Member of association	0.02219	4.920***
Type of canoe	0.4560	1.170

Source: Field Survey 2006

Table 34. Socio-Economic Factor Affecting Technical Inefficiency among the Lagoon Respondents

Variables	Coefficient	T-Ratio
Constant	1.021	0.336
Age	-0.1781	-9.347***
Fishing experience	-0.0557	-1.290
Secondary income	-0.01177	-2.900***
Type of gear	-0.1765	-1.090
Member of association	-0.9086	-2.680**
Type of canoe	0.08779	1.100

Source: Field Survey 2006

In both water bodies (pooled data), there was a negative relationship between age and technical inefficiency of the fisherfolks in the study area and the coefficient was significant. ($p<0.10$). This implies that younger fisherfolks were more efficient that the older fisherfolks. The coefficient of fishing experience was negatively but significantly related to technical inefficiency. The implication is that fisherfolks with more years of fishing experience tend to be more efficient in fishing operation in the study area. This, presumably, may be due to their enhanced ability to acquire technical knowledge over time, which makes them closer to the frontier output. The fisherfolks learn from experience good location and signs of fish abundance and this experience certainly enhance the efficiency of the fisherfolks.

Secondary income was negatively related to technical efficiency and the negative relationship was significant at ($p<0.05$) indicating that fisherfolks without secondary income were more efficient that fisherfolks with secondary income. One possible explanation is that substantial part of the secondary income may be used to over employ labour and to purchase excess production inputs. Membership of association operates at lower efficiency level than their counterparts. This is not in line with the general belief that farmers learn from interaction with other farmers.

Results of the inefficiency model from the stochastic cost frontier model are present in Tables 36 and 37. Table 36 presents the socioeconomic factor affecting allocative inefficiency of both water bodies (pooled data) while Table 37 presents the socioeconomic factors affecting economic efficiency of both water bodies. Allocative and economic inefficiency were conducted for only the pooled data because in the cost frontier, sigma and gamma were not significant for the two water bodies. Tables 36 and 37 revealed that type of canoe had negative and significant effect on allocative inefficiency ($p<0.10$) and economic inefficiency ($p<0.10$).

4.9 Distribution of Efficiency Indices of Marine and Lagoon Fisherfolks

The technical efficiency indices derived from the analysis of the stochastic production are depicted with grouping made at interval of 10. The distribution of the fisherfolks technical efficiency indices is provided in Table 38. The technical efficiency of the

Table 35. Socio-Economic Factor Affecting Technical Inefficiency of Respondents.

Variables	Coefficient	T-Ratio
Constant	1.267	0.253
Age	-0.215	-5.635***
Fishing experience	-0.058	-1.747*
Secondary income	-0.009	-2.525**
Type of gear	-0.151	-1.485
Member of association	-0.456	-3.800***
Type of canoe	0.272	1.140

Source: Field Survey 2006

Table 36. Socio-Economic Factor Affecting Allocative Inefficiency of Respondents.

Variables	Coefficient	T-Ratio
Constant	0.217	3.277***
Age	0.030	0.638
Fishing experience	-0.030	-0.648
Secondary income	0.061	-1.327
Type of gear	-0.076	-1.332
Member of association	-0.024	-0.486
Type of canoe	-0.187	-2.837**

Source: Field Survey 2006

Table 37. Socio-Economic Factor Affecting Economic Inefficiency of Respondents.

Variables	Coefficient	T-Ratio
Constant	0.157	2.912***
Age	0.052	1.046
Fishing experience	-0.030	-0.615
Secondary income	-0.061	-1.253
Type of gear	-0.089	-1.485
Member of association	0.002	0.033
Type of canoe	-0.161	-2.332**

Source: Field Survey 2006

sampled fisherfolks was less than one (or 100%) indicating that all the fisherfolks sampled were operating below the frontier. For the marine, the best performing fisherfolk had a technical efficiency of 0.83 or 83%, while the least performing fisherfolk has a technical efficiency of 0.56 or 56%. Also, the mean technical efficiency of the fisherfolks is 0.73 or 73%. This implied that the fisherfolks were able to obtain about 73% of optimal output from a given set of production inputs. For the lagoon, the best performing fisherfolks had a technical efficiency of 0.83 or 83%, while the least performing fisherfolk had a technical efficiency of the fisherfolks is 0.51 or 51%. This implied that the fisherfolks were able to obtain about 51% of optimal output from a given set of production inputs. The pooled data revealed that the mean technical efficiency was 0.71 or 71%. This implied that the fisherfolks in the study area were able to obtain about 71% of optimal output from a given set of production inputs.

The distribution of technical efficiency of the fisherfolks revealed that none of the fisherfolks had a technical efficiency of less than 50%. In general, the results suggest that the sampled fisherfolks were fairly technically efficient. The mean technical efficiency of 71% suggested that there is scope for increasing fish landing in the study area by 29% if they were to operate at the frontier. The result is in line with observations made that artisanal fisherfolks in developing nations are technically efficient but poor.

Table 38. Distribution of Technical Efficiency of Fisherfolks

	Marine		Lagoon		Pool	
Category	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 0.3	0	0.00	0	0.00	0	0.00
0.3 - < 0.4	0	0.00	0	0.00	0	0.00
0.4 - < 0.5	0	0.00	0	0.00	0	0.00
0.5 - < 0.6	1	0.60	22	12.22	23	6.65
0.6 - < 0.7	39	23.49	73	40.56	112	32.37
0.7 - < 0.8	115	69.28	76	42.22	191	55.20
> 0.8	11	6.63	9	5.00	20	5.78
Total	166	100.00	180	100.00	346	100.00
Mean	0.73		0.68		0.71	
Minimum	0.56		0.51		0.51	
Maximum	0.83		0.83		0.83	

Source: 2006 Field Survey

The allocative efficiency indices derived from the analysis of the stochastic cost function are depicted with grouping made at interval of 10. The distribution of the fisherfolks allocative efficiency indices is given in Table 39. The allocative efficiency of the sampled fisherfolks was less than one (or 100%) indicating that all the fisherfolks sampled were operating below the frontier. For the marine, the best performing fisherfolk had a allocative efficiency of 0.53 or 53%, while the least performing fisherfolk has allocative efficiency of 0.06 or 6%. Also, the mean allocative efficiency of the fisherfolks is 0.20 or 20%. This implied that the fisherfolks were not very efficient in their choice of inputs and purchase of production inputs. For the lagoon, the best performing fisherfolks had an allocative efficiency of 0.86 or 86%, while the least performing fisherfolk had an allocative efficiency of 0.09 or 9% with a mean value of 0.36 or 36%. This also implied that the fisherfolks were not very efficient in their choice of inputs and purchase of production inputs. The pooled data revealed that the mean allocative efficiency was 0.28 or 28%.

The distribution of allocative efficiency of the fisherfolks revealed that majority (62%) of the fisherfolks had allocative efficiency of less than 30%. In general, the results suggest that the sampled fisherfolks were not allocatively efficient in their choice of inputs. The mean allocative efficiency of 28% suggested that there is scope for increasing fish landing in the study area by 72% if they were to operate at the frontier.

Table 39. Distribution of Allocative Efficiency of Fisherfolks

	Marine		Lagoon		Pool	
Category	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 0.3	145	87.35	70	38.89	214	61.85
0.3 - < 0.4	12	7.23	43	23.89	60	17.34
0.4 - < 0.5	8	4.82	31	17.22	36	10.40
0.5 - < 0.6	1	0.60	16	8.89	16	4.62
0.6 - < 0.7	0	0.00	11	6.11	12	3.47
0.7 - < 0.8	0	0.00	6	3.33	5	1.45
> 0.8	0	0.00	3	1.67	3	0.87
Total	166	100.00	180	100.00	346	100.00
Mean	0.2		0.36		0.28	
Minimum	0.06		0.09		0.06	
Maximum	0.53		0.86		0.86	

Source: 2006 Field Survey

The economic efficiency indices derived from the product of technical and allocative efficiency indices are depicted with grouping made at interval of 10. The distribution of the fisherfolks economic efficiency indices is provided in Table 40. The economic efficiency of the sampled fisherfolks was less than one (or 100%) indicating that all the fisherfolks sampled were operating below the frontier. For the marine, the best performing fisherfolk had an economic efficiency of 0.44 or 44%, while the least performing fisherfolk has an economic efficiency of 0.04 or 4%. Also, the mean economic efficiency of the fisherfolks is 0.15 or 15%. This implied that the fisherfolks were not very efficient in their choice of inputs and purchase of production inputs. For the lagoon, the best performing fisherfolks had a economic efficiency of 0.72 or 72%, while the least performing fisherfolk had a economic efficiency of the fisherfolks is 0.15 or 15% with a mean value of 0.26 or 26%. This also implied that the fisherfolks were not very efficient in their choice of inputs and purchase of production inputs. The pooled data revealed that the mean economic efficiency was 0.20 or 20%. The distribution of economic efficiency of the fisherfolks revealed that majority (81%) of the fisherfolks had an economic efficiency of less than 30%. In general, the results suggest that the sampled fisherfolks were not economically efficient. The mean economic efficiency of 20% suggested that there is scope for increasing fish landing in the study area by 80% if they were to operate at the frontier.

Table 40. Distribution of Economic Efficiency of Fisherfolks

	Marine		Lagoon		Pool	
Category	Frequency	Percent	Frequency	Percent	Frequency	Percent
< 0.3	155	93.37	115	63.89	281	81.21
0.3 - < 0.4	10	6.02	35	19.44	39	11.27
0.4 - < 0.5	1	0.60	13	7.22	14	4.05
0.5 - < 0.6	0	0.00	13	7.22	9	2.60
0.6 - < 0.7	0	0.00	3	1.67	3	0.87
0.7 - < 0.8	0	0.00	1	0.56	0	0.00
> 0.8	0	0.00	0	0.00	0	0.00
Total	166	100.00	180	100.00	346	100.00
Mean	0.15		0.26		0.2	
Minimum	0.04		0.15		0.04	
Maximum	0.44		0.72		0.72	

Source: 2006 Field Survey

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of Findings

This study was to investigate the economic efficiency of fishing among marine and lagoon artisanal fisherfolks in Lagos state. The study was carried out in three operational zones of Lagos State Agricultural Development Authority. Three hundred and sixty (360) questionnaires were administered to randomly selected fisherfolk from thirty-six (36) communities spread across the three operational zones. However, only three hundred and forty six (346) respondents participated. Both primary and secondary data were used for this study. Data collected were analyzed using descriptive statistics, fishing budget analysis, stochastic frontier production and cost function were used to determine technical, allocative and economic efficiencies, profitability indices. The descriptive statistics examined the socio-economic characteristics of respondents.

The study showed that in the lagoon communities, the male fisherfolks accounted for about 94% while in the marine communities all the fisherfolks interviewed were male. The few women who were sampled in the lagoon communities were those who set traps for crabs and shrimp.

Majority of the respondents in the marine and lagoon communities were married (94.6% and 92.8% respectively) while only a few were divorced, widowed or single. This could also have implication for artisanal fishing. Married fishfolks are likely to depend on their wives and children for post harvest activities.

In the marine communities, 115 fisherfolks representing 69.3% were between the age range of 41 to 50 years while in the lagoon communities, 73 fisherfolks representing 40.6% were between the age range of 41-50 years. The low percentage recorded in the age category 60 years, and above is a reflection of the stress and energy sapping exercise involved in going far into the sea and landing afterwards; which may be rather too much for the elderly. In the lagoon, however, the relatively high percentage recorded in the age category 60 years and above may be due to the fact that healthy elderly man can still go fishing in the lagoon which is not as stressful and energy sapping as the sea operations.

The percentage distribution of fisherfolks in the age range 30-40 years in both marine and lagoon communities were 7.2% and 20% respectively. The distribution is indicative of the dearth of able-bodied young men in artisanal fishing and this can be attributed to rural-urban drift for white collar jobs in the cities by the youth. If viewed from the aspect of capital investment, the lagoon's respondents percentage appear to be more than those of marine due to the fact that investment capital required for marine artisanal fisheries establishment is considerably higher for someone starting out in life without subsidy or credit facility to fall back on. In the marine communities, 51.2% of the respondents fall in the household size range of 6-9. In the lagoon, about 48.9% of the respondents have family size range 2-5 members. Majority of fisherfolks are known to have more than one wife and therefore large family size. The large family size therefore, serve as labour and also have economic advantage by rendering services that can be quantified financially. In this study, the family size was relatively high and this may have positive effect on their productivity as the other family members may be available for post-harvest operation and other activities associated with fishing operation.

The respondents with primary, secondary vocational and quoranic education in the marine and lagoon communities were regarded as being literate. In the state, literacy level is very high, 280 fisherfolks out of the sampled 346 (80%) were literate while illiteracy level is relatively high among the sampled fisherfolks and could have implication for artisanal fishing in the study area. According to Azhar (1991), education affects productivity in two distinct ways via choice of better inputs and outputs (allocative efficiency effects), and through a better utilization of existing inputs (technical efficiency aspect).

Among the artisanal fisherfolks, it was observed that the most popular secondary occupation apart from their main occupation was farming (43.6%). Majority of the 18.2% involved in trading were into fishing input sales such as net bundles, ropes, twines, out board engine spare parts and other fishing accessories. The farming population among the marine communities was higher (51.8%) than in the lagoon communities (36.15%). On the other hand, those who claimed not to have any form of secondary occupation in the marine communities were lower (19.35%) than in the lagoon communities (26.7%).

In the marine communities sampled, those respondents who claimed not to have any form of secondary occupation might be migrating fishermen or fulltime fishermen who followed fish movement about. In the case of lagoon respondents who belong to the above category, majority of them are preoccupied throughout the day using different gears such as cast nets, set gill nets, and traps. Alongside regular fishing, some are also into another form of fishing from the wild, referred to as Acadja (a form of cage culture). In the marine communities apart from subsistence farming claimed to be farmers had ageing coconut plantation while those in the lagoon-rural settings, involved in farming, may be into subsistence crops and vegetable farming.

Fishing activities revolve round the type of water bodies, the experience of the operator, and the means of operation. Fisherfolks carry out their fishing activities in the marine, lagoon, rivers, lake and swampy environments. They operate both at night and in the daytime using their crafts and gears. Therefore, skill in handling of craft and gears and mode of operation can partially determine quantity of fish captured. In the absence of formal training, such skills are acquired over years. Marine communities monthly income distribution, were between the range of ₦70,001 to ₦80,000 (33%). While monthly income distribution for lagoon communities was in the range N20,000 - N30,000 (49%). The t-test for equality of means of monthly fishing income for and lagoon water bodies revealed that the average monthly fishing income for marine (₦96,111) was significantly different ($p<0.01$), from lagoon (N30,538). Further analysis revealed that the net fishing income for marine (₦51,359) was significantly different ($p<0.01$), from lagoon (₦13,746).

Chi-square test of monthly fishing income and some socio-economic characteristics across water bodies revealed that for lagoon, there was significant difference ($p<0.05$) in monthly fishing income across gender. In addition, there was significant difference ($p<0.01$) and ($P<0.05$) in monthly fishing income across age groups in marine and lagoon respectively. Finally, there was also significant difference (p<0.01) in the fishing income for fisherfolks who were members of co-operative societies.

The fishing gear types revealed that 90% (160) of the lagoon respondents used cast net while 51.8% (86) of the respondents used beach seine net. Only 9% (15) used surrounding net while 5.2% (10) used gillnets. About 32% (53) of the marine respondents used surrounding net while about 52% (86) used hooks and line. Appropriate gear relevant to the water terrain and the fish species sought were applied. For instant, long lines are used by fisherfolks looking for *Arius gigas* on rocky bottom sea portion whereas traps are set in relatively calm portion of lagoons, streams, creeks, swamps, having shallow depths.

The problems faced by fisherfolks in carrying out fishing operations fall into different categories. The main problems faced are physical and financial. Under physical are natural and man-made problems. Under financial, the identified problems were lack of fund, high cost of inputs, lack of credit facilities, high interest rate on loans and inconsistent government policies. The two major problems above can determine the spate of operation or lack of operation by fisherfolks.

Fisherfolks do not fish fifty-two weeks in a year, they experience period of low catch when it may not be profitable to go fishing. This off-season period takes two to three months in a year. During this period which may be around August and between September and October, majority of fisherfolks concentrate on their secondary occupations. New nets and canoes construction are embarked upon. Leaking canoes and boats are mended. The study revealed that off-season period may be regarded as a product of stormy weather, severe turbulence, water hyacinth and low catches. On the contrary, water hyacinth does not affect marine water communities.

The financial constraints affecting fishing operation directly or indirectly are lack of fund, lack of credit facilities, high interest rate on loans, high cost of inputs and inferior quality gears. Gross margin analysis is done to determine the profitability of artisanal fishing operation in Lagos state. Revenue per month was ₦81,644 for marine and ₦41,704 for lagoon. Gross margin for marine was ₦61,000 and ₦27,973 for lagoon. Net fishing income was obtained by deducting monthly total cost from revenue. The higher monthly revenue obtained in marine could be due to the level of investment and the distance covered by marine fisherfolks. Among the fixed cost items, OBE amounted to 89% and 87% respectively in the marine and lagoon communities. Labour cost accounted for 85% of the variable cost items in both the marine and lagoon communities. The fixed cost items accounted for 19% and 18% of the marine and lagoon total cost respectively. Another profitability index used in the study is the Cost Benefit Ratio. For the fisherfolks in the study areas, the Cost Benefit Ratio was 2.50 for lagoon and 3.20 for marine. The ratio shows that for every one naira invested in artisanal fishing operation in lagoon, ₦1.50 kobo would be realized. Similarly, every one naira invested in marine ₦2.20kobo would be realized suggesting that artisanal fishing in Lagos state was profitable.

The results of the stochastic frontier model are presented in Tables 28 and 29 for marine and lagoon respondents respectively. From the maximum likelihood (ML) estimates for the production frontier for the marine fisherfolks, the estimate of λ (0.0429) and (0.376) were significantly different from zero at 1%, indicating a good fit and the correctness of the specified distribution assumption. In the marine artisanal fishing, the significant variables were labour, canoe length, distance covered and engine capacity. However, for lagoon, none of the coefficients listed above were significant. This suggested that the variables included in the stochastic frontier analysis for the lagoon did not significantly determine the level of artisanal fishing output in the study area.

The results of the stochastic cost frontier for the lagoon, marine and both water bodies revealed that the coefficients of output was not significant for the lagoon and marine stochastic cost frontier model. However, estimate of λ(1.870) and σ(0.401) are large and significantly different from zero at one percent, indicating a good fit and the correctness of the specified distribution assumption. The coefficient of output (0.1466) is statistically significant at one percent level and has expected positive sign. The coefficient is highly significant and has a positive correlation with the cost of production. This suggested that farmers whose output were high had increased gross margins which may be ploughed back into production, sufficing to say that farmers with higher output have better capacity to employ improved farm input with the associated cost which are usually higher.

Results of the inefficiency model from the stochastic frontier regression analysis revealed that in the marine environment, age, fishing experience, secondary occupation and cooperative membership were the socioeconomic factors that significantly affected the technical efficiency of the fisherfolks. While in the lagoon environment, age, secondary income and membership of cooperative societies were the socioeconomic factors that significantly affected the technical efficiency of the fisherfolks. In both water bodies (pooled data), there was a negative relationship between age and technical inefficiency of the fisherfolks in the study area and the coefficient was significant. ($p<0.10$). The coefficient of fishing experience was negatively but significantly related to technical inefficiency. Secondary income was negatively related to technical efficiency and the negative relationship was significant at ($p<0.05$) indicating that fisherfolks without secondary income were more efficient that fisherfolks with secondary income. Allocative and economic inefficiency were conducted for only the pooled data because in the cost frontier, sigma and gamma were not significant for the two water bodies. The results revealed that type of canoe had negative and significant effect on allocative inefficiency ($p<0.10$) and economic inefficiency ($p<0.10$).

The distribution of technical efficiency of the fisherfolks revealed that none of the fisherfolks had a technical efficiency of less than 50%. In general, the results suggest that the sampled fisherfolks were fairly technically efficient. The mean technical efficiency of 71% suggested that there is scope for increasing fish landing in the study area by 29% if they were to operate at the frontier. The result is in line with observations made that artisanal fisherfolks in developing nations are technically efficient but poor. The distribution of allocative efficiency of the fisherfolks revealed that majority (62%) of the fisherfolks had a allocative efficiency of less than 30%. In general, the results suggest that the sampled fisherfolks were not allocatively efficient. The mean allocative efficiency of 28% suggested that there is scope for increasing fish landing in the study area by 72% if they were to operate at the frontier. The distribution of economic efficiency of the fisherfolks revealed that majority (81%) of the fisherfolks had a economic efficiency of less than 30%. In general, the results suggest that the sampled fisherfolks were not economically efficient. The mean economic efficiency of 20% suggested that there is scope for increasing fish landing in the study area by 80% if they were to operate at the frontier.

5.2 Conclusion

OBE is one of the de-facto tools in fishing operation. Among the fixed cost items for marine and lagoon communities, OBE recorded 89% and 87% respectively. Income-expenditure ratio for fisherfolks in the study area was 2.5 and 3.2 for lagoon and marine respectively. The coefficient of OBE capacity (0.162) obtained from technical efficiency analysis for marine was statistically significant ($p<0.05$) and has expected positive sign. The above highlighted facts is a pointer to the fact that reduction of tariffs on imported fishing inputs such as OBE will enhance technical efficiency as fisherfolks will be able to go faster and farther into the water bodies, thereby preventing over exploitation.

Male involvement in fishing (100%) in the coastal Communities is an indication of the hazard and the physical exertion involved in fishing trips at sea and landings. It is beyond the female capability. The few women sampled in the lagoon are those who set traps for crabs and shrimp. Majority of women deal exclusively with post harvest activities.

The age distribution pattern for marine and lagoon showed that age range (41-50) years recorded the highest number of fisherfolks at 115 (69.3%) and 73 (40.6%) respectively. This pattern agreed with Coppet *et al* (1985); Vabi and Williams (1991) who documented the economic active age of famers in developing countries to be at middle age, that is 30-50 years. For secondary occupation, those who claimed not to have, might be migratory fisherfolks. In the case of lagoon respondents, some go fishing twice daily with different gears. The distance covered by lagoon fisherfolks is shorter than that of marine. The same goes for the fish landed which is usually more for marine than lagoon.

Positive gross margin and the income expenditure ratio of 2.5 for lagoon and 3.2 for marine shows that for every one naira invested in artisanal fishing operation in lagoon, ₦1.50 would be realized. Similarly, every one naira invested in marine yields ₦2.20, suggesting that artisanal fishing in Lagos state was profitable. The problems faced by fisherfolks in carrying out fishing operations fall into different categories. The main problems faced are physical and financial. Under physical are natural and man-made problems. Under financial, the identified problems were lack of fund, high cost of inputs, lack of credit facilities, high interest rate on loans and inconsistent government policies. The two major problems above can determine the spate of operation or lack of operation by fisherfolks.

Based on the evidence revealed by the stochastic production and cost frontier and the distribution of efficiency indices, it can be concluded that the sampled fisherfolks were fairly technically efficient because there is scope for increasing fish landing by 29%, if they were to operate at the frontier. The sampled fisherfolks were not allocatively and economically efficient because is scope for increasing fish landing by 72% and 80% respectively if they were to operate at the frontier.

5.3 Recommendations

Based on the study of technical efficiency of fishing among marine and lagoon artisanal fisherfolks in Lagos State, the following recommendations are suggested to improve the fisherfolks performance and to prevent rural-urban drift by the youths for better life.

i. Economic impact of fisheries can be enhanced by provision of infrastructural facilities by the government and NGOs. These facilities include rural electrification and storage facilities (cold rooms); to prevent loss of revenue from fish spoilage.
ii. Provision of motorable roads for easy evacuation of fish from landing sites.
iii. Encouragement of active and financially viable cooperative societies formation, thereby making it less difficult for fisherfolks to obtain credit facilities, as banks and NGOs would rather extend credit facilities to viable Cooperative societies than individuals.
iv. Provision of health facilities to cater for the health needs of the fishing communities.

v. Subsidized fishing inputs should be provided by the government by reducing tariffs on imported fishing inputs such as OBE and net in order to increase efficiency.

vi. Establishment and upgrading of more vocational fisheries schools that should include repairs and fabrication of gears and crafts in the curriculum.

vii. There is need to reinforce and enforce the monitoring and surveillance unit of the Federal Department of Fisheries to prevent incidence of trawler and fisherfolks should be encouraged.

viii. Insurance of expensive gears, crafts and fisherfolks should be encouraged.

REFERENCES

Adebayo, R. (1997): "Communication in Agriculture" An Imprint of Precept house, Lagos, Nigeria. PP 45.

Adekoya B.B. (1991): A diagnostic survey of small scale capture and culture fisheries in Ogun State, A Quarterly Publication of Fisheries Society of Nigeria (FISON).pp105.

Adekoya, B.B. (1993): "Fueling in Crisis". Fish Net Work A Quarterly Publication of Fisheries Society of Nigeria (FISON), Lagos Vol. 1, 6-8.

Afriat, S.N. (1977): Efficiency Estimation of Production Function: International Economic Review. Vol. 13, No. 3, 569-598.

Aigner, D.J. and Chu, S.F. (1968): On Estimating the Industrial Production Function. American Economic Review 58, No. 4, 826-839.

Aigner, D.J. Lovel, C.A.K and Schmiddt, P. (1977): Formulation and Estimation of Stochastic Frontier Production Function model: *Journal of Econometrics*. Vol. 6, 21-37.

Ajayi T.O. and J.G. Tobor, (1992): Current Management of marine Fisheries Resources for Sustainable Development in Nigeria, Nigerian Institute for Oceanography and Marine Research (NIOMR). Technical paper 77. Pp8

Ajayi T.O. and O.S. Talabi (1984): The Potential and Strategies for Optimum Utilization of the Fisheries Resources of Nigeria, Nigerian Institute for Oceanography and Marine Research (NIOMR). Technical Paper 18. Pp10

Ajibefun, I.A. and Daramola, A.G. (2000): Measurement and Sources of Technical Inefficiency in Poultry Egg Production in Ondo State, Nigeria. *Journal of Rural Economic and Development*, Vol. 13 (2): 85-94.

Akande, G. N. (2011*): Nigeria Loses 800m Naira to Fish imports* (Monday 8th August, 2011). Business Day Newspaper. Pp9.

Akanni K.A and Akinwumi, J.A (2007): Determinants of Variation in Fish Catch levels in Artisanal Fishing of Lagos State, Nigeria. *Research Journal of Fisheries and hydrobiology*, 2(1): 1-12.

Akinlade, I. (1996): Lagos State Facts and Figures (No. 20). P 30.

Akpaniteaku, R.C. Weimin, M. and Xinhua (2005): Evaluation of the contribution of fisheries and Aquaculture to food Security in Developing Countries. NAGA World Fish center Newsletter; Vol. 28, No. 1&2. Jan-Jun, 2005 P 115.

Alamgir M. and Panuccio T., Jazary, I. (1992): The State of World Rural Poverty: An inquiry into its Causes and Consequences. IFAD, New York. University Pres, Pp 25-27.

Ali, M. and M.A Chaudhary (1990): Inter-Regional Farm Efficiency in Pakistan"s Punjab: Frontier Production Study: *Journal of Agricultural Economics* 41 (1) 62-74.

Allison E.H. and Kllis, F. (2001): The livelihood Approach and Management of Small Scale Fisheries. Marine Policy 25:377-388.

Amaza, P.S. and Olayemi, J.K. (2000): Analysis of technical Inefficiency in Food Crop Production in Gombe State, Nigeria. Applied Economic Letters, 9; 51-54

Awotide, D.O (2004): Resources use efficiency and inputs substitution, in Upland rice production in Ogun State, Nigeria. PhD. Thesis, Department of Agricultural Economics, University of Ibadan pp194.

Awotide, D.O, Rahji, M.A.Y, Adejobi A.O and Bamire A.S. (2005): Technical Efficiency and Management factors in Plantain production in humid forest zone in Nigeria; Asimulation analysis, *South African Journal of Economics and Management Science* (SAJEMS). Vol 8, No. 2, 238-245

Aromolaram A.B. (2000)", Analysing the resource use efficiency on fish farms. Aquafield. 1(1):12-21.

Azar, R.A (1991): Education and technical efficiency During Green Revolution in Pakistan Economic Development Culture Change 39: 651-665s

Broack, J. Van Deu, Forsund, F.R. Hjalmarsson, L. and Meeusen, W. (1980): On the estimation of deterministic and stochastic frontier production functions: A comparison, *Journal of Econometrics*. 4;23-30.

Battese, G.E and Coelli, T.J. (1996): Frontier Production Functions, technical Efficiency and Panel Data with Application to Paddy Farmers in India. *Journal of Productivity Analysis*, 3; 153-169.

Berkes F. (1990): Native Subsistence Fisheries: A Synthesis of Harvest Studies in Canada. Artic 43 (1): 35-42.

Bonaventure, R.H Diana, E.T. and Annet, M.I (1990): Report of Roundtable meeting on Women's Activities and Community development in Artisanal Fisheries (Projects) in West Africa, Cotonou, IDAF, P. 12.

Bravo-Ureta, B.E and Pinheiro, A.E. (1993): Efficiency Analysis of Developing Country

Agriculture: A Review of the Frontier Function Literature. Agriculture and Resources Economic Review 22 (1): 88-101.

Bolorunduro, P.I., and Falaiye, A.E (2003): Socio – economics characteristics as predictors of adoption of improved fish smoking by fish procession in North West Nigeria. *Nigerian Journal of fisheries*. Vol. Nol, June 2003. Pp 70-84.

C.B.N (2001): Central Bank of Nigeria Annual Report and Statement of Account. Pp 150.

C.B.N (1994): Central Bank of Nigeria Statistical Bulletin Vol.: 9,2,121-124. Caves, R.E. and D.R. Barton, (1990): Technical Efficiency in U.S. Manufacturing Industries, M.I.T. Press Cambridge M.A. pp 66.

Caves, R.E. and D.R. Baron (1990): Technical Efficiency in U.S. Manufacturing Industries, M.I.T. Press Cambridge MA. Pp66.

Charnes A., Cooper, W.W., Aewin, A.Y. and Seiford L.M. (1994): Data Envelopment Analysis: Theory, Methodology and Applications; Kluwer Publishers. Pp 145.

Coelli, T.J. (1995): Recent Development in frontier Modeling and Efficiency Measurement. Australian *Journal of Agriculture Economics,* Vol. 39, 219-245.

Coelli, T.J. (1996): A Guide to frontier Versions 4.1: Computer Programme for Frontier Production Function-Estimation. CEPA Working Paper 96/97, Department of Econometric University of New England, Armidale.

Coppet, J.H, Sill, M.L. and Brown, E.J. (1958): The function of information sources in the farm practice adoption process in Rural Sociology pp146-157.

Coughanowr, C.A. Ngoile, M. and Linden O. (1995): Marine Zone Management in East Africa Including the Island States; A Review of Issues and Initiatives Ambio 24:448.

Daizellet, A., Adams, N.V. Poulin, C. (1996): Marine Fisheries in the Pacific Island. Oceanography and Marine Biology Annual Review, 34:304-531.

Dales, S. Quentin Grafton R,. Alam M.F. Omar I.H. (2003). Technical Efficiency in the Analysis of Gill Net Fishery. US Marine Fisheries Services. South West Fisheries Science Centre P.O. Box 271. La Jolla, Ca. Pp 15.

Dada, B. F. (2003): "Contribution of fisheries to Employment, National Economy and food Security in Nigeria. "Being a paper Presented, at the 2003 FISON Public Lecture. Held at the Nigerian Society of Engineers, .V.I Lagos.25p.

Dada, B.F. (2005): Procedings of the NEPAD – Fish for All submit; 22-25 August, 2005, Abuja Nigeria, 110 pp.

Dawang, N.C., Manggoel, W. and Dasbak, M.A. (2012): Journal of Economics and Sustainable Development, Vol. 3(5):62-71.

Demujnck, K. (1994): The Participatory Rapid Appraisal on Perceptions and Practices of Fisherfolk on Fishery Resources Management in an Artisanal Fishing Community in Cameroon. FAO Technical Report, No. 60 Cotonu: FAO 24pp.

Dugger, R. (1974): An application of bounded non-parametric estimating function to the analysis of the bank cost and production function. PhD. Dissertation University of North Carolina, Chapel Hill, N.C 187pp.

Department for International Development (DFID), (2000): Sustainable Fisheries livelihood programme (DFID) in West African FACU 6pp.

Elliot, O. (1993): Nigerian Coastal Fisheries Resources: in Proceedings of the National Conference on Conservation of Aquatic Resources organized by the National advisory committee on conservation of Aquatic Resources in cooperation with Federal Department of Fisheries (FDF), Abuja and NIOMR, Lagos Nigeria. Egborge *et al* (Eds). 45-60.

Eyo, A.O. (2001): Fish processing in the Tropics. National Institute of Fresh water Fisheries Research, New Busa, Niger State, 8pp.

F.A.O., (1992): Food and Agriculture organization of the United Nations Production Year Book, Rome, Italy. pp 110.

FAO (1990): Field Guide to the Commercial Marine Resources of the Gulf of Guinea, Rome Italypp130

F.A.O, (1996): Food Requirement and population Growth. WFS 961/Tech/10 Provisional Text, Rome, Italy.

F.A.O. (2002): Fisheries Development in the Third Millennium: Challenges and Opportunities. Paper presented at 22nd Regional Conference for Africa, Cairo, Egypt, 4-8 February 2002. 22p. .

Farrel M.J. (1957): The Measurement of Production Efficiency. *Journal of the Royal Statistical Society. Series* A (General) Part 111,125, Part 2, 120: 253-290..

Farrel M.J. and Fieldhouse, M. (1962): Estimating Efficiency production under Increasing Return to Scale. *Journal of the Royal Statistical Society, Series A (General), Part 11,* 125:252-1167

Faturoti E.O. (1999): Fisheries Potentials and Investment Opportunities in Nigeria. Fisheries Society of Nigeria bulletin Lagos Vol. 1 (5): 32-56.

Federal Department of Fisheries (1994): Fisheries Statistics of Nigeria 3rd edition (1985 – 1994) 51pp.

Federal Department of Fish Publication (1997): National Seminar on the Development of Artisanal Fisheries in Nigeria: In Fisheries Development Policies in Nigeria and the Contribution Strategies for Future. Abuja, Nigeria. Pp 111-116.

Federal Department of Fish Publication (2004): Fisheries Statistics of Nigeria 1994-2002). Pp55.

Federal Department of Fish Publication (2007): Fisheries statistics of Nigeria 4th Edition (2002-2008) pp 60.

Feder, G., Richard, E.J, Zilberman D. (1985): Adoption of Agricultural Innovation in developing countries. A survey in Economic Development and Cultural Change. University of Chicago, USA. Vol 33, No2: 86-90.

Fisheries Development Plan (2005): Published by Ministry of Economic Development Central Planning Office, Abuja, Nigeria pp105.

Ferguson, C.E. (1966): Micro Economic Theory. Homewood.: Irnin 132pp

Firth, R. (1966): Malay Fishermen, their Peasant Economy (2nd ed.) Revised. Hamdgen. CT 60pp.

Fregene B.T (2002): Poverty Assessment in Fishing Communities in Lagos State, Nigeria 176pp.

Forsund, F.R. Lovell, C.A.K. and Schmidt, P. (1980): Survey of frontier production functions and their relationships to efficiency measurement *Journal of Econometric,* Vol. 13, 5-25.

Garhardson, G.M (1997): *Strategies for projects in Small Scale fisheries,* FAO Rome, Policy Formulation Publication10pp.

Gerrand, S. (1995); "When Women take the lead: Changing Conditions for Women's Activities, Role and Knowledge in North Norwegian Fishing Communities. Social Science Information, 34:593-631.

Greene, W. (2000): "Simulated Likelihood Estimation of the Normal-Gamma Stochastic Frontier
Model: Sterm School of Business, Department of Economics, Working paper 00-05, P.55.

Gulland, J.A. (1979): Towards the Management of the Marine Fisheries Resources of the CECAF/region. Rome. Food and Agricultural organization (FAO/CECAF/ECAF series 79.en). pp45.

Haakonsen M.J., (1992): West African Artisanal Fisheries in Fishing for Development "Small-Scale Fisheries in Africa. The Scandinavian Institute of African Studies, Uppssala, Motala 23-27p.

Handerson, and Quandt, R.E (1980): Micro Economic Theory. McGraw Hill pp. 220 Third Edition. 220pp

Hanock, G. and M. Rothschild (1972): 'Testing the assumption's of Production Theory: A Non Parametric Approach. *Journal of Political Economy*, Vol. 80, 256-275.

Hardin, G. (1968): The Tragedy of the Commons Science Wash 162: 1234-48.

Horemans, Benoit (2006): Education for Rural: Sustainable Fisheries Livelihood programme – FAO/FDF.12pp.

Ijff, A.M. (1990): "Socio-Economic Condition in Nigerian Fishing Communities. Program Development of Artisanal Fisheries in West African, Cotonou. IDAF/GCP/RAF/192/DEN.P.119.

Ita, E.O. (1994): Self Sufficiency in National Resources Products Supply by the Year 2000: The Role of Fisheries. In Symposium of Fauna Conservation Society. Pp 21-23.

Jamiyu, A.G. (2002): An Evaluation of artisanal fisheries resources in Ogun State Ogun State Agric Devpt Program. 45pp.

Jazairy, I. Alamair M., Panaccio, T. (1992): *The State of World Rural Poverty:* An enquiry into its causes, and consequences. IFAD, New York Universe Press 114pp.

Jinadu O.O (1999): Bio-economic analysis of marine small-scale fishing operations in Lagos State. Nigeria, Ph.D. Thesis, University of Ibadan, Ibadan, Oyo State, Nigeria. P 185.

Johannes, R.E.K, Ruddle and E. Hividinp, (1993): The Value of traditional Management and knowledge of Marine Resources in Oceania: In Workshop on People, Society and Pacific Island Fisheries Development and Management Selected Papers. Noumea. New Caledonia Inshore Fisheries Research Project Technical Document. No. 5(1)p.45.

Jondrow, J. and Jasnin, L. (1982): On the Estimation of technical inefficiency in the stochastic frontier Production function model *Journal of Econometrics* 19, 233-238.

Kaushik, S.J. (2000): Applied Nutrition for sustainable for sustainable Aquaculture development. In Book of synopses, P. 155-158. NACA/FAO international Conference on Aquaculture in the Third millennium, 20-25 February 2000. Bangkok.

Kelly, P.D. (1977): A frontier Approach to measuring technical Efficiency in the New South Wales, Egg Industry M, Agric Sc. Thesis, University of Queensland, Brisbane.

Kusemiju, K. (1993): Development, Utilization and conservation of Aquatic Resources in Nigeria: in Proceeding of the National Conference on Conservation of Aquatic Resources, Egborge *et al.* (Eds). 63pp.

Lagos State (1983): "Facts and Figures No. 11 edited by Akinbiyi, Public information Division on social Development, Youths and Sports p14.

Lagos State Agricultural Development Authority (1997): Village Listing Survey Report P. 134.

Lagos State (1985): Progress Report: 1984 – 1985 Min of Agriculture and Cooperatives Public information Division. Pp14

Lagos State Agricultural Development Authority (2005): Village listing survey report 23pp.

Lambeth L.R. (2000): An Assessment of the Role of Women within Fishing Communities inTuvalu. SPC Field Report No. 2 p.18.

Lambeth L.R. and Abraham, (2001): An assessment of role of women in fisheries in Kosrae FSM Field Report no. 3.P.15.

Lubis, R. (1994): Factors influencing the success of fishermen's cooperative in south Sulawesi: In Pollnas, R, Bailey, C., Poenomo, A (Eds). Contribution to Fishery Development Policy in Indonesia. Central Asia Research Institute for Fisheries, Jakarta pp 114 – 125.

Linden, O. and Lundi, C.J. (1996): Integrated coastal zone management in Tanzania Proceedings of the National workshop, May 1995), Tanzania SIDA – SAREC, Stockholm. Pp166.

Mabanwonku A.F. (1979): Fishing efforts and Earnings in the Nigerian Artisanal Fisheries, *Journal of Rural Economics and Development*, 12. (2), 10.

Mabanwonku A.F. (1989): The Process of Fisheries Development Plan Formulations for West African Marine States, *Journal of West African Fisheries*. 1(1):2-3.

Mabanwonku, A.F. (1981); Programmes and Strategies for the Development of Artisanal Fisheries in Nigeria, *Indian Journal of Agricultural Economics*, vol. xxxv(4) 12p.

Malberg-Calvo Christian (1994): Case Study on the role of women in Rural transport SSATP working papers No. 11 World Bank, Washington, D.C.

Makun, D. O. (1992): Agricultural Development in Third World; Issues and strategies. *Agricultural Quarterly Report*, Vol 6 86pp.

McGrone, David (1994): "Getting by and making Out in Kirkcaldy". In the Social and Political Economy of the Household. Oxford University Press. Oxford, UK. Pp. 68-99.

McGodwin, J.R (1992): *Crises in the World's Fisheries: People's problems and policies.* Standford University press, California 285p.

Meeusen W. and J. Van deu Broeck, (1977) "Efficiency Estimation from Cobb-Douglass Production function with composed error". International Economic Review, Vol. 18,435-444.

Meller, P. (1976): Efficiency Frontiers for Industrial establishment of different sizes *Exploration in Economic Research* 3, 379 – 407.

Moffat, D. Ngoile, M, Linden, O. and Francis, J. (1998): The reality of the Stomach: Coastal Management at the local level in Eastern Africa, Ambio, 27: 590 – 598.

Moses B.S. (1986): Introduction of Artisanal Fisheries Resources of Cross Rivers State of Nigeria: In 1986 FISON Conference Proceedings, Ita *et al.* (Eds).Pp128-155.

Nielsen, J.R. Sen, Sverdrup-Jesnsen, S. and Pomeroy, R.S. (1996): Analysis of Fisheries Co-Management Arrangement: A Research Framework. Institute for Fisheries Management and Marine Community Development (IFM) International Centre for Living Aquatic Resources Management (ICLARM). 27pp.

NIOMR (1990): Diagnostic survey of Lagos State Fisheries – Nigerian Institute of Oceanography and Marine Research, Lagos. Nigeria 150p.

Obwona, M.B. (2000): Determination of Technical Efficiency differentials amongst small and medium scale farmers in Uganda; A case of tobacco growers. A report presented at AERC Biannual Workshop, Nairobi, Kenya May 27 – June 2, 2000. 18pp.

Okpanefe, (1997): Agricultural and Marketing Resources. Fisheries Statistics Survey in Nigeria, NIOMR, Lagos 39pp.

Olaniyi A.O. A. (1998): Conservation of Renewable Resources: Presidential address to the Inaugural Technical Committee of the Fisheries Institute of Nigeria (FIN) delivered on 28/7/1998 at the National Headquaters, FISON Apapa, Lagos. Pp16.

Olayemi, J.K. (1998): Elements of Applied Econometrics: A publication of Department of Agricultural Economics University of Ibadan. Elshaddai, Global ventures Ltd, Ibadan Nigeria. 55pp

Onuoha P. and Nnadi, N.F. (1991): Socio-economic characteristics as predictors in farm practice: "Leson in rural sociology". pp 68.

Panayotou, T. (1982); Management Concepts of Small Scale Fisheries Economics and Social aspects. FAO Fishery Technical paper (228): 53

Pauly, D. (1990): On Malthusian Overfishing. NAGA ICLARM Quarterly 3-4, January. pp 45.

Pomeroy, R. S and Trinidad, A.C. (1995): Industrial organization and Analysis: Fish marketing in prices, Products, and People: Analyzing Agricultural markets in Developing countries Lyne Rinner Publishers. Boulder, London, 93pp.

Price Gitinger, J. (1992): Economic Analysis of Agricultural Projects. John Hopkins, Press. Baltimore pp 133.

Rahji M. A. Y. (2003): Determinants of Fish Catch Level in Capture Fisheries. A Case study of Ogun Water Side Local Government. Ogun State Agricultural Devpt. Program. 25Pp.

Sargent J. (1992): New Development in the Omega – 3 story; from Man to fish and heart to brain. Aquacult. News. 14:4-5.

Sesabo, J.K and Tal R.S.T (2005): Technical Efficiency and Small Scale Fishing Households in Tanzanian Marine Villages; An Empirical Analysis, Ocean and Coastal Management. P26.

SFLP/DFID/FAO: (2002a): "Key Livelihoods" Groups Involved in Artisanal Fisheries in Marine Communities 14-59.

SFLP/DFID/FAO. (2002b): Sustainable Fisheries Livelihood Programmes Fisheries Research Organization: Potential and Contribution to Sustainable Livelihood. Pp 53.

Snith, I.R. and T. Panayoto (1984): Territorial use rights and economic efficiency The case of the Philippine fishing concessions, Food and Agricultural Organization (FAO) Fishery Technical Paper 245pp.

Squares, D., Grafton, Q. Alam, F. and Omar, H: (2003)a: Technical Efficiency in Malaysian Gillnet Artisanal Fishery. *Journal of Environment and Development Economics:* 8(3): 481-500.

Squares, D. F; Alam, M. and Ishak H.O (2003): where the land meets the sea: Integrated sustainable fisheries development and Artisanal Fisheries. *Journal of Environment and Development Economics* 15pp.

Tacon, A.G.J. (2001): Increasing the contribution of aquaculture for food security and poverty alleviation. In R.P. Subasinghe, P. Bueno, M.J. Philips C, Hough, S.E. McGladtery (eds). Aquaculture in the Third Millennium. Technical proceedings of the conference on Aquaculture in the Third millennium, Bangkok, Thailand, 20-25 February 2000. NACA, Bangkok and FAO, Rome. pp 63-72

Thompson, D.B, (1983): Conflicts within the fishing industry. In FAO Paper presented at the Expert consultation on the Regulation of Fishing Effort (Fishing mortality) Rome, 17-26 Jan. (1983).

Timmer, C. P. (1971): Using a probabilistic frontier production to measure technical efficiency, *Journal of Political Economy*. 79: 776-779.

Tobor, J.G. (1993): Finfish and Shellfish of Conservative interest in Nigeria: In Proceedings of the national conference on conservation of aquatic Resources organized by the National Advisory Committee on conservation of Renewable Resources in Cooperation with the Federal Department of Fisheries (FDF), Abuja and the Nigerian Institute for Oceanography and Marine Research, Lagos. Egborge *et al*. (Eds)P 63.

Tredten I. and Hersough B. eds. (1992): Fishing for Development: Small-Scale Fisheries in Africa. The Scandinavian Institute of African Studies, Uppsala 1992) Motala Grafiska. P.40.

Udolisa R.E.K and B.B. Solarin (1979): Design characteristics of cast Nets and Gill Net in the Lagos Lagoon Nigeria. Nigerian Institute for Oceanography and Marine Research (NIOMR) Lagos, Nigeria. Occasional Paper 31:1979.

UNCLOS (1983): United Nation's Conference On Law Of the Sea. 133pp.

Vabi, M.B and Williams, C. E. (1991): Factors determining Technology adoption behaviour of Ruminant Livestock farmers in Kwara state of Nigeria. *Journal of Rural Development in Nigeria*. Vol 4, No1. 8-15

Widtech, (2000): Women's Business Links: A preliminary Assessment of Women Cross-

Border Traders in West Africa. USAID.

William Stella, (2002): Socio-Economic Potentials of Women in Riverine Small-Scale Fisheries in Nigeria. In Contribution of Fisheries Research to the Improvement if Livelihood in West Fisheries Communities SFLP/DFID-FAO.(2) P.11.

Wokoma, K. (1991a): Role of Fish Mummies in Fishing Communities. Proceedings of Fisheries Development Extenionist Training course FAD.UNDP Assisted Artisanal Fisheries Development Project, Uyo, Akwa-Ibom State. Published by Federal Department of Fisheries Wuse I, Abuja 44pp.

Wokoma, K. (1991b): Farm Input subsidies for the Green Revolution in Nigeria: Lessons from Experience, Food Policy Technical Paper 23pp.

Appendix – Estimated technical, allocative and economic efficiency for the sampled fisherfolks in Lagos State

s/n	Water body	Allocative efficiency	Technical Efficiency	Economic Efficiency
1	1	0.14	0.76	0.11
2	1	0.19	0.77	0.14
3	1	0.16	0.74	0.12
4	1	0.23	0.76	0.18
5	1	0.25	0.71	0.18
6	1	0.18	0.77	0.14
7	1	0.11	0.72	0.08
8	1	0.21	0.75	0.16
9	1	0.21	0.79	0.17
10	1	0.21	0.71	0.15
11	1	0.20	0.79	0.16
12	1	0.44	0.80	0.35
13	1	0.32	0.80	0.26
14	1	0.15	0.64	0.10
16	1	0.16	0.76	0.12
17	1	0.22	0.64	0.14
18	1	0.20	0.78	0.16
19	1	0.18	0.76	0.13
20	1	0.25	0.69	0.17
21	1	0.17	0.72	0.12
22	1	0.23	0.69	0.16
23	1	0.21	0.75	0.16
24	1	0.20	0.71	0.14
25	1	0.19	0.72	0.13
26	1	0.21	0.75	0.16
27	1	0.23	0.73	0.17
28	1	0.21	0.75	0.16
29	1	0.16	0.72	0.11
30	1	0.19	0.64	0.12
31	1	0.20	0.71	0.14
32	1	0.17	0.70	0.12
33	1	0.17	0.66	0.11
34	1	0.11	0.65	0.07
35	1	0.12	0.59	0.07
36	1	0.11	0.69	0.08
37	1	0.40	0.61	0.25
38	1	0.37	0.78	0.28
39	1	0.17	0.76	0.13

40	1	0.24	0.69	0.17
41	1	0.32	0.76	0.25
42	1	0.25	0.69	0.17
43	1	0.20	0.72	0.15
44	1	0.39	0.71	0.27
45	1	0.25	0.72	0.18
46	1	0.24	0.75	0.18
47	1	0.31	0.73	0.23
48	1	0.21	0.78	0.16
49	1	0.39	0.77	0.30
50	1	0.41	0.77	0.31
51	1	0.21	0.77	0.16
52	1	0.18	0.71	0.13
53	1	0.18	0.77	0.13
54	1	0.11	0.72	0.08
55	1	0.14	0.73	0.10
56	1	0.13	0.77	0.10
57	1	0.36	0.74	0.26
58	1	0.27	0.76	0.21
59	1	0.18	0.64	0.12
60	1	0.15	0.73	0.11
61	1	0.40	0.79	0.31
62	1	0.14	0.61	0.08
63	1	0.15	0.78	0.12
64	1	0.14	0.61	0.08
65	1	0.14	0.73	0.10
66	1	0.21	0.76	0.16
67	1	0.21	0.64	0.14
68	1	0.10	0.72	0.07
69	1	0.11	0.69	0.08
70	1	0.22	0.64	0.14
71	1	0.15	0.68	0.10
72	1	0.17	0.70	0.12
73	1	0.14	0.66	0.09
74	1	0.23	0.65	0.15
75	1	0.17	0.63	0.10
76	1	0.23	0.72	0.17
77	1	0.23	0.61	0.14
78	1	0.32	0.79	0.25
79	1	0.39	0.79	0.30
80	1	0.41	0.83	0.34

81	1	0.15	0.73	0.11
82	1	0.22	0.79	0.17
83	1	0.29	0.80	0.23
84	1	0.53	0.81	0.43
85	1	0.40	0.81	0.32
86	1	0.18	0.78	0.14
87	1	0.39	0.78	0.30
88	1	0.17	0.73	0.12
89	1	0.33	0.74	0.25
90	1	0.32	0.75	0.24
91	1	0.20	0.76	0.15
92	1	0.12	0.70	0.09
93	1	0.12	0.73	0.09
94	1	0.19	0.67	0.13
95	1	0.30	0.72	0.22
96	1	0.13	0.74	0.09
97	1	0.09	0.72	0.07
98	1	0.16	0.75	0.12
99	1	0.16	0.77	0.13
100	1	0.11	0.79	0.08
101	1	0.07	0.68	0.05
102	1	0.14	0.77	0.10
103	1	0.40	0.82	0.33
104	1	0.14	0.78	0.11
105	1	0.20	0.79	0.16
106	1	0.17	0.74	0.13
107	1	0.20	0.76	0.15
108	1	0.13	0.75	0.10
109	1	0.29	0.81	0.23
110	1	0.29	0.81	0.24
111	1	0.15	0.70	0.10
112	1	0.14	0.77	0.10
113	1	0.19	0.80	0.15
114	1	0.27	0.79	0.22
115	1	0.36	0.79	0.29
116	1	0.13	0.76	0.10
117	1	0.15	0.74	0.11
118	1	0.16	0.75	0.12
119	1	0.16	0.77	0.13
120	1	0.10	0.79	0.08
121	1	0.07	0.68	0.05

122	1	0.15	0.77	0.11
123	1	0.19	0.80	0.15
124	1	0.28	0.79	0.22
125	1	0.40	0.79	0.31
126	1	0.12	0.76	0.09
127	1	0.15	0.74	0.11
128	1	0.10	0.68	0.07
129	1	0.09	0.69	0.06
130	1	0.06	0.68	0.04
131	1	0.09	0.68	0.06
132	1	0.13	0.73	0.09
133	1	0.13	0.67	0.09
134	1	0.17	0.72	0.12
135	1	0.30	0.74	0.22
136	1	0.13	0.74	0.09
137	1	0.09	0.68	0.06
138	1	0.11	0.69	0.07
139	1	0.10	0.70	0.07
140	1	0.06	0.66	0.04
141	1	0.09	0.71	0.06
142	1	0.13	0.67	0.09
143	1	0.26	0.75	0.19
144	1	0.10	0.72	0.07
145	1	0.23	0.72	0.16
146	1	0.12	0.71	0.08
147	1	0.09	0.69	0.06
148	1	0.17	0.75	0.13
149	1	0.12	0.70	0.08
150	1	0.14	0.73	0.10
151	1	0.12	0.67	0.08
152	1	0.26	0.75	0.20
153	1	0.09	0.72	0.07
154	1	0.15	0.72	0.11
155	1	0.16	0.71	0.11
156	1	0.09	0.69	0.06
157	1	0.20	0.75	0.15
158	1	0.12	0.70	0.08
159	1	0.16	0.73	0.11
160	1	0.10	0.67	0.07
161	1	0.25	0.75	0.19
162	1	0.10	0.72	0.07

163	1	0.20	0.72	0.14
164	1	0.13	0.74	0.10
165	1	0.11	0.68	0.07
166	1	0.18	0.74	0.13
167	2	0.26	0.73	0.19
168	2	0.12	0.66	0.08
169	2	0.38	0.78	0.29
170	2	0.11	0.67	0.07
171	2	0.24	0.76	0.18
172	2	0.12	0.65	0.08
173	2	0.10	0.65	0.07
174	2	0.27	0.72	0.20
175	2	0.16	0.70	0.11
176	2	0.24	0.66	0.16
177	2	0.20	0.62	0.13
178	2	0.12	0.56	0.07
179	2	0.22	0.72	0.16
180	2	0.09	0.76	0.06
181	2	0.57	0.74	0.43
182	2	0.66	0.64	0.42
183	2	0.57	0.69	0.39
184	2	0.62	0.78	0.49
185	2	0.50	0.80	0.40
186	2	0.54	0.73	0.40
187	2	0.16	0.54	0.09
188	2	0.25	0.64	0.16
189	2	0.33	0.68	0.23
190	2	0.29	0.71	0.21
191	2	0.27	0.65	0.17
192	2	0.51	0.62	0.32
193	2	0.32	0.59	0.19
194	2	0.37	0.83	0.31
195	2	0.56	0.75	0.42
196	2	0.34	0.78	0.27
197	2	0.32	0.65	0.21
198	2	0.33	0.62	0.20
199	2	0.45	0.69	0.31
200	2	0.36	0.65	0.23
201	2	0.31	0.58	0.18
202	2	0.27	0.60	0.16
203	2	0.31	0.67	0.21

204	2	0.33	0.66	0.22
205	2	0.49	0.59	0.29
206	2	0.29	0.68	0.20
207	2	0.39	0.71	0.28
208	2	0.44	0.63	0.27
209	2	0.34	0.66	0.22
210	2	0.42	0.74	0.31
211	2	0.20	0.57	0.11
212	2	0.21	0.63	0.13
213	2	0.21	0.52	0.11
214	2	0.32	0.70	0.23
215	2	0.43	0.60	0.26
216	2	0.42	0.63	0.27
217	2	0.43	0.59	0.25
218	2	0.64	0.81	0.52
219	2	0.34	0.78	0.27
220	2	0.54	0.66	0.36
221	2	0.81	0.73	0.59
222	2	0.36	0.81	0.29
223	2	0.64	0.81	0.52
224	2	0.46	0.81	0.38
225	2	0.49	0.69	0.34
226	2	0.42	0.66	0.28
227	2	0.51	0.72	0.37
228	2	0.71	0.62	0.44
229	2	0.43	0.57	0.24
230	2	0.37	0.60	0.22
231	2	0.38	0.58	0.22
232	2	0.39	0.76	0.30
233	2	0.10	0.51	0.05
234	2	0.38	0.72	0.27
235	2	0.21	0.66	0.14
236	2	0.27	0.67	0.18
237	2	0.10	0.67	0.07
238	2	0.20	0.56	0.11
239	2	0.16	0.51	0.08
240	2	0.37	0.61	0.23
241	2	0.39	0.65	0.26
242	2	0.44	0.58	0.26
243	2	0.33	0.72	0.24
244	2	0.56	0.76	0.42

245	2	0.10	0.66	0.07
246	2	0.16	0.70	0.11
247	2	0.18	0.70	0.13
248	2	0.18	0.70	0.12
249	2	0.32	0.75	0.24
250	2	0.47	0.60	0.28
251	2	0.18	0.68	0.12
252	2	0.38	0.72	0.27
253	2	0.38	0.66	0.25
254	2	0.28	0.70	0.20
255	2	0.30	0.72	0.22
256	2	0.43	0.71	0.31
257	2	0.20	0.57	0.11
258	2	0.27	0.57	0.15
259	2	0.24	0.60	0.15
260	2	0.59	0.57	0.33
261	2	0.49	0.66	0.32
262	2	0.17	0.58	0.10
263	2	0.35	0.65	0.23
264	2	0.14	0.67	0.09
265	2	0.16	0.68	0.11
266	2	0.15	0.61	0.09
267	2	0.21	0.65	0.14
268	2	0.18	0.74	0.13
269	2	0.35	0.66	0.23
270	2	0.48	0.77	0.37
271	2	0.22	0.62	0.14
272	2	0.10	0.57	0.06
273	2	0.23	0.64	0.15
274	2	0.23	0.73	0.17
275	2	0.18	0.68	0.12
276	2	0.20	0.57	0.11
277	2	0.23	0.64	0.15
278	2	0.15	0.68	0.10
279	2	0.44	0.76	0.33
280	2	0.62	0.72	0.45
281	2	0.65	0.74	0.48
282	2	0.72	0.73	0.53
283	2	0.43	0.65	0.28
284	2	0.48	0.68	0.32
285	2	0.37	0.69	0.25

286	2	0.16	0.70	0.11
287	2	0.30	0.68	0.20
288	2	0.29	0.62	0.18
289	2	0.86	0.80	0.68
290	2	0.17	0.66	0.11
291	2	0.52	0.74	0.38
292	2	0.79	0.77	0.61
293	2	0.49	0.76	0.37
294	2	0.73	0.71	0.52
295	2	0.85	0.78	0.67
296	2	0.69	0.76	0.52
297	2	0.58	0.67	0.39
298	2	0.33	0.69	0.23
299	2	0.23	0.66	0.15
300	2	0.67	0.71	0.47
301	2	0.21	0.70	0.15
302	2	0.20	0.60	0.12
303	2	0.40	0.68	0.28
304	2	0.29	0.64	0.19
305	2	0.65	0.70	0.45
306	2	0.42	0.77	0.32
307	2	0.39	0.73	0.29
308	2	0.50	0.77	0.39
309	2	0.21	0.65	0.14
310	2	0.18	0.74	0.14
311	2	0.66	0.78	0.52
312	2	0.66	0.64	0.43
313	2	0.40	0.72	0.29
314	2	0.47	0.77	0.36
315	2	0.57	0.77	0.43
316	2	0.37	0.59	0.22
317	2	0.30	0.70	0.21
318	2	0.51	0.72	0.37
319	2	0.36	0.72	0.26
320	2	0.26	0.76	0.20
321	2	0.19	0.72	0.14
322	2	0.15	0.73	0.11
323	2	0.15	0.72	0.11
324	2	0.16	0.69	0.11
325	2	0.20	0.71	0.14
326	2	0.70	0.76	0.53

327	2	0.42	0.72	0.30
328	2	0.32	0.66	0.21
329	2	0.43	0.64	0.27
330	2	0.32	0.74	0.23
331	2	0.38	0.72	0.27
332	2	0.34	0.80	0.27
333	2	0.36	0.64	0.23
334	2	0.35	0.62	0.21
335	2	0.38	0.57	0.22
336	2	0.42	0.66	0.27
337	2	0.27	0.76	0.21
338	2	0.28	0.72	0.20
339	2	0.46	0.76	0.35
340	2	0.42	0.72	0.30
341	2	0.26	0.62	0.16
342	2	0.43	0.74	0.32
343	2	0.59	0.71	0.42
344	2	0.71	0.76	0.54
345	2	0.46	0.72	0.33
346	2	0.39	0.76	0.30