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A comparative analysis of fish catches composition in crude oil polluted and non polluted areas of Gokana and Khana Local Government Areas in Rivers State Nigeria

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Abstract

The study compared fish catch composition in crude oil polluted and non-oil polluted areas in Gokana and Khana Local Government Areas, Rivers State, Nigeria. A total of 120 fisher folks were randomly selected from the study area. Structured questionnaire and scheduled interviews were used for the data collection. Descriptive statistics, net farm income model, regression analysis and t-test were the analytical tools used. Linear, semi-log, exponential and double log were used. Double log functional form was used as the lead equation because it had the highest R^2 of 56.9%. All the respondents were male and 46.7% of them were within the age of 30-50 years. Tilapia and mullet fish species were the most commonly fish species found during the study period. Revenue from the non-oil polluted location was higher than that of the oil polluted area, with a t-value of -7.38 which implied that mean revenue of the two areas was statistically different at 1% level. Labour variable was significant and showed negative influence on the fishers' net income. Fish type was significant and positive. Community crisis and oil pollution were the major constraints faced by the fishermen in the two Local Government Areas. It is recommended that fishermen from the oil polluted area should consider fish farming as an alternative means of livelihood in order to increase the quantity and availability of fish in the area.
Keywords: *Fish catch, composition, crude oil, polluted, non-oil polluted communities*

INTRODUCTION

Nigeria is endowed with rich and abundant water resources capable of supporting a large population of fishes. The country is also blessed with a vast expense of land, fresh water, marine, and brackish water eco-system that is richly blessed with aquatic life (Inoni & Oyaide, 2007). About 214 billion m^3 of surface water and 87km^3 of ground water in the country could be useful for aquaculture and artisanal fishery business (Authman, Abbas & Abbas, 2013). They further noted that fishery sub-sectors accounts for about 40% of animal's protein in the diet of individuals in Nigeria. Fishery sector contributes 4.4% of the agricultural share of the nation's gross domestic product (GDP) as at 2001 to 2003 (World Health Organization (WHO), 2012).

Oil pollution is one of the biggest problems the world is facing today. There has been increasing global concern over the public health impacts attributed to environmental pollution, in particular, the global burden of disease in the last three decades. Water pollution is one of the principal environmental and public health problems residents in the southern Nigeria are facing (Anwar, 2013). It is noteworthy to mention that water pollution does not only damage and threaten the aquatic ecosystems and the terrestrial organisms but it also exert significant effects on natural resource and environments (Authman et al.; 2013). United Nations Development Program -UNEP (2011) reported that crude oil worth hundreds of billions was been extracted from the Niger Delta wetlands, earning huge profits.

The report also noted that quality of life and livelihood of the people in the communities were mostly affected by the ugly scenario of pollution. Ogoni land like other part of the Niger Delta of Nigeria, where offshore and onshore drilling are carried out, are reported to have experienced spills from wells and transporting mishaps from which oil may spread to form a surface film. As the spill occurs in this region, emulsification occurs and there is the degradation of the immediate and adjoining environment (Abdullahi, Madu & Abdullahi, (2010). This scenario appears to seriously hinder the chances of survival of individuals who are engaged in fishing activities in the area, thereby creating a great concern for the people in area. The indiscriminate discharge of oil into the environment from oil and gas exploration activities has resulted in the accumulation of these products in water. Such accumulations endanger estuarine and marine organisms. Fishing and aquaculture are important industries which are greatly affected by oil pollution in various ways (Ogwu, Salihat & Joseph, (2015).

Attempts have been made by individuals, government, non-governmental organizations to address the menace caused by oil pollution. Also, world institutions like UN, World Bank, had also made frantic efforts to finding solution to the lingering environmental pollution associated with oil spills and flaring of gas in the Niger Delta. Regrettably, these efforts have not yielded the expected outcome. Scholars like Aghalino (2012,

2016), Ashton (2015), Akujuru (2012), Augustine & Sanford (2010), Brouwer (2011), Emoyan (2015), Frynas (2013) and Fentiman Fentiman & Zabbey, (2015) in their research works attempted to address the perennial problems associated with the causes of oil pollution in Ogoni land. However, oil pollution has continued to impact negatively on the environments in the oil producing communities in the area. Oil spills contaminate the sources of drinking water, rivers, farmlands, fish ponds etc. The exploration and production of petroleum (oil and gas) and its subsequent transportation and distribution in the Niger Delta have led to degradation and subsequent pollution of aquatic habitats with serious threats to associated flora and fauna (Raufu., Adepoju, Salau & Adebiyi, (2009).

Spills are the major challenges in the exploration and exploitation of oil affect the ecosystem in several ways. Fishes and other aquatic organisms use the food-rich estuary and creeks as breeding, nursery and feeding grounds and spend their adulthood in the nearby ocean but the oil spills have reportedly driven them away (Abdullahi et al., 2010). Alagoa., Ngodigha, Daworiye, Charles & Ipiteikemuh, (2018) reported that, the variation in number of fishes species and families that the artisanal fisher's catch in the water body could be attributed to fishing methods and gears selectivity, which could also be a result of fish size and target species. Although the fish caught compares with that of similar water bodies in the Niger Delta, the problem of pollution on the river may have contributed to the low fish catch in the river. Fishing and farming being basic activities of people are affected, thereby reducing the number and the quantity of fish catch. It is observed that when oils spill occur, its effects especially the thorns and thistles linger for a long time after occurrence. This subsequently contributes to variations in the quantity of fish catch in the area. It is on this ground that the study was designed to compare fish catch composition in oil polluted and non-polluted communities in Ogoni land. Specifically, socio-economic characteristics of fishermen in oil polluted and non- oil polluted communities in Ogoni land were described, various fish catch compositions were identified in the area, profitability of fish catch in oil polluted and non-oil polluted communities was estimated, effects of oil pollution on volume of fish catch in the oil polluted community were determined and constraints faced by the fishermen in oil polluted communities and non-polluted communities in the study area were identified.

MATERIALS AND METHODS

Area of Study

This study was carried out in Bodo city community in Gokana Local Government Area and Kaa in Khana Local Government Area both in Rivers State, Nigeria. This covers area of about 159sq km. Aaccording to the National Population Census(2006), it had a population of 117,797 (Gokana Local Government Council - GLGC, 2009). Bodo community creek could be located between latitudes 4°36′ and 4°35′N and between longitudes 7°15′ and 7°16′. The Gokana Local Government Area consist of seventeen (17) including the Bodo community which includes the following; B. Dere, Barako, Bera, Biara, Bodo, Bomu, Deken, Deeyor, Gbe, Goi, K. Dere, Kibangba, Kpor, Lewe, Mogbo, Nwenbiara, Nweol while the Khana Local Government Area consist of (38) communities which are; Boten, Kani, Luawii, Zaakpong, Kayangbe, Gure, Gbamboue and Kaa among others. The primary occupations are farming and fishing. Gokana and Khana is one of the 23 Local Government Areas in Rivers State. Fishing is the main occupation of large number persons in Bodo as well as Kaa people in Rivers State. The mean temperature of the area 27°C, the area is characterized by alternate wet and dry seasons, with annual rainfall ranging between 160mm and 298mm and relative humidity of about 90% (Azimi and Moghaddam, 2013).The population of the study comprised of all the fishermen in both oil polluted and non-polluted communities which covers Bodo and Kaa communities respectively. There are about 53,000 fishermen in Bodo, Gokana Local Government Area and about 25,000 fishermen in Kaa, Khana Local Government Area (GLGC, 2010).

Sampling Technique

Random sampling technique was used to select the fishermen who are involved in fishing activitiess from the entire population. Bodo community was purposively selected from Gokana Local Government Area as community that experienced crude oil pollution and Kaa community was purposively selected from khana local government area as the non-oil polluted community. There are about three sub-villages in Bodo community which are, Nwezor, Bara, Bara-Nwezor respectively. Twenty (20) fishermen were randomly selected from each of the sub-villages in Bodo community giving a total of 60 fishermen in Bodo city while sixty fishermen was randomly selected from Kaa community since there is no sub-village in the community. A total of 120 fishermen were selected from the study area.

Method of Data Collectio : The data for the study was collected from both primary and secondary source. The primary source of the data was obtained through the use of structured questionnaire and scheduled interview. Secondary data was collected through online sources and a review of various government departmental reports such as the Ministry of Agriculture was also used. Other source includes various publications by the government, non-governmental organizations, research organizations, universities and international bodies.

Method of Data Analysis: Objectives 1, 2, and 5 were determined using descriptive statistical tools such as mean, median, mode, frequency distribution and percentages. Objective 3 was achieved using net farm income model. Objective 4 was achieved using multiple regression analysis.

Model Specification

Net Farm Income Model is thus;

TC = TFC + TVC

Where;

TC = Total cost incurred in naira by fishermen in the study areas.

TVC = Total variable cost incurred in naira by fishermen in the study areas, they include the aggregate of the cost of baits per kg, cost of basket, cost of labour, cost of transportation, cost/rent on canoe.

TFC = Total fixed cost incurred in naira by fishermen in the study areas, which include; cost of Net (N), cost of basin (N).

TR = P x Q

Where;
TR = Total revenue generated by the fishermen in the study areas from the sales of fish (Quantity of fish X price of fish)
P =Unit Price of fish per kg
Q = Quantity of fish catch in kg

NI = GM – TFC

Where;
NI = Net income of the fishermen in the study areas
GM = Gross margin
Gross margin is defined as the difference between total revenue and total variable cost.
Mathematically it is usually expressed as thus;
GM = TR – TVC
Where
GM = Gross Margin of the fish catch

Multiple Regression Analysis

The regression model is specified as shown below;
The implicit form is given as;
$Y = f(X_1, X_2, X_3, X_4, X_5 \ldots\ldots X_n)$
$Y = \beta_0 + {}_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e$
Where
Y = Quantity of fish catch
β_0 = intercept
e = error term
X_1 = Size of net in meters
X_2 = Quantity of baits in (kg)
X_3 = Size of canoe in meter
X_4 =Distance covered in (km)
X_5 = Number of hours spends in fishing per day

RESULTS AND DISCUSSION

The result in Table1 showed that all the respondents was male, meaning that fishing is basically done by male folks in the study area. This result is in line with the findings of Inoni and Oyaide (2007) who reported that (72.3%) of males in the Niger Delta region are involved in fishing activities. This is because the fishing activity is very strenuous and seen as a hard labour for the female folks. It involves staying on the shore for a good number of labour hours and most times staying late.

The result also showed that those within the ages of 30-50years constitute the largest percentage of 46.7%. The finding supports Bolorunduro, (2003) view who observed that age group 31-50 years is the most active productive years of

X6 = Crude oil debris on the surface of the water (scanty = 1, fair = 2, dense = 3)
X7 = Fish type (scaly = 1, Non scaly = 0)
X8 = Labour
The functional forms were tried and the best fit was used as final equation is based on a priory expectation and significant, R2 and F- Statistics.
The four functional Forms will be;

Linear Form;

$Y = \beta_0 + {}_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + e$

Semi Log Form;

$Y = \beta_0 + {}_1 \text{LogX}_1 + \beta_2\text{LogX}_2 + \beta_3 \text{LogX}_3 + \beta_4 \text{LogX}_4 + \beta_5 \text{LogX}_5 + e$

Double Log Form;

$\text{LogY} = \beta_0 + \beta_1 \text{LogX}_1 + \beta_2\text{LogX}_2 + \beta_3 \text{LogX}_3 + \beta_4 \text{LogX}_4 + \beta_5 \text{LogX}_5 + e$

Exponential Form

$\text{LogY} = \beta_0 + {}_1X_1 + \beta_2X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e$

Where;
$\beta_1 \ldots\ldots\ldots \beta_5$ are the co-efficient to be determined
$X_1 \ldots\ldots\ldots X_5$ are the independent variable

T-test

$$T = \frac{\bar{x}_1 - \bar{x}_2 - \Delta}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where
T = t-test
$\bar{x}_1$ and $\bar{x}_2$ are the means of the two samples

Δ is the hypothesized difference between the population means

s_1 and s_2 are the standard deviations of the two samples

n_1 and n_2 are the sizes of the two samples.

The number of degrees of freedom for the equation is the smaller of the n_1- 1 and n_2_1. The statistic is significant if the value of the test statistic lies in the critical region. The null hypothesis is rejected, but if it lies in the accepted region, the test is insignificant and the null hypothesis will be rejected. That is null hypothesis is rejected if the t-computed is greater than the t-table value (t_a=0.05).

fishermen in the Niger Delta, Nigeria. The result is also in accordance with the findings of Ndubueze-Ogaraku, Onoja and Monsi, (2016) who described youthful individuals who are majority of fisher folks as productive and energetic farmers. The results further showed that majority (47.5%) of the fishermen were married while 30.8% were single. This implied that responsible married men dominated the fishing activities in the study area because of the family size, thereby contributing to productivity by serving as a source of labour. The result is in line with the findings of Raufu et al. (2009) who observed that 81.3% of the fishermen were married while only 10% were single and the remaining were divorced or widowed. The result also showed that majority of the fishermen (48.3%) as observed in the study area had 1-5 household members. The result also revealed that most of the fishermen (49.2%) had

more than 11 years of fishing experience, 32.5% had 6-10 years of fishing experience. This showed that the fishermen are much familiar with the terrain of fishing in the study area. The result is similar to the findings of Dogondaji et al. (2009) who documented that 56% of the respondents in their study had more than 16 year of fishing experience in Toidi Lake of Binji Local Government area, Sokoto State, Nigeria. It also explained that 40.8% (majority) were fishing for commercial purposes. This result implied that most of the fishermen earned their living from artisan fisheries and also earned their living from fishing. It was found that (51.7%) covered a distance range of 11 kilometers and above when fishing. This was observed majorly among the fishermen in the oil spilled community (Bodo-City). They explained that they had to fish this far to overcome the dreaded effects of the crude oil debris on the water surface like (staining and easy spoiling of fishing nets and other fishing equipment, less species diversity, less fish catch, skin irritation, etc). They also explained that fishes within this polluted area easily get weak and loss market value or die from lack of oxygen as it becomes difficult for oxygen to penetrate through the dense medium of crude-oil debris on the water surface while the other 48.3% covered a distance of 6-10 kilometers. Majority (41.7%) spent 3-5 hours during fishing while (35%) spent 6-12 hours. This is because of the distance they had to cover to get to a good and suitable fishing ground so as to overcome the crude debris.

Table 1: Socio-economic Characteristics of the Fishermen

Variables	Frequency (f=120)	Percentage (%)
Gender		
Male	120	100
Age		
Below 30 years	42	35.0
30-50 years	56	46.7
51years and above	22	18.3
Marital status		
Single	37	30.8
Married	57	47.5
Separated	20	16.7
Widowed	6	5.0
Household Size		
1-5 persons	58	48.3
6-10persons	57	47.5
11 persons and above	5	4.2
Fishing experience		
1-5 years	17	14.2
6-10 years	22	18.3
11-15	39	32.5
15 and above	42	35.0
Fishing purpose	17	14.2
Food	49	40.8
Trading	8	6.7
Recreation	46	38.3
Occupation		
Fishing distance covered		
6-10km	62	51.7
11km and above	28	48.3
Time spent on fishing		
1-2 hours	11	9.2
3-5 hours	50	41.7
6-12 hours	42	14.7
13 hours and above	17	14.7

Source: Field Survey, 2019

Table 2: Various fish catch compositions identified in the study area

Common Names	Local Names	Fish Composition From Oil Spilled Community (Kg)	Percentage Composition (%)	Fish Composition From Non-Oil Spilled Community (Kg)	Percentage Composition (%)
Tilapia	Kpao	35	33.0	29	24.5
Mullet	Sunu	21	19.8	20	16.1
Sardine	Bali	9	8.4	12	8.4
Snapper	Kodo	14	13.3	13	9.0
Croaker	Nyorno	1	0.9	0	0
Bonga Fish	Kugbo	2	1.9	10	7
Stingray	Kamuu	0	0	10	7
Sol	Pelape	1	0.9	0	0
Grouper	Giavisaana	1	0.9	7	4.9
Grunt	Gah	6	5.6	2	1.4
Silver Catfish	Bui	2	1.9	6	4.2
Barracuda	Dorlor	6	5.6	15	10.5
Shinose	Tel	4	3.9	0	0

Source: Field Survey, 2019.

The results on the Table 2 showed that (*Tilapia and Mullet*) are the most commonly caught species in the study area with the highest percentages of (33.0 and 19.8) and (24.5 and 16.1) respectively. It was found that fish catch from the oil spilled community in Gokana Local Government Area (Bodo-city) was higher than that of the non-oil spilled community in Khana Local Government Area (Kaa) despite the oil pollution incidence recorded in the area. This could be because most fishermen in the oil spilled community fish far away (13km) from the spilled area so as to overcome the effects of the spillage and also to get a good catch thereby catching bigger sizes of fish. It was also found that these species have the ability to withstand crude debris to an extent because of the strong nature of their scale and because of their tolerant nature which enable them strive better than other species.

Table 3: Fish types and their composition in the study area

Oil spilled community (Bodo-city, Gokana)						Non-oil spilled community (Kaa, Khana)					
Scaly Fish	catch composition (kg)	%	Non-scaly fish	Catch composition (kg)	%	Scaly Fish	Catch composition(kg)	%	Non-scaly fish	Catch composition(kg)	%
Tilapia	35	33.0				Tilapia	29	24.5			
Mullet	21	19.8				Mullet	20	16.1			
Sardine	9	8.4				Sardine	12	8.4			
Snapper	14	13.3				Snapper	13	9.0			
Croaker	1	0.9				Croaker	0	0			
Bonga fish	2	1.9				Bonga fish	10	7			
			Stingray	0	0				Stingray	10	7
			Sol	1	0.9				Sol	0	0
Grouper	1	0.9				Grouper	7	4.9			
Grunt	6	5.6				Grunt	2	1.4			
			Silver catfish	2	1.9				Silver catfish	6	4.2
Barracuda	6	5.6				Barracuda	15	10.5			
Shinose	4	3.9				Shinose	0	0			

Source: Field survey, 2019.

The results on the Table 3 indicated that the commonest fish species caught in the study area are the (*Tilapia, Mullet, Sardine* and *snapper*) and they constituted the highest percentage of catch (33.0%, 19.8%, 8.4%, 13.3%) in the oil spilled community and (24.5%, 16.1%, 8.4%, 9.0%) in the non-oil spilled community respectively. It was noticed from the table that there was a higher percentage of catch composition in the oil spilled community (Bodo-city). This could be as a result of the fact that the fishermen from this area fish far away from the polluted areas and thereby got good catch in quantity and composition and also in size compared to that of the non-oil spilled area (Kaa). Other species caught in the area also include *Bonga fish, Grunt, Barracuda, Shinose, sol, stingray, Silvercatfish.*

Table 4: Difference in the fish catch composition of the study area (Gokana and Khana)

Parameters	Mean fish catch in Gokana	Mean fish catch in Khana
Mean fish catch	140.1667	245.3898
Df	117	
t-Stat	-7.380***	
P (T≤t)	0.000	
No of observations	60	59

Source: Field Survey, 2019.

The result on the Table 4 showed that the mean fish catch from Gokana was estimated 140.16 kilograms per week while the mean fish catch for Khana was estimated 245.38 kilograms. The t-Stat was -7.38 which indicated that the mean fish catch between Gokana and Khana was significant at 1% level. The null hypothesis was rejected. The alternative hypothesis that the mean fish catch in Gokana is lower than the mean fish catch from Khana was accepted. This implied that fishermen in Khana achieve greater fish catch than their fishing counterpart from Gokana.

The result on the Table 5 showed the cost and returns of fish catch in the non-oil spilled community (Kaa) in Khana Local

The result on the Table 6 showed the cost and returns of fishermen in the oil spilled community (Bodo) in Gokana Local Government Area and the variable cost was found to be twenty-three thousand, seven hundred and thirty-five naira (₦23,735.00), fixed cost was estimated as thirty-seven thousand six hundred and forty-one naira, sixty-seven kobo (₦37,641.67) and the total cost was sixty-one thousand three hundred and seventy-six naira sixty-seven kobo (₦61,376.67). The total revenue was eighty thousand three hundred and ten naira (₦80,310.00). The gross margin was estimated as fifty-six thousand five hundred and seventy-five naira (₦56,575) while the net profit was found to be eighteen thousand nine hundred and thirty-three naira, thirty-three kobo (₦18,933.33).

The result on the Table 7 showed that the mean net profit made by fishermen in Khana Local Government Area was estimated as one hundred and fourteen thousand, eight hundred and eighty-three naira thirty-three kobo (₦114,883.33) while the mean net profit of fishermen in Gokana Local Government Area was eighty thousand three hundred and ten naira (₦8,310.00). The t-value was (14.42) which indicated that the mean profit value between the two Local Government Areas is significantly different at 1 percent level of significance. The null hypothesis was rejected. The alternative hypothesis that the mean profit from Khana LGA was higher than the mean profit from oil Gokana LGA was accepted. This implied that people in Khana made higher profit than those in Gokana. This could be as a result of oil pollution in Gokana which may have damaged some aquatic life, causing a decline in the fish catch recorded by fishermen in Gokana LGA. This confirmed the findings of Zabbey (2004), who highlighted that the explosion of dynamite as a result of oil exploration in aquatic environments leads to narcotic effects and mortality of fish and other faunal organisms. A multiple regression model was used to determine the effect of crude spills on fish catch in Gokana Local Government Areas. Four functional forms (linear, semi-log, exponential and double log) were used. The double-log functional form was chosen as the lead equation because it had the highest R^2 value of (0.569). This implied that about 56.9 % of the variation in the volume of fish catch made by fishermen was explained by the explanatory variables introduced in the model while the remaining 43.1% was due to other factors not specified in the model. The F-ratio which determines the overall significance of the regression has a coefficient of 9.271 which implied that the regression has a high explanatory power. The result showed that crude oil debris with a negative significant (-0.1741) was 5% level which implied that a percentage increase in crude oil debris will cause fish catch to drop by 17.4%. This means that as debris from crude oil increases, the number of fishes caught by fishermen in the study area decreases. This result was in line with the findings of Akpokodje and Salau (2015) who stated that oil spill is a major impediment to agricultural activities in the Niger Delta region of the country.

Government Area. The result showed that variable cost was forty-five thousand seven hundred and twenty-nine naira sixteen kobo (₦45,729.16), fixed cost was estimated as thirty-two thousand and thirty-three naira thirty-four kobo (₦32,033.34) and the total cost was seventy-eight thousand seven hundred and sixty-two naira fifty kobo (₦78,762.50). The total revenue was one hundred and fourteen thousand eight hundred and eighty-three naira, thirty kobo (₦ 114,883.30). The gross margin was estimated as sixty-nine thousand one hundred and fifty-four naira fourteen kobo (₦ 69,154.14) while the net profit was found to be thirty-six thousand one hundred and twenty naira, eighty kobo (₦36,120.80).

The result on the Table 9 showed that health related issues with mean score (3.39), physical contamination of water bodies had a mean score of 2.98 and loss of market confidence with a mean score of 2.72 were among the three major effects of crude oil pollution on the fishing activities of the fishermen in the study areas. However, destruction of the habitat was surprisingly viewed as the least effect of oil debris in the crude oil polluted area (Bodo) in Gokana Local Government Area.

Decision rule: Accept as a constraint if mean score is approximately 2.0 or greater, otherwise reject.

Table 5: Cost and returns of fish catch in the non-oil spilled community in Khana LGA

Variables	Items	Amount in Naira (₦)
Fixed Costs	Cost of Net	30,516.67
	Cost of Basin	1,516.67
Total Fixed Cost		32,033.34
Variable Costs	Cost of Baits (Kg)	390.83
	Cost of Baskets	2,596.67
	Cost of Labour	17,008.33
	Cost of Transportation	13,733.33
	Cost of Canoe Rent	12,000
Total Variable Costs	TVC	45,729.16
Total Cost	Total Fixed Cost + Total Variable Cost	78,762.5
	Sales from fish	
Revenue	TR – TVC	114,883.3
Gross Margin	Total Sales from fish	69,154.14
Total Revenue	Total revenue – Total Cost	114,883.3
Net Margin (profit)		36,120.8

Source: Field Survey, 2019.

Table 6: Cost and returns of fish catch in the oil spilled community in Gokana LGA

Variables	Items	Amount in Naira (₦)
Fixed Costs	Cost of net	37,416.67
	Cost of basin	225.00
Total Fixed Cost		37,641.67
Variable Costs	Cost of baits (Kg)	281.67
	Cost of baskets	250.00
	Cost of labour	13,525.00
	Cost of transportation	3,350.00
	Cost of canoe Rent	6,328.33
Total Variable Costs	TVC	23,735.00
Total Cost	Total Fixed Cost + Total Variable Cost	61,376.67
	Sales from fish	
Revenue	TR – TVC	80,310.00
Gross Margin	Total Sales from fish	56,575.00
Total Revenue	Total revenue – Total Cost	80,310.00
Net Margin (profit)		18,933.33

Source: Field Survey, 2019.

Table 7: Difference in revenue between non-oil polluted and oil polluted communities

Parameters	Mean profit from the non-oil spilled community (₦)	Mean profit from the oil spilled community (₦)
Mean Profit	80,310.00	114,883.33
Standard deviation	40,437.16	18,150.12
Standard error	5,220.42	2,343.17
Degree of freedom	188	

t-Stat	23.98	

Source: Field Survey, 2019.

Table 8: Effects of oil pollution on fish catch composition in the oil polluted community in Gokana LGA

Variables	Linear	Semi-log	Exponential	Double-log^{+}
Constant	28440.920 (0.083)	-90225.26 (-1.034)	10.774*** (28.489)	8.986805*** (9.917)
Canoe size	192.141 (0.147)	13319.76 (0.922)	0.002 (0.139)	0.10448 (0.4885)
Crude debris	4704.414 (0.404)	11032.76 (1.180)	0.078 (1.268)	-0.1741** (1.347235)
Fish type	17777.77** (1.991)	25584.80** (2.185)	0.158 (1.605)	0.2146* (0.1.765)
Fish distance	489.554 (0.408)	2956.66 (0.228)	0.012 (0.922)	0.09876 (0.701)
Fishing hours	-25.363 (-0.015)	5210.26 (00.362)	-0.002 (-0.137)	0.009876 (0.066)
Labour	-0.393 (-1.157)	-14429.82** (-2.266)	-1.40E-06 (-0.371)	-0.0670 (-1.0129)
Net size	-1245.903 (3.161098)	3210.84 (0.194)	-0.040 (-1.334)	-0.1416 (-0.826)
Bait quantity	543.113 (0.4993)	2287.16 (0.266)	0.00964 (0.802)	0.0359 (0.402)
R-Squared	0.486	0.475	0.409	0.569
F-statistic	6.619568	9.508601	4.851464	9.271647
Akaikeinfo criterion	23.540	23.348	0.716	0.399340
Durbin-Watson stat	1.516421	1.421113	1.654287	1.504088

Source: Field Survey, 2019. ***1% level of significance, **5% level of significance

The result on the Table 10 showed the three major constraints faced by the fishermen in the study area where community crisis with a mean value of (2.58) was the major constraint. This implied that majority of the fishermen find it difficult engaging in fishing activities as a result of communal crisis in the study areas. The result further showed that difficulties in accessing fishing grounds was also a constraint with mean value of (2.56) which indicated that the fishermen had difficulties accessing fishing grounds. This could be as a result of communal crisis in the study area and also as a result of the oil pollution. Inadequate market for fish was also considered a constraint with a mean score of (2.44), implying that the fishermen most times find it difficult to market their fish. This could be as a result of the effect crude oil on the fishes (e.g. removal of the eyes and breakage of the fins especially the *Tillapiaspp)* as living organisms.

Lastly the result on the table showed that the respondents did not see Government restrictions (1.87) and inadequate fishing equipment (1.57) as major problem to fishing. This is because most of the fishermen see it as an occupation and also a source of revenue and try as much as they can to get the necessary fishing equipment needed for the job.

CONCLUSION AND RECOMMENDATIONS: The study concludes that male dominated the fisher folks in the study area. Tilapia and mullet fish species were the most commonly fish species found during the study period. There was a significant difference in the mean quantity of fish catch in the oil spilled and non crude oil spilled communities. Revenue from the non-oil polluted location was significantly higher than that of the oil polluted area. Quantity of labour variable was significant and showed negative influence on the fishers' net

income. Fish type was significant and positive. Community crisis and crude oil pollution were the major constraints faced by the fishermen in the two Local Government Areas. Community leaders should encourage peaceful co-existence in the area to enable fisher men participate actively in the fishing activities. Also, cold storage facilities should be provided in the communities in order to reduce quantity of fish spoilage. This can be jointly owned and managed by the fishermen. Efforts should also be made to provide the fishermen with motorized boat by the government as an empowerment programme to curb unemployment in the study area. Crude oil companies operating in the area should honour the UNPEP MOU by implementing cleaning up of the polluted environment to ensure increased fish catch in the study area.

Table 9: Perceived effects of oil spillage on fish catch by the fishermen in the study area

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Rank	Remark
Health issues	80(66.7%)	19(15.8%)	11(9.2%)	10(8.3%)	3.3917	1st	Constraint
Physical contamination	62(51.7%)	4(3.3%)	43(35.8%)	11(9.2%)	2.9833	**2nd**	Constraint
Loss of market confidence	49(40.8%)	13(10.8%)	32(26.7%)	26(21.7%)	2.7250	3rd	Constraint
Reduced fish catch	45(37.5%)	19(15.8%)	35(29.2%)	21(17.5%)	2.6917	4th	Constraint
Tainting	27(22.5%)	1(0.8%)	77(64.2%)	15(12.5%)	2.3417	5th	Constraint
Change in water colour	27(22.5%)	0(0.0%)	49(40.8%)	44(36.7%)	2.0917	6th	Constraint
Destruction of fish habitat	27(22.5%)	0(0.0%)	45(37.55)	48(40.0%)	2.0583	7th	Constraint

Source: Field survey, 2019.

Table 10. Constraints Faced by the Fishermen in the study Area

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Rank	Remark
Community crisis	10(8.3%)	60(50%)	38(31.7%)	12(10.0%)	2.5833	1st	Constraint
Difficulties in assessing fishing grounds	10(8.3%)	60(50%)	36(30.0%)	14(11.7%)	2.5667	2nd	Constraint
Inadequate market for fish	12(10.0%)	45(37.5%)	46(38.3%)	17(14.2%)	2.4417	3rd	Constraint
Inadequate transportation	27(22.5%)	9(7.5%)	69(57.5%)	15(12.5%)	2.3917	4th	Constraint
Bad road network	37(30.8%)	1(0.8%)	53(44.2%)	29(24.2%)	2.3833	5th	Constraint
Water pollution	12(10.2%)	43(36.4%)	29(24.6%)	34(28.8%)	2.2881	6th	Constraint
Restriction by local authorities	12(10.0%)	31(25.8%)	46(38.3%)	31(25.2%)	2.2167	7th	Constraint
High cost of fishing equipment	12(10.0%)	22(18.3%)	60(50.0%)	26(21.7%)	2.1750	8th	Constraint
Government restrictions	12(10.0%)	10(8.3%)	46(38.3%)	52(43.3%)	1.8417	9th	No constraint

Inadequate fishing equipment	10(8.3%)	0(0.0%)	38(31.7%)	72(60.0%)	1.5750	10th	No constraint

Source: Field survey, 2019.

REFERENCES

Abdullahi, U.; Madu, I. & Abdullahi, F. (2010). Evidence of Petroleum Resources on Nigerian Economic Development (2000-2009). *Business and Economics Journal*. 6(2): 5-6

Aghalino, S.O. (2016). Gas flaring, environmental pollution and abatement measures in Nigeria (1969- 2001). *Journal of Sustainable Development in Africa*. 11(4): 219-238

Akpokodje, J. & Salau, S. (2015). Oil pollution and agricultural productivity in the Niger Delta of Nigeria. *Journal of Environmental Economics*. 6(4): 68–75

Alagoa, K. J, Ngodigha, S., Daworiye, P. S., Charles, E. E. & Ipiteikemuh, B. (2018). Landing fish catch assessment of artisanal fishing in the polluted river nun, Amassoma Axises, Bayelsa state. *International Journal of Fisheries and Aquatic Studies*. 6(3): 215-220

Akujuru,V. (2012). The professional duty of valuer in oil pollution compensation valuation. *Paper presented at the NIESU 22nd Annual Conference Port-Harcourt*.Pp.394

Anwar, P. (2013) Environmental health in Egypt. *International Journal of Hygiene, Environmental Health*. 206(4-5): 339-350

Ashton, J.N. (2015). The human eco-system in the Niger Delta Era. Edo: Benin City. 40-50

Augustine, O.I. & Sanford, W. W. (2010). The Effects of waste gas flare on the surface of vegetations in south-eastern Nigeria. *Journal of Applied Ecology.*13:173

Authman, N; Abbas, H.H. & Abbas, W.T. (2013). Assessment of metal status in drainage canal water and their bio-accumulation in *oreochromisniloticus* fish in relation to human health. *Journal of Environmental Monitoring Assess*. 185(1): 891- 907

Azimi, S. &Moghaddam, M.S. (2013). Effect of mercury pollution on the urban environment and human health. *Journal of Environmental Ecology and Resources*. 1(1): 12- 20

Bolorunduro, P.I. (2003). Improved fisheries technologies and approaches for their dissemination. A Case Study of Niger State. *Proceedings of the 16th Annual Conference of the fisheries society of Nigeria, November 4th-9th, Maiduguri, Nigeria*. Pp.74-79

Brouwer, R.(2011). Nutritive influences on the distribution of dry matter in the plant. *Netherland Journal of Agricultural Science.*10:361-76

Dogondaji, S.D.;Wadatan, U. & Ibrahim, K. (2009). Analysis of fishing in Toidi Lake, Binji Local government Area, Sokoto State. *Proceeding of the 23rd Annual National Conference of Farm Management Society of Nigeria*. Pp. 576

Emoyan, O.O.; Akpogorie, I. A. & Akporhonor, E. E. (2015). The oil and gas industry and the Niger Delta: Implication for the Environment. *Journal of Applied Science Environmental Management.*12 (3): 30-31

Fentiman, A. & Zabbey, N. (2015). Environmental degradation and cultural erosion in Ogoniland: a Case Study of the Oil Spills in Bodo. *Extra-ordinary Industrial Society International Journal.* 2: 615-624

Frynas, J.G. (2013). Oil in Nigeria: Conflict and litigation between oil companies and village community. Harmburg: Lit Verlag. Pp. 27

Gokana Local Government Council – GLGC, (2009). *Bulletin*. Pp. 5

Inoni, O. E. & Oyaide, W. J. (2007). Socio-economic analysis of artisanal fishing in the south agro-ecological zone of Delta State, Nigeria. *Agricultural tropical and subtropical Journal*. 40(4): 11-17

National Population Census – NPC.(2006). *Nigerian Census*. Pp. 250

Ndubueze-Ogaraku, M. E., Onoja, A.O. & Monsi, B. (2016). A Comparative analysis of productivity on shell-fish collection in oil-spill and non-oil spill communities of Rivers State, Nigeria. *The Journal of Sustainable Development*. 15(1): 34-49.

Ogwu, F.A.;Salihat, B.S. & Joseph, C.(2015). Environmental risk assessment of petroleum industry in Nigeria:

International Journal of Scientific Research and Innovative Technology. 2(4): 60-71

Raufu, M.O., Adepoju, A.A.; Salau, A.S. & Adebiyi, O. A. (2009). Determinants of yield performance in small scale fish farming in Alimosho Local Government Area of Lagos State. *International Journal of Agricultural Economics and Rural Development.* 2(1): 10-17

United Nations Development Programme -UNDP. (2011). Environmental Assessment of Ogoni land, United Nations Environment Programme. Kenya: Nairobi.

World Health Organization – WHO. (2012). The health effects of industry air pollution exposure in developing countries. Published by WHO. Switzerland: Geneva.

Zabbey, N. (2004). Impacts of extractive industries on the biodiversity of the Niger Delta region, Nigeria. *Paper presented at National Workshop on Coastal and Marine Biodiversity Management, Calabar, Cross-River State,* 7th–9th September.

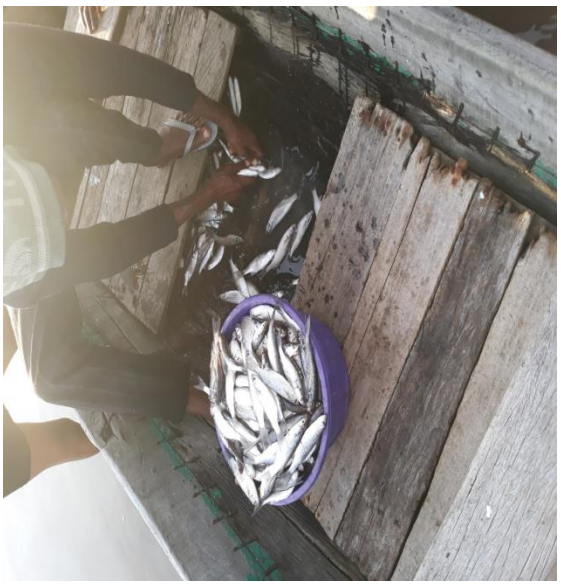
APPENDIX I

Croaker fish, locally called Nyornor

Silver catfish, locally called Bui

(Non-scally)

Tilapia fish, locally called Kpao



Mullet fish, locally called Sunu

Source: Field Survey, 2019.