Effect of Oil Spillage on Fish Farming in Warri North Local Government Area of Delta State, Nigeria

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Abstract
Fish farming is one of the basic sources of livelihood in Niger Delta region and when compromised by environmental mishaps such as oil spillage could have a far-reaching consequence. Therefore, the study assessed the effect of oil spillage on fish farming in the study area. To achieve the main objective, the specific objectives are to describe the socio-economic characteristics of fish farmers in the study area, estimate and compare the catch of fish and the net income accruable to fish farmers in non-oil spill area and oil spill area. Identify causes and finally coping strategies employed by farmers to mitigate the effect of oil spillage on their fisheries resources. A multi-stage sampling procedure involving both purposive and random sampling techniques were used to select 100 respondents, data were elicited from the respondents using well-structured questionnaire, data obtained were analyzed using descriptive statistics, inferential statistics, budgetary techniques and four point-likert scale. The results showed a mean age of 50 years and 56 years of respondents in non-oil spill and oil spill communities respectively while, 82% and 64 % of respondents in both communities were married with respondents from non-oil spill and oil spill communities having an average household size of 7 persons. Pipeline vandalism was the major causes of oil spillage with a mean of 3.96. The revenue generated from fish farming in the non-oil spill communities and oil spill communities were ₦ 900,000 and ₦ 322,750 respectively, the study concluded that oil spillage affected fish farming in the study area.
Key word: Artisanal fish farming, Catch of fish, Oil-spillage and Niger Delta region.

Introduction

Human activities have been foremost among factors responsible for rapid degradation of the earth's rich environmental endowment. Man through technological and scientific advancement have caused environmental changes that are impossible to both estimate and comprehend, our ability to cause changes in the environment has outpaced our ability to remediate the adverse environmental impacts. Oil spillage on the environment is one of the major effects of human technological advancement. This form of pollution as others, results when changes in the environment harmfully affect the quality of human life including effects on animals, micro-organism and plants. Hence, Oxford Advanced Learner's Dictionary (2015) defined oil spill pollution as the process of causing oil spill to make air, water and soil dirty and in an amount dangerous to health.

The regions that have witnessed a systematic reduction in their livelihood potentials are the states of Niger Delta region. The mainstay of the economy of the people in this region are subsistence farming and fisheries but fish farming is the most prominent source of livelihood because of the peculiarity of the soil base. Niger Delta is a rich wetland containing a number of ecological zones (Shell, 2012). The large bodies of fresh water and the rich aquatic life in Niger Delta affords the capabilities and potential to produce, supply and meets high percentage of local demand for fish through fish farming. Food and agriculture organization estimated that 2.2 million metric tons of fish was supplied in Niger Delta in 2018. Despite this potential, over 60% of annual fish consumption is imported into the country. However, with the persistent increase in environmental degradation as a result of oil spillage, the supply of fish has been drastically affected by oil spillage (Shell, 2012).

The Niger Delta is unique because it is the home of Nigeria's oil industry with attendant's environmental hazards such as water, land and air pollution. The ecosystem is particularly sensitive to changes in air and water quality caused by salinity or pollution. Various workers have reported the adverse effect of crude oil spillage on fish farming, (Nlebem and Eze (2020), Sudha, 2017) the effect is proportional to the levels as well as amount of oil spillage.

Although, Nigeria still depends most significantly on crude oil for income earnings, crude oil spillage is a very common problems in the country. Therefore, there is a need for continuous research on the problem associated with pollution resulting from oil spillage and its effect on fish farming. Hence, this particular study has its focused objectives, vis;

(i) describe the socio-economic characteristics of fish farmers between Fisher folks is oil spill and non-oil spill communities

(ii) estimate and compare cost and return to fish farming between fisher folk in oil spill and non–oil spill communities.

(iii) compare the catch of fish between non-oil spill and oil spill communities

(iv) identify the causes of oil spillage and mitigation response employed by fisher folk to augment their livelihood.

Material and Methods

Study Area and Scope

The study was carried out in Delta State. Delta State, apart from being an oil and gas producing state, is also an agrarian state. It is made up of twenty-five (25) local government areas. Delta State is located within the south-south region of Nigeria and lies between longitudes 5°00′ and 6°45′ of the Greenwich Meridian and Latitudes 5°00′ and 6°30′ of the Equator (Delta State Environmental

Protection Agency, 2015. It has a total land mass area of about 18,050 km² and a total population of over five million (Nigerian Buruea of Statistics (NBS) (2018). The major tribes are Urhobo, Itsekiris, Ijaws, and Isokos. The state is endowed with abundant natural resources and has good weather conditions supporting agricultural production all year round. Delta State is rich in tubers and root crops such as cassava, yam, cocoyam, and sweet potatoes.

Warri north is one of the Local Government Area of Delta state with total area of 1,841km^2 and a population of 210,000 (NBS, 2018). The study area is located in the co-ordinators of latitudes 5˚, 51' North and longitude 5˚, 9' 41 East. The LGA is headquatered in Koko, a predominantly riverine area inhibited mostly by Itsekiris and Ijaw people. The major occupation of the indigenes in this LGA are fishing, carving canoes, net-weaving, trading, small scale farming mainly cassava, rubber, oil-palm and other agro-applied activities.

Sampling Procedure and Method of Data Collection

A multi-stage sampling procedure was used for the study. The first stage involved a purposive sampling of oil spill communities and of adjacent non–oil spilled communities for effective comparison.

The second stage involved a simple random sampling of oil spill communities from the list of oil spilled communities, while snowballing was used in sampling an adjacent non–oil spill communities.

The final stage involves the simple random sampling of five (5) fish from oil spilled communities and a corresponding five (5) fish farmers from non-oil spilled communities. Thus, giving us a sample size of hundred and ten (110) fish farmers, however, 100 respondents farmers' questionnaire were found adequate and useful for the study.

Validity of Research Instruments

Validity is the extent to which an instrument measures what it is supposed to measure and perform as it is designed to perform. An instrument is considered valid when there is confidence that it measures what it is intended to measure in a given situation (Rana *et al.,* 2018). The validity of the instrument was determined by the opinion of experts from the Department of Agricultural Economics and Resource Management, Faculty of Agriculture, University of Benin, Benin city, Nigeria. The experts critically examined the instrument with respect to its fitness for this study. His corrections and comment improved the format and structure of the items and were finally used for the study.

Model Specification

Descriptive Statistics such as Mean, Frequency and Percentages were use to achieve the socio-economic Characteristics. Net farm income was used to compare the cost and returns of fish farming between fisher folks in oil spill and non-oil spilled communities. Farm budgeting is a detailed physical and financial plan for the operation of a farm for a certain period. Farm budgeting helps the farmers to compare how profitable different types of enterprise combination.

The specification of net farm income is:

NFI=GI + TC --------- (1)

TC=TVC+TFC ------- (2)

Where;

NFI=Net farm income (₦/ha)

GI=Gross income (₦/ha)

TVC=Total variable cost (₦/ha)

TFC=Total Fixed cost (₦/ha)

The total fixed component includes:

Cost of canoe ₦

Cost of Engine ₦

Depreciation cost ₦

Cost of fish net N Cost of Lantern lamp ₦

The total variable component include;

Cost of labour (man day) ₦

Cost of rope (bundle) ₦

Cost of kerosene ₦

The Revenue include;

Total Revenue ₦

Results and Discussion

Socio-Economic Characteristics of Respondents

Table 1 shows detailed analysis of the socio-economic characteristics of fisher folks in oil spill communities and non-oil spill communities. The gender distribution of respondents in the study area showed that in the oil spill and non-oil spill communities 70% and 75% of the respondent forming simple's majority were males respectively while 30% and 25% were females, this finding implies that male respondent had a preponderance over female respondents. The age demographics showed that the majority of respondent 40% in oil spill communities and 45% in non-oil spill were within the age bracket of 45-64 years, both groups were having a mean age of 55years. Thus, indicating that fish farming is carried out by the younger folks and not the elderly.

The results also showed that (88%) of the respondents in the oil spill regions were within household size of 6-10 persons while a simple majority of respondents in the non-oil spill regions were within 15 person per households, The ultimate average household size were 6 persons. The study also found that the highest number of baskets of fish caught per month by respondents was 2 baskets (40%) and 7 baskets (50%) in the oil spill and non-oil spill communities respectively. This clearly suggests that oil spill incidences have a devastating effect on fish population in Niger Delta region.

Gross Margin Analysis Results

Table 2 shows the results of the estimation of the gross margin of oil spilled and non-oil spilled communities of Niger Delta regions. The results showed that the revenue obtained from sales of harvested fish in the oil spill communities was just over ₦322,000 with a unit price of ₦2,129.00 for an 85kg basket of fresh fish. However, in the non-oil spill communities, revenue of over ₦900,000 was obtained with a unit price of ₦13,290 for an equivalent 85kg basket of fish. This deficit of over ₦600,000 can be attributed to the results of incessant oil spill which has reduced the quantity of fish in the aquatic habitats of the oil spill area. Also, the slight difference in the unit price of an 85kg basket of fresh fish might be

attributed to the fact that the quality of fish obtained in the oil spill areas was inferior to those obtained in the non-oil spill communities. The results also showed that, the total fixed cost of an average fish farmer in the non-oil spill area was ₦347,080 while that of oil spill communities was N286,071. This implies that the fish farmers from the non-oil spill communities invested more on physical assets than fish farmers from the oil spill communities. The total variable cost was ₦14,053 for non-oil spill communities as against N13,000 for oil spill area. This also implies there is a marginal difference in the variable assets between fish farmers in non-oil spill and oil spill communities. The total cost of procuring engines contributed the most to the total cost, accounting for about 79% and 80% in the non-oil spill and oil spill communities respectively, followed by the cost of canoe (₦368 and ₦612) and fish net (₦25,744 and ₦20,000) respectively.

The cost of labour accounted for 2.19% and 2.59% respectively for non-oil spill and oil spill communities, while the cost of a bundle of rope accounted for 1.43% and 1.48% respectively. The net profit obtained in the non-oil spill communities was as high as ₦557,267 while a net profit of as low as ₦23,896.22 was obtained in the oil spill region. The very high difference in net profit might be attributed to volume and quality of fish caught in the two different fishery resources one was impacted by oil spill while the other was not. This finding agrees with robust empirical surveys, that the freshness, aroma and colour of fish in oil spilled communities might have been compromised which in turn depict them as inferior with corresponding low prices, although both farmers were able to cover their total operating expenses.

The results of the causes of oil spillage in the study area are presented in Table 3. The most significant cause of oil spillage was pipeline vandalism with a mean of 3.96. Pipeline vandalism was largely attributed to a deliberate attack and sabotage of pipelines. This finding corroborates the work of Tyger and Akujuri (2021) which reported that the youth, who are usually restless due to lack of improvement in living standards, usually vandalize pipelines to make money from illegal sales and thereby draw attention of oil companies to their plight.

Report by Niger Delta Voice (2019) stated that vandalism of oil facilities as a result of crude oil theft on the pipeline network resulted in a loss of around 1,000 barrels of oil per day (bbl/d) in 2018. The second most significant cause of oil spillage was an explosion of oil wells with a mean value of (3.78). This situation is also called a "blow-out". It is the uncontrolled release of crude oil or natural gas from an oil well or gas well after pressure control systems have failed, while other causes are accidents faced by oil-carrying tankers with a mean of (3.42), corrosion of oil pipelines due to obsolescence with a mean of (3.28), leakages from oil tanks (3.24), and maintenance error of drilling companies (2.7) respectively.

Hypothesis Test

Effect of Oil Spill on Capture of Fishes in the Study Area.

The results of the effect of oil spill on the capture of fish is captured in the hypothesis test of the mean difference between the capture of fish in the oil spill and the non-oil spill communities is presented in Table 4 as indicated, there was a significant difference between the capture of fish in the study area. The fisher folk in the study area, prefers measuring their capture in the number of baskets rather than in kilograms, accordingly a simple majority (64%) of fish farmer in oil spill captured 4 baskets of fish while another majority 58% of fish farmers in non-oil spill communities reported a capture of 18 baskets of fish as at the time of data collection and study. This is significant at 5% level of significance, with a T-value of 11.85 and a P-value of 0.000.

The finding of a significant difference between the capture of fish in oil spill and non-oil spill area. Aligns with robust empirical studies, and agrees with a prior expectation on the facts that oil spill in Niger Delta regions has significantly reduced the livelihood of the people in the region. The findings corroborate the work of Ofuokwu *et al.,* (2014) who concluded that oil spillage was a major setback to agricultural productivity, which in turn culminated in significant losses of both income and livelihood. It further agrees with the study, reported by Eguvbe *et al*., (2021) where in was found out that oil spillage resulted in loss of life of aquatic animals, absence of freshwater for aquatic animals to breed and reduction of aquatic animal population

Conclusion

In general, the results obtained from this study suggest that crude oil spillage creates adverse conditions in the water body of the Niger Delta region, which in turn renders such water to a condition that produces both quantitative and qualitative differences between the catch and freshness of fishes in oil spill and non-oil spill communities.

Therefore, the incidence of oil spill in the Niger Delta region has an adverse effect on the aquatic ecosystem and the livelihoods of the farmers who depend on the ecosystem for sustenance. Finally, oil spill affects the revenue generated from oil fish farming in the affected area. Hence fish farmers are advised to adopt multiple streams of income.

Table 1: Socio-economic characteristics of respondents

Category	Oil spill communities Frequency	Percentage (%)	non-oil spill communities frequency	Percentage (%)
Sex				
Male	35	70	38	75
Female	15	30	12	25
Total	50	100%	50	100%
Age				
25	0	0	0	0
25 – 44	15	30	25	50
45 – 64	20	40	21	42
65 – 85	15	30	1	8
Total	50	100%	50	100%
Marital Status				
Single	6	12	4	8
Married	32	64	41	82
Divorced	7	14	1	2
Widowed	5	10	4	8
Total	50	100%	50	100%
Household size				
1 – 5	22	44	42	84
6 – 10	24	48	8	16
11 -15	4	8	-	-
> 15	-	-	-	-
Total	50	100%	50	100%
Quantity of fish caught monthly (basket)				
½	1	2	-	-
1	11	22	-	-
2	20	40	-	-
3	12	24	-	-
Quaintly of fish caught monthly (basket)				
4	6	12	-	-
5	0	0	1	22
6	0	0	7	14
7	0	0	1	22
8	0	0	9	18
9	0	0	5	10
10	0	0	3	6
11	0	0	3	6
12	0	0	1	2

Source: field survey, 2022

Table 2: Cost and Returns of Fish Farming in Oil Spill and Non-oil Spill Communities.

	Oil Spill Region				**Non-Oil Spill Region**			
	Qty	**Unit cost**	**Amount (₦)**	**% Contribution to total cost**	**Qty**	**Unit cost**	**Amount (₦)**	**% Contribution to total cost**
Revenue 85kg/Basket (Fresh fish)	2.5	129,100	322750		7	131,200	918400	
Fixed cost								
Un-depreciated cost								
Canoe	1	22750	22750	7.61	1	30,191	30191	8.36
Engine	1	241300	241300	80.74	1	286655	286655	79.38
Fish net	2	10000	20000	6.69	2	12872	25744	7.13
Lantern	1	917.5	917.5	0.31	1	1590	1590	0.44
Lamp	1	1104.28	1104.28	0.37	1	2900	2900	0.80
Total fixed Cost			**286071.78**				**347080**	
Variable cost								
Crew/labour (man day)	2	3846	7692	2.57	2	3950	7900	2.19
Rope (bundle)	1	4440	4440	1.49	1	5155	5155	1.43
Kerosene (liter)	2.6	250	650	0.22	4	250	1000	0.28
Total variable Cost			**12782**			**14053**		
Total cost			**298853.78**			**361133**		
Net profit			**23869.22**			**557267**		

Source: field Survey, 2022

Table 3: Causes of Oil Spillage in the Study Area

Causes	Oil spill area		non-oil spill areas	
	Mean	Standard deviation	Mean	Standard deviation
Accidents faced by tanker carrying crude oil	3.42	0.575	1.82	0.388
Pipeline vandalization	3.96	0.198	1.78	0.418
Improper drilling activities	3.96	0.198	1.74	0.443
Explosion of oil wells	3.78	0.418	1.62	0.490
Corrosion of pipeline	3.28	0.454	1.56	0.501
Leakage from oil tanks	3.24	0.476	1.80	0.404
Maintenance error of drilling companies	2.7	0.505	1.60	0.495
Natural gas	2.4	0.571	1.30	0.463

Source: Field survey, 2022

Table 4: Hypothesis Test of mean differences between catch of fish in Oil Spill Communities and Non-Oil Spill Communities

	Catch in Oil spill	Catch in Non- Oil spill
Mean	4 baskets	18 baskets
Variance	453786	643289
Observed	50	50
Hypothesized		
Mean difference	0.00	
Degree of Freedom		63.00
T stat		11.38
P (T < = t) one tail = 0.000*		
T control one tail = 1.67		
Significant at 0.05----------		

Source: Computed from Field survey, 2019.

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