

Analysis of the Socio-Economic Impact of Oil Spills in Gokana Local Government Area of Rivers State, Nigeria

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Abstract: This study is anchored on the socio-economic impact of oil spillage in Gokana Local Government Area of Rivers State, Nigeria. Due to the landmass of the area, only three communities were selected and these were B-dere, K-dere and kpor communities. Purposive sampling technique was adopted to select these communities because of the incessant oil spillage in the area. Again, the sources of data used in this study include both the primary and the secondary sources while the instrument adopted to collect data from the sampled respondents was questionnaire. A total of 147 respondents were used as the sampling for the entire study which represents ten per cent (10%) of 1471 of farmers and fishermen who were the target population. In analyzing the data, the statistical tool used was percentages with the aid of a well-constructed table. The result of the survey showed that Farmers and fishermen are the most hit during an oil spill, farmers activities in the area have reduced to the barest minimum as a result of oil spillage and oil spills in the community have contributed to starvation in the area. The study further revealed that the high rate of polluted water observed is as a result of groundwater contamination in the area. Consequently, the study recommended among others; emphasis on remediation should not be an agitation for compensation rather a move to restore the originality of the land, the areas covered by SHELL pipes and their manifold should be declared a non-farm area and at the same time the company should make provisions for any zone classified as a farming centre and the ongoing plans to implement the Ogoni UNEP Report should not be politicized.

Keywords: Host Communities, Impact, Oil Spill, Shell, Socio-economic, Ogoni

I. INTRODUCTION

An oil spill is the release of a liquid petroleum hydrocarbon into the environment, especially in marine areas and terrestrial land due to anthropogenic activities as a form of pollution. The term is usually applied to marine oil spills, where oil is released into the ocean or coastal waters, but spills may also occur on land. The emphasis of this study is on land and water specifically in Gokana Local Government Area (LGA) of Rivers State, Nigeria. Oil spill may equally be seen as the release of crude oil from tankers, offshore platforms, drilling rigs as well as spills of refined petroleum products (such as gasoline, diesel) and their byproducts, heavier fuels used by large ships such as bunker fuel, or the spills of any oily refuse or waste oil. Another significant route

by which oil enters the marine environment is through natural oil seeps. (UNEP,2011; Sekha, 2012; Morris, 2012).

Oil spills mainly impact vegetation and wildlife. Most of the impacts are due to the physical characteristics of the oil. The adhesive properties lead to reduced mobility and dissolution of natural fats and wax on body surfaces, feathers etc. (NRC, 2003; ITOPI, 2011a; Wali *et al.*, 2019). Certain aromatic petroleum hydrocarbons may also cause direct toxic impacts due to ingestion or penetration through body surfaces such as gills (Middleditch1984; Jenssen 1996; Heubeck *et al.*, 2003). Many of the toxic as well as non-toxic hydrocarbons evaporate and are degraded by microorganisms quite rapidly (NRC, 2003). However, there may be adverse long-term effects under a particular condition (Peterson *et al.*, 2003).

Oil spillage globally has attracted several spillage responses among scholars and academia who have researched thoroughly on the concept. According to Paul et al (2011), a reversed chronological order has been deduced in recording the number of the oil spill that occurred throughout the world and the spill (s) that are currently ongoing. He went further to explain that quantities are measured in tons of crude oil with one tone roughly equal to 308 U.S. gallons of 7.33 barrels or 1,165 litres.

In Nigeria, oil spillage has concentrated much in the Niger Delta Region, its impact on the peoples' livelihood is so glaring in terms of habitation, mangrove and other tropical trees which are located within the area. Most fruits such as oranges, mangoes, paw-paw, etc., fell beneath the hierarchical tree but when the oil spill occurs, the further distance scares the inhabitants away because of the oil spillage surrounding the trees.

Ojimba (2012) highlighted the effects of oil pollution on crop production in Rivers State, Nigeria on a sample of 296 respondents drawn from 17 out of 23 Local Government Areas. The study applied a stochastic trans-log production function in a multi-stage sampling technique. The results revealed that the effect of crude oil pollution on crop farms reduced the size of farmland, significantly at 1%, reducing marginal physical product (MPP), while in non-polluted farms output increased significantly.

An estimated 2 million tons of oil is released into the environment annually from human and natural processes (NRC, 2003). About half of this comes from natural seepage of oil into the sea and coastal environments from oil deposits on the continental shelf (NRC, 2003). Once the oil has contaminated wetlands such as marshes and mangroves, it is often very difficult to remove without causing further damage to these environments (NOAA 1994, 2002; NRC, 2003; Chan and Baba, 2009; Wali *et al.*, 2019). Oil slicks may enter such areas during high tide and as the tide recedes, oil is deposited on the vegetation causing asphyxiation of the plants (Plate 1). Toxic effects may also occur if the oil is fresh and contain a high amount of light aromatic hydrocarbons. If the mangrove vegetation dies, many plants and animals associated with this

ecosystem will also suffer due to the keystone character of the mangrove vegetation (Linden, 2013. Wali *et al.*, 2019).

NOSDRA (2015) through data acquisition in the monitoring of oil spill from January 2013 to September 2014 revealed that there were 1,930 oil spill incidents in the core Niger Delta with a predominantly offshore incidence in wetlands ecosystem of Akwa-Ibom State. Oil spills pose one of the greatest environmental challenges globally, constituting harmful effects on both human health and aquatic organisms (Plate.2). Fishing resources can be damaged through physical contamination, bio-accumulation, and damaging of spawning grounds, as well as habitat destruction, depending on the circumstances of the spill and time of response. Many coastal communities are affected (Okonkwo *et al.*, 2015).



Plate 1: Destruction of Vegetation by Oil Spill



Plate 2: A Duck Soaked with Oil During Spill

The activities of Shell Petroleum Development Company (SPDC) in curtailing the levels of oil spillage are not helping matters. This is represented fully in the oil spill that took place on the 18th of July 2012, in B-Dere community, where a rupture of the pipes which are so old and as such weak, most of them 28, 24 and 18 inches pipe buried and the pipes are so old, laid during the civil war of 1967. As a result of this weak

pipes, some points from the pipe started spilling oil in the area, destroying all agricultural and economic activities in the area (Plate 3). The latest report had it that the economy that was reaping up to N5million per day is gone, the entire ecosystem is lost. The choking odour from this oil spill could be perceived from about 100 meters from the spill spot (SPDC, 2015).



Plate 3: B-Dere Recent Oil Spill

Gokana people have protested that shell's oil production has not only devastated the local environment but has destroyed the economic viability of the area for local farmers and producers. The Federal Government, on the other hand, has been charged with failing to enact and enforce environmental protection Act against oil damage by Shell and other oil

companies in Gokana land. Many Gokana indigenes have been harassed and even killed by the Federal armies for organizing protests and threatening sabotage of oil facilities. This has served as a strong indicator for the researcher to pen down this problem and its socio-economic impact on the people which has been puzzling the Gokana land.

Oil spillage in Gokana land has had severe environmental and socio-economic consequences for the indigenous people who inhabit the areas surrounding oil extraction. The level of this destruction has not been properly determined because of the level of politics going on in the area, the exact economic hardship imposed by oil spillage in Gokana land has become a myth told by SPDC.

Environmental problems such as oil spill have a way of affecting the socio-economic life of the people through dislodging them from their traditional means of sustaining themselves such as oil coverage of their land cultivated with crops, affecting the marine life such as fishes, the destruction of mangrove and other tropical trees. As a result of this, unemployment will spring forth followed by famine, poverty and the destruction of ecological systems.

Several scholars have written on the socio-economic impact of the oil spill, ranging from unemployment, low capital income, occupational displacement, environmental degradation and poor standard of living. National newspapers tagging it as the total alienation of the hereditary occupation by the foreign and multinational corporations. Some scholars have viewed oil spillage and socio-economic impact as a total displacement of traditional occupation, impact on fish production and man's inhumanity to man (Osugwu and Olaita, 2018).

Oil spill incidents have occurred at different times along the Niger Delta area. From the records available at the Department of Petroleum Resources, within the period 1976–2015, a total no of 16,476 spills occurred at different locations and a total quantity of approximately 3 million barrels spilt into the Niger Delta environment leading to severe degradation and resultant socio-economic impacts on the people (DPR, 2002; 2016). Interestingly, over 70% was not recovered, 69% of these spills occurred off-shore, a quarter was in swamps and 6% spilt on land (Plessl et al, 2017).

The record from the Nigerian National Petroleum Corporation (NNPC) shows that the amount of crude oil spilt into the Niger Delta is estimated at 2,300 cubic metres. On average over 300 spills occurred every year from 1975 to 1995 (Bronwen, 1999). In contrast, the World Bank provides figures which estimate oil spill to the environment at almost ten times the NNPC figures (World Bank, 1995; 2011). In the same vein, Nwilo and Badejo (2008) categorically describes the largest individual spills to include the blowout of a Texaco offshore station in 1980, which dumped an estimated 400,000 barrels (64,000 m³) of crude oil into the Gulf of Guinea and Royal Dutch Shell, Forcado Terminal tank failure with an estimated spillage of 580,000 barrels (92,000 m³). Baird (2010) nevertheless estimated the quantity of crude oil spilt in the Niger Delta through oil exploration and exploitation activities as falling between 9 million and 13 million barrels.

Ebegbulem (2013) critically assessed the effect of oil exploration on poverty in the Niger Delta region of Nigeria. The extensive review of the literature by the author and

drawing of conclusion from the empirical findings revealed the neglect of the delta and the consequences of pollution as a drawback to socio-economic progress. The study further concludes that the greatest negative tendency associated with oil exploitation activities in the delta is environmental degradation with its significant effects on the livelihood of the people.

The gaps most of the pieces of the literature failed to identify is the psychological implication of oil spillage vis-a-vis to its socio-economic content. Again, the high rate of criminality associated with the post-oil spillage. These and other environmental factors are encapsulated in this survey serving as an addendum of information to existing studies emphasized especially when the issue of its effect is taken into consideration. This study equally looked at other dependent variables that can occur when the independent variables (oil spill) takes place. Emphasis is that oil spillage in Gokana LGA has a serious socio-economic impact when it occurs. Such environmental effect can be in the marine or terrestrial ecosystem.

Oil spills in Gokana land has led to the destruction of various environmental phenomena, aquatic lives endangerments, non-habitable human land, springing forth of infertility, psychological problem within the environment, destruction of animals, deserting of the environment by the people; and this by implication, shows that there is a strong linkage between oil spillage and socio-economic impact.

Although the natural conditions for degradation of petroleum hydrocarbons are favourable with high temperatures and relatively high rainfall, the recovery of contaminated areas is prevented due to the chronic character of the contamination. Oil spills of varying magnitude originate from facilities and pipelines; leaks from ageing, dilapidated and abandoned infrastructure; and from spills during transport and artisanal refining of stolen oil under very primitive conditions (Linden, 2013). It is against this background that this present study examines the socio-economic impact of the oil spill in Gokana LGA of Rivers State, Nigeria.

II. MATERIALS/METHODS

This study took a finite population of all adult male and female farmers and fishermen in kegbara Dere, B.Dere and kpor communities in Gokana LGA of Rivers State, Nigeria. The heterogeneous population of the three communities were purposively adopted in a bid to represent both sexes. These communities are the major oil-producing communities in the areas. A simple random sampling technique was used in selecting the respondents. Out of one thousand four hundred and seventy-one (1,471) adult farmers and fishermen in the three sampled communities, a percentage of ten was used representing 147 respondents which constituted the sample size of the study.

Two major sources of data were used for this study. Questionnaire-based interviews were conducted with community members who are farmers and fishermen (primary sources) while information from Journals and available data on the socio-economic impact on oil spill constituted the secondary sources of data.

The instrument used in the study is a questionnaire. The researchers used a closed-ended questionnaire to elicit responses from the respondents. It has such weights as strongly agreed (3), agreed (2), indifferent (1), disagreed (-1) and strongly disagreed (-2). The data collected from the study were ordinal data that ranked the various responses. As a result of this, percentage analysis was used as an instrument for data analysis.

III. STUDY AREA

Gokana is a Local Government Area in Rivers State, South-South Nigeria. Its headquarters is at Kpor. It has an area of 126 square kilometres and population of 301, 828 going by the 2006 National Census. Gokana LGA was created on 23rd September 1991. It lies on the coastal low land of the Niger Delta in the south Eastern part of Rivers State. Gokana is about fifty-four (54) kilometres by road from Port Harcourt and is located between latitude 4.36o N and Longitude 7.21o E of the equator. It is bounded on the North by Tai and Khana communities, on the east by the Andoni people, on the west by the Bolo people of Okrika kingdom and the south by the Ibani (Bonny) and the Atlantic Ocean (See Figure1).

Gokana is a patrilineal society and speaks the Gokana dialect of the khana group, classified under the Cross-River cluster, which belongs to the Benue-Congo sub-group of the N-Congo family of languages. The local government is made up of eighteen communities and numerous villages; there are farm and fishing settlements located on its numerous peninsula and islands by the sea. All these are clustered in seventeen (17) electoral wards and voting centres. The dominant economic activity of the people is fishing and farming. They also engage in other subsidiary occupations such as hunting, carving, weaving, oil palm and garri processing. Others include palm wine tapping, carpentry, sewing, and trading among others by indigenous technology. They produce such items as animal skin, mortars and pestles, sculpture and carvings, curative herbs, and bone mending. Other past time of the people includes itinerant storytelling and local birth attendants.

Traditional political leadership in Gokana is based on village administration headed by paramount chiefs who owe their allegiance to the Gberemene of Gokana. The area enjoys a raining and dry season. The rainy season starts in late April, to October with a peak in July and September. It experiences an average annual rainfall of about 250 cm which diminishes in October. The dry season lasts from November to March with the periodic dust-laden harmattan winds between December and February. This is followed by the south-west monsoon winds which blow across the area with violent storms in March and

April destroying economic trees and blowing off fragile roofs.

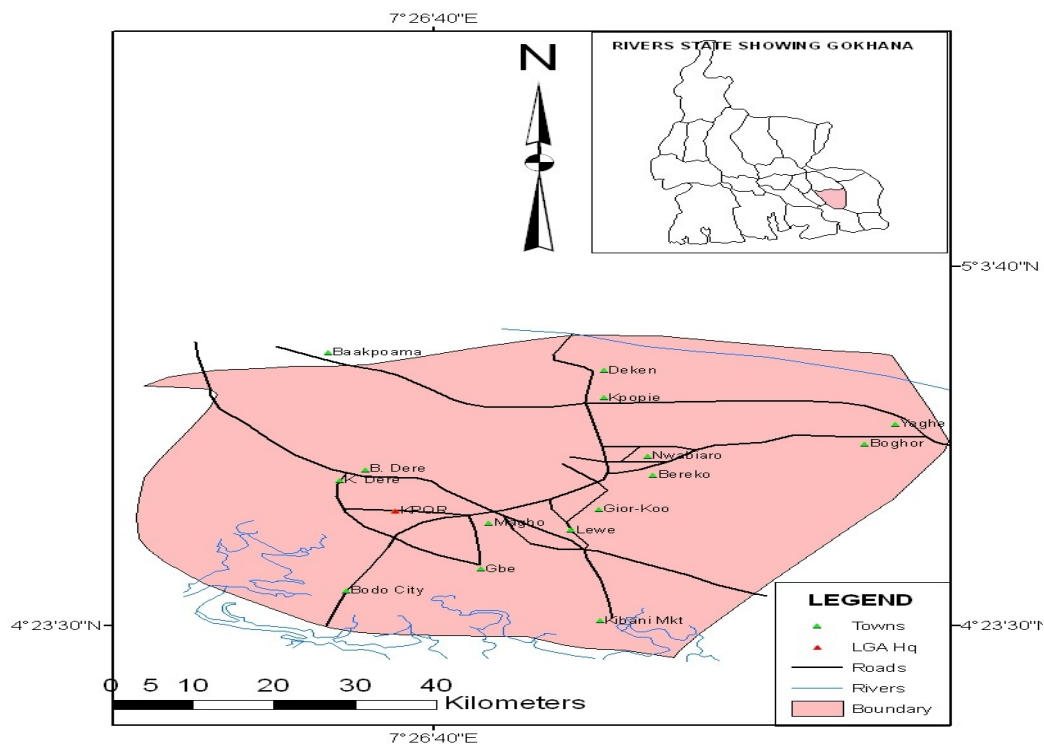


Figure 1: Gokana L.G.A, Rivers State, Nigeria

IV. RESULTS

The study utilized quantitative and qualitative data in its analysis. The type of data that was generated led to the use of

percentages in computing the data. The responses in tables 1 and 2 were generated from the questionnaire.

Table 1: First Set of Responses from the Sampled Communities: B-Dere, K Dere and Kpor

S/N	Response Statement	Strongly Agreed		Agreed		Disagreed		Strongly Disagreed		Total
1.	The farmers and fishermen are the most hit during oil spillage	10	6.80%	72	48.9%	8	5.44%	15	10.20%	115
2.	Farming activities in the area have reduced to a barest minimum as a result of oil spillage	17	11.56%	48	32.65%	5	3.40%	38	25.85%	108
3.	The socio-economic live of the people has been affected because of oil spillage	38	25.85%	66	44.89%	25	17.00%	15	10.20%	144
4.	The basic livelihood of both farmers and fishermen reduce by 7% each time there is an oil spill	31	21.08%	62	42.17%	7	4.76%	17	11.56%	117
5.	The increase rate of criminality in the area is associated with the displacement of traditional means of survival by oil spillage	41	27.89%	67	45.5%	2	1.36%	27	18.36%	127

Tables 1 and 2 represents the statistical responses of Gokana people who are more of farmers and fishermen. The table was polarized into two: Section A and B. Table 1 represents the response statement from number one to five while table 2 represents the next section from six to nine, all were extracted

from the questionnaire. The sample size as stated earlier is 147 which is 10% of 1471 fishermen and farmers in the three selected communities. The percentage was calculated by dividing the number of responses in each question and multiplied by one hundred.

Table 2: Second Set of Responses from the Sampled Communities: B- Dere, K Dere and Kpor

S/N	Response Statement	Strongly Agreed		Agreed		Disagreed		Strongly Disagreed		Total
1	There is a high level of behavioural change whenever oil spill occurs in the land	61	41.4%	76	51.70%	3	2.0%	4	2.70%	144
2	Oil spills in the community have contributed to starvation in the area	56	38.09%	70	47.6%	4	2.70%	11	7.4%	141
3	Most chemicals used in cleaning up the area harm the land and farmers	31	21.08%	61	41.4%	8	5.44%	8	5.44%	108
4	The high cost of clean water is as a result of ground water contamination in the area	26	17.68%	81	55.10%	3	2.04%	21	14.28%	131

V. DISCUSSION OF FINDINGS

Table 1 shows that a total of 72 respondents (48.9%) agreed that farmers are the most hit during oil spillage while 10 respondents (6.80) and 15 respondents (10.20%) strongly agreed and strongly disagreed respectively. The response which is the core of this study shows that 66 (33.65%) respondents agreed that the socio-economic life of the people

has been affected because of oil spillage, 25 (17%) disagreed, 38 respondents (25.85%) strongly agreed while only 15 respondents (10.20%) strongly disagreed. This result is consistent with the study of Olusiyi (2009) which highlighted the socio-economic implications and environmental effect of oil spillage in selected communities in the Niger Delta region of Nigeria.

It was equally observed in table 1 that 67 respondents (45.5%) agreed that the increased rate of criminalities in the area is associated with the displacement of traditional means of survival by oil spillage. 26 (1.36%) respondents disagreed with the statement and 27(18.36%) strongly disagreed. This simply proved that the high rate of criminality has been and will remain a major consequence of oil spillage. Those displaced in their traditional means of survival takes the next option which often leads to restiveness in the area (Albert et al, 2018).

Table 2 dealt with questions six to nine. A quick observation shows that the sixth question rightly confirmed the claim that oil spillage automatically changes the behavioural pattern of the community members (Okonkwo, 2014). Assenting to this, 76 (51.70%) respondents agreed that behavioural change occurs as a result of high and incessant oil spillage in the area. 61 (41.4%) strongly agreed with the statement while 3 (2.04%) disagreed. The seventh response is on the concept of starvation. 70 (47.6%) respondents agreed that oil spills in the community have contributed to starvation increase while a total of 11 (7.4%) strongly disagreed. The conclusion is that oil spills in Gokana land have contributed to high starvation in the area (Elum et al, 2016)

From the analysis and the tables above, the following are evident:

- Farmers and fishermen are the most hit during the oil spill.
- Farmers activities in the area have reduced to the barest minimum as a result of oil spillage.
- The increased rate of criminality in the area is associated with the displacement of traditional means of survival by the oil spill. There is a high level of behavioural change whenever oil spills occur in the community.
- Oil spills in the community have contributed to starvation in the area.
- The high rate of water poisoning is as a result of groundwater contamination in the area.

VI. CONCLUSION AND RECOMMENDATIONS

Having x-rayed the different dimensions of socio-economic impact on oil spillage, emphasis on how this spillage has impacted negatively to the people, it is very pertinent to draw the cotton here, but this cannot be completed without stating very clear that the study is about the people and means of livelihood after an oil spill. It highlighted that the basic economic activity of the people of Gokana LGA is mainly farming and fishing, which is destroyed once there is an oil spillage including their ecological system.

The study, therefore, recommends that the multinational companies operating in these areas should utilize the community members in cleaning up the environment, the areas covered by SHELL pipes and their manifold should be declared a non-farm area and at the same time the company

should make provisions for any zone classified as a farming centre, the economy of the community members should not solely be based on agriculture rather it should be diversified and emphasis on remediation should not be an agitation for compensation rather a move to restore the originality of the land. The study further recommends that NESRA, ministry of environment, Federal and state government including well-meaning Nigerians should provide Relief Camp/Zones outside the community until thorough remediation is observed whenever oil spills occur and the non-politicization of the ongoing plans to implement the Ogoni UNEP Report.

REFERENCES

- [1] UNEP. Environmental Assessment of Ogoni land, United Nations Environment Programme, P. O. Box 30552, Nairobi, KENYA. 2011
- [2] www.unep.org/newscenter/default.aspx?DocumentID=2649&ArticleID=8827
- [3] Sekha, H. Toxicity of traces elements: truths or myth. *Advanced Aquarist*, 2012. 2 (5)
- [4] Morris, G.J. Psychological effect of B.P oil spill, London Rec, Mac views Publishing Limited. 2012.
- [5] NRC. Oil in the Sea III: Inputs, fates, and effects. Washington, DC: National Academy. 2003
- [6] ITOPF. Effects of oil pollution on the marine environment. International Tankers Owners Pollution Federation (ITOPF). 2011a
- [7] Wali et al. Oil Spill Incidents and Wetlands Loss in Niger Delta: Implication for Sustainable Development Goals. *International Journal of Environment and Pollution Research*. 2019. 7 (1), Pp.1-20, European Centre for Research Training and Development UK www.eajournals.org
- [8] Middleditch, B.S. Ecological effects of produced water effluents from offshore oil and gas production platforms. *Ocean Management*. 1984; 9: 191-316
- [9] Jenssen, B.M. An overview of exposure to, and effects of, petroleum oil and organochlorine pollution in grey seals (*Halichoerus grypus*). *Science of the Total Environment*. 1996; 186: 109-118
- [10] Heubeck, et al. Assessing the impact of major oil spills on seabird populations. *Marine Pollution Bulletin*. 2003; 46: 900-902
- [11] Peterson, et al. Long-term ecosystem response to the Exxon Valdez oil spill. *Science*. 2003; 302: 2082-2086
- [12] Paul, et al. Aromatic Hydrocarbon concentrations in seawater: Deepwater Horizon oil spill. *International Oil Spill Conference Proceedings: March 2011*; 1: abs371
- [13] Ojimba, T.P. Determining the Effects of Crude Oil Pollution on Crop Production Using Stochastic Translog Production Function in Rivers State Nigeria, *Journal of Development and Agricultural Economics*, 2012. 4 (13),346–360
- [14] NOAA. Recovery of mangrove habitats at the Vesta Bella spill site. *Hazmat Report*, 1994. 1–37. National Oceanic and Atmospheric Administration (NOAA)
- [15] NOAA. Oil spills in mangroves: Planning and response considerations Report, 2002. 1–72. National Oceanic and Atmospheric Administration (NOAA)
- [16] Chan, H.T. and Baba, S. Manual on guidelines for rehabilitation of coastal forests damaged by natural hazards in the Asia-Pacific region. ISME & ITTO 2009
- [17] Linden, O. and Jonas, P. Oil Contamination in Ogoni land, Niger Delta. Royal Swedish Management of the issues in the petroleum industry in Nigeria. Paper presented at SPE International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production; Jun 7–10; Caracas, Venezuela. 2013
- [18] NOSDRA. Oil spill monitor data and JIV forms. 2015- available online: <https://oilspillmonitor.ng.september2015> National Oil Spill Detection and Response Agency (NOSDRA)

- [19] Okonkwo et al. The Niger Delta Wetlands Ecosystems: What threatens it and why should we protect it. *African Journal of Environmental Science and Technology*. 2015. 9 (5) Pp 451-463.
- [20] Shell Petroleum Development Company of Nigeria Limited [SPDC]. Annual Report, United Nation Development Programme (UNDP). 2015
- [21] Osuagwu, E.S and Olaifa, E. Effects of oil spills on fish production in the Niger Delta. *PLoS ONE*. 2018; 13 (10)
- [22] Department of Petroleum Resources Statistical Bulletin, (2002) 32.
- [23] Department of Petroleum Resources Statistical Bulletin, (2016) 33.
- [24] Plessl et al. Fish as bioindicators for trace element pollution from two contrasting lakes in the Eastern Rift Valley, Kenya: spatial and temporal aspects. *Environmental Science and Pollution Research*, 2017.
- [25] Bronwen, M. "The Price of Oil", Human Rights Watch.1999 [Online] Available http://scholarship.claremont.edu/cgi/viewcontent.cgi?article=1087&context=pomona_theses
- [26] World Bank. Environmental Economic Study of the Niger Delta, A Report on the Niger Delta, Nigeria. Washington, DC.1995
- [27] World Bank. Nigeria Socio-Economic Assessment. AFCW2, Africa Region. Washington, DC. 2011
- [28] Nwilo, P.C. Badejo, O. T. Oil Dispersion and Trajectories on Nigerian open sea. The Conference Proceedings of the International Conference on the Nigeria State, Oil Industry and the Niger Delta, 2008. 164–192
- [29] Ebegbulem et al. Oil Exploration and Poverty in the Niger Delta Region of Nigeria: A Critical Analysis. *International Journal of Business and Social Science*, 2013. 4(3), 279–287.
- [30] Olusiyi, I. Socio-economic implications and environmental effects of oil spillage in some communities in the Niger Delta. *Journal of Integrative Environmental Science*, 2009; 6 (1).
- [31] Albert, et al. Evaluation of the impact of oil spill disaster on communities and its influence on restiveness in Niger Delta, Nigeria. *Procedia Engineering*, 2018; 212: 1054-1061.
- [32] Okonkwo, E. C. Oil spills in Nigeria: Are there social and economic impacts? *International Oil Spill Conference Proceedings: May 2014, Volume 2014 No 1*.
- [33] Elum et al. Oil exploitation and its socioeconomic effects on the Niger Delta region of Nigeria. *Environmental Science and Pollution Research*. 2016; 23: 12880-12889