

## **Impact of Oil Spill Pollution on Fresh Water ecosystem and Infant Mortality in Impacted Communities in the Niger Delta**

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### **Abstract**

*This study therefore was carried out to examine the impact of Oil Spill Pollution on freshwater ecosystem and infant mortality in impacted communities in the Niger Delta. The study adopted the survey research design and make use of both secondary and primary data. Non parametric analytical tool and descriptive statistical technique including; tables and simple percentages were employed to analyze the data for the study. The results of the analyzed data show a strong negative relationship between oil spill pollution and fresh water bodies of streams, rivers, lakes, ponds and spring as sources of water supply for drinking, cooking, washing and bathing in the Niger Delta. The study further indicates that there exists a high negative relationship between oil spill pollution and the health of pregnant women and nursing mothers and mortality rate of infants in Niger Delta due to usage of oil spill polluted and contaminated freshwater bodies by these vulnerable people. Again, our findings show that oil operational activities cause pollution and contamination of freshwater bodies and in some instances lead to dried up and extinction of such freshwater bodies resulting into non availability and accessibility to sources of water supply for drinking, cooking, bathing, washing and other domestic use by the local population including pregnant women, nursing mothers and infants. Therefore, the study recommends that International Oil Companies (IOCs) should endeavor to provide pipe borne water to their host communities as part of their corporate social responsibility (CSR) and also adopt operational measures that are eco-friendly, and observe industry best practices.*

**Key Words: Oil Spill Pollution, Freshwater Bodies, Women and Infant Mortality**

**Introduction:** Natural ecosystems remain a major source of supply of food and services for human society especially rural communities, and therefore the well-being of every human population fundamentally and directly depends on ecosystem services. "Natural capital refers to the elements of nature that produce value, directly and indirectly, for people, such as forest, rivers, land, minerals and oceans. It includes the living aspects of nature, such as fish stocks, as well as the non-renewable resources. Natural capital underpins all other types of capital and is the

foundation on which our economies, societies and prosperity are built (CIMA)." The Niger Delta environment is blessed with abundant fresh water ecosystem including streams, rivers, lake, ponds and springs (Ayande A. 2014) and in most rural communities of the Niger Delta region, these has remained the dominant sources of water supply to the local population before the advent of oil exploration and exploitation activities. The local population depend largely on fresh water ecosystem to source their water needs of drinking, cooking, bathing, washing and other domestic

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uses. Access to clean and safe water is considered a key indicator in the health component of Human Development index (HDI) (MDG6, 2017). Again, United Nations Development Programme considered non-access to water as a measurement of deprivation of overall economic provisioning which is used to measure deprivations and human poverty. Clean and safe water is very essential to life and health of pregnant women and their unborn babies (foetus), and more important nursing mothers and their infants. It is important to note that infants, depends largely on their mothers for their nourishment (calorie intake) including water and breast milk.

The immunity, growth, development and overall wellbeing of the infant to a great extent depends on the water intake of their mothers and these infants. Thus, were access to clean and safe water remain unhindered, there is the possibility of improve health and overall well-being of the infant and likewise their mortality rate is drastically minimized. However, life of pregnant women, unborn babies and infants are threatened in cases or area where access to clean and safe water is a challenge. Instances of reported non availability of steady supplies of clean and safe water in many rural communities of the Niger Delta region are abound, where there exist dense population of women in their reproductive age including pregnant women, nursing mothers and infants putting their health and lives of the unborn babies at risk. Sustainable Development Goal 6 (SDG) which state thus: ensure availability and sustainable management of water and sanitation for all. Attainment of SDG 6 in local communities of the Niger delta region depend largely on the preservation, protection and sustainability of fresh water bodies located in the environment. The neglect and seemingly lack of government presence in many rural communities of the Niger delta in terms of provision of social services including water supply facilities which are vital to SDG 6 make imperative to ensure safety, availability and accessibility of the fresh water ecosystem which were common in the region and serve as dominant sources of water supply to local population for drinking, cooking, washing, bathing and other domestic uses. It is on record that the Niger Delta region of Nigeria is blessed with abundant natural capital. Ecological and biodiversity represents natural capital which provides the repository for life and wellbeing of mankind. Humanity depends on the natural environment for food, clean water, energy sink for waste including carbon, health and protection from flood and soil erosion. Interestingly, Ahston-Jones (1998), contends that the geographical Niger Delta or true Delta of the Niger basin covers Bayelsa, Rivers and Delta states and is about 25, 640km<sup>2</sup>, of which fresh water swamp ecological zone has an area of 11,700km<sup>2</sup>. However, the study area of this work covers the entire south-south states of Edo, Delta, Bayelsa, Rivers, Akwa-Ibom and Cross-River.

It is noteworthy that the Niger Delta region is endowed with crude oil and gas reserve, (Ite, et al 2013) and since its discovery in commercial quantities about six decades ago, it has contributed immensely to both revenue and exchange earnings of government and our country. Thus today, our economy is driven by oil and gas, expectedly investment in the sector has also grown over time. The international oil companies in collaboration with the government in an

attempt to increase oil and gas production, tax revenue, profit and wealth accumulation has invested heavily in the building of critical oil infrastructure including pipelines, flow stations, oil wells flow lines, manifold and trunk lines etc. and these pipelines, criss-crossed the Niger Delta environment and its natural ecosystems including fresh water bodies (Ite et al 2013). In course of laying these pipelines, and other infrastructure, the process of canalization and clearing of right of way is carried out including seismic operations. There are instances where fresh water bodies of streams, rivers, ponds, lake and springs fall on seismic survey areas and likewise areas earmark for canalization. And these crude oil and gas exploration process of canalization and seismic operations and oil spill without doubt affect, alter, decimate and degrade fresh water bodies of streams, rivers, lakes and springs. These oil exploration activities in some cases, altered the flow, freshness and continual existence of the natural water ecosystems, thereby threatening the water supply source of such communities and its people including pregnant women, nursing mother and infants. A case in point is Bodo community in the Niger Delta that was once blessed with numerous fresh water bodies including; streams of Obara, Vikee-oor, Kolda, Kesuute, Bangha, oor-zua, oor-kele as well as Si-demgoi and Ke-oor springs. Oil spill incidences in most cases flow into the environment for days without containment by concern authorities and in such instances fresh water bodies of streams rivers, lakes, ponds and springs are polluted and contaminated and render sun safe and unclean for drinking, cooking, bathing, washing and other domestic uses. **Statement of the Problem :** Apparently, incidences of oil spill pollution in Niger Delta communities has become intensive and frequent. For instance, the Nigeria National Petroleum Corporation (NNPC) in her 2019 annual statistical bulletin shows that oil loss (spill) through Product Pipeline Marketing Company (PPMC) pipeline within 2010-2019 was 1, 576,903 barrels respectively, and the regulatory authorities are doing little or nothing to enforce compliance to the industry standard as encapsulate in the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN). Systemic corruption that characterize Nigeria institutions including the regulator and the non-institutionalization of the 'polluter pay principle' have been identified as the primary reason for the corporate negligence in the pipeline maintenance integrity and lack lustre attitude of International Oil Companies (IOCs) towards oil spill response and containment. Hence, natural ecosystem including freshwater bodies (which serve as major source of water supply of the Niger-Delta communities) have become a sink or pool for oil spill discharges.

The local population including pregnant women, nursing mothers and their infant (CEHRD 2015) who depends largely on fresh water bodies of streams, rivers, lake, pond and spring for drinking, cooking, bathing, washing and other domestic uses are not only in a dilemma of where to source their water need, but also at risk of their health, especially in cases where alternative water sources are difficult to locate. Against the backdrop of the above identified problems, this research is being carried out. The main objective of this study is to examine the impact of oil spill pollution on fresh water ecosystem and infant mortality in impacted

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communities of the Niger Delta. The specific objectives are as follows; To determine the effect of oil spill pollution on fresh water bodies of streams, rivers, lakes, pond and spring sources of water supply for drinking, cooking, washing and bathing in the Niger Delta. And to examine the effect of the usage of oil spill polluted/contaminated water sources on the health of pregnant women, nursing mothers and infants' mortality in Niger Delta.

This study shall be guided by the following research questions; To what extent has fresh water bodies of streams, rivers, lakes, pond and spring sources of water supply for drinking, cooking, washing and bathing impacted by oil spill pollution in the Niger Delta? And to what extent has the usage of oil spill polluted/contaminated water sources affected the health of pregnant women, nursing mothers and mortality of infants in the Niger Delta?

**Methodology:** This study adopts non-parametric (descriptive) survey design to examine the impact of oil spill pollution on freshwater ecosystem and infant mortality in oil impacted communities in the Niger Delta region. The study make use of both primary and secondary data. The secondary data were sourced from National Bureau of Statistics (NBS), Federal/State Ministries of Health, National Population Commission (NPC). Besides, our primary data was a four-point rating questionnaire developed to solicit response on the research topic as well as key informant interviewers (KIIs). Structured questionnaire on the topic were constructed and administered in affected communities to selected respondents. Our study adopted descriptive statistical techniques including tables and percentages to analyzed our data and provide answer to our research questions. The study population is three hundred (300) while the study sample is two hundred and twenty-five (225) as indicated in table 3.1 below.

**Table 3:1 Questionnaire Distribution Per Sample States**

S/N	Sample (States)	Population	Questionnaire Distribution	Number Retrieved	Percentage
1.	Delta	100		70	31
2.	Bayelsa	100		75	33
3.	Rivers	100		80	36
	<b>Total</b>	<b>300</b>		<b>225</b>	<b>100</b>

A total of three hundred copies of questionnaires were administered by the researchers to respondent in the three sample states as shown above. Two hundred and twenty-five (225) copies were successfully retrieved from respondents. This represents 75% of the number of questionnaires administered as response rate.

**Table 3:2 Questionnaire Distribution Per Sample States/Respondents**

State	Traditional Rulers	Pregnant Women/Nursing Mothers	Women/Youth Groups	Key Informant Interviewers	Total	%
Delta	10	28	22	10	70	31
Bayelsa	15	30	20	10	75	33
Rivers	10	35	25	10	80	36
<b>Total</b>	<b>35</b>	<b>93</b>	<b>67</b>	<b>30</b>	<b>225</b>	<b>100</b>

## Data Presentation and Analysis

### 4.2 Data Presentation

**Table 4.1 Dominant Fresh Water Bodies in the Niger Delta Region**

S/N	Dominant Freshwater Bodies	Uses	Present Status of the Freshwater Bodies	Threats to Fresh Water Bodies in the Region	After Effect of Oil Spill on Fresh Water Bodies Availability.
1	Streams	Drinking, Cooking, Bathing, and Washing	Contaminated	Oil Operation activities of Seismic survey, discharges, canalization for laying of pipeline, oil spill pollution.	Contaminated and no longer safe fir usage. -Dry out -Extinction
2	Rivers	Drinking, Cooking, Bathing and Washing	Same as above	Same ads above	Same as above
3	Ponds and Lakes	me as above	Same as above	Same as above	Same as above
4	Springs	Same as above	Same as above	Same as above	Same as above.

Source: Nabie and Gbaraba Field Survey 2021

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**Table 4.2: Major Sources of Water Supply for Household Dependency for Drinking, Cooking and Washing in Niger Delta States**

States	Total household	No of persons use pipe borne water	Pipe borne water %	No of persons use well/borehole	Well/bore hole %	No of persons use streams/river/s/rain water	Streams/r ivers/rain water %	No of persons use other sources	Other source %
Akwa-Ibom	953,822	30,522	3.2	324,299	34	537,956	56.4	61,945	6.4
Bayelsa	394,296	37,952	9.6	71,762	18.2	276,401	70.1	1,577	0.4
Cross River	636,336	80,174	12.6	172,447	27.1	383,711	60.3	Nil	Nil
Delta	1,264,935	89,910	7.1	730,584	62.5	361,771	28.6	21,504	1.7
Edo	838,107	25,143	3.0	357,972	42.7	374,534	44.7	80,458	9.6
Rivers	960,259	78,741	8.2	742,280	77.3	109,470	11.4	29,808	3.0
<b>Total</b>	<b>5,047, 755</b>	<b>342,442</b>	<b>43.70%</b>	<b>2,399,344</b>	<b>261.8%</b>	<b>2,943,843</b>	<b>271.5%</b>	<b>195,292</b>	<b>21.1%</b>

Source: Nation Bureau of Statistics (2007, pp.28-29)

From table 4.1, we establish that fresh water bodies of streams, rivers, lake, ponds and springs were dominant sources of water supply in Niger Delta region for drinking, cooking, washing, bathing and other domestic uses before its contamination by oil spill pollution. From table 4.2 we contend that a total of 2,943,843 persons representing 271.5% total household members depends largely on streams, rivers, lake and pond which again attest to the predominant usage of these sources of water supply (fresh water bodies) in the Niger Delta region by the local population including pregnant women, nursing mothers and infants for drinking, cooking, bathing and other domestic uses. Again, we observed in table 4.2, the percentage of people including pregnant women, nursing mothers and infants in the Niger Delta states that depends on streams, rivers and rain water are as follows; Akwa-Ibom, 56.4%,

Bayelsa 70.1%, Cross-River 60.3%, Delta 28.6%, Edo 44.7% and Rivers 11.4% giving a total of 271.5%. Table 4.2 shows a greater dependence of the people of the region on streams, river and rain water sources with Bayelsa accounting for the highest percentage of 70.1% and Rivers with the lowest percentage of 11.4%. Again, table 4.1, maintained that oil activities of seismic operations, canalization, discharges and oil spill contaminate and pollute these fresh water bodies and render them unsafe and unclean for usage. Table 4.1 also indicate that oil spill pollution causes these freshwater bodies to dried up leading to its extinction .We deduce from the above analysis in table 4.1 and 4.2 that oil operation activities of seismic survey, discharges and oil spill pollution impacted negatively on fresh water bodies and render them unsafe for usage, thereby providing answer to our specific research question one (1).

**Table 4:3 Incidences and Volume of Oil Spill from 1999 – 2020**

S/n	Year	Incidences	Volume (barrel)
1.	1999	319	23, 377
2.	2000	340	3,071
3.	2001	302	76,854
4.	2002	262	20,007
5.	2003	221	9,900
6.	2004	236	8,317
7	2005	224	11,921
8	2006	241	23,000
9	2007	330	30,000
10	2008	997	22,598
11.	2009	856	36,988
12.	2010	889	47,260
13.	2011	1,059	73,106
14.	2012	1,135	41,802
15.	2013	1,666	32,292
16	2014	1,418	78,304
17	2015	127	29,006
18.	2016	72	737,325
19.	2017	90	450,342
20.	2018	145	76,150
21	2019	190	233,076
22	2020	445	23,117

Sources: NOSDRA Oil Spill Yearly Report

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**Nigeria National Petroleum Corporation (NNPC) 2019 Annual Statistical Bulletin**  
**Table 4:4 Infant Mortality Rate in States of the Niger Delta**

S/n	Year	Rate
1.	1999	N/A
2.	2000	N/A
3.	2001	N/A
4.	2002	N/A
5.	2003	N/A
6.	2004	N/A
7.	2005	98.106
8.	2006	95.180
9.	2007	92.255
10.	2008	89.330
11.	2009	86.458
12.	2010	83.587
13.	2011	80.715
14.	2012	77.844
15.	2013	74.972
16.	2014	72.972
17.	2015	69.840
18.	2016	67.274
19.	2017	64.708
20.	2018	62.142
21.	2019	60.662
22.	2020	59.181

Source: National Bureau of Statistics (NBS)  
 Federal Ministry of Health (FMH)

**Table 4.5 Infant Mortality Rates by Regions of Nigeria**

Region	Infant Mortality
North Central	103
North East	125
North West	114
South East	66
South-South (Niger Delta Region)	120
South West	69

Source: United Nations Development Programme- Niger Delta Human Development Report (2006 p. 47)

Table 4.3 indicates that occurrences of oil spill incidences in the region are frequent and intensive and its volume also massive. Oil spill leaked into the environment and flow into fresh water bodies of streams, river, lake and pond. Oil spill pollution contaminates these water bodies and render them unclean and unsafe for drinking, cooking, washing, bathing and other domestic uses. Usage of these oil spill polluted/contaminated fresh water bodies by the local population including pregnant women, nursing mothers and infants poses health risk to the users especially pregnant women, nursing mothers, unborn babies, while leading to mortalities in infants. Again, frequent incidences of oil leak into the fresh water bodies of streams, river, lake, pond and spring lead to outbreak of water borne diseases of cholera, diarrhea and typhoid which also resulted to cases of infant mortality

From table 4.4, we established that infant mortality in Nigeria has been significantly high within 2005 and 2011 in relation to other years, and also from table 4.5, we maintain that infant mortality rate in Niger Delta states (South-South) is second highest in the country after North-East in 2006.

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Regular and intensive incidences of oil spill pollution constitute a major threat to availability and accessibility of safe and clean fresh water bodies streams, river, lake, pond and spring for usage by the local population including pregnant women, nursing mothers and infants. From table 4.3, 4.4 and 4.6, and the analysis thereof, we deduce that oil spill pollution and contamination of fresh water bodies of streams, rivers, lake, pond and spring has a significant and negative relationship on infant mortality in the Niger Delta region thereby providing answer to our specific research question two (2).

**Discussion of Findings:** Our findings indicate that fresh water bodies of streams, river, pond, lake and spring were in abundance and serve as primary and dominant source of water supply in the Niger Delta region before the advent of oil exploration activities. And these water sources were clean and safe for drinking, cooking, washing, bathing and other domestic uses, posing no health hazards or risks to the people including pregnant women, nursing mothers and infants. Our findings are in consistence with the work of Oku

(2014) and the report of National Bureau of Statistics (NBS 2007, pp 28-29).

We deduce that oil spill occur as a result of oil operation, equipment failure, sabotage and others and its incidences has become frequent and intensive and it pollute and contaminate fresh water bodies of streams, river pond, lake and spring render them unsafe for usage and in many instances the streams and rivers dries up. Our findings confirm the findings of Nabie and Gbaraba field work 2021 and Effe and Mgborukor field work 2007. Our research also showed that due to frequent oil spill pollution of fresh water bodies which serve as dominant source of water supply for the local people, there have been reported cases of outbreak of water borne diseases of cholera, diarrhea and typhoid. And the usage of these contaminated water sources of streams, river, pond, lake and spring by the local people including pregnant women, nursing mothers and infants have led to increase in infant mortality in the region. Our findings are also shared by Chinemerem et al (2018) and National Bureau of Statistics (NBS 2007 pp 172-175)). Our findings established that presently, most fresh water bodies of streams, river, pond and lakes have been extinct due to oil operation activities including spill, and the sustainability and safety of the few available ones are under threats of frequency of occurrence of oil spill incidences. Again, assess to clean and safe water in local communities of the Niger Delta for usage by pregnant women, nursing mothers and infants remain a challenge. Our findings are consistent with Nabie and Kornom-Gbaraba field work (2021) and Efe and Mogborakor (2008)

**Conclusion:** Access to clean and safe water supply is a key indicator of longevity/ life expectancy at birth. While non-access is a major indicator of deprivation and a parameter for shorter life span. In Niger delta region, fresh water bodies of streams, river, lake, pond and springs were in abundance and they serve as the dominant sources of water supply of the local population including pregnant women, nursing mothers and infant for drinking, cooking, washing, bathing and other domestic uses. Again the same Niger delta region is endowed with abundant deposit of crude oil. Oil exploration and production is characterize with seismic operations, canalization, discharges and spill which impacted adversely on the fresh water bodies located in the Niger delta environment and render it unclean and unsafe for usage by the local population including pregnant women, nursing mothers and infants. We conclude that oil operational activities of seismic survey, canalization, discharges and oil spill pollute and contaminate fresh water bodies of streams, river, pond, lake and spring and render it unclean and unsafe for drinking, cooking, washing bathing and other domestic uses thereby resulting in reported cases of infant mortality.

**Recommendations:** This study hereby makes the following recommendations:

1. **Policy:** We recommend that to reduce the frequency of incidences of occurrence of oil spill the “Polluter Pay Principle” should be institutionalized in our system. Again, the study

recommends payment of compensation to communities and individual owners of fresh water bodies in cases of oil spill pollution. We recommend the Environmental Impact Assessment (EIA) be carried out before oil operations activities are embark upon in the region.

2. **Regulator:** The study recommends enforcement of compliance to Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (EGASPIN) by the International Oil Companies (IOCs) operating in the Niger Delta region.
3. **International Oil Companies (IOCs):** We recommend that oil companies operating in the region should place high value on local population sources of livelihood including fresh water bodies of streams, river, lake, pond and spring and endeavor to preserve and protect them in course of their operations. We recommend that IOCs should provide pipe borne water to their host community as part of their corporate social responsibility to enable the local population including pregnant women, nursing mothers and infants access to clean and safe water source. We implore that IOCs should painstakingly observe international best practices in their operations especially as it relates to pipeline maintenance integrity and oil spill response and containment. We recommend that IOCs should honour commitments including MOUs entered into with their host communities.
3. **Host Communities:** Local communities in the Niger delta that play host to the International Oil Companies should developed an ownership mentality and protect their sources of livelihood including fresh water ecosystem from oil operational activities. The people of the local community in collaboration with the ministry of environment should identify their sources of livelihood and designate such as high protected habitat and fenced them ac

## References

- Anna, B. and Roland, H. (2018); Effect of oil spills on infant mortality in Nigeria: Swiss Institute for International Economics (SIAW-HSG), University of St. Gallen, CH-9000 St. Gallen, Switzerland.
- Ayanlade A. (2014) Remote Sensing of Environmental Change in the Niger Delta, Nigeria. PhD thesis submitted to Department of Geography, School of Social Sciences and Public Policy, King’s College London, University of London; 2014.
- Chinemerem C, Ngbala-Okpabi Obele, Daprim O and Agu I (2018) Effects of Environmental Crude Oil Pollution on New Born Birth Outcomes: A Retrospective Cohort Study. *The Journal of Nursing Research* VOL. 29, No 4, 2021
- Centre for Environment, Human Right and Development CEHRD 2015 Yearly Report and Scorecard

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- Efe, S. I and Mogborukor, J. O.A (2008); Acid Rain in Niger Delta Region; Implication on Water Resources Quality and Crises. Journal of International on Nigerian States, Oil Industry and the Niger Delta. Harey Publications Company.
- FEPA (1998); Federal Environmental Pollution Act
- Hicks, N. L and Streeten P (1979); 'Indicators of Development: The search for a Basic Needs *Yardstick Journal of World Development*, Vol 7.
- Ite, A. E., Ibok, U. J., Ite, M. U., & Petters, S. W. (2013). Petroleum Exploration and Production: Past and Present Environmental Issues in the Nigeria's Niger Delta. *American Journal of Environmental Protection*, 1, 78-90. <https://doi.org/10.12691/env-1-4-2>
- Institute of Medicine Report (2010): The Future of Nursing 500 Fifth Street, NW Washington, DC 20001 202.334.2352 FAX 202.334.1412 [www.iom.edu](http://www.iom.edu)
- Jhigan, M. L (2002); The Economics of Development and Planning, Vrina Publication (P)
- Ltd. B. 5 Ashism Complex. Mayur Vihar, Phase I, Delhi
- Kadafa, A.A. (2012): Oil Exploration and Spillage in the Niger Delta of Nigeria. *Civil and Environmental Research*, 2, No. 3.
- Kalagbor, S.B. (2004); Development Theories, Strategies and Administration.
- Horizon Concepts, Port Harcourt.
- Kornom-Gbaraba, M.E, Nabie, J.V, Lass, R. and Ephraim A. T (2022): Effect of Environmental Pollution on Rural Women in the Niger Delta. *International Journal of Environment and Pollution Research*. Vol 10(1), 2056-7537
- Mark L. B., Ian L. P., and Gerba, C.P (2019): Environmental and Pollution Science Academic Press, Third Edition
- National Bureau of Statistics (2008): Annual Abstract of Statistics
- Nduka, J.K., Orisakwe, O.E. (2010) Water Quality Issues in the Niger Delta of Nigeria: Polyaromatic and Straight Chain Hydrocarbons in Some Selected Surface Waters. *Water Qual Expo Health* 2, 65–74 (2010). <https://doi.org/10.1007/s12403-010-0024-5>
- NNPC (2019): Nigerian National Petroleum Corporation Annual Statistical Bulletin
- Nwabueze Ikenna Igu (2016) Freshwater Swamp Forest Ecosystem in the Niger Delta: Ecology, Disturbance and Ecosystem Services. Ph.D. Thesis University of York
- Oku H.B (2014), The Niger Delta Environment: Its local Geography Paragraphic, Port Harcour
- Oluduro, O (2012): Nigeria: In Search of Sustainable Peace in the Niger Delta through the Amnesty Programme. *Journal of Sustainable Development*; Vol. 5, No. 7; 2012 ISSN 1913-9063 E-ISSN 1913-9071 Published by Canadian Center of Science and Education
- Opukri C.O and Ibaba (2008) oil induced environmental degradation and internal population displacement in Nigeria Niger Delta. *Journal of sustainable development Africa*.
- Terminski, Bogumil,(2011): The Right to Adequate Housing in International Human Rights Law: Polish Transformation Experiences (August 19, 2011). *Revista Latinoamericana de Derechos Humanos*, Vol. 22, pp. 219-241, Available at SSRN: <https://ssrn.com/abstract=2026699>
- Vidal John (2016)"Nigeria's agony dwarfs the Gulf oil spill. The US and Europe ignore it" achieves 12-15 at the Way back Machine

