

# ENVIRONMENTAL POLLUTION AND THE EFFECTS ON MARINE FOOD RESOURCES IN THE MANGROVE FOREST AREAS OF NIGER DELTA REGION, NIGERIA

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## Abstract

When oil pollutes the water, some of its components are degraded and dispersed by evaporation, photochemical reactions, or bacterial degradation, while others are more resistant and may persist for many years, especially in shallow waters with muddy sediments. Accumulation of contaminants to hazardous levels in aquatic biota has become a problem of increasing concern. It is of paramount importance that a constant assessment and monitoring of the health of the aquatic system in Niger Delta be carried out. Despite existing, abundant natural resources in this region, the region's potentials for sustainable development remains unfulfilled while the crisis there is exacerbated by environmental degradation. The imprints of the multi-national oil corporations operating in the Niger Delta are visible throughout the region. Some of the oil industry activities that have led to mangrove vegetation clearance include construction of flow stations, pipelines, and seismic lines. Oil settles on beaches and kills organisms that live there while it also settles on ocean floor and kills benthic (bottom-dwelling) organisms such as crabs and also disrupts major food chains. This study therefore evaluated the impact of oil exploitation on the mangrove forests, fisheries resources and sustainable livelihood in the Niger Delta, Nigeria.

**Keywords:** Environmental Pollution, Marine, Resources and Mangrove  
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## Introduction

The Niger Delta region is situated at the apex of the Gulf of Guinea on the west coast of Africa (Doust, 1990; Haack, *et al.*, 2000,) and on the Nigeria's South-South geopolitical zone. The Niger Delta, which is home to some 31 million people (Young, 2012), occupies a total area of about 75,000 km<sup>2</sup> and makes up 7.5% of Nigeria's land mass. The Niger Delta region consists of 9 oil-producing states (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Ondo, Imo and Rivers) and 185 local government areas (Myers *et al.* (2000). This region cuts across over 800 oil-producing communities with an extensive network of over 900 producing oil wells and several petroleum production-related facilities (Osuji, and Onojake, 2004). The ecological zones in the Niger Delta region can be broadly grouped into tropical rainforest in the northern part of the Delta and mangrove forest in the warm coastlines of Nigeria. Mangrove forests and swamps, which are characterized by regular salt-water inundation, lie at the centre of a complex and sensitive ecosystem which is vital to the local economy and accommodates important flora and

fauna (Ugochukwu, and Ertel, 2008). The Niger Delta, which is the largest mangrove forests in Africa and the third largest in the world, is the richest part of Nigeria in terms of petroleum resources and diverse natural ecosystems supportive of numerous species of terrestrial and aquatic fauna (Myers *et al.* 2000).

The Niger Delta is one of the world’s largest tertiary delta systems and extremely prolific hydrocarbon provinces globally. The Niger Delta basin has been one of the most studied basin because of the occurrence of vast deposits of petroleum resources and the current production of all Nigeria’s oil and gas are derived from this region (Obaje, 2009). According to Curtis, 1986), a large portion of the world’s oil and gas reserves are deposited in tertiary sedimentary rocks found on continental margins and the most significant hydrocarbon deposits of this type could be found in the U.S. Gulf of Mexico, Canadian Beaufort-Mackenzie Delta and Nigeria’s Niger Delta. Advances in evaluation and improved seismic technology showed that the Niger Delta petroleum systems consist of Lower Cretaceous (lacustrine), Upper Cretaceous–lower Paleocene (marine) and Tertiary (deltaic) (Haack, *et al.*, 2000). The geological assessment of the source material has shown that the principal source for oil and gas in the Niger Delta belonging to the tertiary deltaic petroleum system (Haack, *et al.*, 2000; Doust,1990). Over the past five decades, a total of about 1,182 exploration wells have been drilled to date in the delta basin, and about 400 oil and gas fields of varying sizes have been documented (Obaje, 2009).

**Table 1: Ecological Zones of the Niger Delta by State as at Year 2000**

Delta eco-region States		Upper Floodplain Forest		Lower floodplain Mangroves		Barrier Islands	
States in the Niger Delta	Size km2	State coverage km2	% of state	State coverage	% of state	State coverage	% of state
Akwa Ibom	8,412	7,747.5	92.11	546.8	6.5	117.8	1.4
Bayelsa	10,773	6485.3	60.2	3533.5	32.8	754.1	7
Delta	16,842	13,271.5	78.8	2,863.1	17	707.4	4.2
Rivers	10,393	7,89.9	7.6	3,367.3	32.4	6,235.8	60
Total	46,420	28,294.2		1,0310.7		7,815.1	

\* Includes 1.7% of Akwa Ibom that is Savannah.

Source: Myers *et al.* (2000)

### **Effect of Oil Exploitation on local communities**

According to World Bank, 1995; Akpofure *et al.*, (2000) and Badejo, 2005, Nigeria flares more natural gas associated with oil extraction than any other country on the planet, with estimates suggesting that 3.5 billion cubic feet (100 000,000 m) of associated gas (AG) is produced annually, of which 2.5 billion cubic feet (70 000,000 m), or about 70%, is wasted via flaring. AG wasted during flaring is estimated to cost Nigeria US \$2.5 billion per year. Apart from the inefficiency of gas flaring, another problem which gas flaring poses is the release of large amounts of methane, which has very high global warming potential. Methane losses are accompanied by another major greenhouse gas escape, that of carbon dioxide, of which Nigeria was estimated to have emitted more than 3 438 metric tonnes in 2002, accounting for about 50% of all industrial emissions in the country and 30% of the total CO<sub>2</sub> emissions. Gas flaring potentially has harmful effects on the health and livelihood of the human communities in their vicinity, as they release a variety of poisonous chemicals. Combustion by-products include nitrogen dioxides, sulphur dioxide, volatile organic compounds like benzene, toluene, xylene and hydrogen sulfide, as well as carcinogens like benzopyrene, dioxin and many other substances. Humans exposed to such substances can suffer from a variety of respiratory problems, which have been reported amongst many children in the Niger Delta areas but have apparently gone un-investigated. Flares located close to local communities portend a high public health risk (Nwilo and Badejo, 2005)

### **Effect of Oil Exploitation on the Mangroves**

According to Nwilo and Badejo (2005) mangrove forests provide a wide range of beneficial natural ecosystem goods and services for man. Oil spills are a serious concern in regard to the health of Nigeria's remaining mangrove forests. Leaked oil permeates the coastal waters and streams, coating the exposed, air breathing roots of the mangroves. It is difficult, if not impossible, for the plants' breathing lenticels to perform their essential functions when covered in oil thus, in effect, they are slowly suffocated. Massive mangrove die-off is a common phenomenon plaguing the mangrove regions where coastal oil exploitation occurs. Because oil spills often occur in remote regions, many frequent accidents may go undetected for long periods of time, and if not cleaned up in an effective and timely manner a lot of harmful effects will result from that. Oil spills in the Niger Delta are attributed to oil-well blow-outs, sabotage, corrosion, equipment failure, and operator or equipment maintenance errors. In 2006, an independent team of experts from Nigeria's Ministry of Environment, World Wildlife Fund (WWF), UK and the IUCN Commission on Environmental, Economic and Social Policy in their preliminary findings reported that an estimated 9-13 million barrels (1.5 million tons) of oil had spilled in the Niger Delta ecosystem over the past 50 years, representing an amount equivalent to about one "Exxon Valdez" spill in the Niger Delta each year, while the financial valuation of the environmental damage was estimated to be tens of billions of dollars.

### **Impact of Oil Exploitation on Sustainable Livelihoods**

Akpofure *et al.*, (2000), in their study, observed that human populations in the Niger Delta were found to be predominantly farmers and fishermen, living off the rich alluvial farm lands and abundant surface water-web that characterizes the basin. It is universally known that mangrove forests act as nursery grounds for many marine fish. The Niger Delta is bordered by a deep belt of mangrove forests, which protects vast areas of freshwater swampland in the inner Delta. The trees and roots provide rich habitats for a wide variety of fauna, much of which is only just beginning to be known and understood. The Niger Delta also has the greatest extension of freshwater swamps in Africa. The region's brackish creeks, bays and tidal pools are breeding grounds for the marine life upon which many people depend for their livelihoods. It has been estimated that 60% of the fish in the Gulf of Guinea breed in the mangrove forests of the Niger Delta (Akpofure *et al.*, (2000)). Oil spillage has been found to be impacting the fisheries resources adversely. Aworawo (2000) commented that the economic conditions in the Niger Delta reflect unequivocally that poverty is endemic in the region and that it is getting worse as a result of oil pollution of the coastal water that provides fish consumed by the people. According to the members of communities interviewed, there has been over recent years massive reduction in fish catches by fishermen. It was also observed in the present study that in rivers polluted by oil spillage, some fishes were severely coated with crude oil, making them inedible, while some others were found floating dead on the surface.

Women and children are the worst hit, because mangrove swamp fisheries such as hand-picking of periwinkle (*Tympanotonus* spp and *Pachymenalia* spp) are mostly a job of the womenfolk in the Niger Delta. On the average, fish constitutes 40% of the animal protein intake in Nigeria. The percentage of fish consumption is generally higher for residents of the Niger Delta region. A decline in fish availability will have serious consequences on the nutritional status of the people, especially children who require adequate fish intake their development. Because of economic incapacitation, inhabitants of the Niger Delta are today living in poor health conditions and in an environmentally polluted atmosphere that constrain a good standard of living. According to World Health Organisation, "an urgent need exists to implement mechanisms to protect life and health of the regions inhabitants and its ecological system from further deterioration" (World Bank, 1995).

The oil spills in mangrove habitats permeate exposed tree trunks, accelerating the rate of decay of these precious plants and, as a consequence of their disappearance, will lead to shoreline erosion. They will also devastate fauna and other flora, organisms big and small that depend on mangroves for survival. The destructive will spiral continue down the food chain as fish populations diminish as do the fishermen's catches. There is a need for careful and continuing environmental monitoring, the more so because of the increasing importance of fish as a source of protein for human populations and the interest in understanding the accumulation of heavy metals and polyaromatic hydrocarbons (PAHs)

at the different trophic levels of the foodchain (Greig *et al.*, 1978; Obasohan and Oronsaye, 2004)

### **Mangroves and their Sustainable Use in the Niger Delta**

Non-sustainable use of the mangrove ecosystems can lead to loss of the whole mangrove habitat, and associated losses of shoreline organic matter production and the disappearance of species dependent on the habitat and mangrove-based food chains. Appropriate responses needed to ensure sustainability of the mangroves forests of the Niger Delta include:

- Stabilization and protection of shorelines;
- Filtering, trapping and removal of water-borne pollutants;
- Maintenance of nursery and feeding grounds for numerous species of fish and prawns and habitat for crabs and molluscs;
- Provision of nesting sites for sea and shore birds.

### **Conclusion**

Oil development occurred in the Niger delta of Nigeria without a comprehensive, strategic plan which would have protected its natural resources. Many of the oil facilities and operations are located within sensitive habitats - including areas vital to fish breeding, sea turtle nesting, mangroves and rainforests; that have often been severely damaged, contributing to increased biodiversity loss and poverty. The damage from oil and gas operations is chronic and cumulative, and has acted synergistically with other sources of environmental stress to result in a severely impaired coastal ecosystem and compromised livelihoods and health of the region's impoverished residents. Sustainability of mangrove forests and coastal ecosystems depends on collaboration by all stakeholders to introduce adjustments to industrial processes, oil spill prevention, response preparedness; restoration framework and implementation plan.

It could be seen from the above that the externalities of oil extraction have resulted in profound adverse impacts on traditional lifestyles and livelihood patterns in the Niger Delta region where unchecked oil exploration and exploitation had taken place for the past forty years. The oil companies have not helped matters as they continue to flout environmental regulations in their areas of operations and pay less attention to environmental protection regimes that would have helped to abate oil pollution. The government on its part has not shown any commitment to enforcing the minimal environmental laws which it created.

A case in point is the government regulation which forbids the exploitation of oil in sacred lands yet this is routinely flouted without any government intervention on behalf of the community.

The oil companies and the government should show more commitment to the use of abatement procedures and environmentally sound and cleaner technologies for oil exploration and exploitation.

Corporate Social Responsibility (CSR) and Environmental Stewardship should be required of the oil exploitation industries and enforced by the federal government.

### References

- Adeyemo O.K., 2003. Consequences of Pollution and Degradation of Nigerian Aquatic Environment on Fisheries Resources. *Environmentalist*, Vol. 23:4 pp 297-306.
- Adeyemo O.K., 2008. Habitat assessment for seasonal variation of River pollution in Ibadan, Nigeria, in a geographic information systems interface. *Veterinaria Italiana*, 44 (2), 361-371.
- Akpofure, E.A., Efere, M.L. and Ayawei, P. 2000. The Adverse Effects of Crude Oil Spills in the Niger Delta. *Urhobo Historical Society*.
- Aworawo D. 2000. The Impact of Environmental Degradation of the Rural Economy of the Niger Delta' in Osuntokun, Akinjide, *Environmental Problems of the Niger Delta*, Lagos, Friedrich Ebert Foundation.
- Curtis, D. M., 1986. Comparative Tertiary petroleum geology of the Gulf Coast, Niger, and Beaufort-Mackenzie delta areas, *Geological Journal*, 21 (3). 225-255.
- Doust, H., 1990. Petroleum geology of the Niger Delta, *Geological Society, London, Special Publications*, 50 (1). 365-365.
- Greig RA, Wenzloff DR, Mckenzie CL, Merrill AS, Zdanowicz V.S., 1978. Trace metals in the sea Scallops *Pecten magelanicus* from Eastern United States. *Bull. Environ. Contam. Toxicol.* 19: 326-334.
- Haack, R. C., P. Sundararaman, J. O. Diedjomahor, H. Xiao, N. J. Gant, E. D. May, and K. Kelsch, 2000. Chapter 16: Niger Delta Petroleum Systems, Nigeria," *Petroleum Systems of South Atlantic Margins: AAPG Memoir 73*, M. R. Mello and B. J. Katz, eds., pp. 213-231: American Association of Petroleum Geologists (AAPG).
- Human Rights Watch, 1999. *The Price of Oil*. Retrieved May 17, 2007, from <http://www.hrw.org>
- Idodo-Umeh, G., 2002. Pollution assessments of Olomoro Water bodies using Physical, Chemical and Biological indices: PhD. Thesis, University of Benin, Benin City, Nigeria, p. 485.
- Moffat, D. and Olof, L., 1995. Perception and Reality: Assessing Priorities for Sustainable Development in the Niger River Delta. *Ambio* Vol. 24. 7/8 December PP. 527-538.
- Nigeria's Ministry of Environment, WWF UK and the IUCN Commission on Environmental, Economic and Social Policy.

- Myers, N. et. al. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403. 853-858.
- Nigeria's Ministry of Environment, WWF UK and the IUCN Commission on Environmental, Economic and Social Policy 2006. Niger Delta Natural Resource Damage Assessment and Restoration Project; Executive Summary. 13pp.
- Nwilo and Badejo, 2005. Assessing Priorities for Sustainable Development in the Niger River Delta. *Ambio* Vol. 24. 7/8December, pp. 527-538.
- Nwilo, P.C. and Badejo, O.T., 2005. Oil Spill Problems and Management in the Niger Delta. International Oil Spill Conference, Miami, Florida, USA.
- Obaje, N. G. 2009. Geology and mineral resources of Nigeria, Berlin; London: Springer.
- Osuji, L. C., and C. M. Onojake 2004. Trace heavy metals associated with crude oil: A case study of Ebocha-8 oil-spill-polluted site in Niger Delta, Nigeria, *Chemistry and Biodiversity*, 1 (11). 1708-1715.
- Ugochukwu, C. N. C., and J. Ertel 2008. Negative impacts of oil exploration on biodiversity management in the Niger De area of Nigeria, *Impact Assessment and Project appraisal*, 26 (2). 139-147.
- World Bank 1995. Defining an Environmental Strategy for the Niger Delta.