

ASSESSMENT OF TOTAL PETROLEUM HYDROCARBON (TPH) IMPACT ON AQUATIC ECOSYSTEMS IN NIGERIA

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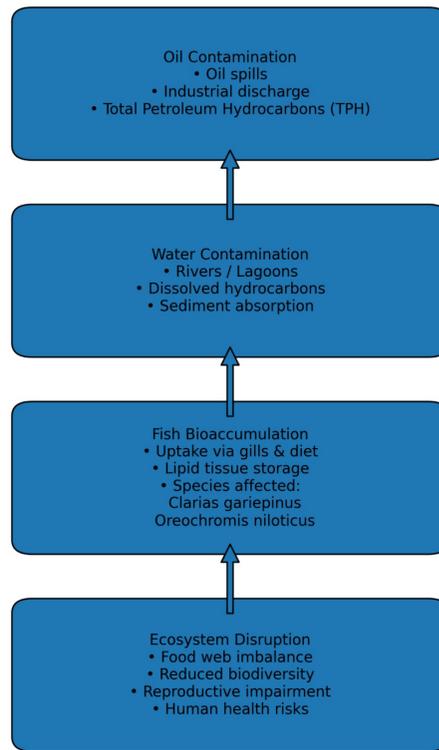
INTRODUCTION

Nigeria's aquatic ecosystems, particularly in the Niger Delta and Ondo State, support diverse aquatic species and coastal livelihoods. However, petroleum exploration, industrial discharge, and agricultural runoff have significantly increased Total Petroleum Hydrocarbon (TPH) contamination in surface waters and sediments (UNEP, 2011; Nwilo & Badejo, 2006).

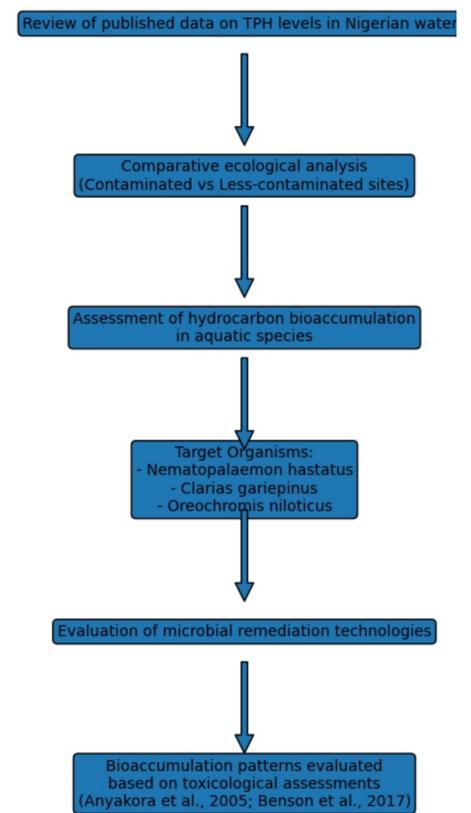
Petroleum hydrocarbons including alkanes, cycloalkanes, aromatics, and heteroatomic compounds are chemically stable and persistent in aquatic environments, posing long-term ecological risks (Wang et al., 2016).

Studies report that TPH concentrations in parts of the Niger Delta frequently exceed environmental safety thresholds, leading to biodiversity decline and habitat degradation (UNEP, 2011). This study evaluated the ecological impact of TPH contamination and assess sustainable biotechnological remediation strategies.

Fig 1: Pathways to Ecosystem Disruption



METHODS



RESULTS

TPH Levels

Table 1: Level of Total Petroleum Hydrocarbon (TPH) in some Fin Fishes in Oliha Market Benin City and Degele Community, Niger Delta

Species	Place/State	Level of TPH found	Dominant TPH	Status
<i>Trachurus trecae</i>	Oliha Market, Benin city, Nigeria.	178.82 mg / kg in gills.	C9 – C30	High in Gills, Liver and Kidney. Low in muscle (Anyanwu et al., 2023)
		73.32mg / kg in the liver.		
		64.37mg / kg in Kidney.		
		30.40 mg / kg was recorded in the muscle.		
<i>Oreochromis niloticus</i>	Degele Community, Niger Delta, Nigeria.	0.001 to 1123.70 ± 952.10 µg / kg	Poly Aliphatic Hydrocarbons	High in <i>Oreochromis niloticus</i> ,
<i>Clarias gariepinus</i>		0.001 to 46.7 ± 16.7 µg / kg ;		Low in <i>C. gariepinus</i>
<i>Heterobranchius longifiliis</i>		0.001 to 42.7 ± 17.4 µg / kg		<i>H. longifiliis</i> , <i>L. falcipinnis</i>
<i>Liza falcipinnis</i>		0.001 to 29.0 ± 1.4 µg / kg		(Nsikak et al., 2007)

Table 2: Level of Total Petroleum Hydrocarbon (TPH) in some Shell Fishes in Ayetoro Coastal water, Ondo, and Littoral Waters of the Bight of Bonny, Niger Delta.

Species	Place/State	Level of TPH found	Dominant TPH	Status
<i>Nematopalaemon hastatus</i>	Ayetoro coastal water, Ondo State, Nigeria.	2585.62 ± 23.01 mg / kg	C13, C9, C31, C14	High (Enuneku et al., 2015)
<i>Ocyropa africana</i>	Littoral Waters of the Bight of Bonny, Niger Delta, Nigeria.	6.40 and 10.42 µg / g	Not Reported	Low (Olaji et al., 2014)
<i>Macura reptantia</i>		4.98 - 6.95 µg / g		
<i>Procambarus clarkia</i>		1.62 - 2.73 µg / g		
<i>Penaeus notialis</i>		3.05 - 5.15 µg / g		

Impact on Aquatic Species

Hydrocarbon exposure leads to: Bioaccumulation in finfish and shellfish, reproductive impairment, oxidative stress, and reduced population diversity

Studies show that petroleum hydrocarbons disrupt membrane integrity and induce physiological stress in fish species such as *Clarias gariepinus* and *Oreochromis niloticus* (Benson et al., 2017; Anyakora et al., 2005).

Ecosystem-Level Effects

Observed level of destruction of spawning habitats, food chain disruption, decline in artisanal fisheries, and long-term ecological imbalance.

Chronic hydrocarbon contamination alters trophic dynamics and reduces ecosystem resilience (UNEP, 2011).

BIOREMEDIATION STRATEGIES

Emerging eco-friendly technologies include: Bioremediation, Biosparging, Bioslurry, Bioventing.

Hydrocarbon-degrading microorganisms such as: *Pseudomonas* spp., *Bacillus* spp., *Penicillium* spp. have demonstrated significant degradation capacity (Das & Chandran, 2011).

Bioremediation techniques have shown removal efficiencies of up to 90–99% under optimized conditions (Das & Chandran, 2011).

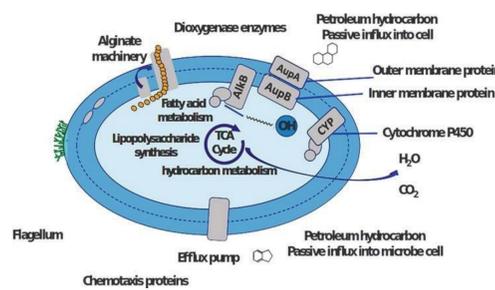


Fig 2: Microbial bioremediation of petroleum hydrocarbon.

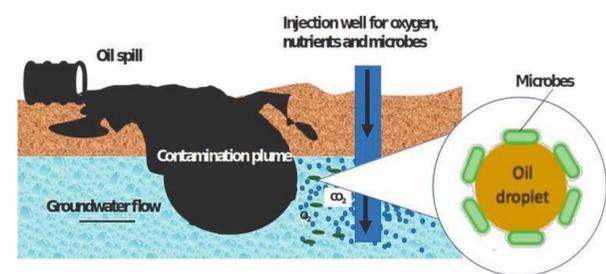


Fig 3: Biosparging in petroleum hydrocarbon polluted soil

CONCLUSION

TPH contamination has significantly altered the structure and function of Nigeria's aquatic ecosystems. Bioaccumulation in commercially important species threatens biodiversity and fisheries sustainability.

Adoption of biological remediation strategies combined with stricter environmental monitoring is essential for ecosystem restoration.

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