Justin Palazzolo
A&M Consolidated High School
College Station, TX, USA
Nigeria, Industrial Water Pollution

Nigeria: Poison in Every Drop

Deep within the industrial neighborhood of Agege in Lagos, the clamor of automobiles and busy streets intermingle with the dark billowy clouds of industry wafting through Nigeria's largest city. However, within the home of one of Lagos's 16 million residents, the commotion of the surrounding city is replaced by the intimate picture of a family gathered around the dinner table. The rickety tenement housing of Agege and the parents' calloused palms, products of their jobs at the local aluminum plant, do little to diminish the radiant smiles of the family as they fill their empty stomachs with flatbread from the local market and their mouths with cheerful conversation about the day's events. Within this moment, one of the children seeks to rinse their meal down with some water; as she lifts her cup, light reflects off the glimmering swirls of color that form a film across the water. Excited by the sight of these vibrant colors that dance across the surface of the usually brown and murky contents of her cup, she drinks the water only to be greeted by an oily, metallic, and bitter taste that contrasts with the vibrant and colorful film in her water. Over the next day, the family's stomachs will be filled with searing pain rather than the warmth of flatbread or the fulfillment of a hot meal.

Families like these increasingly form the backbone of both the Nigerian economy as well as its urban society. Nigeria's urban population already constitutes 53% of its total population and is expected to rise to more than 70% by 2050 (Adedini). The lightning-fast growth of Nigeria's extractive industries and manufacturing has led to an urbanizing effect unparalleled throughout the continent of Africa. Within Lagos, both Nigeria and Africa's largest city, the influx of millions of new workers in its industrial districts has been accompanied by the rise of tenement slums. Naturally, the growth of these settlements has rapidly outpaced the development of water sanitation infrastructure. Furthermore, accessible water infrastructure around the urbanizing southern coast of Nigeria is practically non-existent for the lower-class populations that reside there, meaning that a stable source of water, let alone clean water, is not attainable for millions. Within Lagos, such a situation has resulted in hundreds of thousands of people sharing water from the Ogun River with the waste of chemical plants and the excrement of animal markets and slaughterhouses (Ekundayo).

The crisis of Nigeria's industrial water pollution has spread across Nigeria's urbanizing southern coast and has not merely been limited to cities like Lagos but entire regions. In the Ogoniland province, companies like Shell and BP have exploited the oil-rich region for their extractive industries at the expense of the local population. Over half a century of industrial oil extraction has led to 2,976 separate oil spills in the region since the arrival of Shell, with 822 combined spills occurring in 2020 and 2021 alone (Saint). Such irresponsible oil spillage has led to the pollution of the entire Niger Delta, which serves as the economic backbone for local fishing communities and the direct source of water for millions of residents. The systematic destruction of the fishing industry as a result of oil extraction and the poisoning of the drinking water of millions has destroyed local economies and the health of the region's residents. As a result of poverty and chronic health issues, the average life expectancy in Ogoniland is 41 years, nearly a decade lower than the national average ("Timeline: Half a Century of Oil Spills"). The vast masses of the already marginalized urban poor are the most victimized within Nigeria, with nearly 40% of Nigeria's protein intake coming from fish from the Niger Delta and southern coast (Onoja). Thus, systemic pollution in Nigeria's waterways ensures that Nigeria's poor have no choice but to consume food and water tainted by carcinogenic chemicals or suffer the consequences of food and water insecurity (Ordinioha).

Considering the difficulty of building a sanitized water infrastructure that can effectively service a developing nation of 213.4 million people within a reasonable time frame, an immediate solution is critical to mitigating the approximate 159,777 yearly Nigerian deaths stemming from water pollution (Omilana). Moreover, the dependence of the poor on the Ogun and Niger Rivers and their respective tributaries for drinking water means that any solution should focus on these rivers for the sake of Nigeria's most marginalized. Luckily, a focus on the rivers of Nigeria allows for a select few strategies to be implemented that are both intuitive and proven regarding their prior uses.

The unique conditions of Nigeria set certain prerequisites for any possible solution. The wide-scale corruption in Nigeria's government as well as its status as a developing country necessitate a cost-effective solution that can coexist with its goal of servicing millions of Nigerians with clean water. Luckily, the emerging yet already-proven strategy of bioremediation fulfills these criteria by being a cost-effective solution to the problem of large-scale river purification. Bioremediation entails using biologicals such as aerobic and anaerobic bacteria to remove chemical and heavy metal pollutants by stimulating the breakdown of these compounds (Bala et al.). Microbial bioremediation often encompasses the stimulation of existing bacterial cultures or the introduction of new microbes to bodies of water to break down oil, heavy metals, or other industrial pollutants. Various aerobic bacteria that are oxygen-dependent such as *Pseudomonas, Nocardia,* and *Mycobacterium* are particularly effective in breaking down pesticides and hydrocarbons that are commonly seen in oil spills. Meanwhile, anaerobic bacteria that are not oxygen-dependent such as *Aeromonas* and *Methanosarcina* are used to break down biphenyls, chlorinated compounds, and industrial azo dyes (Bala et al). Usually, bioremediation is present in existing chemical treatment plants; however, a multitude of examples and inferences point to a potentially successful large-scale implementation in the major rivers of Nigeria.

Firstly, bioremediation would certainly fit the economic parameters of a solution for Nigeria. Since the technology only involves the deployment of commonly found mass-grown bacteria cultures or fertilizing nutrients that can stimulate the growth of bacteria already in the water, bioremediation does not need any sanitation infrastructure such as expensive treatment plants or thousands of maintenance personnel (Mitchell). Due to these unique advantages, the cost to treat one cubic meter of water was near zero (Shan et al.). Additionally, the pollutants commonly seen within Nigeria's waterways are uniquely susceptible to the efficacy of bioremediation. The aforementioned issue of oil spillage in the Ogoniland region could be resolved by aerobic bacteria that are effective in breaking down the hydrocarbons that comprise the petrol in the Niger Delta. Likewise, anaerobic bacteria could resolve the industrial waste of the Ogun River in Lagos by neutralizing industrial sulfate waste products and dyes that are dumped by the various textile factories throughout the city. The efficacy of bioremediation in these proposed uses has been demonstrated in previous cases. In 1998, the oil tanker Exxon Valdez ran aground in Prince William Sound, Alaska, and dumped a record-breaking 11 million gallons of crude oil along the Alaskan Coastline. Immediately, the EPA and Exxon looked to bioaugmentation as a bioremediation strategy to use Inipiol, an oleophilic fertilizer, to stimulate the growth of existing bacteria that could degrade the oil (Atlas et al.). In 2001, the NOAA measured 114 sites along the Alaskan coastline and found that 97.8% of the sites had no oil or little oil residue, proving the effectiveness of these strategies in lowering oil contamination back to regular trace levels (Atlas et al.). The example of Exxon Valdez suggests that the same bioremediation strategies that were implemented in Alaska can be implemented in Ogoniland to reduce the continuous oil contamination of the Niger Delta. Combined with its ability to remove carcinogenic chemicals, dyes, and industrial waste products, bioremediation can be a feasible solution to restore the food security of millions along Nigeria's urbanizing coast by restoring local fishing economies and securing the water security for millions who have seen their life expectancy on a downward trend due to chemical and waste contamination.

However, unless the root causes of industrial pollution are addressed, even the most sound strategies are mitigatory in nature. Therefore, it is necessary to address the underlying policy reasons for Nigeria's

water pollution crisis. Nigeria's skyrocketing growth as a developing country has unfortunately resulted in the sacrifice of industry-focused regulatory policy. Regarding waste disposal, Nigeria's water regulations are largely unclear, unenforceable, and impeded by their own legislative structure (Obialor). Conflicts of interest have allowed multinational companies to completely bypass local and regional dumping regulations regarding Nigeria's rivers. This trend is especially prevalent among many extractive multinational corporations that Nigeria's government holds stock in (Obialor). Nowhere is this more evident than in the previous example of Ogoniland. Throughout the early 1990s, Ogoni protests against the ecological disaster created by Shell's oil spillage into the Niger Delta were brutally suppressed by the Nigerian military via executions, beatings, and unlawful detentions ("Nigeria: Shell Complicit"). Nigeria's government displayed its fervent interest in preserving its lucrative trade dealings with Shell even amidst the outcry caused by the ecological disaster. Given that the ecological crisis of Ogoniland persists to this day, Nigeria's government is far more content with remaining complicit in the crisis of pollution than regulating its industries to protect Nigeria's waterways.

The first step to address this regulatory crisis necessitates enforceable regulation that can bypass current impediments. Under Nigeria's current constitution, courts are prevented from making decisions that can impede the federal government, presenting a significant barrier to enforcing any regulations on government-affiliated industries (Obialor). A constitutional provision would be able to govern the conduct of the federal government, allowing for increased accountability via a commission within the federal government. Such a commission would be able to bypass the barriers faced by courts to uphold the constitutional requirements for the conduct of the government. This commission would finally be able to tackle industry effectively since government-affiliated enterprises would no longer be able to hide from court-mandated enforcement behind the federal government's backing (Obialor). A federal focus on enforcement instead of maintaining a business-friendly posture would open the door to further regulation since existing regulations that prohibit the dumping of hazardous materials can now be reasonably enforced. Otherwise, the current lack of a clear constitutional provision allows for corporations and industry to guise their pollution via legal ambiguity and the impossibility of enforcement (Obialor).

Luckily Nigeria's government already has a preexisting legislative blueprint for such a commission. Nigeria's Integrated Water Resources Management Commission or the NIWRMC already exists within the government. However, the bill that would have granted it authority—the Water Resources Bill—was never passed due to controversy regarding its legislative introduction onto the Senate floor (Ikemitang). Had the bill been passed, the commission would have had far greater authority in managing licenses to access water resources in Nigeria such as the crucial rivers that millions use daily ("FG to Strengthen Regulations"). Moreover, despite the grim condition of Nigeria's governmental integrity, the success of other regulatory commissions in Nigeria cast an optimistic outlook on the prospects of an empowered NIWRMC. The Economic and Financial Crimes Commission (EFCC) secured a record 2,200 convictions in the fight against corruption, a 127.46% increase in success rate since 2020 (Amata). The success of the EFCC suggests that NIWRMC can effectively regulate private industry and government-affiliated industry alike given adequate resources and authority. Furthermore, considering that the EFCC tackles internal government corruption, the success of the EFCC suggests that subversive barriers resulting from governmental corruption that the NIWRMC may face are not insurmountable. Nevertheless, the example of Ogoniland and the environmental abuse of Shell in conjunction with a complicit Nigerian government demonstrates the necessity of the possibility of governmental enforcement becoming a reality. Only when corporations are given a financial incentive to halt their damaging activities will Nigeria see water security. Otherwise, a half-century of oil spillage in the Niger Delta will only continue, and the fish of the Ogun, a food source for millions, will remain cancer risks to all who consume them (Adegbola et al.).

With these concrete steps, Nigeria only has to follow the path outlined by its prior actions and other nations to address the crisis of water pollution within its borders and waterways. Bioremediation can mitigate the immediate crisis of human suffering caused by industrial waste and petrol within the water

consumed by millions, while policy reform and oversight can address the underlying corruption that permits the intentional proliferation of water pollution from domestic and foreign industries. For Nigeria, rectifying decades of environmental disaster may seem daunting; however, such a path of action is necessary for the sake of the Nigerian people. After all, Nigeria's government does not owe policy responsibility to a UN Climate goal or some lofty campaign promise about sustainability, but rather to the 28 children in Rafi, Nigeria who died from lead poisoning after drinking water from a contaminated stream (Reuters). Nigeria's government stands at a crossroads where their only choices are to either clean up their policy and their waterways or to permit thousands of families living within the slums of Lagos to fall into a revolving door of chronic illness, tainted fish, and vibrantly colored water.

Works Cited

Adedini, Sunday. “Nigeria’s Cities are Growing Fast: Family Planning Must be Part of Urban Development Plans.” *The Conversation*, 12 Mar. 2023, theconversation.com/nigerias-cities-are-growing-fast-family-planning-must-be-part-of-urban-development-plans-199325.

Adegbola, Ifeoluwa Peter et al. “Health Risk Assessment and Heavy Metal Accumulation in Fish Species (*Clarias gariepinus* and *Sarotherodon melanotheron*) From Industrially Polluted Ogun and Eleyele Rivers, Nigeria.” *Toxicology reports* vol. 8 1445-1460. 14 Jul. 2021, doi:10.1016/j.toxrep.2021.07.007/.

Amata, Dennis. “EFCC Records 98.49% Success Rate in Its 2021 Prosecution.” *Dataphyte*, 13 Jan. 2022, www.dataphyte.com/latest-reports/security/efcc-records-98-49-success-rate-in-its-2021-prosecution/.

Atlas, Ronald M, and Terry C Hazen. “Oil Biodegradation and Bioremediation: a Tale of the Two Worst Spills in U.S. History.” *Environmental Science & Technology* vol. 45,16 (2011): 6709-15. doi:10.1021/es2013227.

Bala, Saroj, et al. “Recent Strategies for Bioremediation of Emerging Pollutants: A Review for a Green and Sustainable Environment.” *Toxics* vol. 10,8 484. 19 Aug. 2022, doi:10.3390/toxics10080484.

Bayagbon, Oluwatoyin. “Slums in the City: Why These 3 “Urban” Slums in Lagos Thrive.” *Medium*, 24 Aug. 2017, medium.com/@oluwatoyin.bayagbon/slums-in-the-city-why-these-3-urban-slums-in-lagos-thrive.

Ekundayo, Solomon. “The Loud Cry of Ogun River.” *StoryMaps*, 4 Nov. 2022, storymaps.arcgis.com/stories/404f44d7fe814f1cb4c5c31efdb3e456.

“FG to Strengthen Water Regulations: Minister.” *Peoples Gazette Nigeria*, 12 Sept. 2023, gazettengr.com/fg-to-strengthen-water-regulations-minister/.

Ikemitang, Sampson. “Regulating Nigeria’s Water Resources Sector for Sustainable Development.” *PunchNG*, 25 Aug. 2023, punchng.com/regulating-nigerias-water-resources-sector-for-sustainable-development/.

Mitchell, Cory. “What Is Bioremediation, and How Does It Work (With Examples)?” *Investopedia*, 27 July 2022, www.investopedia.com/terms/b/bioremediation.asp.

“Nigeria: Shell Complicit in the Arbitrary Executions of Ogoni Nine as Writ Served in Dutch Court.” *Amnesty International*, 29 June 2017, www.amnesty.org/en/latest/press-release/2017/06/shell-complicit-arbitrary-executions-ogoni-nine-writ-dutch-court/.

Obialor, Noble Ik. “The Analysis of Water Pollution Control Legislation and Regulations in Nigeria: Why Strict Implementation and Enforcement Have Remained a Mirage.” *SSRN*, 29 Aug. 2023, papers.ssrn.com/sol3/papers.cfm?abstract_id=4600394#:~:text=The%20conclusion%20reached%20is%20that,free%20water%20and%20environmental%20sanitation.

Omilana, Timileyin. “Nigeria Leads Africa in Pollution-Related Deaths.” *The Guardian*, 23 Dec. 2019, guardian.ng/news/nigeria-leads-africa-in-pollution-related-deaths/.

Onoja, Anthony O., et al. “Determinants of Market Participation in Nigerian Small-Scale Fishery Sector: Evidence from Niger Delta Region.” *Consilience*, no. 9, 2013, pp. 69–84. *JSTOR*, www.jstor.org/stable/26476126.

Ordinioha, Best. “The Human Health Implications of Crude Oil Spills in the Niger Delta, Nigeria: An Interpretation of Published Studies.” *Nigerian Medical Journal* vol. 54,1 (2013): 10-6. doi:10.4103/0300-1652.108887.

Reuters. “At Least 28 Children Killed by Lead Poisoning in Nigeria.” *Reuters*, 15 May 2015, www.reuters.com/article/us-nigeria-lead-casualties-idUSKBN0O013I20150515/. Accessed 17 Mar. 2024.

Saint, Ekpali. “Timeline: Half a Century of Oil Spills in Nigeria’s Ogoniland.” *Al Jazeera*, 21 Dec. 2022, www.aljazeera.com/features/2022/12/21/timeline-oil-spills-in-nigerias-ogoniland.

Shan, Yina, et al. “Cost and Efficiency of Arsenic Removal from Groundwater: A Review.” *UNU-INWEH*, 2 Feb. 2019, inweh.unu.edu/wp-content/uploads/2019/02/inweh.unu.edu/wp-content/uploads/2019/02/Cost-and-Efficiency-of-Arsenic-Removal-from-Groundwater-A-Review.pdf.

“Timeline: Half a Century of Oil Spills in Nigeria’s Ogoniland.” *News24*, 21 Dec. 2022, www.news24.com/fin24/climate_future/environment/timeline-half-a-century-of-oil-spills-in-nigerias-ogoniland-20221221.

https://www.reuters.com/article/us-nigeria-lead-casualties-idUSKBN0O013I20150515/