Enhancing Microplastic Monitoring through Citizen Science in Coastal Nigeria

Isaac Chukwuleta[1,2]
[1]RE-cycleME, Lagos, Nigeria
[2]Pan Atlantic University, Lagos, Nigeria
[1]Correspondence: chukwuletaisaac1@gmail.com

Abstract

Microplastics, defined as plastic particles less than 5 mm, pose a pervasive threat to marine ecosystems, originating from diverse sources and impacting ocean health. This manuscript reviews microplastic sources and ecological consequences, highlighting limited monitoring efforts in Africa. Through RE-cycleME, a youth-led citizen science initiative in Lagos, Nigeria, we propose a scalable model for monitoring microplastic hotspots using affordable sampling techniques. While monitoring cannot eradicate microplastics, it informs targeted clean-ups, reducing secondary microplastic formation via macroplastic removal. Pilots demonstrate community driven data collection, aligning with UN Sustainable Development Goals (SDGs 12, 13, 14). This approach bridges data gaps in Africa, supporting policy and Conservation.

Keywords: Microplastics, ocean pollution, citizen science, monitoring, Nigeria, clean-up strategies

1 Introduction

Microplastics, plastic particles smaller than 5 mm, are ubiquitous in marine environments, infiltrating surface waters to deep-sea sediments [1]. Categorized as primary (e.g., microbeads in cosmetics) or secondary (from degradation of larger plastics via weathering, UV radiation, and abrasion) [10, 9], they stem from inland sources like wastewater (synthetic fibers from laundry), agricultural runoff, and urban litter, with rivers as conduits to oceans [5]. Sea-based sources include fishing gear, shipping waste, and aquaculture debris, while atmospheric transport deposits microplastics in remote regions [4].

Microplastics disrupt marine ecosystems by ingestion, causing physical blockages and reduced feeding efficiency in organisms from plankton to whales [6, 7]. They act as vectors for pollutants (e.g., PCBs, DDT), amplifying toxicity through bioaccumulation [3]. Ecosystem-level impacts include altered nutrient cycling, disrupting plankton communities critical for carbon sequestration [7]. Human health risks arise via seafood consumption, with microplastics in fish and shellfish [6].

Monitoring efforts are limited, especially in Africa, where research is concentrated in South Africa and Nigeria, hindered by inadequate infrastructure and funding [2, 3, 4]. Nigeria's coastal pollution, driven by urban waste and oil activities, lacks comprehensive microplastic data [2, 8]. This impedes policy development, necessitating accessible monitoring solutions.

2 Materials and Methods

The RE-cycleME Ocean Micro-Plastic Monitoring Club, partnered with Pan Atlantic University, employs citizen science in Lagos, Nigeria. Youth participants use low-cost filtration kits (plankton nets, sieves) to sample coastal waters and sediments monthly, following protocols from the Big Microplastic Survey [7, 9]. Samples from hotspots (beaches, river mouths) are filtered and analyzed microscopically for particle density (particles per liter or square meter). Data is aggregated via a Google Sheets-based dashboard with GPS mapping. Training workshops ensure quality, with 20% of samples verified in labs. The model integrates educational outreach, aligning with SDGs 12 and 14.

3 Results

Pilot data (n=50 samples, 20242025) indicate microplastic density of 0.52 particles/L in Lagos coastal waters, primarily secondary polyethylene and polypropylene fragments. Hotspots align with urban runoff, with fibers comprising 60% of particles. Over 200 participants generated baseline maps for clean-up prioritization.

4 Discussion

Monitoring alone cannot halt microplastic entry, which requires upstream policies, but it enables targeted macroplastic clean-ups to prevent fragmentation [10, 8]. RE-cycleMEs model reduces ecological risks and supports the blue economy, mirroring global citizen science programs [7, 9]. Limitations include sampling biases and resource constraints, but partnerships (e.g., OceanHub Africa) enhance scalability. Future AI integration, like PlasticNet could improve detection accuracy [1].

5 Conclusion

RE-cycleMEs citizen science model democratizes microplastic monitoring in Nigeria, providing data for clean-ups and policy. Collaborative expansion can advance global ocean health and UNOC3 goals.

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