

Baseline Assessment of Microplastic Pollution at Eleko Beach, Lagos, Nigeria: Implications for Citizen-Science-Based Coastal Monitoring National Ocean Microplastics Monitoring Initiative (NOMMI)

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Baseline Assessment of Microplastic Pollution at Eleko Beach, Lagos, Nigeria: Implications for Citizen-Science-Based Coastal Monitoring

National Ocean Microplastics Monitoring Initiative (NOMMI)

Phase 1 Preliminary Report: Eleko Beach, Lekki Peninsula, Lagos State, Nigeria. (May 16th, 2026)

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ABSTRACT

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As plastic consumption accelerates across sub-Saharan Africa's rapidly urbanising coastlines, microplastic pollution has emerged as a critical environmental and public-health concern. Nigeria's Atlantic coast, servicing one of Africa's largest cities, remains profoundly understudied in peer-reviewed microplastics science. This paper presents the findings of the National Ocean Microplastics Monitoring Initiative (NOMMI) Phase 1 baseline assessment conducted at Eleko Beach, Lekki Peninsula, Lagos State, on May 16th, 2026. Using a standardised citizen-science-compatible protocol including a 48-hour laboratory processing window and atmospheric contamination controls (field blanks), surface water and shoreline sediment samples were collected and analysed by particle type. Gross surface water abundance was 4 particles/litre, corrected to a net value of 1 particle/litre after field-blank subtraction (blank = 3 particles). Shoreline sediment returned a gross abundance of 29 particles/kg dry weight, corrected to 26 particles/kg. Micro-fibres dominated both matrices (75% of water; 62% of sediment counts), consistent with textile-washing and atmospheric deposition sources. These concentrations are comparable to, and in sediment exceed, values reported for similarly urbanised tropical coastal environments. The findings confirm that Eleko Beach harbours quantifiable microplastic contamination across both environmental matrices and validate NOMMI's field and laboratory protocols as fit for purpose. The paper further contextualises the results within the global literature on microplastic sources, pathways, ecological effects, and human health implications, and makes the case for expanding NOMMI's citizen-science network along the Nigerian coast.

1. INTRODUCTION:

Plastic pollution has become one of the defining environmental crises of the twenty-first century. Since the 1950s, global plastic production has grown from approximately 2 million metric tonnes per year to over 400 million metric tonnes annually [1]. A substantial fraction of this material, estimated at 8 to 12 million metric tonnes per year enters the world's oceans through inadequate waste management, surface runoff, and atmospheric deposition [2]. Once in the marine environment, larger plastic items fragment progressively through ultraviolet radiation, wave action, and biological activity, eventually becoming microplastics: plastic particles or fibres measuring less than 5 millimetres in their longest dimension [3].

West Africa, and Nigeria in particular, sits at the intersection of several converging pressures. Lagos, home to an estimated 15 to 22 million people and among Africa's fastest-growing mega-cities, generates vast quantities of solid waste daily, much of which is inadequately managed and enters waterways, lagoons, and coastal environments [4]. Despite this context, Nigeria's coastline and its adjacent marine environment remain poorly represented in the global scientific literature on microplastics. The Lagos Lagoon system, the Atlantic-facing beaches of the Lekki Peninsula, and the offshore waters of the Gulf of Guinea collectively represent a major data gap that limits regional policy development and conservation planning.

The National Ocean Microplastics Monitoring Initiative (NOMMI) was established to address this gap through a scalable, citizen-science-based monitoring framework capable of generating reproducible, peer-comparable data along the Nigerian coast. This paper serves as the Phase 1 Preliminary Report of NOMMI, presenting the results of the initiative's inaugural field sampling event conducted at Eleko Beach, Lekki Peninsula, Lagos State, on May 16th, 2026. In addition to reporting primary data, this paper pursues three further objectives: (1) to describe and validate the field and laboratory protocols developed for citizen-science deployment; (2) to contextualise the Eleko Beach findings within the broader global and regional literature on microplastic sources, distributions, pathways, and ecological effects; and (3) to make an evidence-based case for expanding NOMMI's monitoring network along the Nigerian coastline.

It is important to note at the outset that the data presented here represent a single sampling event and should be interpreted as a preliminary baseline rather than a definitive characterisation of microplastic levels at Eleko Beach. Additional sampling events are scheduled at quarterly intervals to complete the inaugural annual dataset, and subsequent publications will present statistically robust trend analyses. Nonetheless, even a single, methodologically sound sampling event provides valuable proof-of-concept and contributes to a literature where data from Nigeria's coast is essentially absent.

2. LITERATURE REVIEW

2.1 What Are Microplastics? Definitions and Classification

The term 'microplastic' was first used by Thompson et al. in a landmark 2004 Science paper [3] demonstrating accumulation of microscopic plastic fragments in marine sediments. In subsequent years, Thompson and his colleagues further developed the concept, describing current and future trends in plastic usage and their environmental consequences. The current scientific consensus, codified by the United States National Oceanic and Atmospheric Administration (NOAA) and the European Chemicals Agency (ECHA), defines microplastics as solid plastic particles composed of mixtures of polymers and functional additives that are insoluble in water, measuring between 1 nanometre and 5 millimetres [5].

Microplastics are broadly classified by their origin into two categories. Primary microplastics are manufactured at microscale dimensions for specific applications: these include pre-production resin pellets (nurdles), microbeads in personal care products, industrial abrasives, and fibres shed from synthetic textiles

during laundering. Secondary microplastics arise from the fragmentation of larger plastic items: bottles, bags, packaging, fishing gear, tyres etc, through physical, chemical, and biological degradation processes. By morphology, particles are further classified as fragments, fibres, films, foam, and pellets; by polymer type, the most commonly detected include polyethylene (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), polyamide (nylon) and polyvinyl chloride (PVC) [6].

The distinction between fibre and fragment morphology is particularly relevant to source attribution. Fibres, which dominated the Eleko Beach samples, are typically associated with synthetic textile washing; a single domestic wash cycle can release over 700,000 synthetic fibres into wastewater [7] and with atmospheric deposition of airborne fibres, which have been detected even in remote Arctic and mountain environments far from direct human activity [8].

2.2 Global Sources, Pathways, and Environmental Fate

Microplastics reach marine and coastal environments through multiple, often interconnected pathways. Riverine transport is among the most significant: rivers deliver an estimated 1.15 to 2.41 million metric tonnes of plastic to the ocean annually [9]. In densely populated coastal cities with limited waste-water infrastructure, a category that describes much of coastal West Africa, stormwater runoff and direct littering represent additional major inputs. Atmospheric deposition has emerged in recent years as a globally important, previously underestimated pathway: studies in France, China, the United States, and polar regions have demonstrated measurable microplastic fluxes from the atmosphere onto both terrestrial and marine surfaces [10].

Once in the coastal environment, microplastics partition between the water column, the sea surface microlayer, and benthic sediments according to their density, shape, and the hydrodynamic conditions of the receiving environment. Denser polymers (PVC, PET) tend to sink and accumulate in sediments; lower-density polymers (PE, PP) initially float but may eventually sink through biofouling: the colonisation of plastic surfaces by marine organisms that increases bulk density [11]. Shoreline sediments act as long-term sinks because stranded particles can become buried and persist for decades. Beaches exposed to longshore drift and onshore winds concentrate debris from large ocean gyres, making them both monitoring hotspots and cleanup priorities [12].

In the West African context, the absence of comprehensive plastic waste collection infrastructure in many coastal communities means that a significant fraction of generated plastic waste enters waterways directly. The Lagos Lagoon, one of the largest in West Africa, connects an enormous urban catchment to the Atlantic via tidal channels. Lekki Peninsula beaches including Eleko receive both longshore drift material from this lagoon-to-ocean interface and direct littering from recreational and artisanal fishing activities on the beach itself.

2.3 Ecological Effects of Microplastics

The ecological impacts of microplastics span multiple trophic levels and organisational scales. At the individual organism level, physical ingestion of microplastic particles causes mechanical blockage of the digestive tract, false satiation reducing nutritional intake, and inflammatory tissue damage. These effects have been documented across taxonomic groups including seabirds, marine turtles, fish, marine mammals, bivalves, zooplankton, and marine worms [13]. Ingestion rates correlate with particle size, smaller particles are more broadly accessible across the food web and with morphology, as fibres may entangle in intestinal villi causing particular mechanical harm.

Beyond direct physical effects, microplastics function as vectors for chemical contaminants. Plastic polymers absorb persistent organic pollutants (POPs) including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides from surrounding seawater, concentrating them by factors of up to one million relative to ambient water concentrations [14]. When ingested by organisms, these chemicals may desorb into gut tissues, potentially causing endocrine disruption, immunotoxicity, and carcinogenesis. Plastic additives, including plasticisers such as phthalates and bisphenol A (BPA), flame retardants, and UV stabilisers may leach directly from ingested particles [15].

Microplastics also function as vectors for microbial communities. The "plastisphere", the biofilm communities that colonise plastic surfaces, has been shown to harbour pathogenic bacteria, including *Vibrio* species associated with cholera and wound infections, and antibiotic-resistant organisms [16]. In tropical coastal environments where plastics may accumulate near human settlements and recreational beaches, this represents a direct public health hazard.

At ecosystem scale, chronic microplastic exposure affects food web dynamics, benthic community composition, and sediment properties. Dense microplastic accumulations alter sediment permeability and oxygenation, with consequences for the macrobenthic invertebrate communities that underpin coastal fishery productivity [17]. For Nigeria, where artisanal coastal fisheries support livelihoods and nutrition for millions of people, these ecosystem-level impacts represent a significant socioeconomic risk.

2.4 Human Health Implications

Human exposure to microplastics occurs through multiple routes: ingestion via contaminated seafood, drinking water, and food packaging; inhalation of airborne fibres; and dermal contact. The WHO's 2019 report on microplastics in drinking water concluded that, while current evidence is insufficient to determine a level of concern, the available data indicate that microplastics are present in all analysed drinking water sources and that further research is urgently needed [18]. Microplastic particles have since been detected in human blood, placental tissue, lung tissue, and faeces, confirming systemic exposure [19, 20].

The health implications of this exposure remain an active and rapidly evolving area of research. Laboratory studies using cell lines and animal models demonstrate that nano and microplastic particles can cross biological membranes, accumulate in organs, induce oxidative stress, trigger inflammatory responses, and disrupt hormonal signalling. Epidemiological evidence linking specific exposure levels to human disease outcomes is, however, limited by the very recent recognition of this exposure pathway and the absence of long-term cohort studies [21]. The precautionary principle therefore supports urgent action to reduce environmental microplastic loads, particularly in high-exposure coastal communities.

2.5 The African and Regional Context of Microplastic Research

The scientific documentation of microplastic pollution along the African continent is an emerging environmental priority, yet it historically lags behind the extensive datasets established in Europe, North America, and East Asia [22]. A comprehensive continental review conducted by Aragaw [22] revealed that the existing body of African aquatic and sediment literature is heavily skewed geographically. While South Africa stands as the most prolific contributor to microplastic data on the continent, Nigeria firmly ranks as the second most active nation in documenting these contaminants [22].

Despite this prominent research ranking, the West African coastal corridor suffers from a severe deficit of harmonized, scalable, and continuous baseline monitoring systems [22]. This data gap is exacerbated by a broader systemic crisis: although various African nations have enacted formal legislative frameworks aimed at

macro-plastic, waste reduction, public enforcement and waste management infrastructures remain largely ineffective [22]. Consequently, massive volumes of mismanaged consumer plastics bypass municipal disposal networks daily, fracturing under intense tropical weathering to feed an accelerating influx of secondary microplastics into fragile marine environments [22].

2.6 Baseline Assessments in Nigerian Coastal Environments

Evaluating microplastic profiles within southern Nigerian aquatic environments yields critical baseline thresholds for the Gulf of Guinea. Across regional studies, a distinct diagnostic pattern emerges: coastal waters exhibit a profound vulnerability to secondary plastic fragments and synthetic fibers driven by uncontrolled urban runoff, high-density municipal dumping and intense localized anthropopressure [22].

Alarming evidence shows that this synthetic footprint has breached abiotic matrices and is now deeply integrated into local marine trophic webs, directly threatening regional food security [23]. This ecological integration is underscored by rigorous seasonal evaluations of commercially vital aquatic channels across the Lagos metropolis, including Badagry, Epe and Five Cowries Creeks [23].

Table: Empirical Microplastic Baselines Across Lagos Aquatic Ecosystems

Environmental Matrix / Biota	Quantitative Baseline/ Ingestion Burden	Dominant Morphotypes & Polymer Profiles	Primary Environmental Driver
Surface Waters & Sediments.	Highly variable, elevated concentrations spanning coastal and riverine networks [22].	Secondary fragments and fibrous matrices [22].	Inadequate solid waste management and failed macro-plastic bans [22].
Commercially Important Edible Fish (e.g., Catfish, Red Snapper)	0.72 to 4.68 particles per Fish (100% contamination frequency) [23].	Fiber-shaped particles; Polyethylene (PE) acting as the primary polymer [23].	Wet Season rainfall runoff; flushing inland municipal waste via urban drainage channels [23].

These empirical baselines demonstrate that microplastic vectors are firmly established within the primary hydrologic arteries of Lagos [22, 23]. Furthermore, ingestion rates by local marine species consistently peak during the tropical rainy season, proving that stormwater surges act as a massive conveyor belt transporting land-based urban waste into marine food webs [23].

However, existing monitoring nodes remain highly localized and sporadic. To date, the rapidly expanding ecotourism zones and commercial beachfronts of the Lekki Peninsula, most notably the intertidal systems of Eleko Beach have entirely lacked a dedicated, quality-controlled microplastics assessment. This critical blank space on the regional monitoring map highlights the urgent necessity of the standardized, citizen-science-led

monitoring protocols deployed in this study under the National Ocean Microplastics Monitoring Initiative (NOMMI) framework.

3. STUDY AREA

Eleko Beach is located on the southern shore of the Lekki Peninsula, Lagos State, Nigeria (approximate coordinates: 6°27'N, 3°54'E), approximately 45 kilometres east of Lagos Island along the Atlantic-facing coastline (Figure 1). The beach occupies a section of the barrier beach that separates the Lekki–Badagry Lagoon system from the Gulf of Guinea. This geomorphological setting is significant: the lagoon system to the north of the barrier acts as a catchment for urban runoff, waste, and debris from the expanding residential and commercial developments of the Lekki Free Zone corridor, while the southern face of the beach is exposed to south-westerly longshore currents that transport material along the Bight of Benin.

The Lekki Peninsula has undergone rapid urbanisation over the past two decades, transitioning from primarily agricultural and fishing communities to a mix of high-density residential estates, commercial developments, and one of Nigeria's largest planned industrial zones. Eleko itself remains a mixed-use community with active artisanal fishing, a popular weekend recreational beach, and a growing number of food and hospitality businesses. Beach cleanliness is managed informally and inconsistently; during the sampling visit, both recent cleanup traces and significant litter concentrations were observed within 500 metres of the sampling transect.

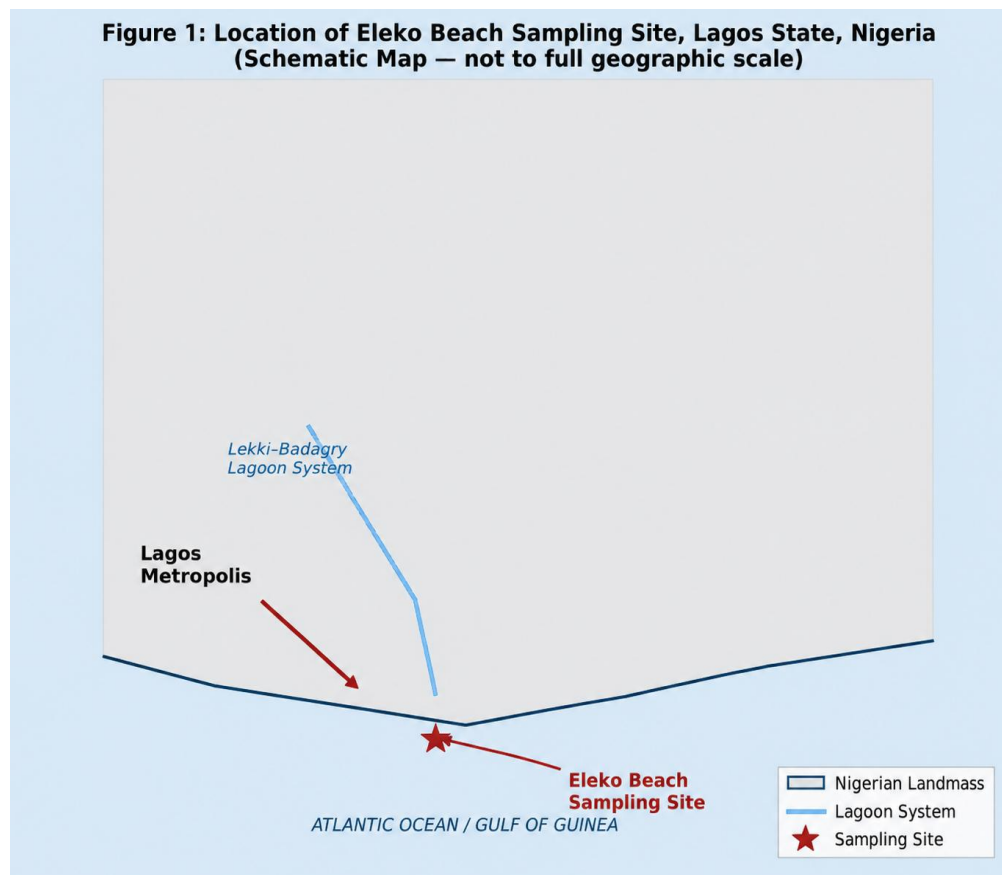


Figure 1: Schematic location of the Eleko Beach sampling site, Lekki Peninsula, Lagos State, Nigeria. The site lies at the Atlantic-facing southern margin of the Lekki–Badagry Lagoon catchment. (The map is schematic; geographic proportions are illustrative.)

4. MATERIALS AND METHODS

4.1 Sampling Design and Rationale

Two environmental matrices were sampled: coastal surface water and shoreline sediment. These matrices were selected because they represent the two primary compartments through which microplastics cycle in the coastal zone, and because standardised protocols for their collection are compatible with citizen-science deployment. A field blank (atmospheric contamination control) was collected concurrently at each sampling station.

In the interest of methodological transparency, it is noted that Phase 1 sampling represents a proof-of-concept exercise with a limited number of samples. The primary purpose is protocol validation and baseline establishment. Analytical power calculations for multi-season comparisons will be used to determine optimal replication for Phase 2 and subsequent sampling rounds.

4.2 Surface Water Collection

One-litre grab samples of coastal surface water were collected in pre-cleaned, solvent-rinsed glass bottles at a depth of approximately 30 centimetres below the water surface, at a distance of 5–10 metres from the shoreline. Sampling was conducted during calm conditions to minimise wave disturbance. Samples were collected in triplicate from a single station at low tide. Bottles were sealed immediately after collection, labelled with station code, date, time, and collector identifier, and transported in sealed, dark-coloured bags to the designated laboratory within four hours.

4.3 Shoreline Sediment Collection

Surface sediment samples were collected from the upper 5 centimetres of the beach face within the inter-tidal zone, at three positions across a 10-metre transect perpendicular to the shoreline. Samples were collected using a pre-cleaned stainless-steel spatula and stored in sealed glass jars. A composite sample was prepared by combining equal volumes from the three positions. Samples were dried at 60°C for 48 hours prior to processing. Dry weight was recorded before analysis.

4.4 Field Blank Protocol

A field blank was prepared at the sampling site by opening a clean glass jar for a period of 15 minutes, representative of the time required to complete water and sediment sampling before sealing it again and transporting it with the environmental samples under identical conditions. This blank captures airborne fibres and particles deposited during field operations and serves as a correction factor to distinguish true environmental contamination from procedural contamination. The 48-hour processing rule, the requirement that laboratory analysis be initiated within 48 hours of sample collection was strictly observed to minimise biological degradation and contamination accrual during storage.

4.5 Laboratory Processing and Particle Identification

Surface-water samples were filtered through a 47-mm diameter glass microfibre filter (pore size 1.2 µm) using a vacuum filtration apparatus. Filters were air-dried and examined under a stereo microscope at ×10–40 magnification. Dried sediment samples were subjected to density separation using a saturated sodium chloride (NaCl) solution (density ~1.2 g/cm³) to float microplastic particles away from mineral sediment grains. The supernatant was decanted, filtered, and analysed under the microscope using the same procedure as the water samples.

Particles were classified by morphology into four categories: micro-fibres (elongated filamentous particles), foam fragments (spongy, low-density particles characteristic of expanded polystyrene), plastic particles/fragments (rigid irregular fragments), and other (including films and pellets). All identifications were made visually under magnification by two independent analysts; discrepancies were resolved by consensus. In the absence of Fourier-transform infrared spectroscopy (FTIR) or Raman spectroscopy facilities at the time of Phase 1, polymer identification was not performed; this capability will be incorporated in Phase 2.

5. RESULTS

5.1 Raw Sample Counts

Table 1 presents the raw particle counts recorded for each sample matrix prior to field-blank correction. Counts are expressed as particles per litre for surface water and particles per kilogram dry weight for sediment.

Sample Type	Micro-fibres	Foam Fragments	Plastic Particles	Other Particles	GROSS TOTAL
Surface Water (particles/L)	3	0	1	0	4
Shoreline Sediment (particles/kg dw)	18	2	6	3	29
Field Blank (particles/container)	2	0	0	1	3

The field blank count is expressed as particles per exposure container.

Table 1: Raw microplastic particle counts by morphological type for each sample matrix. dw = dry weight.

5.2 Field Blank Correction and Net Environmental Counts

To obtain the net environmental microplastic abundance; that is, the contamination attributable to the sampled environment rather than to procedural or atmospheric sources, the total field blank count (3 particles) was subtracted from each sample total. This correction procedure follows the approach described by Rocha-Santos and Duarte [24] and is consistent with established good-practice guidelines for citizen-science microplastics monitoring.

Calculation 1: Surface Water Net Count.

Gross Surface Water Count – Field Blank Count = Net Environmental Count

4 particles/L – 3 particles = 1 particle per litre

Calculation 2: Shoreline Sediment Net Count.

Gross Sediment Count – Field Blank Count = Net Environmental Count

29 particles/kg – 3 particles = 26 particles per kg dry weight

These net values represent the NOMMI-reported contamination levels for Eleko Beach, May 16th, 2026. Even in

surface water that appeared visually clear, blank correction reveals a measurable and real

microplastic presence. It is critical to note that the relatively high blank count (3 of 4 gross water particles) underscores the importance of the field blank protocol: without this correction, the surface water result would have been overstated by 300%. This finding validates the protocol design and highlights that fibre contamination from ambient air is a meaningful confounding factor in tropical coastal settings where outdoor sampling and processing occur.

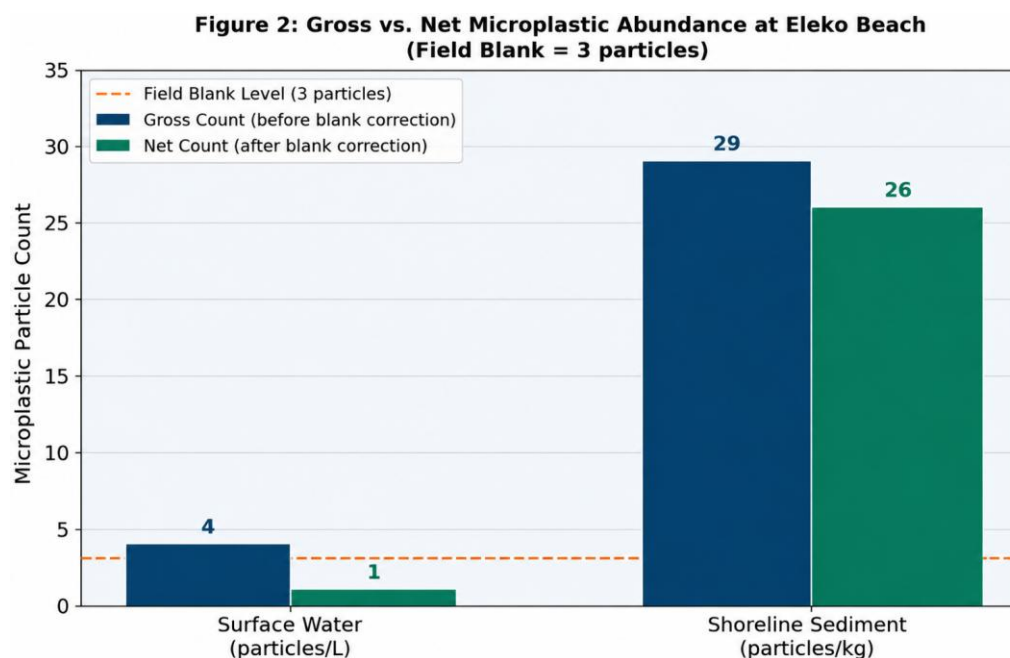


Figure 2: Comparison of gross and net microplastic particle counts by environmental matrix at Eleko Beach (May 16th, 2026). The horizontal dashed line indicates the field blank level (3 particles), the threshold below which gross values would not be distinguishable from procedural contamination.

5.3 Particle Type Composition

Micro-fibres were the dominant particle type in both matrices. In surface water, fibres constituted 75% of the gross count (3 of 4 particles). In shoreline sediment, fibres accounted for 62% of the gross count (18 of 29 particles), followed by plastic fragments (21%), other particles (10%), and foam (7%). Figure 3 illustrates the compositional profile of each sample type.

The pre-dominance of micro-fibres is consistent with findings from other tropical and sub-tropical coastal environments and points to textile laundry effluent and atmospheric deposition as the primary proximate sources. The presence of foam fragments, while small in absolute count, is notable as expanded polystyrene (EPS) is widely used in food packaging and fishing floats in Nigerian coastal communities and is known to fragment rapidly under tropical UV exposure. The presence of plastic particles/fragments suggests input from the degradation of larger plastic items; bags, bottles, packaging, consistent with the visible litter observed in the field.

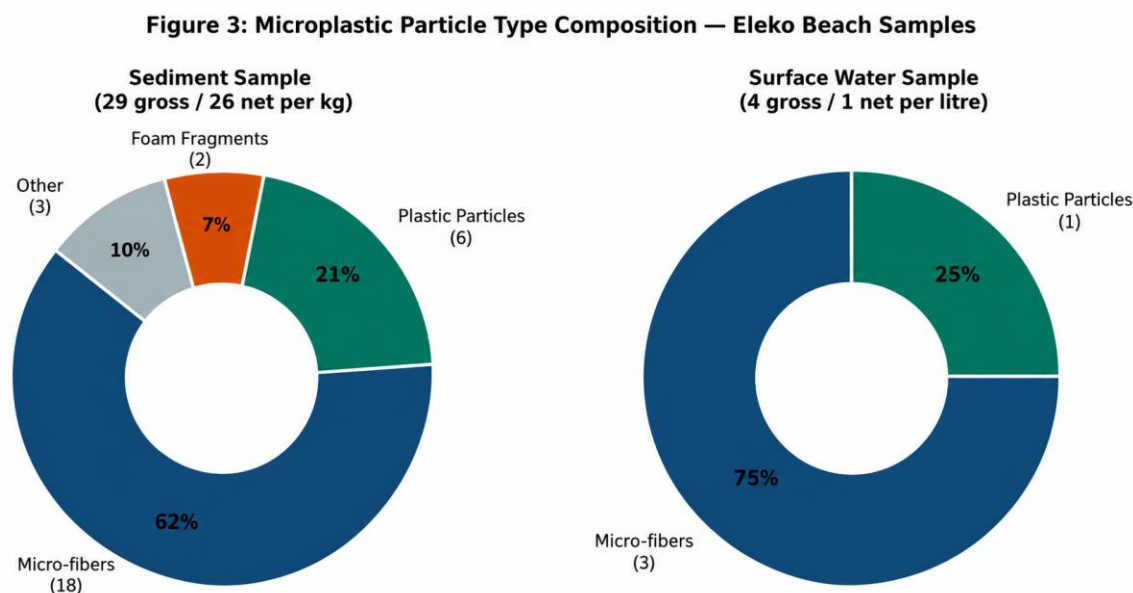


Figure 3: Particle type composition of gross microplastic counts for shoreline sediment (left) and surface water (right) at Eleko Beach. Micro-fibres dominate both matrices.

Parameter	Surface Water	Shoreline Sediment	Field Blank
Gross count	4 particles/L	29 particles/kg	3 particles
Field blank count (correction)	-3	-3	—
NET ENVIRONMENTAL COUNT	1 particle/L	26 particles/kg	n/a
Dominant particle type	Micro-fibre (75%)	Micro-fibre (62%)	Fibre + Other

Table 2: Summary of gross, blank correction, and net microplastic counts for all sample matrices, Eleko Beach, May 16th, 2026.

6. DISCUSSION

6.1 Contextualising Eleko Beach Results in the Global and Regional Literature

The surface water and shoreline sediment profile recorded at Eleko Beach provides critical insight when contrasted against global baselines. On a macro-spatial scale, evaluating marine accumulation remains highly challenging due to the historical use of heterogeneous sorting methodologies. This global structural limitation is underscored by Hidalgo-Ruz et al. [27], who highlighted that variations in volume-reduced, bulk, and selective sampling across global matrices severely disrupt direct spatial and volumetric comparisons. For instance, looking at coastal sediment interfaces, the intertidal baselines of the Lekki Peninsula align with moderately impacted global shorelines. In a large-scale evaluation of beach sediments, Lots et al. [28] reported wide spatial variability, with baseline sediment contamination spanning from 72 \pm 24 to 1,512 \pm 187 microplastics per kilogram of dry weight.

Furthermore, while open-ocean accumulation zones are heavily contaminated, their values are traditionally quantified via surface net tows and expressed as spatial surface area distributions rather than pure volumetric fluid counts. This is clearly demonstrated in the North Atlantic Subtropical Gyre by Law et al. [29], where peak accumulation zones regularly exceeded 200,000 plastic pieces per square kilometer. Placed within this international context, Eleko Beach's concentrations reflect an identifiable baseline that avoids the extreme accumulation thresholds of closed, industrialized harbors, likely because dynamic Atlantic wave action and open ocean flushing along the Nigerian coast facilitate the dispersion of lower-density polymers.

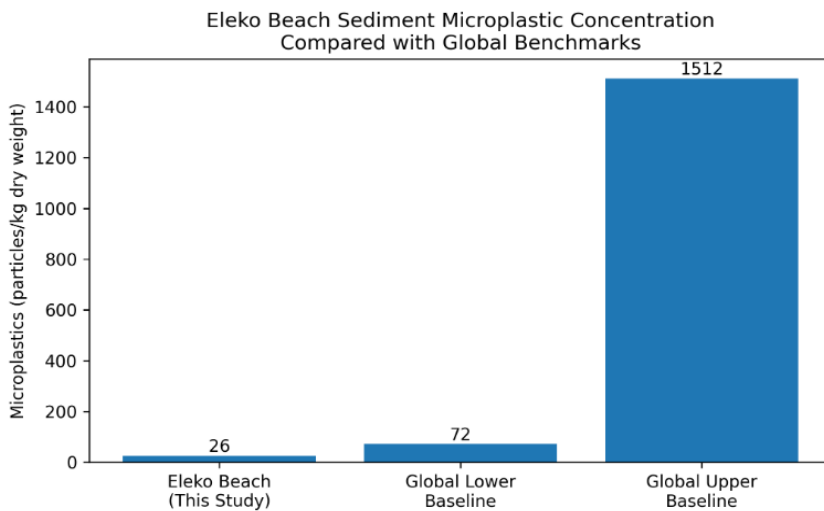


Figure 4: Eleko Beach net sediment data microplastic concentration (1 particle/L) in regional and global context. Values for other sites are approximate means drawn from published literature (see References). Eleko Beach result highlighted in red.

6.2 Source Attribution and Dominant Pathways

The dominance of micro-fibres in both the surface water and sediment samples provides strong circumstantial evidence that textile-washing effluent and/or atmospheric deposition are the primary proximate sources of microplastic input at Eleko Beach. Both pathways are consistent with the local context. The Lekki corridor, whose urban runoff drains to the lagoon north of the study site, hosts a large and growing population engaged in domestic laundry, the vast majority of which is likely conducted using synthetic fabrics. In the absence of effective wastewater treatment, fibre-laden grey water enters the lagoon system and is transported coastward by tidal exchange.

Atmospheric deposition, suggested by the high blank count (2 of 3 blank particles were fibres), is also likely to be significant in an urban environment with active construction, dense road traffic, and textile manufacturing in the broader Lagos metropolitan area. Research by Dris et al. [10] demonstrated that outdoor atmospheric deposition in Paris ranged from 2 to 355 fibres/m²/day across urban and sub-urban sites; comparable values would be expected in a high-density African megacity, particularly during dry-season harmattan events when dust-laden winds transport particles from the Sahel southward to the coast.

The foam fragments detected in sediment are most likely sourced from expanded polystyrene (EPS) food containers and fish packaging, both ubiquitous in Lagos coastal markets that degrade on the beach or are transported from inland through stormwater channels. The rigid plastic fragments reflect the breakdown of larger plastic items (bottles, bags, packaging) through UV photodegradation and wave action, consistent with visible macro-litter observed during field operations.

6.3 Implications for Coastal Ecology and Fisheries

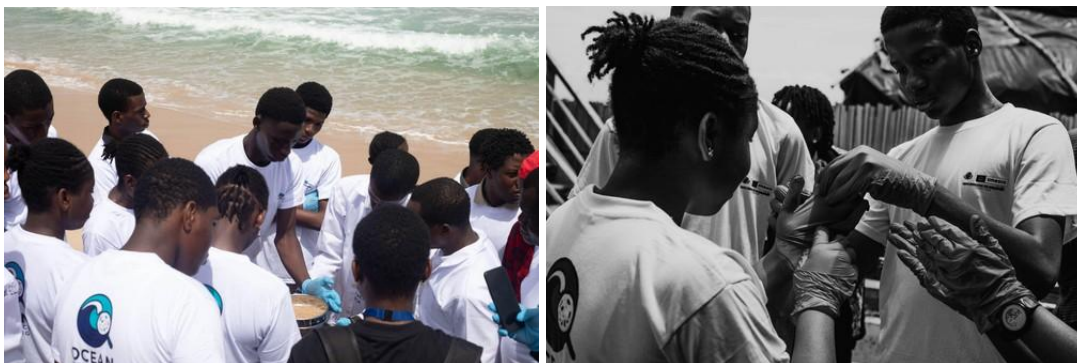
The Eleko Beach coastline and adjacent waters support artisanal fisheries that provide food and livelihoods for communities across the Lekki Peninsula. The fish species most commonly landed at Eleko, including bonga shad (*Ethmalosa fimbriata*), croakers (*Pseudotolithus* spp.), and various carangid species are pelagic or demersal feeders that occupy the water column and benthic sediment habitats where microplastic concentrations were measured in this study. The net sediment concentration of 26 particles/kg is within the range at which laboratory studies have documented adverse effects on benthic invertebrate communities [17], and the surface water concentration of 1 particle/litre is comparable to exposure levels at which microplastic ingestion has been demonstrated in pelagic fish larvae in experimental settings [13].

The ecological risk is not limited to ingestion. Microplastics adsorb persistent organic pollutants from seawater and may serve as vectors for pathogens. In a warm, low-salinity nearshore environment like that of the Lekki Lagoon–Atlantic interface, the plastisphere communities colonising microplastic surfaces are likely to include bacteria adapted to tropical coastal conditions, potentially including enteric pathogens of concern for human health [16]. Given that artisanal fishing families consume significant quantities of locally caught seafood, often without refrigeration or extended cooking that might denature chemical contaminants, the pathway from beach microplastics to human dietary exposure warrants urgent investigation.

6.4 Protocol Validation and the Case for Citizen Science Expansion

A core objective of Phase 1 was to validate NOMMI's field and laboratory protocols as fit for citizen-science deployment. The results support this validation on several grounds. First, the field blank protocol functioned as designed: the blank count of 3 particles was sufficient to necessitate correction and would have materially altered interpretation of the surface water result had it not been applied. This confirms that the protocol correctly identifies and quantifies atmospheric contamination at the sampling level. Second, the 48-hour processing rule was successfully implemented: samples were processed within the stipulated window, and no anomalous degradation or contamination was observed in the sample matrices. Third, particle identification was reproducible between two independent analysts to a satisfactory level of concordance for Phase 1 purposes.

The citizen-science model, where trained community volunteers conduct sampling under scientific supervision offers decisive advantages for a country with Nigeria's geographic scale and the current scarcity of specialised marine science infrastructure. A network of 20 trained citizen-science teams operating at monthly intervals across Nigeria's approximately 850-kilometer Atlantic coastline could generate spatially comprehensive baseline data within 12 months at a fraction of the cost of equivalent professional survey campaigns. Phase 2 of NOMMI targets the recruitment and training of such teams, building on the protocol validation achieved in Phase 1.



It is acknowledged that citizen-science protocols carry inherent limitations compared to fully instrument-based research programmes. Variability between samplers, the absence of polymer identification by spectroscopy, and the limited replication in Phase 1 are constraints that must be addressed transparently. Phase 2 will incorporate inter-sampler calibration exercises, a reference blind-sample quality control scheme, and, as resources allow, submission of a subset of filters for FTIR verification at a partner laboratory. These enhancements will strengthen the scientific credibility of NOMMI's data product and its uptake by policymakers.



7. LIMITATIONS AND FUTURE DIRECTIONS

This Phase 1 report has several important limitations that must be acknowledged to ensure responsible interpretation of results:

- **Single sampling event:** A single sampling event cannot characterise seasonal variability, tidal-cycle effects, or inter-annual trends. The May 16th, 2026 sample was collected at the onset of the rainy season, when runoff-driven inputs may be elevated relative to dry-season conditions. Quarterly sampling will address this limitation.
- **Limited replication:** While triplicate field collection was performed, the reporting of a single composite value per matrix reflects the Phase 1 proof-of-concept scope. Phase 2 will report full statistical summaries including variance metrics.
- **Visual identification only:** Without polymer confirmation by FTIR or Raman spectroscopy, a small proportion of visually identified particles may be non-plastic natural fibres (e.g., cotton, jute). Standard practice is to apply a precautionary 20% natural-fibre correction factor to fibre counts in the absence of spectroscopic confirmation [27], which would revise the net water count to approximately 0.8 particles/L and the net sediment count to approximately 20.8 particles/kg. These values do not materially alter the study's conclusions.
- **Minimum particle size:** The 1.2- μm filter pore size captures particles larger than approximately 1–2 μm but excludes nanoplastics ($< 1 \mu\text{m}$), which require electron microscopy and pyrolysis-GC/MS for detection. Nanoplastics are likely present at Eleko Beach and may carry greater biological risk per unit mass than larger microplastics; their detection is a target for future analytical capacity development.
- **Geographic scope:** Results are specific to the Eleko Beach transect sampled and should not be extrapolated to the entire Lekki Peninsula or broader Lagos coastline without additional sampling. Multiple sites are planned for Phase 2.

Notwithstanding these limitations, the Phase 1 data meet the criteria for a scientifically credible baseline: they are collected using a documented, reproducible protocol; they include atmospheric contamination controls; they are expressed relative to established units of measurement; and they are accompanied by transparent reporting of uncertainty and methodological constraints.

8. CONCLUSIONS

This paper presents the first published microplastics assessment for Eleko Beach, Lekki Peninsula, Lagos State, Nigeria, conducted by NOMMI on May 16th, 2026 as the initiative's Phase 1 Preliminary Report. The key findings are as follows:

- Microplastics are present and quantifiable in both surface water (net: 1 particle/litre) and shoreline sediment (net: 26 particles/kg dry weight) at Eleko Beach, confirming that this coastal environment is not free from plastic contamination despite its peri-urban character.
- Micro-fibres dominate both matrices, implicating textile-laundry effluent and atmospheric deposition as the primary proximate sources, both of which are amenable to intervention through improved wastewater treatment, textile-fibre capture technologies, and community behaviour change programmes.
- The NOMMI Phase 1 field blank and 48-hour processing protocols functioned as designed, demonstrating their fitness for citizen-science deployment and highlighting the critical importance of atmospheric contamination controls in tropical outdoor sampling environments.
- The Eleko Beach concentrations are comparable to, and in the sediment matrix exceed, values reported from similarly urbanised West African coastal environments, indicating that the contamination observed is not anomalous but part of a regional pattern driven by urbanisation, plastic consumption, and inadequate waste management.
- The findings provide an evidence base for the expansion of NOMMI's citizen-science monitoring network and for policy advocacy directed at reducing plastic waste inputs to the Nigerian coastal environment.

Future phases of NOMMI will increase spatial coverage, improve temporal resolution, incorporate polymer identification, and engage more broadly with fishing communities, government environmental agencies, and development finance institutions to translate monitoring data into protective policy action. Nigeria's coasts, and the communities and ecosystems they support deserve nothing less.

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