PROTEGO
Prevention of Marine Litter in the Gulf of Guinea

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Ghana

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# Report - Beach Sampling, Tema, Ghana

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# Imprint

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The project team expresses its gratitude to all the participants for a very valuable and highly appreciated contribution.
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## Project Contribution to SDGs:




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## Table of Contents

## List of Figures

## List of Tables

# 1. Introduction

The Prevention of Marine Litter in Tema (PROTEGO) project focuses on addressing plastic pollution in Tema, Ghana, by identifying leakage points and promoting sustainable waste management practices through community-inclusive approaches and detailed diagnostics. This report documents findings from beach sampling and waste characterization activities conducted at the wild beaches of the Regional Maritime University (RMU) and the Ghana Ports and Harbours Authority (GPHA). Both sites are key locations along the Gulf of Guinea, significantly contributing to marine litter problems in the region.

## 1.1. Environmental Challenges Identified

Tema, as one of Ghana's primary industrial and commercial hubs along the Gulf of Guinea, faces mounting environmental pressures due to rapid urbanization and industrialization. These factors have led to increasing volumes of waste, particularly plastic, which is often inadequately managed. Several critical environmental challenges have been identified:

- **Rapid Urbanization and Industrialization:** Industrial operations and population growth have significantly increased waste generation, often outpacing available infrastructure and services.
- **Rising Plastic Pollution:** Major sources include household and commuter littering, industrial waste, improper disposal by businesses, and maritime activities. Additionally, stormwater runoff frequently carries plastic debris from inland dumpsites to coastal areas.
- **Inadequate Waste Management Infrastructure:** Many communities lack reliable waste collection services, and open dumpsites are common, especially in underserved areas.
- **Improper Disposal Practices:** Public awareness of waste segregation and recycling remains low, with widespread dumping into drains, open spaces, and unapproved sites.

These challenges contribute to the leakage of plastics into marine environments, threatening ecosystem health and posing socioeconomic risks to local communities. In response, the PROTEGO project implements diagnostic and participatory methods to understand and mitigate these issues through direct action.

## 1.2. Overview of Activities

This beach sampling and characterization study was conducted as part of PROTEGO's

waste management strategy initiative The activities took place on April 9 and April 22, 2025, at two critical coastal points as shown in Figures 1: Regional Maritime University (RMU): 5°36'24.2"N 0°03'31.9"W and Figure 2: Ghana Ports and Harbours Authority (GPHA): 5°37'45.7"N 0°00'03.1"W


Figure 1: Satellite Image of Regional Maritime University (RMU) in Tema, Ghana

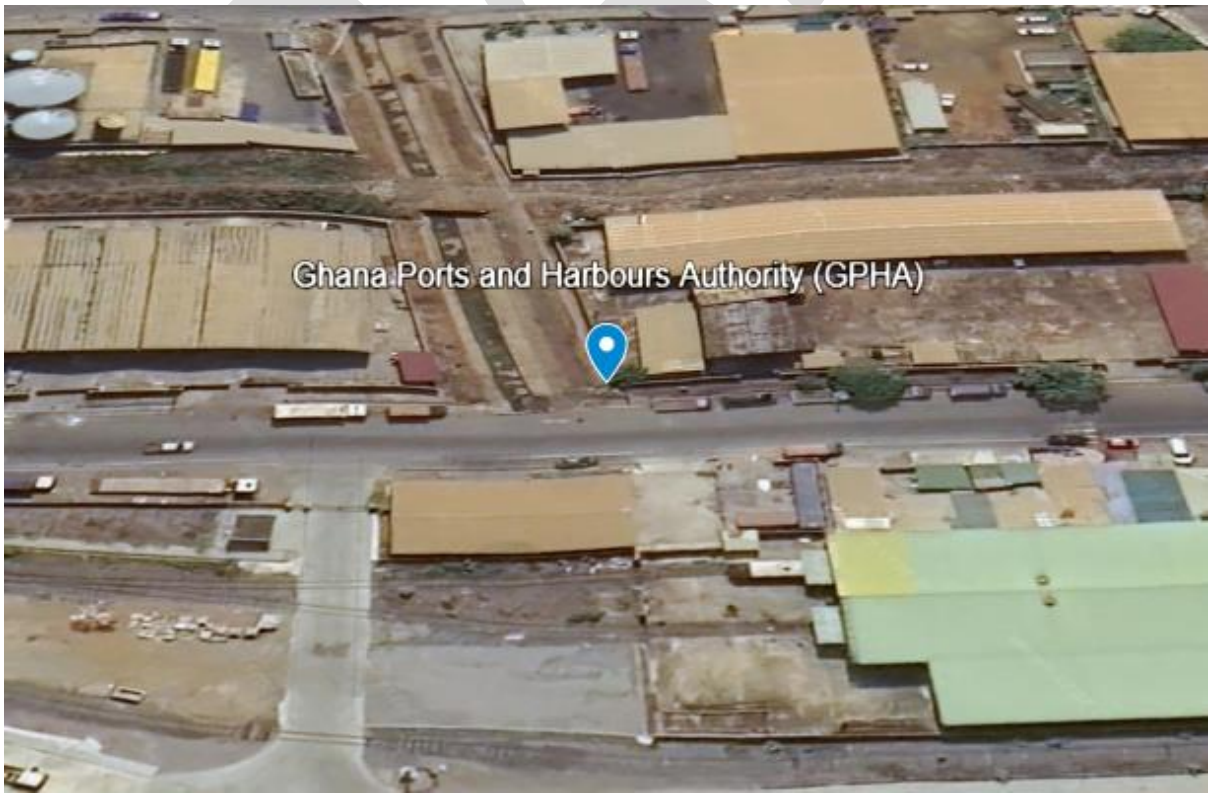


Figure 2: Satellite Image of Ghana Ports and Harbours Authority (GPHA) in Tema, Ghana

Sampling at RMU occurred during rainfall on April 9, while GPHA sampling was undertaken in sunny conditions on April 22. The transect method was applied at both sites, covering a 10-meter by 5-meter area. At GPHA, visual counting was additionally employed to assess litter within drainage areas.

These assessments involved multi-stakeholder collaboration, with participation from various local stakeholders, enhancing contextual understanding and community engagement in addressing environmental challenges specific to the Tema coastal area.

**Sampling Objective**

The objective of this activity was to assess the types, quantities, and sources of marine litter along the Tema coastline, particularly at RMU and GPHA wild beaches. The study aimed to provide a baseline understanding of waste composition and distribution patterns to support improved waste management planning and policy development.

By identifying predominant waste types and their potential sources, the activity seeks to inform targeted interventions for reducing plastic leakage into the marine environment. These findings are intended to contribute to long-term solutions for pollution mitigation and sustainable coastal ecosystem management in Ghana.

# 2. Methodology

The beach sampling methodology at the RMU and GPHA sites in Tema involved the application of standardized procedures for physical waste collection and qualitative assessment. The methodology included the transect sampling technique for both sites, complemented by visual counting at GPHA. Key parameters such as item count, material categorization, and weight were recorded. Furthermore, a brand audit was conducted to trace potential sources of pollution.

## 2.1. Wild Beach at Regional Maritime University Beachfront

- Date: 9th April, 2025
- Time: 10:30 AM – 12:30 PM UTC
- Location: Wild beach at Regional Maritime University (5.60672, 0.05885)
- Transect Size: 10m x 5m
- Participants: 7
- Weather Conditions: Rainy (showers occurred during sampling)

The sampling was carried out using the transect method. Participants were equipped with gloves and PPE, and each was assigned a specific type of material to collect. Only visible non-organic litter was collected. After collection, items were sorted by material type, counted, and weighed. The process also included a brand audit and visual

documentation. It was noted that some waste items, such as foams, retained water and sand, influenced their weight.

Figure 3: Waste collection by PROTEGO Team from RMU site for sorting and characterization

## 2.2. Wild Beach at GPHA

- Date: 22nd April, 2025
- Time: 8:34 AM – 10:00 AM UTC
- Location: Wild beach at Ghana Ports and Harbours Authority (5.6293577, -0.0008539)
- Transect Size: 10m x 5m
- Participants: 6
- Weather Conditions: Sunny

GPHA sampling utilized both the transect method and a visual counting approach to assess litter in a nearby drainage. Participants wore PPE and collected assigned material types. As at RMU, the litter was sorted, counted, and weighed by category. Notably, the site exhibited severe contamination, with items including medical waste, tyres, textiles,

and fecal matter. A brand audit was conducted, and photographs were taken to document drainage-related waste accumulation.

Figure 4: Waste collection by PROTEGO Team from GPHA site for sorting and characterization

## 3. Results and Analysis

The beach sampling conducted at RMU and GPHA provided important insights into the scale, nature, and types of marine litter found along the Tema coastline. These results offer a comparative understanding of the two sites, highlighting site-specific waste accumulation patterns, material composition, and dominant product types. The following sections describe the findings at each location and interpret their implications for waste management planning.

## 3.1. Regional Maritime University (RMU)

At RMU, a total of 925 items were collected during the sampling exercise, weighing approximately 43.29 kilograms. This relatively high quantity and weight of waste can be attributed to the widespread presence of plastics and the water content in certain items, such as foam-based materials. Plastics overwhelmingly dominated the waste profile, accounting for 97.6% of all collected items. Minor quantities of rubber, textiles, and miscellaneous waste were also recorded, while categories like metals, glass, and cardboard were entirely absent. The table below illustrates the material breakdown:

Table 1: Material Composition of Litter from RMU

| **Summary by type of material** | | |
|---|---|---|
| Plastic | 903 | 97.6% |
| Styrofoam | 0 | 0.0% |
| Textiles | 4 | 0.4% |
| Glass and ceramics | 0 | 0.0% |
| Metals | 0 | 0.0% |
| Paper and Cardboard | 0 | 0.0% |
| Rubber | 4 | 0.4% |
| Wood | 0 | 0.0% |
| Polylaminates | 0 | 0.0% |
| Others | 14 | 1.5% |
| **Total** | **925** | **100%** |

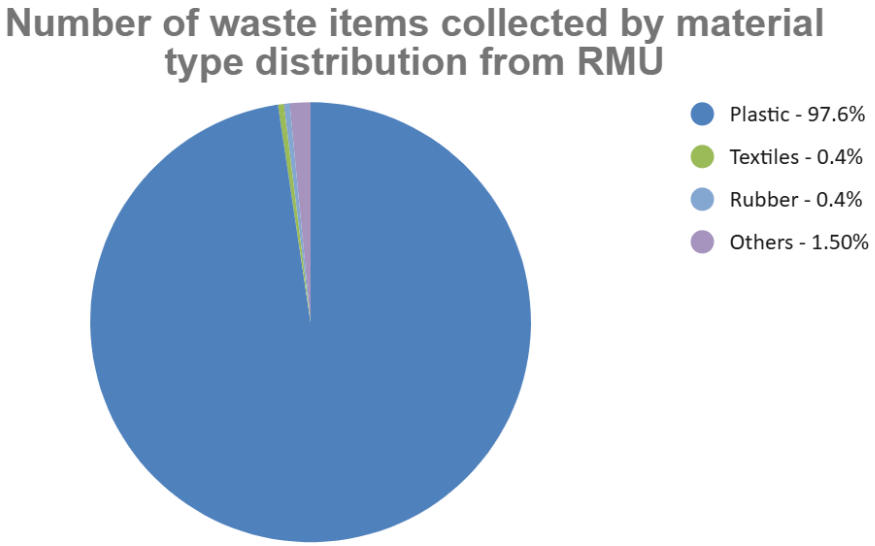


Figure 5: Material Type Distribution from RMU

**Observation:** Plastics dominated the litter profile, accounting for 97.6% of total items collected, reflecting widespread plastic use and challenges in disposal and recycling systems. Other uncategorized material types were the second most common material detected, accounting for 1.5% of the total items collected. Textiles and rubber constitute only a small fraction of 0.43%, with Styrofoam, glass, paper, cardboard, and metals being negligible (0.0%). The widespread use of plastic presents significant environmental challenges owing to its high durability and resistance to degradation, thereby underscoring the urgent need for improved waste management systems and the adoption of sustainable, eco-friendly alternatives. Some of the waste collected on this beach had some water and sand in them, making their weights extremely large (i.e., foams).

This composition indicates a strong reliance on plastic packaging and single-use items in the area, coupled with inadequate waste collection and disposal infrastructure. The most common items found were disposable plastic cups (307), followed by mixed single-use plastics (145), water sachets (110), plastic wrappings (78), and plastic bottle caps (72). These findings suggest prevalent consumption of single-use plastic items with low recovery or recycling rates. The photos provided below illustrate the predominant waste types found at RMU.

Figure 6: Plastic Beverage Cups

Figure 7: Plastic Bottle Caps

Figure 8: Plastic Straws

Figure 9: Plastic Cutlery

Figure 10: Soiled Tissue Paper

Figure 11: Used Toothpaste Tubes

## 3.2. Ghana Ports and Harbours Authority (GPHA)

At GPHA, the team collected a total of 367 items, amounting to 9.52 kilograms in weight. Although this was less than half the number of items collected at RMU, the diversity of material types was greater. Plastic waste still dominated, comprising 86.4% of the total, followed by rubber (5.7%), styrofoam (3.3%), and textiles (2.2%). Notably, glass and ceramic fragments (0.8%) and even wood (0.3%) were present, indicating more diverse human activity at the site. The table below provides a breakdown:

Table 2: Material Composition of Litter from GPHA

| **Summary by type of material** | | |
|---|---|---|
| Plastic | 317 | 86.4% |
| Styrofoam | 12 | 3.3% |

| | | |
|---|---|---|
| Textiles | 8 | 2.2% |
| Glass and ceramics | 3 | 0.8% |
| Metals | 0 | 0.0% |
| Paper and Cardboard | 0 | 0.0% |
| Rubber | 21 | 5.7% |
| Wood | 1 | 0.3% |
| Polylaminates | 0 | 0.0% |
| Others | 5 | 1.4% |
| **Total** | **367** | **100%** |

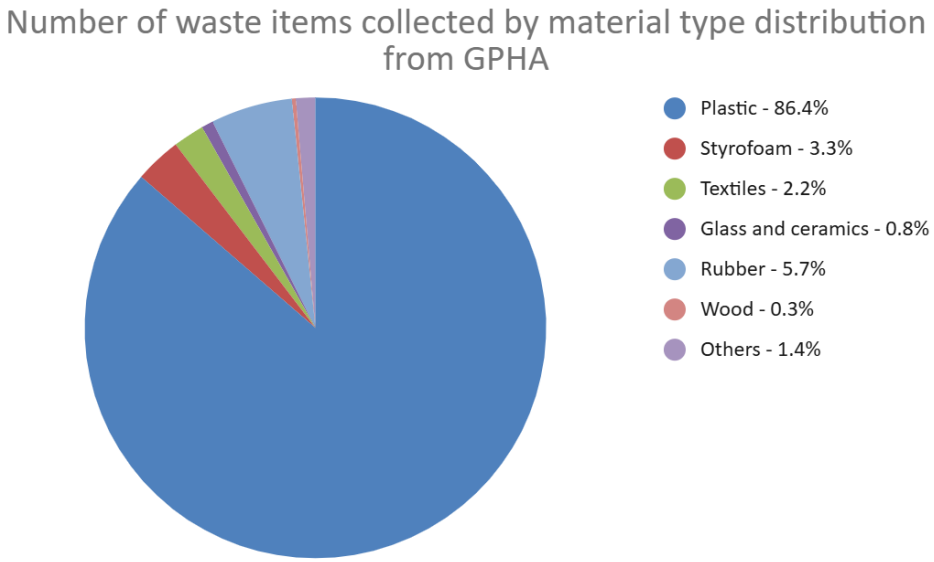


Figure 12: Material Type by Distribution from GPHA

**Observations:** Plastics dominated the litter profile, accounting for 86.4% of all items collected, indicating pervasive plastic use and issues with disposal and recycling methods. Rubber was the second most common material found, accounting for 5.7% of the total items collected. Styrofoam, textiles, glass, and ceramics were the next common material types identified, with percentages of 3.3%, 2.2%, 0.8%, and 0.3%, respectively, whereas metals and paper and cardboard account for 0%. Plastic's extensive use poses substantial environmental issues due to its durability and resistance to degradation, emphasizing the urgent need for improved waste management systems and the development of sustainable, eco-friendly alternatives. This beach was a particularly interesting one. Medicines and pharmaceuticals were found at the site. A syringe with blood was also found there. A lot of tyres and textiles were found there too. This beach had a lot of diverse waste; unfortunately, most of them were soiled with feces as the site has been turned into an open-air toilet facility.

The most frequently encountered items at GPHA were foams (66), plastic straws (43), hard plastic fragments (38), PET beverage bottles (31), and other unlabelled PET bottles (37). The presence of medical waste, including syringes with traces of blood, raises serious health concerns, as the site is reportedly used as an open-air toilet. This further underlines the urgency for improving sanitation and waste disposal services in the port area.

In addition, a brand audit conducted at GPHA revealed several recurring products among the waste collected. Notably, brands such as Beta Malt (23 items), Tasty Tom Tomato Paste (9 items), LaVonce Tomato Paste (3 items), Gino Tomato Paste (3 items), and Kivo Gari (2 items) were frequently identified. This information can serve as a foundation for future corporate engagement efforts and extended producer responsibility discussions.

Figure 13: Plastic Bottles

Figure 14: Plastic Residue

Figure 15: Flexible Plastic Packaging

Figure 16: Plastic Straws

Figure 17: Foam Waste

Figure 18: Plastic Cups

## 4. Brand and Item-Level Analysis

The brand and item-level analysis provides crucial insights into the specific waste types

and recurring product labels found at the RMU and GPHA sites. This level of detail helps trace the origin of marine litter and supports the development of targeted interventions, such as extended producer responsibility (EPR) schemes and awareness campaigns focusing on frequently littered products.

## 4.1. RMU

Table 3: Common items identified at RMU

| Item | Count |
|---|---|
| Plastic fragments (loose) | 307 |
| Plastic fragments (hard) | 145 |
| Beverage Bottles | 110 |
| Other PET bottles | 78 |
| Bottle rings | 72 |
| Plastic bottle caps | 45 |

The prevalence of these items at RMU suggests widespread consumption of single-use plastics in the form of beverage containers and food packaging. Their presence in high volumes reflects local usage patterns and the lack of effective waste capture systems.

## 4.2. GPHA

Table 4: Common items identified at GPHA Site

| Article | Count |
|---|---|
| Plastic fragments (loose) | 66 |
| Plastic fragments (hard) | 43 |
| Beverage Bottles | 38 |
| Other PET bottles | 37 |
| Bottle rings | 31 |
| Plastic bottle caps | 31 |

At GPHA, the common items found highlight the diverse and often improperly discarded nature of waste entering the marine environment. The discovery of foams, straws, and

PET bottles signals issues with disposable packaging and consumer items. The hard plastic fragments suggest ongoing degradation of larger plastic items over time.

## 4.3. Brands Frequently Found

Table 5: A brand audit at GPHA revealed the following frequently observed branded products

| Brand | Quantity |
|---|---|
| Beta Malt (Accra Brewery PLC) | 23 |
| Tasty Tom Tomato Paste (Nutrifoods Ghana) | 9 |
| Gino Tomato Paste (GB Foods) | 3 |
| laVonce Tomato Paste (Happy Sunshine Company Limited) | 3 |
| K-75 Vietnamese Rice | 2 |
| Kivo Gari (Procus Ghana) | 2 |

The presence of branded packaging materials, particularly from beverage and food products, provides an opportunity to engage with manufacturers and distributors. These findings could serve as a starting point for collaborative action with producers to reduce packaging waste through improved labeling, material substitution, or take-back programs.

# 5. Environmental Impacts

- **Pervasive Plastic Pollution:** The report shows that plastics constitute the vast majority of litter on both sampled beaches, 97.6% at RMU and 86.4% at GPHA. These materials are degradable, posing long-term environmental threats to marine ecosystems.
- **Marine and Coastal Ecosystem Threats:** The accumulation of non-biodegradable waste such as plastic, rubber, and styrofoam disrupts marine life through ingestion, entanglement, and habitat destruction. Additionally, pollution contributes to the degradation of the natural beauty of the coastline.
- **Health Hazards:** The GPHA site, used as an open-air toilet, was contaminated with fecal matter and biomedical waste, including syringes with blood. This condition raises significant concerns for both public health and worker safety during cleanup activities.
- **Inadequate Waste Management Infrastructure:** The report highlights weak waste collection systems and informal dumping grounds, exacerbated by poor disposal practices among residents and industries.

## 6. Socio-economic Impacts

- **Public Health Risks:** Contaminated coastal zones near residential and industrial hubs threaten the health of coastal dwellers, port workers, and beach users due to exposure to pathogens and hazardous waste.
- **Economic Strain on Fishing and Tourism**: Polluted beaches can deter tourism and affect livelihoods that depend on clean coastal environments, such as fishing, as marine litter disrupts fishing zones and may result in reduced fish stocks.
- **Cost of Remediation:** The ongoing accumulation of waste implies long-term financial commitments from local and national governments for cleanup, awareness campaigns, and infrastructure upgrades.

## 7. Recommendations

- **Enhanced Waste Management Systems**
  - Expand and modernize waste collection services in Tema, particularly in underserved communities.
  - Introduce regular beach cleanup schedules with local community participation and public-private partnerships.
- **Policy and Regulatory Reforms**
  - Implement stricter regulations for industrial waste disposal, especially for port and manufacturing operations.
  - Enforce bans or restrictions on single-use plastics and provide incentives for biodegradable alternatives.
- **Community Engagement and Education**
  - Launch awareness campaigns about the consequences of improper waste disposal and the benefits of recycling.
  - Promote school-based programs and youth initiatives for environmental stewardship.
- **Infrastructure Development**
  - Invest in recycling and plastic recovery facilities within the Tema Metropolitan area.
  - Improve drainage systems to prevent waste transportation from inland areas to the ocean.
- **Monitoring and Research**
  - Conduct periodic sampling and audits to track progress and adapt strategies based on new data.
  - Engage research institutions like EPA, RMU for environmental impact studies and policy advisory roles.

## 8. Conclusion

The beach sampling exercise in Tema reveals a critical environmental crisis marked by extensive plastic pollution and inadequate waste management. Both sampled sites, RMU

and GPHA highlight systemic issues including public health hazards, environmental degradation, and socio-economic consequences. Urgent, coordinated action is required, involving local authorities, industries, academia, and the community to implement sustainable waste management practices, strengthen infrastructure, and foster a culture of environmental responsibility. By addressing the root causes and enhancing public engagement, Tema can reclaim and protect its vital coastal ecosystems for future generations.