SHORELINE WASTE AUDIT ON MARINE DEBRIS IN MUBARAK VILLAGE – KARACHI, PAKISTAN

INTRODUCTION:

In rapidly growing cities like Karachi, managing waste and dealing with plastic pollution has become a major challenge. One of the most significant issues we face today is marine debris due to the excessive discharge of litter items into the marine environment, coastal areas, and water bodies. Marine debris commonly enters the ocean from sources located on land. This includes direct deposition, unintentional loss, abandonment, as well as transportation through rivers, wastewater outflows, wind, and tidal forces.

Past research indicates that the accumulation of marine debris on shorelines varies based on factors such as geographical location, oceanographic and meteorological conditions, climatic patterns (including events like El Niño), and the nearness to terrestrial or marine sources of waste (Agustin et al., 2015; Sheavly & Register, 2007) – establishing the immediate need for substantive data on the coastal areas, shoreline, and marine environment and more similar studies should be periodically conducted.

The data factsheet on marine debris- especially plastic waste can guide stakeholders, and responsible bodies about the contemporary issues faced by the coastal community through evidence based planned and communication. The factsheet can assist the Municipal bodies, policymakers, and waste experts in designing waste management models based on the principles of circular economy, and community inclusive policies. The fact-based data asks for conscious production and consumption and behavior change.

WHAT IS MARINE DEBRIS?

Marine debris constitutes solid materials that are intentionally or unintentionally abandoned, discarded, or disposed of within the coastal or marine environment, comprising primarily of anthropogenic origin and may include plastic, metal, glass, rubber, and textile (Federigi et al., 2022). Plastic debris is a well-known subject and frequently documented; however, it is difficult to quantify the rate it is entering the oceans (Aslam et al., 2022; Jambeck et al., 2015).

STUDY AREA:

Mubarak Village beach is approximately 45 km west of Karachi with a population of approximately 10,000, mostly comprising a fishing community. It has a sandy beach with a rocky substratum, this location attracts visitors for sport fishing as well as snorkeling and diving activities (Ali et al., 2021). It features a rocky terrain interspersed with white sandy expanses containing numerous man-made tourist activity areas and naturally formed sand pits.

METHODOLOGY:

Data were collected at each sampling location using the survey methodology for macro-debris as prescribed by National Oceanic and Atmospheric Administration (NOAA) for the monitoring and assessment of beach debris (Lippiatt et al., 2013). Transect horizontal to the shoreline was selected for sampling (referred as P1-MV). The transect was delimited to 100m x 50 m (length x width) area. The second point of sampling referred to as P2-MV was situated 200 meters from the shoreline, see table.1 for details. In each transect, debris sized 2.5 cm or larger were surveyed, following the guidance of NOAA (Lippiatt et al., 2013).

The waste items at P2-MV were assumed to be generated by tourists on the shoreline. The assumption was based on the waste items observed at the point. The selection of P2-MV (disposal point) as a survey site was in accordance with NOAA's monitoring guidelines, which recommend choosing survey areas based on a variety of activities (such as land use, commercial and recreational fishing, political boundaries, or management areas) in order to gather a more statistically significant dataset.

Table 1 Description of surveyed sites of the Mubarak Village

Inspection point code	Location type	Characterization of the surroundings	Environmental Condition
P1-MV	Point on the shoreline	On the shoreline with high tourist activity. Guest lodging commercial activity	Low-tidal currents, Stretches of wet, sandy beach
P2-MV	Disposal point	200 meters from the shoreline Adjacent to the commercial lodging units	Non-confined area on the land Point. Surrounded by open and excessive shrubs and thatched-roof units

KEY FINDING:

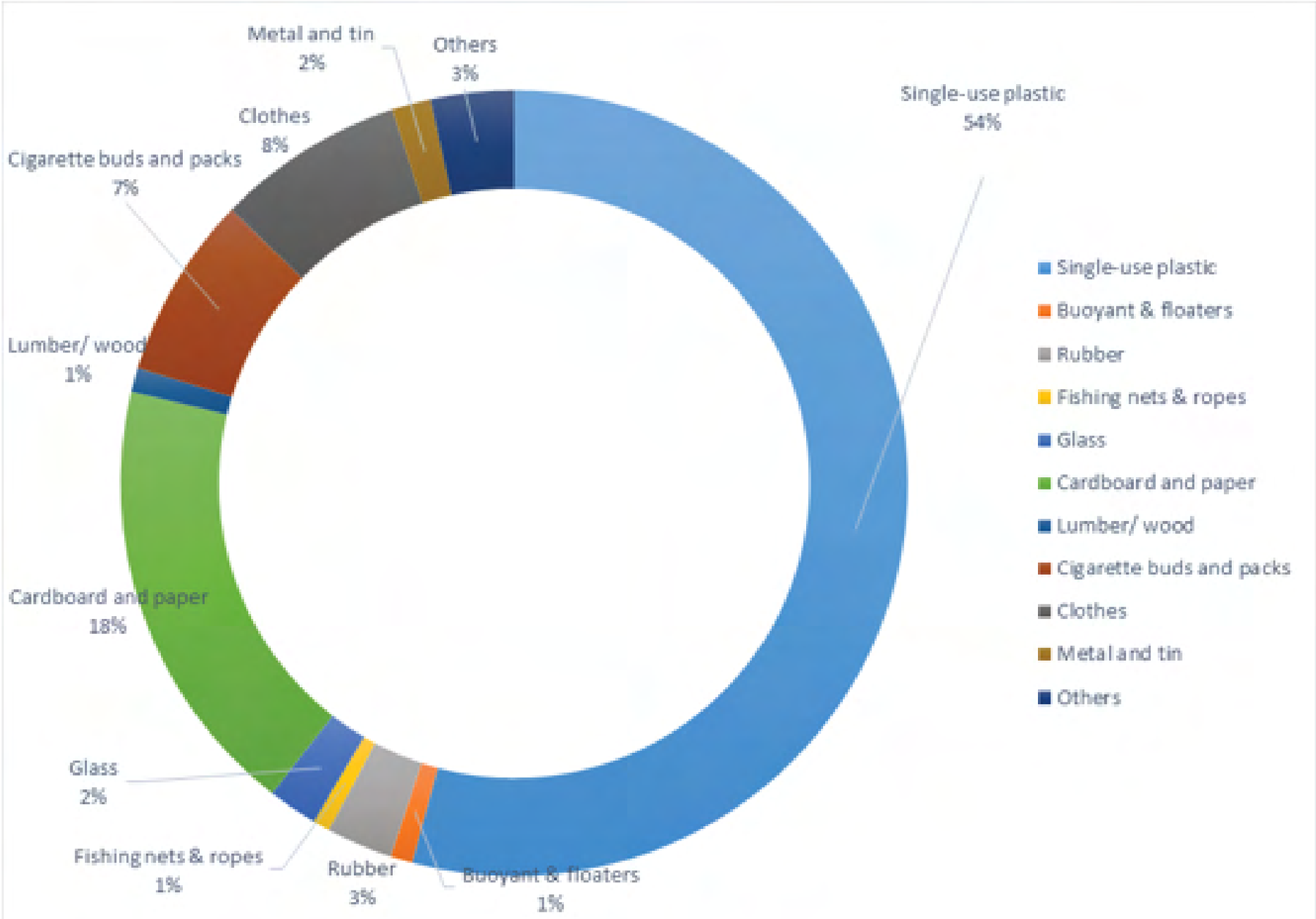
Overall, the audit revealed that an alarming 76.7% of the total marine debris composed of plastic waste, of which around 40% were single use-plastic such as shopping bags, food packaging, straws, utensils, and wrappers. This ubiquitous material, known for its durability and longevity, is a significant threat to marine ecosystems, often mistaken for food by sea-animals and causing fatal injuries to them.

Out of overall plastic waste (76.7%), fishing-related plastic waste such as buoyant/ floaters and fishing nets and ropes cumulatively accounted for 35.4%. These items, often discarded or lost during fishing activities, pose a serious risk to marine creatures who can become entangled in or ingest them.

Single-use plastic was the most common type of waste from the shoreline with tourists and the dump point, comprising 30% and 54% respectively. While items made from rubber constituted around 3% of total waste from both survey points.

From the shoreline area, Cardboard and paper materials accounted for 4% of the waste comprising tetra packings, milk packs, food boxes, paper wrapping materials, and so on. While cigarette buds and packets accounted for 2% of the waste found embedded in the sandy beach. Same percentage was noted from the shoreline area for glass items having bottles, sharp shards, and other potentially hazardous fragments blatantly exposed to the visitors.

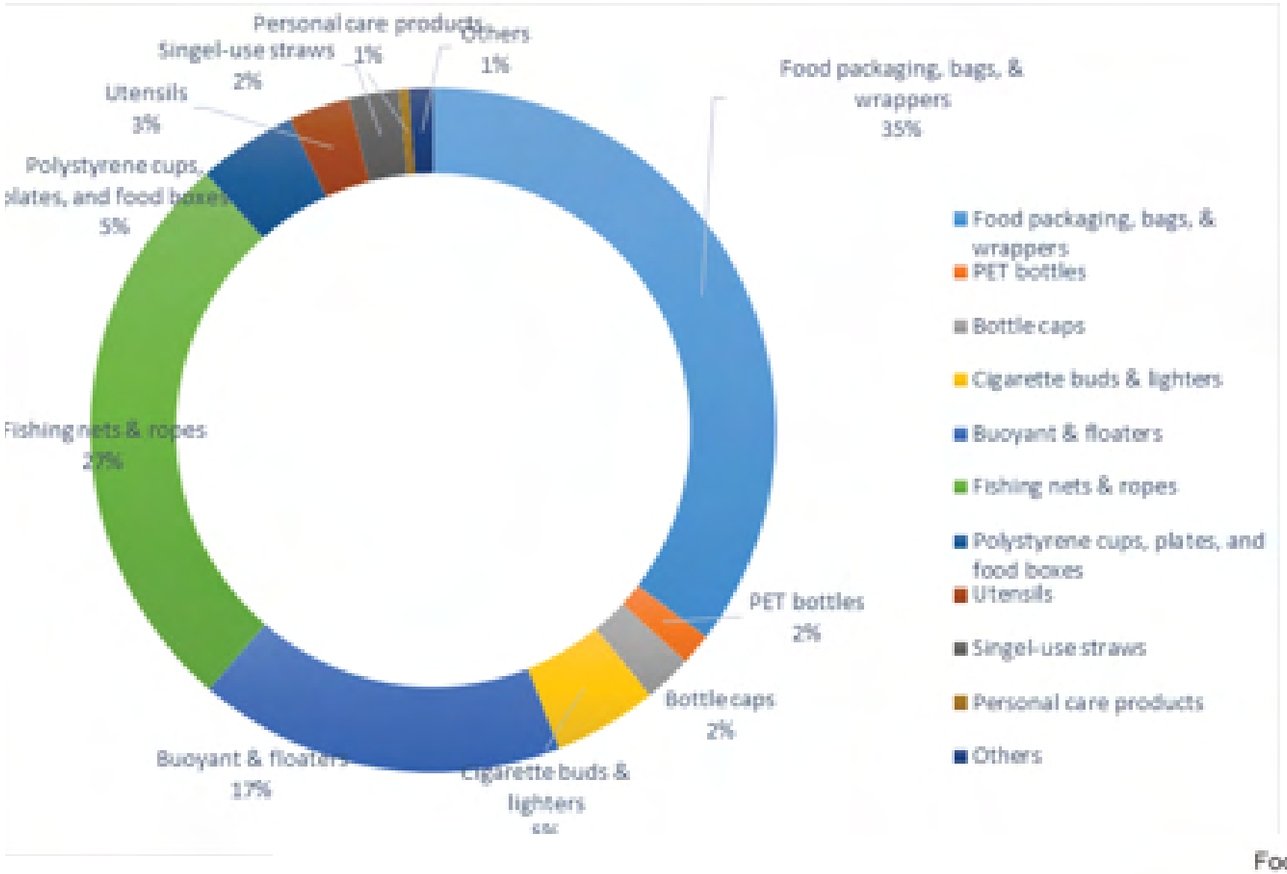
Overall, 3% of waste items were from rubber and composite material, which included flip-flops, and other fragments. While lumber/ wood was recorded as 2% of the total marine debris found on the shoreline suggestive of boat repair and maintenance work on the shoreline.



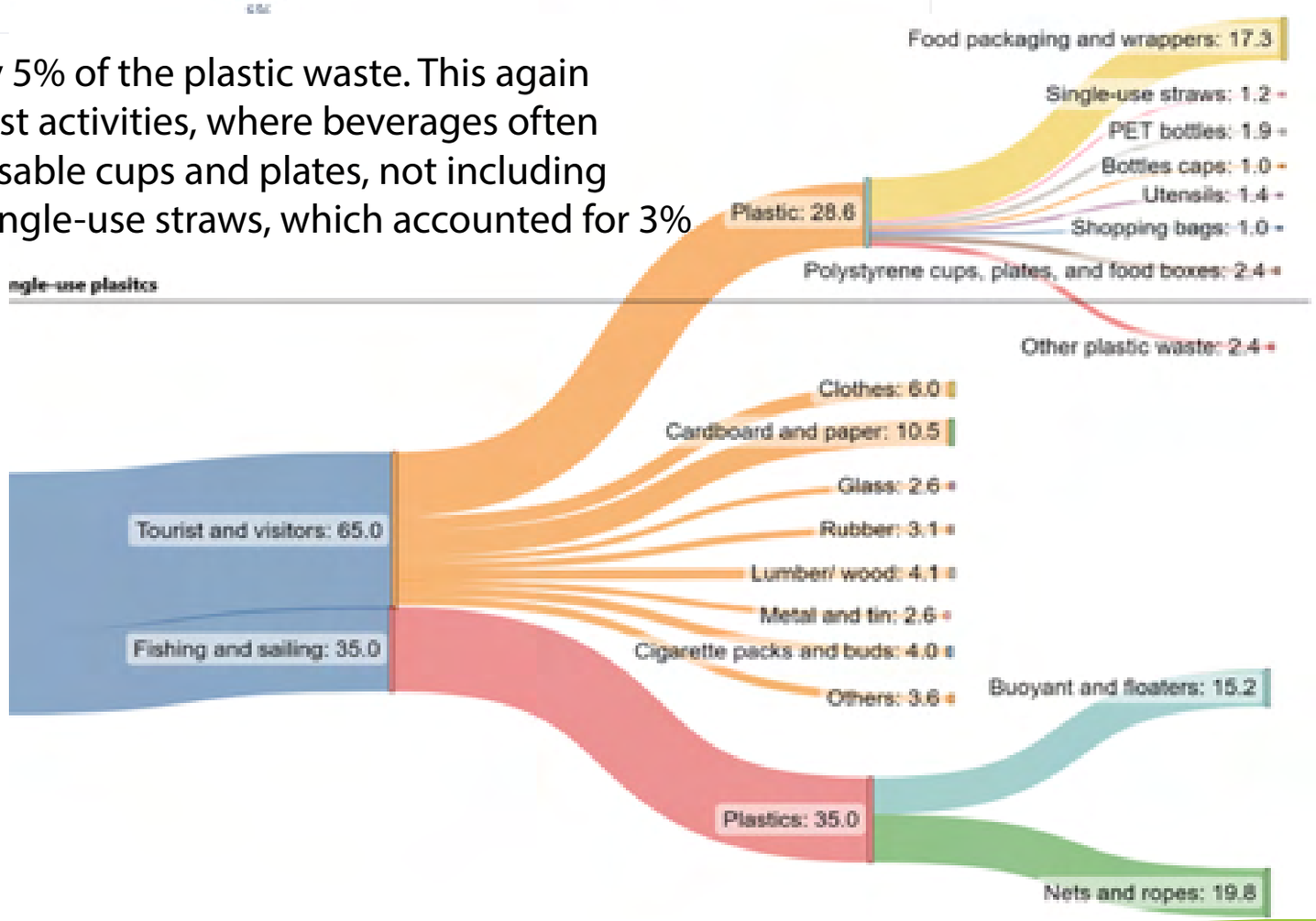
PLASTIC WASTE COMPOSITION:

Figure. 3 explains the composition and types of plastic waste found on the two points (P1-MV & P2-MV) on the beach. The data shows that the plastic waste, including single-use plastic, and P.S items are mostly tourist related, while buoyant and floater and other equipment use for fishing and sailing is primarily generated through the fishing and sailing activity on the beach.

The most common plastic items found on the beach were plastic food packaging, bags and wrappers, comprising 35% of the total plastic waste, while pet bottles with separate caps accounted for 4% of the total marine debris on the shoreline. It is indicative of our common consumer behavior in consuming products having single-use plastic packaging. This issue is significantly amplified during the tourist season, as visitors often leave behind a trail of such wrappers and rubbish



without ensuring its adequate disposal. Cigarettes buds, packaging, and disposed lighter accounted 5% of the total plastic waste on the shoreline, depicting a potentially pernicious tourist behavior neglecting the effects it has on marine life. Plastic cups, including those made from polystyrene or foamed plastic, constituted approximately 5% of the plastic waste. This again points to tourist activities, where beverages often come in disposable cups and plates, not including utensils and single-use straws, which accounted for 3% and 2% of the waste respectively.



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REFERENCES:

Figure. 3 explains the composition and types of plastic waste found on the two References:
Agustin, A., Merrifield, M., Potemra, J., & Morishige, C. (2015). Temporal variability of marine debris deposition at Tern Island in the Northwestern Hawaiian Islands. Marine Pollution Bulletin. https://www.semanticscholar.org/paper/Temporal-variability-of-marine-debris-deposition-at-Agustin-Merrifield/1860e153bd8732db851905fb132b08395a2d7836

Ali, A., Siddiqui, P. J. A., Ahmad, N., Amir, S. A., Masroor, R., Shafique, S., & Burhan, Z.-N. (2021). Ecology of Fish Communities in Coral Habitats Along the Coast of Pakistan: Potential Threats and Conservation Strategies. Pakistan Journal of Zoology, 53(4). https://doi.org/10.17582/journal.pjz/20180602100601

Aslam, S., Tzoraki, O., & Krasakopoulou, E. (2022). Anthropogenic litter in freshwater bodies and their estuaries: An empirical analysis in Lesvos, Greece. Environmental Science and Pollution Research, 29(11), 16563–16575. https://doi.org/10.1007/s11356-021-16793-z

Federigi, I., Balestri, E., Castelli, A., De Battisti, D., Maltagliati, F., Menicagli, V., Verani, M., Lardicci, C., & Carducci, A. (2022). Beach pollution from marine litter: Analysis with the DPSIR framework (driver, pressure, state, impact, response) in Tuscany, Italy. Ecological Indicators, 143, 109395. https://doi.org/10.1016/j.ecolind.2022.109395

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. Science, 347(6223), 768–771. https://doi.org/10.1126/science.1260352

Lippiatt, S., Opfer, S., & Aurthur, C. (2013). Marine debris monitoring and assessment: Recommendations for Monitoring Debris Trends in the Marine Environment. NOAA Technical Memorandum NOS-OR&R ; 46. https://repository.library.noaa.gov/view/noaa/2681

Sheavly, S. B., & Register, K. M. (2007). Marine Debris & Plastics: Environmental Concerns, Sources, Impacts and Solutions. Journal of Polymers and the Environment, 15(4), 301–305. https://doi.org/10.1007/s10924-007-0074-3