Water Quality and Floating Microplastics Pollution along Southern to Northwestern Coast, Sri Lanka

M.G.Y.L. Mahagamage[1], P. Gajanayake[2], S.G. Gamage[1,3], D. Samarathunga[4], B.A.D. Peiris[3], M.M.K.I. Marasinghe[5], A.D. Igalavithana[6,7], H.D.L. Abeynayaka[8,9], A. Abeynayaka[10,11]*

[1]*Centre for Environmental Studies and Sustainable Development, The Open University of Sri Lanka, Nugegoda, Sri Lanka*
[2]*Department of Biosystems Technology, Faculty of Technology, University of Sri Jayewardenepura, Homagama, Sri Lanka*
[3]*Minds Experimental Station, Green Plus (Pvt) Ltd, Piliyandala, Sri Lanka*
[4]*International Union for Conservation of Nature (IUCN), Sri Lanka Country Office, Battaramulla, Sri Lanka*
[5]*Department of Zoology and Environment Sciences, Faculty of Science, University of Colombo, Colombo 03, Sri Lanka*
[6]*Department of Soil Science, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka*
[7]*Commonwealth Scientific and Industrial Research Organization (CSIRO), Environment, Land and Water, Waite Campus, Urrbrae, South Australia, Australia*
[8]*Department of Natural Science, Faculty of Education, Saitama University, Saitama, Japan*
[9]*Department of Science and Environment, Roskilde University, Denmark*
[10]*Pirika Inc., 2-1 Udagawacho, Shibuya, Tokyo 150-0042, Japan*
[11]*Quantitative Sustainability Assessment, Department of Environmental and Resource Engineering, Technical University of Denmark, Kongens Lyngby 2800, Denmark*

Corresponding author: mgyma@ou.ac.lk

ORCID ID: https://orcid.org/0000-0002-7406-0423

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Abstract Microplastics (MPs) are prevalent and dispersed in coastal ecosystems, heightening the risk of MPs consumption by marine wildlife, thereby leading to contamination of food webs. The present study investigated the abundance of MPs and respective water quality in coastal waters from Matara to Chilaw. MPs and water quality (pH, dissolved oxygen, electrical conductivity, turbidity, alkalinity, total dissolved solids, total suspended solids, total solids, and phosphates) were analysed in 12 sites in the study area in December 2021. MP analysis was done following the NOAA method and water quality was analysed according to the APHA standards. A total of 225 MP particles were found in all 12 sites covering Matara to Chilaw. The highest number of MP types was observed in the samples collected from Mattakkuliya (400 particles/m^3). There were morphological differences among MPs and the highest to lowest morphological types were filament>film>fragment>pellets>foam, and the most dominant colour was blue. Based on FTIR analysis, polyethylene was identified as the most frequently detected (52%) polymer type of MPs in the analysed samples. Pearson correlation analysis indicated that there were no significant correlations among the water quality measures and MPs. However, further research is essential to determine the potential impacts of MPs on biotic and abiotic factors of the study locations.

Keywords: Microplastics, Pearson correlation, Southern coast, Water Quality, NorthWestern coast

INTRODUCTION

Plastic pollution has recently drawn increasing attention on a global scale due to the enormous volume of plastic waste and the pervasiveness of plastic materials in the environment. From 1950 to 2019, worldwide plastic production has increased from 2 million tons to 459.75 million tons, which represents an increase of approximately 230 times (Gayer *et al.*, 2017; OECD, 2022). Notably, Asia is the largest plastic producer in the world (Qi *et al.*, 2022).

Microplastics (MPs) are plastic fragments <5 mm in size and have been identified as emerging hazardous contaminants due to their persistence in air, water, and soil (Piyawardhana *et al.*, 2022) and they are of two types based on the origin. Primary MPs are produced in a particular microscopic size for a specific purpose while secondary MPs are generated as larger plastic fragments (meso, macro, and mega plastic) gradually break down into smaller sizes, as frequently observed in marine environments (Athapaththu *et al.*, 2020; Yuan *et al.*, 2022). MPs further degrade into nanoplastics due to several environmental influences such as UV radiation, microbial activities, and wave action (habitats, including the atmosphere, estuaries, coastline sediments, deep oceans, marine biota, and human bodies have shown evidence of containing MPs. Based on studies the total accumulated MPs on ocean surface water were estimated to be 93,000–236,000 tons per year (De Silva *et al.*, 2021). Alarmingly the existence of plastics in oceans was found to increase the coral contamination by 4% to 89%. Therefore, MP pollution can have a serious impact on coral reefs and the surrounding flora and wildlife (Dharmadasa *et al.*, 2021; Lamb *et al.*, 2018).

Recent investigations in the region have indicated that MPs were present throughout the Indian Ocean (Wignaraja *et al.*, 2019). Kapukotuwa *et al.* (2022) found that plastics were washed into the ocean with an average contribution of 3.3 kg per person indicating that Sri Lanka currently faces a severe challenge with plastic pollution. Furthermore, MP contamination on the Southern coast of Sri Lanka has been identified in the surface water and beach sediments (Koongolla *et al.*, 2018). Athapaththu *et al.*, (2020) documented that, at least one form of plastic was present in every sample of surface water taken from the Southern Coast of Sri Lanka. The most recent maritime accident, the X-Press Pearl explosion that occurred on 20 May 2021, approximately 17 km northwest of the Colombo port of Sri Lanka, has added significant MPs to the western coast (De Vos *et al.*, 2021, Karthik *et al.*, 2022).

As a coastal state, Sri Lanka benefits from having detailed information on the presence of MPs and their extent in coastal ecosystems. The present study aims to,

(i.) Determine the abundance and composition of MPs in the selected coastal areas
(ii.) Access the water quality of the respective coastal areas
(iii.) Analyse the potential correlations between the level of MPs in water and the water quality

MATERIALS AND METHODS

Sampling

Coastal water sampling (n=3) was completed at twelve locations (Chilaw: 7°36'25.6"N 79°47'11.4"E, Matara: 5°56'30.6"N 80°33'22.1"E) in December 2021 (Figure 1). Pre-cleaned polypropylene sampling bottles were used to collect water samples for water quality analysis, following the APHA (2017) guidelines. The collected water samples were transported to the laboratory in cold conditions and stored at a temperature below 4 ^{0}C. GPS coordinates were taken using a Garmin eTrex 30 GPS receiver.

MPs were extracted from each site using a 300 µm net by filtering 110 L of water through the sampling net. First, the water samples were collected using a metal bucket (capacity – 11 L) ten times and filtered through the 300 µm net. Then, the collected samples (MPs which are > 300 µm) were carefully transferred to a 100 µm net for storing purposes and, properly packed using aluminium foil. Finally, the samples were labelled and transported to the laboratory for further analysis.

Additionally, the present study screened zooplankton as a biological parameter. From each location, samples (n=3) were collected in the morning (9 AM - 11 AM) using a 75µm plankton net by filtering 60 L of surface water per sample into 250 mL glass bottles. Immediately after collection, samples were fixed with 4% formaldehyde (APHA, 2017).

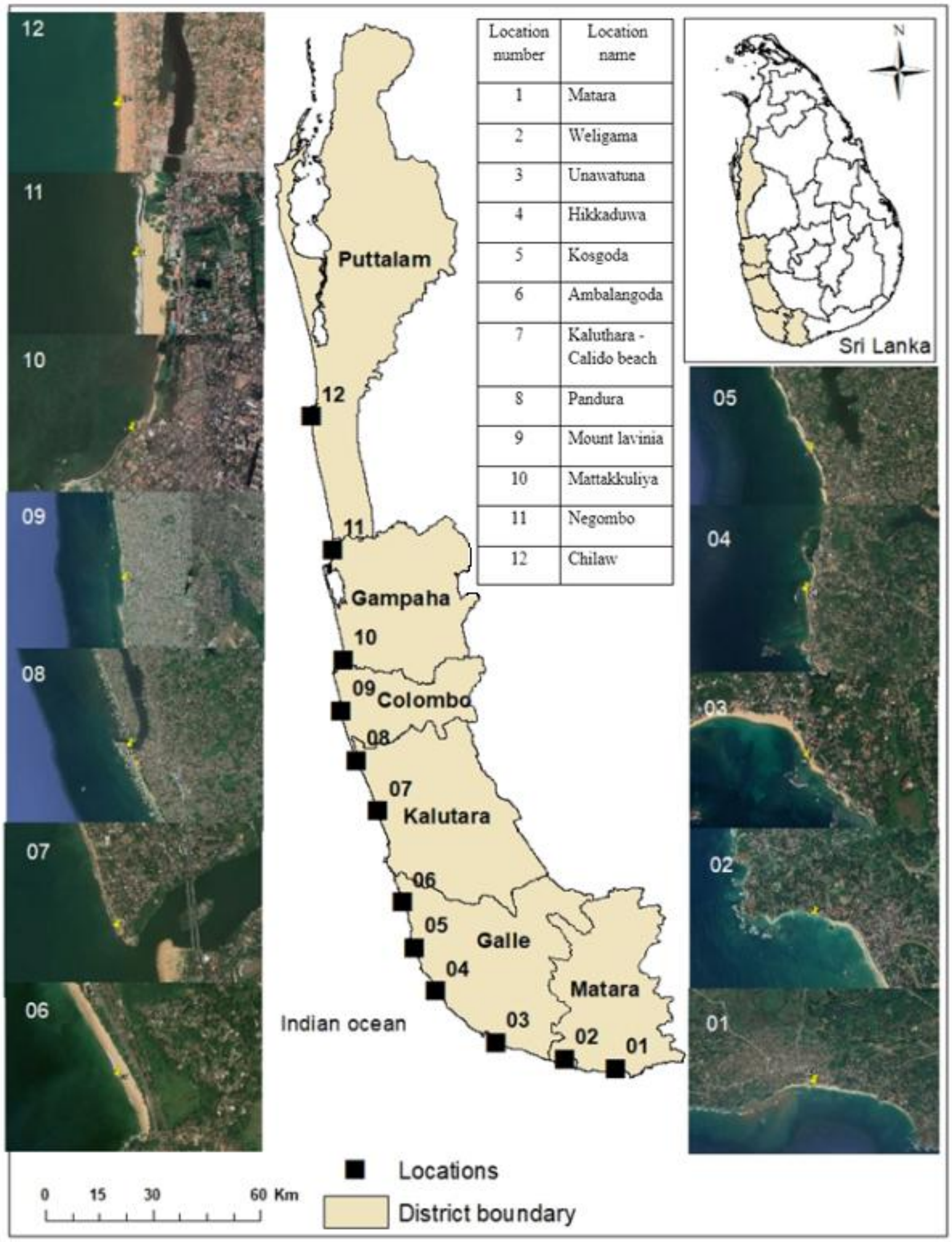

Fig 1. Map showing sampling locations of the coastal area on the west coast

Sample analysis

Water quality analysis

Water temperature, Dissolved Oxygen (DO), pH, Electrical Conductivity (EC), and salinity were measured *in situ* using a portable multiparameter device (AZ EB 86031). Turbidity was also assessed on-site using a portable digital Turbidity meter (Yieryi - DZ-2A). Ammonia (as $N\text{-}NH_3$), nitrates (as $N\text{-}NO_3^-$), nitrite (as $N\text{-}NO_2^-$), and orthophosphate concentrations were measured using Spectrophotometric methods. Alkalinity and total hardness were determined by titrimetric methods following the standard method. Total Dissolved Solids (TDS), Total Solids (TS), and Total Suspended Solids (TSS) were measured using gravimetric methods (APHA. 2017).

To screen the zooplankton, fixed samples were kept overnight in a dark environment to allow for natural sedimentation. They were then concentrated to a volume of 10 mL. Identification and enumeration were done under a light microscope (10 x 40) using a scaled Sedgwick rafter counting chamber. Triplicate samples were used from each location for enumeration, employing standard keys for taxonomic identification of plankton (APHA. 2017; Conway *et al.*, 2003).

MPs isolation

Each sample was transferred into glass jars and oven-dried at 90 ^{0}C until the samples were completely dry. Subsequently, the dried samples were digested through catalytic wet peroxide (Fe(II) catalyst and 30% hydrogen peroxide) oxidation at 75 ^{0}C until no natural organic material was visible (Masura *et al*., 2015). The digested sample mixture was filtered through a 100 µm net and the residue was then transferred into a smaller jar. A Pre-filtered sodium chloride solution (1.2 g/cm^3) was added to the jar and vigorously mixed with a glass rod (Cashman *et al.,* 2020). Glass jars were then kept undisturbed overnight to facilitate the density separation of MP particles. Once the MPs were density separated the upper layer of the solution was sucked out of the solution with the use of a vacuum pump. Then the separated solution was vacuum-filtered through a 0.45 µm membrane filter paper and further washed with distilled water to prevent salt crystallization. Finally, filter papers were stored in glass Petri dishes.

MPs Identification

MPs were visually identified by observing through a stereo microscope (x500) (TIMESISO, China) and a hot needle test was conducted to further refine the identification of plastic particles. The morphological types of plastic particles were recorded, including fragments, foam, film, pellets, granules, and filaments, as well as their colours, such as blue, red, black, white, transparent, green, and others. Once visual observations were concluded, selected MPs were characterized using the Attenuated Total Reflectance process in Fourier Transform Infrared Spectroscopy (ATR-FTIR) (Nicolet iN10, Thermo Scientific, Waltham, MA, US). Each item was examined in transmission mode at a speed of 5 Hz, in the wavelength range of 4000–600 cm^{-1}. The resulting spectra were compared with the pristine FTIR spectra of common polymers (PE, PP, PS, PA, PVC, PET/Polystyrene, etc.) (Rose & Webber, 2019; Abeynayaka *et al.,* 2020).

Statistical analysis and Spatial map preparation

The statistical analysis was performed using Minitab version 15. Pearson correlation and Principal Component Analysis (PCA) were conducted for physicochemical parameters, MPs, and zooplankton data across 12 sampling sites. PCA is generally used for reducing the dimensions of multivariate studies without losing the gathered information (Hotelling, 1933). Spatial distribution maps for the selected water quality parameters in the study area were created using ArcGIS 10.3.

Contamination and quality control

Cotton lab coats and nitrile gloves were worn to minimize contamination during the MP sample isolation. All the chemicals and water used were filtered through 0.75 µm glass fibre filters before use. Three filtered water samples were analyzed as blanks to assess the magnitude of possible contamination.

RESULTS AND DISCUSSION

Water quality

The spatial variation of each water quality parameter across the 12 sampling locations are illustrated in Figure 2.

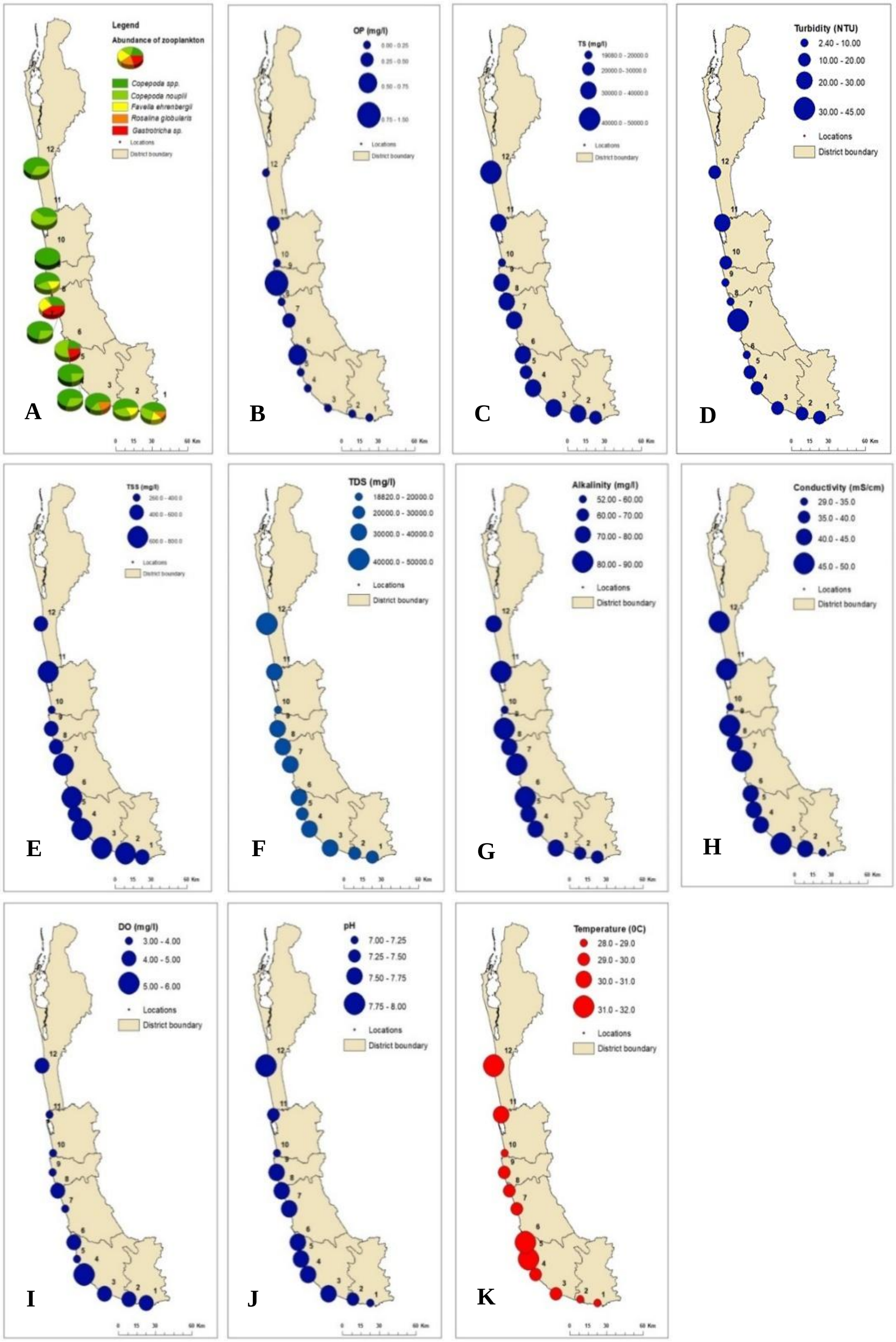

Fig 2. Spatial variation of, A- Zooplankton; B- Orthophosphate; C- Total solids; D- Turbidity; E- Total suspended solids; F- Total dissolved solids; G- Alkalinity; H- Conductivity; I- Dissolved oxygen; J- pH; K- Temperature in the sampling locations

Abundance and spatial variability of floating MPs along the coastal area

A total of 225 MP particles were isolated and identified, and they were found in all 12 sampling locations and all the samples (n=3) with a mean ± SD abundance of 171.20 ± 97.82 particles/m^3. The highest value was recorded at the Mattakkuliya sampling location (400 particles/m^3) and the lowest was detected at the Matara location (72.72 particles/m^3) (Figure 2). The recorded values were consistent with those published for coastal water in Sri Lanka and the Indian Ocean (Bimali Koongolla *et al.,* 2018; Athawuda *et al.*, 2020; Vaid *et al.,* 2021). The Mattakkuliya site is located in the Kelani River basin and the Kelani River is one of the most polluted rivers in Sri Lanka in many aspects (Mahagamage *et al.,* 2020). Dharmadasa *et al.* (2021) documented that a high abundance of MPs was recorded in beach sediment and water adjacent to river mouths. River mouths can be considered to be a major emission source of land-based plastic debris into the seas (Lebreton *et al.,* 2017; Kataoka *et al.,* 2019). The second-highest MPs concentration was recorded from the Hikkaduwa sampling site and Dharmadasa *et al.* (2021) also documented the highest values in their study related to MP pollution in Marine Protected Areas of Southern Sri Lanka. Further, Dharmadasa *et al.* (2021) documented that the entire coastline can be contaminated due to factors such as the Hikkaduwa fishery harbour, large hotels and guesthouses in the area, the opening of a large drainage passage from Hikkaduwa municipality and other neighbouring areas. Tidal fluctuations and monsoon currents could be the potential reasons for litter accumulation in the southern part of Sri Lanka. For instance, Dharmadasa *et al.* (2021) reported that the high accumulation rates of plastics in the river mouths in the southern part of the island are mainly due to the southwest monsoon current and wave actions.

Characterization of floating MPs along coastal areas

The shape of MPs is significantly important since it directly influences the distribution of MPs, their removal, and their interactions with other organisms and contaminants (Sun *et al.,* 2017; Zhang *et al.*, 2021). Figure 3 shows some isolated MPs according to their particle types and according to the results of the MP morphologic description, more than 57% of the total MPs described were “filaments”, 30% were “films”, and 10% were “fragments” respectively. The least common shape categories identified were “foams" (1%) and “pellets” (2%). In most water bodies filaments are the most dominant shape of MPs. This is mainly due to the synthetic materials used in modern clothing. On the other hand, in marine environments, the usage of fishing gear also releases MPs into the coastal waters (Dris *et al.,* 2016). The highest number of filaments was recorded from the Hikkaduwa sampling location (191.91 particles/m^3) and most of the filaments could be generated from fishing gear and wastewater from hotels located near the Hikkaduwa fishery harbour. However, high values of filaments (181.82 particles/m^3) and films (181.82 particles/m^3) were also observed in the Mattakkuliya sampling location. Many plastic items find their way into the Kelani River and its canals ultimately end up in the marine ecosystems. This phenomenon is evident around the Modara estuary of Kelani River and Crow Island in Mattakkuliya where the river meets the Indian Ocean.

All the coastal sampling locations recorded both filament and film types of MPs except for the Kosgoda sampling location. Further, many fragment particles were observed from Mattakkuliya, Negombo, and Chilaw sampling sites. Interestingly, relatively fewer foam particles were recorded during the study period and pellets were recorded from Weligama, Hikkaduwa, Mount Lavinia, and Negombo sampling locations. Jayathilaka *et al.* (2021) conducted a study about the spatiotemporal variation of plastic pellet distribution in the shoreline of Sri Lanka in relation to the catastrophic maritime accident of the cargo ship X-Press Pearl, and it was revealed that pellet dispersion was high in the coastal zone from Matara to Kalpitiya.

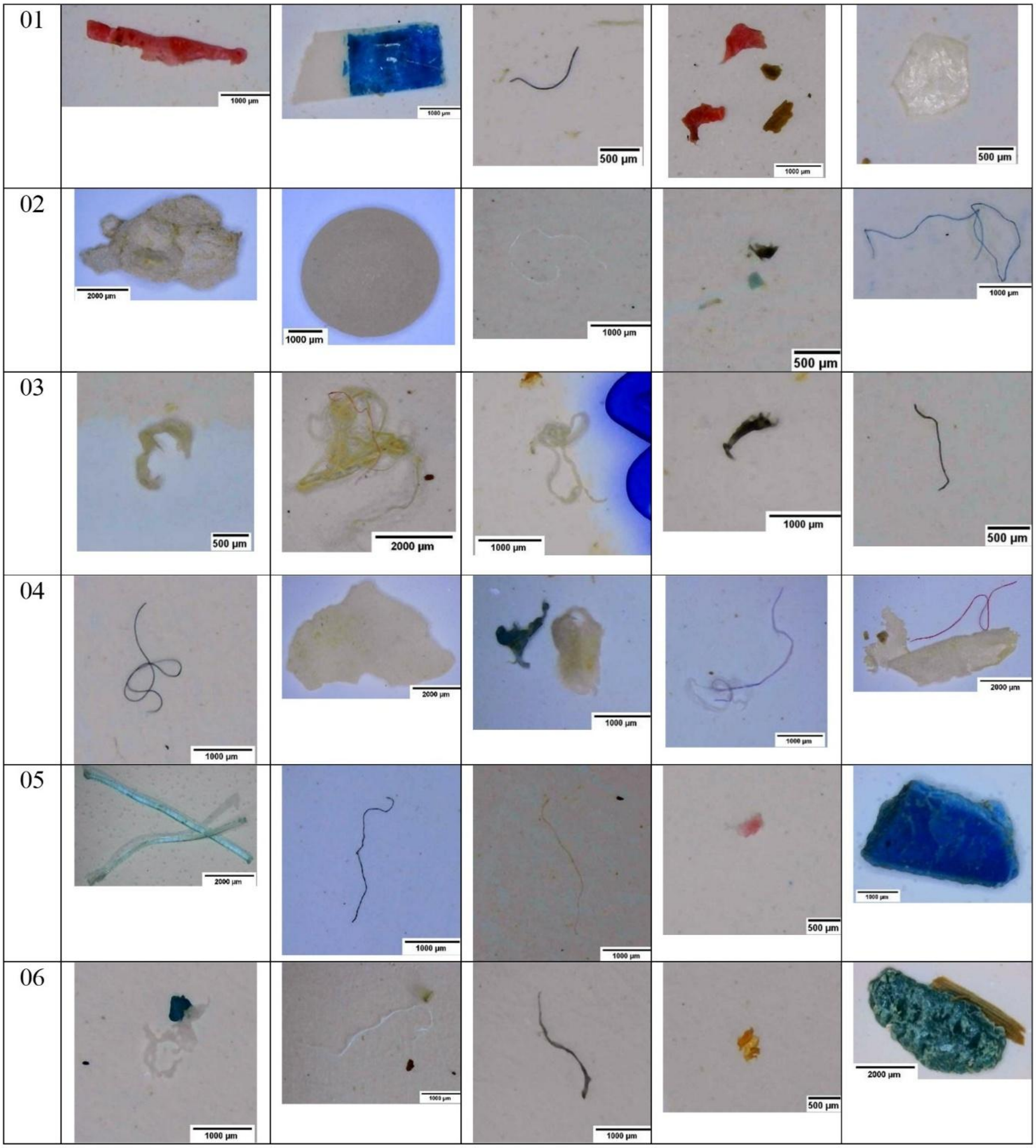

Fig 3 (a). Images of selected MPs recorded from sampling locations (01-06) during the study period

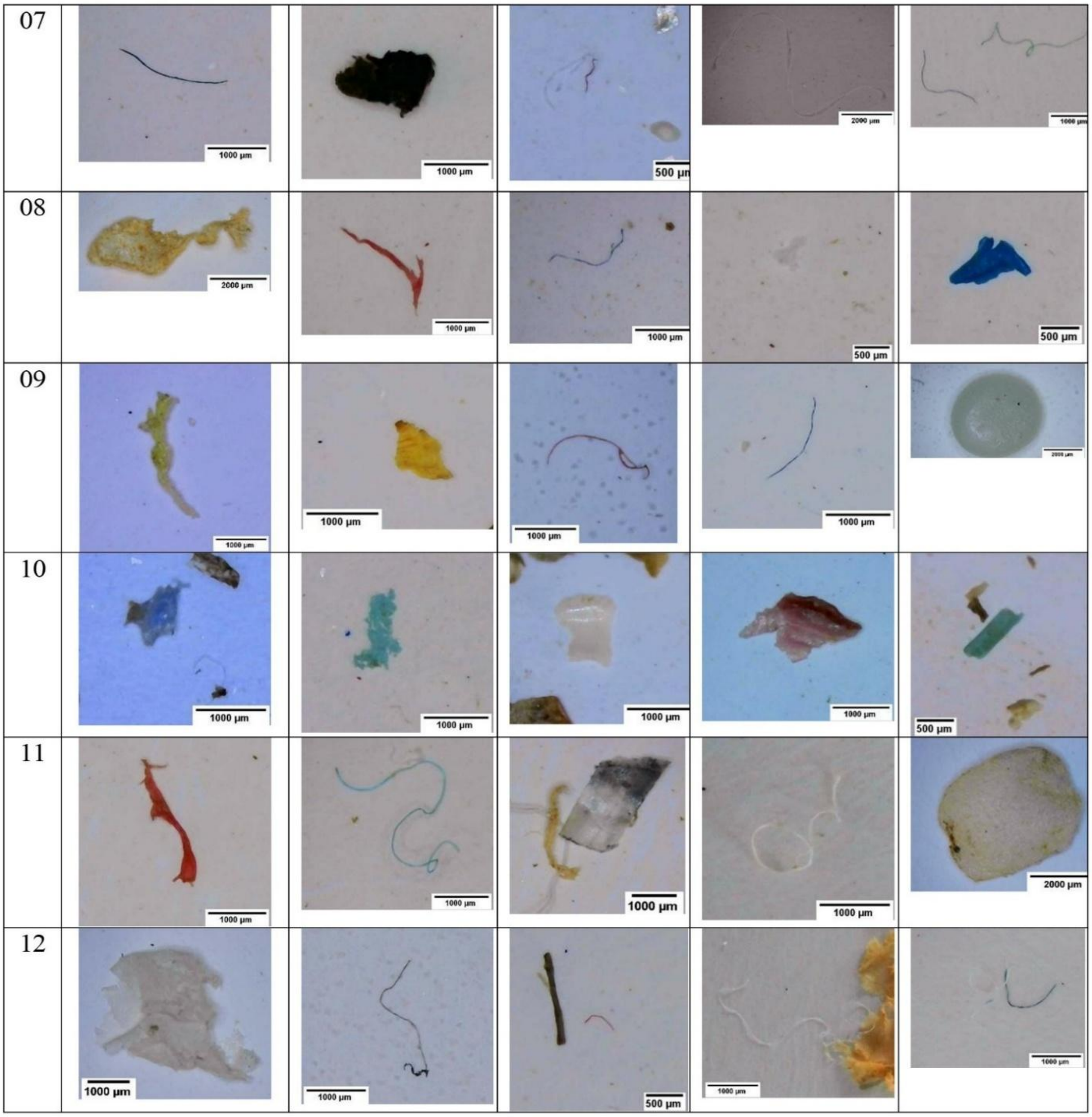

Fig 3 (b). Images of selected MPs recorded from sampling locations (06-12) during the study period

In the 12 sampling locations, the physical types of MPs followed the order filament>film>fragment >pellet>foam. Similarly, in the coastal waters of Colombo, the research detected shape categories of filaments (61%), fragments (25%), and films (14%) (Athawuda *et al.*, 2020). In the coastal waters of southern Sri Lanka fragments and filaments were the most dominant shape of MPs (Koongolla *et al.*, 2018). In Marine Protected Areas (MPAs) of the southern province of Sri Lanka fragments and filaments were also dominant (Dharmadasa *et al.*, 2021) and 90% of MPs detected in the southern coastal belt of Sri Lanka were also filaments (Athapaththu *et al.,* 2020). This might be attributed to the widespread use of plastics for day-to-day activities and it underscores the importance of studying the type of plastic contaminants in marine water. Gamage and Mahagamage (2024) reported that the usage of microbeads in personal care and cosmetic products is one of the significant ways of releasing MPs into aquatic systems while plastic weathering (secondary MPs such as fragments, foams, and films) (Efimova *et al.*, 2018), and MPs emissions from tyres also provide a high percentage of MPs (Kole *et al.*, 2017). Therefore, understanding the shape of plastic is essential for determining the source and the pathways of contamination.

Colour of MPs along coastal areas

Results revealed that more than 42% of the total MPs observed were "blue" in colour, 27% were "transparent" and 11% were "red" colour. The highest number of blue-coloured MPs was recorded from the Mattakkuliya sampling location (145.45 particles/m^3) (Figure 4). All types of colours were recorded from both Ambalangoda and Mattakkuliya locations. Similar to the present findings, blue is the dominant colour among detected MPs in coastal beaches and waters in southern Sri Lanka (Koongolla *et al.*, 2018). Athapaththu *et al.* (2020) also stated that blue-coloured MPs were highly abundant in the surface waters of the southern coastal zone of Sri Lanka (Northern Indian Ocean). When considering the MPs in marine biota, blue-coloured MPs were detected in fish, seabirds, marine mammals, and sea turtles in the percentages of 28.1%, 33.3%, 50%, and 75%, respectively. These numbers provide a clear picture of the dominance of blue-coloured plastic particles in the environment.

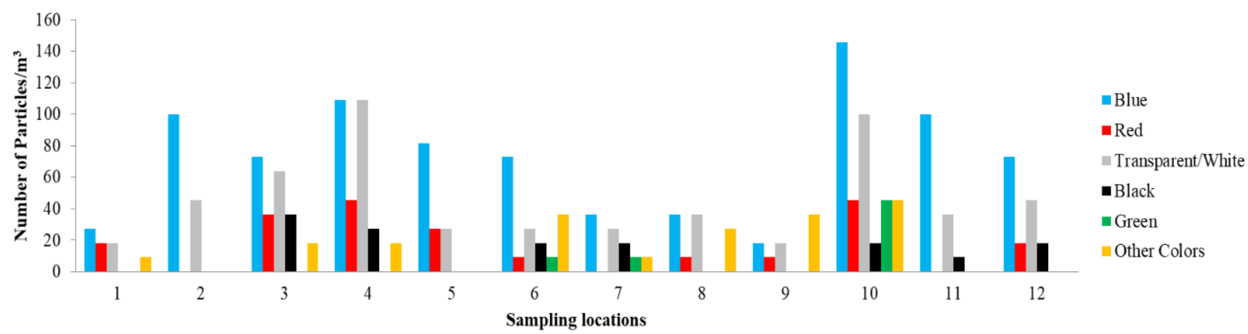

Figure 4. Abundance of MP colour categories detected from the 12 sampling locations

Polymer types of MPs along coastal areas

Based on polymer characterization, MPs detected along the coastal areas were highly composed of polyethylene (PE, 52%) followed by polypropylene (PP, 23%), polystyrene (PS, 13%), polyamide (PA, 10%), and other polymers like PET and polyester (2%) (Figure 5). Additionally, there were a few (<10%) polymer types that could not be assigned for any of the above polymer categories based on the FT-IR analysis (Figure 6). These may probably consist of more than one plastic polymer (i.e. multilayered). PE is one of the most commonly used materials worldwide, accounting for 34% of the global plastics market as of 2017, with an annual production volume exceeding 100 million tons. Polyethylene (PE) is primarily divided into three major groups: low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE), and high-density polyethylene (HDPE), globally being commonly manufactured using one of these types (Basmage & Hashmi, 2020). Polypropylene (PP) has various chemical and mechanical properties while PS serves excellent packaging and is an insulating material (Basmage & Hashmi, 2020; Tomić & Marinković, 2020). As many global research studies indicate, these three polymers, PP, PE and PS dominate the MP pollution in coastal waters.

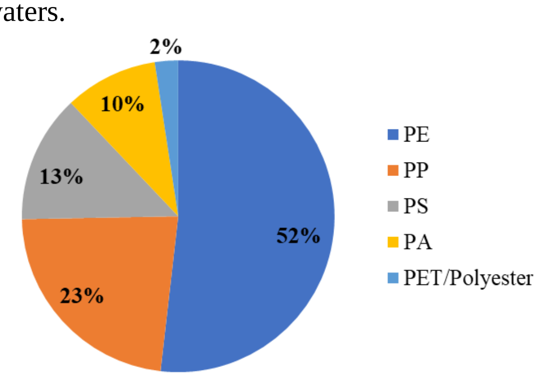

Fig 5. Percentage (in abundance) of MP polymer categories collected within the coastal waters (data given represent the composition of the detected polymer types - 83 items out of a total 91 items tested using FTIR; 8 particles were not able to confirm as polymer types given in the figure)

In the China Sea, 27,840 items/m^3 amount of MPs were detected and most of them belonged to the PP and PE chemical composition (Wang *et al.*, 2022). In the local context, PE was found to be the most abundant MP in the Marine Protected Areas of Southern Sri Lanka (Dharmadasa *et al.*, 2021). The results of the present study align with both local and global scenarios as discussed. However, further analysis is necessary to identify seasonal variations and sources of the MPs. As MP concentration will ultimately change between wet seasons and dry seasons, the potential effects of MPs may vary. Simultaneously, the sources of MPs will differ with the seasons as the wet season provides more opportunities/pathways for MPs to end up in the water bodies. Thus it will be ultimately beneficial to develop the necessary regulations and management procedures for MP pollution.

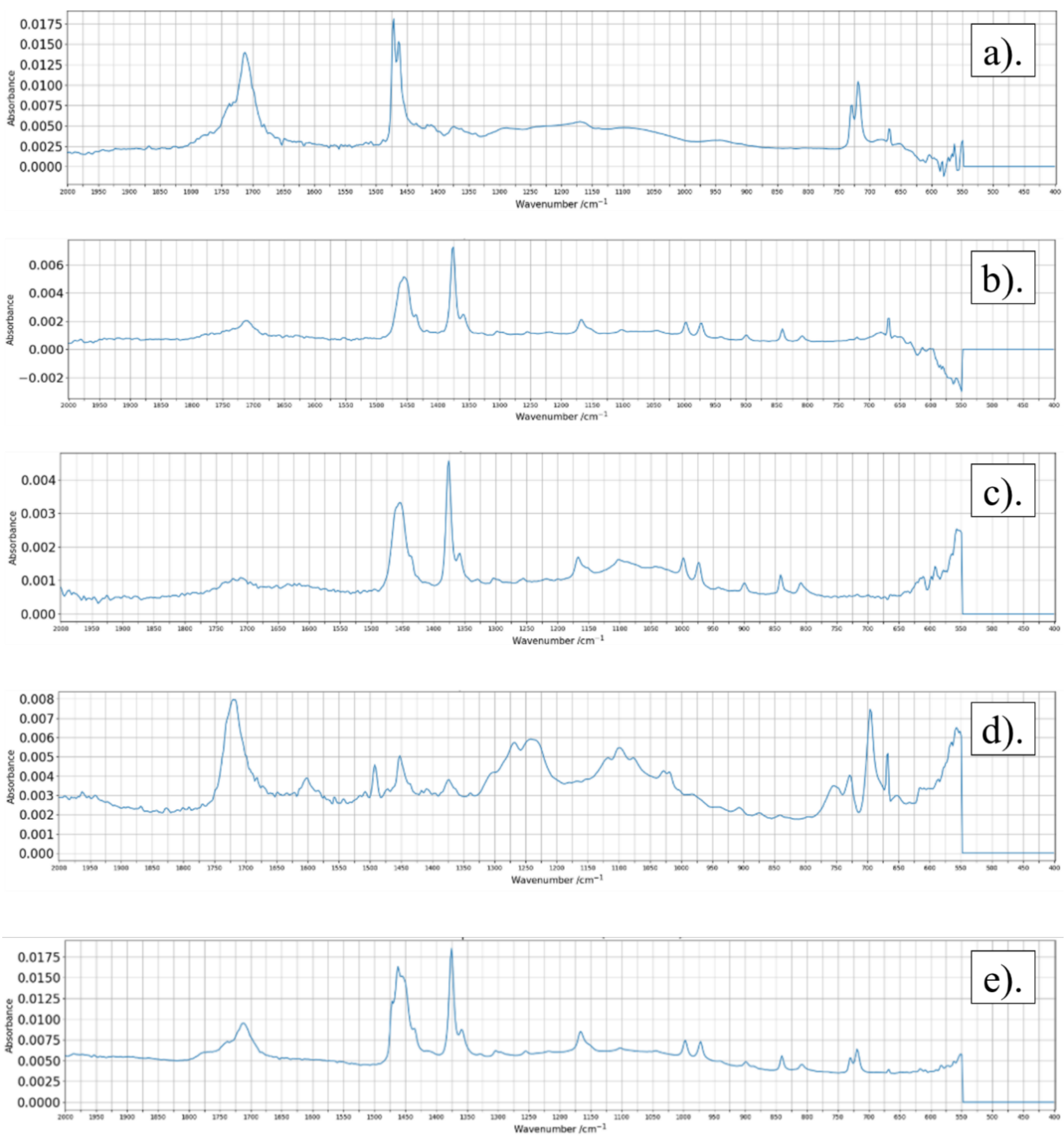

Fig 6. IR spectra of selected MP pieces observe in the study. a). Polyethylene (PE) b). and c). Polypropylene (PP), d). Polystyrene (PS) and e). Mixed layers (probably PE and PP mixed)

Zooplankton abundance and composition

In the present study, four different zoo planktonic taxa were identified in the 12 samples collected during the sampling period (Figure 7).

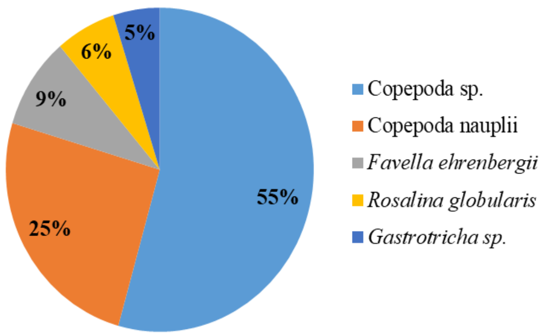

Fig 7. Percentage (in abundance) of zooplankton taxa categories in coastal waters

Zooplankton are the heterotrophic component of the plankton community. They are the secondary producers in pelagic ecosystems and an extremely important aspect of the aquatic food webs (Belgrano *et al.*, 2012). Zooplankton mostly live in surface waters where MPs are abundant with a high likelihood of being in contact with or ingesting MPs impacting their diversity, growth, reproduction, gene expression and survival (Botterell *et al*., 2019; Yu *et al.*, 2020). Similarly, the quality of water impacts the quality and abundance of zooplankton (García-Chicote *et al.*, 2018).

In the study area, the highest numbers of zooplankton species were identified at Matara (26,042 Individuals/m^3). The lowest total abundance was observed at the Negombo sampling location (1,786 Individuals/m^3). The most abundant zooplankton were copepods and spatial distribution patterns of Copepoda, Copepoda nauplii, *Favella ehrenbergii*, *Rosalina globularis*, *Gastrotricha* sp. taxa were identified separately by a spatial distribution map. The highest number of copepods, copepod nouplii, *F. ehrenbergii*, *R. globularis*, *Gastrotricha* sp. were detected from the Unawatuna location (15,000 Individuals/m^3) followed by Matara (7,292 Individuals/m^3), Matara (4,167 Individuals/m^3), Unawatuna (4,375 Individuals/m^3) and Panadura (4,688 Individuals/m^3) sampling locations respectively. The size of the most abundant zooplanktonic taxa like copepods is similar to the size of the most abundant MPs recorded and some of them were very tiny particles. In a highly MP contaminated environment, MPs can potentially act as fake food for organisms that feed on zooplankton-like species. Panti *et al.* (2015) documented that filter-feeders and sediment feeders consume MP particles and MPs can be another prey for zooplankton predators. As global literature indicates, under the field conditions in the Northern South China Sea, all groups in the copepod, ingested MPs (fibres, particles, and irregularly shaped unidentified plastic particles). Similarly, in Kenyan oceans, copepods were found to be ingesting MPs 0.33 particles per individual, in one sample site of Bohai Sea China copepods, had the highest MPs ingestion compared to other zooplankton (Sun *et al.*, 2017; Kosore *et al.*, 2018; Zheng *et al.*, 2020). MPs can be mistaken for natural prey by zooplankton or passively ingested during normal feeding behaviour due to their similar size. Several species of zooplankton have been observed to ingest MPs ranging in size from 1.4 to 30.6 µm (Cole *et al.*, 2013). The present study did not investigate smaller particle sizes; however, as MPs undergo further degradation and fragmentation in the environment, the abundance of bioavailable MPs to organisms is expected to increase over time. Cole *et al.* (2015) reported that MP ingestion of copepods significantly reduces algal feeding, resulting in impacts on the health of zooplankton and their functionality. They further discussed that MPs could block feeding appendages, restrict feed intake, and may clog or harm the alimentary canal. Such low feeding behaviours ultimately lead to significant impacts on growth and development. Furthermore, as Lee *et al.* (2013) documented, those MPs' exposure over longer periods could increase the mortality rates of the zooplankton. However, several studies on the effects of MPs on the lifespan of zooplankton provide contradicting evidence, which poses a significant challenge for the ecosystem in the near future. Based on these findings it is important to investigate the potential impacts of MPs on zooplankton. Therefore, future research studies should be conducted in this aspect to obtain a comprehensive understanding of the effects of MPs on zooplankton in these waters.

Relation of water quality and MPs

Pearson correlation was performed to determine any relationship between water quality and MPs. It revealed a correlation (α = 0.05) between pH (r = 0.734, p = 0.007), TDS (r = 0.591, p = 0.043), alkalinity (r = 0.638, p = 0.025) and TS (r = 0.591, p = 0.043) with temperature. Further, it showed correlation (α = 0.05) between conductivity (r = 0.759, p = 0.004), TDS (r = 0.808, p = 0.001) TS (r = 0.807, p = 0.002), and alkalinity (r = 0.787, p = 0.003) with pH (Table 1). Interestingly, it was found that there was a negative correlation (α = 0.05) between alkalinity and MPs (r = -0.591, p = 0.043); alkalinity also correlated with TDS (r = 0.677, p = 0.016), TS (r = 0.687, p = 0.015), and TSS (r = 0.664, p = 0.018). To further explore the relationships between sampling locations, Principal Component Analysis (PCA) was conducted. This analysis resulted in both a score plot and a loading plot based on the measured parameters (Figure 8). Sampling locations were grouped into four clusters based on their water quality status. Matara and Weligama were grouped into the first cluster due to the high abundance of zooplankton in coastal water. Unawatuna, Hikkaduwa, Panadura, and Chilaw locations were grouped into the second cluster due to recorded high levels of DO, TSS, TS, and TDS levels along with high zooplankton count. Interestingly, a relationship was observed between zooplankton and DO, with lower phosphate concentrations. Kosgoda, Mount Lavinia, and Kalutara locations were grouped into the third cluster where high levels of conductivity, pH, alkalinity temperature, turbidity, and phosphorous concentrations were recorded. Mattakkuliya location has significantly deviated from the other sites with a high level of MPs and low electrical conductivity, due to mixing fresh water from the Kelani river. Further, it was detected that MPs were high when the other water quality parameters recorded low values.

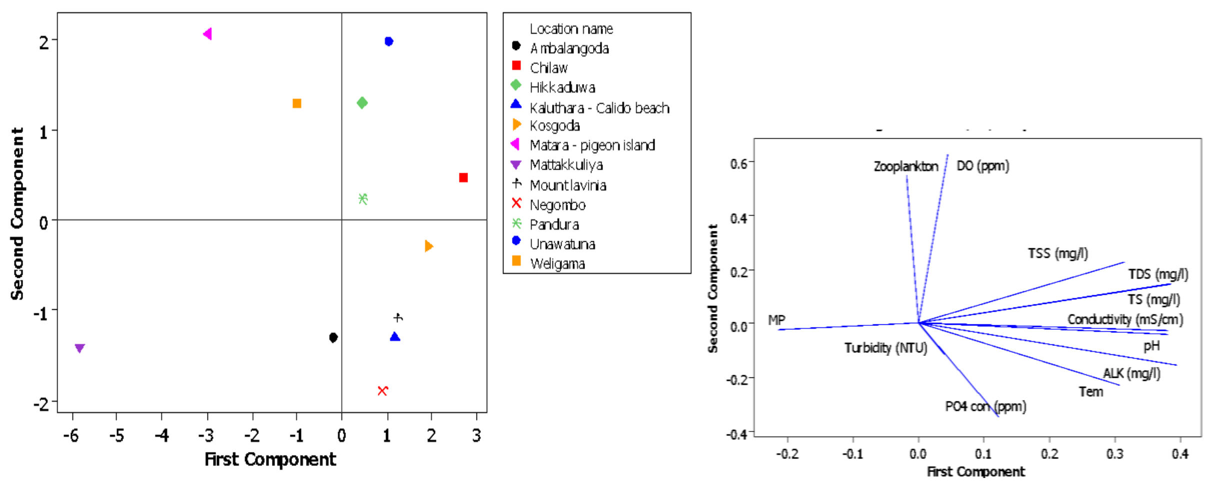

Fig 8. Score plot and loading plot derived from the PCA analysis for sampling locations based on water quality and other measured parameters

Table 1. Pearson correlation values for tested water quality parameters and MPs

	Temperature	pH	DO	EC	Turbidity	Alkalinity	TDS	TSS	TS	PO_4^{-3}	MPs
pH	**0.734**										
	0.007										
DO	-0.150	0.143									
	0.641	0.657									
EC	0.546	**0.759**	0.026								
	0.066	**0.004**	0.937								
Turbidity	-0.144	0.058	-0.184	0.226							
	0.655	0.858	0.566	0.481							
Alkalinity	**0.638**	**0.782**	-0.188	**0.893**	0.234						
	0.025	**0.003**	0.715	**0.000**	0.463						
TDS	**0.591**	**0.808**	0.260	**0.697**	-0.030	**0.677**					
	0.043	**0.001**	0.414	**0.012**	0.926	**0.016**					
TSS	0.405	0.433	0.337	**0.709**	0.137	**0.664**	**0.618**				
	0.191	0.159	0.284	**0.010**	0.670	**0.018**	**0.032**				
TS	**0.591**	**0.807**	0.263	**0.702**	-0.027	**0.682**	**1.000**	**0.630**			
	0.043	**0.002**	0.408	**0.011**	0.934	**0.015**	**0.000**	**0.028**			
TP	0.086	0.129	-0.436	0.202	-0.127	0.435	0.179	0.060	0.178		
	0.790	0.689	0.156	0.529	0.695	0.158	0.577	0.853	0.579		
MPs	-0.164	-0.356	0.052	-0.363	-0.085	**-0.591**	-0.335	-0.309	-0.337	-0.383	
	0.611	0.257	0.872	0.247	0.792	**0.043**	0.287	0.329	0.284	0.219	

Explanation: cell contents: top cells for every parameter Pearson correlation, bottom cells for every parameter – p-value; TP = total phosphate, TDS =total dissolved solids, DO = dissolved oxygen, EC= electrical conductivity, TSS = total suspended solids, TS= total solids, MPs= microplastics

CONCLUSION

This study investigated varying levels of MP pollution in the western coastal waters of Sri Lanka. MP levels were studied along with their types, colours, and shapes at different sampling sites. Considering MPs PE was the dominating polymer type followed by PP, PS, PA and PET/Polyester. Blue was the dominating colour among identified MPs and significant quantities of MPs were filaments. Pearson correlation indicated that there were no significant correlations between MPs and water quality measures and MPs. As a preliminary step, the study screened the abundance of zooplankton in the study area to provide baseline data which is highly valuable, especially in relation to the high pollution levels of MPs, which may interfere with the plankton communities in the study locations. Therefore, thoroughly planned comprehensive studies are required to determine the zooplankton abundance/diversity in coastal water and evaluate the impacts of MPs on such communities. Particularly the temporal analysis is required to understand the pollution levels and their influences over initial stages of the marine food webs. Such investigations will be helpful in predicting future environmental problems and come up with mitigation measures without compromising the environment. In the present conditions, this study is timely as a baseline to understand the condition of the MPs and water quality in study locations and to plan further studies.

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