

Project Update September 2023

The analysis of the microplastics samples taken at Bahía de La Paz (BLP) and Bahía de Los Ángeles (BLA) was conducted. The plastic pieces were separated and placed on copper tape (Figure 1) for SEM analysis (Figure 2). They were peeled off for FTIR analysis (Figure 3).

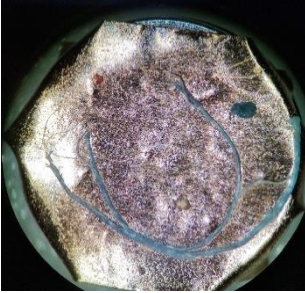


Figure 1. Microplastics on copper tape



Figure 2. SEM analysis

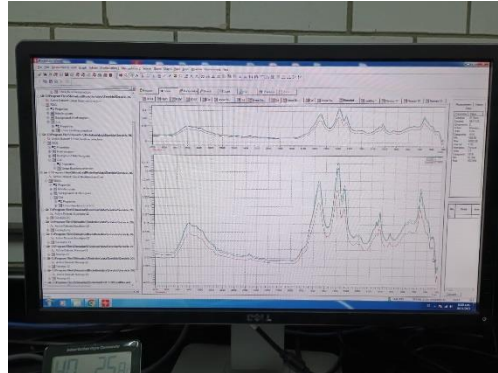


Figure 3. FTIR analysis

Among the results obtained, it was found that the presence of microplastics has increased since the last study conducted in 2017. A Total of 169 were found in BLA and 284 in BLP, with fibres dominating at both sites followed by fragments and flakes (Figures 4 & 5).

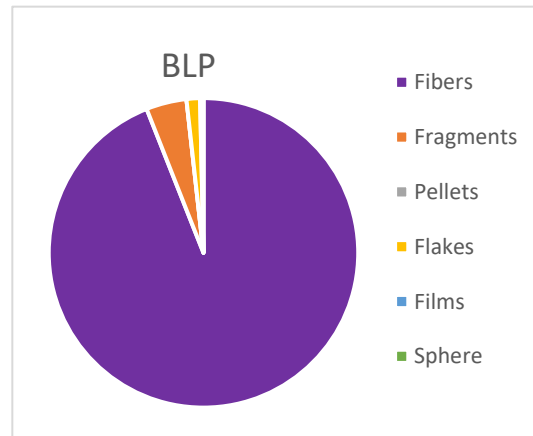
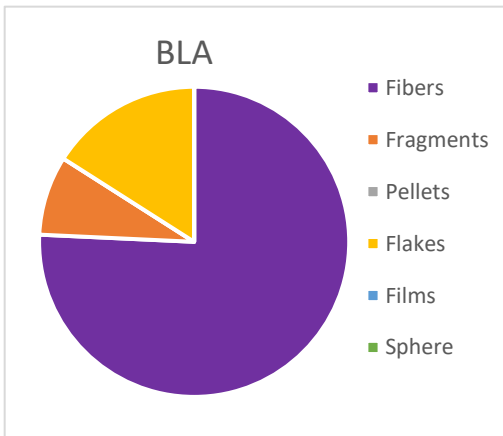


Figure 4. Total pieces of microplastics in BLA
microplastics in BLP

Figure 5. Total pieces of

The types of microplastics found in this study are influenced by terrestrial activities near the beaches. The high concentrations of fibres likely originate from wastewater or fishing nets. These fibres can bend or aggregate into smaller sizes, making them bioavailable to the organisms in Bahía de Los Ángeles and Bahía de La Paz.

Fragments are the second most common form found. These plastic pieces may come from the breakdown and degradation of plastic bottles and bags and fishing gear, as both study areas are significant for this activity, originating from local beaches or being carried by currents.

Regarding colours, the most dominant were blue, black, and green in this study. These colours are associated with fishing nets and equipment. Dark-coloured plastic pieces can be accidentally consumed by organisms, for example, the fishes may confuse blue microplastic pieces with copepods, which are organisms belonging to zooplankton and form the base of the food chain.

Some of the plastic pieces are shown in (Figure 6), these pieces were subjected to SEM and FTIR analyses (Figure 7).

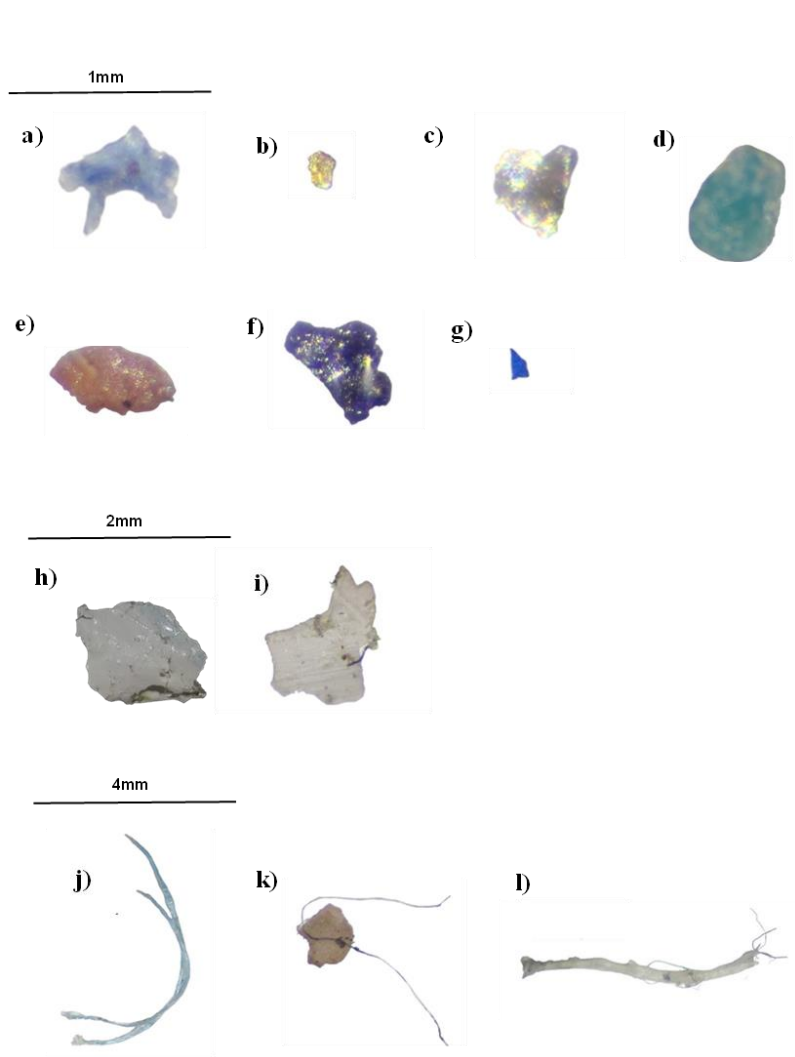


Figure 6. Representative images of microplastic pieces identified in zooplankton: 1mm (a) – (g), 2 mm; (h) e (i) y 4 mm (j) – (l).

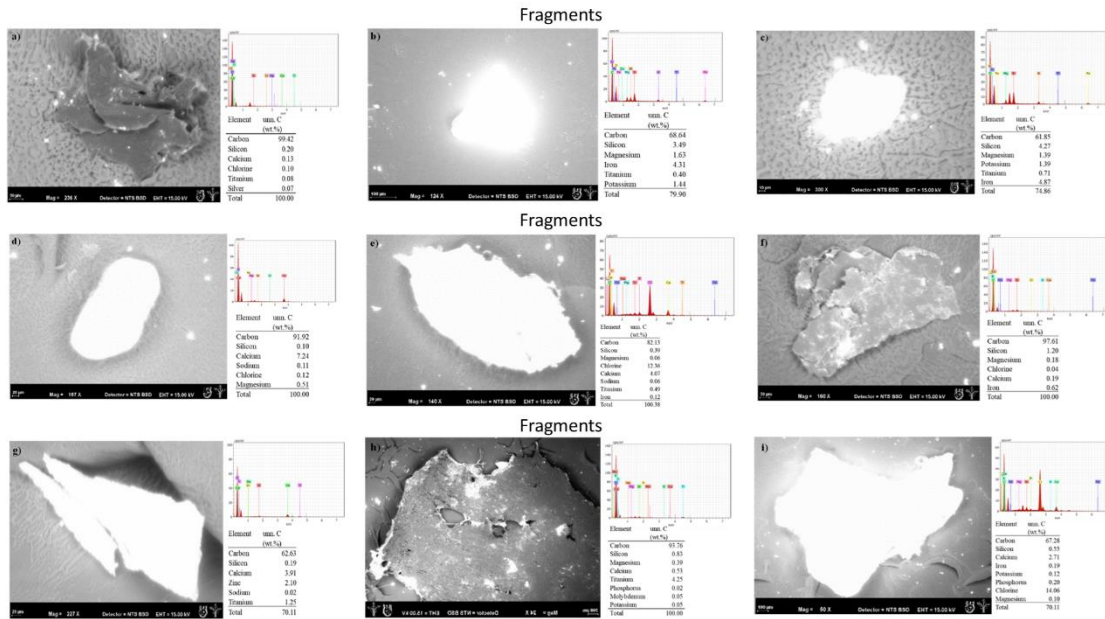


Figure 7. SEM photographs show with the corresponding EDS spectra for the surface profiles of MPs.

The elemental composition with a higher percentage of Carbon (C) and Oxygen (O) confirms that the selected pieces are plastic. The presence of other elements like Silicon (Si) likely indicates that silicon oxides have adhered to the environment. Titanium (Ti) is added to plastics to enhance their stability. Zinc (Zn) is attributed to nutrients available in surface waters, as well as other elements that can be adsorbed by microplastic pieces in the environment or added during their production.

The different morphologies, such as roughness, irregular edges, holes, folds, cracks and flakes, suggest possible thermos-oxidative and photo-oxidative degradation, wave action, and mechanical abrasion, because of exposure in the marine environment.

FTIR analysis detected the presence of polyvinyl chloride (PVC), consistent with SEM-EDS analysis which found chlorine in some microplastic pieces, presenting characteristics like shiny appearance and smooth, irregular surfaces. Polycarbonate (PC) was also detected originating from industries such as automotive, baby bottles, food containers and electronic equipment.

This study shows an increase in plastic pollution in both feeding zones of the whale shark, with the presence of various types of plastics from different anthropogenic activities and nearby cities. One of the potential risks not only for the whale shark but also for other organisms visiting Bahía de La Paz and Bahía de Los Ángeles is that microplastic pieces, due to their degradation, can adsorb contaminants like organochlorine pesticides, polycyclic aromatic hydrocarbons and heavy metals, which have already been reported on the skin of whale sharks.

In addition to the absorption of these contaminants by organisms due to exposure to the marine environment, trophic transfer is another source of incorporation for the organisms.

References

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Several cleaning campaigns were conducted in the mangrove near CICIMAR with the participation of students and academics, and activity that has started to be carried out regularly in this research centre.

Cleaning photo collage





