

Seasonal tendencies of microplastics around coral reefs in selected Marine Protected National Parks of Gulf of California, Mexico

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Abstract

- This study focuses on the presence of MPs in the sediment beds around coral reefs of MPNPs in Baja California Sur, México.
- Based on seasonal sampling results, comparison of MPs from Cabo Pulmo (avg. 680.25 items/100 g⁻¹ d.w) recorded higher values than Espiritu Santo Island (avg. 321.75 items/100 g⁻¹ d.w) from backshore/ foreshore regions.
- Most of the MPs are secondary in origin resulting from man-made and tourist's activities controlled by wave transportation and tidal currents.

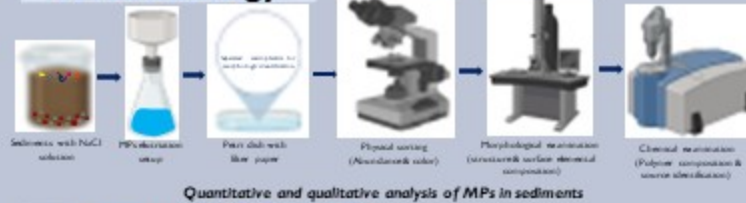
Background

- The Marine Protected Areas near the populated and industrialized areas are susceptible for the presence of marine plastic debris resulting from anthropogenic activities.
- Documenting the marine plastics impacts is increasing particularly in marine sediments which are the carriers of microplastics in the marine environments.
- The present study in coralline regions of Cabo Pulmo and Espiritu Santo Island in Baja California Sur aims to identify the presence/ abundance of MPs and document its seasonal changes near the coral beds of MPNPs of Gulf of California.

Study area



Methodology



Results & discussion

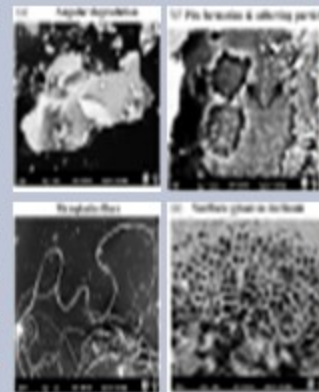


Figure 2: SEM images with EDS spectra for MPs surface profiles from Cabo Pulmo & Espiritu Santos Island

- Cabo Pulmo results show diverse morphology such as angular degradation and surface grooves.
- Espiritu Santos Island shows more abundance of fiber and plastic particles with surface cracks and grooves.
- The morphology of MPs denotes the highly attenuated surface such as surface cracks, pits, grooves, angular/ tubular degradation, filament formation resulted from prolonged physical weathering.

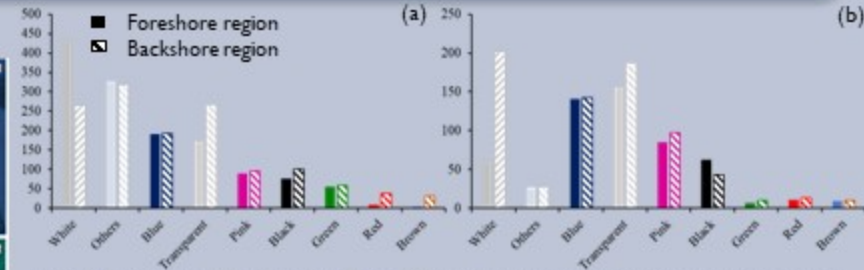


Figure 2: MPs abundance with color differentiation in backshore and foreshore sediments in (a) Cabo Pulmo (b) Espiritu Santos Island

- The overall seasonal trend indicates high influence due to the tidal variations and hydrodynamic conditions of the region (Moreira et al. 2016; Collins and Hermes, 2019; Montserrat Arreola et al. 2022).
- Identified polymers were resulted from food containers, plastics fork (PS); bottles (HDPE, PET); facewash (LDPE); plastics bags (PE); swimming clothes and fishing nets/ropes (PES, RY) (Piñon-Colin et al. 2018; Wu et al. 2020).
- The abundance of PS also results from sporting aids, swimming kickboards, cosmetics along with plastics cutlery (Barboza et al. 2019).

Conclusion

- The evidence of MPs presence in Marine Protected Natural Park indicates the risk on the loss of coral species and marine diversity.
- The studies reports the MPs, especially in coral colonies and aids to address some mitigation practices to reduce the generation of plastic waste generation from tourism.
- Monitoring programs for marine plastics pollution is an essential way for better management of MPNPs.

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Key words: Microplastics; corals; marine sediments; Marine Protected National Parks; Gulf of California

Research areas: Earth Sciences, Environmental Sciences, Ocean Sciences.

References

1. Moreira, F. T., Balthazar-Silva, D., Barbosa, L., Turra, A., 2016. Revealing accumulation zones of plastic pellets in sandy beaches. *Environmental Pollution*. 218, 313-321.
2. Collins, C., Hermes, J.C., 2019. Modelling the accumulation and transport of floating marine micro-plastics around South Africa. *Mar. Poll. Bull.* 139, 46–58.

3. Montserrat Arreola-Alarcón, I., Reyes-Bonilla, H., Sakthi, J.S., Francisco Rodríguez-González, Jonathan, M.P., 2022. Seasonal tendencies of microplastics around coral reefs in selected Marine Protected National Parks of Gulf of California, Mexico, *Marine Pollution Bulletin*, Vol 175, 113333.
4. Piñon-Colin T.J., Rodríguez-Jimenez R., Pastrana-Corral M.A., Rogel-Hernandez E., Wakida F.T., 2018. Microplastics on sandy beaches of the Baja California Peninsula, Mexico. *Marine Pollution Bulletin*.131, 63-71.
5. Wu, F., Pennings, S.C., Tong, C., Xu, Y., 2020. Variation in microplastics composition at small spatial and temporal scales in a tidal flat of the Yangtze Estuary, China. *Science of the Total Environment*. 699, 134252.
6. Barboza, L.G.A., Cózar, A., Gimenez, B.C.G., Barros, T.L., Kershaw, P.J., Guilhermino, L., 2019. Macroplastics pollution in the marine environment. In: *World Seas: An Environmental Evaluation*. Elsevier, pp. 305–328.
7. Erni-Cassola, G., Zadjelovic, V., Gibson, M., Christie-Oleza, J. 2019. Distribution of plastic polymer types in the marine environment; a meta-analysis. *Journal of Hazardous Materials*. 369, 691-698.

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