Marine plastic pollution assessment and monitoring

ARCEMS has monitored and researched plastic pollution in the Arabian Gulf. The work spans the full pathway of plastic in the marine environment, from macro-litter on shorelines to microplastics in sediments and in commercially important marine organisms. Together, these studies provide Saudi Arabia with the scientific evidence needed to monitor, understand, and ultimately reduce marine pollution.

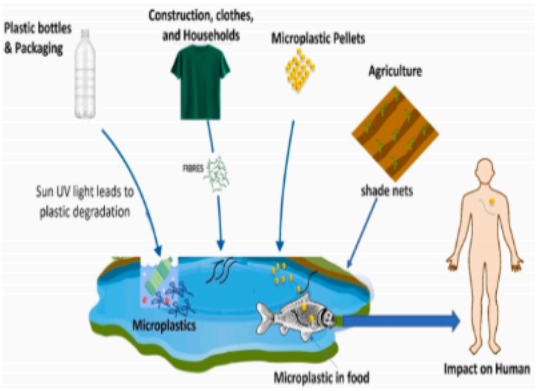
A national review of microplastic research in Saudi Arabia sets the foundation. It consolidates what is known about microplastics in seawater, sediments, biota, food, beverages and dust, and critically evaluates the sampling, extraction and detection methods in use. It highlights the challenges of working in extreme conditions such as high salinity, high temperatures and windblown dust. It also identifies key gaps, including inconsistent methods, limited long-term monitoring, and the need for more advanced polymer identification. This supports Target 14.1 by moving the Kingdom toward standardized, comparable monitoring, which is a prerequisite for any effective pollution reduction strategy.

Field-based studies along the Gulf coast translate this framework into baseline data. A survey of coastal beach litter, combined with pollution and cleanliness indices and hydrodynamic modeling, shows that plastics dominate the litter stranded on Gulf beaches and that most of it comes from land-based sources such as single-use items and packaging. Fishing-related debris is a secondary but distinct input, and the presence of foreign-labelled items and biofouled debris points to transboundary and long-distance transport. The modeling shows how winds, tides and coastal geometry control where litter accumulates, which helps identify retention zones and priority areas for cleanup and management.

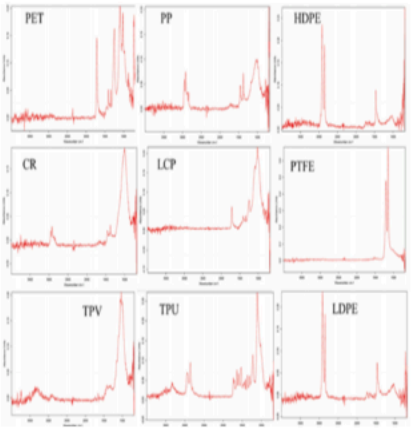
A baseline assessment of microplastics in the sediments of recreational beaches in Halfmoon Bay shows that microplastic contamination has reached popular coastal areas. Polymer identification and analysis of particle shape, color and size help trace likely sources, including packaging, textiles, fishing gear and industrial materials. The study also stresses that spatial patterns reflect both human activity and physical processes, and it recommends improved waste infrastructure, source-specific monitoring and continued beach cleaning. This links the evidence directly to actionable measures for reducing land-based inputs.

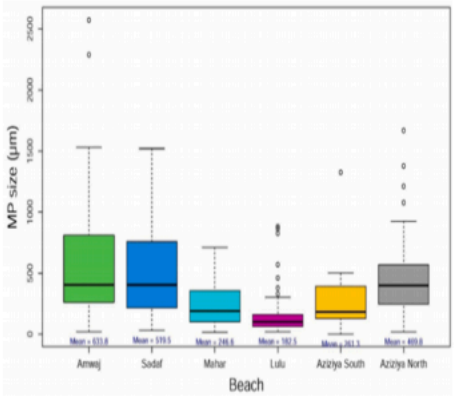
Research on green tiger prawns, a commercially valuable benthic species, extends the assessment into marine life. It documents the ingestion of microplastics, mostly fibers, and the range of polymers involved, and it uses risk indices to evaluate polymer hazards. The findings link fishing activity, sediment disturbance and lost gear to microplastic availability. They also show that shrimp can serve as effective bioindicators of benthic pollution, with implications for ecosystem health and seafood safety.

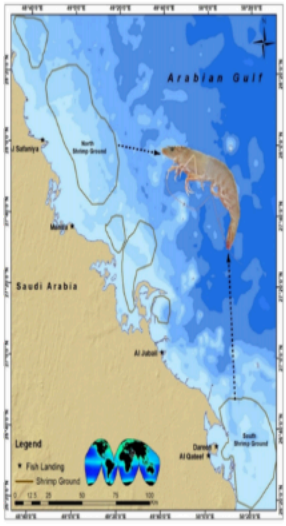
The study quantifies and characterises litter and microplastic pollution in the Arabian Gulf, identifies land- and sea-based sources, and clarifies how plastics move, accumulate, and enter marine food webs. They also establish reference baselines and indicator species for long-term monitoring, and they offer practical recommendations on waste management, monitoring standardization, fishing gear loss and public awareness. This evidence supports the Kingdom's marine environmental policies and its Vision 2030 commitment to a sustainable blue economy, and it contributes to the global goal of protecting oceans and coastal ecosystems from pollution.

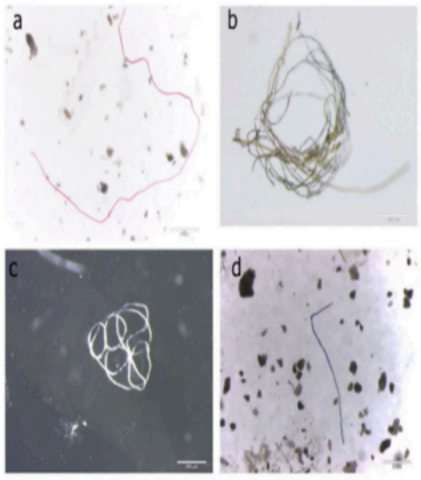












Research Publications:

1. Halfmoon Bay Sediment Baseline Study

Pulikkoden, A. K., Kannaiyan, N., Gopalan, J. V., Manikandan, K. P., Meleppura, R., Alhems, L. M., Rabaoui, L. J., Angari, M., Qasem, A., & Lozano-Cortés, D. (2026). First baseline assessment of microplastic presence in the coastal sediments of Halfmoon Bay, Arabian Gulf. *Marine Pollution Bulletin*, *231*, Article 120010. https://doi.org/10.1016/j.marpolbul.2026.120010

2. Arabian Gulf Marine Litter & Hazard Assessment Study

Pulikkoden, A. K., Neelavannan, K., Meleppura, R., Gopalan, J., Chaitanya, A. V. S., Saleem, A. A., Alaqad, K. M., Mohammed Ramees, P. V., Premlal, P., Rajaneesh, K. M., Alnuwairah, M. A., Manokaran, S., Rabaoui, L. J., Albert, J., Manikandan, K., Joydas, T. V., Alhems, L. M., Qasem, A., Katheeri, A. M., … Lozano-Cortés, D. (2026). Spatial distribution and hazard assessment of plastic-dominated marine litter along the Saudi Arabian Gulf Coast. *Journal of Hazardous Materials Advances*, *23*, Article 101262. https://doi.org/10.1016/j.hazadv.2026.101262

3. Saudi Arabia Microplastics Review Paper

Pulikkoden, A. K., Qashqari, M., Kannaiyan, N., AlAqad, K. M., Meleppura, R., Gopalan, J. V., Premlal, P., Manikandan, K. P., Maneja, R. H., Nazal, M. K., Qasem, A., Balkhi, H., Joydas, T. V., Rabaoui, L. J., Alhems, L. M., & Lozano-Cortés, D. (2026). Microplastics in Saudi Arabia: Environmental occurrence, research gaps, and challenges in extreme conditions. *Journal of Hazardous Materials: Plastics*, *2*, Article 100018. https://doi.org/10.1016/j.hazmp.2025.100018

4. Green Tiger Prawn Microplastic Ingestion Study

Pulikkoden, A. K., Shemsi, A. M., Kannaiyan, N., Manikandan, K. P., Qashqari, M. S., Qasem, A., & Lozano-Cortés, D. (2026). Assessing microplastic pollution in the gastrointestinal tract of green tiger prawns (*Penaeus semisulcatus*, De Haan, 1844) caught off the west coast of the Arabian Gulf, Saudi Arabia. *Environmental Monitoring and Assessment*, *198*, Article 550. https://doi.org/10.1007/s10661-026-15412-z