

## ASSESSMENT OF PLASTIC AND OTHER ANTHROPOGENIC DEBRIS POLLUTION IN BEACH AND MARINE HABITATS WITH ITS PREVALENCE IN FISHES OF SAINT MARTIN'S ISLAND

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### Abstract

Plastics and other anthropogenic debris have become emerging global pollutants due to their widespread dispersion and potential threats to marine ecosystems. In the present study, we have evaluated two types of pollution in Saint Martin's Island (SMI). First, we assessed the abundance and distribution of different anthropogenic debris (i.e. marine debris) comprising large/macro plastic (MaP; Size:  $\geq 5$  mm) items (e.g., plastic bottle, snacks and polythene packet etc.) and other debris materials (e.g., paper, cloth, wood, metal etc.) on the beach and underwater habitat. Secondly, microplastic (MP) concentration was assessed in the beach sand, marine waters, and three coral-associated fish species of SMI with their chemical composition (polymer types). Both field study and laboratory analysis were performed in the present study.

After first arrival of the research team at SMI for the present study, a beach cleaning activity was performed by the research team and volunteers from where available marine debris (MDB) of SMI was collected and counted. A total of 2549 items of MDB were counted for a combined weight of 62.35 kg from 10 collection sites during the beach cleaning event which contained a total of nineteen types of MDB, namely plastic bottles, snacks packets, soft plastic, coconut shell, straw, hard plastic, transparent polythene, tin can, paper, cloth, net, rope, wood, cork sheet, glass, rubber, metal, foam and mask.

In the assessment of daily accumulation of debris particularly by tourists along with other people, a total of 10153 numbers of MDB (i.e., MaP and other debris items) for a combined weight of 212.81 KG belonging to 20 types were measured in this study. The densities of MDB ranged from an average of 0.077-0.446 items per square meter of beachfront. Soft plastic was found to have the highest (25.91%) followed by snacks packet (20.77%) and plastic bottles (16.07%), coconut shells (8.66%), paper (5.89%), transparent polythene (4.83%), straw (3.85%). The other categories of debris like paper, cloth, net, rope, wood, cork sheet, nylon sacks, glass, rubber, metal, foam, mask were found as the lowest (less than 3%). Daily accumulation rates for marine debris were the highest on Saturday (18.05%) followed by Friday (16.95%) and Sunday (14.98%) which

denotes more MDB abundance is high in the national holidays when the tourist number is usually high.

The MP concentration in sediment samples of SMI was 51.67 to 278.33 particles per kg sand which were counted as 1225.65 to 6213.02 particles/m<sup>2</sup> area. The highest concentration of MPs was found in Site-5 (Navy point) whereas the lowest concentration was found in Site-1 (Chera dip). On the other hand, we measured the average MPs pollution in the marine water samples of SMI as 0.03 particles/m<sup>3</sup> of water which varied from 0.014 to 0.059 particles/m<sup>3</sup>. The highest concentration of MPs was found in Site-3 (adjacent marine water of Jetty) whereas the lowest concentration was found in Site-1 (marine water near Chera Dip). In the study of microplastics accumulation in fish, the average size of MPs found in orange-spotted grouper (*Epinephelus coioides*) was 24-1000 micrometers. The average size of MPs in two spotted red snapper (*Lutjanus bohar*) and black pomfret (*Parastromateus niger*) were 540-940 and 150-200 micrometers, respectively.

A total of five types of polymers in microplastics namely, Polyethylene (PE), Polypropylene (PP), Polystyrene (PS), high-density low-density Polyethylene (HDPE), low-density Polyethylene (LDPE) polymers were identified in sand and water samples. Polyethylene (PE) was found the most dominant (32%) followed by HDPE (24%), PP (20%) and LDPE (16%). PS was found the lowest as 8%.

A total of 116 items of thirteen types of marine debris (MDB) were found in underwater habitats and the average marine litter and debris pollution in underwater habitats varied from 0.12 to 1.18 items/meter. The highest number of MDB were found Near Jetty Ghat (52%) followed by in front of the coast guard office (25%). The lowest MDB was found in Jetty of Chera dip (5%).

The possible sources of macroplastic and microplastic in SMI were tourist plastic waste, nearby market waste, domestic plastic waste, and fish-market plastic waste. This work provides detailed plastic (macro and micro) pollutants and other anthropogenic debris data in the beach and water environment of SMI for the first time. It would be helpful for making effective strategies to deal with environmental problems of this recently declared MPA.

Two attractive giant sculptures of a coral fish and a sea turtles were set up at the beach made by using discarded plastic and polythene wastes collected from the beach. These unique art pieces were made to encourage the tourists and policy makers reducing, refusing, reusing and recycling of plastic pollutants in SMI. A number of waste bins were also distributed to the shopkeepers of beach shops so that they accumulate and remove the plastic debris and wastes in a certain place, not on the beach.

**Keywords:** Saint Martin's island, micro plastic, marine debris