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A preliminary study on coastal debris in Nallathanni Island, Gulf of Mannar Biosphere Reserve, Southeast coast of India

S. Krishnakumar^{a,*}, S. Srinivasalu^b, P. Saravanan^a, A. Vidyasakar^c, N.S. Magesh^d

^a Department of Geology, University of Madras, Guindy Campus, Chennai 600 025, India

^b Institute for Ocean Management, Anna University, Chennai 600025, India

^c Department of Geology, Periyar University PG Extension Centre, Dharmapuri 636701, India

^d Department of Geology, Anna University, Guindy Campus, Chennai 600 025, India

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ABSTRACT

Nine sampling stations were fixed to carry out the preliminary investigation on coastal debris from Nallathanni island, Gulf of Mannar Biosphere Reserve, Southeast coast of India. The coastal debris were separated and identified using hand picking, visual identification and microscopic studies. The coastal areas of the study region were less dominated by micro plastic contamination. The coastal debris was dominated by polyethylene bottles and fibrous fishnet materials. The distribution of the coastal debris along the coastal region is chiefly controlled by winnowing action of sea waves and Aeolian action along the berm region.

1. Introduction

Marine litter/debris is a new threat to the marine environment in the recent past, it's defined as any persistent, anthropogenically derived solid material abandoned into the marine and coastal environment. The recent studies reported that the manufacturing of plastic materials reaching > 300 million tons (PlasticsEurope, 2015). According to Jambeck et al. (2015) approximately 4.8 to 12.7 million tons of plastic wastes entered the ocean during 2010 (Table 1). The wide distribution of plastic materials rather than the other marine debris due to low degradation rate, buoyancy and long range surface transport through ocean currents and surface winds (Cózar et al., 2015; Perez-Venegas et al., 2017). Various studies have reported the occurrence of microplastic materials in the marine and coastal environment, especially in the following medium like seawater (Desforges et al., 2014; Cózar et al., 2016), beach sand/marine sediment (Blaskovic et al., 2017; Duarte, 2014) and marine animals (Besseling et al., 2015; Karami et al., 2017). Similar work also reported in the freshwater (Free et al., 2014; Jambeck et al., 2015), waste materials, treated waters (Dris et al., 2015) and lake environment especially in sediments (Fischer et al., 2016). Among these marine bottom dwellers, bivalves and oysters have been widely used in biomonitoring surveys for micro plastics in coastal waters due to their suspended particle filter feeding habit, sedentary living and their importance in human food web (Phuong et al., 2017). The remote coastal areas, especially coral island/islands have higher plastic debris accumulation compared to continental coastal sites due to the wave action

(Hidalgo-Ruz and Thiel, 2013). The marine debris accumulation in the remote islands is primarily from the non local sources. Most of the debris is transported from continental sources, fishing boats and ships in the high seas (Ingraham and Ebbesmeyer, 2001). The recent reports were documented the harmful effects of marine plastic/microplastics on marine vertebrate species due to ingestion and/or entanglement of fish, turtles and marine mammals (Mizraji et al., 2017; Gramentz, 1988; Denuncio et al., 2017; Avery-Gomm et al., 2017).

The Gulf of Mannar Marine National Park (GOMMNP) is the first Marine Biosphere in South East Asia. This biosphere reserve consists of 21 coral islands and its 10 km buffer zone was declared as a Biosphere by the Government of India in 1989. The GOMMNP is flourished by 77.8% of reef building coral and 22.2% of the reef is made of non-reef building coral. The geology of the coral islands is chiefly manifested by coral sand and lithoclastic fragments. Two non-perennial rivers, namely Vembar and Vaippar are closely confluent into the study region. The Aeolian and marine process chiefly controls the distribution of sediments along the study area (Krishnakumar et al., 2017a, b). The anthropogenic induced marine pollution on coral species and marine sediments was extensively documented (Jayaraju et al., 2009; Krishnakumar et al., 2010; Krishnakumar et al., 2017a, b). The awareness about marine debris and plastics was recently created by the government and research organization of India through awareness programs. Recently, the accumulation of marine microplastic debris in coastal sediments after major flood event at Chennai Metropolitan, India was reported by Veerasingam et al. (2016). A preliminary

* Corresponding author at: Institute for Ocean Management, Anna University, Chennai 600025, India
E-mail address: coralkrishna@yahoo.co.in (S. Krishnakumar).

Table 1

Coastal population, waste generation including plastic wastes, marine plastic materials of the selected Asian countries.

Source – Jambeck et al., 2015.

S.no	Country name	Coastal population (in millions)	Waste generation rate (kg/ppd)	Plastic waste (in %)	Mismanaged plastic wastes (MMT/year)	Total mismanaged plastic wastes (in %)	Plastic marine debris (MMT/year)
1	China	262.9	1.1	11	8.82	27.7	1.32–3.53
2	Pakistan	14.6	0.79	13	0.48	1.5	0.07–0.19
3	Burma	19	0.44	17	0.46	1.4	0.07–0.18
4	Bangladesh	70.9	0.43	8	0.79	2.5	0.12–0.31
5	Sri Lanka	14.6	5.1	7	1.59	5	0.24–0.64
6	India	187.5	0.34	3	0.6	1.9	0.09–0.24

ppd - person per day; MMT, million metric tons; total mismanaged plastic waste is calculated for populations within 50 km of the coast in the 192 countries considered.

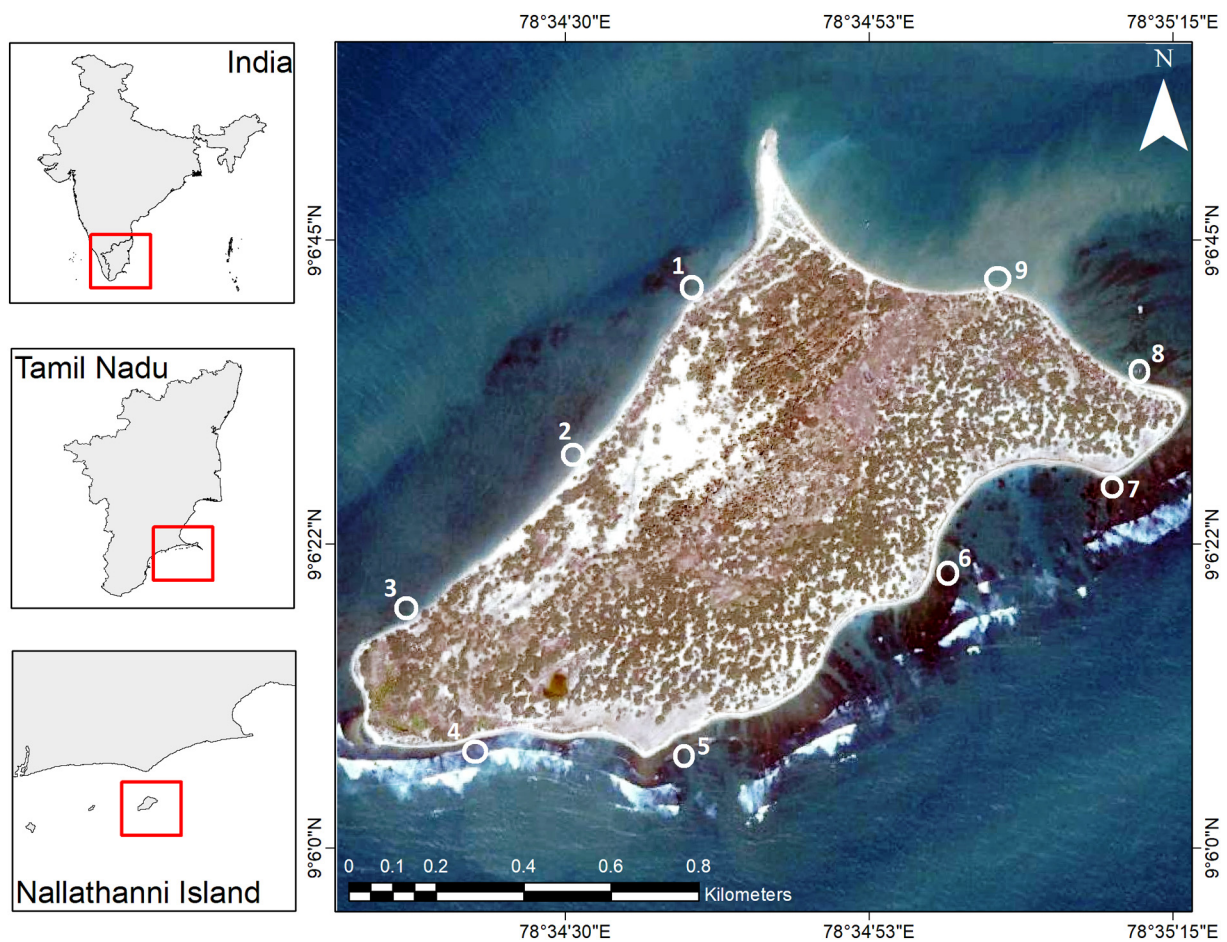


Fig. 1. Sampling stations and location map of the Nallathanni Island.

investigation was carried out on marine debris on the Chennai Marina Beach (Arunkumar et al., 2016). Similarly, the detailed investigation was carried out on remote islands and tropical coral reef environment of various part of the world (Perez-Venegas et al., 2017; Nunes et al., 2017; Herrera et al., 2017). Under this circumstance, a study was designed to find out the extent of marine debris in the coastal environment with an aim to create and document the marine debris pollution in coral islands of the Gulf of Mannar Biosphere reserve, Tamil Nadu, India.

2. Materials and methods

The study was conducted during 16th October 2017 to 19th October 2017. The marine litters/debris was collected from the coastal stretch of the Nallathanni Island for evaluation. The maximum marine debris was observed and collected from the seaward side of the coast (size of the seaward side of the coast 0.83 × 0.02 km). The nine sampling quadrants were marked between the berm and high tide line of the coast. The amount of marine debris per quadrant was counted by visual

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