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Short Communication

Anthropogenic Interventions in the Coastal Environment – A Serious Threat to Insular Ecosystem in Kadmat Island, Lakshadweep, Southwest Coast of India

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ABSTRACT

The growing crisis in the coastal environment is the presence of pollutants and other anthropogenic activities which ultimately results in deterioration of coastal biodiversity and ecosystem. Present study reports based on the research conducted during November 2019 provide the initial findings regarding the threats faced by the insular ecosystem of Kadmat Island. Transect line with equal intervals and quadrate method were used for the survey of marine debris. Field observations and photographs were taken to record the impact of coastal modifications by unscientific constructions. Sandy beaches are the highly vulnerable marine ecosystem and a number of persistent drivers are negatively impacting and undermining their ability to provide these services. Marine debris contributed mainly by plastic is considered as one of the principle reason for concern in the coastal environment. The uncontrolled developmental activities and unscientific coastal protection measures are another leading cause deteriorating the health of the beaches. This study forms a baseline data for efficient management of coastal environments based on field survey at Kadmat Island of Laskhadweep, southwest coast of India.

Keywords*:* Coastal Pollution, Lakshadweep island, Anthropogenic activities, Aquatic Environment, Marine debris, Coastal Ecosystem.

INTRODUCTION

Coastal environment plays an ideal role in providing ecosystem functions and services that humans derive from the ocean. The numerous ecosystem services offered by the coastal habitats including livelihood, food, leisure, and socio-cultural well-being rely on the health of the ecosystem. Biodiversity loss is the most critical environmental issue of the world, threatening essential ecosystem services as well as human well-being (Ceballos et al. 2015). Over the years, coastal environments have been facing so many recurring natural hazards and anthropogenic interventions resulting in coastal erosion and ecosystem degradation. The marine lifes are susceptibile to a number of hazards which comes in different forms such as pollution, overexploitation of resources, disposal of wastes, land reclamation, dredging, coastal modifications and climate changes (Beatley 1991). Vulnerability of sandy beach ecosystem to a number of persistent changes threaten their ability to continue providing their services. One of the most pressing of these drivers is marine debris, which is contributed mainly by plastic littered on the shore and discarded into the sea. Hence plastics have significant and wide-ranging repercussions on human health, environment, tourism, and beach aesthetics (Thompson et al. 2009). Recent studies show the detrimental impact of microplastic exposure on human beings and living animals (Smith et al. 2018, Barboza et al. 2018). Microplastics in the coastal and aquatic ecosystem cause significant harm to ocean life, fishery resources, death of marine animals through the entanglement and ingestion of plastics, their consequent leaching and introduction

of harmful chemicals into the food chain (Wilcox et al. 2015). The sensitive balance between the biodiversity and growth on the atolls of Kadmat, Lakshadweep is heavily dependent on the complex fragile ecosystems, with the livelihoods of the Islanders relying on coconut, agriculture, fish and coral reefs. Land area of Kadmat Island is very limited, but the seas around the islands are diverse. Thereby the development activities in such land areas alter and degrade the health of associated ecosystem. With an increasing population along the coast, artificial structures are being built to protect the coastal community from the natural process. This has resulted in severe coastal hardening and changes in sediment dynamics in many coastal areas (Airoldi et al. 2005). A relatively less number of anthropogenic intervention studies related to coastal environment have been conducted in Lakshadweep Islands so far. Earlier studies of Kokranikkal et al. (2003) depicted the environmental implications due to island tourism in Lakshadweep. The assessment of human impacts is crucial for the prediction and prevention of structural and functional alterations in habitats (Jayappa 2017). Such hazards impose high risk to small oceanic coral islands like Lakshadweep atolls of southeastern Arabian Sea. The present study on the threats to the island ecosystem of Kadmat, Laskshadweep was carried out to highlight these issues.

MATERIALS AND METHODS

Kadmat is an important atoll belonging to Lakshadweep archipelago (Fig. 1), southwest coast of India (Lat. 11°102 and 11°162 N and Long. 72°452 and 72°482 E). The atoll has an area of 3.20 km^2 with a lagoon on the south west side. Studies were conducted in the month of November 2019. Sample materials from the coastal areas were collected using a quadrate of 1m x 1m size selected on a transect line with equal intervals. This method was opted entirely for the survey of marine debris. Field observations were made to record the outcomes of coastal modifications by unscientific constructions. Photographs of the marine debris and coastal structures were taken using Nikon digital camera. Marine debris in each quadrate was sorted and their percentage of occurrence computed,

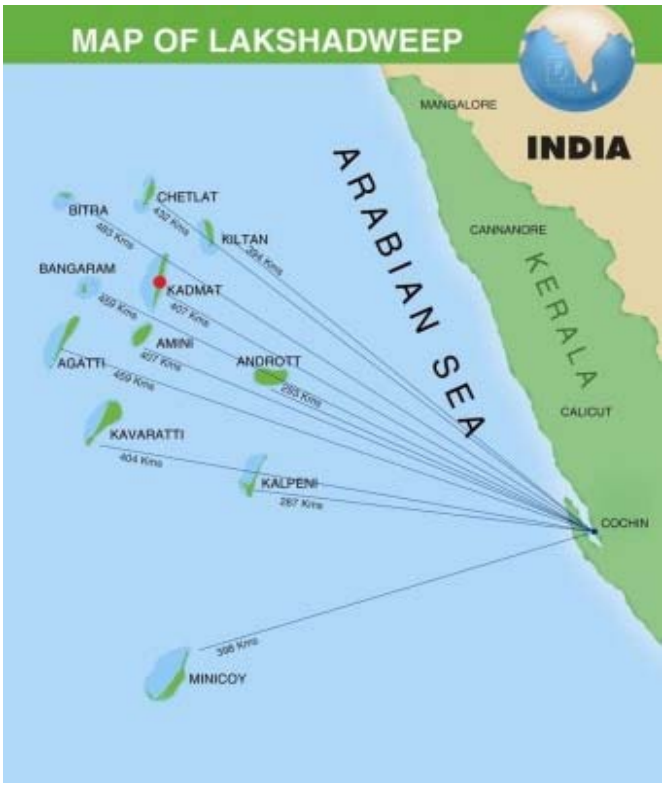

Figure 1. Map showing study area (•)

respectively.

RESULTS AND DISCUSSION

The study provides an account of the prevalence of marine debris in many areas, including polluted coastlines and ports. It was observed that the major share of debris was contributed by plastic bottles (70%), followed by plastic covers (20%), glass materials (5%) and the remaining miscellaneous include chappals, nets and thermocol sheets (polystyrene). The biomedical waste discarded into the beach included remnants of capsule strips, medical bottles and sanitary napkins which act as foul smelling stagnant pools aiding the mosquitoes to breed and thus causing high chance of propagation of several diseases. It was found that the unscientific construction of coastal protection measures formed the second major risk to the coastal environment of Kadmat Island (Fig. 2). Plastic debris burned in some areas of the beaches imposes a severe environmental issue in Kadmat Island. The splinters of leftover glass tubelights on being transported by wind and water create serious annoyance by entering coastal waters and thereby impart disturbances to the organisms by rupturing their internal organs upon ingestion of these

Figure 2. Unscientific construction of coastal structures

remains. According to Jambecket et al. (2015), less denser plastic particles transported to adjacent coastal areas by the action of tidal waves, drift current and wind in turn lead to their accumulation indifferent parts of the shoreline. According to the report of (GESAMP 2015), among 8 million tons of plastic are entering the world'socean every year, less than 20 per cent derives from ocean-based sources such as fishing and fishing vessels; the remaining 80 per cent arises from land-based sources.

Studies of (Verma et al. 2016) revealed that burning of plastics releases toxic gases such as Mercury, Dioxins, Polychlorinated Biphenyls and Furans into the atmosphere which in turn increases the threat to human and animal health, crops and vegetation, water bodies and associated environment. Consequently, the effects of marine debris are not only affecting the aesthetic value, it impose significant impacts on marine environments, ecosystems, as well as on human health and wellbeing .The pitfalls arising from the unscientific construction of coastal protection structures in inappropriate locations could be overcome by encouraging the establishment of bioshields. Many coastal environments that were once stable have turned its way to erosion due to unscientific coastal protection structures adopted without conducting adequate studies to determine the suitability of such structures (Nair et al. 2018). Little work has been done till date investigating the effect of such structures on coastal vulnerability of Kadmat Island. In addition, coastal structures disintegrate habitats, decrease connectivity with neighboring habitats, and prevent serious ecotone processes (Jahangirzadeh et al. 2012). Construction of coastal structures by placing tetrapods increased the coastal erosion instead of reducing. Although the coast is secured with coastal structures, thorough investigation is needed to analyse and comprehend the sequels of these construction activities. The seagrass ecosystem is the most peculiar and periodic types of biotopes in the coastal environment around the world (Prabhakaran et al. 2013). The hitting of waves and the churning of sediments increased the turbidity of the lagoon and adversely affected the growth of seagrass and enhanced the growth of filamentous algae.

Loss of seagrasses has been correlated with large volumes of sediment load, originating from extensive land clearing and coastal constructions within the catchment and lagoons. The loss of seagrass ecosystem is a menace to the biodiversity of the lagoon, coral reef ecosystem and the existence of oceanic coral islands. Once the integrity of the meadow has been damaged (whether natural or anthropogenic), it will be exposed to increased damage by sediment re-suspension and siltation (Nakaoka et al. 2014). Observations of survey based studies makes the situation very alarming in Lakshadweep Islands, especially in Kadmat. Importance of developing awareness among the native people towards sustainability is a matter so relevant of concern in the area. Sustainable development goal 14 focused on seas, oceans, and its resources, was adopted in 2015 foreseeing the outcomes of the 2030 agenda for sustainable development. The aim is to achieve the specific target of pollution free marine environment that intensify and maintain the health of marine ecosystem. In this context, this preliminary survey is a pointer towards achieving such goals.

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