INTRODUCTION

Geological phenomena such as sediment deposition and erosion, destructive waves and currents, and heavy winds have a great influence on structuring coastal environments, causing people to face fear due to natural hazards as well as pleasing through wonderful sediment deposition as natural beaches (Dronkers, 2016). However, these processes are not so easy to regulate, but evidence based previous documentations and time lapsed studies alone will help to understand these events to an extent. Many coastal regions around the world are known to face coastal erosion and depositions, including damage of underwater ecosystems such as coral reefs due to coastal processes (Scheffers et al., 2009; Lim et al., 2018). Therefore, understanding such processes will greatly help scientists to make immediate and safety measure to protect islands, ecosystems or coastal lands from hazardous geologic processes. Gulf of Mannar Marine Biosphere Reserve (GOMMBR) is one of the rich marine biodiversity hot spots well studied in the tropical marine environments of Southeast Asia. Specially, coral reefs and seagrass ecosystems are greatly explored for different aspects including ecological, physiological, biochemical, nutritional and biomedical applications (Kumaraguru et al., 2006). Earlier studies have detailed the coastal changes and coral reef changes with regard to coastal erosion and accretion aspects have been reported from some islands in the GoM (Thanikachalam and Ramachandran, 2003; Muthukrishnan et al., 2013). However, geological aspects such as reef ridges, sediment accretion, coral mounds from coastal environments are not documented. In this connection, the present study has aimed to document such events occurring in coral reef areas and coastal waters of GoM and Palk Bay regions for taking immediate action to protect reef areas as well as coastal lands.

MATERIALS AND METHODS

Extensive field surveys were conducted on fringing coral reefs distributed in 14 Islands under GoM region (Mandapam and Keezhakkarai groups) as well as in Palk Bay region. Surveys were performed during August 2018 to May 2019 in both the regions. Series of geological events such as coral mounds, coral ridge, sand bars, sand alluviation and coastal erosion observed

*Corresponding author: CH. Ramesh
National Centre for Coastal Research (NCCR), Ministry of Earth Sciences, NCCR Field Office, Mandapam-623519, Tamil Nadu, India
during this study period were documented by photography using Nikon Coolpix camera. Dimensions (length, width and height) of coral mounds, coral ridge and sand bars were measured using measuring tape. Locations of these geological phenomena are recorded using Garmin GPS.

RESULTS AND DISCUSSION

Three coral rubble mounds have been observed in GoM, of which two at Appa Island (AI) and another at Talari Island (TI) (Fig. 1). The dimensions of TI coral mound were 18 m length, 17 m width and 1.5 m height. Coral mound of TI also connected with 46 m length coral ridge. The dimensions of first and second coral mounds in AI were 52 m length, 16 m width and 3.5 m height and 18 m length, 18 m width and 5 m height, respectively. Heavy waves flashing these coral mounds were observed (Fig. 2a-c, e&f). Interestingly, field evidences reveal that previous fringing dead reefs around the AI were observed to be damaged by series of sediment deposition (Fig. 2d). These damaged reefs were now covered by sediment and appears as coastal land. However, the present southwest coastal land of up to 5 m in AI presents past decade dead fringing reef which was covered by series of sediment deposition events. Sea caves and cliffs were also observed at north side of AI. Similarly, accretion of dead corals followed by sediment deposition pattern over accreted corals in Shingle Island and Nallathanni Island are observed to change the island topography by extending island area at some points (Fig. 2g&h). Deposition of large amount of sediment over washed ashore massive seagrass in Dhanushkodi beach area also found to be dangerous (Fig. 2i), as this does not provide a solid base like true sediment bar but goes inside as quicksand. There is chance of struck into this quicksand for unknown people who walk across this area. Thus this area needs to be highlighted for public safety.

Also, large amount of sediment deposition near Hare Island and a large coral ridge formation near Manoli Island were observed during this study (Fig. 3a-i). The total area of sediment deposition observed was 50 m length, 34 m width and 3 feet height (Fig. 3). While, coral ridge dimensions was 410 m length, 12.4 m width and 3 feet height (Fig. 3e-i). Many seabirds and few eagles were sighted at coral mounds, sediment accretion and coral ridge areas. Despite of coral mound formations and commonly seen sand dunes, several other coastal processes such as sand stone formation and beach erosion were observed around Mandapam region (Fig. 4a-i). Recently, development of a coral mound due to current processes was observed from northeast Atlantic (Lim et al., 2018). Thus these aspects are needs to be studied with reference to geologic processes for further coastal management to protect inland and island ecosystem topographies.
records the dimensions of coral ridge (f), eagles and some marine birds relaxing at ridge area (g & h).

Field observations indicated that wind driven heavy waves and current patterns might be the reason for accretion of these coral mounds, coral ridge and sediment depositions. However, several other aspects such as wave and tidal energy across reefs (hydrodynamics) and bottom topography (elevation and slope) aspects are needed to be studied during nonstorm and storm conditions. This will help to understand the actual geomorphic activity involved in regulation of these geomorphic features in coral reefs areas of GoM. Formation of coral rubble ridges and mound on shores of Caribbean and other areas were reviewed and found that these phenomena occurred due to tides and wave run-up, orbital movement of waves, storm surges, hurricanes, and cyclone or tsunamiis (Scheffers et al., 2009; Spiske and Halley, 2014). Perhaps, frequent cyclone events, storms and heavy wind driven waves and currents might be the key factors involved in these processes observed in GoM and Palk Bay regions (Muthukrishnan et al., 2013). While, erosion of inland and island beaches in both GoM and Palk Bay regions are needs to be studied with regard to current pattern. Landforms are known to develop over a range of different time scales. Some develop quickly, while others would take millions of years to form geological structures. Although coastal landforms are very dynamic in nature; seasonal variations in the hydrodynamic conditions could bring about vast changes in the landforms at regional or local scale. Therefore the present study documentation will be usefulas timely events occurred in GoMfor geologists to investigate these aspects for future predictions on topographic changes happening in coral reef areas as well as the surrounding coastal beaches. Further studies are urgent to understand these geological processes for protecting coral reefs as well as coastal lands of GoM and Palk Bay from erosion.

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