

Assessment of Coastal Erosion and Shoreline Changes in Dutch Bay, Trincomalee, Sri Lanka

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Assessing long-term coastal behavior is important to detect coastal erosion, deposition, and shoreline changes in important coastal areas. Dutch Bay, located at Trincomalee, Sri Lanka, has historical value, ecological significance, tourism potential, and economic importance. This study examines coastal erosion and shoreline changes from 2015 to 2025 along the Dutch Bay coastline, using high-resolution Google Earth satellite images with appropriate corrections and the Digital Shoreline Analysis System in ArcGIS. The End Point Rate (EPR) method quantified shoreline changes over time. The results indicate substantial spatial variability in shoreline movement, with EPR values ranging from -1.66 m/year to +2.02 m/year. Despite this variation, the mean EPR value of +0.12067 m/year suggests a slight overall accretional trend. Severe erosion is mainly concentrated in the northern area of the Dutch Bay, especially near man-made coastal structures, which block the natural longshore sediment transport and increase the speed of shoreline retreat due to stronger wave energy. Low erosion areas are located near severe erosion areas, but they are also slightly eroding due to not receiving sufficient sand over time. The central region exhibits relatively stable shoreline conditions due to a balance between sediment gain and loss. Accretion was observed in the central and southern parts of the study area. Coastal erosion and shoreline changes in the study area are influenced by a combination of natural factors such as wave energy, longshore sediment transport, seasonal wind patterns, coastal geometry, and anthropogenic activities, including coastal structures. As a result, these coastal changes pose risks to habitats, biodiversity, and socio-economic activities such as tourism, fishing, and recreation. The findings highlight the need for sustainable coastal development strategies for effective management of the Dutch Bay coastal zone.

Keywords: Coastal erosion, Dutch Bay, End point rate method, Shoreline changes