

Spatial and temporal variation of surface chlorophyll-a and sea surface temperature over coral growing territorial water of Sri Lanka

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Abstract

Environmental drivers on coral reef ecosystems vary spatially and temporally with natural or anthropogenic induces. Reef structure, function, extent, growth rate, quantity, diversity, and species, are influenced by such environmental variabilities. Understanding the dynamics of abiotic–biotic interactions requires accurate characterization of environmental drivers on reef ecosystems. Hence, this study reports the chlorophyll-a concentrations and Sea Surface Temperature (SST) demarcated by remote sensing techniques in territorial waters (12 nm zone) where the majority of coral reefs are situating around Sri Lanka, in periods of different monsoon patterns (First inter-monsoon, Southwest monsoon, second inter-monsoon, and Northeast monsoon) are occurring from 2005 to 2020. Hence, Moderate Resolution Imaging Spectroradiometer (MODIS) aqua images of Chlorophyll-a and SST which were taken as three per month were analyzed by SeaDAS 7.5.3, and then ArcGIS 10.8 was used to clip reprojected raster layer into 12 nm zone from the baseline of the country. Those were further clipped into different study regions as Eastern, Northern, Southeast, Southwest, and Northwest regions concerning climatic patterns. Significantly different ($p < 0.05$) mean chlorophyll-a concentrations and SST resulted for the above different study regions during the 2005–2020 period. The mean chlorophyll-a concentrations and SST also differed significantly ($p < 0.05$) to different monsoon patterns affected throughout the study period. The highest mean chlorophyll-a value (3.75 mg/m^3) was recorded during the southwest monsoon period in the Southwestern territorial water while the lowest value (0.40 mg/m^3) was in the Southeastern territorial water during the first inter monsoon. The highest mean SST value ($29.51 \text{ }^\circ\text{C}$) was recorded in the Northern region during the first inter monsoon while the lowest SST ($18.96 \text{ }^\circ\text{C}$) was in the Southwestern region during the Southwest monsoon. Observed irregularities of chlorophyll-a could be due to nutrients drained from terrestrial water runoff with activated monsoon patterns. Sometimes, the upwelling of nutrient-rich cool water into the upper layers could occur with the activated monsoon. Weather conditions, changes of current patterns, activation or deactivation of upwelling systems, and extreme conditions might have caused those variations of SST in different regions and monsoon patterns. Therefore, corals in these 12 nm zones must be sustained with those highly dynamic conditions in different monsoon periods of the year, and therefore, coral conservation strategies are better to be adjusted accordingly.

Keywords: *Coral reefs, ocean color, threats to corals, phytoplankton density, ocean climate*

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