

Spatial and temporal variations in environmental variables and phytoplankton composition and biomass as indicators of coral reef health status around Unguja, Zanzibar, Tanzania

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The release of inorganic nutrients and frequent tourism activities affect coral reefs surrounding the Zanzibar coast. Phytoplankton indirectly indicate health status of coral reefs due to their sensitivity to changes in environmental parameters. This study explored the spatial and temporal variability in water quality and nutrients in relation to phytoplankton community composition and chlorophyll a concentration at four coral reef sites in Unguja Island at Bawe, Mnemba, Chumbe and Pongwe sites. In situ measurements of dissolved oxygen, temperature, salinity and pH was done every month for one year. Surface water samples were collected for determination phytoplankton composition, nutrients and chlorophyll a concentrations. Dissolved oxygen, temperature, salinity and pH did not differ significantly among the four sites ($p > 0.05$) but showed significant temporal variations ($p < 0.05$). Spatially, Bawe had significantly higher phosphate, nitrate and chlorophyll a concentrations than Chumbe Mnemba and Pongwe ($p < 0.05$). Chlorophyll a concentration was spatially inversely related to distance from Unguja town ($p < 0.05$) while it was temporally significantly positively correlated with dissolved oxygen, nitrate and phosphate ($p < 0.05$). The values for phosphate and nitrate were less than 3 mg L⁻¹ and 14 mg L⁻¹, respectively for eutrophic oceans. Phytoplankton species were dominated by Bacillariophyceae (70.83%) while some species identified such as Ceratium sp., Dinophysis sp., Protoperidinium sp. and Prorocentrum sp., Oscillatoria sp. and Dictyocha fibula are known to produce toxins that affect fish species. Conclusively, the coral reef sites have low nutrient levels and are in good health, however, the existence of toxic phytoplankton species suggests careful consumption of fisheries resources therein and frequent monitoring for Harmful Algal Blooms (HABs) is required. Mechanisms are required to limit the release of domestic sewage from households and hotels to safeguard the coral reefs at Bawe.