Spatio-temporal Dynamics of Seaweed Resources in Ghana: Implications for Sustainable Blue Economy Development

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Abstract:

Coastal seaweeds are increasingly recognized as strategic resources for ecosystem stability, climate mitigation, and sustainable blue economy development. Despite Ghana's coastline being among the richest in seaweed in West Africa, quantitative, long-term investigation of their ecological dynamics remains limited. The study presents a comprehensive multiyear assessment of the spatial and temporal variability of seaweed diversity and biomass across five ecologically contrasting coastal sites in Ghana. Sampling at each site involved the use of two transect lines along with quadrats, each with an area of 0.25 m². A total of 35 seaweed taxa were recorded, comprising 15 Rhodophyta, 11 Chlorophyta, and 9 Phaeophyta, confirming the high biodiversity potential of Ghana's coastal system. Significant spatial variation was evident, with Komenda recording the highest species diversity, whereas Takoradi exhibited the lowest. Conversely, biomass patterns displayed an inverse relationship, with Takoradi showing the highest mean monthly biomass and Komenda the lowest, indicating a decoupling between diversity and productivity. Temporal trends indicated strong seasonal influences, with peak biomass occurring during the major upwelling period (August-October), while the lowest values were recorded between December - February. These taxa, *Hydropuntia dentata* (44%), *Ulva fasciata* (15%), and *Sargassum vulgare* (14%), accounted for the majority of biomass and exhibited distinct spatial and seasonal patterns. Environmental drivers, including substrate type, wave exposure, and nutrient availability, were identified as key determinants of observed patterns, with rocky shores supporting higher diversity and biomass accumulation. This study provides a robust ecological baseline for Ghana's coastal seaweed resources, identifying priority sites and optimal harvesting periods. The findings offer critical insights for advancing seaweed-based aquaculture, enhancing coastal livelihoods, and supporting climate-resilient blue economy strategies in West Africa