

Impact of Anthropogenic Stresses on Plankton Biodiversity in Indian Sundarban Megadelta: An Approach towards Ecosystem Conservation and Sustainability

Authors : Dibyendu Rakshit, Santosh K. Sarkar

Abstract : The study illustrates a comprehensive account of large-scale changes plankton community structure in relevance to water quality characteristics due to anthropogenic stresses, mainly concerned for Annual Gangasagar Festival (AGF) at the southern tip of Sagar Island of Indian Sundarban wetland for 3-year duration (2012-2014; n=36). This prograding, vulnerable and tide-dominated megadelta has been formed in the estuarine phase of the Hooghly Estuary infested by largest continuous tract of luxurious mangrove forest, enriched with high native flora and fauna. The sampling strategy was designed to characterize the changes in plankton community and water quality considering three diverse phases, namely during festival period (January) and its pre - (December) as well as post (February) events. Surface water samples were collected for estimation of different environmental variables as well as for phytoplankton and microzooplankton biodiversity measurement. The preservation and identification techniques of both biotic and abiotic parameters were carried out by standard chemical and biological methods. The intensive human activities lead to sharp ecological changes in the context of poor water quality index (WQI) due to high turbidity (14.02 ± 2.34 NTU) coupled with low chlorophyll a (1.02 ± 0.21 mg m⁻³) and dissolved oxygen (3.94 ± 1.1 mg l⁻¹), comparing to pre- and post-festival periods. Sharp reduction in abundance (4140 to 2997 cells l⁻¹) and diversity ($H' = 2.72$ to 1.33) of phytoplankton and microzooplankton tintinnids (450 to 328 ind l⁻¹; $H' = 4.31$ to 2.21) was very much pronounced. The small size tintinnid (average lorica length=29.4 μ m; average LOD=10.5 μ m) composed of *Tintinnopsis minuta*, *T. lobiancoi*, *T. nucula*, *T. gracilis* are predominant and reached some of the greatest abundances during the festival period. Results of ANOVA revealed a significant variation in different festival periods with phytoplankton ($F = 1.77$; $p = 0.006$) and tintinnid abundance ($F = 2.41$; $P = 0.022$). RELATE analyses revealed a significant correlation between the variations of planktonic communities with the environmental data ($R = 0.107$; $p = 0.005$). Three distinct groups were delineated from principal component analysis, in which a set of hydrological parameters acted as the causative factor(s) for maintaining diversity and distribution of the planktonic organisms. The pronounced adverse impact of anthropogenic stresses on plankton community could lead to environmental deterioration, disrupting the productivity of benthic and pelagic ecosystems as well as fishery potentialities which directly related to livelihood services. The festival can be considered as multiple drivers of changes in relevance to beach erosion, shoreline changes, pollution from discarded plastic and electronic wastes and destruction of natural habitats resulting loss of biodiversity. In addition, deterioration in water quality was also evident from immersion of idols, causing detrimental effects on aquatic biota. The authors strongly recommend for adopting integrated scientific and administrative strategies for resilience, sustainability and conservation of this megadelta.

Keywords : Gangasagar festival, phytoplankton, Sundarban megadelta, tintinnid

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