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Editorial: Coastal environmental quality and marine biodiversity assessment, volume II

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Editorial on the Research Topic
Coastal environmental quality and marine biodiversity assessment, volume II

The biological productivity and ecological sustainability of coastal and marine ecosystems are greatly associated with abiotic and biotic factors in the surrounding coastal ecosystem (Yuvaraj et al., 2018). Large volumes of contaminants are being released from anthropogenic sources like industry, agriculture, and urban areas which result in the deterioration of seawater and sediment quality in coastal areas. The bulk of marine pollution comes from above-mentioned sources, accounting more than 80% of its sources on land. Offshore oil & gas extraction and maritime oil transportation are also one of the major sources of pollution in the coastal and marine environments. Consequently, the issue of coastal pollution has spread throughout the world and requires proper mitigation planning for sustainable ecosystem management.

Anthropogenic discharges of pollutants into the coastal zone have led to increased concentrations of nutrients, metals, and microorganisms, which are negatively affecting the world's estuaries and coastal environment. To help understand geographical and temporal changes in coastal environment ecology, it is crucial to prevent and control coastal and marine pollution and develop better monitoring systems. Recent technological advances in monitoring the seawater quality of coastal and marine environments and ecology, such as automated data collecting, real-time data gathering, and periodic monitoring of these ecosystems, are crucial to comprehending real-time data and its environmental implications.

Physicochemical characteristics of water, nutrients, microorganisms, metal toxicity, phytoplankton, and sediment quality are significant variables that require monitoring (Jha et al., 2021; Ratnam et al., 2022; Sathish Kumar et al., 2022). Good water and sediment quality are very important for the sustainable fishery, especially for the small lobsters (Scyllarinids) which do not form a prominent fishery, but they form an important link in the benthic and pelagic biodiversity in nearshore waters (Sekiguchi et al., 2007; Kumar et al., 2009). Regular monitoring of coastal and marine environment is required to estimate the physicochemical and biological characteristics of seawater and sediment to develop a mitigation plan for promoting healthy habitats for flora and fauna, and contribute to coastal conservation and fisheries management (Vijayakumaran et al., 2005; Jha et al., 2017, 2018). The study examines the scientific strategies, including a recently developed statistical model, or a mix of methods in the coastal and marine environment, emphasizing ecological and environmental degradation and suggesting mitigation management.

Seawater quality and its impact on coastal and marine ecosystem

Trace metals are released into the coastal and marine environment by a variety of natural and anthropogenic activities, including dust deposition, volcanic eruptions, mineral weathering, mining, fossil fuel combustion, agriculture, industry, maritime traffic, urbanization, & sewage discharge, and thus enter the food web (Koduvayur et al., 2022). Naik et al. revealed that Cadmium and Arsenic concentrations are considered prime contributors to ecological risk along the estuarine and coastal regions of Tamil Nadu. Further, the findings also revealed the level of metals (Cr, Cu, Pb, Cd, Co, Mn, Ni, Zn, As), would increase over time as a result of emerging industries such as ceramic, painting, glass, pesticides, herbicides, and battery manufacturing in the surrounding vicinity. Water environments may purify themselves to some extent, but when wastewater discharge loads exceed a threshold, a natural equilibrium is upset, resulting decline in water quality. Chen et al. reported that the total nitrogen, total phosphorus, and chemical oxygen demand in Zhanjiang Bay's upstream discharge outlets exceed the permissible limits. However, since Zhanjiang Bay has been largely nitrogen-restricted over the past decade, the impact of nitrogen discharges on eutrophication in the bay may also be insignificant. He et al. reported that chemical oxygen demand significantly and positively correlated with dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphate (DIP) in all the seasons at Guangdong coastal water. Further, DIN/DIP exhibited a significant positive correlation with Chl-a in all seasons, indicating that high Chl-a concentrations could be due to the nutrient supply in marine ecosystems and hence, it is imperative to strengthen the integrated management of land and sea and effectively combat the eutrophication of coastal and estuary waters to prevent algal blooms.

Planktons, which are divided into two groups: zooplankton (animals) and phytoplankton (plants), are a diverse group of aquatic organisms that are unable to swim against the water current (Jha et al., 2023). Small plants known as phytoplankton are considered to be the primary energy source in aquatic environments and constitute the majority of the plankton population. The manmade activities that contribute pollutants and nutrients to coastal waters make them dynamic and these modifications may affect primary production patterns and, consequently, pelagic food webs of the coastal and marine ecosystem (Sathish Kumar et al., 2023). Eutrophication in coastal and marine ecosystems is a serious global issue due to the regular input of nutrients from land-based sources (Ratnam et al., 2022). There is a need for innovative tools to assess eutrophication and hence Zhou et al. applied two comprehensive methods the Assessment of Estuarine Trophic Status (ASSETS) and the Northwest Pacific Action Plan Common Procedure (NOWPAP CP) to better understand the health of the Guangdong coastal waters. Further, it was proposed that the NOWPAP CP approach could provide information about the long-term changes in the biological effects of nutrient enrichment, while the modified ASSETS method could more comprehensively and precisely demonstrate the eutrophication conditions in the coastal waters of Guangdong. Wang et al. revealed that supplementing with B vitamins, specifically B1, B12, and to a lesser extent B2 and B6, caused notable changes in the composition of phytoplankton communities, further, it was observed that some phytoplankton species, such as diatoms and Prymnesiales, may be auxotrophic for B vitamins and that they would become more abundant when given extra B vitamins. The resulting changes in phytoplankton communities reduced Copepoda populations, leading to a decrease in their relative abundance. Sathish Kumar et al. studied several stations scattered across Tamil Nadu's five coastal districts and observed the spatial variation of the phytoplankton community and its response to shifting environmental conditions. They reported 85 species of phytoplankton, including diatoms (64), dinoflagellates (18), silicoflagellates (1), and Cyanophyceae (2) showed that the south coast of Tamil Nadu had a progressive decline in phytoplankton abundance, which was highest in the Thanjavur coast and could be related to the high nutrient in the coastal waters. Wang et al. revealed that there is no clear evidence of diatom and dinoflagellate succession with N:P ratio across seasons in the East China Sea. They demonstrated that the bulk of the study region was mid-eutrophic with severe organic pollution, and that eutrophication and organic pollution had a considerable impact on phytoplankton abundances. Furthermore, faster warming caused by coastal nuclear power plants, as well as nitrogen regime changes, have a substantial impact on the phytoplankton community's temporal shift. These findings provide important insights into how eutrophic conditions affect the structure of phytoplankton communities in coastal aquatic systems.

The ecological function of microbes

It is important to study the microbial load in the seawater to find out the possible rise of infectious diseases and gastrointestinal infections in people linked with the seafood chain (Fleisher et al., 2010; Dheenan et al., 2014) residing in the coastal vicinity. Verma et al. discovered microorganisms in deep water have a major influence on a variety of biogeochemical processes and exhibit a remarkable adaption feature to low temperatures and high pressure. They investigated how changes in the physicochemical conditions and heavy metal concentrations in the Bay of Bengal impacted the composition of deep-sea bacterial communities at three different depths. The structural and metabolic diversity of deep-sea sediment microbial communities was examined using ectoenzymatic experiments, physiological profiling of populations at the community level, and culture-based sequencing of 16S rRNA genes. The genera Fictibacillus, Lysinibacillus, Salinicola, Robertmurraya, and Blastococcus include five potentially new species that have been identified. A high degree of metabolic diversity was seen in the carbon substrate utilization profiles, suggesting that deep-sea microbial communities actively participate in biogeochemical cycles. Thangaraj et al. revealed that how varying water masses affected the prokaryotic communities' composition and metabolic potential for samples taken and analyzed in the autumn of 2018 and 2019 from different layers of the Korea Strait. They also demonstrated that the temperature and salinity of the water masses were significant in controlling the prokaryotic population and metabolic alterations, particularly in the Bottom and Upper Layers in 2019, which were different from those in 2018 because of the water masses' varied composition. Further, compared to the relatively steady variable of temperature in 2018, it was observed that the Freshwater input from the East China Sea into the 2019 Upper Layer significantly affected the prokaryotic population shift from high density in 2018 to high diversity in 2019 than the relatively stable variable of temperature in 2018. Furthermore, to predict the biogeochemical pattern, these findings offer a baseline understanding in this little-studied region and emphasize the need for thorough research that takes into account not only the various water masses from the Upper to the Bottom Layers but also the effects of climate change, such as global warming and ocean acidification.

Author contributions

DJ: Conceptualization, Writing – original draft. TG: Writing – original draft. MW: Writing – review & editing. MD: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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