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Editorial: Macroecology of coastal zones under global changes

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Editorial on the Research Topic
Macroecology of coastal zone under global changes

Introduction

Coastal areas are important for maintaining the ecological integrity of both marine and terrestrial ecosystems but they are sensitive to both human activities and nature changes (Dong et al., 2010; Wu et al., 2010; Wu et al., 2015; Wu et al., 2017). These areas are subject to dramatic stress due to rapid population growth, as well as intensive industrial aggregation and expansion. Environmental problems have arisen in coastal environments from degraded water quality, resulting in highly undesirable conditions that affect coastal ecosystem structures and functions. In this context, it is important to develop sustainable socio-economics for coastal environmental issues and draft relevant management policies (Ling et al., 2014; Wu et al., 2015; Wu et al., 2020). Therefore, short-term and/or long-term environmental and ecological monitoring networks have been established in some coastal areas to evaluate environmental problems such as eutrophication, heavy metal pollution, harmful algal blooms (HABs), microplastic, and organic pollutants along with their biomagnifications. The measurement and analysis of hydro-biogeochemical variables in the marine environment are helpful for a better understanding of aquatic status (Wang et al., 2011; Wu et al., 2023). Coastal ecosystems can also be affected by natural changes, including hurricanes, droughts, and floods. Therefore, a better understanding of both natural and anthropogenic influences on coastal ecosystems has paramount validity in coastal ecosystem management and conservation.

Aiming to address the issues caused by anthropogenic activities and the natural occurrences that can influence coastal environments and ecosystems, this Research Topic concentrates on global patterns of change in the macroecology of coastal zones by identifying these research interests, as follows:

Dataset monitoring

The huge datasets on hydro-biogeochemical parameters created by the growing number of coastal environment and ecological monitoring projects need to be collected and the datasets of all parameters examined to provide a better understanding of anthropogenic activities and natural changes in coastal environments and ecologies.

Coastal responses

The responses of coastal environments and their ecologies such as coral reefs, seagrass, and mangrove resistance against biotic and abiotic parameters.

Ocean-land orientation

The dynamics of coastal ecosystems as a function of ocean-land orientation have also been explored in recent years. In addition, phytoplankton such as the harmful algal bloom have experienced in coastal water.

This Research Topic aims to identify sharp changes in coastal ecosystems, paying special attention to the macroecology of coastal zones with respect to land-ocean interactions.

Hydro-ecosystem identified by remote sensing

Remote sensing is a field that extends from sensor design, validation, and calibration to the application of sensors in environmental sciences, geosciences, and ecology. It is widely used in coastal zones and the open ocean. This Research Topic includes a simple method for estimating macroalgae area under clouds (Area_cloud_GT) on MODIS imagery, which used the principle behind the lowpass filter processes (An et al.). The mean relative difference between the estimation results and the 'real' value was 30.09%. In all, the results supply a reference for quantitating the green tide abundance and its areas. Both satellite observation and numerical simulation were used to study the mechanism of the abrupt decay.

Another contribution to the Research Topic explores the spatiotemporal variation of the Zhejiang-Fujian coastal current, which was assessed by examining the riverine discharge and tidal forcing (Li et al.). Secchi disk depth in the spatial distribution were assessed by multi-source remote sensing data and other fused data from 2011 to 2020 along southeastern Vietnam (Sun et al.). This study includes four sea surface models examining the maximum monthly number of the cyclonic cold-core eddy anticyclonic warm-core eddy, cyclonic warm-core eddy, and anticyclonic cold-core eddy from the monthly distribution over multiple years (2008 ~ 2017), in the months of December (765.70 ± 52.05), January (688.20 ± 82.53), April (373.40 ± 43.09), and August (533.00 ± 56.92), respectively (Sun et al.).

Coastal ecosystem

Coastal ecosystems are located at the interface between land and sea, meaning they are subject to the processes of both of their interactions. For instance, coastal ecosystems often have large volumes of freshwater inputs from terrestrial environments while simultaneously being subject to a massive load of marine inputs via waves and ocean currents. Both of these inputs may consist of an array of toxic or non-toxic constituents. However, coastal zones are rich in biodiversity and highly sensitive to changes in their environment (Balasuriya, 2018) with biological communities that include almost all biological components, ranging from microscopic to macroscopic in size. For example, coastal coral reefs are a diverse habitat that support a large number of invertebrates, vertebrates, algae, and seaweeds. Furthermore, mangroves, sea grass meadows, marshes, and coastal wetlands have been recognized as the most productive ecosystems in the world. However, the integrity of these ecosystems is highly interconnected and largely depends upon inputs from both marine and terrestrial ecosystems. For example, floods caused by river runoff stimulate the spawning of certain fish and other aquatic species. Furthermore, changes in salinity in coastal lagoons and estuaries are important for migratory species (Ishitobi et al., 2000). However, extreme events and manmade influences often disturb the ecological integrity of these ecosystems (Aguilera et al., 2020). In this context, cultural eutrophication, ocean acidification, hypoxia, HABs, heavy metal pollution, and biomagnifications of these issues are highlighted in literature on this subject. Therefore, a proper understanding of the interactions between biotic components and their interactions with their environment is particularly important. In this context, advanced analytical tools such as HPLC-based pigment analysis are superior to conventional microscopic analysis, enabling better understanding of this subject.

Dissolved inorganic nitrogen (DIN) (ammonium and nitrate) and dissolved organic nitrogen (DON) (urea and glycine) were used to quantify the absorption ability of the seagrass *Zostera japonica* and the macroalgae *Ulva pertusa*. The results showed that *Ulva pertusa* had higher absorption rates for ammonium and nitrate after being exposed to higher light (14.67 ± 2.50 and 1.29 ± 0.16 mg^{-1} dry weight (DW) h^{-1}) compared with lower light (4.52 ± 0.95 and 0.18 ± 0.12 mg^{-1} DW h^{-1}) treatments. While *Zostera japonica* adsorbed rates of the belowground seagrass, parts for glycine were 14.71 ± 1.85 and 6.38 ± 0.52 mg^{-1} DW h^{-1} after the high- and low-light treatments. This indicates that eutrophication plays an important role in macroalgae and seagrasses, providing insights into protecting seagrass meadows

(Han et al.). Both optical microscopy and HPLC-pigment analysis were used to analyze the feeding selectivity of blue mussel Mytilus coruscus on natural phytoplankton assemblages. The results showed that cryptophytes dominated the phytoplankton community and concentrated 66.1% of the total phytoplankton abundance (Jiang et al.). Image analysis combined with biological measures established the seagrass-epiphyte dynamic relationship and how it changes with environmental conditions (Huang et al.).

Phytoplankton play an important role in the cooling water systems of nuclear power plants, with the risk of phytoplankton blockage being highest between April to July. Wang et al.'s examination of the available control measures for high-risk phytoplankton species provides new ideas for nuclear power plants. In this study, the relationships between inorganic nutrients and the diversity of dinoflagellate cysts were studied in relation to the range of nutrient concentrations. The relationship between all diversity metrics and nutrients was negative, further proving that eutrophication may result from a low diversity of cysts (Gao and Su).

Modeling ecosystem

Real-time environmental forecasting systems based on modeling approaches in terms of three-dimensional, coupled hydrodynamic-biogeochemistry models are important for providing information on spatio-temporal variations in environmental conditions (Wang, 2001). The Coupled Great Bay Ecological Environmental Prediction System is a real-time marine biogeochemical and ecosystem forecast tool and module, providing daily real-time nowcasts and 2-day forecasts of temperature, salinity, NO2 + NO3, chlorophyll, and pH. It also predicts the spatio-temporal variability of the ecological environmental changes associated with extreme weather events (Luo et al.). The medium and high-risk composition and its distribution characteristics are used in an ecosystem service value model. The results show that the optimized coastal zone landscape pattern and the total ecological value are 462.02 km2 and 105,01.71 million yuan, providing new ideas that could help in implementing ecological development and protection strategies in coastal cities (Yi et al.). Another study in the Research Topic examined the red tide that took place in the central sea area of Lingdingyang Bay using the Delft3D model. Tide and wind, with minimal influence from runoff, were shown to mainly influence the red tide drift-diffusion process (Xu et al.). A coupled dynamical diagnostic framework assessed four factors, including phase speed, the damping rate, and the strength of the annual and semi-annual harmonic forcing of SSTAC. Most coupled models were shown to have a relatively weaker (an average of 18%) propagation speed and stronger annual (18%) and semi-annual (39%) external forcing. Half of the models show a relatively stronger (about one time) damping rate, while the rest show a weaker (30%) damping rate (Chen and Yu).

Contribution and perspectives

This Research Topic, introduces the Research Topic *Macroecology of Coastal Zones under Global Changes*, analyzing different diverse coastal ecosystems around the globe and addressing topics related to hydro-ecosystem identified by remote sensing, coastal ecosystem and modeling ecosystem. It includes 14 articles that provide insights for understanding the macroecology of coastal zones under global changes. The knowledge and insights brought together in this Research Topic are by no means closed, and we believe this Research Topic provides a valid scientific platform for exploring new insights into coastal ecology that are beneficial for the management of coastal ecosystems by integrating scientific, administrative, and financial constituents from coastal environmental and ecological sciences.

Author contributions

All the listed authors made a substantial contribution to the work and approved it for publication.

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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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