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Sustaining Coastal and Marine environments in the Anthropocene

Guest editors

Colin D. Woodroffe[1] · **Margarita Stancheva**[2]

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Coastal environments are places of abundant resources and natural beauty. They are highly valued by people and are consequently under pressure with burgeoning populations, also providing substantial cultural and recreational amenities. Human activities are directly impacting coastal and marine ecosystem services through pollution and degradation. Coastal and adjacent marine zones are threatened by natural and anthropogenic activities in the catchments. The low-lying plains associated with deltas and estuaries support ever-increasing populations engaged in agriculture, fishing, aquaculture, and industrial activities. Rapid urbanization is being experienced with many of the world's megacities on deltas associated with big rivers; deltaic cities are home to more than 150 million people and seem likely to exceed 200 million in the next two decades.

The papers in this special issue address issues relating to sustaining coastal and marine environments in the Anthropocene. The Commission on Coastal Systems encourages the study of interactive systems, both human and physical, in coastal areas throughout the world, and convened a session on this topic at the 34th International Geographical Congress (IGC) held 16–20 August 2021. Several of the papers that follow were presented at that congress, complemented by additional papers on associated topics.

Initially planned to be held in Istanbul in Turkey (Türkiye) in 2020, the Congress had to be postponed in view of the Covid-19 pandemic, and took place as a hybrid conference in 2021. 600 delegates from 75 countries attended, addressing the broad geographical theme of 'Bridging the continents'. The 34th IGC reaffirmed that geographers continue to play a role, promoting greater global sustainability.

The nine papers in this special issue include studies from different coastal environments from around the world, including Bulgaria, China, the Gulf Coast of the United States of America, Indonesia, Vietnam, two papers on Australia and two papers on India. Topics range from coastal erosion and the vulnerability of coastlines to land use, coastal protection and pollution with microplastics. The various studies illustrate the complex interplay between human activities and natural processes along the coastline, highlighting the importance of understanding these interactions for sustainable coastal and marine resource management.

Stancheva et al. focus on land-sea interactions in their evaluation of cliff erosion along the northern part of the Bulgarian Black Sea coast, emphasizing the environmental and socio-economic impacts, including loss of habitats and biodiversity. They emphasize the need to consider Land-Sea Interactions (LSI) and erosion when developing Marine/Maritime Spatial Planning (MSP). Coastal erosion at rates of >20 m/year are occurring along parts of the Mekong River delta in Vietnam, and Le Xuan et al. consider the effectiveness of offshore breakwaters to reduce the severity of incoming waves. They use multiscale numerical modelling to indicate how breakwaters can reduce wave velocity, indicating that under certain conditions these may promote sedimentation and enable mangrove forest regeneration.

Coastal ecosystem restoration, and particularly using mangrove forests, to overcome coastal degradation is also a focus of the study by Rudianto et al. These researchers addressed issues in east Java, where the coast is subject to tidal flooding and the impacts of tsunami. Their study focused on establishing public opinion and assessing

✉ Colin D. Woodroffe
colin@uow.edu.au

Margarita Stancheva
stancheva@ccms.bg

[1] School of Earth Atmospheric and Life Sciences, University of Wollongong, Wollongong, NSW 2522, Australia

[2] Center for Coastal and Marine Studies (CCMS), 33 Podvis str., A, floor 5, Varna 9000, 75, Bulgaria

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vulnerability using the coastal vulnerability index (CVI). They show that there is a high degree of awareness of the need for mangrove restoration. The CVI approach was also used by Naga Kumar et al. to assess vulnerability of a section of the coast of Kerala in southwest India. They assigned weights to five variables, geomorphology, slope, shoreline change history, tidal and wave conditions, and used the analytical hierarchy method (AHM) to determine vulnerability. Their study indicated that almost all of the coast had experienced erosion over a 28-year period, and a third of the coastline investigated is at high risk from coastal hazards, likely to be exacerbated in response to higher waves and sea-level rise. The Indian Sundarban delta is even more vulnerable to issues associated with sea-level rise. Mondal reports on a SWOT-AHP analysis of the opportunities for climate resilient agriculture (CRA) by poor rural households in several of the Community Development Blocks adjacent to the Bay of Bengal. The need for strategies such as rainwater harvesting, adoption of salt-tolerant varieties, multi-cropping and organic farming practices was assessed as potential solutions for sustainable adaptation to climate change.

Woodroffe et al. examine sediment dynamics at different timescales for coastal compartments along the embayed south coast of New South Wales, Australia. Estuarine systems at different stages of infill over millennial timescales are described, demonstrating that sand is delivered to the coast only from the largest river catchment. Variability at century and decadal timescales is outlined, compounded by anthropogenic interventions. Sedimentological analysis and regular beach surveys over a two-year period by Carvalho and Woodroffe demonstrate the individual response of neighbouring beaches within one of these compartments, reinforcing the importance of considering sediment supply and morphodynamics in terms of coastal management.

A further theme in this special issue is growing concern over marine pollution, particularly the presence and impact of microplastics. Culligan et al. investigate sedimentary records of microplastic pollution in coastal Louisiana, emphasizing the environmental implications of microplastics in estuaries influenced by various industries, using FTIR spectroscopy and discriminating fibers, fragments and sheets in cores, in which mixing by bioturbation is inferred. Song et al. delve into the impact of microplastic pollution on marine microbes in offshore sediment cores from Zhanjiang, China. They used density flotation to separate and sequencing to discriminate polyamides, polyurethanes and polyethylenes. These studies highlight the urgent need to address and mitigate microplastic pollution in coastal and marine ecosystems.

These themes collectively reflect the multifaceted challenges and opportunities within coastal and marine environments, providing valuable insights for policymakers, researchers, and stakeholders working towards the protection and sustainability of these vital ecosystems.

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