

PREFACE

The marine and coastal environment is a dynamic and complex domain where multidisciplinary research plays a crucial role in sustainable development, ecological conservation, and technological advancements. Given the close interaction and profound influence of this environment on coastal and seafaring populations, as well as its significance for national security and safety, **Vijnana Bharati (VIBHA)** initiated the **World Ocean Science Congress (WOSC)** as its flagship program.

VIBHA is a national movement dedicated to the integrated development of **Bharat** through the application of science, engineering, and technology in all aspects of life. It was launched on **October 20-21, 1991, in Nagpur** at a gathering of eminent scientists, academicians, science communicators, social scientists, non-governmental organizations, and prominent citizens. This initiative aimed to expand the **Swadeshi Science Movement**, which was originally started under the guidance of **Prof. K. I. Vasu** by a group of distinguished scientists, into a national-level science movement.

WOSC, conducted every four years in collaboration with renowned research and academic institutions, serves as a common platform for all stakeholders, fostering close interactions to collectively address nationally significant, people-centric issues. The **first WOSC** was held in **Kochi in 2015**, followed by the **second in Visakhapatnam in 2019**. The **third international conference, WOSC-2024**, was held at **IIT Madras Research Park in Chennai from February 27th to 29th, 2024**, in collaboration with the **National Institute of Ocean Technology (NIOT), the Ministry of Earth Sciences, and the Indian Institute of Technology (IIT) Madras**. The conference saw the participation of **over 600 attendees** from diverse sectors, including research, academia, civil society, governance, policymaking, industry, shipping, and fisheries.

A total of 210 research papers were presented orally across 28 technical sessions, while 136 research papers were presented as posters at WOSC-2024. From the 346 research papers presented at the Congress, session chairs, with the assistance of experts who attended the presentations and posters, shortlisted 56 papers for publication in a special issue of Indian Journal of Geo-Marine Sciences (IJMS). Invitations were sent to the authors to submit their full papers in accordance with the requirements of IJMS by a specified deadline. While 33 authors responded positively, 24 research papers were ultimately received for consideration in the WOSC special issue of IJMS. These research papers underwent a rigorous peer-review process, evaluated by a minimum of two experts and one guest editor. The comments and suggestions were duly conveyed to the authors, who revised their articles accordingly, incorporating constructive feedback before resubmitting them for further review. The revised manuscripts were subsequently reassessed by at least one reviewer and one guest editor before the final decision on acceptance or rejection was made. Out of the 24 research papers, 16 met the criteria for novelty of results, data analysis, and research significance, and were ultimately selected for publication.

This special issue brings together a diverse collection of studies addressing various aspects of ocean and coastal science and technology, ranging from wave interactions and energy harnessing to fisheries management, aquaculture, and digital transformation. The featured research underscores the interplay between physical oceanography, engineering solutions, environmental sustainability, and socio-economic considerations in maritime domains.

The issue begins with investigations into **wave-structure interactions and coastal engineering**. The study on *Oblique wave interaction with pile-restrained dual H-shaped breakwater* provides insights into the hydrodynamic performance of novel breakwater designs, while the *Assessment of wave tranquillity aspects for the development of a Passenger Terminal near Gateway of India, Mumbai* evaluates the suitability of marine infrastructure for safe navigation and operational efficiency. Further, the research on *Developing Indigenous Wave Energy-based Navigational Buoy* highlights innovations in renewable energy utilization for maritime navigation.

Recognizing the critical role of **marine resources and the blue economy**, this issue features a *Blue Economy Framework for India*, offering a strategic perspective on harnessing ocean-based resources for sustainable economic growth. Complementing this, the *Geospatial analysis of brackish water seaweed farming site selection in Chengalpattu District using Fuzzy Analytic Hierarchy Process* presents a novel approach to optimizing

aquaculture site selection, aligning with the goals of sustainable marine resource management. Furthermore, the paper on *Digital Transformation for enhancing Productivity and Sustainability of Aquaculture* underscores the impact of technology on advancing aquaculture practices.

Understanding **fisheries and marine biodiversity** is crucial for ensuring food security and ecological balance. The study *Unravelling the dynamics of Indian mackerel abundance: a comprehensive analysis of oceanographic influences using GLM, GAM, and BRT models* provides a data-driven approach to understanding fish stock variability. In a similar vein, *Navigating the Future: Advancing Fisheries Predictions with a Front-to-Fish Approach* introduces an innovative framework for improving fisheries forecasting. The *Assessment of Occupational Hazards among Small-scale Motorised Fishers in Southernmost Coasts of India* sheds light on the risks faced by coastal communities dependent on fisheries, emphasizing the need for improved safety measures and policy interventions.

Advancements in **marine exploration, ocean monitoring, and climate studies** are represented through a spectrum of research. The paper on the *Upper ocean response to tropical storm Biparjoy in the Arabian Sea based on moored buoy observations* examines oceanic responses to extreme weather events, while *Modeling Ocean Diurnal Cycle and its Scale Interaction to Longer Scale Climate Variabilities* provides insights into ocean-atmosphere interactions vital for climate projections. The *Instrumentation system for parametric data collection of OTEC using deep sea moored surface buoy* presents technological advancements in deep-sea observation systems, contributing to improved oceanic data collection methodologies. Additionally, *Advancing Marine Ecological Services for the Indian Seas: INCOIS's Contribution* highlights institutional efforts in marine conservation and ocean information services.

The issue also delves into **deep-sea resource exploration, utilisation and ocean geochemistry**. The research on *Configurations of tracked vehicle for development of deep-sea mining vehicles for enhanced traction in soft seabed* addresses the engineering challenges of seabed resource extraction. The study on the *High Incidence of Vanadium and Copper in the titanomagnetite and ilmenite samples off Ratnagiri, Maharashtra, India* provides geochemical insights into undersea mineral deposits, offering potential avenues for sustainable resource utilization.

Lastly, the integration of **digital transformation in maritime sectors** is explored through two compelling studies. The paper *Transforming Sri Lanka's Maritime Future: Digital Transformation driven by the Underwater Domain Awareness (UDA) Framework* discusses the role of digital frameworks in enhancing maritime security and resource management. Similarly, *Comparative analysis of bacterial microbiomes and its functional profiles from mangroves, a blue carbon ecosystem, and terrestrial forest habitats* bridges microbiological studies with ecosystem services, highlighting the significance of microbial communities in blue carbon ecosystems.

This special issue is a testament to the breadth of contemporary research in marine and coastal sciences, showcasing innovative methodologies, analytical approaches, and technological solutions that drive the sustainable development of oceanic resources. We extend our sincere gratitude to all authors, reviewers, and contributors who have enriched this compilation with their valuable research and insights. We hope that this issue will serve as a catalyse for further advancements in oceanography, marine technology, and sustainable maritime policies.

Guest Editors

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