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Fostering Island Prosperity through Blue Partnerships

Yuncheng Deng [1,2†], Qinqin Zheng [3,4†], Antoine Grima [5], W. M. D. N. Wijeyaratne [6], Peiru Lin [4,*], Ran Guo [7,*]

[1] Law School, Shanghai University, Shanghai 200444, China
[2] Southern Marine Science and Engineering Guangdong Laboratory (Zhuhai), Zhuhai 519099, China
[3] College of Liberal Arts and Social Sciences, City University of Hong Kong, Hong Kong 999077, China
[4] Island Research Center, Ministry of Natural Resources, Pingtan 350400, China
[5] Faculty of Laws, University of Malta, Msida MSD 2080, Malta
[6] Department of Zoology and Environmental Management, Faculty of Science, University of Kelaniya, Kelaniya 11600, Sri Lanka
[7] School of Law, Shanghai Maritime University, Shanghai 201306, China

† These authors share first authorship
* Correspondence: linpeiru2021@163.com (P.L.); guoran@shmtu.edu.cn (R. G.)

Abstract: The seas and islands are inextricably linked to the sustainable growth of islands. Multi-pathways, including sustainable utilization of island and marine resources, are essential for fostering the prosperity of island nations and regions. In this context, on November 4th, 2024, a forum was organized by various units specialized in marine and island studies, including the Island Research Center of the Ministry of Natural Resources of China. The chosen theme was "Blue Future Hinged on Island Prosperity". Participants from various countries around the world - including representatives of government agencies, academic institutions, and experts - attended the hybrid conference to discuss some of the key issues involved in

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fostering island prosperity.

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1. Introduction

With a theme entitled "Blue Future Hinged on Island Prosperity", the 2024 International Island Forum was convened on November 4th, 2024, in Pingtan, China. The forum was jointly hosted by the Island Research Center (IRC) of the Ministry of Natural Resources (MNR), the China Oceanic Development Foundation (CODF), and the Pacific Island Countries Development Forum (PIDF). The Pingtan Comprehensive Pilot Zone Administrative Committee (PCPZAC), in collaboration with Xiamen Municipal Ocean International Cooperation Center and other relevant research institutions, provided organizational support. The conference was attended by 180 policymakers, economists, scientists and academics from over 20 nations, including Antigua and Barbuda, China, Japan, Malta, Singapore, and the United Kingdom.

During the opening ceremony, Antao Wang, Deputy Director-General (DDG) of the MNR Department of International Cooperation, highlighted the strategic importance of islands in sustainable regional socio-economic development. Besides expressing China's commitment to strengthening blue partnerships within the United Nations Decade of Ocean Science for Sustainable Development (2021-2030), DDG stressed the importance of technology and expertise sharing in marine spatial planning and the blue economy, so as to strengthen the ocean's potential for sustainable development. CODF Vice President Xinchun Pan emphasized the accomplishments of the Maritime Silk Road initiative projects and announced enhanced support for collaborative research and development programs to foster sustainable development and prosperity among island nations. Ms. Arpana Pratap, Director of PIDF's Blue Economy, emphasized PIDF's commitment to promoting sustainable development in Pacific Island Countries (PICs) and expressed the intention to strengthen practical cooperation with countries in the global South, develop a sustainable blue economy, and improve social welfare. According to Jian Xie, DDG of the MNR South China Sea Bureau, the forum is an essential platform for exchanging empirical research findings and best practices relating to a new model and path for the protection and development of islands. He emphasized that practical cooperation is key to realizing the "blue dream" and ensuring prosperity for islands. It was pointed out by Xinya Pan, Deputy Director of PCPZAC, that a high-quality marine economy coupled with the protection of island resources has helped the Pingtan Islands

flourish and develop their marine industry [1]. This has contributed to the creation of the "blue engine" for revitalization and development. As a permanent academic forum [2,3], the forum continuously facilitates comprehensive discussions on island and ocean issues, with a special focus on advancing collaborative "blue partnerships" to achieve island prosperity. This forum brought together scholars from around the world to examine and discuss the latest developments in climate adaptation and resilience, blue partnership and marine economy, resource and ecosystem management, sustainable governance and policy, marine ecology and cultural heritage.

2. Adaptive Strategies and Resilience Building for Reducing Coastal Impacts of Climate Change

Climate change is undeniable [4–8]. For islands to achieve sustainable development and prosperity, it is imperative to minimize or even eliminate its negative impacts to the greatest extent possible. Wenshan Li, Associate Research Fellow at the Sea Level Center of National Marine Data and Information Service, China, noted that global mean sea levels (GMSL) are increasing and accelerating, which poses a threat to many coastal Asian cities, including China's coastal cities. As with sea level rise (SLR), high Extreme Sea Levels (ESLs) can cause severe hazards to coastal ecosystems as well as human settlements (flooding, coastal erosion, and infrastructure damage) [9]. The accelerated rise in sea level, for instance, will result in a decrease in the coastal protection capacity. The decreases in Hebei, China, are greater on the northern coast than on the southern coast. Professor Jian Chu, from Nanyang Technological University in Singapore, highlighted "Long Island" is an integrated solution for coastal protection, space creation, flood control and clean water in Singapore. He outlined Singapore's latest development in response to several challenges posed by sea level rise, including land reclamation using dredged mud, flexible seawall construction, and the use of eco-cement [10–12] to control coastal erosion [13]. Professor Kishore Boodhoo at the University of Mauritius (UoM), stated that the government of Mauritius is attempting to increase its efforts through the strengthening of climate change mitigation and adaptation measures, because Mauritius is ranked 51st worldwide for disaster risk. In April 2021, the Climate Change Act came into effect, with the stated objective of ensuring compliance with international climate change agreements and setting national goals and targets. Further, the United Nations Development Programme (UNDP) Climate Change Adaptation Programme in Mauritius' Coastal Zone has been analyzed and some suggestions have been made regarding future adaptation, including early warning systems, community awareness campaigns, postgraduate capacity-building programs, and innovative climate policies.

Professor Muhammad Zahir Ramli, of the International Islamic University Malaysia, has assessed coastal changes along the Pahang coastline in Malaysia. Using Geospatial Information System (GIS) to analyze the data from 2000 to 2022 with SWAN - XBeach Coupling Model,

identifying key morphological parameters influencing coastal erosion and demonstrating the value of predictive models for early warning systems and informed management strategies. Based on the findings of this study, Pahang beach faces erosion problems along its entire coastline. In addressing disaster preparedness, Professor Weihua Fang from Beijing Normal University, China discussed the importance of high-resolution wind hazard mapping in assessing cyclone impacts in vulnerable areas such as Small Island Developing States (SIDS). By utilizing a parametric wind field model to simulate historical tropical cyclone wind footprints, Fang and his team derived the topographic effects for eight wind directions from 30 m Digital Elevation Models (DEM) [14], and estimated surface roughness lengths from 30 m land-use/land-cover maps. Utilizing historical wind footprints, they developed wind hazard maps for various return periods (e.g., 50 years, 100 years) to enhance resilience by constructing wind load quantification and other measures. Weiqiang Wang, Director of the China-Sri Lanka Belt and Road Joint Laboratory on Tropical Oceanography, presented a review of the collaborations that have been carried out. A comprehensive oceanographic and atmospheric observation network, including open ocean, coastal, and land-based measurements around Sri Lanka, has been established and has become increasingly useful for preventing ocean-related disasters.

During this session, the research presented focused on coastal vulnerability and adaptation strategies to address climate change impacts on island and coastal communities. Scholars emphasized the need for innovative, data-driven, and context-specific solutions that integrate advanced modeling techniques, engineering innovations, and policy interventions. Clearly, greater support for research in this area is essential for successful climate adaptation.

3. Integrated Approaches for Stimulating the Development of Blue Partnership and Marine Economy

Dr. Guojie Liang at Dalian University's Indian Ocean Rim Research Center for Island Countries argued that the “blue partnership” is a way for China to foster open, inclusive, pragmatic, mutually beneficial, and win-win cooperation with countries and international organizations in the marine field, focusing on the development of dialogues and consultations, sharing and developing mutually beneficial outcomes. China and Small Island States (SIS) should use this opportunity to communicate further and formulate practical and feasible plans for marine cooperation under the Global Development Initiative (GDI). Mr. Eddie Tapiero, an independent economist and advisor to the Panamanian government, examined the potential of Panama's blue economy, emphasizing the country's strategic geographic location and extensive marine resources. In March 2024, the Panamanian government approved Executive Decree No. 013, thereby establishing the Multimodal Dry Canal for Transshipment of Goods [15]. It encompasses railways, roads, airports, ports, and other logistics providers and is Panama's sole special jurisdictional zone for transshipment [16]. Such

win-win cooperation and collaboration present an opportunity for blue economies worldwide.

Professor Jing Yu of Ocean University of China (OUC) emphasized the importance of marine spatial planning (MSP) in the development of the blue economy. For the development of MSP in Mauritius, five OUC specialized groups (compilation of MSP, study of hydrodynamic environment, survey of fishery resources, fishery planning, tourism planning) have been established in collaboration with experts at the UoM as a result of a research project funded by CODF. An analysis of Mauritius' marine development, protection status, and socio-economic-natural conditions has been undertaken as part of a phased achievement, which identifies issues and requirements and suggests preliminary macro planning patterns for the territorial sea of Mauritius. According to Dr. Chunlin Li of the Zhejiang Ocean University in China, Zhoushan City, as the largest archipelago in China [17], is rich in marine resources and has many uninhabited islands, which provide ideal conditions for the development of the blue economy. For sustainable utilization of uninhabited islands, policy guidance, technological innovation, environmental protection, and social participation were recommended. Dr. Hajime Tanaka of the University of Tokyo/Promotion and Research Institute for Ocean Industry, Japan, stressed the importance of sustainable seafood originating from fisheries or aquaculture operations that minimize environmental harm and boost the development of the marine economy. Considering consumers' willingness to pay (WTP) for traceable fish products in Japan is an essential measure. Three key findings are revealed: (1) Japanese consumers' WTP for traceability information is positive with 99% statistical significance; (2) the impact is lower than their WTP for eco-labels and whether the fish is wild-caught or farmed; (3) A person's WTP for traceability information is strongly influenced by his or her purchasing behavior and past experiences. It was recommended that seafood traceability systems be adopted in the Japanese market for the fish products for which most Japanese have a long familiarity.

There is a strong correlation between blue carbon and Sustainable Development Goals (SDGs) and it plays an important role in the global carbon cycle, carbon market, and so on [18,19], which affects everyone. Professor Dimuthu Wijeyaratne at the University of Kelaniya, Sri Lanka, argued that identifying species with high carbon sequestering capacity is of vital importance for blue carbon ecosystem rehabilitation. She further emphasized the importance of quantifying their carbon storage capability. The destructive method of sampling trees for estimating their carbon storage capacity is widely practiced throughout the world; however, estimating the carbon storage capacity in the vegetative portions of the trees using non-destructive methods are increasingly popular in Sri Lanka as they do not harm individual trees or the blue carbon ecosystems [20–22]. Dr. Jie Chen from the Fourth Institute of Oceanology, MNR, China shared several examples of blue carbon ecological restoration in Beihai City, China. This includes a 2022 project to restore mangrove ecosystems, converting

abandoned salt fields into mangrove forests, an investigation and improvement project in Hepu County, a coastal zone restoration and protection project in 2020, the restoration of seagrass bed in Tieshangang District, and the restoration of seagrass bed in Hepu Dugong National Nature Reserve. The implementation of ecological restoration resulted in the successful transformation of carbon sinks, including the first blue carbon transaction in the Guangxi Zhuang Autonomous Region and the first purchase of blue carbon (seagrass beds) in China. Accordingly, Professor Xiangjun Zhang of Fuzhou University, China examined the legal and economic complexities associated with blue carbon projects about climate change adaptation. Blue carbon projects should be integrated into production systems as marketable resources under robust legal protections, covering critical issues such as resource allocation, access, and conflicts with pre-existing rights around the world.

The thematic focus of this forum is the blue partnership and marine economy. Achieving island prosperity depends on many factors, rather than on a single one, and is more dependent on the sea than just island land. Studies have been conducted on the concept and possible framework of blue partnerships, the multiple approaches to stimulate the blue economy, and the potential contribution and feasible ways of utilizing blue carbon. It is necessary to focus on blue growth in a way that promotes development to achieve a high-quality marine economy.

4. Integrated Solutions to Managing Island and Coastal Resources and Ecosystems

Dr. Yingxin Zhou, a Fellow at the Academy of Engineering Singapore, noted that water has always been a strategic challenge for Singapore ' s survival and growth since independence. Several lessons can be learned from the water loop system for achieving water sustainability and developing sponge cities. Given its scarce land and high population density, Singapore has placed its Four National Taps – recycling, rainwater management, desalination, and local reservoirs – at the heart of its water supply strategy to secure a diversified water supply. Further strengthening resilience is achieved through advanced flood prevention, drought mitigation, and long-term water storage solutions, such as the innovative Deep Tunnel Sewerage System (DTSS) and underground reservoirs [23]. A combination of long-term planning, integrated implementation, and systematic management has been employed by Singapore in its efforts to achieve water sustainability and resilience management. Researcher Fei Zhang and Senior Engineer Kunxian Tang, both from the Third Institute of Oceanography, MNR, China, presented the Technical Guidelines for Ecological Restoration of Island Vegetation, advocating for the use of resilient native plants to enhance tolerance to these stressors and proposing scalable solutions to large-scale restoration projects.

In 2023, China launched a national reward initiative for the Hemei Islands project. In order to achieve a harmonious relationship between people and islands, featuring clear waters and abundant resources, this initiative seeks to ensure that the Hemei Islands embody ecological harmony, aesthetic living, and productive vitality. Dr. Junhui Chen from IRC used the example of Haitan Island to illustrate China's experience with green development. Engineer Feiyang Ge, from the South China Sea Ecological Center, MNR, China, presented the framework for "Island Governance Toolkit," which integrates technical methods, policy guidance, and blue economy practices in order to address ecological conservation, disaster management, and sustainable development on fragile island ecosystems, as illustrated by the case study of Nan'ao Island.

Dr. Di Dong of the South China Sea Development Research Institute, MNR, China, examined the *Spartina alterniflora* invasion in two mangrove ecosystems: Zhangjiangkou National Mangrove Nature Reserve (Fujian Province) and Shankou Mangrove National Nature Reserve (Guangxi Zhuang Autonomous Region) and found distinct expansion patterns, rapid invasion stages, and the displacement of mangroves by *Spartina alterniflora* [16]. Feng Chen from Xiamen University of Technology, China, argued that YOLO models from SAR imagery can be used to detect ships in major ports on Hainan Island and other islands. The study identified several key findings: (1) YOLOv6 and YOLOv9 performed more efficiently in terms of detection accuracy, though YOLOv9 had significantly slower processing speed; (2) YOLOv5 and YOLOv8 performed well in terms of computational accuracy and efficiency; (3) YOLOv8 was further enhanced. Sustainable energy and conservation management are pressing issues throughout the Caribbean. Cleveland Julien of the University College of the Cayman Islands (UCCI), Grand Cayman presented the initiatives on renewable energy transition and the commitment of UCCI towards responsible resource consumption and enhancing the use of renewable energy technologies. The data gathered from the UCCI's monitoring and evaluation framework highlights the importance of aligning individual accountability with building talented remote teams and demonstrates the model's scalability for educational institutions in other SIDS.

Professor Cherry Aung from Myeik University in Myanmar emphasized Myanmar's exceptional coral reef biodiversity, with the Myeik Archipelago hosting over 528 documented coral species. As in many other countries, the coral reefs of Myanmar are suffering from degradation as a result of fishing, trade, and tourism. Dr. Yihua Lyu, from the South China Sea Ecology Center, MNR, China, investigated coral bleaching during the unprecedented 2020 South China Sea bleaching event. The study found that massive and encrusting corals are highly susceptible to heat stress, while resilient taxa such as Acropora are more resistant. A follow-up study conducted in 2021 provided evidence that coral acclimation had occurred, as no significant loss of coral cover was observed despite repeated episodes of heat stress. In terms of reef resilience against thermal stress, these findings

indicate that shifts in coral assemblages and adaptive responses, including monitoring data on Degree Heating Weeks (DHW), are crucial. A 20-year (2000-2022) analysis of ecosystem service dynamics across 295 Chinese coastal islands was shared by Professor Min Xu of Nanjing Normal University, China. Several ecosystem services were systematically analyzed to determine their spatial and temporal characteristics, including food production, carbon storage and sequestration, water yield, soil conservation, coastal vulnerability, habitat quality, and tourism and recreation [24]. Professor Yuncheng Deng developed the innovative concept of Island Ecosystem Services Justice (IESJ) to address historical inequalities in the distribution and access to ecosystem services. The IESJ framework offers a new, feasible method for balancing island protection and utilization.

This section describes ongoing progress in the sustainable use of island & coastal resources and the conservation of ecosystems. Scholars analyzed ecosystem contributions and challenges from the perspective of the Western Pacific, the Indian Ocean, and national practices. The conclusion drawn is that effective resource management contributes to more sustainable use. The new knowledge of island and coastal ecosystems provides a replicable and scalable framework for island and coastal regions worldwide.

5. Diversified Discussion on Sustainable Governance and Policy Relating to Islands and Their Communities

A growing number of policy-oriented and critical imaginaries seek to use the island's liminal and disruptive capacities. Professor Jonathan Pugh at Newcastle University, United Kingdom explored the conceptual power of ‘islandness’ in Anthropocene, demonstrating how islands provide unique insights into the entanglements of human and non-human systems, and how freely accessible resources promote critical thinking about ecological and cultural interdependencies [25]. Professor Agus Heri Purnomo of the Research Center for Society and Culture of the National Research and Innovation Agency, Indonesia suggested that ocean issues be examined from a regional perspective. It was concluded that: (1) Economic development and environmental concerns are the top concerns across regions, including pollution, water supply, and waste; (2) Many regions perceive government efforts to address environmental issues to be inadequate; (3) Marine sustainability, food provision, and coastal livelihoods are key priorities; (4) Individual citizens are viewed as being the most responsible for ocean management; (5) Species extinction, marine pollution, and marine business development are the primary concerns. Professor Kuncheng Zhang of OUC introduced an evaluation index system that incorporates 27 individual indices under the Pressure-State-Response (PSR) model on the marine ecological civilization in Chinese island counties. In light of the actual evaluation results of island counties obtained by Back-Propagation (BP) neural networks, the ecological civilization of these

islands has been proposed as a whole under the coordination of land and sea [26].

There was a proposal submitted by Vanuatu, Fiji, and Samoa in September 2024 seeking to amend the Rome Statute of the International Criminal Court (ICC), which allows genocide crimes to be prosecuted. An analysis of the history and main progress was carried out by Professor Yifang Lin from Fujian Normal University, China, who argued that criminalizing ecocide could strengthen the protection of ecosystems and biodiversity, particularly in SIS disproportionately affected by climate change. It is, however, still necessary to address three challenges: (1) the definition of ecocide presents considerable challenges; (2) political factors may hinder the enforcement of the criminalization of ecocide; (3) comparing ecocide with the other international crimes remains a subject of considerable debate. A presentation by Dr. Antoine Grima from the University of Malta, looked into the importance of referring to climate change cases heard before national, regional and international courts and tribunals [27–34]. He noted that these are on the rise since society is becoming increasingly aware of the benefits attached to living in a healthy environment and the detrimental effects of certain activities. He suggested that such cases are useful in identifying the unique challenges faced by islands and coastal communities because of a changing climate. He argued that integrating societal concerns into policymaking would both advance climate resilience and yield better solutions to a wide range of issues—from national-level questions such as solar-rights regulation to global challenges like climate-induced population displacement. According to Jiarui Liang, Researcher at Liaocheng University, China's Pacific Island Research Center, the Pacific islands region is particularly rich in customary maritime tenure (CMT) systems, which play a significant role in the social, economic, and cultural development of the region in general. As far as concepts and practices are concerned, the CMT system in the Pacific Islands has some implications for global fishery governance.

During this part of the forum, a variety of perspectives were presented regarding sustainable governance and policy in relation to islands and their communities. The experts recommended utilizing the latest research advancements and management practices to enhance the prosperity of islands. To promote good governance, it is necessary to strengthen scientific research and policy innovation.

6. Multidimensional Trends in Marine Ecology and Cultural Heritage

According to Researcher Yi Hou of the China Academy of Social Sciences, China is one of the first nations in the world to develop and utilize the ocean. A long-term process of developing and utilizing ocean resources has resulted in the development of China's Marine Ecology Culture (CMEC). The ancient CMEC consists of two main aspects: (1) The understanding of marine life and the oceanic environment; (2) The awareness and reflection on the relationship between people and the ocean. There was a theoretical

review of the protection of marine pearl resources during the Ming Dynasty (1368-1644 AD). Despite this historical significance, public awareness of marine ecology remains relatively low. During the 1980s and early 21st century, China formulated over ten marine environmental laws and regulations, which formed the basis for China's marine environmental protection legal system. When reviewing the historical process of the formation and evolution of CMEC, the following characteristics can be identified: Firstly, CMEC has a long history and is continually inherited and evolved. The concept of CMEC has evolved under the influence of Western thought. The practice of marine ecological governance has begun to take shape in conjunction with scientific evidence. Secondly, the traditional Chinese concept of CMEC possesses cultural features that distinguish it from similar marine-culture traditions elsewhere, even though some common elements remain. Thirdly, CMEC has become an integral part of China's ecological civilisation development. Increasing awareness of the importance of protecting marine resources and the marine environment has led to the formation of a modern marine ecological culture.

Because of the Indian state's social engineering policies of resettling mainland populations on the islands and transporting them there, the Andaman Islands have acquired the nomenclature of "mini-India." Dr. Raka Banerjee, an independent researcher in India, has been focusing on the creation of a digital archive of Bengali refugees' memories of settlement in the Andaman Islands following the partition of Bengal and India's independence. It was primarily Bengali refugees who were transported to the islands to repopulate and develop them. It was primarily under the schemes of "colonization" and "rehabilitation" that they were settled between 1949 and the early 1980s. Professor Ran Guo from Shanghai Maritime University, China, emphasized the significance of protecting underwater cultural heritage (UCH), particularly its role as a "time capsule," during discussions based on the Convention on the Protection of Underwater Cultural Heritage. To encourage states to allocate sufficient resources for UCH protection, it is essential to adopt a multi-layered value approach. This approach aims to foster appreciation for the diverse values of UCH at regional, national, and local levels [35]. Several innovative methods have already been employed to preserve UCH, raise public awareness, and stimulate local economies. Notable examples include the Yangtze River Estuary No. 2 Shipwreck and the Guangdong Maritime Silk Road Museum, both of which showcase effective UCH preservation strategies while underscoring the importance of safeguarding this valuable "time capsule" of history.

This section discusses the trends in marine ecology and cultural heritage. To protect cultural heritage, it is imperative to adopt a multi-layered value approach to transmit cultural memory, as researchers have stressed. By adopting this approach, we are able to effectively inherit our culture in order to achieve island development and prosperity.

7. Conclusion

The 2024 International Island Forum highlighted the complex challenges and opportunities associated with fostering prosperity across the island and coastal regions, highlighting the need for many solutions about climate resilience, blue partnership, marine economy, resource and ecosystem management, sustainable governance and policy, marine ecology and cultural heritage. In addition to providing valuable insights, these efforts also yielded innovative approaches to preserving these fragile yet vital island economies. The forum provided an excellent platform for international academic exchanges as island prosperity encompasses a wide range of subjects. The discussions carried out in the Forum also highlighted the importance of including additional perspectives in the research of island studies such as climate change in relation to international law, the development of small islands, and the role of artificial intelligence [29,36,37]. The ultimate goal of fostering island prosperity is to encourage more scholars and practitioners to engage in, support the modernization of island economies through blue partnerships, and improve the well-being of island communities.

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