IMBeR West Pacific Symposium 2021

Session 4: Ecosystem-Social Interactions in the Coastal Sea

November 22, 2021

Session Introduction

Continental marginal systems are supporting human well-being from important and valuable goods to services, but anthropogenic activity and climate change have substantially altered the oceans and are impacting their ability to sustain ecological and human communities. Integrating environmental, ecological and economic knowledge of continental margin systems, and how these systems may change under different perturbation scenarios, is imperative to understand the interplays between human uses of the oceans, present management strategies of marginal systems, and optimize the services they provide. Lessons learned from multidisciplinary syntheses and inter-regional comparative studies of coastal socio-ecological systems will help rationalize and optimize marginal seas management approaches. This session is aimed at improving our understanding of marginal social-ecological systems, guiding sustainable development of resources and advising governance regimes to facilitate sustainable governance, facilitating equitable sharing of margin resources, and evaluating alternative research approaches and partnerships that address major margin challenges.

Co-moderators: Sumei Liu (Ocean University of China, China) and **Suvaluck Satumanatpan** (Mahidol University, Thailand)
Rapporteur: Jingling Ren (Ocean University of China, China)
Number of participants: 100

1. One or two major highlights from each presentation

I: Key note speeches and oral presentations:

1) Key note speech 1- **Ratana Chuenpagdee** (Memorial University, Canada)
Governing the ungovernable: challenges in governance of coastal seas
   - ✓ Coastal seas are complex and dynamic social-ecological systems. Issues and challenges in coastal seas are wicked problems. It is social problem, not only scientific problem. Difficult to define and differentiate from other problems. No formula, no stopping rule, no solution, only resolution.
   - ✓ We should think about how to expand from “integrated coastal management (ICM)” to “interactive coastal governance (IGC)” and address current and emerging challenges in coastal seas through ICG requires. Look for governability problems and opportunities in all three orders of governance.

Being creative, innovative and transformative in our research for solution/resolution. Embracing a "transdisciplinary" approach in co-identifying problems / co-creating solutions.

2) Key note speech 2 - **Juying Wang**, (National Marine Environmental Monitoring Center, China) **National strategy research for climate change adaption in the ocean and coast in China**
   - ✓ Through reviewing on long term changes in SST, sea level rise, ocean acidification, hypoxia, climate related disasters and their impacts on marine ecosystem (e.g., fishery resources, habitats) in the marginal seas of China, try to provide decision support for the preparation of national climate change adaptation strategy 2035.
   - ✓ Existing experience in adaptation to climate change is achieved through improving the risk response capacity and protecting and restoring the marine ecological environment.
   - ✓ Recommendations on the oceanic adaption in China: 1) improve the capability of monitoring, early warning, risk assessment of marine disasters; 2) strengthen infrastructure construction in coastal areas, improve relevant systems and mechanisms, and further improve the capability to prevent and resist disaster; 3) promote the synergy between marine pollution reduction and climate change, improve the quality of marine ecosystem; 4) promote the synergy between ecological conservation and adaptation to climate change, and enhance the resilience of marine and coastal ecosystems.
3) Oral Presenter 1 – **Andrew Allison (**National Institute of Water and Atmospheric Research, New Zealand**)**, Cumulative effects and coastal management in New Zealand: making room for expression of knowledge
   - ✓ The interactions of multiple stressors act to push systems closer to tipping points and thresholds. These stressor interactions may be synergistic or antagonistic and operate on a variety of spatial and temporal scales.
   - ✓ Avoidance of environmental bottom lines can be used to move toward avoiding ecological bottom lines through management of multiple stressors.
   - ✓ With increasing complexity driven by anthropogenic stressors including climate change and land use change, society needs better spaces to think through interdisciplinary work on multiple interacting stressors: spaces to allow us to get to grips with cumulative effects.
4) Oral Presenter 2 – **Qinhua Fang (**Xiamen University**)**, Marine spatial planning evaluation for island seas based on an Ecological Vulnerability Index
   - ✓ A framework combining three dimensions of Exposure, Sensitivity and Adaptability to evaluate the marine spatial planning (MSP) of Pingtan Island sea area based on ecological vulnerability is proposed.
   - ✓ The Island Ecological Vulnerability Index (IEVI) of the main island of Pingtan and its surrounding waters is on a 0.58-0.60 scale, which is in a moderate to low vulnerability state. Indicators of ecological vulnerability of marine spatial planning scenarios are interlinked. The evaluation results can inform the revision of marine spatial plan to reduce ecological vulnerability.
5) Oral Presenter 3 – **Dhanya Kandarattil (Asmabi college, India)**, Livelihood diversification among the fisherfolks of Kerala Coast of India
   - ✓ This talk is to explore the level and relative contribution of the determinants

of livelihood diversification across different regions and demographic conditions among the fisheries folks in Kerala, India.

- ✓ Three factors of livelihood diversification are: 1) Risk related diversification 2) Economic related diversification 3) Psychological related diversification. Livelihood diversification was high in the fishers those who are engaged in motorized fishing. The lack of interest in the younger generation to take up the fishing field as a profession is another reason for the occurrence of livelihood diversification.
- ✓ The government should undertake actions and programs to uplift the living conditions of the fisher folks through proper governance and developmental initiatives; Initiatives should be taken to keep the fishermen in their own traditional employment coupled with programs facilitating their revenues which ensure the sustainability.

6) Oral Presenter 4 – **Kamalaporn Kanongdate (**Mahidol University, Thailand**)**, Responsible consumption and production embedded in the Thai marine shrimp farming certification programs
   - ✓ This talk aimed at reviewing the progress of implementing the certification programs on the marine shrimp farming in Thailand through gathering and analyzing data from the Fishery Department and other responsible organizations. The ASC (Aquaculture Stewardship Council) and CoC (Code of Conduct) certification for Thai shrimp are mainly concerned with sustainable farming/aquaculture that assist consumers to track the quality of each product from the farms.
   - ✓ Certification schemes for shrimp products throughout the whole supply chains assist leading to achieve Sustainable Development Goal 12 (sustainable consumption and production, SCP). However, voluntary application of certification schemes may be obstacle for the goal of achievement. Expanding small shrimp farms on land has been increasing that may affect well monitoring.
7) Oral Presenter 5 – **Jarina Mohd Jani (**University Malaysia Terengganu, Malaysia**)**, Making a case for community-based artificial reefs management for the sustainability of coastal fisheries resources and livelihoods
   - ✓ This talk present the role of artificial reefs in the lives of small scale coastal fisher folks in Terengganu, Malaysia, using the Sustainable Livelihoods Approach, a case study for establishing community based fisheries management (CBFM).
   - ✓ Integrating the existing local practices associated with traditional artificial reefs could bridge the perceived technological divide between fisheries users and managers who in the end want the same thing, albeit in different ways.
   - ✓ The resources and use of the resources by humans can be monitored, and the information can be verified and understood at relatively low coast. Rates of change in resources, resource-user population, technology, and economic and social conditions are moderate. Communities maintain frequent face to face communication and dense social networks. Outsiders can be excluded at relatively low coast from using the CBFM. Users support effective monitoring and rule enforcement.

8) Oral Presenter 6 – **Ming-An Lee (**National Taiwan Ocean University**),** Fishery-based adaption to climate change: The case of migratory species grey mullet in Taiwan Strait, Northwestern Pacific
   - ✓ This talk analyzed the long-term (1954–2020) records of grey mullet catch and sea surface temperature in the Taiwan Strait (TS) to investigate the influences of climatic indices on the annual catch of grey mullet at multiple timescales.
   - ✓ Increases in SSTs may be a main reason for the decreased catches of grey mullet after 1980. Current velocity is the most important environmental variables. The fishing grounds of grey mullet shift to the north following changes in the 20^{o}C isotherm. Fishing method was dominated for gill net with the low coast expense as the abundance increased since 2013.
   - ✓ Fishery-based adaption of the resilience between purse seiner and gill net fleet conducted from fishermen responding to the mullet catch fluctuation, climatic index and cost benefit is identified.
9) Oral Presenter 7 – **Arkaprava Mandal (**Indian Institute of Science Education and Research Kolkata**)**, Tracking the ecological health of a mangrove ecosystem from the Northern Indian Ocean - Applicability of benthic foraminifera as bioproxy
   - ✓ This talk is to decipher the ecological health of Sundarbans mangrove ecosystem using benthic foraminifera as biological proxy and to explore biocomplexity of benthic foraminifera across coastal biotopes of the Northern Indian Ocean.
   - ✓ Observed diversity of benthic foraminifera is low. Dead test outnumbered the live ones, indicating the studied ecosystem are prone to severe disturbances. The dominance of populations of stress-tolerant taxa *Ammonia* spp. and decreasing *Jadammina macrescens* population across studied sites indicate rapid degradation of ecosystem quality.
10) Oral Presenter 8 – **Hui Liu (**Yellow Sea Fisheries Research Institute**)**, Status and perspectives on mariculture spatial planning and implementation
   - ✓ This talk provides an account of how mariculture is implemented and the processes experienced for MFZ (marine functional zoning) in China, and MSP in EU, Norway and Canada. The comparison of how mariculture is implemented in the stepwise processes of MFZ and MSP frameworks clarifies the differences in status of mariculture among the countries.
   - ✓ Overcapacity is one of the most challenging issues for mariculture in China. MFZ at all levels is the legal framework regulating the use of marine space in China. Ecological redline is a necessary supplement to MFZ. We should balance the relationship between intensification and environmental sustainability. Mariculture spatial planning in China is carried out by policy suitability assessment, environmental suitability assessment, modelling of individual growth and ecosystem coupling.
11) Oral Presenter 9 – **Roshni Subramaniam (**Sydney Institute of Marine Science**)**, Ecosystem modelling to support decision making for the coastal South-West Pacific (Eastern Australia)
   - ✓ This talk is to understand how the complex coastal ecosystem is changing to plan effective mitigation and adaption strategies in the south-west Pacific

Ocean.

- ✓ Using qualitative and quantitative (Ecopath) ecosystem models to simulate ecosystem responses under different perturbation scenarios by using 46 functional groups, and to provide an understanding of current ecosystem structure and function. The works are helpful to understanding ecosystem change in New South Wales and their socio-ecological consequences.

II: Poster Presentations / Speed-Talk presentations:

1) Poster presenter 1 – **Jiayu Bai & Kailei Zhu,** Review of Fukushima nuclear contaminated water discharge event: International law analysis and stakeholders' response
   - Japan's recent intention to discharge Fukushima nuclear waste water into the sea is a major challenge to today's international law and violates relevant obligations under international law. In order to protect the domestic marine ecological environment and national health of stakeholders, it is necessary to analyze the illegality of Japan's treatment of Fukushima nuclear wastewater, and summarize the response measures proposed by current stakeholders from three aspects of politics, law and culture.
2) Poster presenter 2 – **Mohammed Bouchkara,** Study of morphodyanmic changes along the lagoon of Oualidia (Morocco) using bathymetric data
   - Changes in morphodynamics and sedimentation in the Oualidia lagoon after the sediment trap dredging were studied using bathymetric data surveys and a 3D GIS analysis tool. The remarkable changes in average height and eroded area/volume are mainly related to natural (hydrodynamics, waves, currents...) and anthropogenic (dikes, sediment traps...) factors. Creation of sediment trap in 2011 can increase the current velocity inside the lagoon and facilitate hydrodynamic which leading to an increase in depth of the main channel.
3) Poster presenter 3 – **Beatriz Casareto,** Community structure and rearing experiments of the Shrimp *Lucensosergia lucens* Hansen 1922 (Crustacea, Decapoda, Sergestidae) (Sakura-ebi) in Suruga Bay
   - Several measures to limit the catches have been taken by Yui Fishermen's Association in Suruga Bay, particularly in fall season. This resulted in positive effect for the recovery of shrimp *Lucensosergia Lucens*. Rare experiments of *Lucensosergia Lucens* are been conducted in order to assess larvae growth, mortality rates and food preferences. Suitable rearing conditions and food combinations for growing the shrimps to juveniles in a laboratory aquarium were determined.
4) Poster presenter 4 – **Kai Chen,** Evaluation of marine ecosystem services in China based on meta-analysis
   - Using OLS and MLM methods to study the impact of various factors on ecosystem service value in China based on meta-analysis. The regional distribution, research methods and ecosystem services of marine ecosystems have significant effects on ecosystem service value.
5) Poster presenter 5 – **Xiaokun Ding,** Seasonal variations of nutrient concentrations and their ratios in the central Bohai Sea
   - Develop a vertical one-dimentional physical-biological coupled model to capture the seasonal variations in nutrient concentrations and the N/P ratio in

the central Bohai Sea (CBS). N/P stoichiometry in phytoplankton uptake was lower than seawater, which leading to lowest nutrient concentration and highest N/P ratio in summer. River input, atmospheric deposition and sediment release are the major sources of nutrient in the CBS, while benthic nitrogen loss is the key factor maintaining the nitrogen balancing in summer and autumn.

6) Poster presenter 6 – **Nouhaila Erraji Chahid,** Hydrodynamic and morpho-sedimentary modelling of the Moulay Bousselham lagoon and their impact on the socio-environment: Application to the study of "Fishing" and "Agricole" practices
   - Using numerical model to understand the processes of sediment dynamics in the Moulay Bosselham Lagoon and to help decision maker for the proper management of this ecosystem and the mitigation of human impacts. This multidisciplinary methodology highlight the links between socio-economic and climate change and their impacts on the lagoon, bearing in mind that conflicts of use, environmental or societal are multiplying, which will call for Integrated Coastal Zone Management.
7) Poster presenter 7 – **Mohammad Saydul Islam Sarkar,** Integration of the socioeconomic status into MSP-theoretical aspects and recommendations for Moheshkhali Island
   - A case study to evaluate the direct economic impacts linked to the development and implementation of Marine Spatial Planning (MSP) for Moheshkhali Island is presented. Conduct a respondent analysis based on various types and stages of people's participation is a key factor for a successful management regime of MSP process for sustainable ocean governance.
8) Poster presenter 8 – **Faddrine Jang,** Increased transfer of trace metals and *Vibrio* sp. from biodegradable microplastics to catfish *Clarias gariepinus*
   - Polylactic acid and polyamide 12 act as shuttles for trace metals from the seawater to catfish *Clarias gariepinus*. Continuous uptake the microplastic coated with trace metals altered the gut microbiome and lowered the fish immunity thus enabling potentially pathogenic *Vibrio* infections.
9) Poster presenter 9 – **Yerkenaz Karibayeva,** Caspian Sea: Isolated, yet mutually engaged
   - Caspian Sea's ecosystem is sensitivity to climate and also is polluted by uncontrolled or unauthorized waste disposal. Priorities of protection action for the Caspian Sea should be established by assessing the relative importance of impacts upon marine and coastal ecosystems and resources, public health, socio-economic benefits, including cultural values. Social and political interaction can provide a platform for implementation of sustainable ecosystems management approaches.
10) Poster presenter 10 – **Hyun-Woo Kim,** Fish biodiversity survey in Korean waters using environmental DNA analysis
   - Establish a pipeline for fish diversity survey using eDNA metabarcoding in Korean waters.Metabarcoding analysis clearly demonstrated seasonal and regional differences in fish assemblage within the Gamak Bay. Fish assemblages constructed by eDNA metabarcoding showed much higher

sensitivity and diversity suggesting it would be one of good alternative methods to replace the laborious traditional methods.

11) Poster presenter 11 – **Elsa Cordelia Durie Lambat,** A community-based qualitative vulnerability assessment tools for rivers in developing participatory response to land-use changes
    - Community based qualitative vulnerability assessment tool is an exploratory work that assess the river systems in relation to land-use changes. The development of this tool need to undertake the integration of natural and social science and highly consider the participation from local communities.
12) Poster presenter 12 – **Shanshan Li,** Source, composition and reactivity of particulate organic matter along the salinity gradient in the Changjiang Estuary and its adjacent sea
    - Source, transformation and fate of POM in the Changjiang Estuary and its adjacent sea (CJEAS) are discussed using multi-parameters. POM variations in the CJEAS are mainly controlled by both terrigenous input and in situ phytoplankton production. Two end-member mixing model calculation results show that the contribution of terrigenous of POM in winter is prominently higher than in spring, while phytoplankton-derived POM dominated the sources in the CJEAS from winter to spring.
13) Poster presenter 13– **Shengkang Liang,** Identification jurisdiction responsibility and land-sea synergistic regulation for coastal total nitrogen based on water quality target in Laizhou Bay, China
    - The polluted segments of Laizhou Bay (LZB) is discerned through land-sea synchronous investigation in this study. Simulating results from water quality model shows that the deadline for achieving the water quality standard through the scheme of the “differentiated percent reduction” is six years earlier than that through the “equal percent reduction” in each justification.
14) Poster presenter 14 – **Deju Lin,** Effect of iron on the preservation of organic carbon in marine sediments
    - Fe and clay contents play important roles in the preservation of OC in the sediments of the marginal seas of China. Two binding mechanisms between Fe and OC are largely influenced by the marine environment.
15) Poster presenter 15 – **Marsya Jaqualine Rugebregt,** Sediment quality in Halmahera Sea waters, North of Maluku
    - Heavy metal concentrations in the sediments of Halmahera, North Maluku, are presented. The sediments of Halmahera are not polluted by the six heavy metals and with small PLI value (<1).
16) Poster presenter 16 – **Abiola Osanyintuyi,** Long-term shoreline analysis of Brunei coast: An application of Digital Shoreline Analysis System (DSAS)
    - Using multispectral satellite images to identify the shoreline behavior of the Brunei coastline exposed to the South China Sea. Erosion dominates despite several coastal engineering modifications including groynes and breakwaters put in place to protect the coastline of Brunei.
17) Poster presenter 17 – **Lihini Prematilaka,** On the bliss of nature: Leveraging Nature based Solutions (NbS) for coastal management
    - A case study from Sri Lanka to highlight the possibility of adopting NbS to reduce coastal disasters while enhancing community well-beings. NbS could

be helpful in tackling the issues that the coasts face including climate change, disaster damage, biodiversity crisis, food and water security and societal coherence in the Anthropocence.

18) Poster presenter 18 – **Jing-Ling Ren,** Impacts of human activities on Arsenic transport in the Huanghe (Yellow River)
    - TDIAs concentrations at Kenli and middle and lower reaches of Huanghe both have significant seasonal and annual variations. Seasonal variations of SPM, riverine runoff (regulated artificially) and Chla have direct impacts on the TDIAs concentrations and distributions. TDIAs concentration in the Huanghe is at pristine level and has small long term variations.
19) Poster presenter 19 – **Matt Roberts,** The potential value of establishing Oyster Shell Recycling (OSR) programmes
    - Oyster Shell Recycling (OSR) programmes have been used as a successful mechanism for procuring lost oyster shells that are crucial to restoring oyster populations. The study undertook processes that experimentally validated shell as a preferred substrate for oyster spat and identified the extent of oyster shell available in Hong Kong to evaluate the cost-benefit and feasibility of implementing an OSR programme.
20) Poster presenter 20 – **Huiying Sun,** China's coastal ecological restoration policies: Evolution, problems, and proposals
    - The poster reviews the development of relevant policies of coastal ecological restoration, the history and major phase of which are implemented in China and gives an analysis on the experience and shortage of it. A holistic restoration approach, fundamental research of coastal ecosystems, and the construction of coastal zone management system, are concluded as the main features.
21) Poster presenter 21 – **Chika Suzuki,** Elucidation of incentive structures for researchers to focus on coastal ecological conservation activities and promotion of industrial use of the ocean
    - This study aimed to obtain knowledge beneficial for improving the university management through policy and to promote partnership with industry and local community. Study promote factors and satisfaction are close related in division of marine sciences. Professors are active in partnership and personnel evaluation and the others tend to give incentives in division of business. Improvement of personnel evaluation to prevent from aging of researchers caused by shortage of post, wage and research funds increase is needed.
22) Poster presenter 22 – **Wenqi Xu,** Effects of integrated multi-trophic aquaculture on the nutrients and phytoplankton size structure in Sanggou Bay
    - Nutrient distribution in the Sanggou Bay (SGB) has significant seasonal variation. Tidal exchange, fluvial input, kelp culture and large scale shellfish culture are important influencing factors of nutrient composition in the SGB.

III. Discussion and conclusion:

All attendees discuss on the following issues: What are our understanding about social-ecological interactions and how best to work across disciplines in promoting

social-ecological interactions in the West Pacific Region. Through thorough discussion, we have got some consensus as followed.

Social and natural scientists can work together to provide strength and share the understanding about social ecological interactions to policy maker to enhance sustainability of ecosystem and their contribution to human being. Including mariculture into Marine Spatial Planning (MSP) is great combination of science and policy and benefit on conserving marine ecosystem. We should think about how to increase nature contribution to human kinds in the coastal region and promote transdisciplinary research across the region.

Capacity buildings are important to help understanding about social-ecological interactions in the coastal sea, especially in the West Pacific Region, that lead to policy implications (such as MSP, Interactive governance, DPSIR, Integrated coastal management, vulnerability & resilience concept, and etc.). How can we understand the contributions of natural processes' changing and some other effects of human activities? Communications is important for scientists from social and natural scientists. Model should be started from case study to understand the interactions in the coastal seas.

2. Session summary

Coastal seas in the West Pacific Ocean are surrounded by land regions with a rapid population rise and economic development, which have experienced strong stresses from human perturbation and climate change. How ecosystem in the coastal seas may change under complex perturbations and how to enhance sustainability of ecosystem are one of the key scientific questions of IMBeR. Two invited keynote speakers and 31 oral and poster presenters give talks in session 4, with concerning issues covering the multidisciplinary studies and inter-regional comparative studies of coastal socio-ecological systems. Social and natural scientists should work together to understand the impacts of the major social service needs on the eco-environment of the coastal seas and their further consequences for human-being, to establish the scientific basis for actions needed to enhance the sustainable use of ecosystems and their contributions to human well-being, to meet the Grand Challenges in the earth system for global sustainability. We need to improve our understanding of marginal social-ecological systems, guiding sustainable development of resources and advising governance regimes to facilitate sustainable governance, facilitating equitable sharing of margin resources, and evaluating alternative research approaches and partnerships that address major margin challenges. For the future directions, we should build a transdisciplinary (TD) research network on coastal seas governance in the region, in order to enhance knowledge, exchange good practices, and develop capacity required to address current issues and emerging threats. Apply for funding to conduct a large-scale collaborative TD research project on coastal seas governance for the region.

3. New IMBeR West Pacific Marine Biosphere Research projects/directions for the next three years from this session

A healthy and sustainable ocean is essential for maintaining prosperous societies now and in future. The marine ecosystems are impacted by human activities both on land and at sea. A sustainably managed coastal environment has immense economic,

cultural and aesthetic value. It is vital to adopt an integrated coastal /ecosystem-based management system to protect these valuable and vulnerable ecosystems.

Encourage and strengthen the use of scientific knowledge and monitoring results relevant for the management of ocean ecosystem and economies, in particular by providing mechanisms and opportunities to access such a knowledge base. Consider establishing a formal mechanism on the regional level, such as a scientific advisory body, to underpin coordinated and holistic use of knowledge in instituting overarching policies on the development of ocean economy and the implementation of ecosystem-based integrated ocean management.