香港都會大學
科技學院
Hong Kong Metropolitan University
School of Science and Technology

CONFERENCE ABSTRACT BOOK

International Conference on Conservation and Sustainable Development of Coastal Wetland






20 - 22 April 2023
Hong Kong

About the Conference

Coastal wetlands are well-known for their ecological importance of providing habitat and food to wildlife, whereas coastal wetlands also possess multiple functions to societies such as shoreline erosion prevention, resilience against storms & floods and recreation. As the rapid development and urbanization continues, protect, conserve and rehabilitate coastal wetlands is more urgent and crucial than ever. In this regards, the conference is called to provide a platform for scientists, scholars, government officials, NGO workers and students to exchange views on issues related to coastal wetland research, and current challenges in and solutions to coastal wetland conservation and development.

This project is funded by Hong Kong Research Grants Council (RGC) under the Institutional Development Scheme Research Infrastructure Grant (UGC/IDS(R)16/19). Hong Kong Metropolitan University, with a long and excellent track record in environmental research, aims to contribute to Hong Kong's efforts in coastal wetland conservation through this project — the establishment of the University Research Facilities (URF) for basic and applied research on coastal wetlands in the Guangdong-Hong Kong-Macao Greater Bay Area (GBA). The University Research Facility (URF), combining existing equipment and facilities in the University with the proposed acquisition, leverages the integrated advantages of the University in environmental research. The facilities will also be open to other academics in the region to facilitate collaborations and knowledge exchange. The URF also nurture new ideas for cutting-edge coastal wetland research and put the University in a stronger position to contribute to coastal wetland research and conservation in the area.

Themes

- Ecological Challenges and Conservation
- Coastal Wetland Degradation and Restoration
- Sustainability: Education, Management and Policies
- Bioresources and Applications of Coastal wetland

International Advisory Committee

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Conference Webpage: Scan the QR code to access the conference website
www.hkmu.edu.hk/coastalwetland

20 April 2023 (Day 1)

International Conference on Conservation and Sustainable Development of Coastal Wetland

School of Science and Technology, Hong Kong Metropolitan University

20 - 22 April, 2023

Programme

Zoom passcode: sent to registered participants by email.

Time	Activity
13:30 – 14:00	Registration
Opening Ceremony Venue: D0309 Zoom link: https://hkmu.zoom.us/j/92899508629	
14:00 – 14:05	Welcome Remarks by Prof. Paul LAM Kwan-sing, SBS, JP President, Hong Kong Metropolitan University
14:05 – 14:10	Opening Speech by Mr. TSE Chin-wan, BBS, JP Secretary for Environment and Ecology
14:10 – 14:15	Opening Speech by Prof. WONG Yuk-shan, SBS, BBS, JP Chairman, Research Grants Council of Hong Kong
14:15 – 14:25	Presentation of e-souvenir by Prof. Philips WANG Fu-lee Dean, School of Science and Technology, Hong Kong Metropolitan University
14:25 – 14:30	Photo Taking
– End of Opening Ceremony –	

20 April 2023 (Day 1)

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<tr><td colspan="3">Presentation Session
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<tr><td>14:30 – 15:10</td><td colspan="2">Keynote Speech 1
Prof. Kenneth LEUNG
City University of Hong Kong
Title: Eco-engineered Shoreline Designs for Enhancing Marine Biodiversity and Facilitating Carbon Neutrality
(Abstract pg. K-1)</td></tr>
<tr><td>15:10 – 15:50</td><td colspan="2">Keynote Speech 2
Dr. Tim JENNERJAHN (Online Presentation)
Leibniz Centre for Tropical Marine Research (ZMT), Germany
Title: A Vicious Cycle: How Coastal Development Impairs Biodiversity, Blue Carbon Storage and Other Ecosystem Services – and What Can Be Done
(Abstract pg. K-2)</td></tr>
<tr><td>15:50 – 16:10</td><td colspan="2">Tea and Coffee</td></tr>
<tr><td colspan="3">Parallel Presentation Sessions</td></tr>
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Session Chair: Prof. Billy K.Y. KWAN, Beibu Gulf University; &
Dr. Ian MO, Hong Kong Metropolitan University
Venue: D0309
Zoom link: https://hkmu.zoom.us/j/92899508629</td><td>Session B
Session Chair: Dr. Haichao ZHOU, Shenzhen University; &
Dr. Ka Tik CHEUNG, Hong Kong Metropolitan University
Venue: E0311
Zoom link: https://hkmu.zoom.us/j/91578900601</td></tr>
<tr><td>16:10 – 16:30</td><td>Dr. Paul SHIN
City University of Hong Kong & IUCN SSC Horseshoe Crab Specialist Group
Title: Horseshoe Crabs and Coastal Wetland Conservation
(Abstract pg. A-1)</td><td>Dr. Carmen OR
WWF-Hong Kong
Title: Studying the Little-Known: Multi-Faceted Approach for Eurasian Otter Conservation
(Abstract pg. B-1)</td></tr>
<tr><td>16:30 – 16:50</td><td>Prof. Derrick LAI
The Chinese University of Hong Kong
Title: Ecosystem-scale Greenhouse Gas Dynamics in a Subtropical Estuarine Mangrove
(Abstract pg. A-2)</td><td>Dr. Asfandyar SHAHAB (Online Presentation)
Beibu Gulf University
Title: Status of Coastal Wetlands in China: A Solution for Restoration of Critical Wetlands and Waterbird Habitats in Coastal Deltaic Systems
(Abstract pg. B-2)</td></tr>
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16:50 – 17:10	Dr. Siu Gin CHEUNG (Online Presentation) City University of Hong Kong Title: Beach Cleanup is an Effective Way to Improve the Habitat Quality for Endangered Horseshoe Crabs (Abstract pg. A-3)	Ms. Huizhe HU Mangrove Foundation Title: Communication, Capacity-building, Education, Participation and Awareness (CEPA) Program in Wetland Centers in China (Abstract pg. B-3)
17:10 – 17:30	Dr. Akbar JOHN (Online Presentation) Universiti Sains Malaysia, Malaysia Title: Assessing the Impact of Human Activities on Biodiversity Loss in Southeast Asia (Abstract pg. A-4)	Dr. Steven Arthur LOISELLE (Online Presentation) University of Siena, Italy Title: The Role of Citizen Science in Wetland Monitoring and Management (Abstract pg. B-4)
– End of Day 1 Presentations –		
18:30 – 21:30	Invited Round Table Discussion Forum on "Conservation and Management of Coastal Wetland: Opportunities, Challenges and Way Forward" (for details, please click HERE)	
– End of Day 1 –		

21 April 2023 (Day 2)

Time	Activity
08:45 – 09:00	Registration
Presentation Session Session Chair: Dr. Steven XU, Hong Kong Metropolitan University Venue: D0309 Zoom link: https://hkmu.zoom.us/j/92899508629	
09:00 – 09:40	**Keynote Speech 3** Prof. Guanghui LIN Tsinghua University and Hainan International Blue Carbon Research Center Title: Coastal Blue Carbon: Challenges and Opportunities for Research, Monitoring and Trades (Abstract pg. K-3)
09:40 – 10:20	**Keynote Speech 4** Prof. Brian FRY (Online Presentation) Australian Rivers Institute, Griffith University, Australia Title: Using Chemical Technology to Probe Mangrove Ecosystem Complexity (Abstract pg. K-4)
10:20 – 10:40	Tea and Coffee
10:40 – 11:20	**Keynote Speech 5** Prof. Joe S.Y. LEE The Chinese University of Hong Kong, Hong Kong and Griffith University, Queensland, Australia Title: Harnessing the Ecosystem Services of Coastal Wetlands Through Science-based Management (Abstract pg. K-5)

21 April 2023 (Day 2)

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	Session C Session Chair: Dr. Emily WONG, Hong Kong Metropolitan University Venue: D0309 Zoom link: https://hkmu.zoom.us/j/92899508629	**Session D** Session Chair: Dr. Ka Tik CHEUNG, Hong Kong Metropolitan University Venue: E0311 Zoom link: https://hkmu.zoom.us/j/91578900601
11:20 – 11:40	Prof. Xiaoguang OUYANG Southern Marine Science and Engineering, Guangdong Laboratory (Guangzhou) Title: Fate and Effects of Macro- and Microplastics in Coastal Wetlands (Abstract pg. C-1)	Prof. Guangping ZHANG Beibu Gulf University Title: Raft Identification and Biomass Assessment of Oyster Culture Based on Machine Learning (Abstract pg. D-1)
11:40 – 12:00	Prof. Luzhen CHEN (Online Presentation) Xiamen University Title: Mangroves as a Nature-based Solution to Climatic Change Mitigation: Research and Application (Abstract pg. C-2)	Mr. Tom CHAN The Nature Conservancy Hong Kong Title: The Nature Conservancy's (TNC) Community and Ecosystem Approaches to Restore the Endangered Oyster Reef and Ecologically Important Habitats in Pak Nai (Abstract pg. D-2)
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12:20 – 12:40		Mr. Sreebin P (Online Presentation) Bharathiar University Title: Fish Diversity, Fishery and Conservation of Less Explored Small Estuarine Habitat in Kerala - Through the Perceptive of Fisherman Community, Western Ghats, India (Abstract pg. D-4)
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21 April 2023 (Day 2)

Parallel Presentation Sessions		
	Session E Session Chair: Dr. Emily WONG, Hong Kong Metropolitan University Venue: D0309 Zoom link: https://hkmu.zoom.us/j/92899508629	**Session F** Session Chair: Dr. Andy CHEUNG, Hong Kong Metropolitan University Venue: E0311 Zoom link: https://hkmu.zoom.us/j/91578900601
14:00 – 14:20	Prof. Guangcheng CHEN (Online Presentation) Third Institute of Oceanography Title: Impacts of Mariculture Wastewater Discharge on Mangrove Processes	Prof. Billy K.Y. KWAN Beibu Gulf University Title: Habitat Distribution and Connectivity for Asian Horseshoe Crabs in Mangrove Wetlands of Northern Beibu Gulf, China: Recommendations for Conservation Management (Abstract pg. F-1)
14:20 – 14:40	Dr. Haichao ZHOU Shenzhen University Title: How Many Mangroves Do We Need? Thinking from the Case of Shenzhen	Dr. Chun-chieh WANG Guangxi Academy of Sciences Title: Bycatch of Asian Horseshoe Crabs in Intertidal Zones of the Northern Beibu Gulf, Guangxi: Suggestions for Conservation Management (Abstract pg. F-2)
14:40 – 15:00	Dr. Varsha BOHRA Hong Kong Metropolitan University Title: Microbial Communities in Mangrove Ecosystem Differs by Intertidal Location and Microhabitat of Pneumatophores (Abstract pg. E-3)	Dr. Xueqin GAO The University of Hong Kong Title: Implications of Nitrogen Enrichment for the Biogeochemical Role of Sesarmid Crabs in Tropical Mangrove Ecosystems (Abstract pg. F-3)
15:00 – 15:20	Dr. Qiong YANG Guangdong Neilingding Futian National Nature Reserve Title: The Practical Experience of Conservation and Restoration in Shenzhen Bay, South China (Abstract pg. E-4)	Ms. Cheuk Yiu CHEUNG Hong Kong Marine Ecological Association Title: Juvenile Fish Communities in Coastal Soft-bottom and Shallow Water Habitats at the Tolo Harbour and Channel in Hong Kong, South China (Abstract pg. F-4)
15:20 – 15:40	Mr. Yamme LEUNG WWF-Hong Kong Title: The Role of Education in Conservation and Sustainable Use of Wetland, a Case Study of Mai Po Nature Reserve (Abstract pg. E-5)	Mr. Yat-tung YU The Hong Kong Bird Watching Society Title: Revealing Population Trends of Deep Bay Wintering Waterbirds and Use of Movement Data Studying Waterbird Habitat Uses (Abstract pg. F-5)

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<tr><td>15:40 – 16:00</td><td colspan="3">Tea and Coffee</td></tr>
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Session Chair: Dr. Andy CHEUNG, Hong Kong Metropolitan University
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Session Chair: Dr. Juan Carlos ASTUDILLO, Hong Kong Metropolitan University
Venue: E0311
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<tr><td rowspan="2">16:00 – 16:20</td><td rowspan="2">Ms. Yue MENG (Online Presentation)
Xiamen University
Title: Coastal Blue Carbon as an Effective Climate Response: Progress in the Development of Blue Carbon Projects in the Global Carbon Market
(Abstract pg. G-1)</td><td>16:00 – 16:10*</td><td>Mr. Yuet-tung TSE
Hong Kong Metropolitan University
Title: Full Size Microplastics Pollution Survey to the Costal Marine Waters of Hong Kong
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<tr><td>16:10 – 16:20*</td><td>Mr. Jialin ZHANG (Online Presentation)
Xiamen University
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<tr><td rowspan="2">16:20 – 16:40</td><td rowspan="2">Dr. Jeffrey CHOW
The Hong Kong University of Science and Technology
Title: Econometric Evaluation of Local Ecosystem Services from Mangrove Plantations in Bangladesh
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Hong Kong Metropolitan University
Title: The Impact of Urban Development on Wetland Conservation
(Abstract pg. H-3)</td></tr>
<tr><td>16:30 – 16:40*</td><td>Ms. Ho-tun NG
The University of Hong Kong
Title: Assessing the Effect of Heavy Metal Pollution on Seagrass Microbiomes in Highly Urbanized Areas: Tools for Monitoring and Restoring Seagrasses in Hong Kong
(Abstract pg. H-4)</td></tr>
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Beibu Gulf University
Title: Current Situation of Mangrove Resources in Guangxi and its Protection Countermeasures
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Hong Kong Metropolitan University
Title: The Distribution and Abundance of Antibiotics and Heavy Metals in Mangrove Sediments and Their Effect on Sediment Microbial Composition and Diversity
(Abstract pg. H-5)</td></tr>
<tr><td>16:50 – 17:00*</td><td>Mr. Hewei ZHAO
The Chinese University of Hong Kong
Title: Magnitude and Controls of Stem Methane Fluxes in a Subtropical Mangrove Ecosystem in Hong Kong
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<tr><td rowspan="2">17:00 – 17:20</td><td rowspan="2">Dr. Juan Diego GAITAN-ESPITIA
The University of Hong Kong
Title: Restoring Ecological Connectivity of Seagrasses and Coastal Wetlands to Enhance Ecosystem Services
(Abstract pg. G-4)</td><td>17:00 – 17:10*</td><td>Mr. Kaze LAI
Hong Kong Metropolitan University
Title: Establishment of Sample Preparation Workflow for Metataxonomic Analysis of Epiphytic Bacteria on Pneumatophores
(Abstract pg. H-7)</td></tr>
<tr><td>17:10 – 17:20*</td><td>Ms. Mingdang LI
Shenzhen University
Title: Effects of Different Sea Level Height on the Growth of Rhizophora Stylosa Seedlings
(Abstract pg. H-8)</td></tr>
<tr><td>17:20 – 17:40</td><td>Dr. Karen TAGULAO
The University of Saint Joseph
Title: Mangroves as a Nature-based Solution for Water and Climate Change Challenges in Macao SAR: From Research to Education
(Abstract pg. G-5)</td><td>17:20 – 17:30*</td><td>Ms. Ka Wai CHAN
Hong Kong Metropolitan University
Title: Comparison of Pneumatophore Characteristics and Epiphytic Microalgae between Two Distinct Mangrove Wetlands in Hong Kong
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<tr><td>17:40 – 17:45</td><td>Break</td><td>17:30 – 17:45</td><td>Student Presentation Q&A Session</td></tr>
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* denotes student presentation

22 April 2023 (Day 3)

Time	Activity
09:00 – 17:00	Eco-tour to a Local Mangrove (for details, please click HERE)

List of Abstracts

Keynote Speech 1

Professor Kenneth LEUNG

Chair Professor, Department of Chemistry;

Director, State Key Laboratory of Marine Pollution;

Associate Dean (Research & Postgraduate Education), College of Science;

City University of Hong Kong

Eco-engineered Shoreline Designs for Enhancing Marine Biodiversity and Facilitating Carbon Neutrality

Abstract

Reclamation and marine infrastructure projects often adopt simple artificial vertical or sloping seawalls as coastal defences against wave action, flooding and land erosion. However, these structures do not possess any microhabitats that can be readily occupied and used by marine organisms as refuges and feeding grounds. Through incorporating the knowledge of marine ecology and collaboration among ecologists, architects and engineers, we are able to design eco-friendly artificial structures to serve dual roles as coastal defences and functional ecosystems for enhancing marine biodiversity and ecosystem services such as carbon sequestration and biofiltration. In this presentation, I will introduce the basic ecological principles for eco-engineered shorelines and draw examples from different parts of the world. I will also highlight the results of several recent trials of eco-engineered shorelines in Hong Kong. The implementation of eco-engineered shorelines for restoring manmade habitats will support the national master plan of China for ecosystem restoration (2021-2035), and the United Nations Decade on Ecosystem Restoration (2021-2030).

Keynote Speech 2

Dr Tim JENNERJAHN

Work Group Leader, Leibniz Centre for Tropical Marine Research (ZMT), Germany

Editor-in-Chief, Estuarine, Coastal and Shelf Science (ECSS)

A Vicious Cycle: How Coastal Development Impairs Biodiversity, Blue Carbon Storage and Other Ecosystem Services - and What Can Be Done

Tim C. Jennerjahn[1,2], Shiquan Chen[3], Xiaoping Diao[4], Lucia Herbeck[1], Esther Thomsen[1,5], Daoru Wang[3], Jialin Zhang[1], Hongwei Zhao[4,6]

[1] *Leibniz Centre for Tropical Marine Research, Bremen, Germany*

[2] *Faculty of Geoscience, University of Bremen, Germany*

[3] *Hainan Academy of Ocean and Fisheries Science, Haikou, China*

[4] *State Key Laboratory of Marine Resource Utilization of South China Sea, Hainan University, Haikou, China*

[5] *Project Seagrass, Edinburgh, United Kingdom*

[6] *College of Ecology and Environment, Hainan University, Haikou, China*

Abstract

The tropical island of Hainan is the largest special economic zone of China and its coasts were once lined with mangrove forests, seagrass meadows and coral reefs. The beauty of these coastal ecosystems founds their economic potential for tourism, which is a major and growing sector. However, activities in other major economic sectors, i.e. agriculture, aquaculture and urbanization/industrialization, affect and impair the integrity of the coastal ecosystems and hence their economic potential and related livelihoods of the population.

This vicious cycle started in the 1960s when mangroves were massively deforested and converted into aquaculture ponds on Hainan. Brackish water aquaculture, with intensive use of artificial fertilizers and feed was and is a major pillar of Hainan's economy. Untreated wastewater including large amounts of anthropogenic nitrogen is either released into semi-enclosed coastal bays or directly into coastal back-reef areas where it leads to eutrophication. We traced the pathway of anthropogenic nitrogen from aquaculture ponds into coastal waters and sediments as well as into the food web over four trophic levels. Seagrasses are strongly impaired, abundance and diversity are declining, in some places they disappeared totally. Coral reefs are similarly affected by eutrophication, organic pollutants, overfishing and other threats. The connectivity of coastal ecosystems is disrupted and ecosystem service supply is diminished.

Long-term research in the inter- and transdisciplinary collaborative Sino-German projects LANCET, ECOLOC and TICAS enabled us to delineate causes and consequences of coastal development for ecosystem functioning, services and connectivity in Hainan's coastal zone. We established a science – society interface and developed and implemented measures towards a more sustainable use of the coastal zone together with stakeholders from policy and civil society. Measures included awareness raising among all stakeholders through education events in schools, public talks, stakeholder workshops, radio interviews, art exhibitions and 'citizen science'. Recommendations for decision-makers were published in a Policy Brief and training courses were conducted for aquaculture farmers. Finally, seagrass conservation and restoration projects led by transdisciplinary teams are in operation. Hainan stands as an example for problems related to coastal development observed around the globe, but also shows a way forward towards sustainability.

Keywords: coastal development, aquaculture, seagrass, eutrophication, global change, anthropogenic nitrogen, biodiversity, transdisciplinary collaboration, stakeholders, sustainable development

Keynote Speech 3

Professor Guanghui LIN

Professor

Tsinghua University

Hainan International Blue Carbon Research Center

Coastal Blue Carbon: Challenges and Opportunities for Research, Monitoring and Trades

Guanghui Lin[1,2], Luzhen Chen[3], Shuguo Lv[2,4], Licheng Wang[2,4], Qiao Xing[2,4]

[1]Tsinghua University; [2]Hainan International Blue Carbon Research Center;

[3]Xiamen University; [4]Hainan Research Academy of Environmental Sciences

Abstract

Blue carbon is broadly considered as nature bases solution (NbS) for mitigating global climate change, which attracts increasing attentions from scientists, policy makers, carbon traders and even investors. Mangroves, salt marshes and seagrass beds are three major blue carbon ecosystems (i.e. coastal blue carbon ecosystems) with global coverages, and very high carbon density, ecosystem CO_2 exchange rates, carbon burial rate and carbon sink potentials. Although great efforts have been made on scientific research, regulation policy and marketing of coastal blue carbon during last 15 years, there are still many knowledge gaps and issues regarding the mechanisms of coastal blue carbon sinks and their future dynamics, the protocols, standards and quantification methodologies for these valuable coastal wetland ecosystems, which hinges our understanding of blue carbon properties, incorporating blue carbon into national carbon trade system and value realization of blue carbon. Meanwhile, the mangroves, seagrass and salt marshes in China are still under significant pressures of human activities, biological invasion and global climate change, even most of them are under strict protections by state and local governmental regulations. Great investment will be placed on restoration of these coastal wetlands in next few years, providing great opportunities for coastal blue carbon research, monitoring, and trading. In this talk, we will summarize (1) Definitions of blue carbon including coastal blue carbon, (2) Progresses of coastal blue carbon research and monitoring, (3) Trends and issues of coastal blue carbon assessments and trading, and (4) future perspectives of coastal blue carbon research and applications.

Keynote Speech 4

Professor Brian FRY

Emeritus Professor

Australian Rivers Institute, Griffith University, Brisbane, Australia

Using Chemical Technology to Probe Mangrove Ecosystem Complexity

Abstract

Natural systems have been evolving for many of millions of years, elaborating complex relationships that suffuse and diversify modern day ecology. Using examples and case studies, this talk examines how complexity develops over time in mangrove systems. Genetic studies indicate mangrove species have diversified greatly over the last 100 million years, but have also suffered many extinctions due to sea level rise. The coming decades may offer an opportunity to observe rapid sea level rise on our warming planet, and possible new mangrove extinctions over the next 100-1000 years. Other time-based examples include how weekly and daily tidal variations can interact with groundwater to export nutrients and carbon from mangroves to the coastal ocean, while also supplying freshwater needed for tree growth. The most complex relationships in the mangrove systems probably involve food web interactions that are very flexible through time, and becoming easier to characterize with new isotope, trace element, lipid and eDNA technology. Also soil-based interactions between tree roots and colonizing fungi are being newly characterized through DNA assays, with an emerging perspective that fungi may control many time-based patterns of tree growth and mangrove forest development.

The talk concludes with a homework assignment: conference participants are asked to use online resources to create a 1-5 page e-scrapbook describing their experiences on the Day 3 Eco-Tour of local mangroves in Hong Kong. Along with cell phone photos and impressions recorded as text, the e-scrapbook should include mangrove ecosystem images from artificial intelligence as second opinions about what was observed. Homework for conference organizers is to archive the e-scrapbooks and make them available for future use; the e-scrapbooks may serve as reminders of what mangrove systems looked like in 2023 and baselines for judging subsequent mangrove complexity evolution or devolution in the Hong Kong area.

Keynote Speech 5

Professor Joe S.Y. LEE

Professor and Director, Simon F S Li Marine Science Laboratory, School of Life Sciences

Director, Institute of Environment, Energy and Sustainability

The Chinese University of Hong Kong

Adjunct Professor

Griffith University, Queensland, Australia

Harnessing the Ecosystem Services of Coastal Wetlands Through Science-based Management

Abstract

The structure and function of coastal wetlands are strongly dependent on intricate interactions of the biological community, e.g., the invertebrate assemblage, and the physical setting, e.g., the hydrological regime. These interactions result in the capacity of different coastal wetlands for delivering various ecosystem services to different extents. Decades of research on ecological processes have provided key knowledge on the interactions driving ecosystem function, which may be used to direct future management to maximize the capacity for specific services as well as optimize the balance of potentially competing demands for services. Using the service of blue carbon storage as example, I will demonstrate how decades of research on the carbon dynamics of mangrove forests may allow managers to harness the capacity of these ecosystems to contribute to emission mitigation, especially on tropical peri-urban coastlines.

Horseshoe Crabs and Coastal Wetland Conservation

Paul K.S. Shin

IUCN SSC Horseshoe Crab Specialist Group, c/o Department of Chemistry, City University of Hong Kong, Hong Kong

Abstract

Horseshoe crabs are regarded as marine living fossil and their distribution is only confined to the east coast of USA to the Yucátan Peninsula of Mexico and along the coastline of some countries in Asia. Of the four extant horseshoe crab species in the world, three are found in Asia. In particular, the mangrove horseshoe crab (*Carcinoscorpius rotundicauda*) is closely associated with the soft sediment on the fringe of mangrove systems. This presentation provides an overview of the importance of horseshoe crabs in marine coastal ecology, the imminent threats of their population decline, and how conservation of coastal wetland can help safeguard their well-being, especially for the mangrove horseshoe crabs. The ongoing work of the Horseshoe Crab Specialist Group under the IUCN Species Survival Commission is also highlighted.

Ecosystem-scale Greenhouse Gas Dynamics in a Subtropical Estuarine Mangrove

Derrick Y.F. Lai & Jiangong Liu

The Chinese University of Hong Kong

Abstract

Coastal mangroves are considered to be important carbon sinks due to their high primary productivity and carbon burial rates. Yet, there is currently a paucity of studies measuring the fluxes of carbon dioxide in mangrove ecosystems at high temporal resolutions. Moreover, the biosphere-atmosphere exchange of other greenhouse gases, e.g. methane, between mangroves and the atmosphere is not well characterized by continuous field measurement. In this presentation, we will present the results of our work on long-term monitoring of carbon dioxide and methane fluxes in a subtropical estuarine mangrove in Hong Kong. Our findings suggest that estuarine mangroves are a net sink of carbon dioxide but a net source of methane. The warming impact arising from methane emissions could offset over 50% of the cooling impact generated by carbon dioxide uptake by estuarine mangroves. Future climate change could further reduce the strength of mangrove wetlands as a nature-based climate solution through the effects on greenhouse gas fluxes.

Beach Cleanup is an Effective Way to Improve the Habitat Quality for Endangered Horseshoe Crabs

Lam, L.[1], Pan, W.S.[1], Kwan, K.Y.[2,3], Cheung, S.G.[1,4]

1. *Department of Chemistry, City University of Hong Kong, Hong Kong, China.*
2. *College of Marine Sciences, Beibu Gulf University, Qinzhou, China.*
3. *Guangxi Key Laboratory of Beibu Gulf Marine Biodiversity Conservation, Qinzhou, China.*
4. *State Key Laboratory of Marine Pollution, City University of Hong Kong, Hong Kong, China.*

Abstract

There are four extant horseshoe crab species, with two of them, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*, being found in Hong Kong. Owing to human exploitation for consumption and biomedical use, pollution and coastal development, horseshoe crabs are facing with extinction risk and *T. tridentatus*, the largest among the extant species, was categorized as endangered in the IUCN red list 2019.

The highest density of *T. tridentatus* in Hong Kong was found on two neighbouring mudflats, Ha Pak Nai and Pak Nai, in Deep Bay. Although the physical environment, including shore profile and sediment organic content of these sites, were similar, Pak Nai had a higher percentage of area covered with oyster rubbles from abandoned oyster farms than Ha Pak Nai because the frequency of beach cleanup organized by green groups in the former was only 1/3 that of the latter.

Horseshoe crabs avoid habitats with a high density of rubbles which affects their foraging behaviour, resulting in a more convoluted foraging trail. Ha Pak Nai is a more favourable habitat for horseshoe crabs, as reflected by a higher population density, a larger median prosomal width, and a higher median wet weight. After correcting for the size difference, individuals *T. tridentatus* in Hai Pak Nai were 20% heavier than those in Pak Nai. Therefore, regular beach cleanup is an effective way to improve the habitat quality for horseshoe crabs and should be promoted as a conservation strategy for these “living fossils”.

Assessing the Impact of Human Activities on Biodiversity Loss in Southeast Asia

Akbar John

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Abstract

The impact of human activities on biodiversity loss in Southeast Asia is a pressing issue that requires attention. This study aimed to assess the extent to which human activities are contributing to the loss of biodiversity in Southeast Asia. To achieve this objective, a comprehensive review of the available literature and analyzed data from various sources was conducted and the analysis revealed that human activities, such as deforestation, land-use change, poaching, and pollution, have led to a significant decline in biodiversity in Southeast Asia. For instance, Southeast Asia is home to 15% of the world's plant species, and 70% of the region's forests have been lost or degraded due to human activities. Additionally, overexploitation of marine resources and habitat destruction have caused the decline of several marine species, including sharks and sea turtles. Significant negative correlation between human activities and biodiversity was noted. Based on our findings, if current human impact on biodiversity continues, it is projected that Southeast Asia could lose up to 45% of its biodiversity by 2050. This projection highlights the urgency of addressing the impact of human activities on biodiversity loss in Southeast Asia. This study provides important insights into the impact of human activities on biodiversity loss in Southeast Asia. The findings underscore the need for effective conservation strategies to protect the region's rich biodiversity. The implementation of policies to reduce deforestation, regulate land-use change, and address overexploitation of marine resources is essential to ensure the long-term survival of Southeast Asia's biodiversity.

Studying the Little-Known: Multi-Faceted Approach for Eurasian Otter Conservation

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WWF-Hong Kong

Abstract

Eurasian otter (*Lutra lutra*) is threatened in China and a small population is known to persist in and around Mai Po Nature Reserve. As a nocturnal species that is elusive with a large home range, studying otter is often a challenge and insufficient data on the demography, spatial ecology and threats of the species hampers the development of effective conservation measures. WWF-Hong Kong is currently working with a multi-faceted approach in order to collect more scientific information about the population and space use of otters through collaboration, engagement and public education.

With generous donation from Hongkong Bank Foundation, WWF-Hong Kong has launched the "Wetland Incubator" project in 2021 to find solutions to improve the city's resilience towards climate and ecological change. As the backbone of scientific research, WWF-Hong Kong is collaborating with Kadoorie Farm and Botanic Garden to study otter population and distribution in and around Mai Po Nature Reserve via camera trapping, regular sign survey and genetic analysis. General public has also been trained as citizen scientists to support otter surveys. With the help of Wildlife Insights - a web-based camera trap data management platform, citizen scientists are able to assess camera-trapped photos at home, amid the pandemic. To further enhance otter sign detection, innovative ideas have been incubated and this include trial of spraint detection dog by engaging local dog trainer and design of otter platform by local secondary school students. A series of public awareness-raising activities focusing on Eurasian Otters have also been designed and developed by our recruited education design teams facilitated by WWF-Hong Kong.

The value of multi-faceted approach lies on the integration of knowledge and strength of different stakeholders in solving the challenges we face. This provides opportunities to not only broaden our knowledge on the species, but also implement ideas that a single party may not be able to achieve and allow more people to understand the conservation issue. In face of development pressure and threats to the otters, engaging different parties together to understand and contribute would bring us closer to achieving holistic management of a landscape where otters and people strive.

Status of Coastal Wetlands in China: A Solution for Restoration of Critical Wetlands and Waterbird Habitats in Coastal Deltaic Systems

Asfandyar Shahab

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Abstract

China's coastal wetlands have been under considerable stress and have been severely damaged due to intense urbanization, climate change, sea level rise, marine disaster, land reclamation activities, natural hazards and pollution. Coastal wetlands in China are mainly distributed in coastal areas within nine provinces and cover an area of 5795 900 ha. Coastal areas have paid a high environmental price, especially with tremendous demand for land resources leading to a sharp decline in coastal wetland areas. By 2013, the wetland area occupied by infrastructural constructions had reached 1292 800 ha, an increase of more than 10 times compared with ten years prior. China has become the world's second-largest economy, and GDP from coastal regions accounts for ~60% of China's total. Thus, the restoration and reclamation of costal area is very essential. Coastal reclamation has occurred rapidly in China since the 1950s, with over 30% of tidal land reclaimed by the 1990s. Mangroves found in southern wetlands along the coastlines for which government initiated several project for its restoration in Zhejiang, Fujian, Guangdong, Guangxi and Hainan, consequently the mangrove area in China has increased from 14877 ha in 1997 to 23 081.5 ha in 2008. For the initial restoration, some invasive species were introduced which improved the wetland ecosystem services and structure. Other restoration practices includes, to solve the sediment shortage in habitat restoration, necessary to restore migratory waterbird numbers. Three other solutions were adopted for the rehabilitation wetland sites, including promoting sediment deposition and settlement through engineering intervention in Chongming Dongtan and Eastern Nanhui, and using dredged sediments to nourish and create new habitats in Hengsha Eastern Shoal. Along with the increase of wetlands and habitats, the abundance of waterbirds increased 1.3 times, 121 times and 1.5 times in these areas respectively. Other national level initiative are “the national Clean Bohai Sea Program”, the first regional ocean governance program in China, “polluters-pay” policy for pollution control and coastal environmental protection and Laws regulating water, environmental protection, and marine environmental protection have been issued during the last decade, which has helped in the reclamation of wetland areas.

Communication, Capacity-building, Education, Participation and Awareness (CEPA) Program in Wetland Centers in China

Huizhe Hu

红树林基金会 MCF Mangrove Foundation

Abstract

Ramsar Convention on Wetlands has highlighted the importance to recognize, maintain, restore and wisely use the vital ecosystem functions and the ecosystem services they provide to people and nature. CEPA program has been developing in China since 1992, and has gone through various stages. Multiple challenges for promoting wetland education in China are identified. For instance, lack of professional exchange and practice, disconnection between wetland nature reserves and formal education, as well as low awareness of public on wetland and migratory birds conservation.

One of the key solutions proposed is the China Wetland Centers (CWC) Initiative established in 2022 at the Ramsar Convention COP14. It aims to connect people and wetlands and promote public engagement in wetland conservation through the development of wetland centers across the country. Its key objectives are to contribute to action plan for the development of wetland centers, capacity building for various stakeholders, platform for exchange and communication, and model wetland centers.

As a keen wetland education group, MCF has established several wetland centers including Shenzhen Bay center. We also developed mangrove education program which integrates with formal education curriculum. Until end of 2022, there were 6,421 students from 133 classes which have participated in the Shenzhen Bay wetland school education program.

In 2020, with help from professional experts, MCF conducted evaluation of the teaching outcomes. It was found that the program has significantly helped students with environmental learning, social communication and academic performance. Capacity building for school teachers and nature reserve education staff was also conducted through training and providing guidebooks.

Looking into future, the enhancement on exchange and collaboration among national and international networks, CEPA curriculum for formal education, as well as outreach in public communication are essential for ensuring the society's recognition on importance of wetland conservation.

The Role of Citizen Science in Wetland Monitoring and Management

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Abstract

Citizen science (i.e. the involvement of non-scientists in scientific research) has been shown in recent years to combine the possibility to expand the collection of valuable scientific data while simultaneously engaging local communities to better understand and manage local ecosystems. Nowhere is this more important than in the management of transitional wetlands, ecosystems that provide a range of services to multiple stakeholders and are severely threatened across the globe.

There is increasing interest in harnessing the scientific, social, economic, environmental, and political benefits of citizen science by using it within environmental monitoring schemes. Here, we explore the opportunities for combining citizen science and water quality monitoring data in wetland and river ecosystems. One example is the monitoring and management of multiuse wetlands in the Yangtze and Pearl river catchments, where wetlands are managed for agricultural, tourism and biodiversity purposes, but whose ecosystem services are poorly defined, largely due to limited data. The second is the Rokel River ecosystem in Sierra Leone, which has multiple stressors and yet provides major services to a population of over 2 million people.

In both cases, the creation of a citizen science programme to engage communities and local persons was shown to provide important data for wetland management. In the Nansha and Tianfu wetlands, citizen scientist data indicated that agricultural conversion of natural areas had important impacts of wetland nutrient and carbon removal services. In the Rokel River, citizen scientists are participating directly in an integrated basin management plan, providing key data and knowledge to the management process.

Fate and Effects of Macro- and Microplastics in Coastal Wetlands

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Abstract

Coastal wetlands trap plastics from terrestrial and marine sources, but the stocks of plastics and their impacts on coastal wetlands are poorly known. We evaluated the stocks, fate, and biological and biogeochemical effects of plastics in coastal wetlands with plastic abundance data from 112 studies. The representative abundance of plastics that occurs in coastal wetland sediments and is ingested by marine animals reaches 156.7 and 98.3 items kg^{-1}, respectively, 200 times higher than that (0.43 items kg^{-1}) in the water column. Plastics are more abundant in mangrove forests and tidal marshes than in tidal flats and seagrass meadows. The variation in plastic abundance is related to climatic and geographic zones, seasons, and population density or plastic waste management. The abundance of plastics ingested by pelagic and demersal fish increases with fish length and dry weight. The dominant characteristics of plastics ingested by marine animals are correlated with those found in coastal wetland sediments. Microplastics exert negative effects on biota abundance and mangrove survival but positive effects on sediment nutrients, leaf drop, and carbon emission. We highlight that plastic pollution is widespread in coastal wetlands and actions are urged to include microplastics in ecosystem health and degradation assessment.

Mangroves as a Nature-based Solution to Climatic Change Mitigation: Research and Application

Luzhen Chen

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Abstract

The human-created greenhouse gas emissions have caused dramatic changes in the earth's climate with warming and sea-level rise. Mangroves are recognized as a key potential and self-sustaining Nature-based solution (NbS) to mitigating climate change attributed to their ability to capture and store carbon. High photosynthetic rates, fast sediment deposition rates, and low decomposition in anoxia sediment with coastal flooding contribute to high carbon capture and storage in mangroves. Fast sediment accretion rates will help build up land to balance the rising sea level. Due to the conservative water use characteristics, mangroves can furthermore contribute to the coastal water cycle and alleviate freshwater shortages. Importantly, mangrove ecosystems conserve high biodiversity and maintain a livelihood in coastal regions, if they are healthy and sustainably managed. However, mangroves are facing the challenges of global climate change and land-use changes. Whether they can serve well as NbS to mitigate climate change depends on their capacities for ecosystem-based adaptation, especially on the adaptations of plant communities. A robust consideration of global change factors and their interactions with mangroves will help us better predict of the future patterns and functions of this ecosystem. Increased knowledge of the combined effects between climate factors (e.g. elevated atmospheric CO_2 concentrations, warming, sea-level rise) and local environmental factors (e.g. hydrology, flooding, nutrient enrichment, species competition, etc.) would reduce uncertainty in the impacts of climate change with varying anthropogenic stressors. Research-integrated fundamental knowledge will broaden the community of practice of blue carbon science, and contribute to the management and new economic pathways to support carbon-neutral strategies.

Impacts of Land-Use Change on Organic Carbon Dynamics in China's Coastal Wetlands

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East China Normal University, The Chinese University of Hong Kong

Abstract

Coastal wetlands such as mangroves and salt marshes are termed "blue carbon" ecosystem due to their strong capacity for carbon (C) storage and sequestration. Unfortunately, many coastal wetlands have been intensively developed by land-use and land-cover change (LULCC) for more than a century owing to the rising population and subsequent economic growth. The impact of LULCC on ecosystem carbon dynamics has been previously documented at local scales or global scales, but uncertainty persists for the coastal wetlands due to geographical variability and field data limitations. Here, field-based assessments of plant and soil C contents and stocks of various LULCC types were conducted on nine regions along the coastline of China, ranging from temperate to tropical climate zones. These regions are cover natural coastal wetlands (including salt marshes and mangroves) and former wetlands converted to different LULCC types, including reclaimed wetlands, dry farmlands, paddy fields and aquaculture ponds. A total of 120 plant samples and 540 soil samples (top 30 cm) were collected in July to August 2020, for the measurement of content and stock of soil total and organic C, and plant biomass C. The results showed that natural coastal wetland had highest ecosystem organic C stock (EOC, sum of plant and soil organic C stocks) of 77.0±24.8 Mg ha-1, while LULCC generally decreased C contents and stocks of plant–soil system by 29.6%±2.5% and 40.4%±9.2%, respectively, but significantly increased the proportion of labile C in soil. Conversion to aquaculture ponds caused largest EOC loss, following reclaimed wetlands, dry farmlands and paddy fields. The proportion of labile C in soil organic carbon can be an indicator reflecting the potential of organic C loss following LULCC. Our results showed that the response of plant-soil organic C to LULCC was mainly related to differences in soil particle size, soil water content, plant biomass, ratio of labile C to soil organic C, and NH4+-N concentration. Our results emphasize the importance of LULCC in triggering C loss in natural coastal wetlands, giving a hint that the current land-based climate models and climate mitigation policies must account for situation of specific land use types.

Raft Identification and Biomass Assessment of Oyster Culture Based on Machine Learning

Guangping Zhang

Beibu Gulf University

Abstract

Qinzhou Bay is not only known as the hometown of high-quality oysters-big oysters, but also the largest oyster breeding base in China. Large-scale and scattered oyster breeding rafts and oyster biomass assessment have become urgent problems in fishery management. Remote sensing images can present large-scale, high-definition oyster farming conditions. Artificial intelligence machine learning, especially target detection algorithms, have the advantages of high recognition accuracy. Therefore, this study uses the remote sensing image data of aquaculture sea area to develop a Raft-YOLO model for machine learning target detection to solve the problem of small target aquaculture raft recognition in complex backgrounds, realize accurate identification of aquaculture rafts and quickly count the biomass of oysters cultured. The experimental results show that: (1) A detection frame generation method based on the Raft-YOLO model with extended rotation angle elements is proposed, which makes it easier for the detection frame to match irregular targets under complex backgrounds. (2) The target IoU is calculated based on the intersection and union method of pixel units, which makes the loss value sensitive to the size, position and rotation angle of the label box, and is more conducive to the non-maximum suppression of NMS to control the selection of the detection box. (3) The AVG Recall of the Raft-YOLO model is 0.73, which is 0.12 higher than the YOLOv5 average recall rate of 0.61. It can be seen that the Raft-YOLO model has a better effect on the identification of oyster farming rafts. (4) Combined with the on-site oyster biomass survey and model evaluation, 4,419 aquaculture rafts and 222,100 tons of oyster resources were estimated. Therefore, the Raft-YOLO model can serve applications such as marine fishery management and typhoon disaster loss assessment.

The Nature Conservancy's (TNC) Community and Ecosystem Approaches to Restore the Endangered Oyster Reef and Ecologically Important Habitats in Pak Nai

Tom Chan, Sheila Wong, Anniqa Law, Marine Thomas

The Nature Conservancy (TNC) Hong Kong

Abstract

Pak Nai, adjacent to Mai Po Inner Deep Bay Ramsar Site, is one of the ecological hotspots in Hong Kong. The mudflat of Pak Nai, where Kon Pak Stream meets Deep Bay, is home to a variety of species including Chinese horseshoe crabs (*Tachypleus tridentatus*), Mangrove horseshoe crabs (*Carcinoscorpius rotundicauda*), black-faced spoonbills (*Platalea minor*), seagrass (*Halophila beccarii*), Hong Kong oyster (*Magallana hongkongensis*) and many mudflat organisms. It is an estuarine area with mangrove, seagrass bed, bare soft shore and a large area of abandoned benthic oyster farms in the low tide areas of the mudflat that has high potential to be converted to oyster reef. Oyster reefs are the most endangered marine habitat on the planet, with an estimated 85% global loss.

Despite its ecological importance, Pak Nai is currently not protected and under a multitude of increasing threats. To address this, The Nature Conservancy (TNC) has adopted the community conservation approach by working with local villagers and community partners to actively manage the coastal ecosystem in Pak Nai, since 2021 summer. TNC's work includes conducting scientific research, carrying out site-based habitat management, promoting responsible tourism, and raising public awareness. Over the past 1.5 years, TNC has engaged more than 3,500 members of public to reconfigure more than 5000m^2 of abandoned oyster reef, removed more than 1200m^2 of invasive cordgrass (Sporobolus alterniflorus), cleaned about 190m^3 of aquaculture debris and 4,278kg of marine litter, in Pak Nai.

In this interim stage of our 3-year plan, TNC would like to share our latest progress and findings on managing different habitats in Pak Nai as well as the importance of adopting the community conservation approach.

Assessing the Marine Biodiversity of Lung Mei and Ting Kok After the Construction of an Artificial Beach

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Abstract

The coastal ecosystems of Lung Mei and Ting Kok in the Tolo Harbour and Channel in Hong Kong are known for their high biodiversity. Unfortunately, the construction of an artificial beach in Lung Mei has threatened the ecological value of the region. This study was conducted to investigate the marine biodiversity of Lung Mei and Ting Kok after the beach was built. Two sites, Lung Mei East and Lung Mei West, and one reference site, Ting Kok East, were selected and monitored for a period of one year. Quantitative surveys were conducted twice during the dry and wet seasons, including transect and quadrat surveys, beach seining and purse seining. Additionally, monthly qualitative monitoring was carried out to supplement the species found at each site. A total of 327 marine species were recorded in the course of the study. Ting Kok East (TKE) was the most biodiverse site, with 243 species, followed by Lung Mei West (LMW) with 239 species, and Lung Mei East (LME) with 208 species. Within the Lung Mei sites, LMW had a higher species richness, abundance and biomass than LME. The dominant taxonomic groups were bivalves, gastropods, crustaceans, and fishes, which accounted for 74.3% of the total species recorded. Additionally, species richness, abundance, and biomass were higher during the summer than in the winter across the three sites. The higher biodiversity of benthic species in TKE compared to LMW and LME could be explained by the differences in the substrate and habitat composition. The more natural and diverse habitats in TKE may have contributed to its higher biodiversity, whereas the less natural and diverse habitats in LME may explain its lower biodiversity. This systematic assessment of biodiversity over the course of a year has allowed for a better understanding of coastal biodiversity in a post-construction scenario. The artificial and degraded shores at Lung Mei could be potentially restored by implementing ecologically engineered techniques to increase the provision of suitable habitats for marine species.

Fish Diversity, Fishery and Conservation of Less Explored Small Estuarine Habitat in Kerala - Through the Perceptive of Fisherman Community, Western Ghats, India

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Abstract

Coastal wetlands are the one of the most disappearing habitat among all the wetland types. Landfilling, construction of buildings, urban development projects, aquaculture farming are some of the major threats to this wetland. The study focused on the less studied and unexplored coastal wetland system in northern Kerala, India. Kavvayi, Azheekkal, Dharmadam, Ezhimala, Valapattanam are the selected estuaries for this study. Azheekkal, Madakkara, Ezhimala, Dharmadam, valapattanam are the major estuaries in Kannur and kasargod district, Kerala state India. The area is part of Western Ghats. All these estuaries ultimately join with Arabian Sea. As a part of the research fish diversity and its availability in each coastal wetland were studied from monsoon to summer season. The diversity and the availability of the fishes were collected from the estuarine landing centers .landing survey was systematically conducted in all season to know the fishery resource of each estuary. Presence of 158 fish species were recorded. There are 28 elasmobranches were present throughout the study area. Fish diversity and species richness was abundant in Dharmadam, Azheekkal and valapattanam. Fish diversity and richness was calculated by PAST software. A community platform we made for the open interaction for the fisherman community in each estuarine zone. There are 580 active Fisherman were interviewed to know the perception on fish and fishery in the estuarine habitat. The unsustainable fishing or Juvenile catch was high during monsoon. Here the study focused only on finfishes and elasmobranches (Rays &sharks).The salinity in each estuary was recorded through the onsite salinometer in every regular interval. The community participation and socially committed fisherman youth wings help to record the water parameter data. We already provide one day training for the fisherman community for conservation and sustainable use of fish and fishery in all six estuaries. Interview, survey, focal group discussion, estuary wise vulnerability assessment were conducted. To ensure proper conservation of estuaries are essential for conserve fish, their habitat as well as livelihood of local fisherman community.

Microbial Communities in Mangrove Ecosystem Differs by Intertidal Location and Microhabitat of Pneumatophores

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Abstract

The periodic tidal cycles in mangroves ecosystem induce wide variation in environmental parameters across small spatial scale. These variations across intertidal locations and pneumatophore lead to the formation of characteristic microbial zones with varying community structure and function. With the purpose of studying microbial zonation, the Ting Kok mangrove in Hong Kong was partitioned into three different zones: mudflat (TK_MF), mangrove (TK_M) and pneumatophore associated sediments (TK_PSAM). The sediment samples from all the three microbial zones were processed for metagenomic DNA extraction followed by shotgun sequencing and metadata analysis. Proteobacteria and Bacteroidetes were the most dominant phyla in all the microhabitats followed by Firmicutes (in TK_MF_ and TK_M_) and cyanobacteria (in TK_PSAM). Archaeal distribution remained uniform across all three habitats with Thaumarchaeota as the most abundant phyla. Simultaneous analysis was performed to study functional zonation associated with crucial energy metabolic pathways (methane and nitrogen metabolism) in mangrove ecosystem. Relatively high proportion of genes associated with methanogenesis was observed in TK_MF_ and TK_M_ samples as compared to TK_PSAM. For nitrogen metabolism, the relative abundance of nitrogen fixation and denitrification pathway were high in TK_MF_ and TK_M_ samples whereas nitrate reduction pathway was high in TK_PSAM_. To the best of our knowledge, this is the first attempt to study prokaryotic zonation in intertidal location and pneumatophore using shotgun sequencing.

Keywords: Mangrove, microbial zonation, prokaryotic distribution, methane metabolism, nitrogen metabolism

This work was partially supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (UGC/FDS16/M06/21)

Poster presentation is also available HERE.

The Practical Experience of Conservation and Restoration in Shenzhen Bay, South China

Qiong Yang

Guangdong Neilingding Futian National Nature Reserve

Abstract

Shenzhen Bay (Deep Bay) is a coastal wetland located between Shenzhen and Hong Kong, and is a wintering ground and transit station for Nearly 100,000 waterfowls on the East Asia-Australia flyway, which has important ecological and social values. The Futian Mangrove wetland on the Shenzhen side is the only national nature reserve in the urban hinterland in China, and is more affected by urban development. This presentation focuses on the experience and practices of conservation and restoration work carried out on the Futian side over the past 30 years, systematically and rigidly protecting and restoring mangrove forests and waterfowl habitats, while taking into account the needs of Cityscape and Public visit. These experiences and practices will hopefully provide practical examples to other countries and regions in the urbanization process, helping to achieve the harmonious coexistence of cities and wetlands, people and nature.

The Role of Education in Conservation and Sustainable Use of Wetland, a Case Study of Mai Po Nature Reserve

Yamme Leung

WWF-Hong Kong

Abstract

The latest edition of "Living Planet Report 2022" concluded that globally, there has been an average decline of 69% in wildlife species populations since 1970, implying the planet is in the midst of a biodiversity and climate crisis, and we have a last chance to act.

With the journey began in 1961, WWF is now active in nearly 100 countries with a mission to build a future in which humans live in harmony with nature. As the world's leading conservation organization, we works at every level. Through collaborating with people around world, WWF strives to bend the curve of nature loss hence people and nature can thrive!

WWF-Hong Kong is an integral part of the WWF global network since 1981. Our work here began with managing the Mai Po Nature Reserve, an important part of the only Wetland of International Importance (Ramsar Site) in Hong Kong SAR. We have since expanded our mission to cover other aspects of conservation and sustainability with the goal to transform Hong Kong into Asia's most sustainable city. To achieve this, it is dependent on all people from across the community.

Engaging all walks of life to become part of the conservation solutions are done through various community education and eco-programmes. WWF-Hong Kong is operating the nature centre at Mai Po Nature Reserve to help create a new generation of conservation and sustainability advocates through fun, engagement and real-life experiences. The conservation management at the wetlands of Mai Po is a good model to demonstrate how the communities in Hong Kong can be engaged, motivated and mobilized to support nature conservation.

"Change the way we live" and "Habits Protect Habitats" has become the mantras for WWF's education works. Let's join hands to create a nature-positive future.

Habitat Distribution and Connectivity for Asian Horseshoe Crabs in Mangrove Wetlands of Northern Beibu Gulf, China: Recommendations for Conservation Management

Kit Yue Kwan, Chun-Chieh Wang, Yijian Fu, Yang Kuang, Xin Yang, Zhou Wu

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Abstract

Asian horseshoe crabs are ancient marine arthropods inhabiting coastal and estuarine ecosystems along the west coast of the Pacific Oceans. The distribution of mangrove and horseshoe crab habitats along the Chinese coastline is highly overlapped. However, the role of mangrove wetlands in supporting horseshoe crab populations is largely unknown. Field investigations in northern Beibu Gulf, China found that, Asian horseshoe crab nests were distributed in bare flats in between mangrove patches, at the bases of mangrove roots, or near tidal creeks adjacent to seawall. Nests can also be found near man-made structures, including mangrove boardwalks, seawall slopes, water control gates. These areas were characterized with elevated, mildly sloping substratum within the high tide zones. For the nursery habitats, juvenile Asian horseshoe crabs are primarily distributed on upper intertidal flats outside the mangrove fringes or saltmarsh patches close to tidal creek outflows. The relative locations of their spawning and nursery habitats suggest that mangrove tidal creek may be the main route for horseshoe crab larval dispersal. Based on the present findings, effective management measures for conservation of Asian horseshoe crab populations include: (1) routinely remove ground cages/erected stick nets and abandoned aquaculture farm structures/rubbles within upper intertidal areas, particularly during peaked breeding and nursery seasons (May-July), (2) regulate artisanal aquaculture, fishing and beachcombing activities near mangrove fringes and along tidal creeks, (3) avoid coastal projects that alter the beach topography and bathymetry, (4) create mounds with suitable slope and sediment textures along the shoreline to improve spawning habitats.

Keywords: Tachypleus tridentatus; Carcinoscorpius rotundicauda; spawning habitat; nursery habitat; mangrove tidal creek

Bycatch of Asian Horseshoe Crabs in Intertidal Zones of the Northern Beibu Gulf, Guangxi: Suggestions for Conservation Management

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Abstract

Bycatch is a severe challenge to global marine biodiversity conservation. Although studies have focused on bycatch of marine megafauna, research on relevant issues regarding invertebrates is limited, especially for the threatened horseshoe crabs. In this study, we explored the spatial pattern of common fishing gears and evaluated the bycatch intensity of two Asian horseshoe crab species in the intertidal zones of the northern Beibu Gulf, Guangxi, where the most abundant juvenile horseshoe crab populations distribute in along the coastline of China. Seven intertidal habitats for *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* were surveyed in the summer. A transect that crossed the tidal creeks and tidal flats between the high tide embankment/vegetation and low tide line of a given habitat was surveyed during the ebb tide. The type, number, and GPS of fishing gears were recorded when sighted; the bycatch number of each horseshoe crab species was counted and prosomal width of every bycaught individuals was measured. Bycatch intensities differed among the habitats, ranging 0.3-18.4 and 1.2-22.7 individuals per kilometer of transect for *T. tridentatus* and *C. rotundicauda*, respectively. Among the three types of fishing gears, ground cages and stick net sets which were located near the tidal creeks, fringes of mangrove forests, and low tide lines, caused a stronger bycatch pressure on these two species. Most bycaught horseshoe crabs were large individuals in late juvenile and adult stages. We suggest regulating the use of ground cages and stick net sets in the intertidal zones to reduce the stress of bycatch on threatened horseshoe crab populations. Ground cages and stick net sets should be regularly removed from focal areas, including tidal creeks, mangrove fringes, and low tide lines to ensure functionality of the intertidal zone as the spawning corridor and nursery habitat for these two species of Asian horseshoe crabs.

Implications of Nitrogen Enrichment for the Biogeochemical Role of Sesarmid Crabs in Tropical Mangrove Ecosystems

Xueqin Gao and Shing Yip Lee

The Chinese University of Hong Kong

Abstract

Often situated on populous tropical coasts, mangroves are commonly threatened by anthropogenic nutrient enrichment. Sesarmid crabs play an essential role in mangrove ecosystem processes, mainly attributed to their leaf-eating habit. This study investigated how mangrove sesarmid crabs respond to nitrogen (N) enrichment and their regulatory role in nutrient dynamics. We hypothesized that N enrichment would change the microphytobenthos (MPB) communities in surface sediment, which may modify the crab's diet, e.g., increased use of MPB and reduced leaf litter consumption, thus affecting their role in nutrient dynamics through shaping the microbial communities in surface sediment. The same amount of 13C-enriched mangrove leaves added to tidal mesocosms with two factors and four treatments (high/low N enrichment and presence/absence of crabs) each day for two months. Field levels of N, crab and MPB abundances were measured as reference. N enrichment at 2x and 20x the background level resulted in significant changes in the MPB composition (increased relative abundance of cyanobacteria). Stable isotope analysis followed by mixing models suggested that the main carbon source of crabs shifted from leaf litter to cyanobacteria in mesocosms for both high (20x) and low (2x) N enrichment. However, their leaf-eating habit (leaf consumption rate) did not change during the experiment. The significantly lower total cellulase activity of mesocosm crabs compared to field crabs might explain the decreased C assimilation from leaf litter. In the mesocosms with crabs, microbiome taxonomic and functional structure showed significant differences between high and low N enrichment, driving significantly higher C processing rate in mesocosms with high N enrichment. This demonstrated linkage between nutrient dynamics (through stable isotope analysis) and the composition of microbial communities provides a framework for achieving mechanistic insights into how sesarmid crabs drive key biogeochemical processes in mangroves under eutrophic conditions.

Juvenile Fish Communities in Coastal Soft-bottom and Shallow Water Habitats at the Tolo Harbour and Channel in Hong Kong, South China

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Abstract

Coastal wetlands, such as mangroves, mud flats and sandy beaches, are often key nursery grounds for marine fishes. These habitats are also important not only in supporting a rich biodiversity, but also in social-economic aspects as they provide various ecosystem services and fishery resources to local communities. Tolo Harbour and Channel (the Tolo Area) at north-eastern Hong Kong in South China harbours various coastal wetlands including the fourth largest mangrove stand in Hong Kong. The Tolo Area has been previously recognised as a nursery ground of marine fish species, including those that are commercially important. However, these coastal wetlands, and the marine biodiversity and fisheries resources in this area have been jeopardised by various anthropogenic threats such as coastal development and pollution. This study aimed at providing up-to-date ecological information of juvenile marine fishes in the Tolo Area, and identifying locations with a high conservation priority. A three-year study, using beach and purse seining, was carried out to assess the current status of the juvenile fish community in coastal soft-bottom and shallow water habitats throughout the Tolo Area. A total of 171 species/taxa were recorded, including the IUCN-red-listed vulnerable species of seahorse Hippocampus kuda. Juvenile individuals were found in 155 of the recorded species/taxa. Juvenile fishes were dominated by small and/or fast-growing species. Significant spatial and seasonal variations in juvenile fish assemblages were recorded in the Tolo Area. Diel differences in juvenile fish assemblages were also recorded in sites where additional night-time surveys were conducted. Species richness was generally higher in outer Tolo Harbour and inner Tolo Channel, and priority should be given to the coastal soft-bottom and shallow water habitats in these areas to protect the species diversity and fishery resources. The results of this systematic study provide an ecological baseline of juvenile fishes in the Tolo Area for future monitoring and conservation of the coastal wetlands marine fish communities.

Revealing Population Trends of Deep Bay Wintering Waterbirds and Use of Movement Data Studying Waterbird Habitat Uses

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Abstract

Waterbird population is an important indicators of a healthy wetland ecosystem and waterbird monitoring is a common practice in wetland conservation to collect data on their population size. In Deep Bay, many are migratory which breed in Siberia in summer, and migrate southward after breeding season along a migration route known as East Asian-Australasian flyway (EAAF). As one of the most important wintering sites for migratory waterbirds, Deep Bay area with long-term waterbird monitoring is shown to hold significant EAAF populations for 13 waterbird species. Along EAAF, studies have shown that wintering populations of many species have declined in Australia and Japan; however, long term data of waterbird population along China coast are limited.

We analyzed population data collected from monthly bird surveys to quantify population trends of wintering waterbirds from 1998 to 2017 in Deep Bay area. Of the 42 species studied, 12 declined, while nine increased significantly. Phylogenetic comparative analysis revealed that population trends were negatively correlated to reliance on the Yellow Sea and body size. Further, waterbird species breeding in Southern Siberia declined more than those breeding in East Asia. This study shows that data collected from wintering sites provide insights on the patterns of declining waterbirds along EAAF and inform conservation actions accordingly.

Building on the study result, we conduct further research in Deep Bay by putting GPS loggers on Eurasian Wigeon and Black-faced Spoonbill, to track its movement and habitat use. Preliminary data show individuals had a home range covering a considerable extent of wetlands in Deep Bay area, and was using a variety of wetlands including fishponds, abandoned ponds, river channels, mudflats and geiwai, and also moved away from the Deep Bay, highlighting the knowledge gap of such diverse habitat use by the species, and the ecological function of different types of wetlands towards waterbirds.

Coastal Blue Carbon as an Effective Climate Response: Progress in the Development of Blue Carbon Projects in the Global Carbon Market

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Abstract

Coastal wetlands have a variety of ecosystem services including blue carbon sinks and biodiversity conservation. As an important component of nature-based solutions (NbS), coastal wetlands sequestrate blue carbon and mitigate climate change. The blue carbon projects (BCPs) that generate carbon credits for the market by conserving and restoring coastal wetlands act as an effective way to realize the value of coastal wetlands, which play an important roles of blue carbon ecosystems in coping with climate change. This study overview the existing carbon market and carbon market methodologies applicable to BCPs in the global, and analyses the development of BCPs in the current carbon market. Currently, totally 12 BCPs, all of which are mangrove projects, have been registered under Clean Development Mechanism (CDM), Verified Carbon Standard (VCS) and Plan Vivo Standard. Methodologies for mangrove BCPs in mainland China have also been developed, and mangrove BCPs in Fujian and Hainan Province have been successfully developed and traded. However, the methodologies applied to the BCPs is still limited, which need to be developed and promoted across a wider range of project types and ecosystems. In addition, we discussed the strengths and challenges of implementing BCPs and compared the management strategies used in global BCPs to provide advice on future BCPs design as well as blue carbon market development. BCPs can not only provide carbon credits for the market, but also enable community development and biodiversity conservation. And political support, effective community engagement and numerous goals in addition to the generation of carbon credits are critical for project success.

Econometric Evaluation of Local Ecosystem Services from Mangrove Plantations in Bangladesh

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Abstract

What is an ecosystem service? Often not well defined even among those who employ the term often, this seminar presents a conceptual framework for understanding ecosystem services that facilitates their assessment and valuation. Produced from a combination of spatial econometric and GIS modelling methods, results from a case study of mangrove plantations in Bangladesh are used to demonstrate this approach for both provisioning and regulating ecosystem services. Results from a household survey across eight coastal villages illustrate how and who among local rural communities utilize these resources. The predominant direct use of the mangrove plantations within local rural communities is the extraction of detritus and non-main stem material (e.g., limbs, leaves) for combustible fuel, disproportionately by the landless and the poor. This study uses household foraging distances to estimate and map net value densities based on reported market prices of extracted goods. Cost-benefit analyses suggest that direct use values alone have justified the establishment and management of previously planted stands. However, other indirect values must be taken into account if these areas are to merit additional plantations. Analysis of GIS data on coastal dynamics and land cover demonstrate the effectiveness of mangrove plantations for facilitating accretion and preventing erosion in Bangladesh. The results indicate that plantation areas experience greater rates of accretion relative to erosion than non-plantation areas. On the other hand, econometric analyses fail to show any benefits of the mangrove plantations from acting as barriers to tropical cyclone activity. Thus, rigorous, data-driven assessment can yield counterintuitive results, which underscores the need for primary data collection in the assessment and evaluation of ecosystem services.

Refocusing on Hong Kong, what key ecosystem services from mangroves and other wetlands are relevant to our urban setting? What methods are appropriate for evaluating them? Prevailing studies of ecosystem services in Hong Kong and the Greater Bay Area have relied upon questionable benefit transfer methods that lack external validity. One possible alternative is the application of local primary data in allometric models. Given the paucity of primary data currently available, this remains a challenging information gap for Hong Kong.

Current Situation of Mangrove Resources in Guangxi and its Protection Countermeasures

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Abstract

Mangrove is a typical natural landscape with great ecological, social and economic functions and values, and should be highly valued and protected. However, in the past few decades, mangrove resources have suffered serious damage. Chinese mangroves, as an important part of the global mangroves, are of great research value. In the present study, the status and challenges of Chinese mangrove resources in Guangxi were investigated. In terms of administrative region, mangroves in China mainly occur in three provinces, Guangdong (9,891ha), Guangxi (8,375ha), and Hainan (3,930.3ha), constituting an area of 22,196ha. Guangxi coast of Beibu Gulf (8,375ha), making up 35.72% of China mangroves. Mangrove area in the three regions constitutes 78.66% of total mangrove coverage in China. In this study, the community types and spatial distribution of mangroves along Guangxi coast was studies based on multi-source high-resolution satellite imageries, using image processing, GIS, GPS technology and field investigations. As per results, there were 7 243.15 hm^2 of mangroves in Guangxi in 2023. Totally, 2793 mangrove patches were found, with the average patch-area of 2.59 hm^2. The total area and the number of patches of mangrove in Beihai city were 3263.66 hm^2 and 905 respectively, accounting for 45.06% of mangroves in Guangxi. There were 2097.41 hm^2 in Qinzhou city, which had 1259 patches and accounted for 28.96% of mangroves in Guangxi. Fangchenggang city had the smallest area of mangroves among the three coastal cities in Guangxi, with 1882.08 hm^2 in area, 629 patches which accounting for 25.98% of mangroves in Guangxi. Twenty-one types of mangrove communities in Guangxi were identified, including Community *Avicennia marina*, Community *Avicennia marina+Aegiceras corniculatum*, Community *Aegiceras corniculatum*, Community *Aegiceras corniculatum+Avicennia marina*, and Community *Bruguiera gymnoihiza -Avicennia marina*, etc. and were among the most dominant mangrove communities. At the same time Guangxi mangrove resource faces serval challenges, for instance, the development of Beibu Gulf Economic Zone threatens the mangrove ecosystems. Seawall construction, shrimp pond enclosures, and mangrove cutting degrade mangrove habitats, leading to mangrove damage and death. Identifying suitable mangrove restoration sites and determining suitable habitat conditions are key factors that affect the success of mangrove restoration.

Restoring Ecological Connectivity of Seagrasses and Coastal Wetlands to Enhance Ecosystem Services

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Abstract

Seagrass, mangroves and saltmarshes are important ecosystem engineers with fundamental ecological roles in coastal areas. These plants mitigate habitat erosion, they help to tackle climate change through carbon removal and storage, they provide shelter and food to many animals, and they also improve water quality by filtering out nutrients and by controlling pathogens. These ecosystem services contribute with numerous socio-economic benefits to the coastal communities, sustaining for instance many commercial fisheries and aquaculture activities. Despite of these valuable and fundamental services, we are witnessing a significant and rapid decline of natural populations of coastal marine plants in Hong Kong. Such declines are mainly driven by anthropogenic pressures, including pollution and the alteration of the seascape configuration. As a consequence, the ecological connectivity of coastal marine vegetation has been strongly affected, generating important functional effects on the health and resilience of coastal wetlands. Here, I will discuss the outcomes of ongoing projects enhancing wetland ecosystem services by restoring the connectivity between seagrasses, mangroves and saltmarshes in Hong Kong. Using an environmental DNA (eDNA) approach, we identified higher biodiversity assemblages in areas where seagrass connectivity was considered as part of the restoration intervention, compared to areas in which seagrasses were restored in isolation. The result of this work highlights the importance of landscape/seascape connectivity when planning restoration and managing efforts for coastal vegetation in highly urbanized and fragmented zones.

Mangroves as a Nature-based Solution for Water and Climate Change Challenges in Macao SAR: From Research to Education

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Abstract

Mangrove forests are vital coastal wetland ecosystems that provide various ecosystem services. In Macao, a city located on the west shore of the Pearl River in southern China, mangroves have become a focus of our scientific investigation. Our research has centered on the local mangroves, particularly investigating their role as nature-based solutions for addressing coastal water pollution and climate change-related issues. Moreover, they have the potential as carbon sinks and natural coastal barriers, which are crucial in mitigating the adverse effects of climate change. Our findings suggest that mangroves have an essential role to play in Macao's local environment. They are, however, vulnerable to threats due to rapid development in the city. To raise awareness about the value of mangroves, we have developed environmental awareness campaigns that aim to translate our research findings into actionable solutions. Through these initiatives, we have engaged thousands of students and other people from the local community in successfully implementing these activities. Overall, our research highlights the potential of mangroves as nature-based solutions for addressing environmental challenges and the importance of raising awareness to protect and conserve these ecosystems in Macao.

Full Size Microplastics Pollution Survey to the Costal Marine Waters of Hong Kong

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Abstract

Microplastics (MPs) are defined as plastic particles with sizes ranging from 1 μm to 5 mm, which are considered as a severe concern to the pollution of marine environment. Traditional practices by the collecting of MPs through trawling a net and quantification by microscopy limited the range of MPs down to around 50 μm. In this study, the abundance of full-size MPs in Hong Kong marine water at twelve locations was investigated using fluorescence microscopy (50 μm – 5 mm) and flow cytometry (1 – 50 μm) respectively, during the wet (September 2021) and dry (March 2022) seasons. The average abundance of MPs with size ranges of 50 μm – 5 mm and 1 – 50 μm from twelve sampling locations marine surface waters were found ranging from 27– 104 particles L^{-1} and 43,675 – 387,901 particles L^{-1} in the wet season respectively, and 13 – 36 particles L^{-1} and 23,178 – 338,604 particles L^{-1} in the dry season respectively. Significant temporal and spatial variations of small MPs abundance were observed at the sampling locations, which might be contributed by the influences of the estuary of Pearl River, sewage discharge points, land structure, and other anthropogenic influences. Ecological risk assessment was conducted and revealed that the small MPs (< 10 μm) in coastal marine surface waters may pose potential health risks to aquatic organisms.

The work was supported by the grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (UGC/FDS16/M07/19 and UGC/IDS(R)16/19)

The Surface Elevation Changes of Salt Marshes and Vulnerability to Sea-level Rise

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Abstract

Salt marshes, as an essential part of coastal wetlands, not only play a critical role in maintaining biodiversity, but are also significant for climate change mitigation and adaptation. Sea-level rise has become a climate change factor that seriously threatens the survival of salt marshes. Although the surface elevation change of salt marshes could keep peace with the sea-level rise through vertical and longitudinal biomorphic processes within normal limits, most of the landward successional paths of salt marshes are blocked by human facilities in China. Therefore, accurate quantification of the relationship between surface elevation changes of salt marshes and sea-level rise rate becomes the key to scientifically assess the vulnerability of salt marshes to sea level rise in the future. The interannual change of surface elevation and sea level rise rate in coastal wetlands are both on millimeter scale, and the tidal and vegetation disturbances greatly limit the study of surface elevation response to sea level rise in coastal wetlands. The surface elevation table-marker horizon (SET-MH) monitoring system enables high-precision monitoring of surface elevation changes, vertical accretion and shallow subsidence in coastal wetlands. We established a unified standard SET-MH monitoring system in salt marshes in China, clarify the range of surface elevation change rates in China's salt marshes, also explore the relationship between different processes of surface elevation change. It will provide a scientific basis and support for accurate assessment of the vulnerability of salt marshes to sea-level rise and the management of climate change response.

The Impact of Urban Development on Wetland Conservation

Zhaobin Li

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Abstract

Wetland is an integrated ecosystem which includes ecosystems such as hydrology, soil, vegetation, and biological environments. At present, the urbanization rate of China's national economic development process is rapidly increasing, and by the end of 2021, the urbanization rate of China's resident population will be 64.72%. This paper analyzes the hydrological effects of urbanization, the impact of water resources, climate change, and biodiversity on wetland ecosystems, and also analyzes the role of wetlands on the ecological environment, especially in terms of ecological and cultural values. The economic and social benefits of the whole society are also analyzed. The ecological and social benefits of urban wetlands have made their conservation and sustainable development increasingly important worldwide. Based on the current situation of China's urban wetland protection and restoration, we put forward countermeasures and suggestions for China's urban wetland protection. This is conducive to promoting the sustainable development of the urban wetland ecosystem, promoting the operation of the market, realizing the optimal allocation of ecological resources, improving the benefits of ecological environmental protection, and promoting the coordinated development of the ecological environment. This paper provides a reference for the better development of wetland conservation under urbanization development conditions.

Assessing the Effect of Heavy Metal Pollution on Seagrass Microbiomes in Highly Urbanized Areas: Tools for Monitoring and Restoring Seagrasses in Hong Kong

Ho Tun NG, JD Gaitán-Espitia

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Abstract

Seagrasses, the only flowering plants that have adapted to live in marine environments, are unique primary producers that play an important role in coastal habitats. They provide various ecosystem services such as carbon sequestration, nursery ground for numerous marine species, water quality improvement and sediment stabilization. Unfortunately, habitat fragmentation and the enhanced pressure of chemical pollution are driving a global decline in seagrass populations, ultimately affecting the services provided and the well-being of our communities. Hong Kong is not the exception to this trend. The five local species of seagrass are evidencing drastic reductions and local extinctions during the last 10 years, following the global trend. However, there is a limited understanding of the drivers behind such declines and the resilience capacity of the seagrasses to withstand further anthropogenic pressures. Heavy metal pollution has been identified as one of the main drivers of seagrass decline and extinction. Metal pollutants such as cadmium (Cd), arsenic (As), chromium (Cr), and lead (Pb) impose detrimental physiological and demographic effects on seagrasses. Nevertheless, as with other plants, the effects of these pollutants on the health and resilience of seagrasses are not only determined by the plant, but also by the functional interplay with their associated microbial communities. Here, we examined the seagrass-associated microbial communities across gradients of metal pollution in Hong Kong aiming to unveil the drivers underpinning local declines of seagrasses. Our study aimed to 1) characterize the levels of metal pollution in seagrasses and their habitats and 2) understand the ecological condition of seagrasses and their habitats through the structure and diversity of seagrass-associated microbiome. We have identified spatial differences of metal pollutions across different seagrass habitats with some of them exceeding standard ranges. By further looking into their correlations with microbiome, we can provide a baseline record of seagrass habitats in Hong Kong with identification of pollution problems, which is a novel information valuable for the planning of seagrass conservation in the future.

The Distribution and Abundance of Antibiotics and Heavy Metals in Mangrove Sediments and Their Effect on Sediment Microbial Composition and Diversity

Kit-Ling Lam, Ping-Lung Chan*, Fred Wang-Fat Lee

Hong Kong Metropolitan University

Abstract

Little is known about the effect of environmental antibiotics and heavy metals on mangrove sediment's microbial composition and diversity. Here, I characterized the distribution and abundance of twenty antibiotics and eight heavy metals and the microbial community profiles in the sediments collected from the three habitats of the Mai Po RAMSAR, namely the mudflat, mangrove, and gei wai, and I also delineated the correlation between all tested environmental factors and microbial community profiles. The results showed that the concentrations of almost all tested antibiotics and heavy metals in the sediments of mangrove and mudflat were higher than that in the gei wai. Proteobacteria was the dominant phylum in the sediment. Shannon indices and microbial composition in the mangrove sediments were higher than in the sediments of the other two habitats. Moreover, the results of canonical correspondence and variance partitioning analyses revealed that pH, macrolides antibiotics (MLs), and manganese (Mn) were the major factors correlated with the variation in microbial composition at the phylum level. Also, the effect of MLs and Mn collectively explained more variation of the microbial composition than pH alone, suggesting that the co-occurrence of MLs, and Mn might play more influential roles among all measured factors in the microbial communities in wetland sediments. This study sheds light on the possible effect of the co-occurrence of antibiotics and heavy metals at low concentrations in shaping microbial composition in wetland sediments.

Poster presentation is also available HERE.

Magnitude and Controls of Stem Methane Fluxes in a Subtropical Mangrove Ecosystem in Hong Kong

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Abstract

Methane is a potent greenhouse gas that contributes toabout 25% radiative forcing and has a global warming potential that is 34 times greater than CO_2 over a 100-year time scale. While detailed investigations of wetland methane emissions have been made from soil and water surfaces, the contribution of trees has largely been overlooked. Coarse woody debris (CWD) and dead standing trees (snags) are important components in forest ecosystems, but their role in ecosystem methane fluxes is poorly known. In this study, we measured methane fluxes at the ecosystem scale and from tree stems in a mangrove ecosystem dominated by *Kandelia obovata* in Hong Kong using eddy covariance and chamber methods, respectively. Our results show that mean methane fluxes from CWD, snags, live trees and ecosystem were 68.10, 58.78, 46.72 and 122.59 μmol m^{-2} h^{-1}, respectively. Results of Pearson correlation analysis suggest that the most important controls for average monthly methane fluxes from CWD, snags, live trees and the whole ecosystem were photosynthetic photon flux density, dissolved oxygen, sap flow density and soil temperature, respectively.

Establishment of Sample Preparation Workflow for Metataxonomic Analysis of Epiphytic Bacteria on Pneumatophores

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Abstract

The highly dynamic microhabitat on pneumatophores of mangrove species harbors unique assemblages of microorganisms that are largely unexplored. Today next-generation sequencing (NGS) is widely used to characterize complex microbial communities in the environment. While often being overlooked, poor sample preparation could introduce significant biases and lead to inconsistent results. However, reference methods for collecting epiphytic microorganisms from pneumatophores are highly lacking. It is believed that some epiphytic microorganisms might attach strongly on pneumatophore surface to withstand tidal flushing so the detachment method is critical. We tested the effectiveness of several approaches to detach epiphytic bacteria from pneumatophores and found that vortex agitation at 2000 rpm detached approximately 1.5X and 2.5X more viable bacteria than bath sonication at 40kHz and vortex agitation at 3000 rpm respectively. Extending the detachment time from 5 min to 10 min not only did not improve effectiveness but led to reduced number of viable bacteria, while the effect of 0.05% Tween 80 depended on other conditions. The results revealed that the balance between detachment efficiency and cell damage has to be well considered. To harvest as much detached cells as possible from the suspension, membrane filtration with pore size 0.2 μm should be used over centrifugation. One DNA extraction kit, under the optimized lysis condition, outperformed the other two kits in terms of yield and purity, mainly due to the flexibility to choose between lysis buffers. As demonstrated by amplicon sequencing of 16S rRNA gene, our suggested workflow was able to produce high-quality NGS data for reliable metataxonomic analysis.

This work was supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, China (UGC/FDS16/M06/21)

Poster presentation is also available HERE.

Effects of Different Sea Level Height on the Growth of Rhizophora Stylosa Seedlings

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Abstract

Mangrove vegetation is typically found in intertidal zones, where they exhibit exceptional resilience to wave impacts and waterlogging. However, rising sea levels have increased the risk of tidal flooding, and the effects of different flooding heights on the growth of *Rhizophora stylosa*, a typical mangrove species, have yet to be explored. In this study, artificial semi-diurnal tides were created to simulate tidal flooding at different heights. *R. stylosa* seedlings were grown for 90 days in incubators at simulated sea water heights of 0 cm, 10 cm, and 30 cm, and morphological and physiological indices were measured every 30 days. The results indicate that *R. stylosa* seedlings may experience optimal growth at a water height of 10 cm during the first 60 days, followed by 30 cm for better growth. Morphological indexes and physiological indices of the roots and buds were positively correlated, and there were no significant differences in superoxide dismutase (SOD) and malondialdehyde (MDA) in the root tissues among all groups. According to the study findings, *R. stylosa* is a type of mangrove plant that exhibits good resilience to flooding stress. As a result, it has the potential to become a significant tree species for the purpose of restoring mangroves in face of rising sea levels. These findings provide insights into the growth conditions of *R. stylosa* and offer a strategy for managing mangrove ecosystems.

Keywords: *Rhizophora stylosa*, sea level rise, mangrove, morphological and physiological indices

Comparison of Pneumatophore Characteristics and Epiphytic Microalgae between Two Distinct Mangrove Wetlands in Hong Kong

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Abstract

Avicenna marina is mangrove species found in Hong Kong which grow vertical roots from root system, called pneumatophores to facilitate the gaseous exchange in root system during low tide. However, the function of pneumatophores cease when immersed into seawater. Hence, epiphytic microalgae is found on pneumatophores and revealed that it may contribute to pneumatophores by photosynthesis during high tide. In this study, pneumatophores characteristics and microalgal species in two distinct mangrove wetland in Hong Kong, Ting Kok and Tai O, were compared. The means of pneumatophore height and density were higher in Tai O than that of Ting Kok. Among the measured environmental variables, strong positive correlation between sediment moisture content and pneumatophore characteristics was found. All the environmental variables and pneumatophore characteristics measured in two sites were summarised using principal component analysis (PCA). It suggested that the features of Ting Kok and Tai O were different, thus the appearance of mangrove habitats in Ting Kok and Tai O was different. Epiphytic microalgal density on pneumatophores in two sites was estimated by counting under microscope with no significant difference was found. Microalgal diversity and relative abundance were compared by 18S amplicon sequencing. The result of sequencing showed that the microalgal communities in seawater and on pneumatophores were different, especially in Tai O. The potential cause of difference in epiphytic microalgae communities has to be further study.

Poster presentation is also available HERE.

Monitoring of Beach Litter in Waters of Hong Kong Using Aerial Drone

Jian Lin CHEN; Leung Chun WONG; Long Chun MOU

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Abstract

Litter in the environment is a problem that affects the shores throughout the world. It causes ecological concerns due to its potential impacts on biodiversity and marine wildlife. As indicated by the HKEPD, western and southern waters of Hong Kong receive large amount of marine debris from the Pearl River Delta, especially during wet season. In order to set up a better strategy for marine conservation, quantification of beach litter is vital. In this study, we employed commercial aerial drone to detect litters on twelve ecologically important beaches scattered from north-western New Territories to southern Hong Kong Island, either categorized as Coastal Protection Area or Marine Park/Reserve. Sites were then ranked against their cleanliness for better follow-up action for marine conservation. The developed method will be readily transferred to the public or organization of interest.

Seagrass Restoration Requires the Understanding of Local Populations' Genetic Diversity

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Abstract

Seagrasses ecosystems are rapidly declining around the world. This trend is mainly driven by anthropogenic pressures (e.g., habitat fragmentation, pollution) and climate change. The decline and extirpation of seagrasses has profound ecological consequences (e.g., habitat and food provisioning, carbon sequestration, water quality, and coastline erosion protection), which would affect the well-being of coastal communities. Therefore, it is imperative to devise effective conservation plans to protect and restore seagrass beds and the ecosystem functions they provide.

Traditional restoration approaches are based on transplantation of plants from a source population to a target population. However, without considering the genetics of the plants transplanted, this approach might induce unwanted demographic effects by introducing clonal genotypes that do not enhance genetic diversity, or genotypes that the less adapted to the local environment. Hence, planning conservation and restoration efforts requires a background understanding of the genetic structure and diversity of seagrass populations, as well as the mechanisms that regulate these characteristics (e.g., sexual/asexual reproduction, connectivity, gene flow).

As part of a large-scale restoration effort of seagrasses in Hong Kong, this study aims to assess the genetic diversity and structure of local populations, exploring the influence of population size, seasonality, and environmental conditions. In parallel, we will assess the potential link between such genetic characteristics and the ecosystem services provided by seagrasses. This mechanistic understanding of seagrass diversity (genetic and functional) will enable conservation practitioners to make informed decisions while planning their seagrass conservation efforts.

The Role of Bioturbation of Ellobium Aurismidae on Biogeochemical Characteristics of Carbon and Nitrogen in Mangrove Sediments

Keying Gan

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Abstract

The biogeochemical cycle of carbon and nitrogen in mangrove wetland sediment plays a key role in indicating the limiting nutrients of mangrove plants, food web characteristics of wetland animal communities and mangrove ecosystem service function, etc. Benthic animals are an improtant component of the wetland ecosystem, their disturbances such as feedings, burrowing, and excretion affect the biogeochemical cycle of wetland. *Ellobium aurismidae* is one of the vital benthic animals in the mangrove area,but there is a lack of relevant research about its contribution to mangrove ecosystem. To further understanding the ecological role of *E. aurismidae*, we conducted field investigation, in-situ and laboratory control experiment. The results show that it can promotes the transfomation of mangrove leaf litter into organic matter through bioturbation behaviors such as feeding and defecation.

Distribution, Enrichment and Transport of Polycyclic Aromatic Hydrocarbons in Spartina Alterniflora Marshes of a Tidal Flat in Northern Beibu Gulf, China

Weiqi Hu, Xueping Wang, Jialing Liang, Kit Yue Kwan

Beibu Gulf University

Abstract

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous and carcinogenic pollutants originated from both anthropogenic and natural processes. Tidal wetlands in China are increasing threatened by the PAHs exposure through oil spills, ship traffic, wastewater and industrial discharge and atmospheric deposition. To support the protection and restoration of tidal wetlands, the level of PAHs in Spartina alterniflora marshes, including the plants and surrounding sediments, from Xichang tidal flat, Beihai City, Guangxi were assessed. Our results demonstrated that: (1) there were 16 PAH compounds detected in sediments, mainly those with high molecular weights (i.e., $\geqslant$ 4 aromatic rings); (2) the detection rate among sediment samples was 99.7%, and the total content was 135.0-394.8 ng/g; (3) the source analysis showed that they were mainly generated from biomass combustion and petroleum sources; and (4) while the ecological risk assessment model found generally low ecological risk level, the four carcinogenic PAHs at low concentrations required careful attentions and further investigations. For S. alterniflora plants, (1) PAHs concentration gradients were roots > stems > leaves; (2) roots had the highest accumulations of low-cyclic PAHs; (3) the accumulation levels were negatively correlated with the log Kow of PAHs; and (4) the stem had stronger capacity in transporting PAHs, especially those occurred within the stable diffusion zone of tidal flat.

Keywords: Polycyclic aromatic hydrocarbons; Sediment; *Spartina alterniflora*; Distribution; Enrichment; Transport

Potential Application of Horseshoe Crabs and Macrobenthic Community Structure to Indicate Anthropogenic Impacts on Mangrove Wetlands in Northern Beibu Gulf, China

Leiheng Huang, Wei Wang, Kit Yue Kwan

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Abstract

Coastal wetlands are increasing suffered from anthropogenic activities, such as overfishing, aquaculture, wastewater and industrial discharge. Horseshoe crabs are iconic macroinvertebrates inhabiting coasts and estuaries along northern Beibu Gulf, China. To test the potential use of horseshoe crabs and other macroinvertebrates as ecological indicators to detect human impacts, the population/community structure of horseshoe crabs and other macroinvertebrates in four mangrove wetlands of northern Beibu Gulf, including Daguansha (wetland park), Ronggenshan (protected area), Zhulin (aquaculture area) and Poweidi (industrial area), were investigated. The results revealed that: (1) There were 69 macrobenthic species with an average density and biomass of 279 ind./m2 and 174 g/m2 per site, respectively; (2) Tri-spine horseshoe crab, Tachypleus tridentatus juveniles were found in all four sites, while mangrove horseshoe crab, Carcinoscorpius rotundicauda juveniles were only found in Daguansha. The average horseshoe crab densities at Ronggenshan and Daguansha sites were both 1.22 ind./100 m2, followed by Poweidi site 0.57 ind./100 m2, and Zhulin site 0.02 ind./100 m2; (3) In terms of age structure, juvenile horseshoe crab population at Daguansha depicted a rapid growth pattern, but those from Ronggenshan and Poweidi sites were at negative growth. The juvenile number at Zhulin was too low to conduct age structure analysis; (4) The permutation test demonstrated that there were significant discrepancies in Berger-Parker dominance index groups among the four sites, while the differences in Shannon-Wiener diversity index (H'), Pielou index (J) and Margalef index (d) were all statistically insignificant; (5) Poweidi site is showed to experience the most intensive anthropogenic influences based on the ABC curve analysis. The results demonstrated that the macrobenthic community structure can be adversely affected by different human activities in the intertidal zones along the outer mangrove fringes, which is useful for future mangrove habitat protection and restoration.

Keywords: macrobenthos; horseshoe crabs; community structure; mangrove; intertidal zone

Mixture of Nitrophenols and Transition Metal Ions: Combined Toxicity to Wildlife and Inconvenient Truth for Coastal Wetlands

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Abstract

The water and sediment pollution of coastal wetlands are mainly caused by terrigenous contaminants, both organic or inorganic, and their mixtures. As important environmental pollutants, nitrophenols and transition metal ions commonly coexist in contaminated coastal wetland, which should pose risks to ecosystem and health. Although their respective toxicity was well documented, to date, their interactive toxicity to wildlife or humans at environmentally relevant concentrations remain unclear. Take 4-nitrophenol and copper for example, our investigation had identified their combined immunotoxicity that causing excessive oxidative stress, aggravated inflammation and structural damage to zebrafish and mouse. Meanwhile, significantly excessive transcription of *nlrp3*, *il-1β,* and *cox2b* and secretion of IL-1β were found, which suggested ROS/NLRP3/IL-1β signaling might be involved in their combined immunotoxicity. We also characterized combined cardiovascular toxicity and neurotoxicity upon co-exposure of 4-nitrophenol and manganese. Our study should provide a more comprehensive and deeper understanding of the interaction between organic and inorganic pollutants, the health effects caused by their co-exposure, as well as helpful references for safeguard of coastal wetlands against potential hazards that caused by contaminant mixtures.

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Discovery of Six Novel Kunitz-type Peptides with Differential Kv1.3 Interacting and Anti-Parkinsonism Activities from the Transcriptomes of Two Coral Species

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Abstract

Parkinson's disease (PD) is the second most common neurodegenerative disease. Potassium voltagegated channel subfamily A member 3 (Kv 1.3) is a potential target for treatments of PD. To discover new novel blockers of Kv1.3, the transcriptomic data of two coral species (*Galaxea fascicularis* and *Favites acuticollis*) were analyzed. Thirty-three Kunitz-type peptides were chosen and annotated by Swiss-Prot and Pfam. After comparison, 13 peptides were selected since they showed characteristics of potassium ion channel blockers. The structures of the peptides were modeled and subjected to molecular dynamics (MD) simulation to verify their stability. Based partly on database annotations, the six peptides with the most significant structural stability were subjected to multiple sequence alignment and phylogenetic analysis. Molecular docking indicated that GfKuz1 (peptide from *G. fascicularis*) showed the highest potency to block Kv1.3 among the reference peptides. The MD simulation of the peptide-protein complexes showed that GfKuz1 interacted with Kv1.3, and was more compact and stable than the other peptides. The blocking effect was confirmed by potassium ion bioassay. Furthermore, GfKuz1 showed no toxicity to PC-12 cells or zebrafish at concentrations up to 100 μM. In addition, GfKuz1 increased the cell viability reduced by 6-hydroxydopamine hydrochloride (6-OHDA), and also downregulated the level of reactive oxygen species and activated the Nrf2 pathway. In summary, GfKuz1 reversed PD symptoms and is a potential peptide drug prototype for PD treatment.

Water Quality and Antibiotic Distribution in Shan Pui River and Mai Po Inner Deep Bay Ramsar Site in Hong Kong, China

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Abstract

Mai Po Inner Deep Bay Ramsar Site has been designated as a Ramsar Site since 1995. It nurtures approximately 440 bird species with 13 globally threatened species. The Ramsar Site is a natural shallow coastal bay located within the Yuen Long Basin and acquires water from both Hong Kong and Shenzhen. Shan Pui River is located within the Wetland Buffer Area, and pollutants from the River may affect the water quality of the Ramsar Site. This study aims to investigate the water quality and antibiotic distribution of Shan Pui River and the Mai Po Inner Deep Bay Ramsar Site to provide an overall understanding of the current situation of antibiotic pollution of the sites.

Water samples of eight sampling points along the Shan Pui River and the intertidal flat of the Ramsar Site (from point A to H) were collected in summer (June 2022) and winter (Jan 2023) respectively. Temperature, pH, conductivity, turbidity, dissolved oxygen concentration, total dissolved solids concentration were determined in-situ using standard methods. The water samples collected were filtered and acidified with nitric acid, and the concentration of total phosphorous (TP), total organic carbon (TOC), and total nitrogen (TN) were measured respectively. In addition, the concentration of 19 antibiotics of four categories including tetracyclines, quinolones, macrolides, and sulfonamides, in the water samples was quantified by solid-phase extraction coupled with liquid chromatography-tandem mass spectrometry.

The physicochemical properties of the water samples were significantly different in summer and winter, and between sampling points. In general, higher TN concentrations of the water samples were observed in summer, whereas higher salinity, TP, TOC concentrations and total antibiotics quantity were measured in winter. The mean concentration of doxycycline (168.16 ng/L) was the highest, which was followed by chlortetracycline (164.18 ng/L) found in the water samples in winter. This study indicated that concentrations of different antibiotics in the water samples were very high when compared the results from Deng et al. 2018. Appropriate management of domestic and industrial wastes is necessary to reduce environmental degradation.

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Phytoplankton Community in Estuary After Reclamation During Karenia Mikimotoi Bloom at Low and High Tide —— A Case Study in the Man-made Channel in Guiwan River, Shenzhen

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Abstract

The estuary is an important link between the sea/bay and land rivers, and its ecological location and function are extremely important. Phytoplankton community in the estuary of a man-made channel in Guiwan River, Shenzhen was studied during Karenia mikimotoi bloom at low and high tide to reveal the response of artificial riverine algae to red tide. Results showed that total 51 algae species, belonging to 6 phyla and 36 genera, were found in the late stages of K. mikimotoi bloom. Most species were Bacillariophyta (diatom, 54.9%) but the dominant species was K. mikimotoi (Pyrrophta) with the relative abundance of 85-99.4% at high tide and 67.8-93.1% at low tide. K. mikimotoi blooming greatly reduces the population density and dominance of other algae and also significantly reduces the biodiversity index (H') and evenness index (J') of the algal community, thus weaken the ecological function of the algal community in the estuary of man-made Guiwan River. Under the K. mikimotoi blooming, most water quality show extremely eutrophic level and very heavy pollution state. No significant relationship was found between the relative abundance of K. mikimotoi and the water quality parameters of Guiwan estuary, and it is presumed that the K. mikimotoi blooming is mainly brought by tidal action. The water environment of Guiwan estuary is weak against the K. mikimotoi blooming, and there are signs of K. mikimotoi retention in the river though the salinities were low after the ebb tide, which may cause the risk of continuous outbreak/hazard and needs more attention.

Ecological Restoration with Oyster Shell Reefs at Sham Wan Restricted Area

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Abstract

As the integrity of coastal environments in the southern and western waters of Hong Kong has become compromised by land reclamation, marine traffic, intensive fishery activities and pollution, the conservation and rehabilitation of this region requires tailored measures. Lamma Island, the third largest island in Hong Kong, is characterized by its prevailing natural shoreline that nurtures species of high conservation value such as coral species and the endangered Green Turtle (AFCD, 2020). The recent expansion of the Restricted Area from Sham Wan beach to Sham Wan (an area of about 98.2 hectares) and extension of the restricted period from five months to seven months each year by Agriculture, fisheries and Conservation Department (AFCD) will reduce commercial and recreational uses of the bay during the restricted period. This will reduce disturbances to Green Turtle breeding, nesting, resting and foraging activities by prohibiting boating and fishing activities in the bay. The restriction to Sham Wan will not only reduce the negative impacts of regular human interference (e.g., physical disturbances; water and noise pollution), but it also provides a unique opportunity to design, implement and evaluate natural-based artificial reefs to further enhance the marine biodiversity and ecosystem functions in Sham Wan.

Due to the long-term degradation of the marine ecosystems in Hong Kong, the rehabilitation of marine biodiversity and ecosystem functions requires effective and urgent actions to achieve conservation goals. To effectively enhance and rehabilitate marine ecosystems, this project aims to design, implement and evaluate tailored ecologically engineered solutions for Sham Wan, Lamma Island. We will install oyster shell reefs in the Sham Wan's subtidal area to increase habitat complexity and provide habitat for species of different trophic levels. The overarching objective of this project is, therefore, to augment biodiversity and ecosystem functions in the marine ecosystem of Sham Wan, and to demonstrate and promote the concept and benefits of ecological engineering for ecosystem rehabilitation to the general public.

To date, the ongoing project has deployed more than 40 oyster shell reef units in Sham Wan across 4 sites and the half-year monitoring results have seen an increase in overall biodiversity and abundance as different marine organisms are settling and utilizing the oyster shell reefs.

Effects of Tourists on Water Quality of the Tai O Water Channels

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Abstract

The COVID-19 pandemic seriously affected international traffic and forced the local citizens to stay in Hong Kong. This significantly increased the demand for local tourism, and more people are visiting local sightseeing spots. Tai O is one of the most popular tourist destinations in Hong Kong. The stilt houses (aka Pang Uk) built along the main water channels create a unique scene and attract tourists. Some of the stilt houses are residence, while some of them are engaged in business activities such as restaurants. The majority of the stilt houses are not connected to the public municipal sewage treatment system, and the sewage generated in the neighborhood is directly discharged into the water channel underneath the stilt houses. Despite lacking of sewage treatment, the environment is odorless in general. It is believed that the sewage generated from the stilt houses are either carried away through tidal actions or consumed by the surrounding mangrove swamps. However, the impact of water quality from tourists has never been studied. Therefore, a study was performed to compare the water quality of the water channel before and after a weekend, when much more tourists visited Tai O. Surface water samples were collected across the Tai O water channels. Physiochemical parameters of the water samples, including pH, conductivity, ammonical nitrogen, nitrite, nitrate, total kjeldahl nitrogen, orthophosphate and total phosphate, were analyzed. Results indicated that significantly higher levels of ammonical nitrogen and orthophosphate were detected in the samples collected near the main street, while those away from the business area were not significantly affected. The increases in ammonical nitrogen could be resulted from the excreta from the tourists, while the increases in orthophosphate could be resulted from the use of detergents. This observation suggested that the influx of tourists into the Tai O did increase the levels of pollutants. Further study would be needed to study the fate of the pollutants.

Development of CO_2 Reduction Catalysts to Mitigate Global Warming and Energy Crisis

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Abstract

The increasing anthropogenic emission of CO_2 has caused many global environmental issues i.e. global warming, ocean acidification and species extinction. Conversion of CO_2 to useful chemicals including fuels utilizing clean and sustainable solar light becomes a promising approach that can not only tackle CO_2 emission caused global issues but also provide a clean and sustainable energy source simultaneously. However, the photoreduction of CO_2 is still challenging due to its high thermodynamic barrier and slow reaction kinetics for producing valuable chemicals, which has been considered as more complicated and uncontrollable than solar hydrogen generation.

In many proposed CO_2 reduction reactions, multi-electron and protons processes are involved. To mediate these processes under mild conditions, suitable catalysts are required to lower the activation energy and provide a favorable reaction pathway. Although many photocatalysts for CO_2 reduction have been reported, most of them show large variabilities in selectivity and stability. For catalysts based on nanoparticles of metals and semiconductors, they are stable; however, they show poor selectivity in photocatalysis; while those based on enzymes and metal complexes usually convert CO_2 to CO with high selectivity, but these catalysts usually exhibit low stabilities. Therefore, it is highly desirable to develop robust molecular catalysts with high selectivity and efficiency for visible-light-driven CO_2 reduction to fuels.

In this project, a series of novel multinuclear metal complexes consists of earth abundance metals and bridging polypyridyl ligands will be designed and synthesized as potential CO_2 reduction photocatalysts. The structures of the new metal complexes will be characterized using IR spectroscopy, ^{1}H and ^{13}C NMR spectroscopy, mass spectrometry as well as x-ray crystallography. The catalytic performance of the new metal complexes will also be studied using (i) Gas Chromatograpy with Thermal Conductivity Detector (GC-TCD) for CO and H_2 generation, (ii) ion chromatography for formate ion.

In addition, isotope-labeling studies, UV-vis absorption spectroscopy and transient absorption spectroscopy will also be used to study the mechanisms of the reactions for CO_2 reduction. It is anticipated that the new direction towards the design of molecular photocatalytic systems for efficient CO_2 reduction and solar energy conversions will be developed. Further modification of these systems should lead to the development of other catalytic systems for different chemical transformation.

Photocatalytic Inactivation/Disinfection of Biofilm Bacteria

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Abstract

Photocatalytic inactivation of bacteria has been extensively studied since 1985. Numerous studies reported excellent performance of various specifically designed and synthesized photocatalysts producing reactive oxidative species (ROSs) to inactivate various types of bacteria. Among these studies, some indicated that the photocatalytic inactivation efficiency of some photocatalysts is significantly reduced for the bacterial cells in biofilms. The presence of an extracellular polymeric substance (EPS), which is produced by biofilm bacteria, protects the bacterial cell in biofilm from the attack of ROSs. To tackle this problem, the synthesis and characterization of photocatalyst(s), which produces large amounts of diffusible ROSs, such as hydroxyl radical (•OH) that can penetrate the biofilm and inactivate the bacterial protected by EPS, is needed. These photocatalyst(s) does not require close contact with the bacterial cell for effective inactivation of biofilm bacteria.

In order to determine the feasibility of using these photocatalysts for the inactivation of biofilm bacteria, the present study will compare the inactivation efficiency of bacterial cells in biofilm by several commonly used photocatalysts to select the most effective photocatalyst. The effectiveness of using the selected photocatalyst to inactivate various types of biofilm bacterial cells in the biofilm generated in wetland water samples will be determined. More importantly, the associated changes/shift of the microbial community will be examined.

Modulation of Ultrasound-assisted Extraction Effect on the Molecular Composition of Fungi

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Abstract

Background: Fungal polysaccharide-protein complexes (PSPs) have the potential to be a valuable tool for environmental remediation in wetland ecosystems due to their ability to remove heavy metals and pollutants from contaminated water and soil. Furthermore, they possess antimicrobial properties that can combat harmful microorganisms in wetland habitats. As interest in fungal PSPs increases, it is worth investigating the effect of bioactivities of PSPs under ultrasound-assisted extraction (UAE) conditions.

Objective: To optimize the UAE method to extract PSPs from fungi and achieve the optimized bioactivity effect.

Method: The study investigated four variables, including ultrasound power intensity, fungal particle size, solid-liquid ratio, and temperature, in the UAE process of two fungi. The polysaccharide and protein contents of the extracts were measured versus time of UAE and fitted to models by linear regression. The antioxidant activity of the extracted PSPs in cell culture was tested.

Result: The optimal UAE conditions for extracting polysaccharides and proteins in both fungi were 16.25W/cm^2 power with 300.5 μm fungal particle sizes and a 1:30 solid-to-liquid ratio. However, the optimal temperatures for extracting polysaccharides and proteins were different, with polysaccharides requiring a higher temperature (70℃) and proteins preferring a lower temperature (55℃). For both fungi, the polysaccharide and protein contents (wt%) in the extracted PSPs were correlated to the US energy density (MJ/m^3) by the Power Law of extraction: $y=\beta x^n$, where y is the polysaccharide/protein content and x is the US energy density. However, this correlation was only valid below the US power intensity of 20 W/cm^2. Within the same US power intensity range (< 20 W/cm^2), the study also observed a constant ratio of polysaccharide to protein content (wt% of polysaccharide/wt% of protein) in the extracted PSPs against the increasing US power intensity. Altogether, this study provided new and interesting results on the UAE processes and the relationships between the efficiency, product quality and the process conditions for bioactivities of fungi, which can facilitate the exploration for the potential use of fungal PSPs in environmental applications.

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Fishponds as Biodiversity Hotspots: Implications for Management and Restoration of Wetlands in Hong Kong

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Abstract

Fishponds in Hong Kong are critical for biodiversity, offering habitat and food to native and migratory birds and breeding grounds and roosting sites for amphibians, reptiles, mammals, and insects. For human being, the use of fishponds as a source of livelihood has been practiced for centuries. Meanwhile, these artificial wetlands are facing significant threats from land reclamation, infrastructural development and rapid urbanization, pollution/water quality, and changes in cultural practices. Therefore, understanding the biodiversity within these habitats is essential to develop sustainable management practices.

Environmental DNA (eDNA) is a powerful tool that can be used to understand the biodiversity within these fishponds. eDNA is a technique that involves collecting and analyzing DNA fragments from the environment, such as water, to identify the presence of different species.

This study aims to use eDNA to understand the biodiversity within fishponds under different levels of human-influenced management. We will collect water and samples from fishponds managed at different intensities, ranging from minimum to intensive, to identify those habitat-related species present within the Northwest fishpond region in Hong Kong.

We hypothesize that the biodiversity within the fishponds will differ depending on the level of human influence. We expect that fishponds managed at a more intensive level will have lower biodiversity homogeneity compared to those managed at a less intensive level.

The results of this study will have significant implications for the conservation and sustainable development of coastal wetlands. By identifying the biodiversity within fishponds under different levels of human-influenced management, we will be able to develop management practices that are more sustainable and effective in maintaining the biodiversity of these wetlands. Additionally, this study will provide valuable information for policymakers and stakeholders working towards conserving and protecting these important ecosystems.

In conclusion, using eDNA technique to understand the biodiversity within fishponds under different levels of human-influenced management can contribute to the development of more sustainable management practices and aid in the conservation and sustainable development of these coastal wetlands in Hong Kong.

Organophosphate Flame Retardants Contamination in Surface Water and Sediment from the Coastal Area of Hong Kong

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Abstract

Organophosphate flame retardant (OPFRs) has been considered as a group of emerging pollutants that is ubiquitously found in various environmental compartments and poses a substantial threat to the ecosystem. Although there were reports on the occurrence and distribution of OPFRs in different environmental compartments, the OPFRs contamination levels, composition profile and potential ecological risk in some regions, such as Hong Kong, are still limited. In the present study, the concentration, spatial distribution, seasonal variation, and ecological risk of OPFRs in surface water and sediment from the coastal area of Hong Kong were assessed. The concentrations of OPFRs in surface water ranged from 30.88 to 1011.81 ng L^{-1} and in sediment from 9.62 to 544.53 ng g^{-1}. The most prevalent chemicals were tris (2-chloroisopropyl) phosphate and tributyl phosphate. Lower OPFRs levels were found in water during the wet season, probably due to dilution effect, but there was no obvious variation of OPFRs concentration in sediment between seasons. The concentration of OPFRs was found higher in Deep Bay and Victoria Harbour for surface water, and in Rambler channel and Victoria Harbour for sediment. Anthropogenic influences and external waste emission from industrial activities were identified to be the potential factors resulting in OPFRs pollution in Hong Kong. The risk assessment revealed that the ∑OPFRs in water and sediment posed a moderate to high risk to organisms and the ecosystem.

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A New Species of Free-Living Nematodes (Enoplida: Enchelidiidae) From The Mangrove Wetlands of China

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Abstract

A new species, *Belbolla mangrove* sp. nov. from mangrove wetlands of Fujian and Zhejiang Provinces in China is described and illustrated. *Belbolla mangrove* sp. nov. is characterized by four pharynx bulbs, small gubernaculum with short dorsocaudal apophysis, four precloacal supplements weakly developed, tail conico-cylindrical with terminal spinneret and without terminal setae. This new species differs from *B. vietnamica* by the absence of ocelli, proximal ends of the spicules blunt and round. The GenBank accession numbers of *B. mangrove* sp. nov. of 18S rDNA is given.