United Nations
Educational, Scientific and
Cultural Organization

Intergovernmental
Oceanographic
Commission

WESTPAC
Advancing Knowledge for a Healthy Ocean

SKLMP
海洋污染國家重點實驗室

CityU

Establishment of RTRC on **Coastal Contaminant Monitoring and Marine Innovative Technologies (RTRC-Coastal COMMIT)**

*PROPOSED BY **State Key Laboratory of Marine Pollution**,*

City University of Hong Kong, Hong Kong SAR, China

14th Intergovernmental Session of the UNESCO/IOC Sub-Commission for the Western Pacific, Jakarta, Indonesia, 4-7 April 2023

SKLMP has been run since 2010 (well funded – USD 2.5m/yr)

Interuniversity & Multidisciplinary (70 Members; 13 Advisors; 281 PhD/MPhil; 87 Postdocs)

CityU

CityU 香港城市大學 City University of Hong Kong

香港大學 THE UNIVERSITY OF HONG KONG

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

香港浸會大學 HONG KONG BAPTIST UNIVERSITY

香港都會大學 HONG KONG METROPOLITAN UNIVERSITY

香港中文大學 The Chinese University of Hong Kong

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

香港教育大學 The Education University of Hong Kong

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State Key Laboratory of Marine Pollution (SKLMP)

SKLMP
海洋污染國家重點實驗室

Vision

- To be **a key international research center** in advancing marine environmental research that contributes to the protection and management of the marine environment and generates positive societal impact.

Mission

- To **protect marine environments through high quality multidisciplinary research and innovations**
- To build capacity by **nurturing and training environmental scientists, managers, and entrepreneurs** in the region
- To **support governments** in the management of environmental quality and protection of marine ecosystems

https://www.cityu.edu.hk/sklmp/about-us/annual-reports

Consolidated Research Themes

Our Platforms and Facilities

1. Trace and Ultratrace Level Instrumental Analysis Platform

USD 0.9m

Thermo Orbitrap LC-MS

USD 0.65m

Thermo Hybrid Quadrupole-Orbitrap GC-MS

USD 0.4m

Agilent UPLC - SCIEX 6500 Triple quadrupole MS

USD 0.5m

Agilent UPLC - SCIEX X500R QTOF MSMS

Elementar Elemental Analyzer

2. Molecular & Cell Biology Research Platform

BD FASC Aria III Flow Cytometer

Illumina MiniSeq System

3. Aquatic Toxicology Research Platform

Model Organisms-Marine Medaka

Aquarium

SKLMP Main Lab

4. Field-based Integrated Research Platform

Fish Raft

Research Vessel

Scientific Buoy

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Innovative Technology for Pollution Monitoring and Control

A Practical and High-throughput Aptasensing Device for Antibiotics Detection

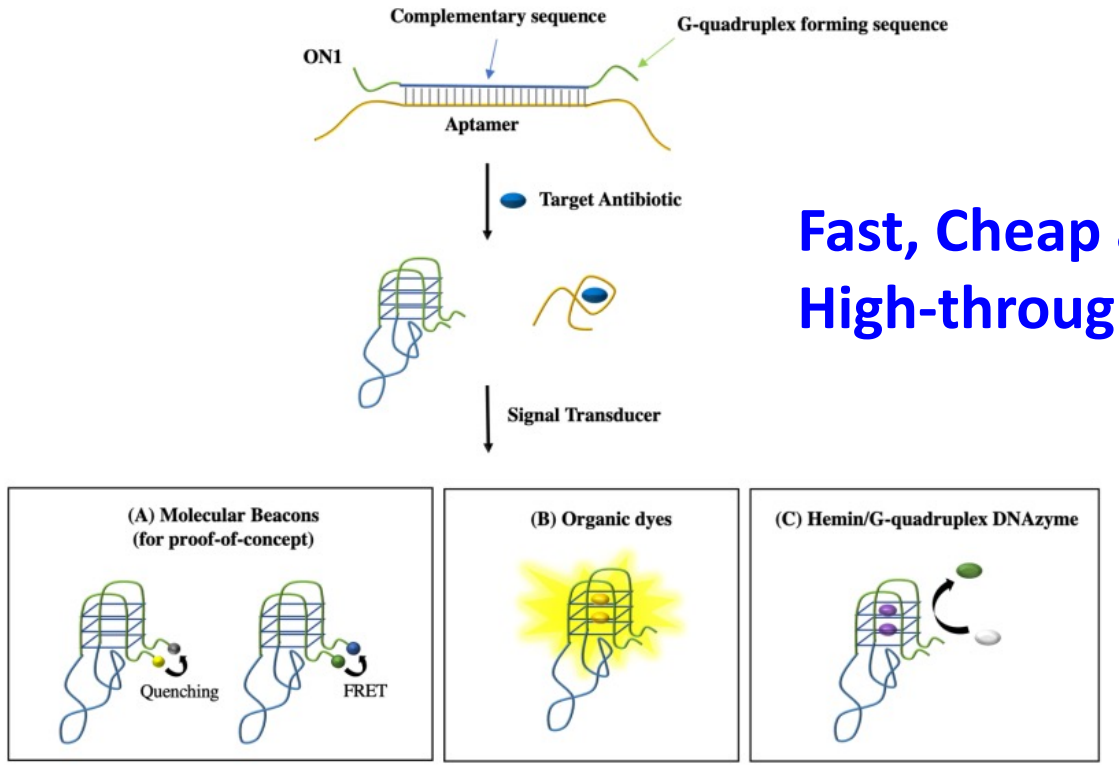


Figure 3. Proposed mechanism for a universal aptamer-based detection platform based on AptaSwitch using (A) molecular beacons, (B) organic dyes and (C) hemin/G-quadruplex DNAzyme system as the signal transducer.

Fast, Cheap and High-throughput

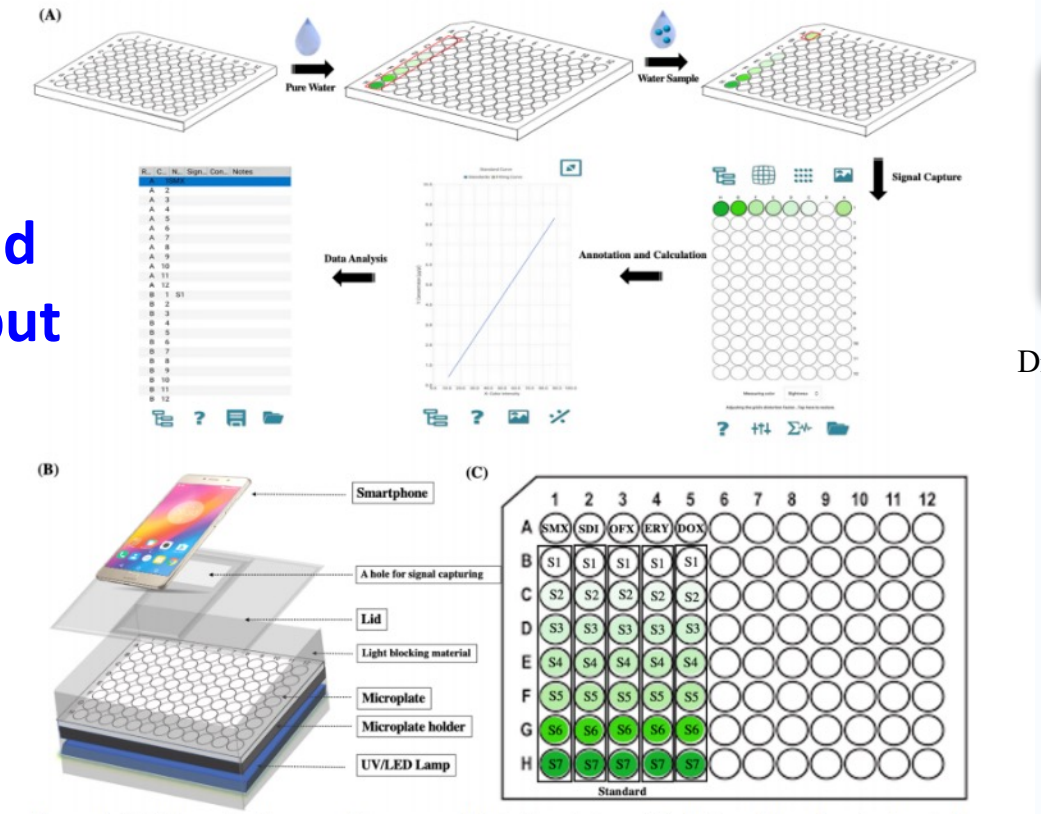
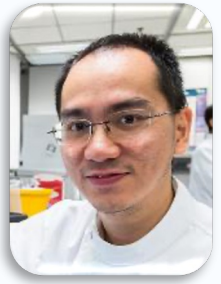


Figure 4. (A) Schematic diagram of the proposed detection strategy; (B) design of the palm-sized portable microplate system; (C) layout of a reagent-coated microplate for the detection of SMX, SDI, OFX, ERY and DOX. S1-S7 are standards containing various concentrations of different antibiotics.



Dr. Chun Kit Kwok

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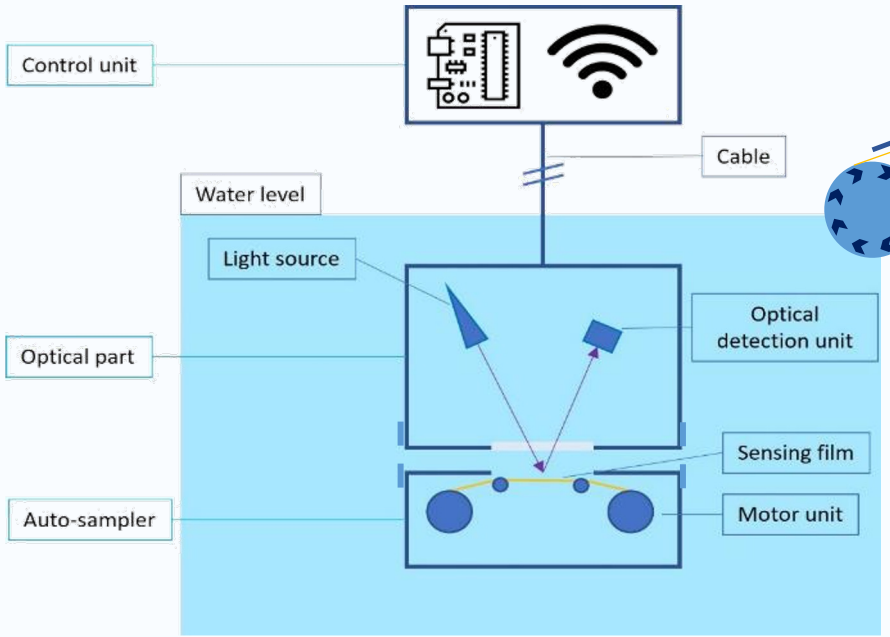
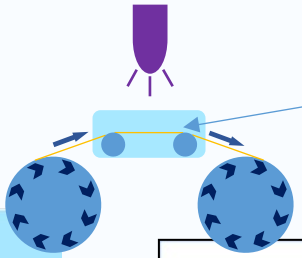
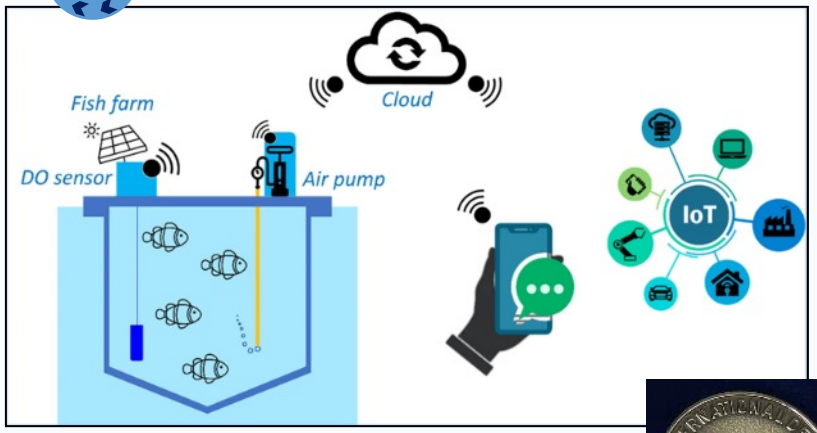
Innovative Technology for Pollution Monitoring and Control

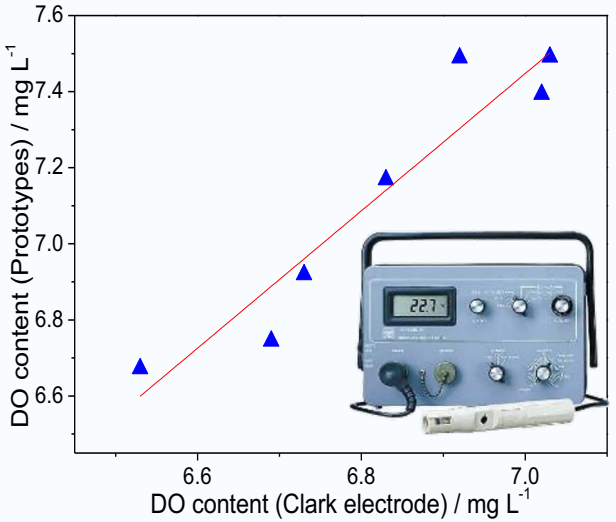
A Novel Dissolved Oxygen Sensor – Overcoming Biofouling





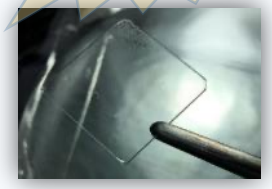
Profs. Rudolf Wu & Vincent Ko





Synthesis of DO sensing compounds

DO sensing material



O_2

light

Oxidized

DO Sensing glass slide

Filed for US, EU and CN patents

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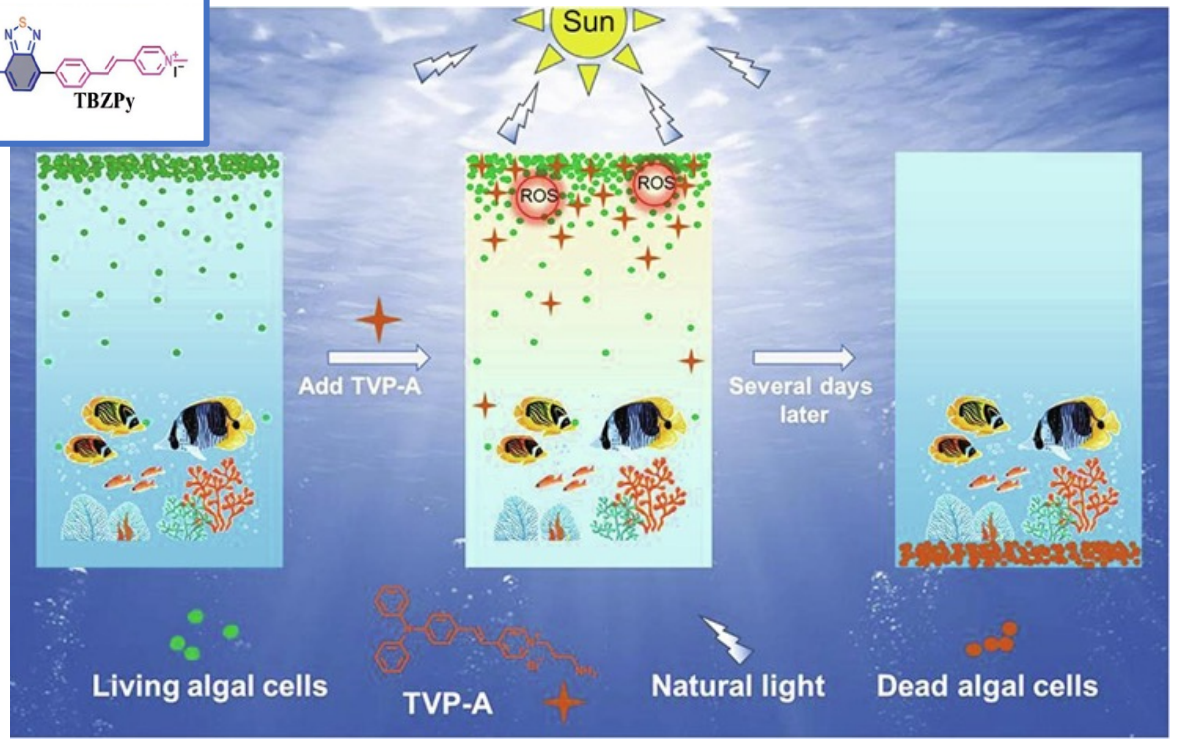
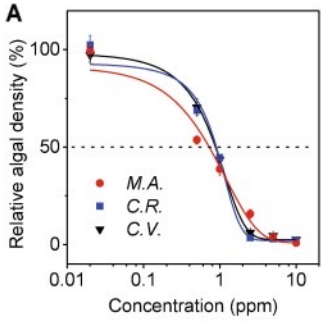
Photodynamic Control of HAB by an Efficient and Degradable Photosensitizer

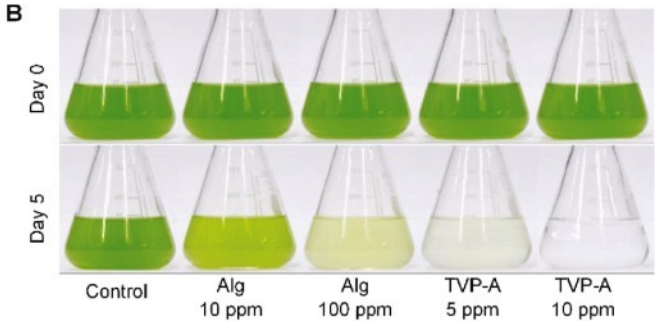
- TVP-A, a photosensitizer is a cost-effective and eco-friendly agent for controlling harmful algal blooms.
- It is water soluble and can quickly adsorb onto algal cells, triggering algal cell death through oxidative destruction.
- It is effective at low concentrations and requires sunlight irradiation only for a few minutes to destroy algal blooms.
- TVP-A is degradable and will not cause pollution to the environment.

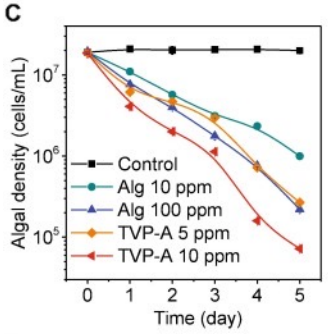


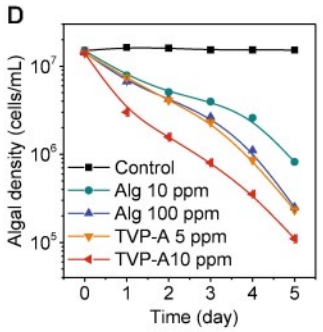
Prof. Wen-xiong Wang

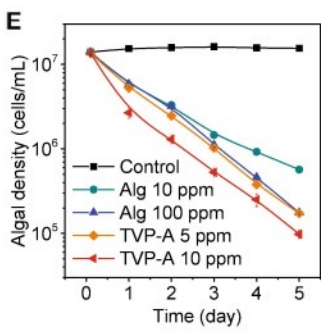
Chem Eng J
417: 127890











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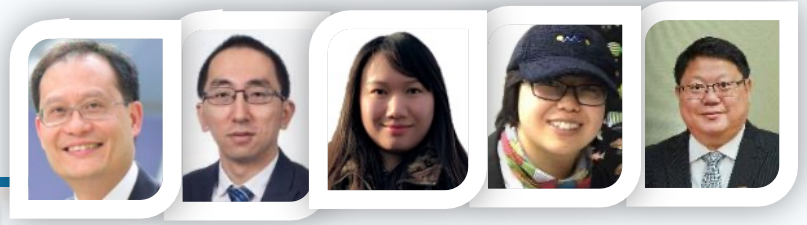
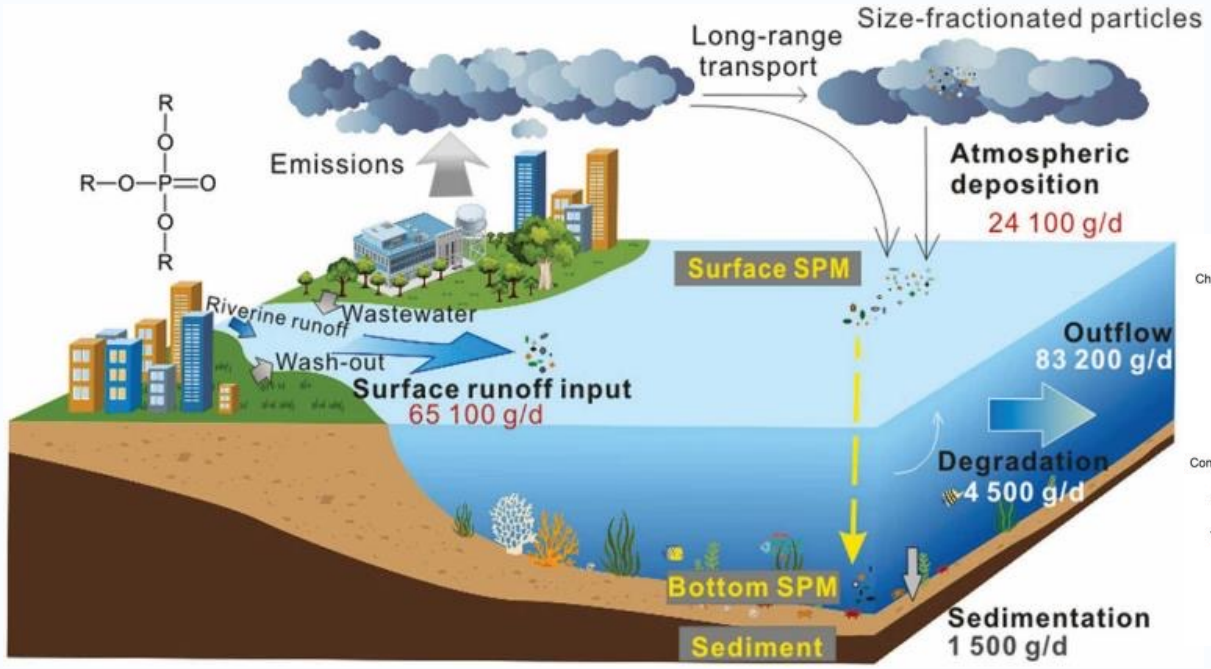
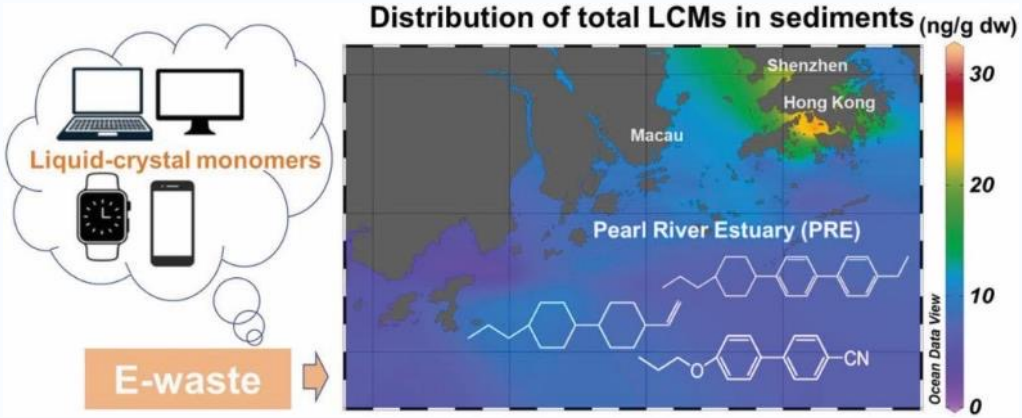


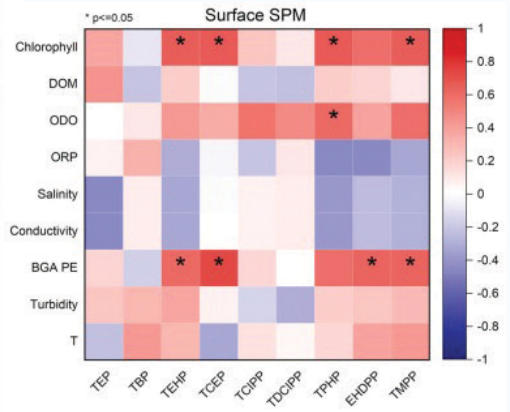
Prof Paul LAM, Rr Henry He, Dr Phoebe RUAN, Dr Meng YAN, Kenneth LEUNG

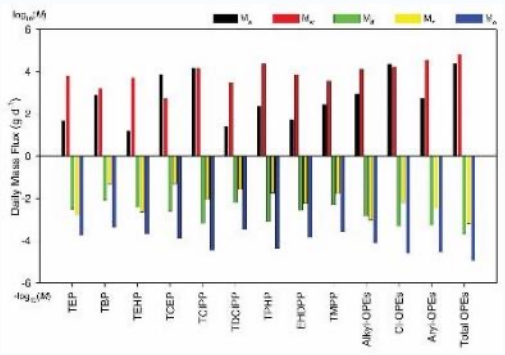
Carrying capacity of contaminants of emerging concern (CECs)

- Reveal and forecast the occurrence of CECs
- Derive water quality criteria, assess their risk and determine environmental carrying capacity
- Formulate risk reduction measures







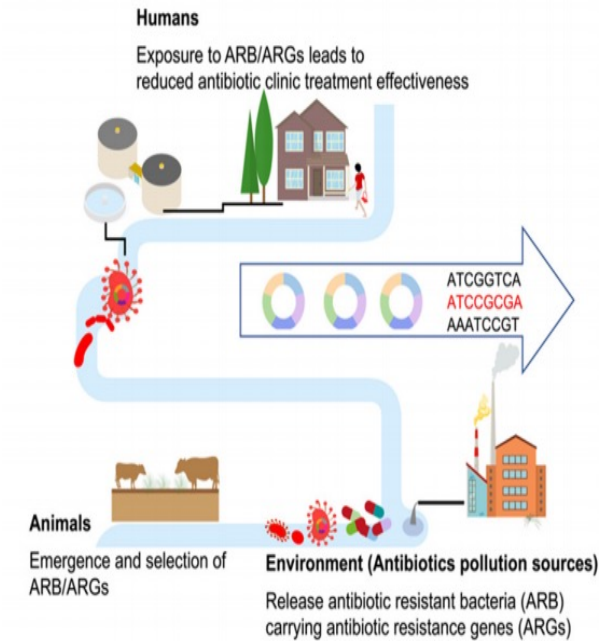


Example

Assessing Antibiotic Resistome Flows from Pollution Hotspots to Environments and Explore the Control Strategies


Profs Tong ZHANG,XD LI, Kenneth LEUNG

USD 4.5 million Theme-based Project



Prof. Tong Zhang

Welcome to ARGs-OAP Galaxy!

Example https://smile.hku.hk/SARGs

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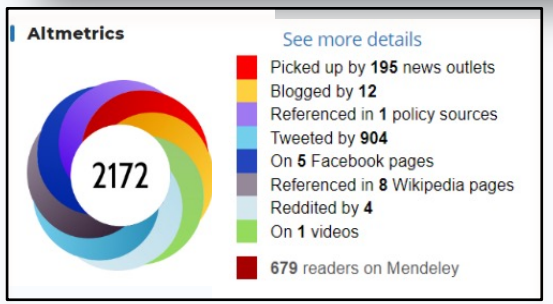
Pharmaceutical Pollution of the World's Rivers

- We monitored 1,052 sampling sites along **258 rivers in 104 countries**, covering 471m people.
- These contaminants in surface water pose a threat to environmental and human health in 25% of the studied locations globally.
- **Most polluted rivers are found in low-middle income countries**.
- **This work paved the way for the Global Estuaries Monitoring (GEM) Programme.**



This is a hot paper (among top 0.1% most cited papers) recognized by WoS, and will receive the **Cozzarelli Prize** on 30 April 2023.

Publication: Wilkinson, J.L., Boxall, A.B.A., Kolpin, D.W., **Leung, K.M.Y.,** Lai, R.W.S., Galban-Malagon, C., et al., (2022). Pharmaceutical Pollution of the World's Rivers. ***PNAS*** 119, 2113947119.

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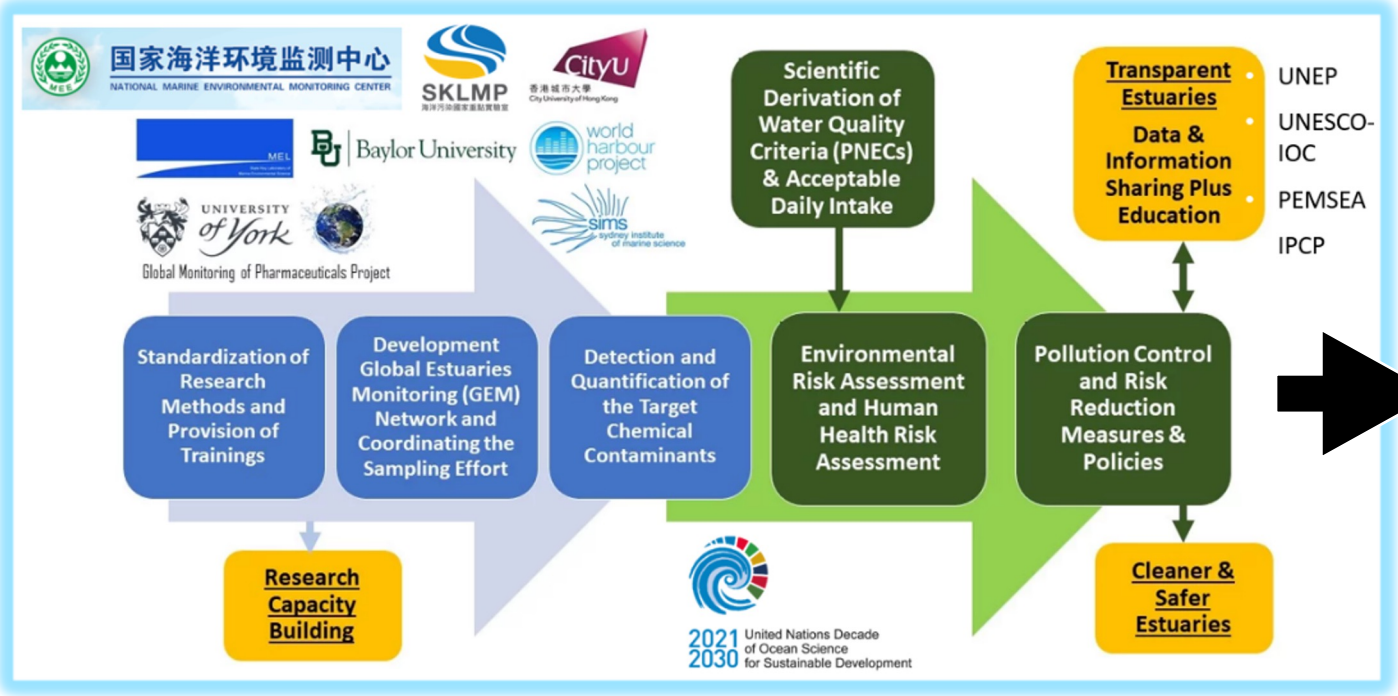
Global Estuaries Monitoring (GEM) Programme

Since June 8, 2021



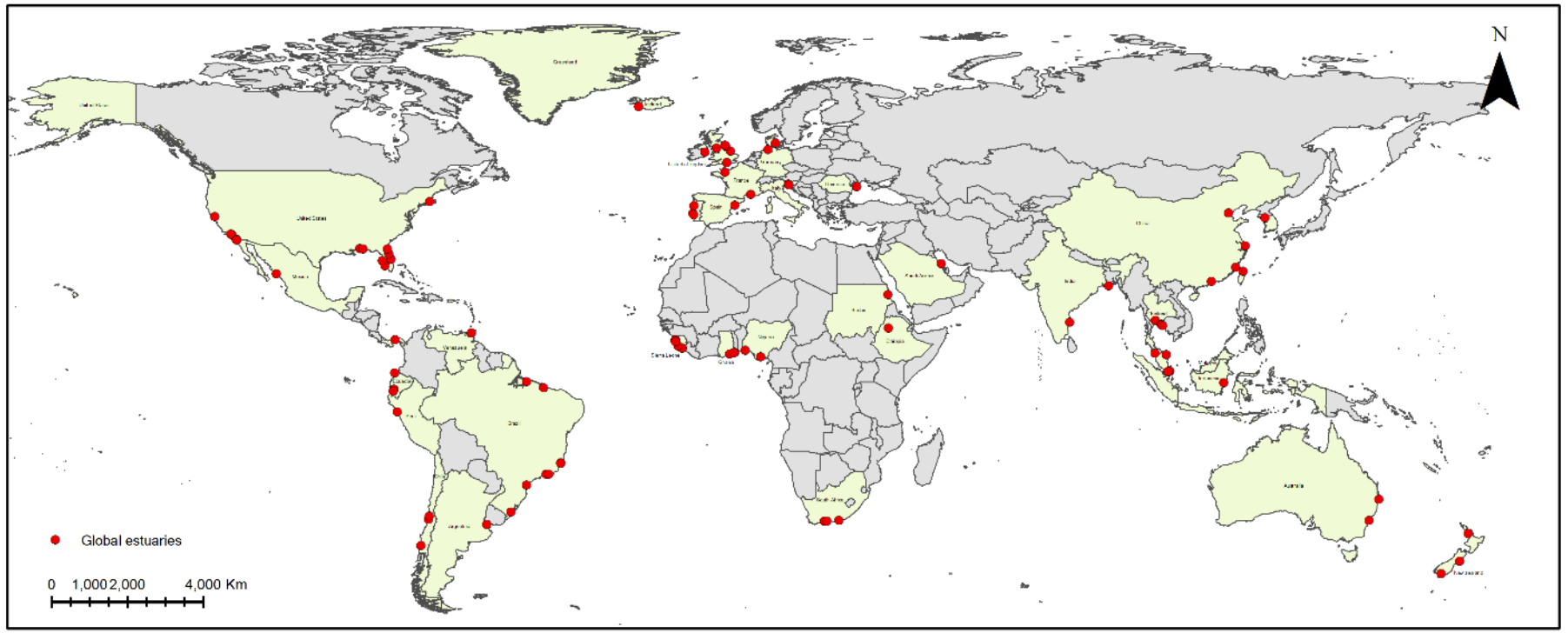
Key Partners: SKLMP (City University of Hong Kong), York University, Sydney Institute of Marine Science, Baylor University, MEL (Xiamen University), National Marine Environmental Monitoring Centre (China)

Expected outcomes	
1	Global network for pollution monitoring
2	Advanced passive samplers
3	Capacity building
4	Data sharing (transparent estuaries)
5	Co-designed solutions for reducing pollution
6	Supporting informed decisions on water quality management
7	Cleaner estuaries

GEM Video: https://youtu.be/iSoTgz6roKA

GEM Website: https://www.globalestuaries.org/

Recruiting Global Partners, launching in May 2023



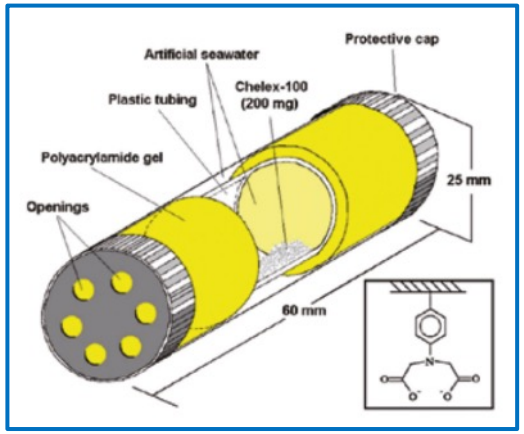
So far, we have….

46 countries

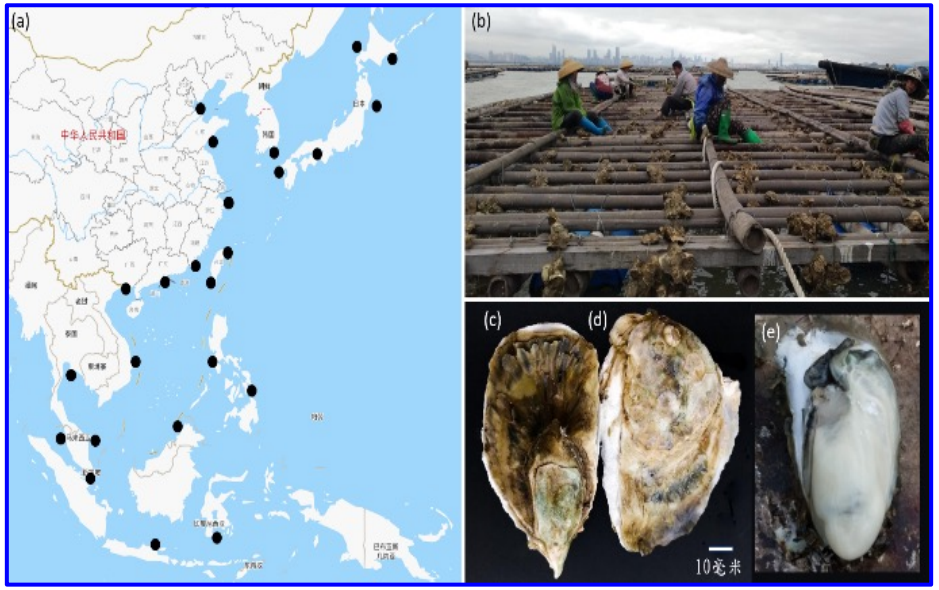
80 collaborators

116 estuaries

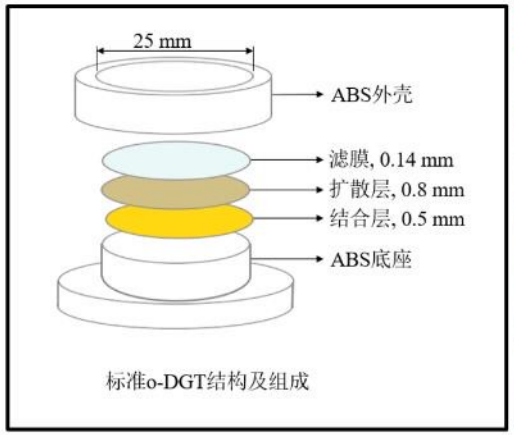
Passive Samplers and Biomonitoring

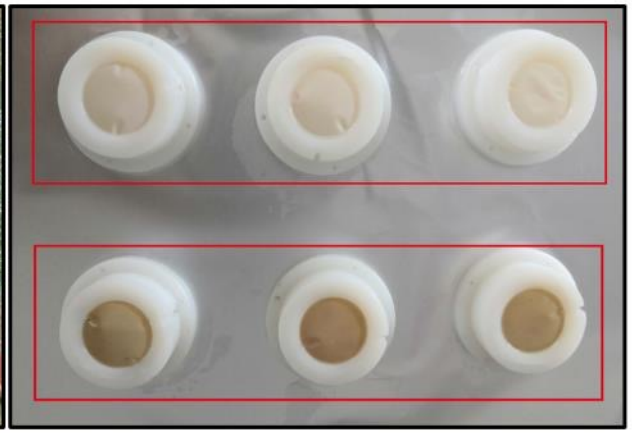


Global Artificial Mussel Watch for Metals and POPs



Global Oyster Watch for Micro-plastics and Chemicals of Emerging Concern



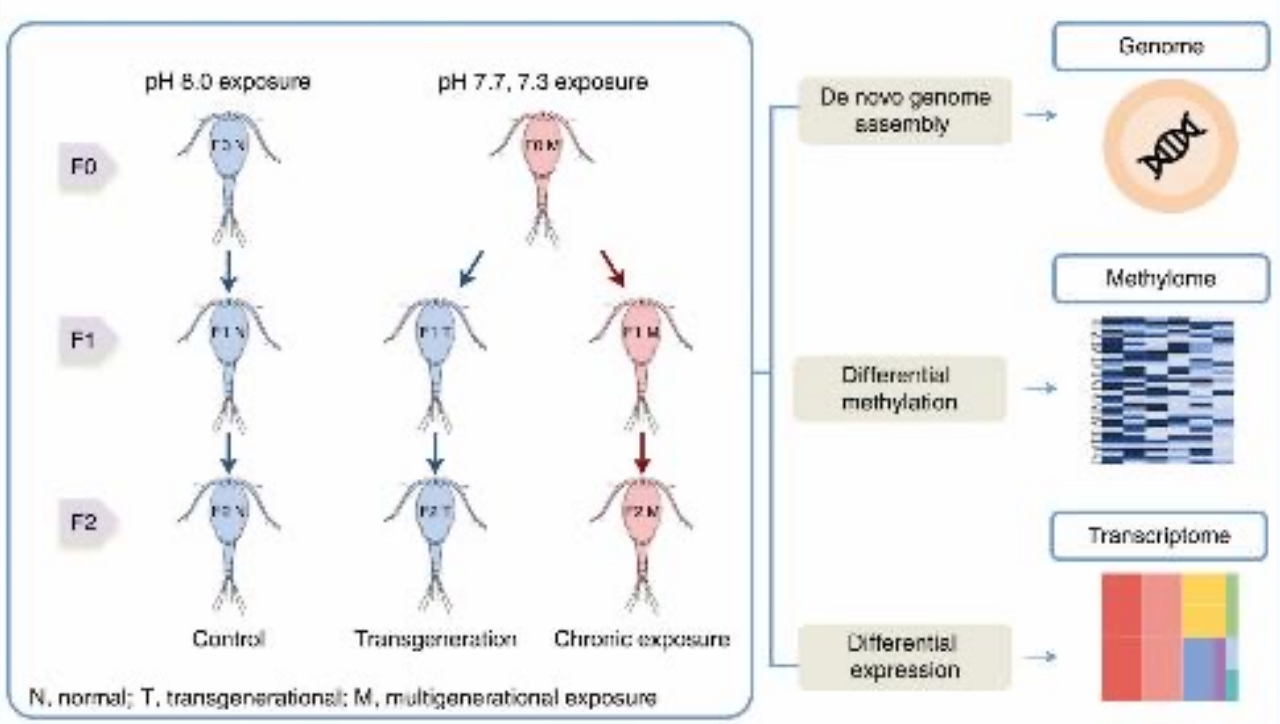


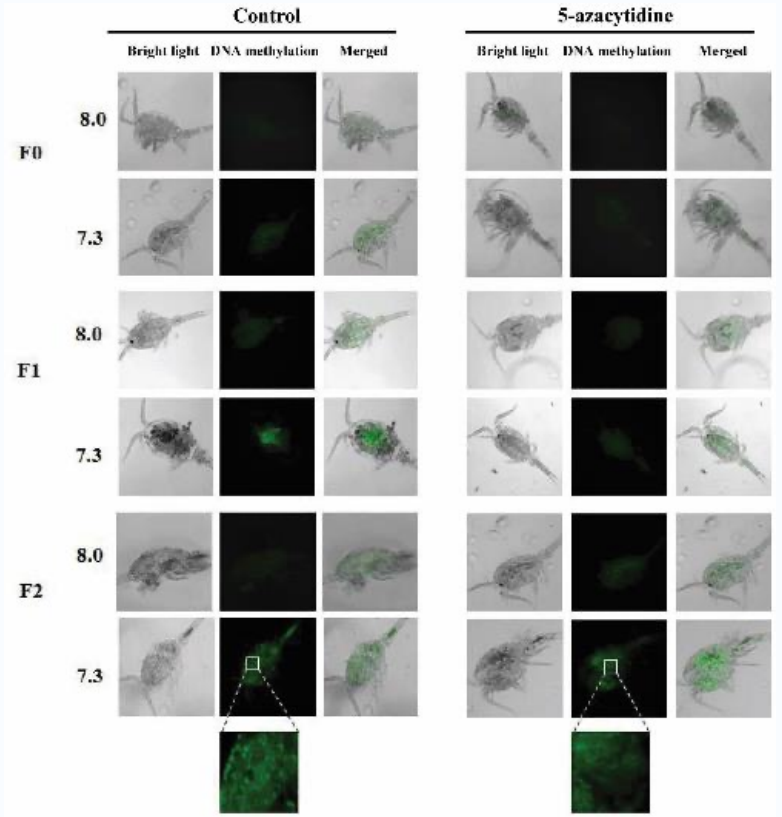
Applying Organic DGT for Emerging POPs

Ecological Responses and Ecosystem Recovery

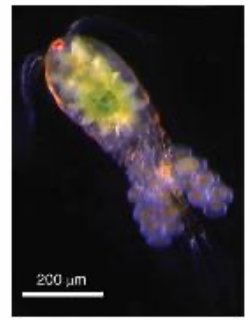
Epigenetic plasticity enables copepods to cope with ocean acidification

The study reports that copepods can adapt to ocean acidification through epigenetic changes.





Prof. Rudolf WU



Publication:

Lee, Y.H., Kim, M.S., Wang, M.H., Bhandari, R.K., Park, H.G., **Wu, R.S.S.**, Lee, J.S. (2022). Epigenetic Plasticity Enables Copepods to Cope with Ocean Acidification. ***Nature Climate Change*** 12, 918. (impact factor 28.862)

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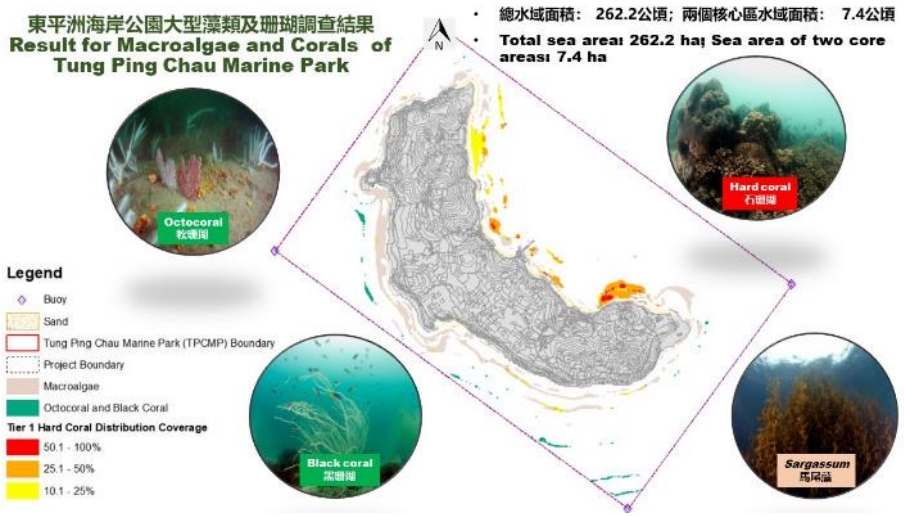
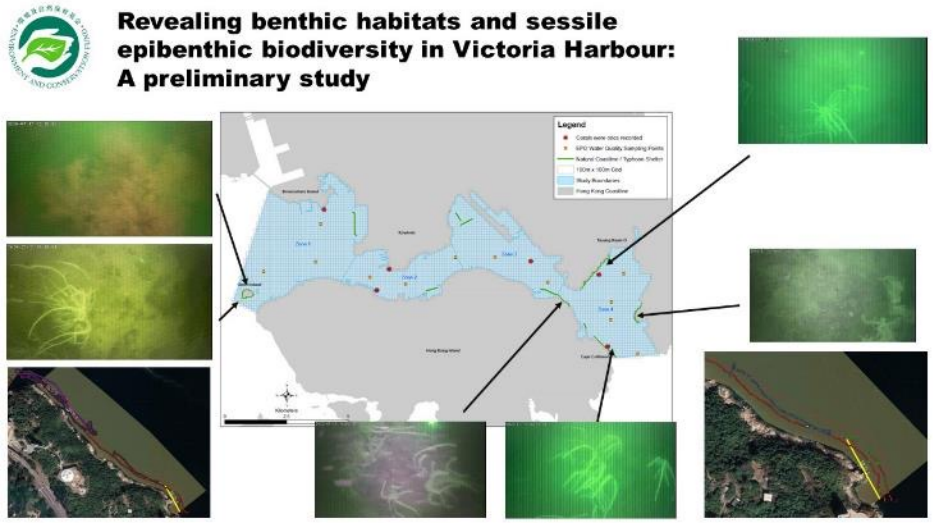
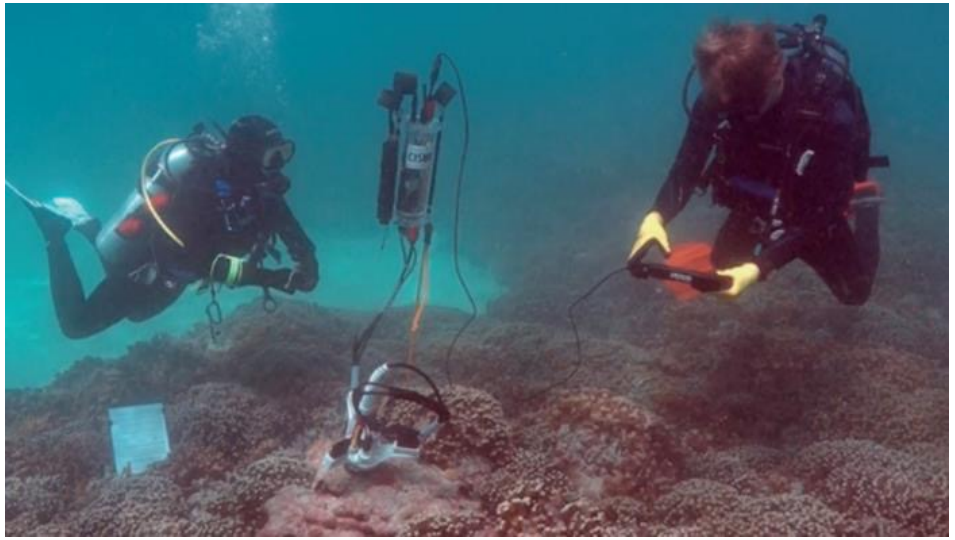
Example

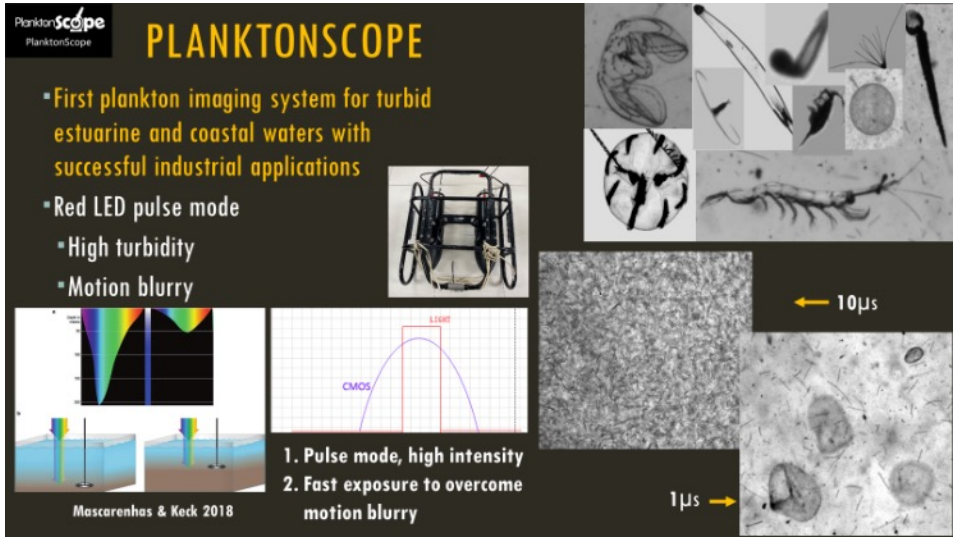
Ecological Responses and Ecosystem Recovery

Underwater Habitat Mapping and Survey Technology









Dr. Leo Lai Chan
Associate Director, SKLMP

Dr. Vicky Jiajun Wu

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Example

Ecological Responses and Ecosystem Recovery

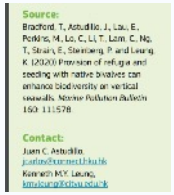
Innovative Technology for Eco-shoreline Implementation

Design of the 3.8 km Eco-shoreline at Tung Chung New Town, Lantau in Hong Kong

Prof Kenneth Leung

Dr Juan Astudillo

European Commission has adopted our research outcomes to inform their environmental policy



UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

Supporting the China's National Master Plan for Ecosystem Restoration and UN Decade on Ecosystem Restoration

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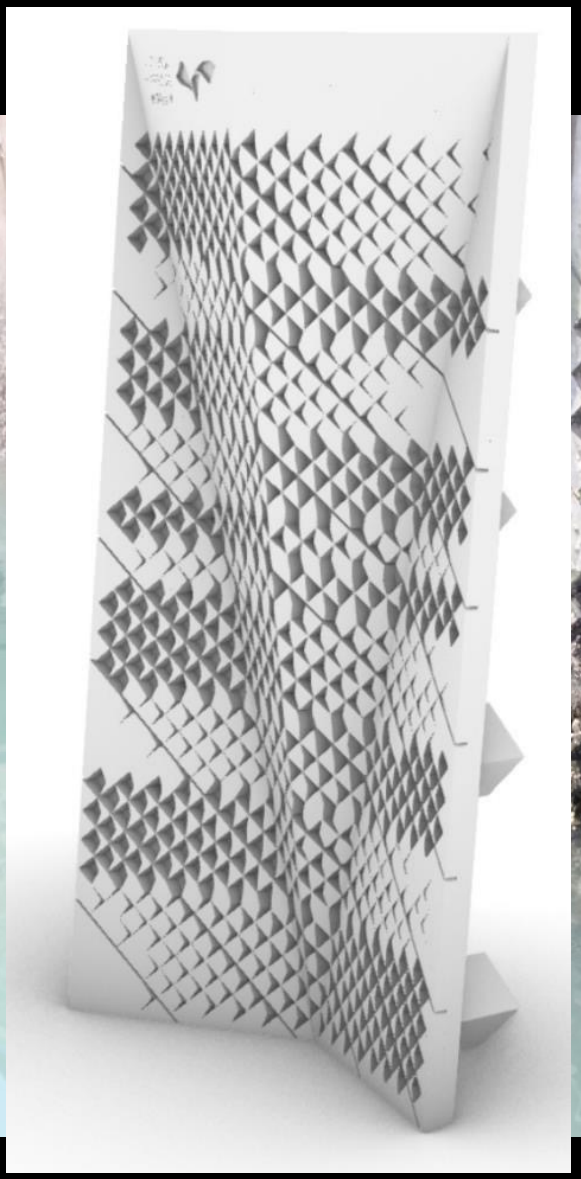
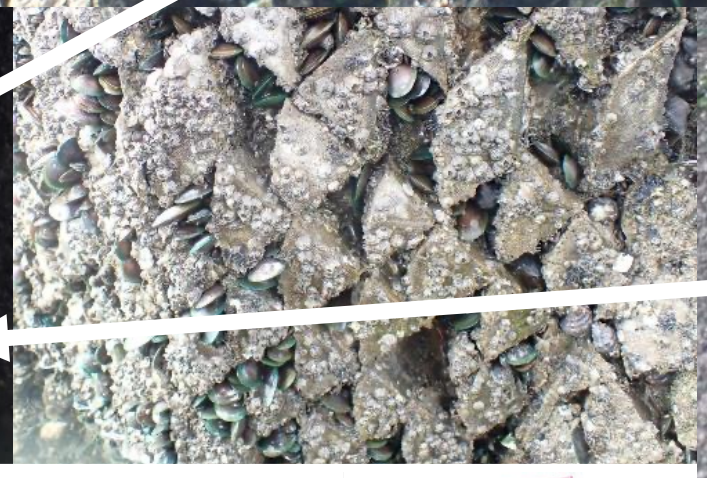
Eco-shoreline at Tung Chung East

Photo Credit: Ir Leo Lam, CEDD

Innovative Technology





CEDD

發展局
Development Bureau

State Key Laboratory of Marine Pollution
SKLMP

CityU
香港城市大學
City University of Hong Kong

Our Track Record and Commitment

SKLMP
海洋污染國家重點實驗室

- SKLMP has ample experience in hosting international conferences and workshops.
- SKLMP is the PEMSEA Regional Centre of Excellence in Marine Pollution Research.
- We will be **able to provide partial or even full financial support to participants** from the WESTPAC region, depending on the funding availability.
- We have **funding for hosting visiting professors and young researchers** to work in our lab.

Our Track Record and Commitment

IOC/WESTPAC Training Workshop on Introductory Scientific Diving for Marine Benthic Dinoflagellates Sampling and Processing

17-21 September 2018

Phuket Marine Biological Center (PMBC), Phuket, Thailand

SKLMP Led the SETAC Global Horizon Scanning

Environmental Toxicology and Chemistry—Volume 39, Number 8—pp. 1485–1505, 2020
Received: 11 March 2020 | Revised: 3 April 2020 | Accepted: 22 May 2020

Critical Review

Toward Sustainable Environmental Quality: Priority Research Questions for Asia

Kenneth M.Y. Leung,[a,b,*] Katie W.Y. Yeung,[a] Jing You,[c] Kyungho Choi,[d] Xiaowei Zhang,[e] Ross Smith,[f] Guang-Jie Zhou,[a] Mana M.N. Yung,[g] Carlos Arias-Barreiro,[h] Youn-Joo An,[i] S. Rebekah Burket,[j] Robert Dwyer,[k] Nathalie Goodkin,[l] Yii Siang Hii,[m] Tham Hoang,[n] Chris Humphrey,[o] Chuleemas Boonthai Iwai,[p] Seung Woo Jeong,[q] Guillaume Juhel,[r] Ali Karami,[s] Katerina Kyriazi-Huber,[t] Kuan-Chun Lee,[u] Bin-Le Lin,[v] Ben Lu,[w] Patrick Martin,[l] Mae Grace Nillos,[x] Katharina Oginawati,[y] I.V.N. Rathnayake,[z] Yenny Risjani,[aa] Mohammad Shoeb,[bb] Chin Hon Tan,[r] Maria Claret Tsuchiya,[cc] Gerald T. Ankley,[dd] Alistair B.A. Boxall,[ee] Murray A. Rudd,[ff] and Bryan W. Brooks[c,j]

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[f]Hydrobiology, Brisbane, Queensland, Australia
[g]Open University of Hong Kong, Hong Kong, China
[h]PETRONAS, Kuala Lumpur, Malaysia
[i]Konkuk University, Seoul, Korea
[j]Baylor University, Waco, Texas, USA
[k]International Copper Association, Washington, DC, USA
[l]Nanyang Technological University, Singapore
[m]University of Malaysia, Terengganu, Malaysia
[n]Loyola University Chicago, Illinois, USA
[o]Supervising Scientist Branch, Canberra, Australian Capital Territory, Australia
[p]Khon Kaen University, Khon Kaen, Thailand
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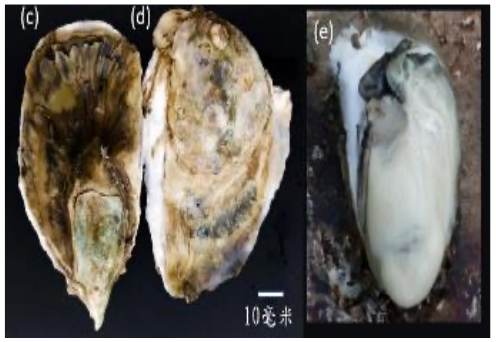
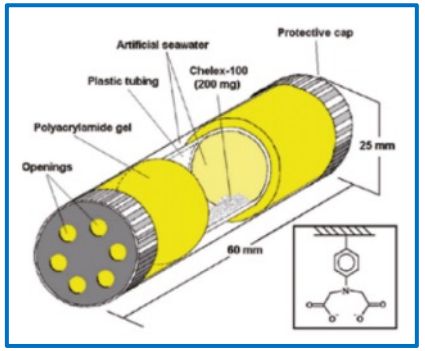
RTRC — Coastal COMMIT

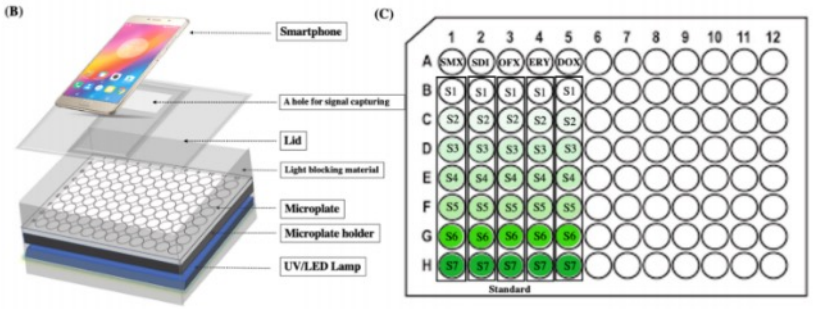
To meet the needs of the WESTPAC region for ensuring ecological safety, and thereby protecting essential marine habitats and conserving biodiversity and natural resources therein.





Objectives

Cost-effective & easy-to-use technologies



1) To enhance the capacity building for monitoring and risk assessment of chemical contaminants as well as marine innovative technologies via **training and technology transfer**;
2) To catalyze and co-design **regional research collaborative projects (e.g. GEM)**;
3) To understand the current situation of chemical contaminants;
4) To promote marine environment protection and facilitate sustainable development, and
5) To recommend regulatory measures to protect marine environments of the WESTPAC region.

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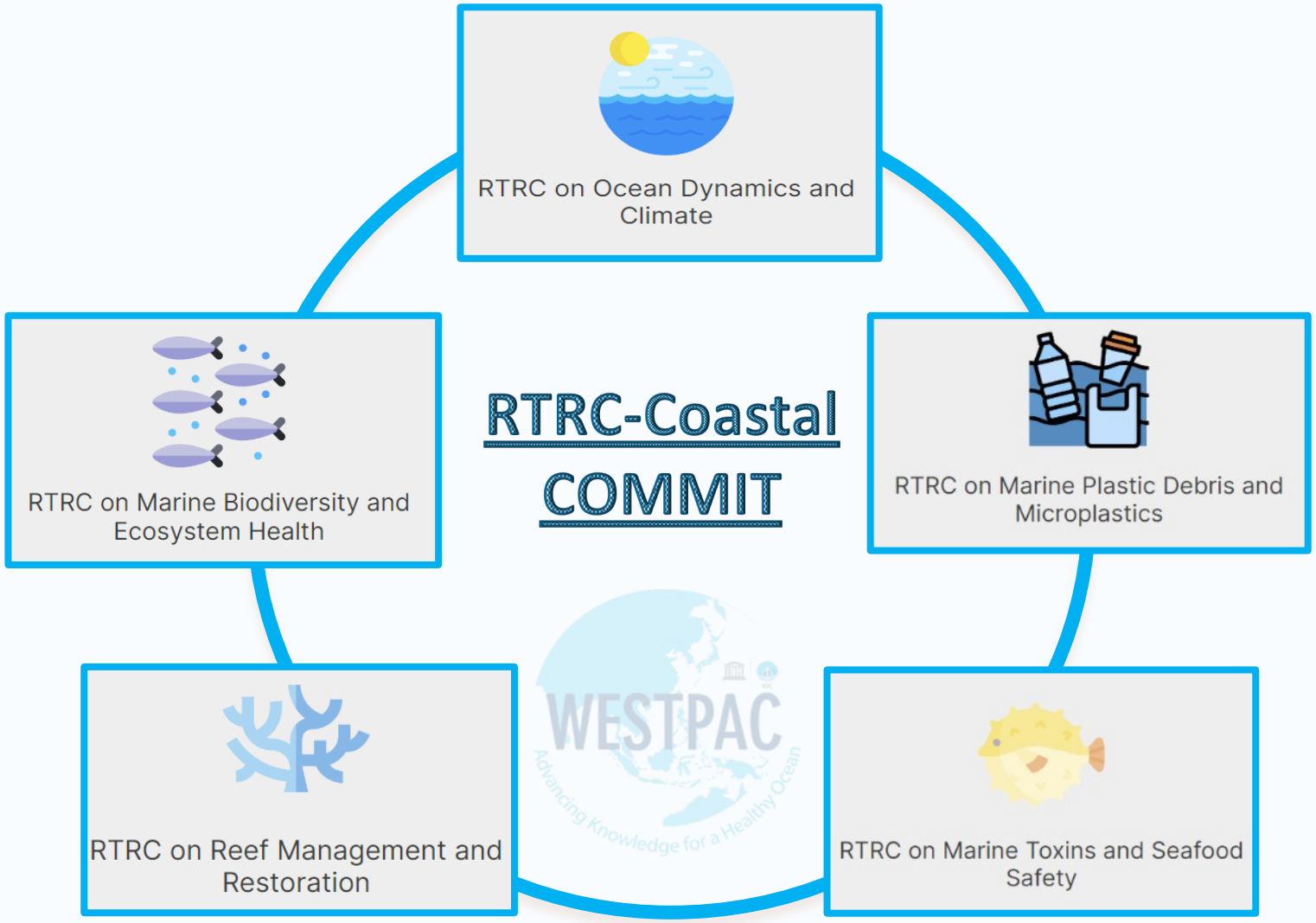
Our Strategy



Core Business

- Transfer knowledge on contaminants of emerging concern (CECs)
- Transfer cost-effective, novel technologies to address the needs of the WESTPAC region
- Coordinate and co-design regional research collaboration

Partnership

- Co-develop research collaboration and training workshops with other RTRCs in cross linked areas (e.g., benthic algal toxins; micro- and nano-plastics)

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Proposed Major Activities

Year	Proposed Activities
2023/2024	Training workshop on “analytical method for per- and poly-fluoroalkyl substances (**PFAS**) characterization and quantification”
2024	The 10th International Conference on Marine Pollution and Ecotoxicology (**ICMPE-10**) (3-6 Jan 2024) Training workshop on “**underwater survey technology for coral ecosystem**” (summer 2024)
2025	Training workshop on “standard protocol and methods for sampling and analysing **active pharmaceutical ingredients**”
2026	Training workshop on “**environmental risk assessment**”
2027	Training workshop on “sampling, isolation, culturing, and identification of **lipophilic phycotoxin producing algal species**” in collaboration with RTRC - Marine Toxins and Seafood Safety

Global Estuaries Monitoring Programme

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

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SKLMP will be keen to support ICO-WESTPAC and UN Ocean Decade

United Nations Decade of Ocean Science 2021-2030

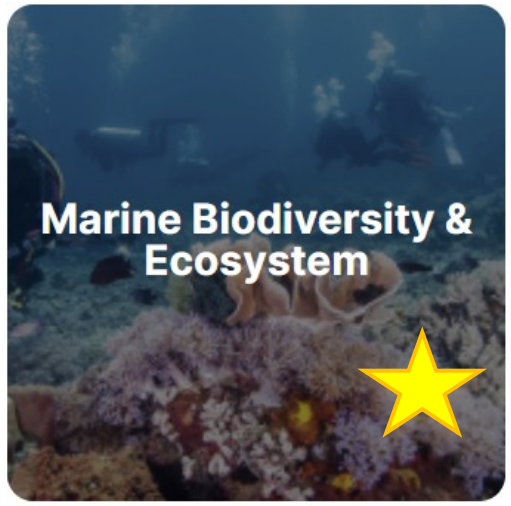
Clean Ocean

Safe Ocean

Transparent Ocean

TARGET 14·1

REDUCE MARINE POLLUTION



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Great minds unite to protect oceans with innovation!
Go together, we go far!
Big Thank You!

Expected Outputs

- ✓ Provision of research protocols and training on the instrumental analysis and toxicity assessment of chemical contaminants.
- ✓ Demonstration and provision of protocols for ecological investigation and assessment of marine biodiversity and ecosystem health using innovative underwater technologies.
- ✓ Recommendations of appropriate management measures and monitoring protocols to governments for enhancing future regional environmental protection and conservation management.
- ✓ Strengthening the regional network and capacity building for knowledge exchange, data sharing, technology transfer and research collaboration.

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Implementation Strategy

a. Management

- Non-profit-making and self-sustaining;
- Led by SKLMP director and steered by Advisory Committee.

b. Capacity building (with the support from IOC/UNESCO)

- Full utilization of complementary expertise and facilities from different institutions;
- Develop cooperation in the WESTPAC region;
- Strengthen national and international networks.

c. Sustainability

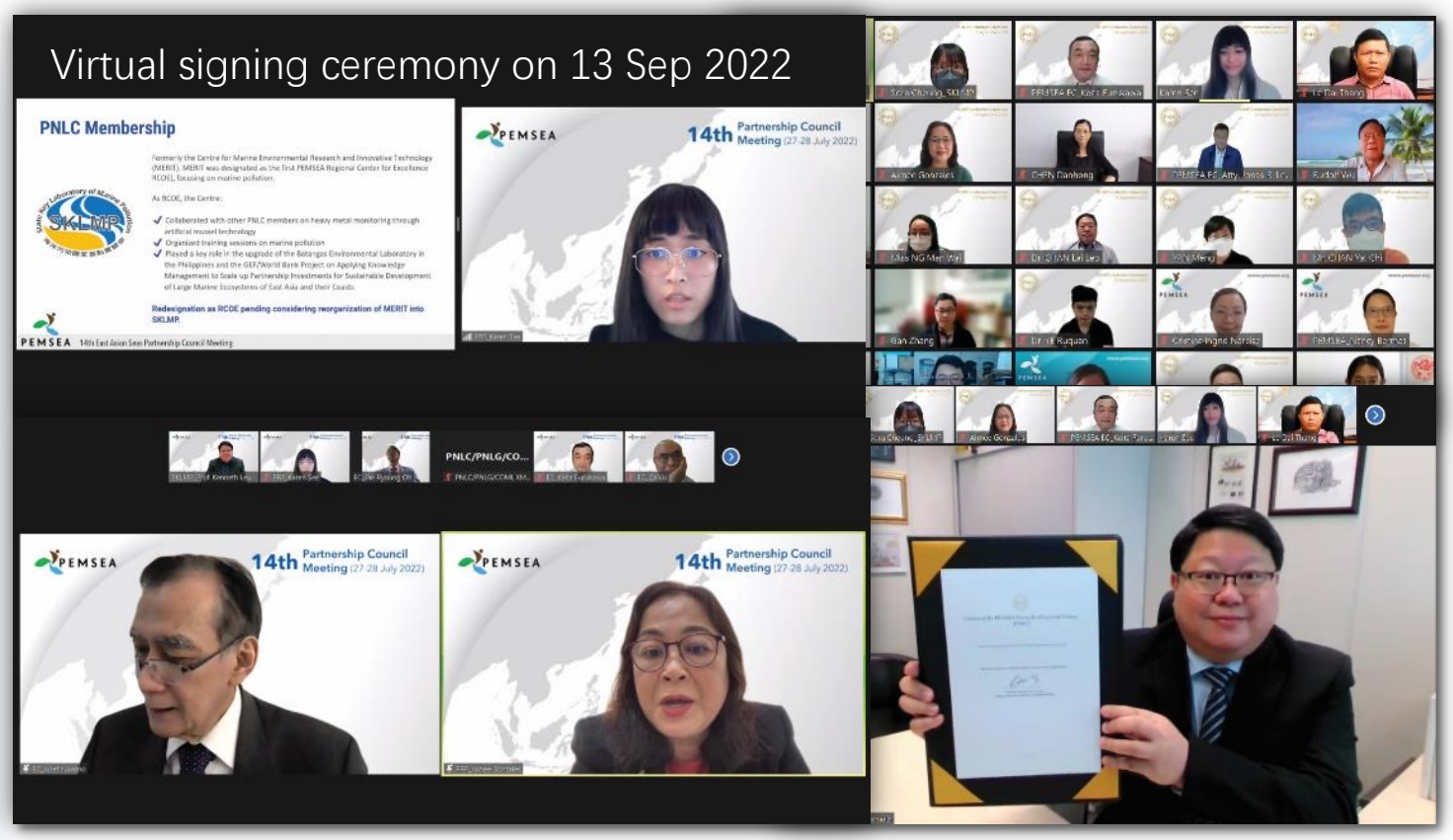
- Produce environmental professionals to meet future demands in the region;
- Establish an academic and technology exchange platform within and outside the region;
- Annual funding support from CityU and the Innovation and Technology Commission of Hong Kong;
- Develop new partnerships and opportunities through regular trainings and research activities;
- Promote training courses, collaboration opportunities and research excellence through website and social media

d. Knowledge sharing

- Skills and knowledge will be transferable and replicable.
- Data can be shared, exchanged, and published together based on the principle of voluntariness.

SKLMP designated as a PEMSEA-RCOE and a member of the PNLC

On 27 July 2022, the Partnership Council of the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) officially endorsed SKLMP as an **Regional Centre of Excellence (RCOE) in Marine Pollution Research**. As a PEMSEA-RCOE, SKLMP automatically becomes **a member of the PEMSEA Network of Learning Centres (PNLC)**.



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