GEO BLUE PLANET

# GEO Blue Planet 6th Symposium

## Digital Solutions for Sustainable Oceans

OCT 31 ~ NOV 2, 2023 Seoul, South Korea

KMI 한국해양수산개발원 KOREA MARITIME INSTITUTE

GEO BLUE PLANET

# Symposium Scope, Objectives, and Agenda

GEO Blue Planet is pleased to announce the 6th GEO Blue Planet Symposium, slated to be held from October 31st- November 2nd in Seoul, Korea. These symposiums are designed to increase regional linkages, promoting linkages between stakeholders and the observing community and gathering community feedback on the focus of GEO Blue Planet activities.

This year's symposium, themed ***Digital Solutions for Sustainable Oceans,*** is specifi cally geared towards improving GEO Blue Planet's engagement with Asian nations to expand the EO community of practice, strengthen local capacity and provide access to resources, tools, and services. The Korean symposium is scheduled to be held by establishing cooperative relationships with international organizations to enhance awareness of GEO Blue Planet in the Asia region.

This in-person event will feature Plenary Sessions centered on the GEO Blue Planet Core Action Areas of Stakeholder Engagement, Cooperation, and Co-design and Capacity Development. Additionally, It will include multiple sessions on Korean Marine Spatial Planning (K-MSP) and digital solutions, Thematic Workshops, and a highly interactive Symposium Forum.

## Programme

### Plenary Sessions

The Plenary Sessions will be designed to inspire various topics related to key activities of regional data conditions, tools and opportunities, stakeholder engagement and collaboration, and capacity development related to GEO Blue Planet. Additionally, this year's event will also cover the current state and issues of the ocean through international organizations and government agencies in the Asian region, as well as examples of institutional and technological applications using digital technology and information.

#### *Introductory keynote presentation: International Organization*

Asia has one of the largest ocean areas in the world and is rich in ocean resources and biodiversity. However, various ocean issues such as marine debris, coastal disasters, and overfishing, are occurring due to climate change, high population density, and industrial and developmental activities. To address these issues, region al countries and international organizations are pursuing various measures for ocea n protection and development. In particular, international organizations develop and implement policies such as international laws and regulations related to the ocean, contributing to policy decision- making through knowledge-sharing and capacity-building programs, including research and data collection, and promoting practical solutions.

This session will briefly introduce the current status and issues of the ocean in the Asian region and explain the role of international organizations in solving ocean problems. Specifically, it aims to discuss the future vision of the ocean in the Asian area by focusing on concrete cases pursued by international organizations, such as cooperation in ocean information and technology between countries or regions, stakeholder engagement, and capacity building for solving ocean problems.

### *GEO Blue Planet Session*

GEO Blue Planet is a very important international program that aims to promote an understanding of the marine and coastal ecosystems, support their conservation and sustainable management, and develop monitoring and prediction systems. It also seeks to develop policies and facilitate their implementation through data and information sharing, research, and collaboration among stakeholders. The establishment of an Asian office and network of marine experts in the region is particularly significant given the importance of Asia as a major ocean region with rich marine resources and biodiversity, as well as significant ocean-related challenges.

This session will introduce the goals and vision, governance of the GEO Blue Planet international program, as well as the background and history of the establishment of the Asia office. We will also discuss the goals and vision for building a network of ocean experts in the Asia region and for promoting cooperation in ocean information and technology, and provide concrete implementation plans to achieve these goals. The aim is to enhance awareness of GEO Blue Planet and its Asia office and to encourage collaboration and participation from domestic and international practitioners, experts, and stakeholders.

### *Digital Solution Session*

To address global ocean issues such as climate change, marine debris, dead zones, marine biodiversity loss, illegal fishing, and overfishing, it is important to establish effective regulations, build the capacity of practitioners, and leverage the knowledge and experience of experts. In addition, the use of ocean observations and information that support the conservation and sustainable use of the ocean is crucial. Based on information about marine ecosystems and various human activities, effective policies and regulations can be developed. Therefore, it is essential to collect and analyze diverse information related to ocean conservation and use it to support appropriate decision-making and planning.

This session aims to introduce cases that utilize ocean information and technology to address current ocean issues and challenges. Through specific examples from the Asian region, the importance of applying ocean information and technology will be emphasized, and the need for cooperation among countries and regions in ocean information and technology will be discussed.

### *K-MSP Session*

In 2018, Korea established the "Marine Spatial Planning Act" and designated the entire sea area into nine designated use zones, including fishing activity protection zones, energy development zones, and marine environment and ecosystem management zones, based on the analysis results of marine spatial big data and consultations with stakeholders. By introducing the marine spatial suitability consultation system to review various usage and development plans in advance, a marine spatial management system was established. This integrated system of marine spatial management in Korea is considered a successful case of a local MSP, unlike the national-level MSP cases in European countries that are advanced in MSP. Currently, other countries in Asia, such as Bangladesh and Indonesia, are requesting cooperation on related regulations and technologies.

This session will introduce the background and current status of Korea's MSP (K-MSP) and provide detailed explanations of the data and related technologies applied during the establishment and implementation of MSP. Through this session, we aim to promote understanding of the MSP system and share knowledge and experience regarding the utilization of technology and information.

Plenary Session Objectives

1. To promote dialogue on the ocean and coastal issues in the Asian region.
2. To explore the role of ocean information in addressing regional issues.
3. To discuss detailed action plans to contribute to sustainable development in the Asian region.

Target Audience

The keynote session of the symposium is targeted to a diverse audience of up to 200 people, including government officials, research institutions, industry representatives, and local stakeholders. Participants may include senior representatives from international organizations, government ministers, policymakers, representatives from regional and local bodies, experts, researchers, students, and other local stakeholders.

### *Symposium Forum*

The Symposium forum is designed as a platform for diverse communication among practi tioners, experts, and stakeholders in Asia and other countries on the use of ocean inform ation for various maritime and coastal issues. The main goal is to explore critical regional issues related to ocean and coastal spaces and coordinate with GEO Blue Planet working groups. Based on a review of the ocean and coastal issues in Asia and other countries, the forum will be organized around digital challenges and practical strategies. In addition, a space will be provided to discuss the detailed outcomes and follow-up actions of this annual symposium together.

Forum Objectives

1. To promote communication and collaboration within local communities regarding ocean and coastal issues.
2. To explore the role of ocean information in responding to ocean issues.
3. To discuss achievable outcomes for sustainable development in the Asian region and propose a new working group.

Target Audience

The Symposium forum is open to general participants throughout the Symposium. Partici pants include international organizations, regional organizations, experts, stakeholders, policymakers, and students in the Asia region.

### *Thematic Workshops*

GEO Blue Planet plans to hold working group workshops by topic at this symposium to establish a network between practitioners, stakeholders, and ocean experts in the Asian region and countries. Eight ocean issues related to marine litter, coastal erosion, eutrophi cation, fisheries, oil spills, climate adaptation, and MSP will be covered in the workshops.

In each workshop, participants will be able to share GEO Blue Planet working group objec tives and details and participate in identifying the information necessary to address natio nal and regional ocean issues. Additionally, workshop participants will discuss the potent ial for working group support and collaboration, cooperation directions, and inter-workin g group interoperability for regional issues.

Workshop Objectives

1. To provide insight into the needs of stakeholders for responding to ocean issues.
2. To provide enhancement of understanding and knowledge for stakeholders in the Asian region.
3. To collect feedback from stakeholders on the potential for collaboration between the Asian region/nations and working groups.

Target Audience

GEO Blue Planet's thematic workshops will be conducted in parallel with side events and should attract the interest of various stakeholders who want to use the ocean and coastal information to support decision-making in the Asian region. These workshops are open to regional experts, NGOs, fisheries stakeholders, as well as public officials, research ins titutions, and students from local communities. In this session, practical managers of coa stal education in each country of the PEMSEA regional collaboration mechanism for marin e environmental management will participate.

### *Side Events*

The symposium side events will be organized by related R&D project teams, academic or ganizations, and relevant institutions that are the target audience of the symposium. Thr ough these side events, the symposium's main topics and agendas related to ocean issues will be discussed, and they will serve as a means to encourage active participation from diverse groups.

Side Event Objectives

1. To discuss current issues related to sustainable oceans and coasts
2. To gain insights into mutual understanding and utilization of various ocean issues
3. To promote dialogue and collaboration among multiple stakeholders

Target Audience

The symposium side events will be held in parallel with the thematic workshops and are open to all symposium participants. Participants may include policymakers, researchers, stakeholders, local organizations, and anyone interested in the agenda and content of the side events.

# Symposium Programme

# 6th GEO Blue Planet Symposium 2023

(Seoul, S. Korea | 31st Oct – 02nd Nov)

| Day 01 (31st Oct) | | |
|---|---|---|
| 8:30-9:30 | **Registration** | |
| 9:30-10:00 | **Opening ceremony** (Location: 2F Grand Ballroom)<br>Facilitator: Sang-Hyeok Lee (KMI) | |
| | 9:30-9:40 | Jong-Doeg KIM (KMI President) |
| | 9:40-9:45 | Woonyul Oh (KIMST President) |
| | 9:45-9:50 | *Paul DiGiacomo (GEO Blue Planet Co-Chair \| NOAA Division Chief) **Video Presentation* |
| | 9:50-10:00 | *"Introduction to GEO Blue Planet and the Symposium"*<br>Sung-Jin Cho (GEO Blue Planet Asia Secretariat \| KMI) |
| 10:00-10:10 | **Group Photo** | |
| 10:10-10:30 | **Coffee Break** | |
| 10:30-11:30 | **Keynote Presentations** (Location: 2F Grand Ballroom) | |
| | 10:30-11:00 | *"Issues and Challenges for Blue Economy"*<br>Young Tae Chang (Professor Emeritus, Inha University) |
| | 11:00-11:30 | *"State of Ocean and Coasts in the EAS region: challenges and opportunities"*<br>Aimee Gonzales (Executive Director, PEMSEA) |
| 11:30- 12:30 | **Plenary session I: *Ocean and Coastal Challenges and Priorities in Asia and Pacific Region.*** (Location: 2F Grand Ballroom)<br>Session Co-chair: Aimee Gonzales (PEMSEA) & Rory Scarrott (University College Cork) | |
| | 11:30-11:35 | Welcome from Moderator |
| | 11:35-11:45 | *"Towards Roadmap 2030: Marine Challenges and Priorities for the Asia Pacific region"*<br>Mahesh Pradhan (Coordinator, COBSEA) |
| | 11:45-11:50 | *"GEO Blue Planet Opportunities"*<br>Emily Smail (GEO Blue Planet US Secretariat \| NOAA) |
| | 11:50-11:55 | Facing realities: A sense-check- Open for Comments |
| | 11:55-12:10 | *"Focusing on People: The importance of considering regional socio-economic contexts for technology uptake"*<br>Andiswa Mlisa (The Pacific Community) |
| | 12:10-12:30 | Panel and audience deep dive<br>Additional panelists:<br>Suk Jae Kwon (KIOST)<br>Laura David (UP Marine Science Institute)<br>Yegor Volovik (Secretary Director, NOWPAP) |
| 12:30- 14:00 | **Lunch** | |

| Day 01 (31st Oct) | | |
|---|---|---|
| 14:00- 15:30 | **Plenary session II: *Digital Solutions for Sustainable Oceans*** (Location: 2F Grand Ballroom)<br>Session Co-chairs: Andiswa Mlisa (The Pacific Community) & Piotr Zaborowski, (Open Geospatial Consortium) | |
| | 14:00-14:10 | Introductory remarks<br>Andiswa Mlisa (The Pacific Community) & Piotr Zabrowski (Open Geospatial Consortium) |
| | 14:10-14:20 | *"Enhancing User Experience in the Western Pacific and Marginal Seas of South and East Asia through the Digital Twin Ocean"*<br>Ryo Furue (JAMSTEC) |
| | 14:20-14:30 | *"New Trends of Reality Tech in Ocean: XR, Digital Twin and the Metaverse"*<br>David Kim (CEO, Samwoo Immersion Co., Ltd.) |
| | 14:30-14:40 | *"Coast Big-Data Platform: Discovering New Marine Industries w/ Bigdata"*<br>Chol Young Lee (Director of Marine Bigdata·AI Center, KIOST) |
| | 14:40-14:50 | *"The Development of Electronic Monitoring in the Western and Central Pacific Long line Fisheries"*<br>Leontine Baje (The Pacific Community) |
| | 14:50-15:30 | Panel Discussion: Opportunities, Challenges and Future Trends Presented by Digital Solutions for Users. |
| 15:30-16:00 | **Break** | |
| 16:00-17:30 | **Plenary session III: *Introduction to K-MSP*** (Location: 2F Grand Ballroom)<br>Session Chair: Jungho Nam (KMI) | |
| | 16:00-16:10 | Session Introduction |
| | 16:10-16:25 | *"Marine Spatial Planning of the Republic of Korea"*<br>Hee-Jung Choi (KMI) |
| | 16:25-16:40 | *"Marine Spatial Assessment of the Republic of Korea"*<br>Myoung Won Kim (GeoSR Inc.) |
| | 16:40-17:30 | **Panel Discussion**<br>**Panelists:**<br>Yegor Volovik (Secretary Director, NOWPAP)<br>Dong-Oh Cho (Senior Policy Consultant, KMI)<br>Jeong-Kyu Yoo (Director of Marine Spatial Planning, KOEM) |
| 18:00-20:00 | **Dinner & 3 minutes for melting pot.** | |

| Day 2 (1st Nov) | | | |
|---|---|---|---|
| | **Workshop 1: Marine Litter**<br>(Location: 2F East Palace) | **Workshop 2: Satellite Derived Bathymetry**<br>(Location: 2F West Palace) | **PEMSEA Learning Exchange Program: Session I**<br>(Location: 2F Jewel Room) |
| 9:00-10:30 | **Chair:** Audrey Hasson (Mercator Ocean Intl.) & Sunwook Hong (OSEAN)<br><br>**Speakers:**<br>Young Nam Kim (KOEM)<br>Jong Soo Lee (OSEAN)<br>Audrey Hasson (Mercator Ocean Intl.)<br>*Noriko Tamiya-Hase (Ministry of Environment Japan)<br>**Video Presentation*<br>**Panelist:**<br>Yoon Jung Lee (KMI) | **Chair: Nashwaan Matheen (MSRO)**<br><br>**Speakers:**<br>Nashwaan Matheen (MSRO)<br>Andiswa Mlisa (The Pacific Community)<br><br>**Panelist:**<br>Jongkuk Choi (KIOST) | **Session I**<br>Sustainable Development Strategy for the Seas of East Asia : Roadmap to 2030<br><br>**Speaker:**<br>Nancy Bermas, PEMSEA Resource Facility |
| 10:30-11:00 | **Break** | | |
| | **Workshop 3: Fisheries**<br>(Location: 2F East Palace) | **KIOST Session:**<br>***Data Centers in Coast Big -Data Platform***<br>(Loca tion: 2F West Palace) | **PEMSEA Learning Exchange Program: Session II**<br>(Location: 2F Jewel Room) |
| 11:00-12:30 | **Chair: Nikelene Mclean (University of Maryland)**<br><br>**Speakers:**<br>*A Gopalakrishnan (Central Marine Fisheries Institute, India)<br>**Video Presentation*<br>Sukguen Jung (Jeju National University)<br>Jaeyoon Park (Global Fishing Watch)<br><br>**Additional Panelists:**<br>Dong-Hun Go (KMI)<br>Manasa Babitu (The Pacific Community) | **Chair: Chol Young Lee (KIOST)**<br><br>**Speakers:**<br>Woo Ram Kim (Haebomdata Inc.)<br>Jin Il Song (Inha University Research and Business Foundation)<br>Chan-Yeong Oh (OCEANIC Co., Ltd.)<br>Ho-Seung Jung (OSEAN)<br>Lukas Kim (NSONESOFT Co., Ltd.) | **Session II**<br>Sharing Sessions<br>1. ICM and Sustainable Coastal Development Approaches<br>2. Biodiversity and Habitat Management<br>3. Role of Learning Institutions in Biodiversity Conservation and Management<br><br>**Speakers: PNLC members** |
| 12:30-14:00 | **Lunch** | | |
| 14:00-17:30 | **Poster Session** (Location: Jewel Room) | | |
| | **Workshop 4: Marine Spatial Planning** | | |
| 14:00-15:30 | **Chair: Daeseok Kang (Pukyung National University)**<br><br>**Speakers:**<br>Jungho Nam (KMI)<br>Shenghui Li (Guangdong Ocean University)<br>Sung-Jin Cho (KMI)<br><br>**Additional Panelists:**<br>Jong-Joo Yoon (Chungnam Institute)<br>Andiswa Mlisa (The Pacific Community)<br>Mahesh Pradhan (Coordinator, COBSEA) | | |
| 15:30-16:00 | **Break** | | |
| | **Workshop 5: Data Needs for National Adaptation Planning** (Location: 2F Ballroom) | | |
| 16:00-17:30 | **Co-Chairs: Joy Chakrabartty (NOAA) & David Cabana (GERICS)**<br><br>**Speakers:**<br>Laura David (UP Marine Science Institute)<br>Hak Soo Lim (KIOST)<br>Soo-Min Kim (GeoSR Inc.)<br><br>**Additional Panelists:**<br>In-Seong Han (National Institute of Fisheries Science, Korea) | | |

| Day 3 (2nd Nov) | | |
|---|---|---|
| 9:00-10:30 | **Symposium Forum Session I: *Digital Challenges and Activities in the Asia-Pacific Region***<br>(Location: 19F Namsan Room)<br>**Co-Chairs: Emily Smail (NOAA) & Mahesh Pradhan (COBSEA)** | |
| | 9:00-9:10 | Session Introduction |
| | 9:10-9:55 | **Speakers:**<br>Han San Park (MTCRC)<br>Johnny Ching (De La Salle University)<br>Hyunsoo Hur (Geostory Inc.)<br>Emily Smail (NOAA) |
| | 9:55-10:30 | **Panel Discussion**<br>**Additional Panelists:**<br>Andiswa Mlisa (The Pacific Community)<br>Piotr Zabrowski (Open Geospatial Consortium)<br>Nashwaan Matheen (MSRO) |
| 10:30-11:00 | **Coffee Break** | |
| 11:00-12:30 | **Symposium Forum Session II: Summary of 6$^{th}$ GEO Blue Planet Symposium and the way forward**<br>(Location: 19F Namsan Room)<br>**Chair: Jungho Nam (KMI)** | |
| | 11:00-11:10 | *Overview of Current Working Group Activities:*<br>Audrey Hasson (Mercator Ocean Intl.) |
| | 11:10-11:20 | *Summary of 5$^{th}$ GEO Blue Planet Symposium:*<br>Nikelene Mclean (University of Maryland) |
| | 11:20-11:30 | *Summary of Key Highlights from Plenary Sessions:*<br>Joy Chakrabarrty (NOAA) |
| | 11:30-11:40 | *Summary of Key Highlights from Thematic Workshops:*<br>Nikelene Mclean (University of Maryland) |
| | 11:40-11:50 | Operational Direction of GEO Blue Planet in Asia:<br>Sang-Hyeok Lee (KMI) |
| | 11:50-12:20 | Open Discussion |
| | 12:20-12:30 | Concluding Remarks:<br>Sung-Jin Cho (KMI) |
| 12:30-14:00 | **Lunch** | |

# Contents

# Opening Ceremony

# 개 회 사

안녕하십니까? 한국해양수산개발원장 김종덕입니다.

「제6차 GEO Blue Planet 해양프로그램 심포지엄」에 참석해 주신 여러분께 진심으로 감사드립니다. 먼저 바쁜 일정에도 불구하고 심포지엄 준비에 큰 도움을 주신 해양수산과학기술진흥원 오운열 원장님께 깊이 감사드립니다.

아울러 기조발표를 맡아주신 인하대학교 장영태 명예교수님과 PEMSEA(펨시)의 에이미 곤잘레스(Aimee T. Gonzales) 사무국장님과 발표와 토론에 참여해 주신 모든 국내외 전문가들께도 특별한 감사의 말씀을 드립니다.

내외 귀빈 여러분,

우리는 해양이 인류 문명과 경제활동에 밀접하게 연관되어 있다는 사실을 잘 알고 있습니다. UN(2017)에 따르면, 해양 기반 경제규모는 약 3조 달러로 추정되고, 세계 인구의 37%가 해양에 의존해서 살아가고 있습니다. 그리고, 전 세계인들은 바다를 통해 80%가 넘는 화물을 주고받고 있으며, 바다 밑에 설치된 해저케이블을 통해 99%의 데이터를 주고받습니다. 바다는 지구의 심장이자 혈관으로 인류문명을 지켜왔으며 앞으로도 그 역할은 변하지 않을 것입니다.

하지만 기후위기는 곧 해양위기라는 말이 나오고 있습니다. 또한 해양의 환경오염과 생태계 파괴, 바다생물 서식지 감소 등 환경.생태적 가치가 크게 훼손되고 있습니다. 우리가 좀 더 데이터에 기반 한 치밀한 해양관리, 과학에 기반 한 해양관리에 나서야 하는 이유입니다.

이렇게 점점 복잡해지고 다양해지는 해양의 문제의 과학적 솔루션 개발을 위해, 전 세계 정부기관, 대학·연구기관, 시민사회 등이 모여 GEO 산하에 GEO Blue Planet이라는 국제프로그램을 마련했습니다. GEO Blue Planet은 개방적.지속적 해양 데이터의 공유와 인프라 확충을 통한 해양 솔루션 개발을 목표로 합니다.

KMI는 2021년 7월 해양과학 기반의 해양문제 해결을 위한 국제사회 거버넌스에 동참하기 위해 북미지역, 유럽연합에 이어 세 번째로 아시아 지역사무국을 설립했습니다.

내외 귀빈 여러분,

현재 해양에서뿐만 아니라 우주로부터 수많은 해양데이터가 빠르게 생산되고 있으나, 해양공간의 합리적 이용과 해양환경관리 등을 위한 해양정책에 활용되는 비율은 낮은 상태입니다. 따라서 해양의 지속가능한 발전을 위해 해양데이터를 환경·사회·경제 현안과 효과적으로 연계해 디지털 솔루션이 제시되어야 한다고 생각합니다.

이런 취지에서 「디지털 기반 지속가능한 해양관리」라는 주제로 열리는 이번 심포지엄은 매우 의미가 있습니다. 오늘 심포지엄에서 전 세계 해양데이터 생산.활용 여건을 공유하고, 특히, 아시아 지역의 지속가능한 해양을 위해 해양데이터의 활용방안이 심도있게 논의될 것으로 기대합니다. 오늘 발표와 토론을 통해 제시될 창의적인 의견이 해양의 지속가능성 확보를 위한 든든한 초석이 되기를 희망합니다.

귀빈 여러분,

한국해양수산개발원은 앞으로 국내외 유관기관과 긴밀한 협력관계를 통해 해양의 지속가능성을 위한 정책을 개발하는데 지속적으로 노력할 것입니다. 특히 오늘 심포지엄을 계기로 디지털 기반 지속가능한 해양관리체제를 구축하도록 노력하겠습니다.

오늘 이 자리를 함께 해주신 모든 분들과 행사를 후원을 해주신 관련 민간기업 및 연구기관에 다시  한 번 깊은 감사를 드립니다. 특히 한국을 방문해 주신 해외 전문가 분들을 진심으로 환영하며, 소중한 시간이 되길 바랍니다.

감사합니다.

2023. 10. 31.
한국해양수산개발원 원장 김 종 덕

# Opening remarks

This is Kim Jong-Deog, President of the KMI (Korea Maritime Institute). I sincerely appreciate everyone who attended the 6th GEO Blue Planet Symposium.

A special thanks goes to Oh Woonyul, President of the KIMST (Korea Institute of Marine Science & Technology Promotion) for a significant assistance in organizing the symposium, despite a busy schedule.

I also want to thank Professor Chang Young-Tae, Honorary Professor at Inha University, and Aimee T. Gonzales, and the Executive Director of the PEMSEA (Partnerships in Environmental Management for the Seas of East Asia) who delivered the keynote address. I also express my gratitude to Dr. Yegor Volovik, the Secretary Director of NOWPAP, Mr. Mahesh Pradhan, the Coordinator of COBSEA, and all local and international experts who participated in presentations and discussions.

Ladies and gentlemen,

We are well aware of the fact that the ocean is closely intertwined with human civilization and economic activities. According to the UN (2017), the ocean-based economy is estimated to be around 3 trillion dollars, and 37% of the world's population depends on the ocean for their livelihoods. Moreover, people worldwide exchange over 80% of goods through the sea, and undersea cables, laid beneath the ocean floor, facilitate the exchange of 99% of global data.
The ocean, serving as the heart and circulatory system of the Earth, has safeguarded human civilization, and its role will remain pivotal in the future.

However, there is a growing acknowledgment that the climate crisis translates into an imminent ocean crisis. Furthermore, environmental pollution, ecosystem degradation, and the reduction of marine habitats are significantly compromising the environmental and ecological values of the ocean. This is why we need to advance into more data-driven and scientifically based ocean management to address these pressing issues and challenges.

To address the increasingly complex and diverse challenges that the ocean faces, the governments, universities, research institutions, civil society, and other stakeholders worldwide have come together under the auspices of GEO to establish the international program known as "GEO Blue Planet." GEO Blue Planet aims to develop scientific solutions for the ocean problems by promoting the open and continuous sharing of ocean data and enhancing infrastructure.

In July 2021, following engagements in the North American region and the European Union, KMI established its third regional office in Asia to actively participate in the international governance for addressing ocean-related issues based on marine science.

Ladies and gentlemen,

Currently, a vast amount of ocean data is rapidly generated not only from the ocean itself but also from space. However, the proportion of this data utilized in ocean policies, such as marine spatial planning and ocean environmental management, remains low. Therefore, I believe that proposing digital solutions that effectively connect ocean data with environmental, social, and economic issues is essential to achieve sustainable development in the ocean.

This is why the symposium themed "Digital Solutions for Sustainable Oceans" is of significant importance. Today, we anticipate sharing global conditions of ocean data production and utilization, with a special focus on discussing in-depth strategies for the sustainable use of ocean data, particularly in the Asian region. We hope that the creative insights presented in today's presentations and discussions will serve as robust cornerstones for securing the sustainability of the ocean.

Distinguished guest,

The KMI will continue its efforts to develop policies for the sustainability of the ocean through close collaboration with relevant local and international organizations. In particular, on the occasion of today's symposium, we will strive to establish a digital-based sustainable ocean management system.

I would like to express deep gratitude to everyone who joined us today and extend sincere thanks to the private companies and research institutions that sponsored this event. We extend a sincere welcome to the foreign experts who came to Korea, and we hope your time here proves to be valuable.

Thank you.

31 October 2023
President, Korea Maritime Institute
Jong-Deog KIM

# 축 사

여러분 안녕하십니까?
반갑습니다. 해양수산과학기술진흥원 원장 오운열입니다.

벌써 6번째를 맞이하는 '지오 블루플래닛 심포지엄 (GEO Blue Planet Sympoisium)'의 개최를 진심으로 축하드립니다.

오늘 뜻깊은 행사를 준비해 주신 김종덕 한국해양수산개발원장님께 감사드리며, 이 자리를 빛내기 위해 함께 자리하여 주신 분들, 전 KMI 원장님이시자 현재 인하대학교 교수님이신 장영태 교수님, PEMSEA의 사무국장이신 Ms. Aimee Gonzales, NOWPAP의 사무국장이신 Dr. Yegor Volovik,COBSEA의 사무국장이신 Mr. Mahesh Pradhan, 한분 한분 언급드리기 어렵지만 그 외 바쁘신 일정에도 불구하고 자리를 빛내주신 모든 내외 귀빈 여러분, 감사합니다.

이 자리에 참석해 주신 해양수산과학기술 공동체 멤버 여러분, 우리는 오늘, 해양 현안 대응을 위해 해양정책이 더욱 과학과 증거에 기반해야 한다는 당위적 명제에 공감하여 이 자리에 모였습니다.

과학기술 발전과 디지털화의 진전을 이룬 선진국들은 정책입안 과정에서 과학기술과 데이터를 활발히 활용해 나가고 있습니다. 그러나, 아직까지 지식인프라가 부족한 일부 도서국과 개발도상국들은 과학기반 정책을 추진하는데 있어 어려운 점이 있는 것도 사실입니다. 하지만 바다는 월경성 속성을 가지고 있습니다. 어느 한 국가의 노력만으로는 지속가능한 바다를 이루는 것이 불가능하다는 점을 이 자리에 함께하신 여러분들과 공유하고 싶습니다.

국제사회와 지역사회에서 국가간 협력이 중요한 이유가 여기에 있고, UN이 2030년까지를 해양과학기술의 국제협력을 위한 "Ocean Decade"로 선언하여 "The Science we need for the ocean we want"라는 슬로건 아래 국제협력 증진에 총력을 기울이는 이유 또한 여기에 있는 것으로 알고 있습니다.

그런 의미에서, 이번 심포지엄에서 "디지털 기반 지속가능한 해양관리"를 논의하고,아시아 지역의 국제협력과 전문가 네트워크를 강화하는 것은 국제사회가 주도하는 전 지구적 노력에 부합하는 매우 뜻 깊은 자리라고 생각합니다.

한국 정부는 과학기술 기반의 해양정책 수립을 위해 2006년, 해양수산과학기술진흥원을 설립하였습니다. 우리 해양수산과학기술진흥원은 해양수산 분야 과학기술 현안을 정책에 반영시키고, 연구개발 기획과 더불어 연구 성과를 확산시키기 위해 노력해 왔습니다.

2006년, 대한민국의 해양수산 예산 가운데 약 55%가 항만 건설에 투입된 적이 있었습니다. 당시 R&D 예산의 비중은 5.2%에 불과했습니다. 17년이 지난 지금, R&D 예산 비중은 14.9%로 성장했습니다. 이는, 해양과학기술을 통해 해양의 전지구적 문제를 해결하고 해양국가 비전을 달성한다는 의지의 표현입니다.

해양수산과학기술진흥원은 친환경 선박, 블루카본 기술개발 등 탄소중립을 선도하고, 자율운항선박, 디지털 해상교통물류, 데이터 기반 수산기술 개발 등 디지털 전환을 이끌기 위한 연구개발에 매진하고 있습니다. 또한, 연안재해 대응, 해양과학영토 확대, 수산업의 신성장 동력 도약 등 해양수산분야 위기대응을 위해 끊임없는 연구개발을 추진하고 있습니다.

이에 더불어, 우리 해양수산과학기술진흥원은 국제협력을 통해 개도국을 지원하는 업무도 수행해 왔습니다. 인도네시아, 칠레 등 신남방 국가에 협력 거점을 마련하고, 네트워크 기반을 구축하여 해양쓰레기, 블루카본, 스마트양식 등 공동협력 아젠다를 발굴하여 연구를 지원해 왔습니다. 그리고 올해 해양분야 위기 대응에 더욱 앞장서고자 유네스코 IOC가 발의한 'UN 해양과학 10개년 계획' 이행을 위한 신규사업도 새롭게 추진하였습니다.

존경하는 내외 귀빈 여러분,

더욱 심각해지는 기후위기를 막을 수 있는 열쇠는 과학기술에 있으며, 재차 강조하지만 이제는 어느 때보다 국가, 지역, 국제사회가 소통하고 협력해야 할 때입니다.

오늘 심포지엄을 통해 "디지털 기반 지속가능한 해양관리"에 대한 심도 있는 토론이 이루어지길 바라며, 오늘 여러 전문가 분들이 주신 좋은 의견들이 우리나라 해양정책에 기여할 수 있도록 돕겠습니다. 다시 한번, 제6회 지오 블루플래닛 심포지엄 개최를 축하드리며, 참석하신 모든 분들의 건강과 행복을 기원합니다.

감사합니다.

2023. 10. 31.
해양수산과학기술진흥원 원장 오 운 열

# Congratulatory remarks

Hello everyone? Nice to meet you.
My name is Woonyul Oh, I am President of the KIMST (Korea Institute of Marine Science and Technology Promotion).

I sincerely congratulate the GEO Blue Planet Symposium, which gathers for the 6th time this year.

I would like to thank Kim Jong-Deog, President of the Korea Maritime Institute (KMI), for preparing today's meaningful event, as well as those who have joined us to bring light to this occasion, prof. Yong Tae Chang, former President of KMI and now Professor at Inha University, Ms. Aimee Gonzales, the Executive Director of PEMSEA, Dr. Yegor Volovik, the Secretary Director of NOWPAP, Mr. Mahesh Pradhan, the Coordinator of COBSEA. It is impossible to mention each and every person, but I would like to thank all the distinguished guests, both local and foreign, for coming despite their busy schedules.

Dear members of the marine and fisheries science and technology community who attended this event!
Today, We are gathered here because we agree with the imperative that, to respond to current ocean issues, the ocean policy should be more based on science and evidence.

Developed countries that have made progress in scientific and technological development and digitalization are actively utilizing science, technology, and data in the policy-making process. However, it is true that some island and developing countries that still lack knowledge infrastructure face difficulties in promoting science-based policies. However, the sea has transboundary properties. I would like to show all of you here that it is impossible to get  a sustainable ocean through the efforts of any one country alone.

This is why cooperation between countries is important in the international and local communities. I understand that this is also the reason why the UN has declared the period until 2030 as the “Ocean Decade” for international cooperation in ocean science and technology and is making every effort to promote international cooperation under the slogan “The Science we need for the ocean we want.”

In that sense, I believe that discussing "Digital Solutions for Sustainable Oceans" and strengthening international cooperation and expert networks in the Asian region during this symposium is a very important, and is in line with global efforts led by the international community.

The Korean government established KIMST in 2006 to establish ocean policies based on science and technology. The KIMST has strived to reflect current science and technology issues in the marine and fisheries field into policies and to spread research results along with research and development planning.

In 2006, approximately 55% of Korea's marine and fisheries budget went to port construction. At that time, the R&D budget was only 5.2%. Now, 17 years later, the R&D budget's share has grown to 14.9%. This is an expression of our will to solve global ocean problems and achieve the vision of a ocean nation through ocean science and technology.

The KIMST is committed to research and development to lead carbon neutrality, such as the development of eco-friendly ships and blue carbon technology, and to lead digital transformation, such as Maritime Autonomous Surface Ship(MASS), digital maritime transportation logistics, and data-based fisheries technology development. In addition, we are continuously pursuing research and development to respond to crises in the marine and fisheries sector, such as responding to coastal disasters, expanding the territory of marine science, and leapfrogging new growth engines in the fisheries industry.

In addition, the KIMST has also been carrying out work to support developing countries through international cooperation. We have established cooperation bases in southern countries such as Indonesia and Chile, established a network foundation, and supported research by discovering joint cooperation agendas such as marine litter, blue carbon, and smart aquaculture. This year, in order to take the lead in responding to crises in the marine sector, we also promoted a new project to implement the 'UN Decade of Ocean Science for Sustainable Development(UN Decade)' proposed by Intergovernmental Oceanographic Commission of UNESCO.

Distinguished guests,

The key to preventing the climate crisis from becoming more serious lies in science and technology. I emphasize again that now, more than ever, it is the time for countries, regions, and international community to communicate and cooperate.

We hope that today's symposium will lead to in-depth discussions on "Digital Solutions for Sustainable Oceans" and that the good opinions provided by various experts today will help contribute to our country's ocean policy. Once again, we congratulate you on holding the 6th GEO Blue Planet Symposium, and we wish good health and happiness to all who attended.

Thank you.

31 October 2023
President, Korea Institute of Marine Science and Technology Promotion
Woonyul Oh

6th Symposium | Seoul, South Korea| OCT 31 ~ NOV 2, 2023

# Introduction to GEO Blue Planet and the Symposium

**Sung-Jin Cho**[1]

[1]Korea Maritime Institute (KMI)

## GEO Initiative - GEO Blue Planet

- **Purpose**
  - Enhancing synergy through the integration of coastal and ocean observation programs,
  - promoting stakeholder participation and collaboration,
  - and raising awareness of the societal benefits of ocean observation data in policy decision-making.
- **Role**
  - BRIDGING THE GAP between ocean and coastal observational data and societal needs to deliver actionable information
- **Co-chairs**
  - Dr. Paul DiGiacomo (Chief of SOCD, NOAA) & Dr. Pierre-Yves Le Traon (Mercator Ocean Intl.)
- **Governance**
  - Comprised of an Executive/Operational Committee, Advisory Committee, and Secretariat.

## GEO Initiative - GEO Blue Planet

- **Secretariat**
  - (Founded in 2012) North American Office by NOAA & University of Maryland
  - (2019) European Office by Mercator Ocean Intl.
  - (2021) Asian Office by Korea Maritime Institute
- **Partners**
  - Over 90 public and private sector institutions, including NOAA, EC, UNESCO-IOC, JAMSTEC, WWF, POGO, and others.

## GEO Initiative - GEO Blue Planet

- **Ongoing Initiatives**
  - Operation of a Marine Litter Monitoring Platform
  - Establishment of a Network of Oceanic Institutions
  - Support for the UN Ocean Science Program
  - Early Warning Systems for Disasters and Flooding
  - Monitoring of Ocean Sustainable Development Goals (SDGs)
- **Working Groups (WGs)**
  - Addressing coastal and marine issues and enhance stakeholder capacity.
  - Issues including climate change, coastal erosion, marine litter, eutrophication, and illegal fishing, among others.

## GEO Blue Planet 6th Symposium

- **Background**
  - organizing an annual symposium to enhance collaboration among regional offices,
  - foster connections with stakeholders and local communities,
  - and gather feedback on the operations and activities of regional offices.
- **History**
  - 1st (2012, Sao Paulo, Brazil) ▶ 2nd (2015, Cairns, Australia) ▶ 3rd (2017, Maryland, USA) ▶ 4th (2018, Toulouse, France) ▶ 5th (2022, Accra, Ghana)
- **Objective:** "*Digital Solutions for Sustainable Oceans*"
  - Sharing the achievements of WGs and building a network of experts in the Asian
  - Proposing a new WG with the theme of '*Digital MSP*'
- **Organized by:** GEO BLUE PLANET, KMI 한국해양수산개발원 KOREA MARITIME INSTITUTE


**First Symposium in Asia!**

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

GEO BLUE PLANET

# Thank You.

**Contact:**
sjcho@kmi.re.kr

# Keynote Presentations

## Prof. Young-Tae (YT) Chang

### Inha University, Republic of Korea

Prof. Young-Tae (YT) Chang is Professor Emeritus at Graduate School of Logistics at Inha University in Incheon, Korea. YT worked for the Korea Ocean Institute of Science and Technology and the Korea Maritime Institute for twenty years including two years' presidency at KMI. While conducting 72 national and international projects, YT has published 8 books and over 90 journal papers. He is PhD and MA in Business Administration at Yonsei University, MSc in Port and Shipping Administration at World Maritime University in Sweden and BSc in Veterinary Medicine at Seoul National University.

## Ms. Aimee T. Gonzales

### Executive Director, PEMSEA Resource Facility

Aimee T, Gonzales is the Executive Director of the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), a regional coordinating mechanism specializing in ocean governance in the East Asian Seas.

Prior to joining PEMSEA, she worked with WWF International on promoting coherence between trade and environment policies, marine ecosystem services valuation and fisheries subsidies reform.

Before then, she served as Head Executive Assistant to two Cabinet Secretaries of the Philippine Department of Environment and Natural Resources.

She holds a Masters in Environmental Assessment and Education from the London School of Economics and a Masters' Degree in Public Policy from the National University of Singapore.

Email: agonzales@pemsea.org

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

# Issues and Challenges for Blue Economy

BLUE PLANET

**Young-Tae Chang**
Graduate School of Logistics
Inha University, Korea

## Outline

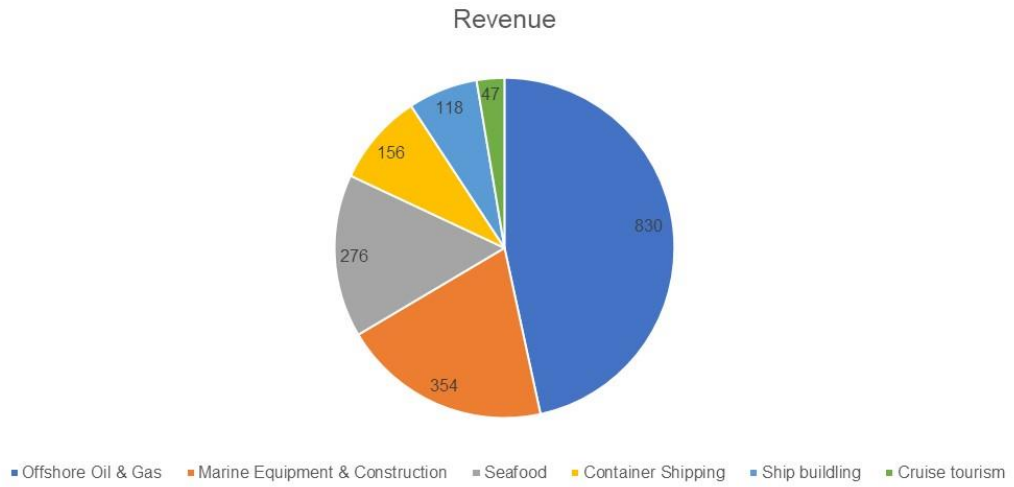
6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

1. Overview of Ocean Industries
2. Major Issues of Maritime Industries
3. Challenges and Responses

# 1. Overview of Ocean Industries

- $ 1.5 trillion value-added
- 3.5 – 7 % world GDP
- 31 Million jobs
- Expected to increase to double size by 2030

# Top 6 Ocean Industries ($ Billion)



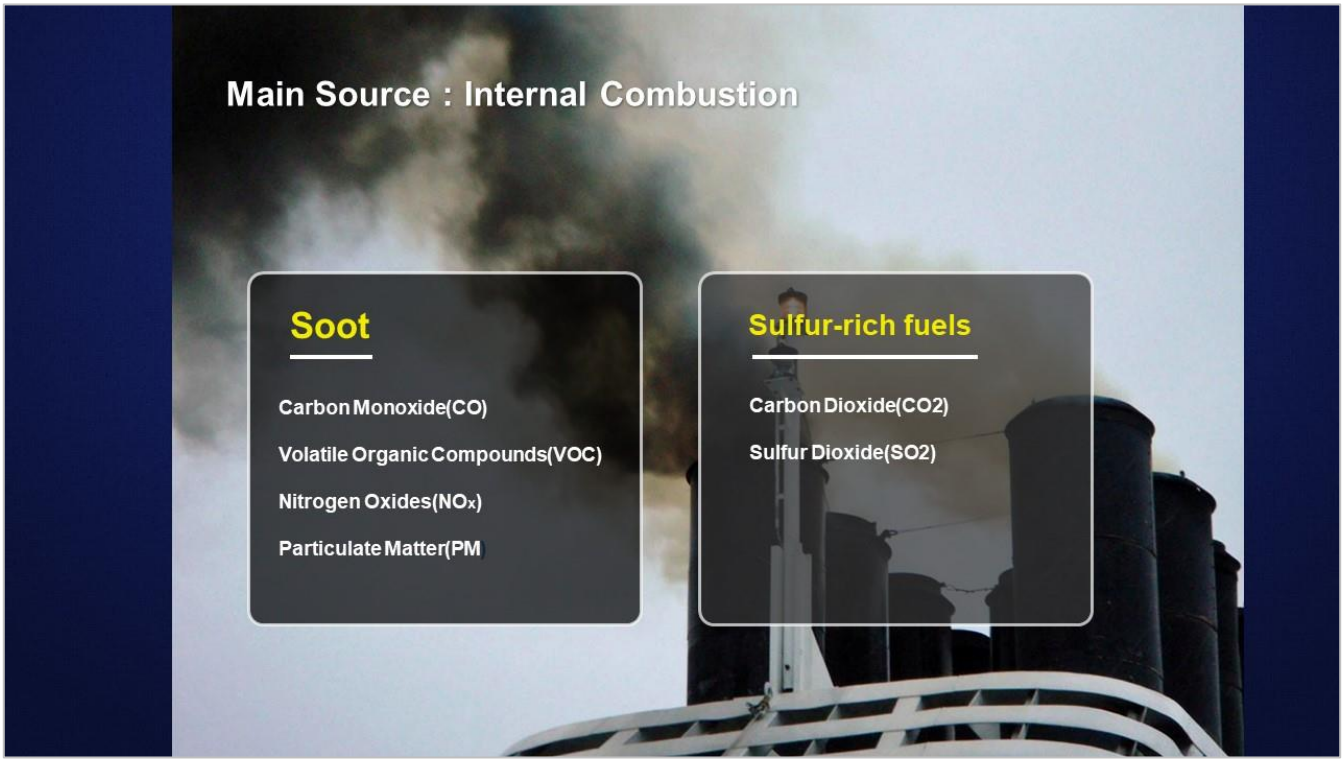
# Major Concerns of Ocean Industries

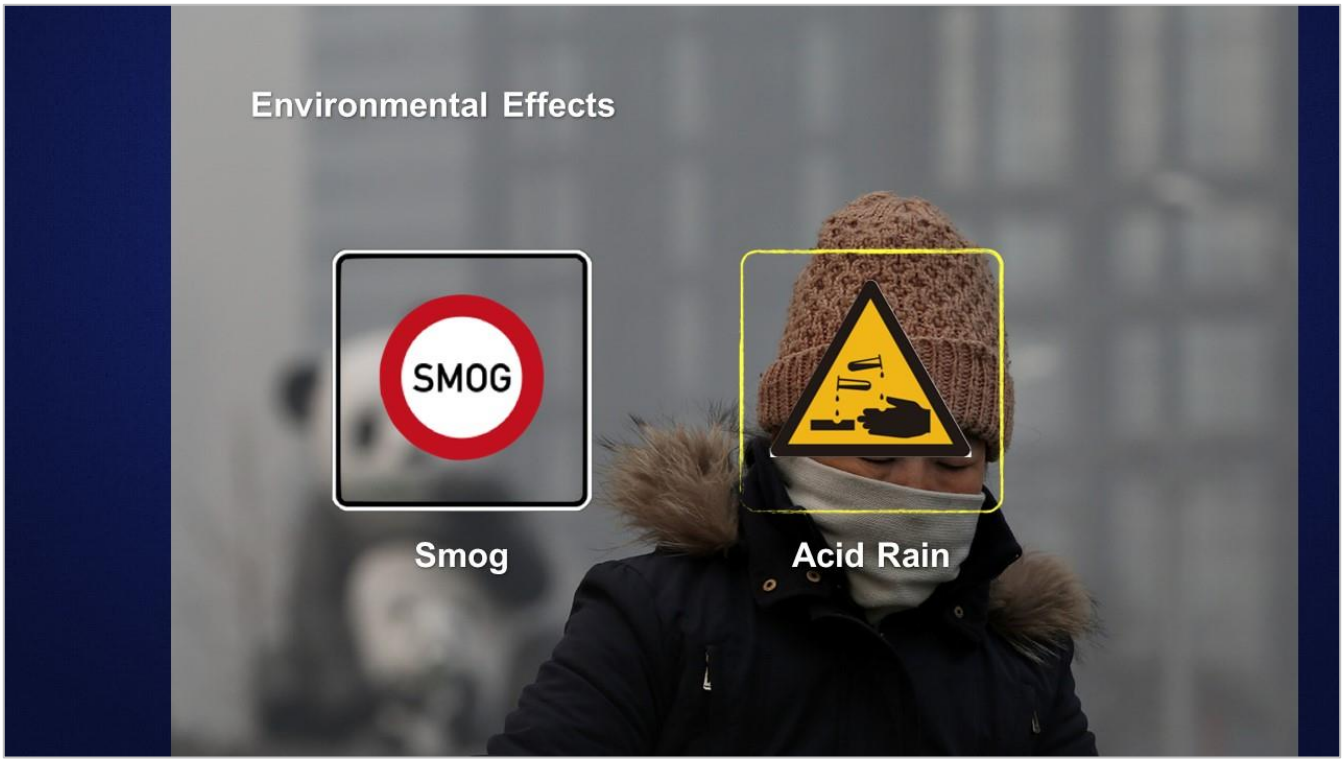
- Unsustainable Fisheries
  - 3 times production increase vs. stock depletion since 1970s
  - 20% IUU (Illegal, Unreported & Unregulated) fishing
  - Sea food system will collapse by 2050
- Pollution
  - Over 1 million tons plastics
  - Deep sea pollution due to oil & gas, and mineral extraction

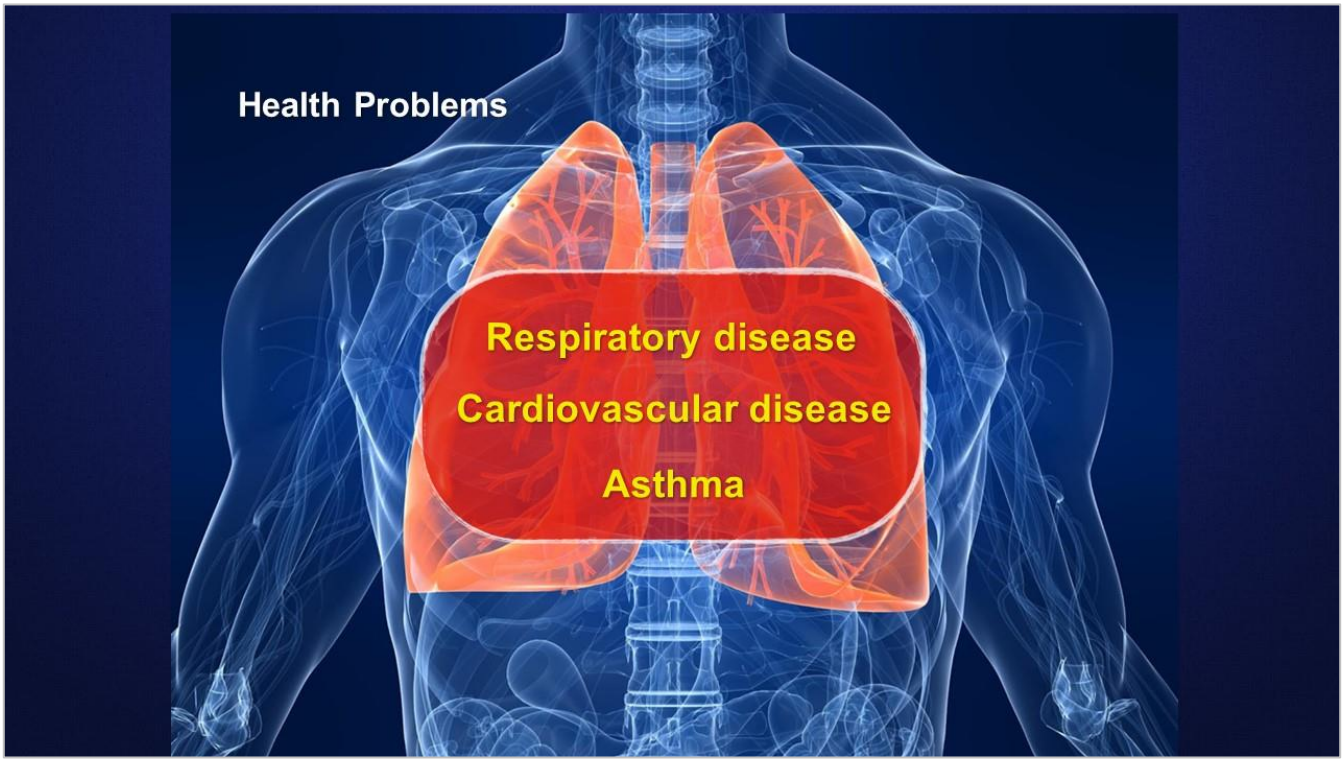
# 2. **Major Issues of Maritime Industries**

- **Shipping: lynchpin of international trade**
- 80 % of trade
- GHG 3% now, but **18% by 2050: 6 times**


UNFCCC' 92
Kyoto Protocol' 97
Paris Agreement 2015


Main Source : Internal Combustion
Soot
Carbon Monoxide(CO)
Volatile Organic Compounds(VOC)
Nitrogen Oxides(NOx)
Particulate Matter(PM
Sulfur-rich fuels
Carbon Dioxide(CO2)
Sulfur Dioxide(SO2)


Environmental Effects
SMOG
Smog
Acid Rain


Health Problems
Respiratory disease
Cardiovascular disease
Asthma

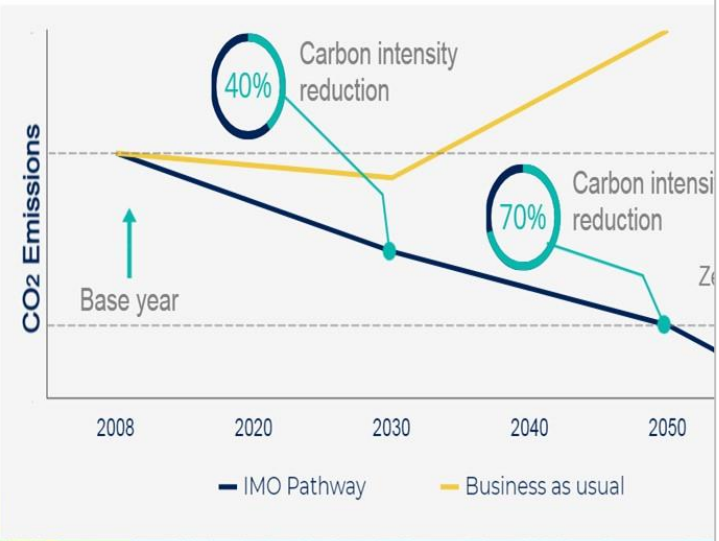
# International Shipping

**IMO**

- **T**echnical **M**easure
- **O**perational **M**easure
- **M**arket Based **M**easure
  - **C**arbon **T**ax
  - **E**mission **T**rading **S**cheme

# IMO GHG Strategy

- 2011 EEDI & SEEMP
- **2018 Strategy for 50%** by **2050**
  2018-2023: National Action Plan
  2023-2030: MBM
  2030-2050: Alternative fuel



## Emission Control Area (ECA)

Graduate School of Logistics
Inha Univ.
Young-Tae Chang


1. Baltic Sea
 - came into force on 19 May 2005

2. North Sea and English Channel
 - came into force on 11 August 2007

## ECA

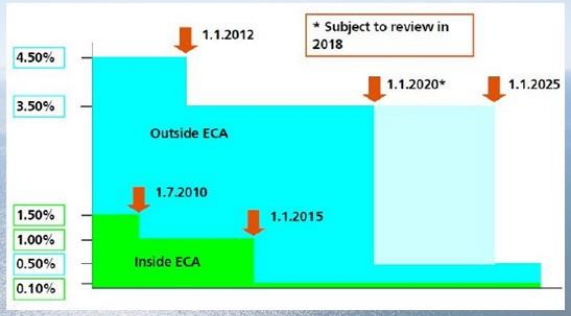
Graduate School of Logistics
Inha Univ.
Young-Tae Chang


1.US East Coast
 - came into force on 1st August 2012

2.US East Coast
 - came into force on 1st August 2012

3.Hawaiian Islands
 - came into force on 1st August 2012

## INTERNATIONAL SHIP ENGINE & FUEL STANDARDS
: MARPOL ANNEX VI




## IMO is too slow! Region can't wait!

- EU Fit for 55
- EU Carbon Border Adjustment Mechanism (CBAM): Oct. 1, 2023
- US Balastwater Management

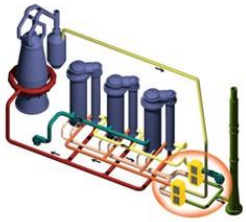
→ Business risk for investment

## Can we trust Carbon Footprinting ?

- Mapping
- Monitoring & Reduction
- Monitoring, Reporting & Verification (MRV)

# Industry Responses: Compliance strategy

Waste Heat Recovery



•**Low sulfer fuel, biodiesel, LNG, etc.**
**Electrification**



Walmart SustainabilityHUB

- 27 countries
- 10,857 stores
- 2.3 million people
- 100,000 suppliers in 30 countries
- Handle 4 million TEUs
- $ 567 billion revenue

**Zero emission by 2040**
without carbon offset

- Facility: RE 100 by 2035 (currently 46%)
- Vehicles: Zero emission by 2040
- 1 Giga ton reduction of suppliers by 2030

= 200 million cars GHG

BSR Clean Cargo A BSR Working Group

SSI

Industry-led **CCWG**

(Clean Cargo WG)

- 2004
- part of Biz Social Responsibility (BSR)
- Measuring & improving performance focus

NGO-led **SSI**

(Sustainable Shipping Initiative)

- 2010
- Clean Shipping Index
- Collaboration & innovation focus

# Sustainable Financing

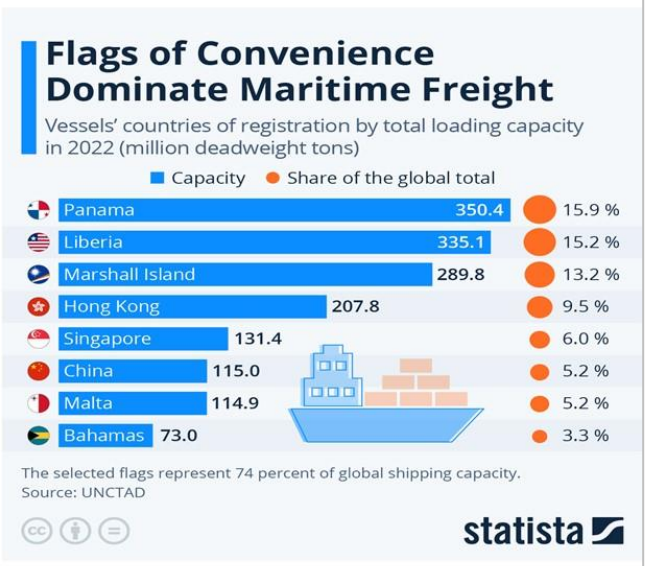
- 2005 EU ETS
- 2016 EU Commission Strategy
- 2016 Green Bond
- 2017 Task Force on Climate-related Financial Disclosure
- 2018 Action Plan
- 2018 EU & European Investment Bank Initiative
- **2018 Green Loan Principles**
- **2019 Poseidon Principles**
- **2019 Getting to Zero Coalition**

# **EU** Commission **S**trategy

- G20 Green Finance Strategy Group
- High Level Expert Group on Sustainable Finance reforms financial system into "**Sustainable**"
- **2018 Action Plan**: 1) climate change; 2) env. & social; 3) long-term finance
- **2030 EU GHG 40%** than 1990 in transport sector
- **2050 Net Zero**
- Annually **EUR 180 billion till 2030**

# Certainty & **Level-playing field**: Pollution Heaven

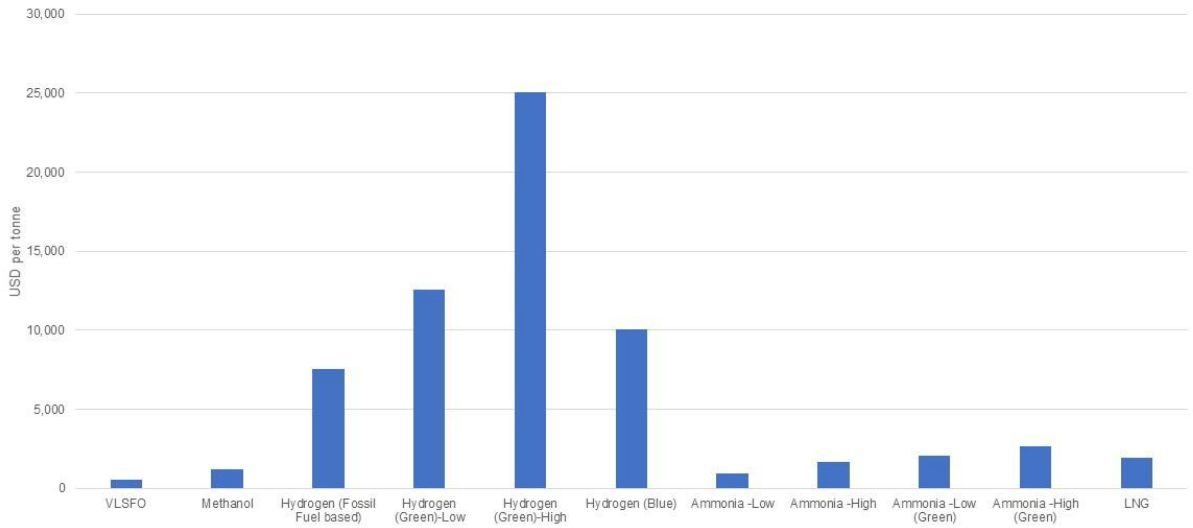

| Rank | Country | Port | TEU (2011) |
|---|---|---|---|
| 1 | Netherlands | Rotterdam | 1,1145,804 |
| 2 | Germany | Hamburg | 8,792,296 |
| 3 | Belgium | Antwerp | 6,548,779 |
| 4 | Germany | Bremerhaven | 5,206,752 |
| 5 | UK | Felixstowe | 3,400,000 |
| 6 | France | Le havre | 2,358,077 |
| 7 | Russia | Saint Petersburg | 1,931,382 |
| 8 | UK | Southampton | 1,540,000 |
| 9 | Sweden | Gothenburg | 867,100 |
| 10 | Poland | Gdansk | 646,800 |
| 11 | Poland | Gdynia | 480,142 |
| 12 | Denmark | Aarhus | 447,000 |
| 13 | Denmark | Esbjerg | 443,106 |
| 14 | Finland | Kotka | 397,286 |
| 15 | Finland | Helsinki | 383,000 |
| 16 | Finland | Rauma | 222,000 |
| 17 | Nethelands | Amsterdam | 203,084 |
| 18 | Norway | Oslo | 201,893 |
| 19 | Finland | Hamina | 115,388 |
| 20 | Denmark | Copenhagen | 150,000 |
| 21 | UK | Immingham | 150,000 |
| 22 | Nethelands | Born | 122,500 |
| 23 | France | Rouen | 99,330 |



# Emissions reduction measures

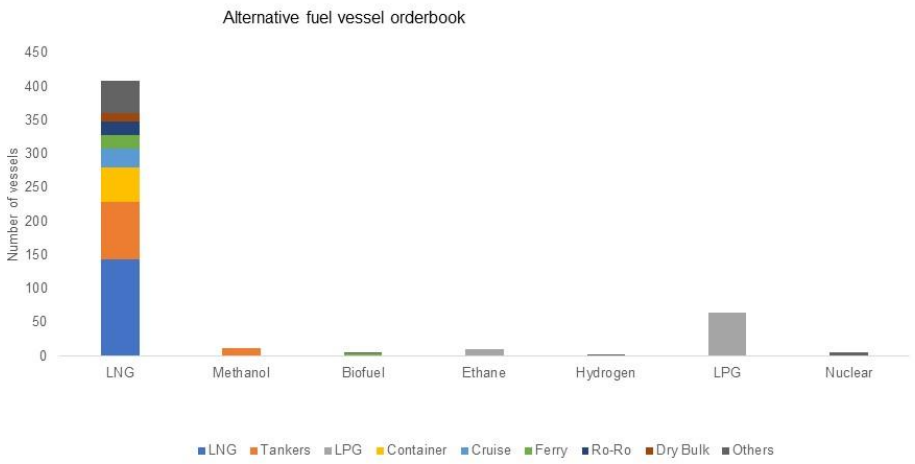
| Options available | Remark |
|---|---|
| Alternative fuels | Results in a significant drop in $CO_2$ emission. However, he fuel has to be selected carefully, considering the emission of other gasses and well-to-wake emission. May require considerable modifications. |
| Energy efficient technologies | Renewable energy sources, for example, wind assistance systems like kites, fixed sails, flettner rotors, solar panels. |
| Engine power limitation | This is lowering of the engine power, resulting in a lower speed of the vessel. |
| Energy saving devices | Propulsion optimisation or propulsion improving devices (PID) are propellers or rudder modifications like propeller Hi-FIN attachment, energy saving rudder with bulb fins, Becker Mewis duct, Propeller Boss Cap Fin (PBCF) etc. |
| Propeller/hull cleaning | By removing the marine growth on the hull, the speed of the vessel increases. |
| Engine optimisation | Variation of fuel injection time and pressure for more efficient combustion of fuel. |
| Hull modification | Bulbous bow modification, air lubrication system (bubble technology) reduces the friction and therefore, increases the speed. |
| Hull paints | Various paints are available to reduce marine growth on the hull which causes a reduction in speed. |
| Shaft generator | Installation of this on the propeller shaft, generates electricity and reduces the need for auxiliary engines. |
| Trim optimisation | For a given draft and speed, there is a trim which results in minimum resistance of the vessel through the water. |
| Weather routing using digital twin | A combination of weather parameters are applied to the digital twin of the vessel to reduce the fuel consumption. |
| New charterparty clauses | Slow steaming clause and virtual arrival clauses as well, as the Just In Time concept, allows the vessel to reduce speed and emission. |

# Fuel cost



# Vessel orderbook

The absence of viable alternatives has left shipowners to concentrate on LNG, despite disagreements about its effectiveness in reducing GHG emissions




# Agile

**Speed** **Flexibility**

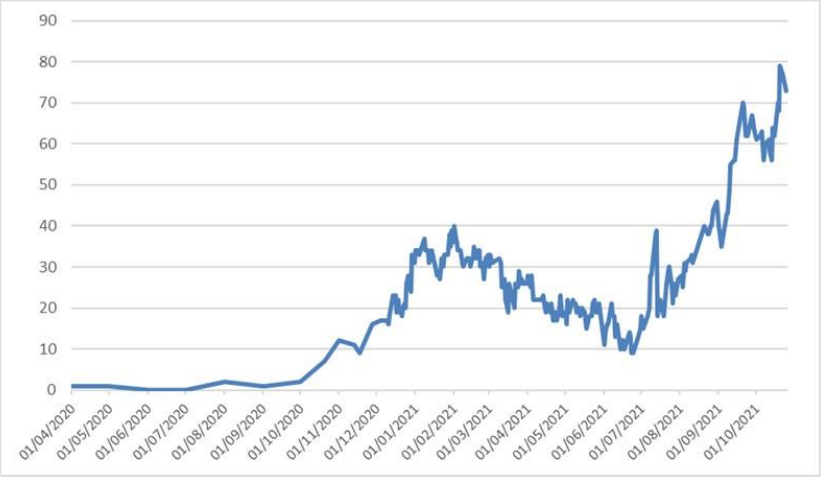
## Supply Chain Resilience

**Disrupted by**

**Terror(9/11)**

**Natural Disaster**

# Disruption: congestion




Containerships at anchor at Los Angeles/Long Beach

Source: Marine Exchange

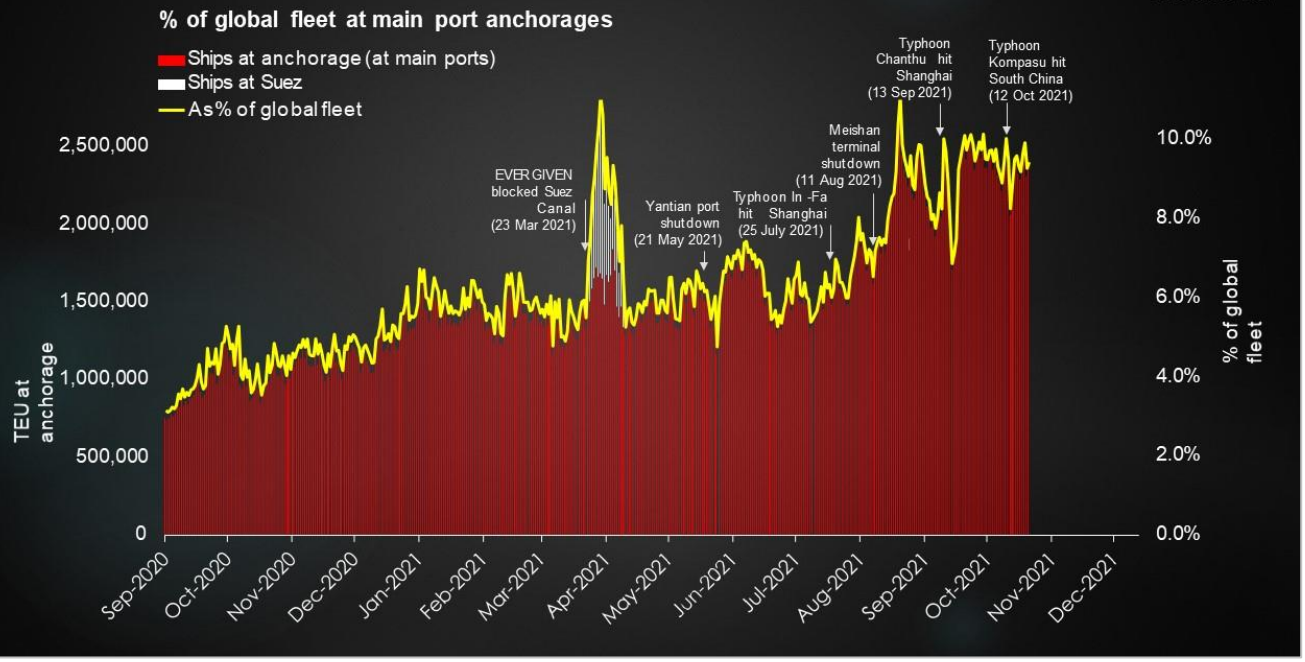
33

# Congestion has taken up to 10% of global fleet

8

LINERLYTICA

22 October 2021

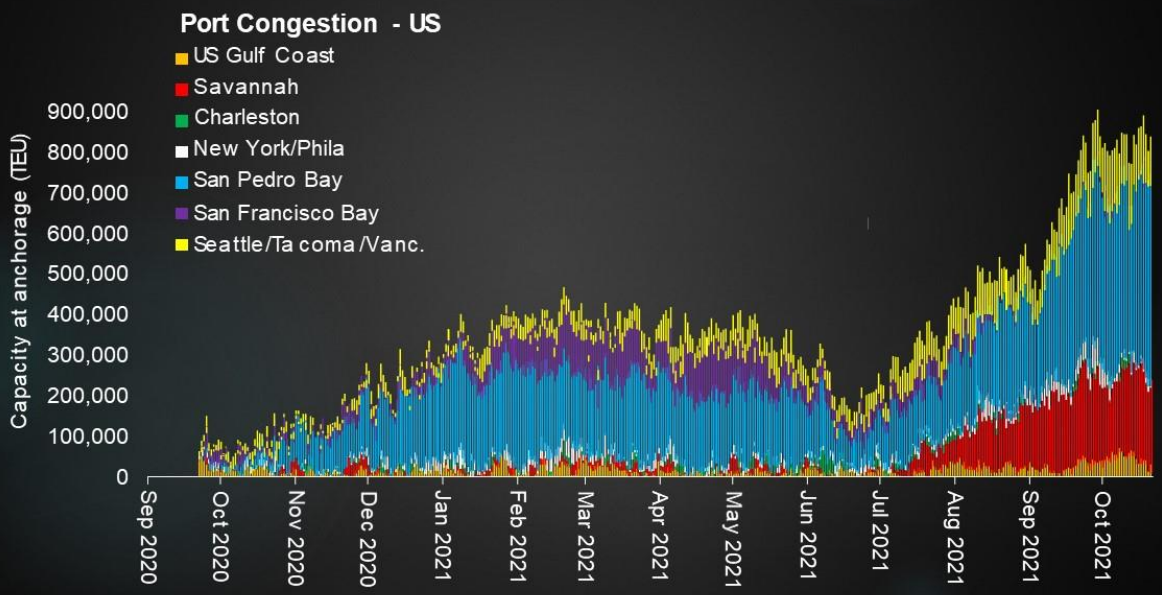


# US port congestion at critical levels



LINERLYTICA

22 October 2021




# What lies ahead

**Digitalization** + **Decarbonization**


6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023
GEO
BLUE PLANET
Thank You.
Contact:
ytchang@inha.ac.kr

GEO BLUE PLANET

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

# State of Ocean and Coasts: East Asian Seas Region Gearing up towards sustainable, inclusive and resilient blue economy

PEMSEA | 30 Years of Partnerships for the East Asian Seas


**Aimee T. Gonzales**
Executive Director
PEMSEA Resource Facility


PEMSEA

## MISSION

**To foster and sustain healthy and resilient coasts and ocean, communities and economies across the Seas of East Asia through integrated management solutions and partnerships**

### COUNTRY PARTNERS

Cambodia | PR China | DPR Korea | Indonesia | Japan | Lao PDR | Philippines | RO Korea | Singapore | Timor-Leste | Viet Nam

### NON-COUNTRY PARTNERS

- ASEAN Centre for Biodiversity
- Coastal Management Center (CMC)
- Conservation International (CI) Philippines
- International Center for the Environmental Management of Enclosed Coastal Seas (EMECS)
- IOC Subcommission for the Western Pacific (IOC/WESTPAC)
- International Ocean Institute (IOI)
- International Petroleum Industry Environmental Conservation Association
- International Union for Conservation of Nature – Asia Regional Office
- Korea Environment Institute
- Korea Institute of Ocean, Science and Technology
- Korea Maritime Institute
- Korea Marine Environment Management Corporation
- Marine Biodiversity Institute of Korea
- Norwegian Institute for Water Research
- Northwest Pacific Action Plan
- Ocean Policy Research Institute
- Oil Spill Response Limited
- Plymouth Marine Laboratory
- PEMSEA Network of Local Governments for Sustainable Coastal Development
- UNDP/GEF Small Grants Programme
- UNEP Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (UNEP/GPA)

### Maritime Collaborators

UNOPS | IMO | WORLD BANK GROUP

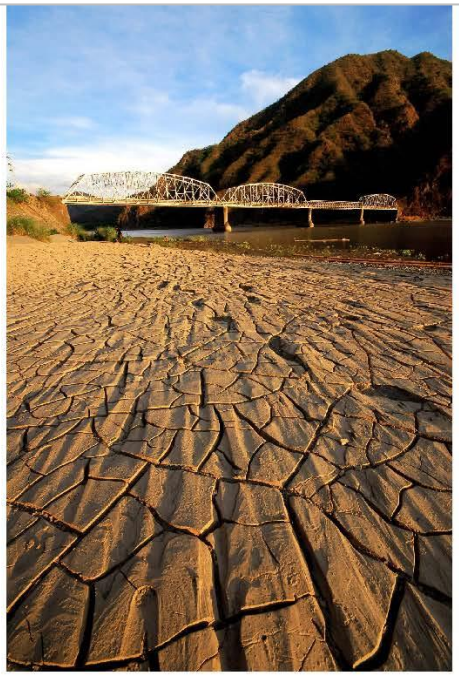
## Outline of Presentation

- Introduction to the East Asian Seas Region
- Regional socio-economic development outlook
- Regional state of ocean and coasts-
  - objectives, process, results, lessons
- Opportunities for collaboration to transition to blue economy in the run up to 2030

## Regional economic outlook

### (IMF, ADB, WB 2023)

- The economic outlook for Asia and the Pacific remains upbeat, with the region's developing economies expected to grow 4.7% in 2023, and 4.8% in 2024, but risks remain elevated.
- Risks of supply disruptions and wide-ranging effects of El Nino raises issue of food security
- Financial stability risks require continued vigilance in vulnerable economies as the era of easy money ends



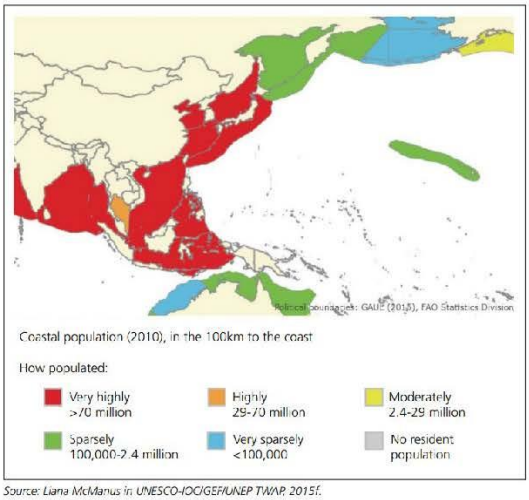
## Regional socio-economic development trends – poverty remains and inequality is growing

- **316 M** people live in extreme poverty
- **915 M** people live below $3.20/day
- **Income inequality** has risen in several countries
- **A host of development problems** — gender gaps, food insecurity, basic sanitation, safe drinking water — endanger stability and economic progress
- **$26.2 trillion** investment needed between 2016–2030 for infrastructure, growth, poverty eradication, and responding to climate change



## Regional socio-economic development trends – population is growing and rapidly urbanizing

- **World population**: **7.6 B** in 2016, increasing to **8.6 B** in 2030, to **9.8 B** in 2050
- Asia is the **second largest contributor** to global population growth
- Share of urban population increased from **20%** in the 1950s, to **50%** in 2017, and further increasing to **58%** in 2030
- Rapidly growing cities are complex to manage



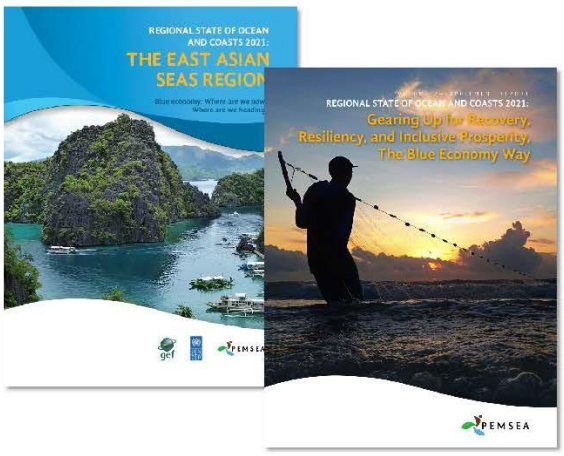

Source: Liana McManus in UNESCO-IOC/GEF/UNEP TWAP, 2015f.

# 14 countries in 6 Large Marine Ecoregions (LMEs)

- Brunei Darussalam
- Cambodia
- China
- DPR Korea
- Indonesia
- Japan
- Lao PDR
- Malaysia
- Philippines
- RO Korea
- Singapore
- Timor-Leste
- Thailand
- Viet Nam

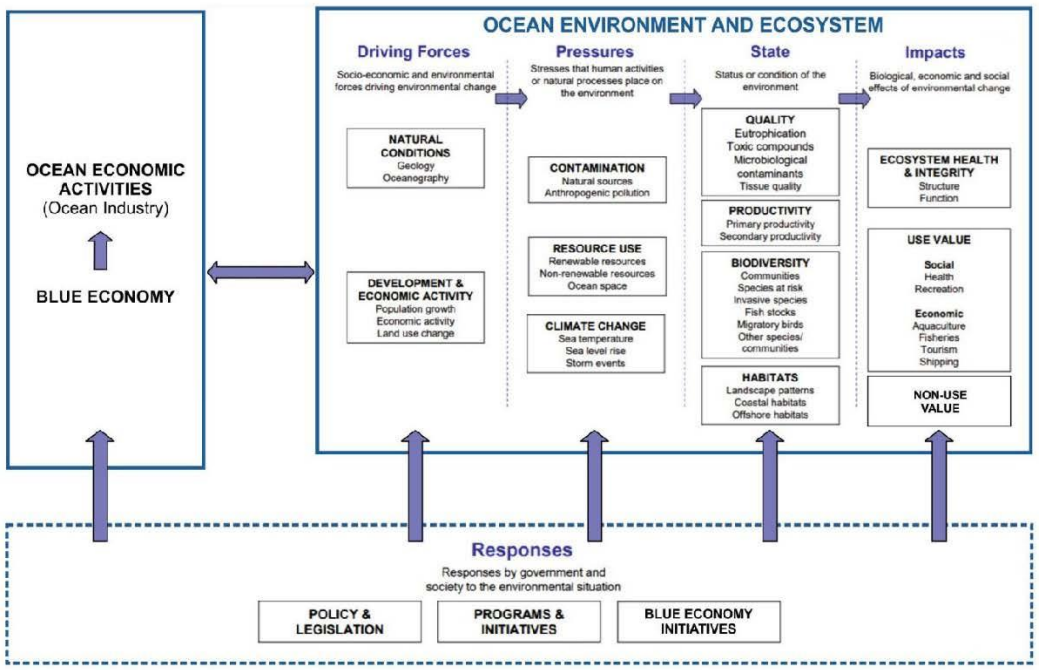

PEMSEA | 30 Years of Partnerships for the East Asian Seas

# PEMSEA State of Ocean and Coasts reports





PEMSEA | 30 Years of Partnerships for the East Asian Seas






# Objectives of the Regional Ocean and Coasts report with Blue economy theme

- show the **critical role and contribution of ocean economic activities and coastal and marine ecosystems** to national economies and welfare of the people in the EAS region
- examine the **benefits, costs, and impacts** at the regional and national levels
- emphasize the values of ecosystem services, and the **losses being incurred due to unsustainable practices**
- assess the **environmental damages and impacts of human activities**
- show how **natural hazards and climate change can affect blue economy development**
- examine **policies, and governance and supporting mechanisms** to **drive innovations and sustainability**
- draw attention to **investment and partnership opportunities**

# VALUE OF THE OCEAN

**75%**

The ocean covers 75% of the Earth's surface, and

represents 99% of the living space on the planet by volume.

**50%**

The ocean produces 50% of the air we breathe.

**30%**

The ocean absorbs 30% of $CO_2$ produced by humans, buffering the impacts of global warming.

The ocean transports heat from the equator to the poles, regulating our climate and weather.

**> 200 000**

The ocean contains 200,000 identified species, but actual numbers may lie in the millions.

**$3 TRILLION**

The market value of marine and coastal resources and industries is est. at $3 trillion per year.

**>3 billion people** depend on marine and coastal biodiversity for their livelihood.

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11

# The ocean provides...

**HOME**

The East Asian Seas (EAS) region is home to **35%** of the world's mangroves, **33%** of seagrass beds, and **33%** of the world's coral reefs, supporting diverse species of flora and fauna, and an array of ecosystem services.

**FOOD**

**15%** of animal protein comes from fish. Countries of the EAS region account for:

**63%** of total global fisheries

**40%** of world's capture fisheries = **$35 B**

**80%** of world's aquaculture = **$197 B**

**TRADE AND TRANSPORTATION**

**90%**

The East Asian Seas serve as conduit of 90% of world trade through shipping.

**TOURISM AND RECREATION**

**>$258B**

in tourism revenues. The EAS region account for 26% of worldwide tourist arrivals.

Swimming, boating, snorkelling, diving, dolphin and whale watching… the ocean provides us with so many unique amenities and activities.

**OIL AND GAS**

**$34 B**

There are around 1400 offshore oil and gas platforms in the EAS region… with production of 2 million barrels of oil per day.

**INCOME AND JOBS**

**$ 1.5 T**

The ocean economy contributes **3% - 28% of the GDP** of five countries in the EAS region.

**MEDICINE**

Many medicinal products come from the ocean, including ingredients that help fight infection, cancer, arthritis, heart disease, and Alzheimer's disease.

*As of 2020.*

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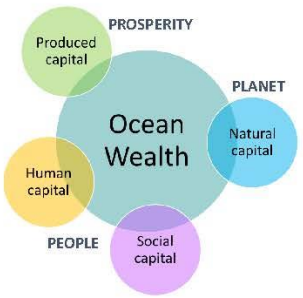
# MEASURING OUR OCEAN WEALTH



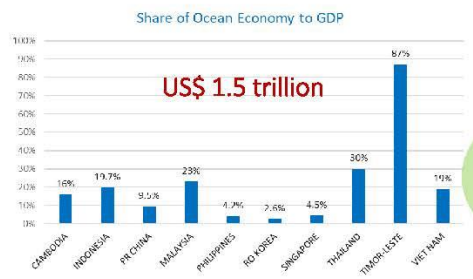

**Ocean Economy**

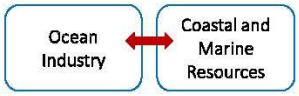
| Ocean Economic Activities | Coastal and Marine Resources |
|---|---|
| • Fisheries & Aquaculture<br>• Oil and Gas; ultra-deep water oil and gas<br>• Mining (Minerals); deep seabed mining<br>• Energy (ocean energy; offshore wind)<br>• Water (desalination)<br>• Manufacturing:<br>  • seafood processing,<br>  • marine biotechnology & pharmaceuticals,<br>  • salt,<br>  • ship building and repair, marine transport equipment<br>• Marine Construction and dredging<br>• Shipping and Ports<br>• Marine tourism and recreation<br>• Public/Government<br>• Marine communications (submarine cables)<br>• Marine education and research<br>• Marine services (mapping, monitoring, consulting, martitime insurance, maritime safety and surveillance) | Intermediate inputs<br>Impacts<br><br>**Provisioning**<br>• Fish and seafood<br>• Water<br>• Medicines<br>• Oil, gas and minerals<br><br>**Supporting**<br>• Nutrient cycling<br>• Primary production<br>• Habitat for species<br>• Genetic diversity<br><br>**Regulating**<br>• Climate regulation<br>• Carbon sequestration<br>• Shoreline protection<br>• Water purification<br><br>**Cultural**<br>• Recreational<br>• Educational<br>• Spiritual<br>• Aesthetic |

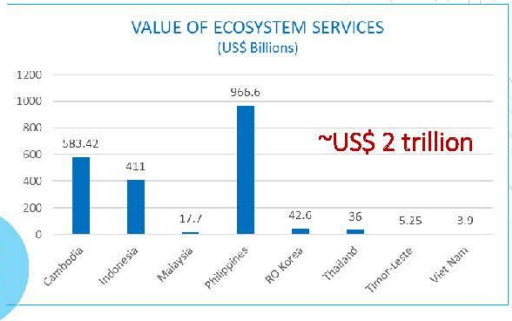
PEMSEA 30 Years of Partnerships for the East Asian Seas

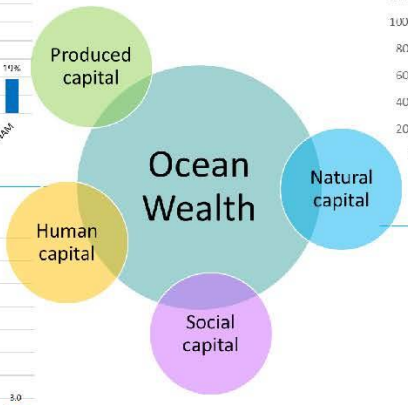


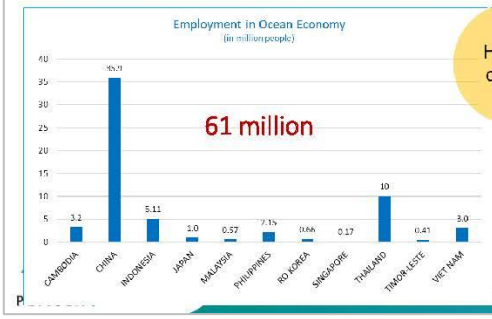
# MEASURING OUR OCEAN WEALTH



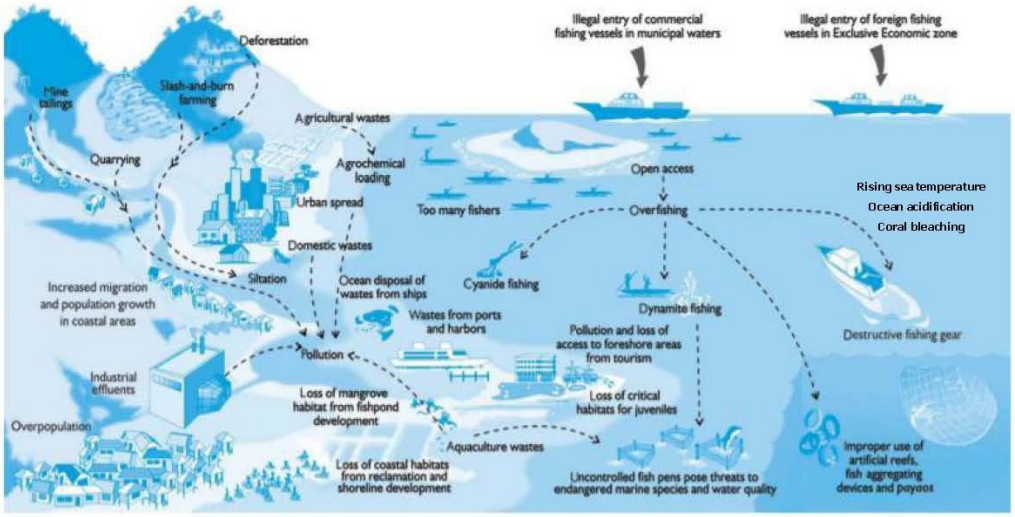




**Blue carbon value** (est):
Mangroves: $68 B
Seagrass: $40 B

# OCEAN... UNDER STRESS




- **Overexploitation of resources**: IUU fishing, illegal mining
- **Habitat loss**: degradation of coral reefs, seagrass, mangroves, mudflats
- **Pollution** from sewage, agricultural runoff, siltation, oil spills, plastics, marine debris
- **Climate change:** sea level rise, coastal erosion, ocean warming, coral bleaching, ocean acidification
- **Multiple resource use conflicts**



# BLUE ECONOMY

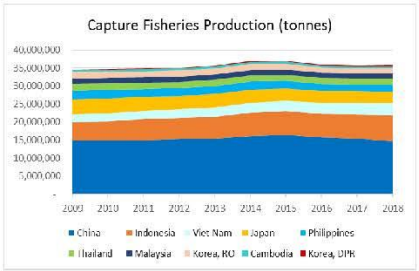
*"We understand the Blue Economy to be a practical **ocean-based** economic model using green infrastructure and technologies, innovative financing mechanisms, and proactive institutional arrangements for meeting the twin goals of **protecting our oceans and coasts and enhancing their potential contribution to sustainable development**, including improving human wellbeing, and reducing environmental risks and ecological scarcities."*

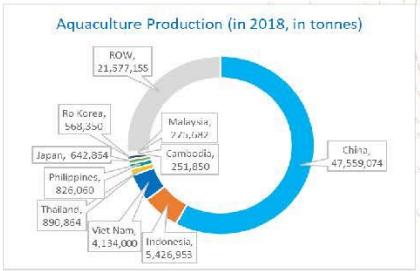
Changwon Declaration 2012

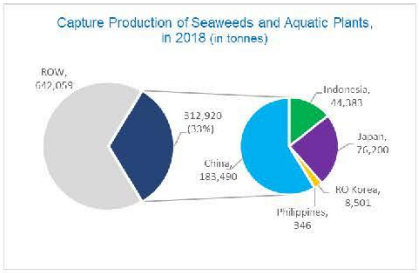
# FISHERIES AND AQUACULTURE

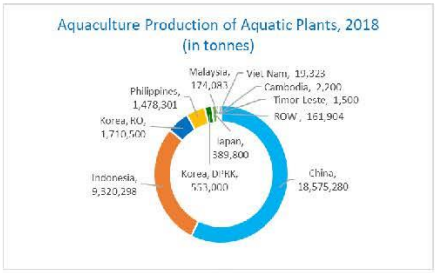
Countries in EAS Region account for:

- **63% of global fisheries and aquaculture**
- 39% of world capture fisheries = **$35 B**
- 73% of global aquaculture of fish = **$184 B**
- 99.5% of global aquaculture of seaweeds = **$13.2 B**




Source of data: FAO

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17

# SUSTAINABLE AND SAFE FISHERIES AND AQUACULTURE

## Conservation

- MSY, Reference Points and Harvest Control Rules
- Total allowable catch
- Closed fishing season
- Ban of certain gears
- Vessel reduction
- Fish sanctuaries & MPAs
- Fisheries Management Areas (FMAs)
- Integrated coastal management

## Anti-IUU Fishing

- Monitoring, control and surveillance
- Vessel registration, and automatic identification system
- Electronic catch documentation and traceability (tuna and sardines)
- Other port measures

## Aquaculture

- Code of Good Aquaculture Practices
- Aquasilviculture
- Aquaponics
- Integrated multi-trophic aquaculture
- Crab condominium
- Marine ranching
- Fish farm mechanization
- Feeds & nutrient mgt
- Biotechnology

## Supporting policies and actions

- Fish ports, community fish landing centers, and post-harvest facilities
- Value-adding industries, linkage to e-commerce
- MSC labeling
- Habitat restoration and protection
- Waste management
- Marine debris prevention
- Digitalization, blockchain, sensors, imagery

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18

# FISH PORTS

## INDONESIA:

Fish Port Classes based on Technical and Operational Criteria.

| Class | Technical Criteria | Operational Criteria | Number of Ports (2017) |
|---|---|---|---|
| PPS | • Able to serve fishing vessels that conduct fishery activities in Indonesian waters, Exclusive Economic Zone (EEZ), and the open seas;<br>• Has mooring facilities for fishing vessels at least 60 GT;<br>• A dock length of at least 300 m, with a pool depth of at least minus 3 m<br>• Capable of accommodating fishing vessels of at least 100 units or a total quantity of at least 6,000 GT; and<br>• Utilize and manage the land of at least 20 ha. | • Partially landed fish for export purposes<br>• There are fish loading and unloading activities and marketing of fishery products averaging 50 tonnes per day; and<br>• There are fish processing industry and other supporting industries. | 8 |
| PPN | • Able to serve fishing vessels that conduct fishery activities in Indonesian archipelagic waters and EEZ<br>• Have mooring facilities for fishing vessels of at least 30 GT;<br>• A dock length of at least 150 m, with a pool depth of at least minus 3 m<br>• Able to accommodate fishing vessels of at least 75 units or an aggregate of at least 2,250 GT<br>• Utilize and manage the land of at least 10 ha | • There are fish loading and unloading activities and marketing of fishery products averaging 30 tonnes per day;<br>• There are fish processing industry and other supporting industries | 13 |
| PPP | • Able to serve fishing vessels that conduct fishery activities in Indonesian coastal waters<br>• Have mooring facilities for fishing vessels of at least 10 GT;<br>• A dock length of at least 100 m, with a pool depth of at least minus 2 m;<br>• Capable of accommodating fishing vessels of at least 30 units or an aggregate amount of at least 300 GT<br>• Utilize and manage a land of at least 5 ha | • There are fish loading and unloading activities and marketing of fishery products, averaging 5 tonnes per day<br>• There are fish processing industry and other supporting industries | 77 |
| PPI | • Able to serve fishing vessels that conduct fishery activities in Indonesian coastal waters;<br>• Have mooring facilities for fishing boats of at least 5 GT;<br>• A dock length of at least 50 m, with a pool depth of at least minus 1 m<br>• Capable of accommodating fishing vessels of at least 15 units or an aggregate of at least 75 GT<br>• Utilize and manage the land of at least 1 ha | • There are fish loading and unloading activities and marketing;<br>• Fishery products at an average of 2 tonnes per day | 553 |

## RO KOREA:

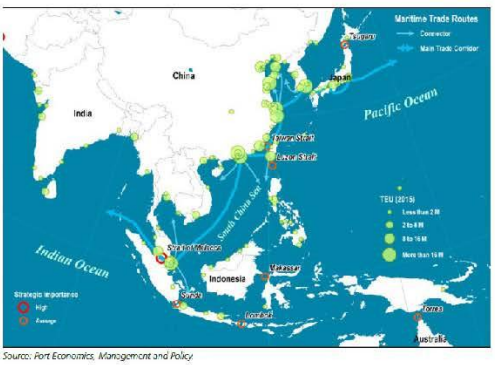
- State-owned fishery harbor:
  - fishery harbor required for development of fishing grounds; also serves as evacuation center of fishing vessels in remote areas
  - Number: 117
- Local fishery harbor:
  - main base serving coastal fisheries
  - Number: 284
- Village fishery harbor: small-scale; main base for livelihood of people in fishing villages
- Village joint-use fishery harbor: small-scale, and jointly used by fishers and other people in the village

### Blue Ports

- Fish waste collection and reuse
- Solar-powered cold storage facilities
- Monitoring and reporting of IUU fishing
- Collaboration with scientists

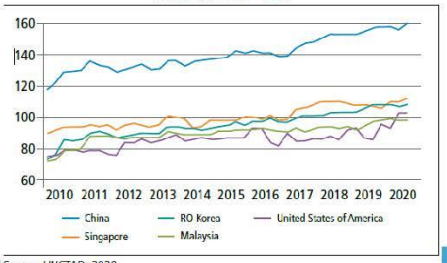
# PORTS AND SHIPPING

- 80% - 90% of world's trade is through shipping (UNCTAD)
- EAS countries:
  - **48% of world container port traffic** in 2018
  - Nine of the top ten container ports in the world
  - Four of the top five ports in **liner shipping connectivity**
- Port of Singapore:
  - top in the region for **quality of port infrastructure**
- Japan:
  - highest in the region for **logistics performance index**




Source: Port Economics, Management and Policy

Liner Shipping Connectivity Index: Top Five Economies.
(China Q1 2006 =100)




Source: UNCTAD, 2020.

# GREEN PORTS FOR BLUE ECONOMY

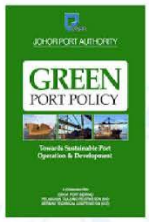
**Issues:**

- Air, water, and noise pollution causing environmental degradation and health issues.
- Threats to local marine species.
- Destruction of marine ecosystems/ habitats/ ecology.
- Negative impacts on livelihood of locals.
- High cost of clean-up
- Bad image for ports and host states/ countries.

| Ports | Ranks | Volume (Million TEUs) |
|---|---|---|
| Shanghai, China | 1 | 36.54 |
| Singapore | 2 | 30.92 |
| Hong Kong | 5 | 20.07 |
| Busan, South Korea | 6 | 19.45 |
| Jebel Ali (Dubai), UAE | 9 | 15.60 |
| Port Klang, Malaysia | 12 | 11.89 |
| Kaohsiung, Taiwan | 13 | 10.26 |
| Port of Tanjung Pelepas, Malaysia | 17 | 9.10 |

World Shipping Council, 2015

These ports won the Green Port Award of the APEC Port Services Network (APSN)





**Malaysia:**

- Tackling oil and chemical spills: Emergency Response Plan
  - Joint cooperation with neighboring countries
- Port Tanjung Pelapas: Port Safety, Health and Environmental Management System (PSHEMS)
- Ballast Water Management
- Study of Fuel Quality of Ships in Ports
- Energy, Electricity & Fuel Saving
- Environment Initiatives

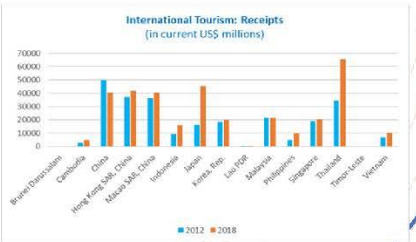
PEMSEA

# COASTAL AND MARINE TOURISM

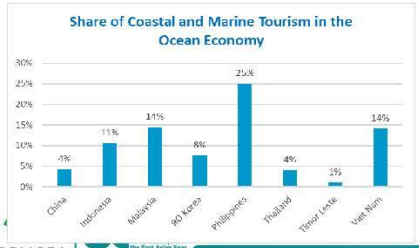

88% (NE Asia) and 82% (SE Asia) drop in 2020

94% (NE Asia) and 98% (SE Asia) drop in Jan-July 2021

~ $285 billion
(revenues from tourism)




Source of data: World Bank 2021




Source of data: NSOC Reports

PEMSEA

# RECOVERY WITH SUSTAINABLE TOURISM

**Responsible Diving**
**Green Fins** (UNEP, SE Asia)
**Dive trails** (Singapore)

**ASEAN Green Hotel Award**

**Zero Carbon resorts**

Hotels and resorts with **plastic ban** and **wastewater treatment and reuse**

**Ecotourism in marine reserves, parks and MPAs**

## Zero-carbon resorts

- **Philippines**:
  - accumulated annual savings of 247 sampled companies: amounted to USD 8,636,208.76;
  - a reduction in energy of 38 MWh;
  - 714,427,966.30 liters of water;
  - avoided 23,348,538.52 kg of carbon emissions
- **Thailand**:
  - accumulated annual savings of 23 companies is US$828,612.
  - offset the energy consumption equivalent to 15,068 households, and the water consumption of 183 homes
  - annual fuel consumption avoided is equivalent to 157 cars, while the avoided carbon emissions offset 1,554 vehicles.

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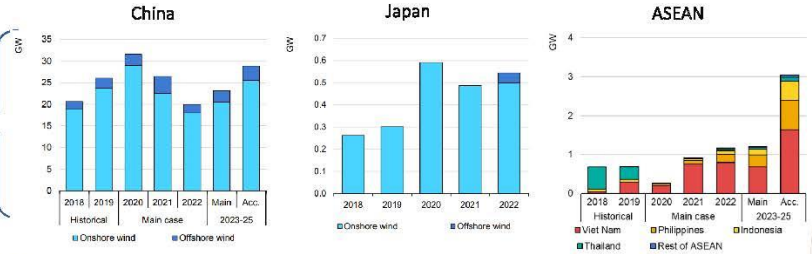
# MARINE RENEWABLE ENERGY

## Ocean energy


**Wind power**




**Offshore wind farms**

- Higher wind speeds are available offshore compared to on land.
- Can act as small marine safety zones
- Contribution to biodiversity
  - Reef effects and connectivity that can increase biodiversity and productivity
  - Structures in the water can create habitat for commercially important fish and invertebrates

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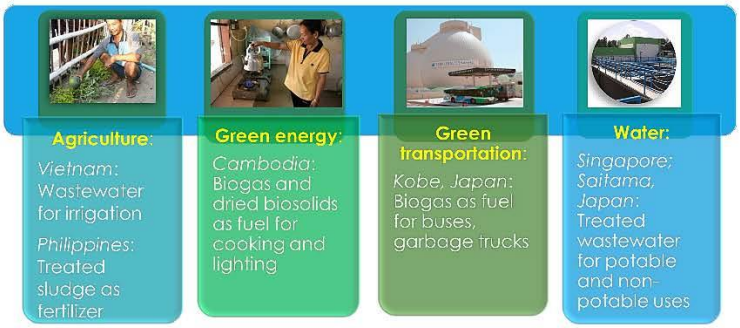
# POLLUTION REDUCTION AND CIRCULAR ECONOMY

## From waste to resource

SDG 6.3 + SDG 11.6.1 + SDG 12.4, 12.5 → TARGET 14-1 REDUCE MARINE POLLUTION





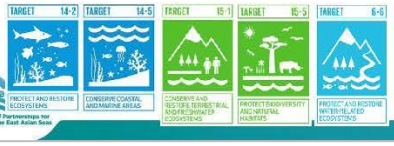
- Gaps
  - Regular water quality monitoring
  - Capacity for integrated waste management: wastewater, solid waste, toxic and hazardous waste, plastics, and marine debris
  - Facilities for collection, treatment, proper disposal, recycling, and reuse
  - Affordable financing
  - Access to cost-effective technologies

PEMSEA 30 Years of Partnerships for the East Asian Seas

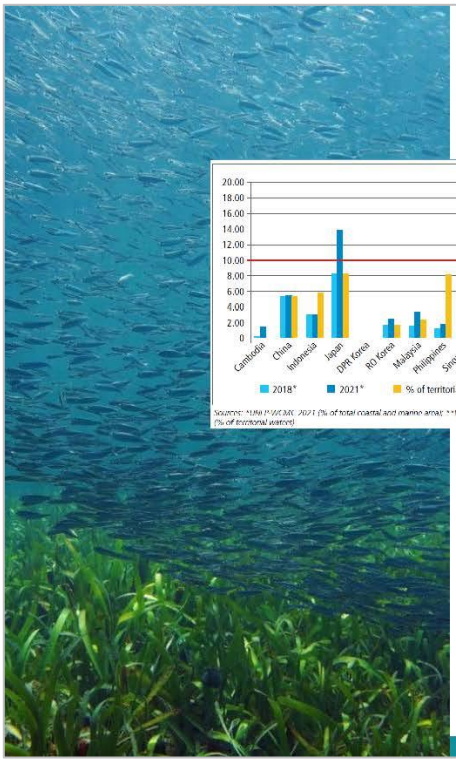
# HABITAT RESTORATION

**BENEFITS**

- Climate change mitigation: **blue carbon** (carbon sequestration and storage)
  - Mangroves: ~ $68 B
  - Seagrass: ~ $40 B
- **Protection from erosion, flooding, storm surge**
- **Other ecosystem services**:
  - fisheries, tourism, food ingredients, medicines, nutrient cycling, waste assimilation, etc.
- **Job creation**:
  - planting, caring, protecting, monitoring, research



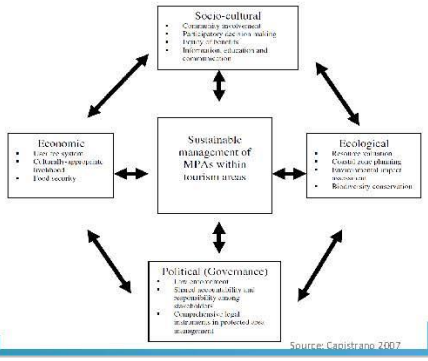

PEMSEA 30 Years of Partnerships for the East Asian Seas



# MARINE PROTECTED AREAS




1. More sites need to be protected
   - Key biodiversity areas
   - Protection of mangroves, seagrass, and coral reefs as integrated system
   - % of territorial and EEZ areas
2. More effective management of MPAs, LMMAs, OECMs
3. Advantages of MPA networks and complexes
4. Synergies
5. BBNJ




Source: Capistrano 2007

# Knowledge Management and Capacity Development

## Monitoring, Forecasting and Modeling, Restoration and Protection

- **Data analytics and modeling**
- **Digitalization**
- **Use of innovative technologies**:
  - Artificial intelligence and deep learning
  - Sensors
  - Drone, satellite, and aerial imagery
  - Internet of Things (IoT)
- **Carrying capacity** studies
- **Fish stock assessment**
- **Climate change** vulnerability and exposure assessment, forecasting, impact modeling

## Environment and natural resource accounting

- **Ocean accounts**
  - GVA of ocean economic activities and employment
  - Natural capital and ecosystem services (mangroves, coral reefs, seagrass, salt marsh)
  - Backward and forward linkages, multiplier effects
- **Fisheries accounts**
- **Forestry accounts**
- **Water accounts**
- **Waste accounts**
- **Environmental damage**
- **Climate change**

## Sustainable fisheries and habitats

- Fishing vessels: **Universal monitoring, control and surveillance**
- **Habitat and biodiversity protection**
- **Use of innovative technologies:**
  - Electronic catch documentation and traceability system
  - digitalization, blockchain, information management
  - imagery, machine learning models, and computer vision technology
  - visible infrared imaging radiometer suite (VIIRS)
- **Role of women and traditional knowledge**

PEMSEA 30 Years of Partnerships for the East Asian Seas

# Traditional Knowledge: Ecological and Cultural Information

Vital information from elders and traditional marine harvesters supports **marine planning decisions**

Many scientific studies of local ecosystems would not have been possible without the knowledge-base of indigenous people helping researchers.

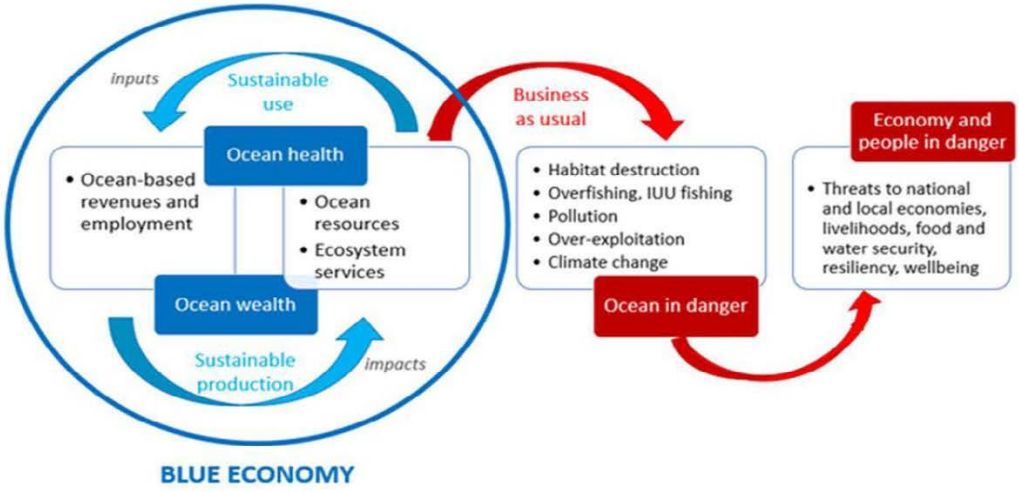
- Important places for fishing and gathering diverse species
- 'Seasonal rounds' for when and where different species are harvested
- Traditional fishing, gathering and food preparation methods
- Important cultural and archaeological sites
- Travel and trade routes of indigenous people
- Observed changes or trends in species abundance and distribution over time




# Gender Equality and Social Inclusion

- **Role of women**
  - In society, coastal communities
  - Opportunities in blue economy sectors
  - Role in habitat restoration, protection, and monitoring
- **Diversity in labor force**
- **Marginalized sectors**
  - fisherfolk
  - Indigenous peoples (IPs)
  - seniors and children
  - PWD

## Protect ocean health to maintain ocean wealth… the blue economy way






## Impacts

- Increased awareness and understanding
- Foster interagency and multisectoral collaboration
- Applications in policy and planning
- International recognition

## Challenges

- Lack of common understanding of blue economy
- Data availability/access to data
- Lack of capacity (blue economy- new concept)
- Lengthy processes (start/ review period)

# Transitioning to blue economy

**Build a shared understanding of the ocean and blue economy.**

- **Blue economy assessment** (National State of Ocean and Coasts Report)
- **Ocean accounting**
- **Ocean monitoring and modeling**
- Digitalization of ocean economy and application of innovative and smart technologies

**Orient blue economy financing towards ecosystem recovery, building resilience, and pollution management.**

- Blue economy plan, financing and investment
- Nature-based job programs, including habitat restoration and protection
- Incentives for sustainability and resiliency upgrades (waste mgt and recycling, decarbonization, modernization of fisheries and post-harvest facilities, green ports and ships, marine renewable energy, marine biotechnology, etc.)

**Improve ocean governance to unlock economic development, spur investments, and improve climate resilience.**

- Taking an archipelagic view of overall development planning
- Institutionalizing integrated coastal and ocean management
- Establishing a high-level coordinating mechanism and permanent body at the national level



# Regional organizations dealing with transboundary/LMEs coastal and ocean issues

PEMSEA
COBSEA Coordinating Body on the Seas of East Asia
Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
IUCN
ESCAP Economic and Social Commission for Asia and the Pacific
ASEAN Centre for Biodiversity
unesco Intergovernmental Oceanographic Commission
WESTPAC
Association of Southeast Asian Nations
ADB Asian Development Bank
AIIB Asian Infrastructure Investment Bank

# Thank you!

PEMSEA | 30 Years of Partnerships for the East Asian Seas

www.pemsea.org

http://seaknowledgebank.net/

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## EAS Congress 2024

Xiamen City, PR China

6-* November 2024

# Plenary Session I

## : Ocean and Coastal Challenges and Priorities in Asia and Pacific Region

## Rory Scarrott

### University College Cork

Rory Scarrott is a senior postdoctoral researcher in University College Cork's Environmental Research Institue. His research focuses on connecting marine and coastal stakeholders with opportunities in the space sector, satellite-derived data and Europe's growing network of data infrastructures and standards.

Rory is an ecologist at heart, with a doctorate that looked at the structure of ocean-surface heterogeneity over space and time for the North Atlantic. From his own experiences, he is keenly aware of the importance of life-long education and capacity building. Through projects such as the Horizon 2020 DOORS, the European Space Agency-funded Blue Economy project, and the E.U. INTERREG-funded KETMaritime project, he engages with a wide range of institutional, business, and social stakeholders, connecting them to problem-solvers and solutions in Europe's technology sectors such as Space and IT. He recognizes the challenges experts and communities face in embracing new technologies and approaches, delivering change-focused policy roadmaps to connect people with technology solutions they can shape and use, and equip them with the skills, training and connections to fully harness them.


## MR. MAHESH PRADHAN

### Coordinator, UNEP COBSEA

With nearly three decades of experience with the UN Environment Programme, Mr. Mahesh PRADHAN was appointed as COBSEA Coordinator on 1 June 2022 and is currently based in Bangkok, Thailand. COBSEA is an intergovernmental mechanism that brings together nine countries (Cambodia, People's Republic of China, Indonesia, Republic of Korea, Malaysia, the Philippines, Thailand, Singapore and Viet Nam) for the sustainable development and protection of the marine environment and coastal areas of the region. Over 2021-22, Mr Pradhan served as interim COBSEA Coordinator, while concurrently leading UNEP's global efforts on sustainable nutrient management from UNEP HQs in Nairobi, Kenya. COBSEA's current efforts are focused on Marine Litter and Plastics, through implementation of a Regional Action Plan on Marine Litter. In addition, efforts are underway for the implementation of a new Framework on Marine and Coastal Ecosystems, closely aligned to the Kunming-Montreal Global Biodiversity Framework.

Email: mahesh.pradhan@un.org

## ANDISWA MLISA

### Principal Advisor Business Development, Pacific Community (SPC)

Andiswa Mlisa is Principal Advisor for Business Development at the Pacific Community (SPC) Partnerships, Integration, & Resource Mobilisation Office (PIRMO), and serves as the Lead on Digital Earth Pacific. Andiswa has extensive executive leadership experience associated with the use and promotion of Earth observation, digital data infrastructures, capacity and industry development, strategic partnerships, and business development. Previously, Andiswa was the Acting CEO of the South African National Space Agency (SANSA) after serving as SANSA's Managing Director of the Earth Observation Program and has participated in GEO activities and governance for many years, including establishment and coordination of AfriGEO and Co-Chair of GEO Programme Board.

Email: andiswam@spc.int

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

# Ocean and Coastal Challenges and Priorities in Asia and Pacific Region

**Rory Scarrott**[1]

[1]MaREI Centre, ERI, University College Cork, Ireland;

Thank you to **Aimee Gonzalez** and **Joydeep Chakrabartty**

## Who am I?

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

1. Senior post-doctoral researcher based in University College Cork, Ireland.
2. Look at how to connect satellite data to marine stakeholders in the Atlantic and Black Sea regions.
3. An ecologist by background
4. Special interest in training and capacity building to support technology uptake

Contact:
r.scarrott@ucc.ie

# Who am I?



Currently I work on:

- **European Space Agency** funded **Blue Economy** project, looking at how **marine technology innovation clusters** can help connect Atlantic stakeholders to satellite data.

www.atin-blueco.eu

- **European Commission** funded **DOORS** project, running **training and capacity building** in the Black Sea region, to connect marine stakeholders to European data opportunities

DOORS BLACK SEA

www.doorsblacksea.eu

# This session

6th Symposium | Seoul, South Korea| OCT 31 ~ NOV 2, 2023

**Ocean and Coastal Challenges and Priorities in Asia and Pacific Region.**

- Highlight examples where regional efforts to address their ocean and coastal challenges, have been restrained by regional capacities
- Explore where satellite data could help, and what limits people's ability to use it
- An opening discussion

| | | |
|---|---|---|
| 11:30 - 11:35 | **Welcome** from chair | Rory Scarrott<br>*(University College Cork)* |
| 11:35 - 11:45 | **Towards Roadmap 2030: Marine Challenges and Priorities for the Asia Pacific region** | Mahesh Pradhan<br>*(Coordinator, COBSEA)* |
| 11:45 - 11:50 | **GEO Blue Planet Opportunities** | Emily Smail<br>*(GEO Blue Planet, NOAA, University of Maryland)* |
| 11:50 – 11:55 | **Facing reality** – a sense check | **You (the audience)** |
| 11:30-12:15 | **Focusing on People: The importance of considering regional socio-economic contexts for technology uptake** | Andiswa Mlisa<br>*(The Pacific Community)* |
| 12:15 – 12:30 | Panel and audience **deep dive** | Mahesh Pradhan *(COBSEA)*<br>Andiswa Mlisa *(The Pacific Community)*<br>Suk Jae Kwon *(KIOST)*<br>Laura David *(UP Marine Science Institute)*<br>Yegor Volovik *(Secretary Director, NOWPAP)*<br>**You (the audience)** |

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

# Towards Roadmap 2030: Marine Challenges and Priorities for the Asia Pacific Region

**Mahesh Pradhan**
UNEP COBSEA Coordinator
Bangkok, Thailand

## Outline

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

1. Asia Pacific region
2. Triple Planetary Crises
3. Pollution – Marine Litter, Nutrients
4. Marine and Coastal Ecosystems
5. Climate Change
6. Regional Seas and Ocean Governance
7. Conclusion

Image Credit: NOAA

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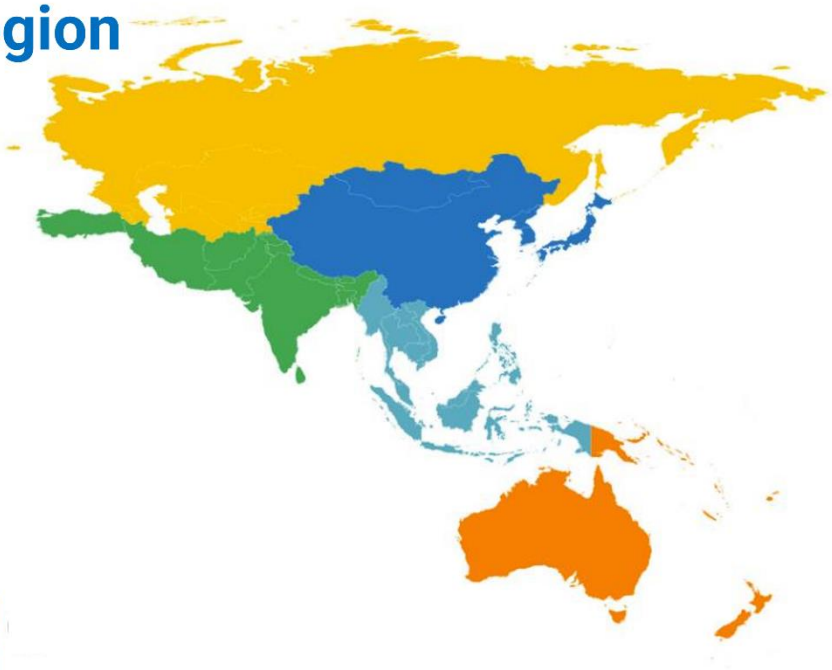
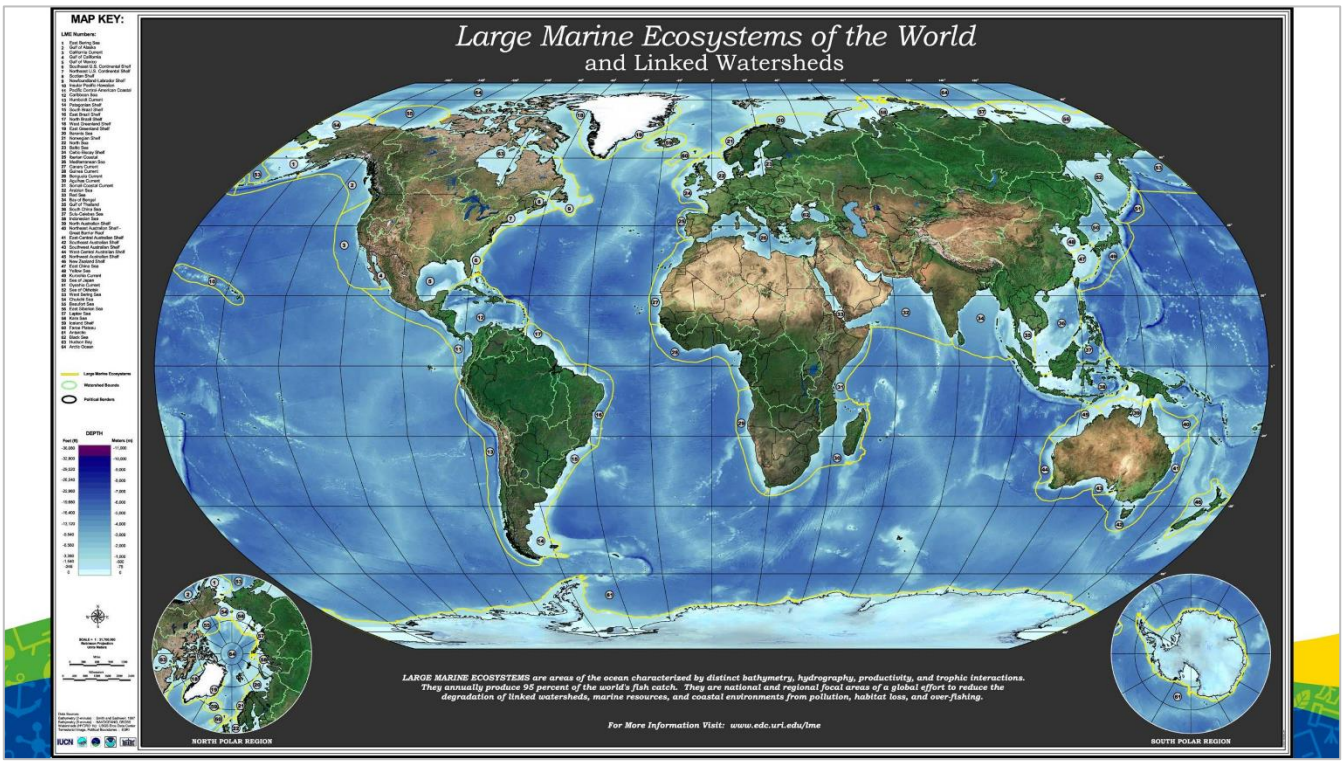
Image Credit: NOAA

# Asia Pacific region

- **Northeast Asia**
- Southeast Asia
- Pacific
- South Asia
- Central Asia

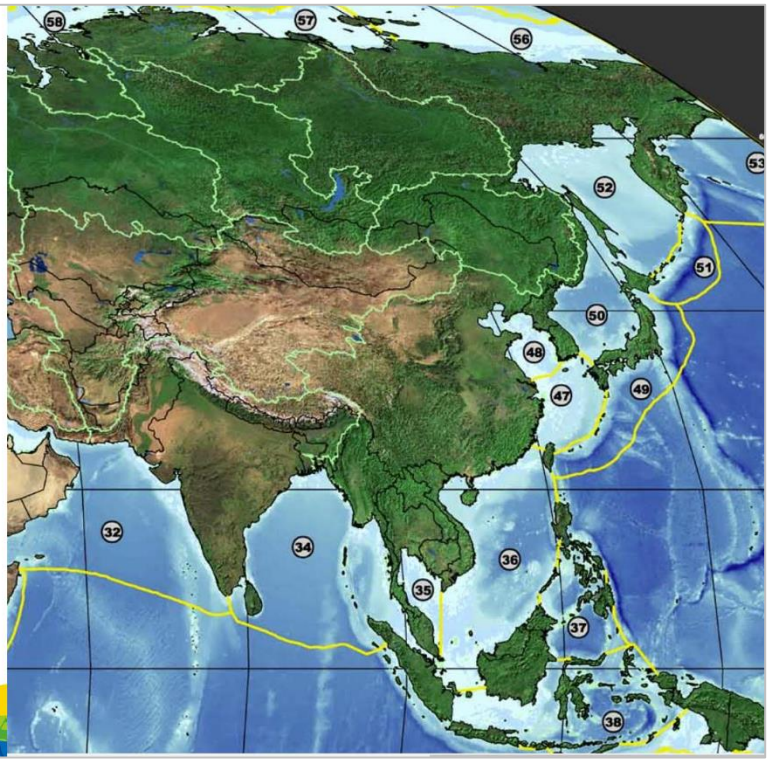
- 53 member countries





# LMEs – Asia Pacific

- 34 – Bay of Bengal
- 35 – Gulf of Thailand
- 36 – South China Sea
- 37 – Sulu-Celebes Sea
- 38 – Indonesia Sea
- 47 – East China Sea
- 48 – Yellow Sea




CLIMATE STABILITY

LIVING IN HARMONY WITH NATURE

TOWARDS A POLLUTION FREE PLANET

## TACKLING THE TRIPLE PLANETARY CRISIS: A NEW FUNDING PARADIGM

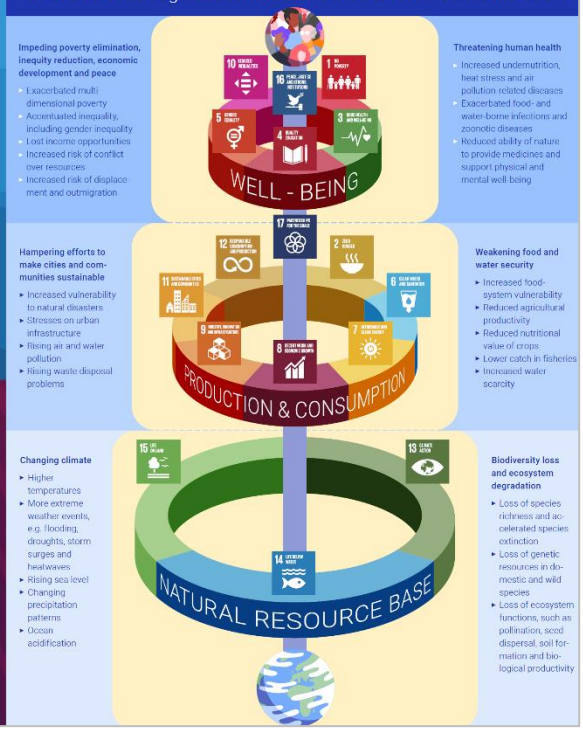
"The truth is, we have been poor custodians of our fragile home. Today, the Earth is facing a triple planetary crisis. Climate disruption. Nature and biodiversity loss. Pollution and waste. This triple crisis is threatening the well-being and survival of millions of people around the world.

**Antonio Guterres,**
**Secretary-General of the United Nations**

The building blocks of happy, healthy lives – clean water, fresh air, a stable and predictable climate – are in disarray, putting the Sustainable Development Goals in jeopardy.

But there is still hope."

Environmental degradation threatens the achievement of the SDGs



# Marine Pollution

Marine Litter and Plastic Pollution
&
Nutrients Pollution

SUSTAINABLE DEVELOPMENT GOALS

TARGET 14·1

REDUCE MARINE POLLUTION

**14.1**
By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

**Kunming-Montreal Global Biodiversity Framework**

**TARGET 7**
Reduce pollution risks and the negative impact of pollution from all sources, by2030, to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects, including: reducing excess **nutrients** lost to the environment by at least half including through more efficient nutrient cycling and use; reducing the overall risk from **pesticides and highly hazardous chemicals** by at least half including through integrated pest management, based on science, taking into account food security and livelihoods; and also preventing, reducing, and working towards eliminating **plastic pollution**.

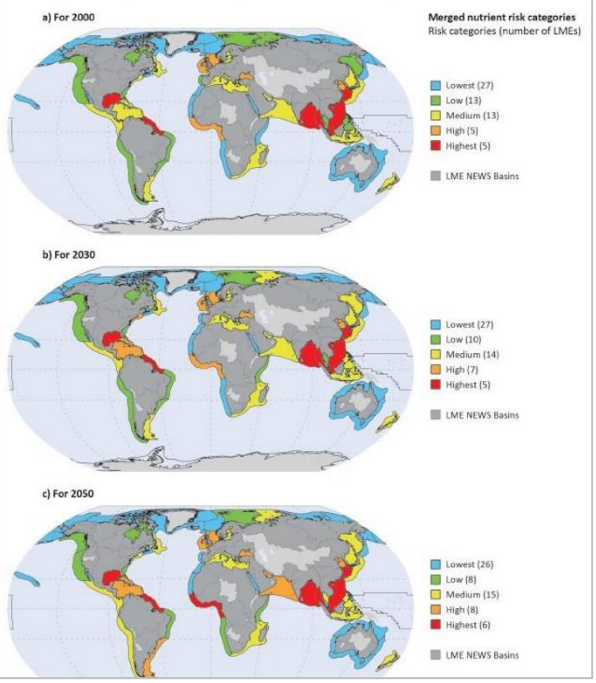
Coastal pollution is one of the most **serious threats to the world's coastal ecosystems**

70-80% of global wastewater is **discharged untreated into the ocean**

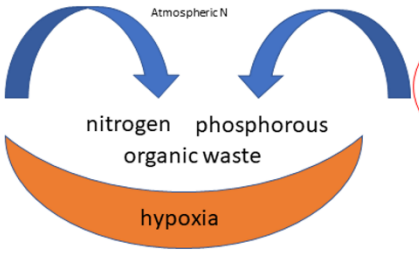
One of the main threats to coastal waters is the increasing levels of **nutrients reaching the ocean from cities and agricultural activities**

Globally **over 500 dead zones** have been identified covering an area roughly the size of the EU

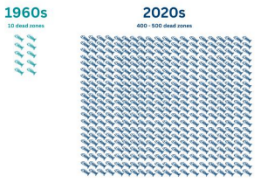
**Figure 7.13 Merged nutrient risk categories for LMEs for a) 2000, b) 2030, and c) 2050.** Based on merging the nitrogen load and Index of Coastal Eutrophication Potential sub-indicators, the combined risk rated as 'high' to 'highest' for ten LMEs. Most of these are located in Western Europe, southern and eastern Asia, and the Gulf of Mexico, as would be anticipated from the two sub-indicators. If current trends continue 13 LMEs will have increased their risk for eutrophication by 2050 (relative to 2000 conditions) due to a combination of increased nitrogen loads and excess N or P relative to silica.



**70 – 80%** global ocean and freshwater eutrophication can be attributed to **Agriculture pollution**




**Municipal & Industrial Wastewater**
may now be responsible for nearly **25% - 30%** of total nitrogen pollution annually released into oceans




**1960's**
10 dead zones
Limited km2

**2020's**
400 – 500 dead zones
+/- EU km2

35 million mts N/P fertilizer
Ag Land: 1 billion hectares
Aquaculture: 2 mts
Cattle: 900 million
Pigs: 400 million
Sheep/Goats: 1.1 billion
Poultry: 4 billion

"Green Revolution"

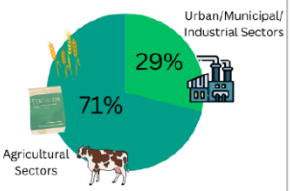
185 million mts N/P fertilizer
Ag Land: 5 billion hectares (38% globe)
Aquaculture: 106 mts
Cattle: 1.5 billion
Pigs: 1.2 billion
Sheep/Goats: 2.2 billion
Poultry: 22 billion

3 billion people
Global GDP: $ 1.2 trillion

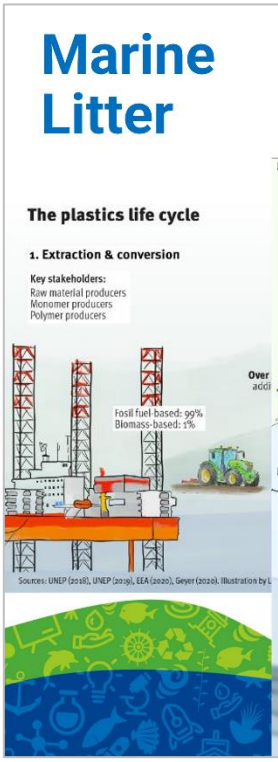
"Expansion"

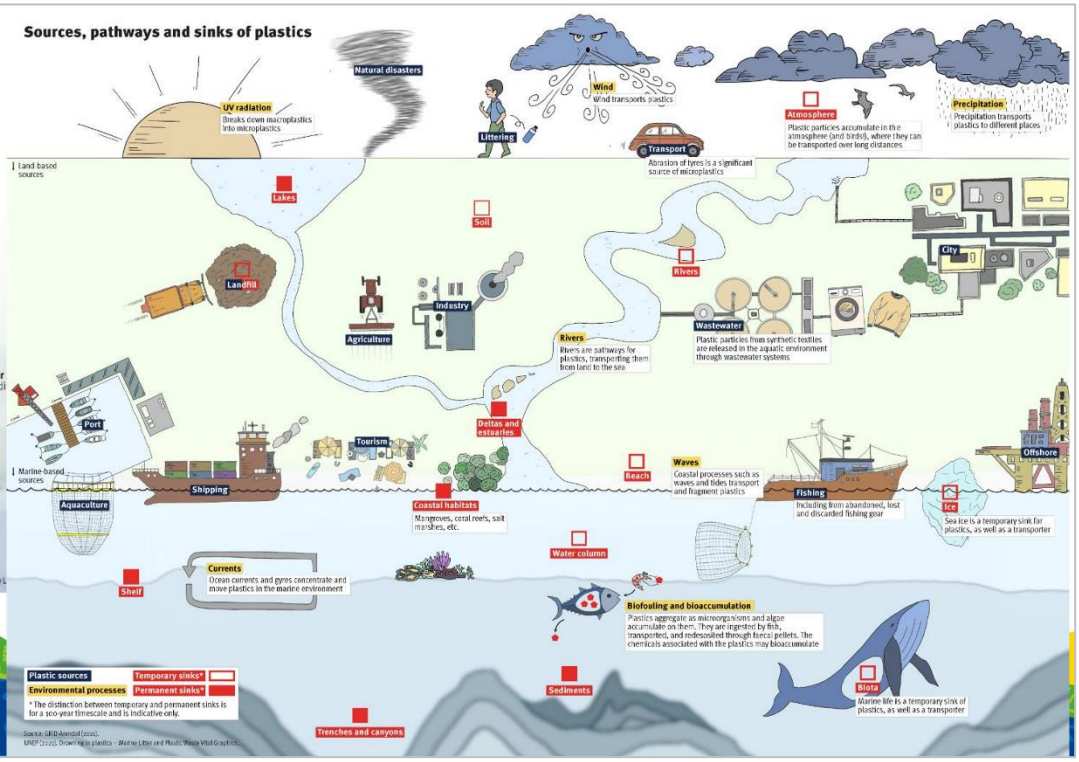
7.8 billion people
Global GDP: $ 96 trillion
80% wastewater untreated
29% of N released to ocean

Share of total nitrogen released into global oceans by

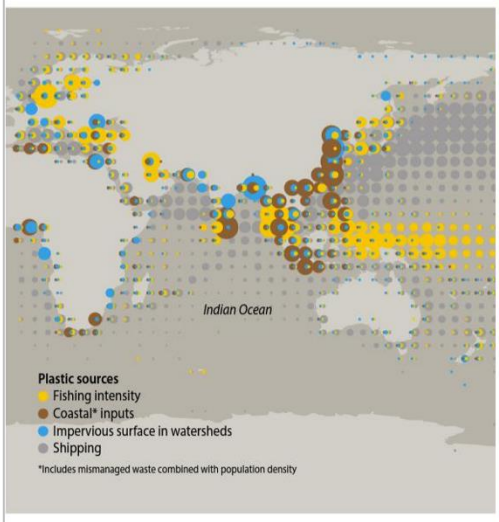



# Marine Litter

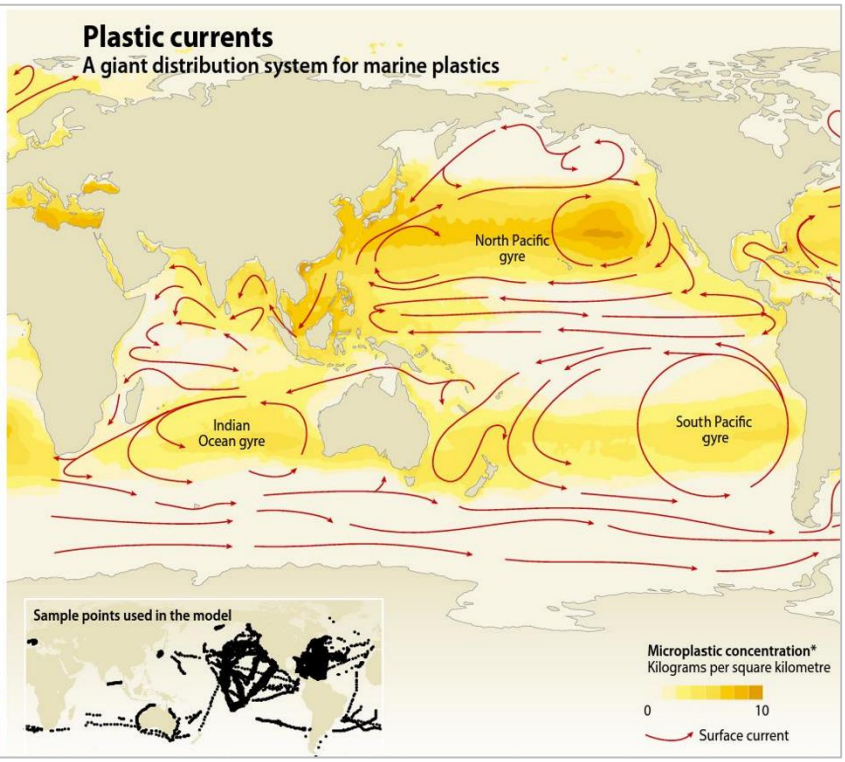


# Marine Litter




*Source*: Map produced by GRID-Arendal (2016a) based on data from Halpern *et al.* (




# Provisional timeline of the INC

UN environment programme 1972-2022

**OEWG**
30 May – 1 June 2022
To discuss the timetable and organization of work of the INC

**INC-1**
28 Nov – 2 Dec 2022
*Forum*
Open to all stakeholders to exchange information and activities related to plastic pollution

**INC-2**
First half of 2023

**INC-3**
Second half of 2023

**UNEA-6**
February 2024
Report progress of the INC

**INC-4**
First half of 2024

**INC-5**
Second half of 2024

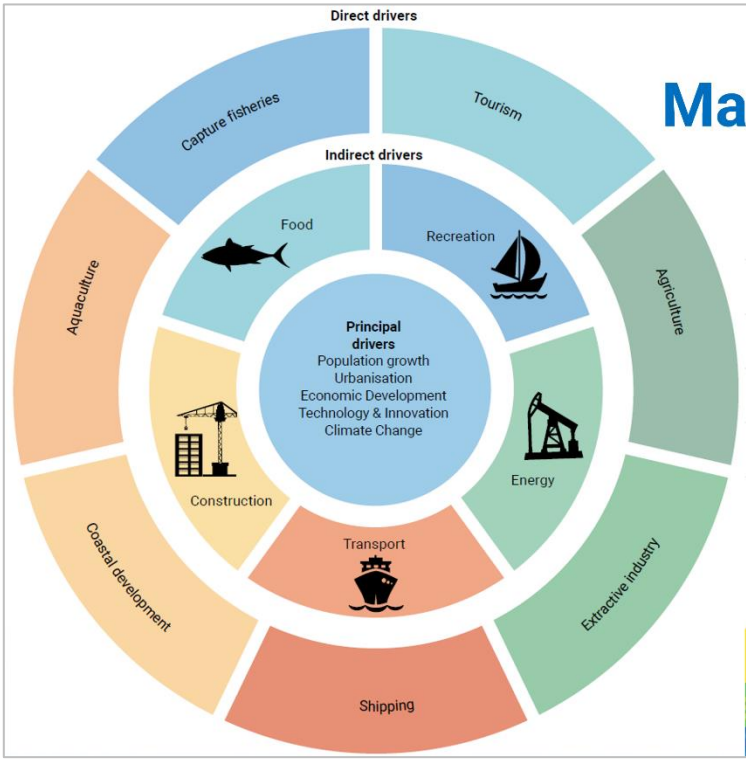
**Diplomatic Conference of Plenipotentiaries**
First half of 2025
For the purpose of adopting and opening for signature the instrument

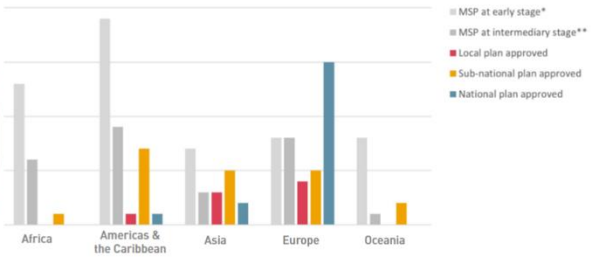
2022 2022 2023 2023 2024 2024 2024 2025

# Marine and Coastal Ecosystems

| | SUSTAINABLE DEVELOPMENT GOALS | Kunming-Montreal Global Biodiversity Framework |
|---|---|---|
| Marine and Coastal Spatial Planning | **14.2** Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts | Target 1: Ensure that all areas are under participatory, integrated and biodiversity inclusive spatial planning and/or effective management processes... |
| Marine Protected Areas and OECMs | **14.5** Conserve at least 10 per cent of coastal and marine areas | Target 2 Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration...<br><br>Target 3 Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed... |

# Marine Spatial Planning




**MSP around the world as of April 2022**
(IOC-UNESCO)

# Marine Protected Areas

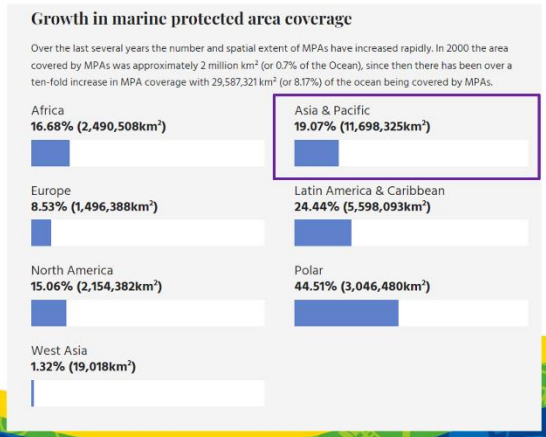
## MPAs in the world

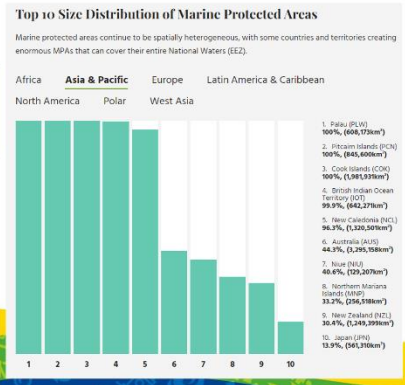
(Protected Planet)

**8.17%**
Percent of the ocean covered by marine protected areas

**18,638**
Marine Protected Areas

**29,587,321km²**
Total area protected



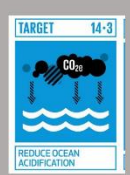




# Climate Change and Oceans

Climate Action

SUSTAINABLE DEVELOPMENT GOALS


**13**
**Take urgent action to combat climate change and its impacts**

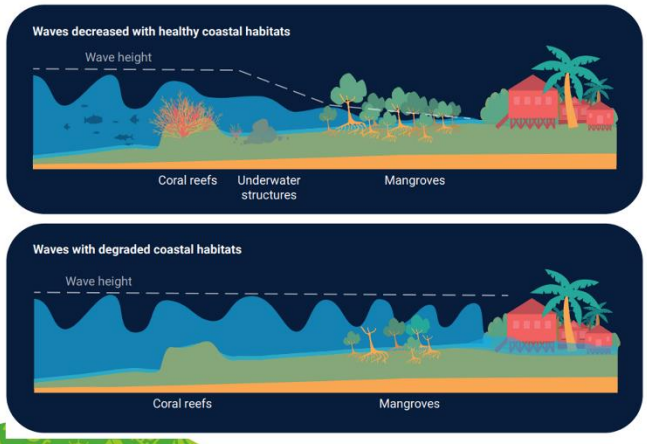



**14.3**
Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

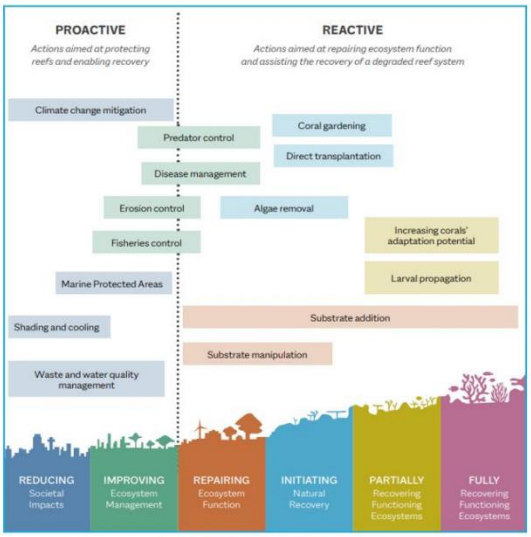
**Kunming-Montreal Global Biodiversity Framework**

**TARGET 8**
**Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through nature-based solution and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity**

# Climate Change and Oceans




*Adapted from* Whelchel *et al.* (2016)




*Source*: Hein *et al.* (2020)

# Climate Change and Oceans

**FIGURE 2: Key facts on climate change in Asia and the Pacific.**

**Key facts**

*The Asia-Pacific region is the most disaster prone region and the consequences of climate change hit the most vulnerable the hardest.*

**>55%** of global GHG emissions come from Asia and the Pacific

**>3/4** of global coal-fired power is located in the region

**43,000** human casualties from climate-induced disasters occurred in the region every year

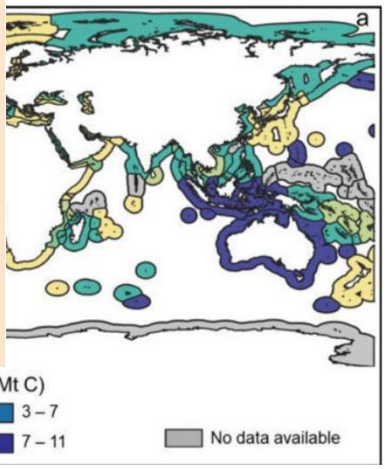
**80%** of global displacements triggered by climate-induced disasters are from the region

**40 out of 53** Asia-Pacific member States pledged carbon neutrality by 2030, 2050, 2060, or 2070 to reverse the trends

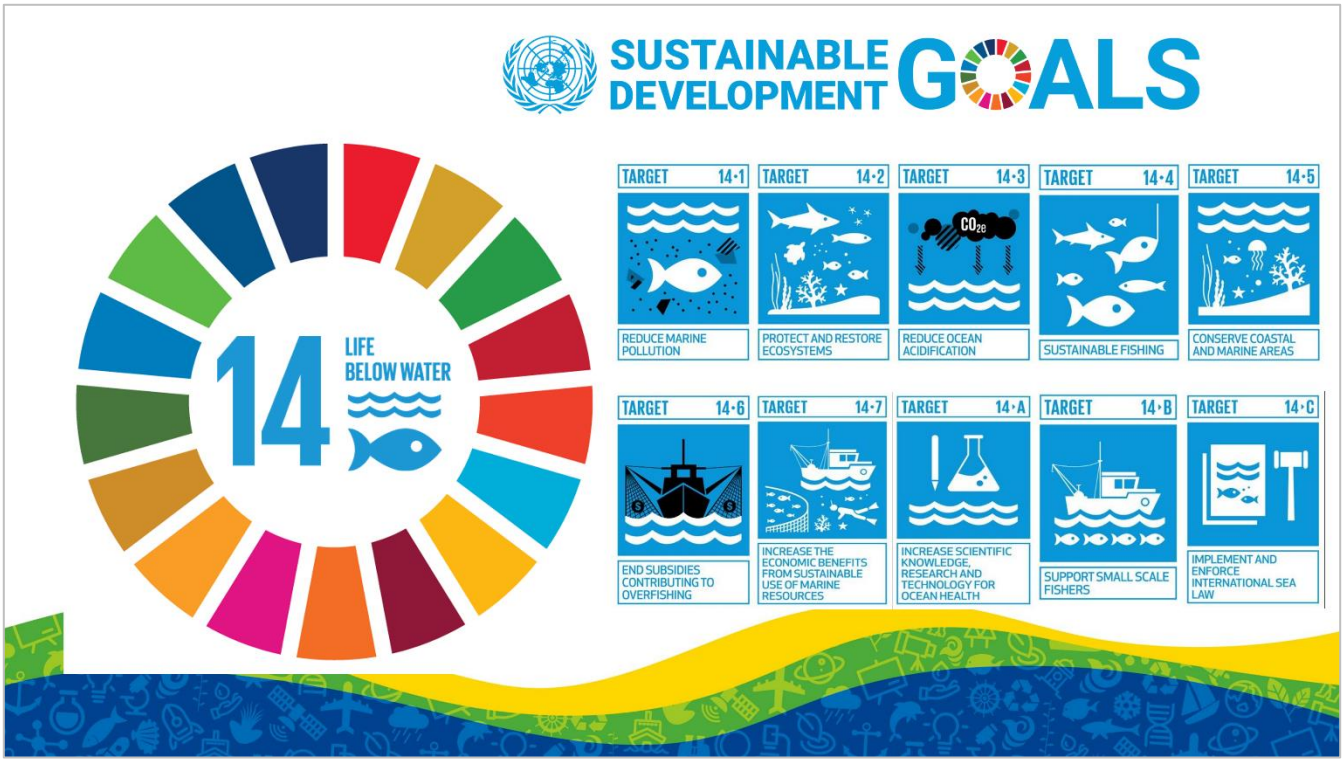
**Source:** ESCAP, 2022.

## Blue Carbon Potential around the World

(World Economic Forum)




Global map of average annual blue-carbon sequestration potentials by country. The shading indicates the size of the potential, from low (yellow) to high (dark blue), in millions of tonnes of carbon per year. Image: Bertram et al. (2021).

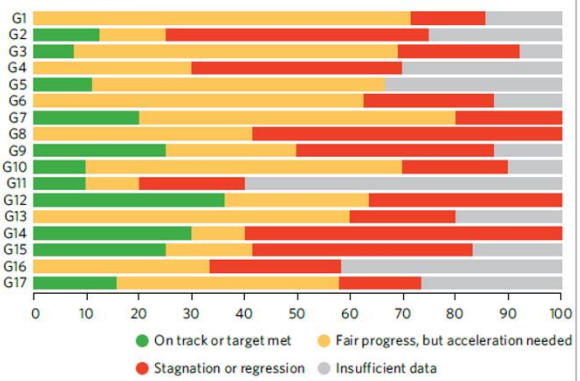


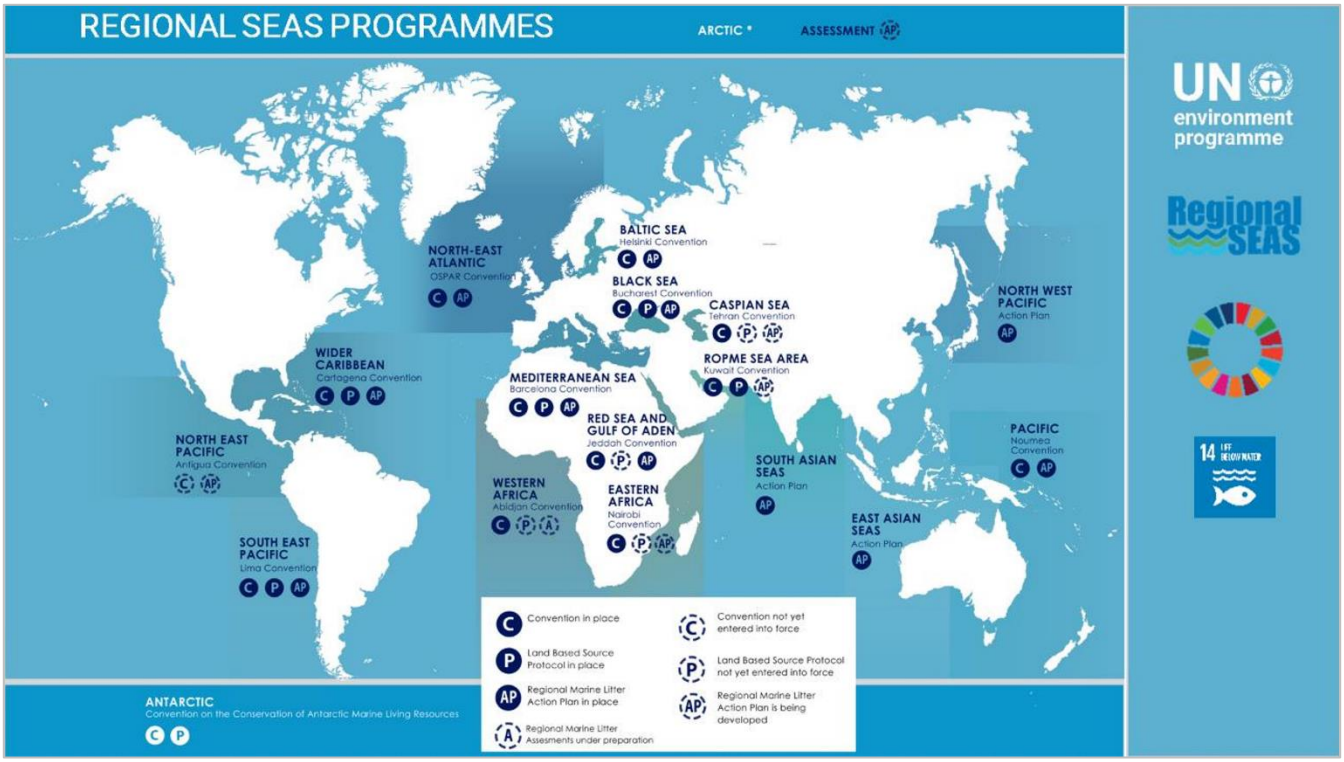

# 2030 – halfway there already!


## Life below water

- The ocean is in a state of emergency as increasing eutrophication, acidification, ocean warming and plastic pollution worsen its health. Additionally, the alarming trend of overfishing persists, leading to the depletion of over one third of global fish stocks.
- While there has been some progress in expanding marine protected areas, combating illegal, unreported and unregulated fishing, banning fishing subsidies and supporting small-scale fishers, action is not advancing at the speed or scale required to meet Goal 14.
- To counter these trends, swift and coordinated global action is imperative. This entails increasing funding for ocean science, intensifyi conservation efforts, advancing nature- and ecosystem-based solutions, addressing the interconnections and impacts of human-induced pressures, and urgently turning the tide on climate change to safeguard the planet's largest ecosystem.

**Progress assessment for the 17 Goals based on assessed targets, 2023 or latest data (percentage)**



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GEO BLUE PLANET

# Thank You!

**Contact:**
mahesh.pradhan@un.org

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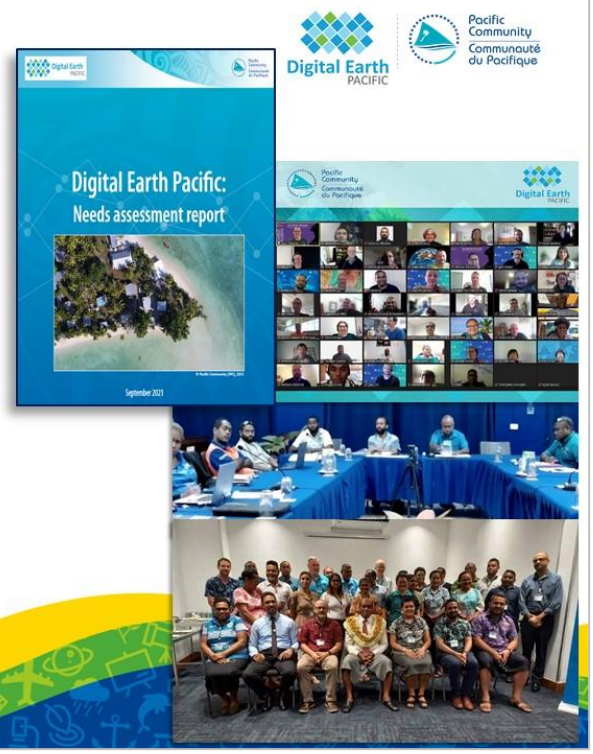
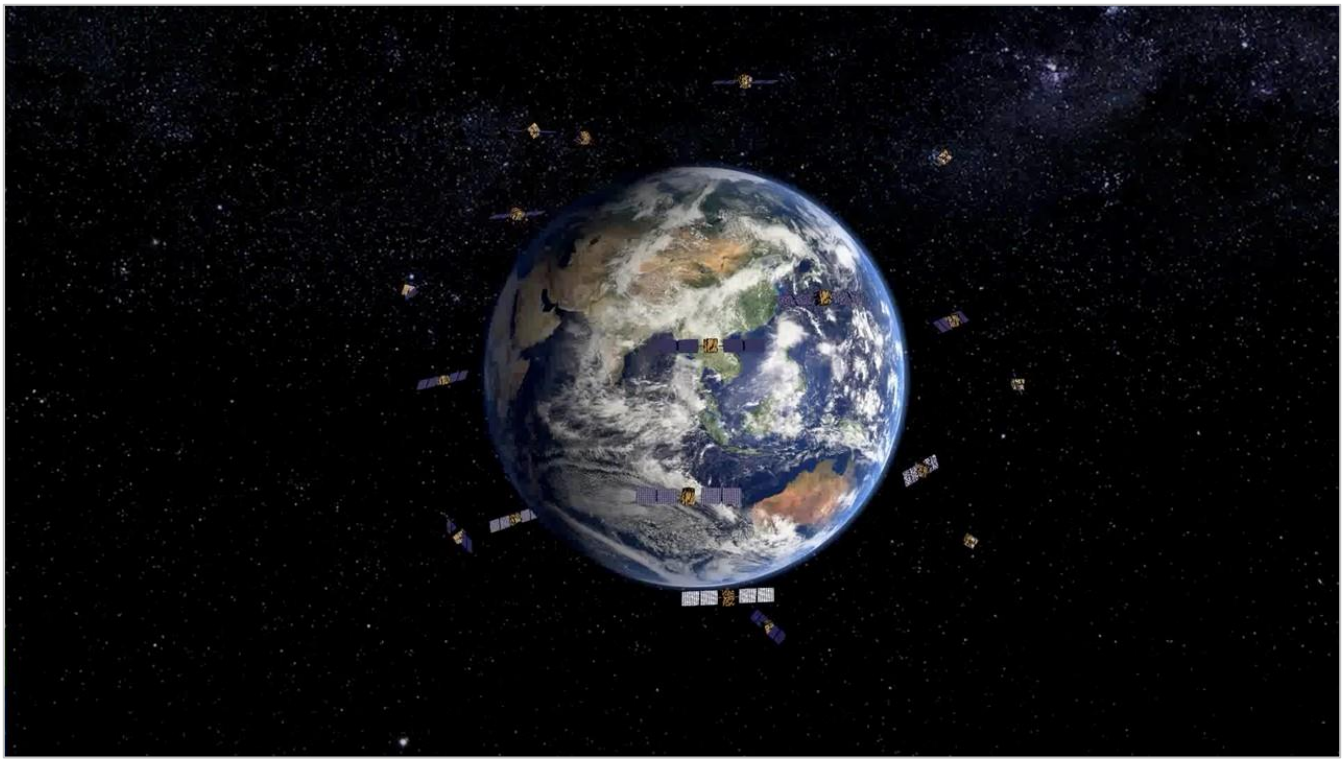
# Digital Earth Pacific

*Andiswa Mlisa*
*Pacific Community*

BLUE PLANET

- Countries have **expressed a need for better access and capacity for applying Earth observation data** to national development priorities and sustainable development.
- Digital Earth Pacific will deliver an **operational Earth and ocean observation system** that takes decades of satellite data and makes it easier to access and use, empowering decision-makers across the Pacific.
- It will provide a fundamental digital infrastructure that will ensure every nation in the Pacific has access to tools, technologies and capacity to **routinely monitor and track challenges from climate change, food insecurity or disaster risk** through robust decision-ready products that are updated with every satellite overpass.





# Digital Earth Programs – Decision Ready Products

Digital Earth PACIFIC

Pacific Community
Communauté du Pacifique

**Structured time-series**

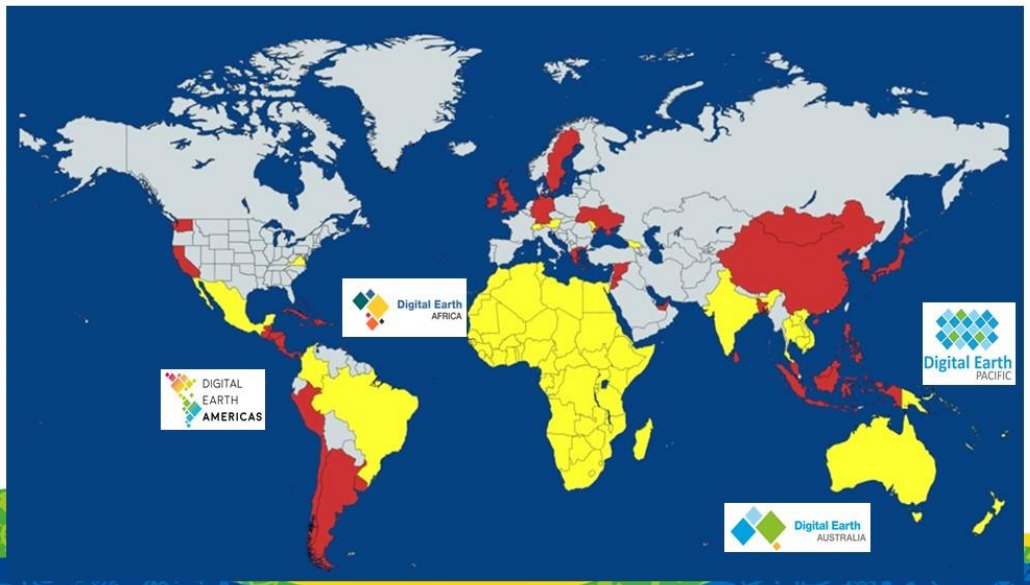

**Observations**

**Analysis Ready Data**

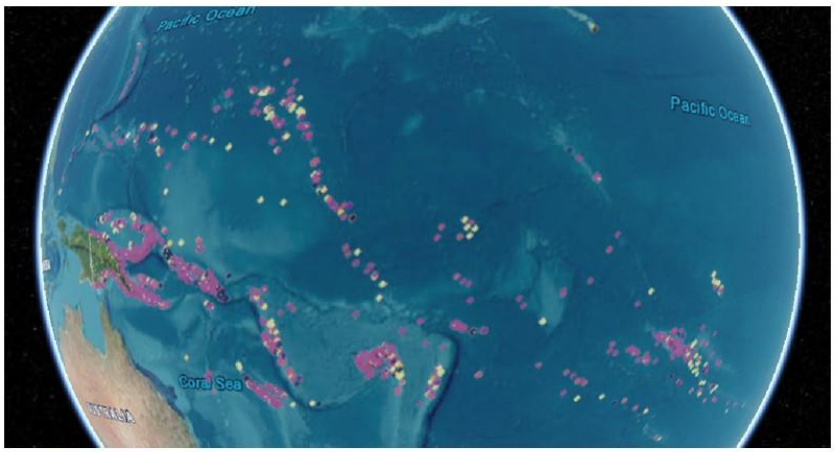
**Products**

**Information for decisions**

# Digital Earth – Expanding Globally



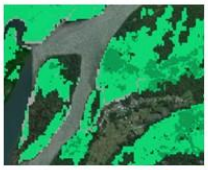

# A Regional Public Good



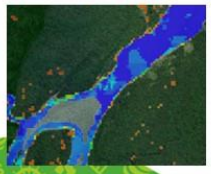

- Free and open data products and services for every member country
- A digital public infrastructure serving the needs and priorities of Pacific Island Countries and Territories

# Earth Observation at Scale

- 22 years of coastline change
- 34k km of coastline for the Pacific
- 10% of global coastline



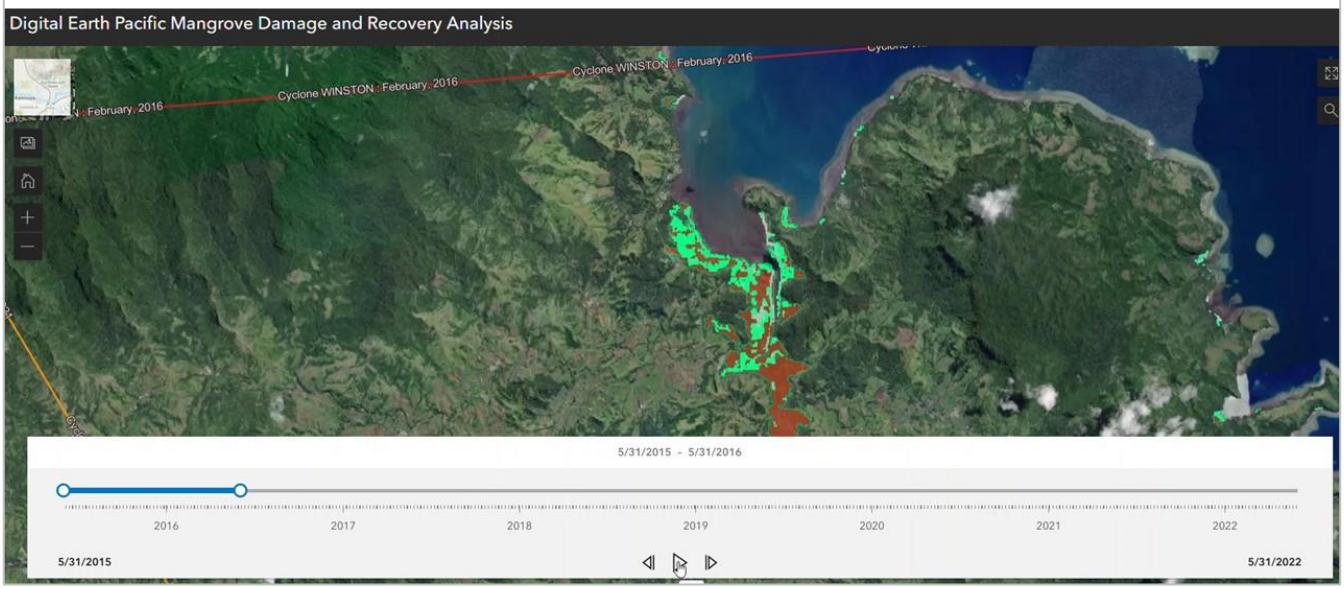
- 7 years of mangrove data
- Illustrates loss and recovery



- 11 years of Wofs
- Useful for understanding flood zones and water security

- Accessed 750,000 satellite images (Landsat and Sentinel-2
- Processed over 500 tb of data

# Partnership with Esri




# Call to Action

- We want to engage with member countries to:
  - Demonstrate current capabilities and products and understand relevance to your country
  - Improve existing products through co-design
  - Identify additional use cases and quick wins
  - Identify opportunities for workshops focused on capacity development
- Improve satellite data coverage
- Develop partnerships that support the long-term sustainability of Digital Earth Pacific
- Embed DEP in your science-policy interface to drive action and decision making from DEP products and services

# For More Information

www.digitalearthpacific.org

Contact us at dep@spc.int

@DEarthPacific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BLUE PLANET

# Thank You

Contact: andiswam@spc.int

# Plenary Session II

## : Digital Solutions for Sustainable Oceans

## Dr. Ryo Furue

### JAMSTEC

Ryo Furue received his PhD in physical oceanography from the University of Tokyo in 1999. He has a wide interest in ocean dynamics. His past and current studies include the global thermohaline circulation, numerical modelling of microscale turbulence, dynamics of equatorial currents, and dynamics of currents around Australia. He worked as a researcher at the University of Tokyo and then at the University of Hawaii before his current workplace, JAMSTEC, Japan.

Email: furue@jamstec.go.jp


## David Kim

### CEO, Samwoo Immersion

David Kim is a former merchant mariner who received his Ph.D. in Marine Police and M.S. in Marine Transportation Information Engineering from Korea Maritime University. He then founded Samwoo Immersion, a marine IT company, which he has been running since then.

Samwoo Immersion is a company that develops and provides on-site problem-solving solutions using VR/XR/Digital Twin technologies. The company focuses on projects that implement location-based information based on GIS technology as a 3D virtual world, i.e., Digital Twin. Samwoo Immersion also actively utilizes VR/XR-based content and solutions for the training of marine and ship-related personnel. In addition, the company established SWXR CAMPUS, the world's first talent development training center, and is continuously building a talent development platform through the XR Eco-Friendly Ship Training Center course.

Email: kdavid73@samwooim.com

English website: https://samwooim-eng.imweb.me/?redirect=no

## DR. CHOLYOUNG LEE

### Director at the Marine Bigdata & A.I. Center / KIOST

Cholyoung Lee holds the position of Director at the Marine Bigdata & A.I. Center at the Korea Institute of Ocean Science and Technology (KIOST). In this role, he conducts research and project planning related to the collection, processing, analysis, and visual representation of spatial bigdata in various fields, including oceanography, fisheries, and shipping. Lately, he has taken on the role of project leader for the 'Building Coast Bigdata Platform and Centers' project, which is supported by the South Korean Ministry of Science and ICT. In this capacity, he manages the data collection, standardization, and operation of a platform for marine-related bigdata produced by 24 institutions and companies, with the aim of making it accessible within the industry. This significant work contributes to the discovery and spread of data-driven innovations in the marine and fisheries sector. He also directly participated in spatial bigdata analysis for zoning during the first phase of the MSP project (2018-2021) and made valuable contributions to standardizing and drafting guidelines for assessing marine spatial characteristics. Besides, he has a keen interest in monitoring and cleaning up marine litter. He's a contributing member of the Our Sea of East Asia Network (OSEAN) and actively participates in related activities, including proposing methods for the selection of nationwide marine litter monitoring sites using GIS technology. Cholyoung Lee pursued his undergraduate studies in the Engineering of Minerals and Resources, specifically Applied Geophysics, at Inha University in Incheon, South Korea. He continued his academic journey by majoring in Geographic Information Systems (GIS) for both his master's and doctoral studies at the same university.

Email: cylee82@kiost.ac.kr

## Dr. Leontine Baje

### Fisheries Advisor – Oceanic Fisheries Program, Pacific Community

Dr Leontine Baje has served in the national fisheries administrations of her home country Papua New Guinea for 11 years and the Federated States of Micronesia for 2.5 years prior to joining the Pacific community as a fisheries advisor in 2022. Her current role is focused on supporting Pacific Island countries and territories to discuss, plan and implement the transition of paper-based reporting to electronic reporting and monitoring. Her post graduate studies focused on the biology, ecology and ecological risk assessment of coastal sharks in Papua New Guinea.

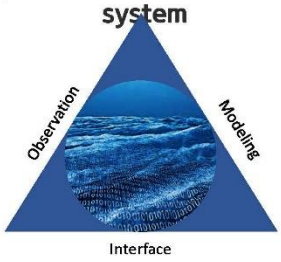
Email: leontineb@spc.int

# Enhancing User Experience in the Western Pacific and Marginal Seas of South and East Asia Through Digital Ocean Twins


*Ryo Furue, Yasumasa Miyazawa and Swadhin Behera*
*Application Laboratory, JAMSTEC*

**Digital Twin**

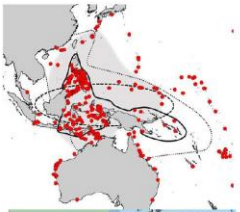

**Developing a digital representation of the earth system**

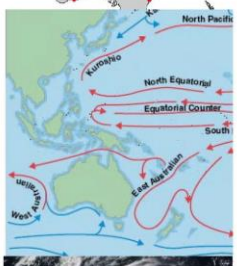



**Ocean and climate predictions and applications - unleashing the power of**

# West Pacific and Marginal Seas of South and East Asia (WPMSEA) is an important region in the world

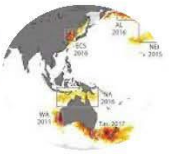
- **Fishery:** These seas are home to a diverse range of marine life, including important fish stocks that support the livelihoods of millions of people in the region. The fishing industry is a crucial source of food and income.
- **Trade and Transportation:** These seas serve as major trade routes, connecting the countries of East and Southeast Asia with each other and with the rest of the world.
- **Energy Resources:** The WPMSEA are also rich in oil and gas reserves
- **Climate variation and change:** The WPMSEA are highly vulnerable to the impacts of climate variation and change, including typhoon, extreme events, rising sea levels
- **Ocean health:** Pollution from various sources, including marine plastics, besides marine heat waves is a major threat to the health of the region's marine ecosystems.
- **Economic development and sustainability:** Economic development is fast. Research on sustainable development strategies that balance economic growth with environmental protection and social equity is essential for ensuring long-term prosperity and stability of the region.
- **Policy:** Effective policy is critical for the conservation and sustainable use of the WPMSEA's marine resources. Science based policy frameworks, governance structures, and regulatory mechanisms will help policy decisions.

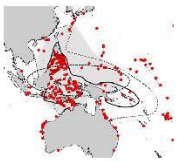


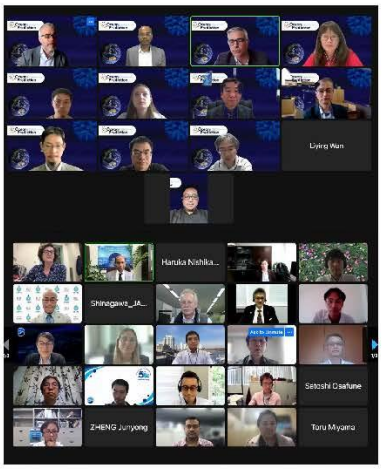



## A Regional Hub — Western Pacific and Marginal Seas of South and East (WPMSEA)

Together with OceanPrediction DCC





*And many more centers in the region*

- ***The regional hub will develop capacity in both cutting-edge science and advanced prediction systems by understanding gaps and co-developing solutions***
- ***Support sustainable developments and ocean literacy***
- ***Improve user experiences through smart and interactive interfaces***

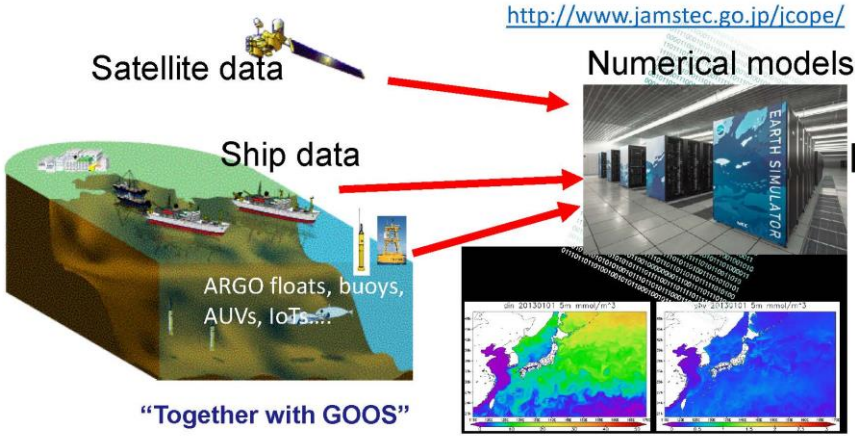
## Recognizing the gaps for developing the regional system

- Identify gaps in our understanding and develop necessary steps and research directions
- Identify gaps in observations to improve analyses and simulations/predictions
- Identify gaps in our operational products for better user experiences
- Identify gaps in capacity to develop it in the region
- Identify issues in policies and their implementations for sustainability and economic improvements
- ....

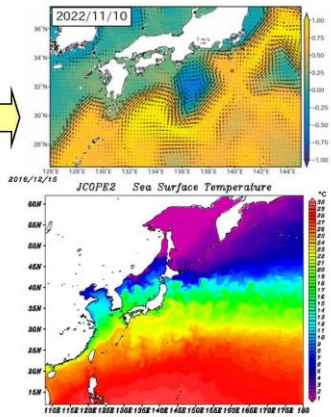
# The state of the art in ocean forecast

**The Japan Coastal Ocean Predictability Experiment (JCOPE) as an example**

http://www.jamstec.go.jp/jcope/




Nitrate and phytoplankton simulation
(Ishizu et al. 2020 Climatic Change)

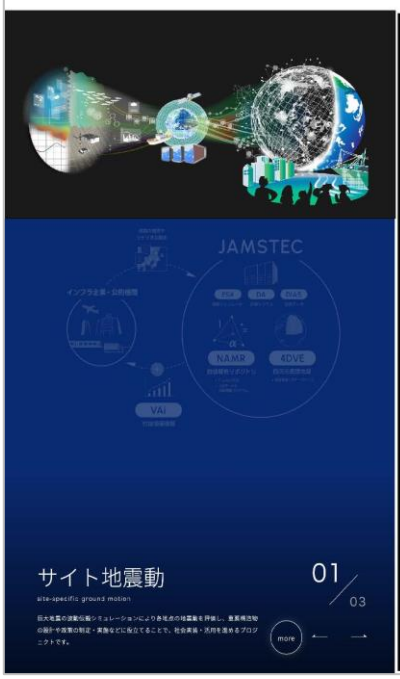



(Miyazawa et al. 2008)

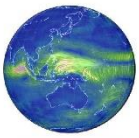
**Other notable forecast systems in the Western Pacific region: JMA (Japan), NMEFC (China), BMKG (Indonesia)**

# Interface: The user experience *Developing the 4D Virtual Earth*

Intelligent & Interactive




https://www.jamstec.go.jp/virtualearth/general/en/



# Strengthening science for better products and services

Support sustainable developments and ocean literacy:

- Ocean forecast systems have evolved and now provide useful information to various user communities.
  - However, still a lot needs to be done to improve our understanding and predictions.

- The WPMSEA regional team will work together with many centers in the region to develop the region's capacity in both cutting-edge science and advanced prediction systems by understanding gaps and co-developing solutions.

- Improve user experiences through smart and interactive interfaces.
  - **Digital twins** are envisioned to revolutionize ocean prediction studies and enrich user experiences with sophisticated interfaces. (The scientific community will also be benefited.)

This can be achieved through collaborations even with other research disciplines, for value-added information generation

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# New Trends of Reality Tech in Ocean : XR, Digital Twin and Metaverse

**David Kim**
CEO of Samwoo Immersion

## Outline

1. Company Introduction
2. XR Solutions
3. Training Center
4. Metaverse Platform
5. Digital Twin Solutions

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Image Credit: IMXR® Defense

**David Kim**
SAMWOOIMMERSION Co., Ltd.

samwoo immersion

## Virtual Education Training Platform

The Most Advanced in Existence Based on
XR Total Solution Metaverse Platform Company

SAMWOOIMMERSION, as a professional developer of XR solutions in the industrial field , has developed/supplied XR technology-based solutions for industrial job training and various education and training fields. We are expanding the XR market with a new paradigm of industrial use of VR and AR technology that was specialized In the existing game industry, and we are providing integrated XR education and training infrastructure and services through a customized metaverse platform.

Major external activities of the CEO


01 About Samwoo Immersion
| Company Introduction

800 government offices, big businesses in 11 years

**Acquire customer pool and complete production team formation**

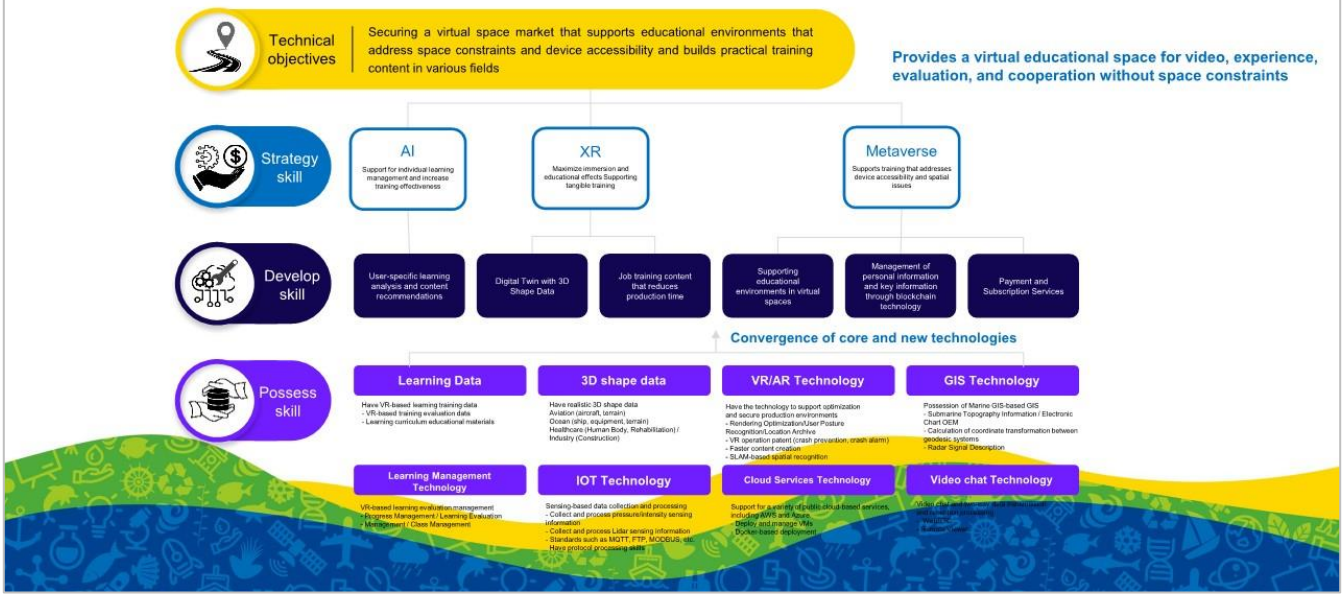
### Professional Team
Formation of Planning-Production-Operation Team
Maximize the expertise of each part

### Content Production
Unique to Samwoo Immersion quality video production

### IMDF
With the application of IMDF standard production system, an efficient way of making

- Producing high-quality content in 'specialized job areas'
- With international standard content, When producing subtitles, overseas export is possible.
- by reducing production costs Maximize Efficiency
- XR-related content, equipment Full of self-technically

## Technology Roadmap for Implementing an Educational Environment Converging Next Generation Metaverse and XR Technologies




01 About Samwoo Immersion
| Company Introduction

XR Integrated Solution for Training

# IMXR®

IMXR® CONTENTS

IMXR® STATION

IMXR® SIM

Image Credit: IMXR® Defense

02 IMXR

| XR Solutions

**High risk**

Dangerous situation
contrast simulation

**Unexperienced**

an inexhaustible situation
or experiencing difficult situations

**Difficult Attempt**

When it's actually implemented
an indirect experience
of a burdensome situation

**High Cost**

It's very expensive to build in reality
an experience of the situation

Realistic content is used as an educational tool in **various fields according to characteristics such as immersion, interaction, and functionalization**.
It is highly valuable for **future education by immersing learners in the learning content and inducing leading and active learning**.

XR ECO-SHIP Job Training

Due to stricter safety and environmental regulations,
the demand for eco-friendly ships is
Increasing, but high cost of training
for sailors and requiring long-term training.

When training with XR
**Low cost,**
**short training**

XR Aircraft Maintenance Job Training

To strengthen the competitiveness of aviation MRO,
the government also
Market expansion, integration with IT technology,
and large-scale support are planned.

Through XR
**Professional technical**
**Capabilities enhancement**

XR Medical Job Training

Medical education institutions require essential practice,
Lack of infrastructure often
makes it difficult to practice properly.

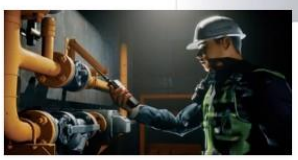
Training with XR
**Address infrastructure shortages**
**and enable repeat learning**

02 IMXR
| XR Solutions

Have **know-how in producing high-quality content** and **100 kinds of international standard content in the "specialized job field."**




**Our Content Solutions (IMXR CONTENTS)**




Point 1.

Reflecting international regulations and standard procedure
beyond the inclusion of general job descriptions

**Create standardized content**

Point 2.

It's a content focused on practical training,
To be recognized for the effect of improving practical skills

**Certification process in progress**

Point 3.

In cooperation with expert groups in each field
There are institutions, so we need to consult them

**Produce professional content**

XR Integrated Contents for Training

## IMXR CONTENTS I Ship

It is a practical education and training content produced based on the educational know-how of experts in various fields
such as marine, industrial, aviation, and medical care, which is beyond the limits of general cramming education.
Beyond simple educational software, you can experience the industry in virtualized environments and learn the same level of training over and over.

### Sailor Emergency response

IMXR Ship Job Training VR Content


### Strengthening the Safety of Coastal Passenger Ship

IMXR Ship Job Training VR Content

### Marine Safety Accident - Rope Hit Accident

IMXR Ship Job Training VR Content

### LNGC Cargo management

IMXR Ship Job Training VR Content



XR Integrated Contents for Training

## IMXR CONTENTS I Safety

It is a practical education and training content produced based on the educational know-how of experts in various fields
such as marine, industrial, aviation, and medical care, which is beyond the limits of general cramming education.
Beyond simple educational software, you can experience the industry in virtualized environments and learn the same level of training over and over.

### Port worker industrial accident

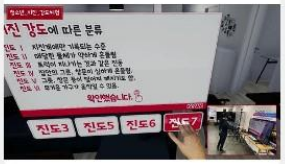
IMXR Industrial Safety VR Content

### How to deal with this current

IMXR Living Safety VR Content

### Natural disasters (Typhoons, earthquakes, water activities)

IMXR Disaster Safety VR Content




### Ladder crash

IMXR Industrial Safety VR Content

XR Integrated Contents for Training

## IMXR CONTENTS I National Defense

It is a practical education and training content produced based on the educational know-how of experts in various fields
such as marine, industrial, aviation, and medical care, which is beyond the limits of general cramming education.
Beyond simple educational software, you can experience the industry in virtualized environments and learn the same level of training over and over.

### Submarine Engine Maintenance Training

IMXR National Defense XR Content

### Flight Practice Imaging System

IMXR National Defense XR Content

### Air Force Aircraft Training

IMXR National Defense XR Content

### Landing Force Training

IMXR National Defense XR Content



XR Integrated Contents for Training

## IMXR CONTENTS I Immersion Experience

It is a practical education and training content produced based on the educational know-how of experts in various fields
such as marine, industrial, aviation, and medical care, which is beyond the limits of general cramming education.
Beyond simple educational software, you can experience the industry in virtualized environments and learn the same level of training over and over.

### Nurse

IMXR Immersion Experience VR Content

### Baker

IMXR Immersion Experience VR Content

### Hairstylist

IMXR Immersion Experience VR Content


### Quarantine manager

IMXR Immersion Experience VR Content

XR Integrated Contents for Training

## IMXR CONTENTS I Realistic Play Learning

It is a practical education and training content produced based on the educational know-how of experts in various fields
such as marine, industrial, aviation, and medical care, which is beyond the limits of general cramming education.
Beyond simple educational software, you can experience the industry in virtualized environments and learn the same level of training over and over.

### AQUA-X SHARK CAGE

IMXR Realistic Play Learning VR Content

### Match the word / Find the wrong model

IMXR Realistic Play Learning VR Content


### Go on a Cruise

IMXR Realistic Play Learning CBT Content


### Admiral Yi Sun-sin's Naval Battles

IMXR Realistic Play Learning AR Content




From SW production to HW platform possession and XR training center

## ‘All-in-one’ offer performance

### Samwoo Simulator Solutions (IMXR SIM)




### Samwoo Hardware Solutions (IMXR STATION)




### Samwoo Flagship Solution (VR Station XO)

XR Training Hardware Solutions

## IMXR STATION

A hardware solution that allows you to experience the virtual world with just one piece of equipment.
With all-in-one products, you can use various types of hardware at your convenience,
and you can get training anywhere by minimizing location constraints.


**VR STATION XO**

High-end type VR Equipment

**VR STATION Cabin**

Non-face-to-face contact VR Equipment

**Portable VR KIT**

High-end type VR Equipment

02 IMXR
| XR Solutions

XR Training Hardware Solutions

## IMXR STATION

A hardware solution that allows you to experience the virtual world with just one piece of equipment.
With all-in-one products, you can use various types of hardware at your convenience,
and you can get training anywhere by minimizing location constraints.

**CPR / AED XR KIT**

Lightening VR Equipment

**IMXR® Instructor**

Training Control Monitoring System

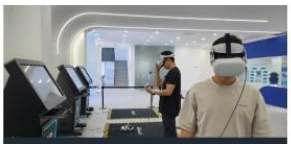
**IMXR® Training Room**

Digital-based realistic XR lab

Digital-based realistic XR lab

## IMXR Training Room

In the educational environment facing the era of the new normal, we can establish an Edutech education environment based on future innovative information and communication technology with new technologies to provide a smart educational environment necessary for training human resources.


Research Institute of Medium & Small Shipbuilding


Busan Port Training Institute


Korea Coast Guard Training Institute

Jeju Air


Daelim University

Dong-eui institute of Technology


Pusan National University


Korea Maritime University



XR-based Training Simulator

## IMXR SIM

Designed to efficiently experience Samwoo Immersion's XR contents in each field in an optimal environment,
IMXR SIM can be implemented identically to actual equipment to increase immersion when performing missions depending on the situation.


FMB (Full Mission Bridge) Simulator


Marine Life Saving Simulator


Fishing boat Simulator


Earthquake Simulator


Ship Escape Simulator


Landing Force Transfer Projection Simulator


Dokdo Experience Simulator


Air Force Aircraft Pilot Training Simulator

World's first XR-based job training
and talent training center

# SWXR® CAMPUS

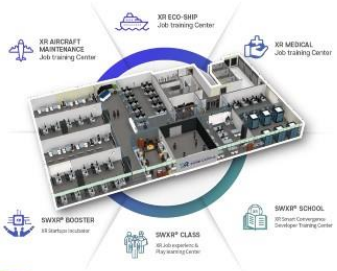



Image Credit: IMXR® Defense

03 SWXR CAMPUS
| Training Center

World's First XR-based Job Training & Human Resources Development Center

## SWXR CAMPUS

Based on Samwoo Immersion's XR job training contents, eco-friendly ships, marine, industrial, aviation, medical fields, etc. It is a future vocational training center operated based on the establishment of an XR educational environment and support for technical personnel necessary for various job training and talent training courses.


XR ECO-SHIP Job Training Center


SWXR® CLASS


XR AIRCRAFT MAINTENANCE Job Training Center


SWXR® SCHOOL


XR MEDICAL Job Training Center


SWXR® BOOSTER

World's First XR-based Job Training & Human Resources Development Center

## SWXR CAMPUS I XR ECO-SHIP Job Training Center

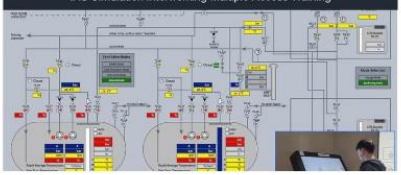
The XR ECO-SHIP Job Training Center will provide actual eco-friendly ships (eco-friendly fuel carriers/eco-friendly fuel ships/eco-friendly fuel bunkering ships/eco-friendly fuel bunkering trucks) You can experience and learn all processes related to the operation of eco-friendly ships by using expanded reality-based educational contents.

LNGC Familiarization Content

Realistic representation of various ship structures and devices such as deck, manifold, CCR, CMR, loading arm, and safety equipment.

**Realistic modeling** when training with XR

IAS Simulation Interworking Multiple Access Training



Control of various cargo transport devices such as pumps, valves, compressors, N2 generators, etc. using IAS

**Control cargo transport equipment** with XR

Practical Training

On-site practical training through analysis of key concepts and laws for each task through curriculum development by LNGC practical training experts

**Improve professional practice, international legal education** through XR training



World's First XR-based Job Training & Human Resources Development Center

## SWXR CAMPUS I SWXR CLASS

It is an XR-based next-generation education system and experience center that enables safety and job experience and play learning for children and teenagers. You can experience a wide range of fields that are difficult to access in one space, and you can expect a natural learning effect through experience.

Natural learning effects through experience

Ability to experience a wide range of areas that are difficult to access in one space

XR (Extended Reality) and Metaverse Platforms

# Beyond Link®

Image Credit: IMXR® Defense



'New School' Metaverse Campus

## Korea Industrial Job Association KIJAVERSE WORLD Metaverse Campus



Campus


Conference Room


Booth Management


Exhibition Hall


Office Zone


Learning Mode Management

'Evolution of Schools' Metaverse Campus

## Metaverse Virtual Campus, Polytech University




'Future-style Group Training' Metaverse Group Training

**Group training that is not limited by time and place I Metaverse Group Training**

**By applying the metaverse, a major technology of the Fourth Industrial Revolution, to emergency response training, we can expect a great effect on preventing crisis response in various situations that require mutual cooperation in job training.**

XR-based Digital Twin Systems

# VARLOS®

Image Credit: IMXR® Defense



## Digital Twin Stage

**Level 1**
**Digital Objects Implementing Real Objects**

Implementing, monitoring, training,
And validating reality replication

**Level 2**
**Connect to the real world for monitoring and control**

Smart Control Systems
(Smart City, Building, Factory)

**Level 3**
**Perform advanced analysis and simulation using AI**

AI deep learning, autonomous driving
Simulation, and predictive data calculation

**Digital Twin Process**

Creation → Transmission → Collection → Analysis → Understanding → Practice


**Terminal Monitoring**
**Digital Twin Systems**

- Monitor high-resolution 3D visualization diversification
- AI-based predictive simulation-accident prevention
- Integrated IOT Device Management

**Safety Monitoring of Smart Construction Technology Marine Engineering**
**Digital Twin Systems**

- Automatic Ship Recognition Program based on Deep Learning
- AI-based ship collision prevention system
- AR-based port navigation/working vessel management

**Building Control Monitoring**
**Digital Twin Systems**

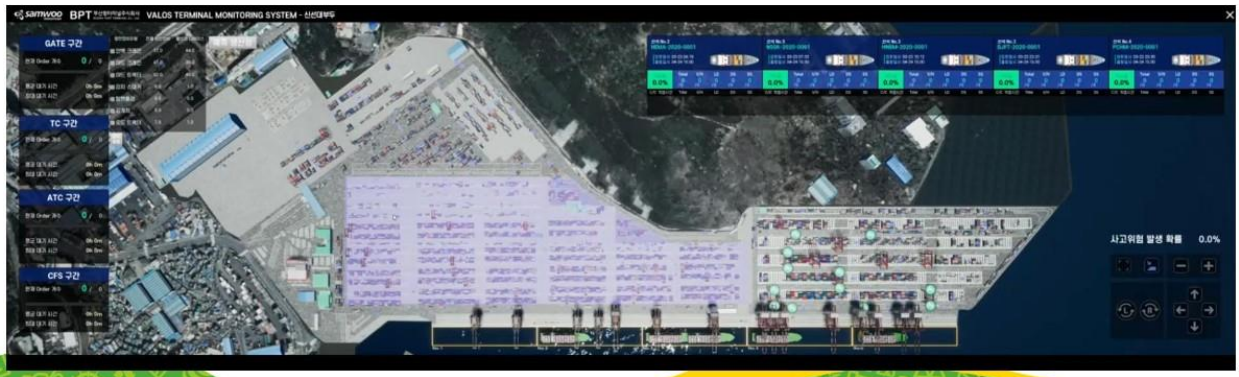
- Integrated control monitoring
- Legacy System Integrated Control
- Risk detection and smart alarm system

05 Varlos
| Digital Twin Solutions

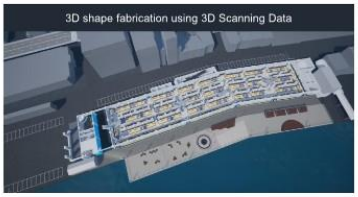
VARLOS®

## Terminal Monitoring Digital Twin System

The VARLOS® terminal operation system improves port productivity and safety through IOT-linked real-time monitoring, 3D visualization of the actual terminal, and statistical analysis and prediction based on big data AI algorithms.



Implementation of optimal digital twin visualization technology using **UNREAL ENGINE** of the latest game engine EPIK GAMES





UNREAL ENGINE

Open World Data connection

Open world data and sources on the GIS platform
Import and connect to the Unreal Engine in a simplified procedure

CESIUM esri OSM HxDR blackshark.ai

digital twin DIGITAL TWIN CITIES CENTRE cdbb



VARLOS®

## Terminal Monitoring Digital Twin System

Constructed **for efficient port logistics management** with a control system that integrates, manages and visualizes data collected from terminals continuously





VARLOS®

## Building Control Monitoring Digital Twin System

It is a **DT-based integrated control and monitoring system for pest control in the Jagalchi market**. It provides integrated data management for existing legacy equipment, visualization of specialized information through various sensors, detection of emergency situations, equipment blocking, and evacuation support functions.


### Busan Facilities Management Corporation Jagalchi Market

- Preemptive facility management service using digital twin technology, disaster and disaster prevention support
- Implement basic machine learning and forecasting models and use large media walls to visualize seawater information
- A service based on fire detection and machine learning to escape dangerous areas and guide them to a safe path

05 Varlos
| Digital Twin Solutions

VARLOS®

Building Control Monitoring Digital Twin System

It is a **DT-based integrated control and monitoring system for pest control in the Jagalchi market**. It provides integrated data management for existing legacy equipment, visualization of specialized information through various sensors, detection of emergency situations, equipment blocking, and evacuation support functions.

Establishment of Integrated Disaster Prevention Monitoring Platform

Support for sea water quality measurement and preventive management

Legacy System Integration Control


Inflood Detection by Using Large-Capacity Seawater Pumps

Detect fire and guide escape routes to hazardous areas

- Power and Mechanical Facilities
- Elevator
- Meter reading facility
- Landscape lighting
- Building lighting
- Parking control

VARLOS®

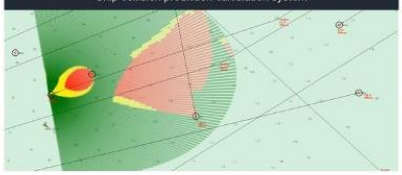
## Smart Construction Technology Marine Construction Safety Monitoring Digital Twin System

A solution for **preventing safety accidents (collision accidents)** between ships by integrating and managing transit ships and working ships in the target area using location information

### Augmented Reality Service System

A safe information system has been established by adding augmented reality (AR) technology to the marine construction safety monitoring system to check ship information in real time and establish a route for safety work during work.

### Ship collision prediction calculation system



It is an AI-based ship collision prevention system (AI-MASTER) that can recognize and judge collisions between fishing boats and coastal small ships based on AI with ship collision detection and avoidance algorithms.

### Automatic Ship Recognition Program Based on Deep Learning

Using deep learning and camera calibration, the recognition of ships passing through CCTV images and It is designed to classify and represent AIS-based adenoma.

05 Varlos
| Digital Twin Solutions

VARLOS®

## Smart Construction Technology Marine Construction Safety Monitoring Digital Twin System

A solution for **preventing safety accidents (collision accidents)** between ships by integrating and managing transit ships and working ships in the target area using location information

### Construction of Sorae Port

AR technology that overlaps construction section information and chart information is added using CCTV filming the target sea area, so ship information can be checked in real time and a route for safe work can be set during work.

User I 금호건설

### Construction of the Port of Incheon, Songdo, Incheon

The only way to prevent accidents at sea was to check the radar on the ship or visually, so night work was difficult for small ships and the exposure of accidents was high, so Samwoo Emotion's technology was adopted.

User I KUKDONG

### Construction of the 3rd Stage of Donghae Port on the Bangpaho Lake

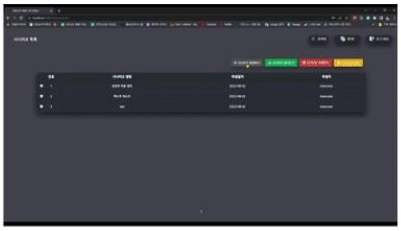
Using CCTV filming the target sea area, AR technology overlapping construction section information and chart information is added, so ship information can be checked in real time, and the route for safety work can be set during work, so the construction was completed without accidents.

User I 현대건설

VARLOS®

## Ship Monitoring Digital Twin System

It is a digital twin system that integrates and manages data collected from ships and visualizes ship operation data and ship construction and simulation information,
**which is used to increase ship operation efficiency and safety and ship construction productivity**

- Deliver services that are visualized based on a variety of data
- Real-time navigation, engine, location, cargo information display

- Enable anyone to leverage their data
- Check various simulation results and monitoring data

- Provides web-based VR content editing capabilities
- Service providers such as institutions and instructors can use
- editors to edit VR content

05 Varlos
| Digital Twin Solutions

VARLOS®

## Shipyard Operation Monitoring Digital Twin System

It is a solution to synchronize 3D image overlap information and 2D block layout information by utilizing location data of dried blocks in the shipyard.
Enables better real-time visualization by linking systems with different types of data, including physical objects, processes, relationships, and behaviors,
Provides advanced analytics and automation for future predictions, **enabling information sharing and collaboration**.
Based on the CCTV attached to the Goliath crane, it has the advantage of optimally using shipyard resources by making the current status of work in the pier a real-time DB.

GEO BLUE PLANET

# Thank You.

**Contact:**
info@samwooim.com
kdavid73@samwooim.com

COAST BIGDATA PLATFORM
연안 빅데이터 플랫폼 KIOST

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

# Coast Big-Data Platform:

## Discovering New Marine Industries w/ Bigdata

GEO BLUE PLANET

**Dr. Cholyoung Lee**

[1]Director of Marine Bigdata & A.I. Center,
Korea Institute of Ocean Science and Technology (KIOST)

# Outline

1. What's the 'Coast Big-Data Platform'?
2. Strategies to Promote the Use of Bigdata
3. Innovation Services in the CBP
4. Future Plans for Self-Sustainability

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

Image Credit: Cholyoung Lee @KIOST
Title: God Bless 'Research Vessel Isabu'
(*) Awarded in the 2022 Photograph Contest @KIOST

## 1 ◦ What's the 'Coast Big-Data Platform'?

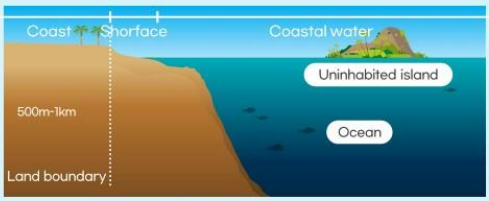
바다에서 찾는 국민의 행복, 인류에 공헌하는 해양과학기술

KIOST 한국해양과학기술원

### Coastal Area

**Coastal Land Area**

- Uninhabited island
- 500 meters from the land boundary (1,000m in the case of ports, national harbors, and industrial zones)




**Coastal Waters**

- (Seashore) Between the coastline and the boundary of parcels registered in the land registry
- (Ocean) From coastline to the outer limit of the territorial waters

**Project Direction**

National Safety and Welfare + Innovative Growth Engine + Discovering New Industry Resources

**Coastal Characteristics**

**Increase of Coastal Disaster**

Increase in coastal disaster risks due to climate change, rising sea levels, and intensified typhoons

**Industrial Complex & Businesses**

Approximately 28% of businesses in the country are located in coastal aeas, employing around 6.09 million people

**Magnitude of Damages**

Over the past 7 years (from 2012 to 2018), approximately 990 million dollars in losses occurred in coastal areas, which accounted for approximately 56.2% of the total national damages.

(The 3rd Coastal Rehabilitation Basic Plan, Ministry of Oceans and Fisheries, 2020)

(Korea Hydrographic and Oceanographic Agency, 2021)

5

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### Project Purpose

In order to activate the accumulation and distribution of coastal big data,

**Building Self-Sustaining Coast Bigdata Platform and Its Networks**

### Background and Necessity

Data is the core power leading the 4th Industrial Revolution

The intensification of data sovereignty competition calls for urgent strategic responses

Domestically, there is a lack of data-related infrastructure such as data collection, distribution, and utilization

There is a vital need for fostering the data industry, which is essential for economic stimulation and addressing societal issues

Need to promote sector-specific data production, openness, and diversify distribution systems

6

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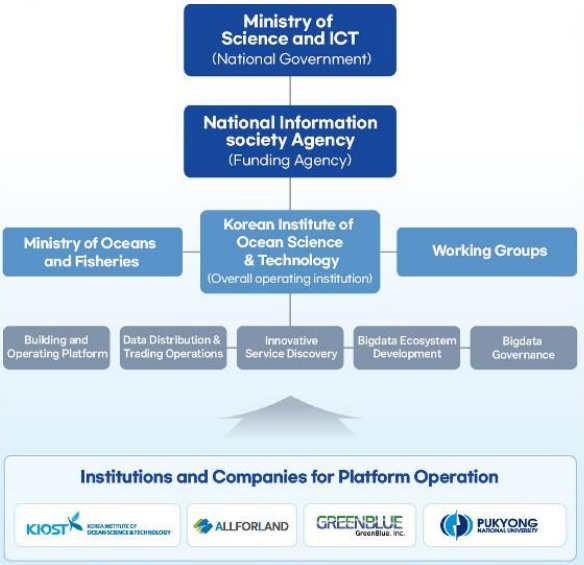
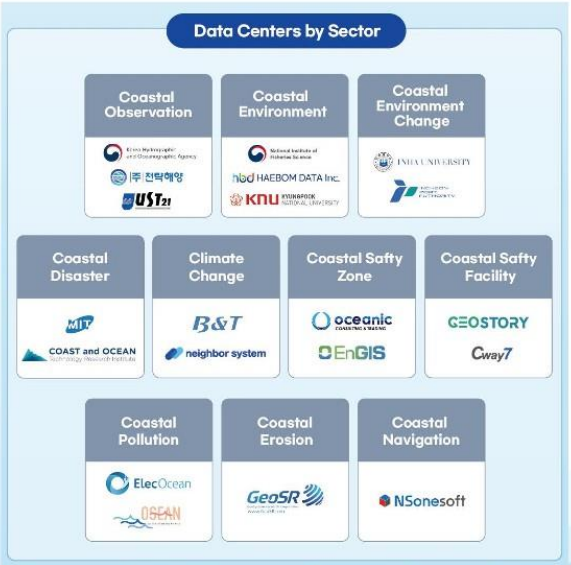
☑ **Optimal Organizational Structure for Successful Execution and Goal Achievement Through Seamless Communication and Collaboration Between Platform and Centers**

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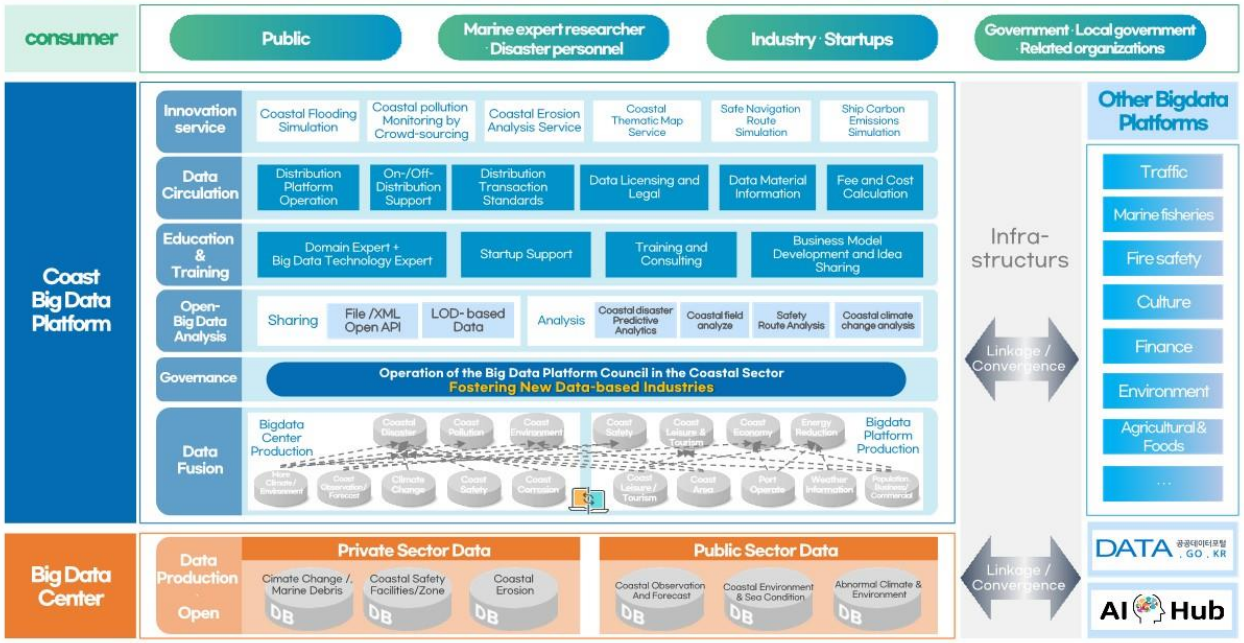

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## Coast Big-Data Platform Webpage


## Data Disclosure Performance by Category ( Up to July 2023 )

| Categories | Number of Types | Data |
|---|---|---|
| Coastal Climate Change | 36 | 269,172 |
| Coastal Safety | 33 | 2,412 |
| Coastal Disaster | 19 | 3,247 |
| Coastal Pollution | 9 | 58 |
| Coastal Environment | 46 | 14,582 |
| Coastal Erosion | 18 | 453 |
| Coastal Operation | 6 | 41 |
| **Entire** | **167** | **289,965** |

***https://www.bigdata-coast.kr***


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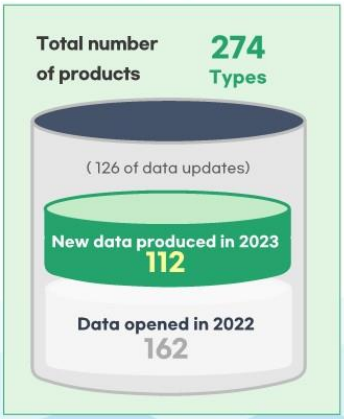
## 2023 Data Disclosure Plan

| Agency | | 2023 Update | 2023 New Production | Number of Types |
|---|---|---|---|---|
| Platform | KIOST | 13 | 0 | 25 |
| | All4Land | 0 | 8 | 0 |
| | GreenBlue | 0 | 0 | 5 |
| Center | KHOA | 22 | 10 | 22 |
| | NIFS | 14 | 8 | 14 |
| | Inha University | 10 | 10 | 10 |
| | Marine Information Technology | 7 | 11 | 10 |
| | BNT | 10 | 10 | 10 |
| | Oceanic | 9 | 14 | 19 |
| | Geostory | 12 | 10 | 12 |
| | ElecOcean | 12 | 15 | 16 |
| | GeoSystem Research | 11 | 10 | 13 |
| | NSONESOFT | 6 | 6 | 6 |
| Sum | | 126 | 112 | 162 |

## 2022 Performance

| Division | Performance | Achievement rate |
|---|---|---|
| Number of New Data Produced ( types ) | 162 | 100% |
| Volume of New Data Produced (GB) | 961 | 100% |

## Coastal big data platform opening plan



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**Data Linkage, Collection and Storage**

Based on Cloud-based and ESB Technology
Establishing Interconnected Environment Between Platform and Center

**Public Centers**

- Korea Institute of Ocean Science and Technology
- National Oceanographic Research Institute
- National Oceanographic Research Institute
- Inha University

**Private Centers**

- Ocean Information Technology Co., Ltd.
- BNTE Co., Ltd.
- Oceonic Co., Ltd.
- GeoStory Co., Ltd
- Elecocean Co., Ltd.
- Geo System Research Co., Ltd.
- NS OneSoft Co., Ltd.

157 species ESB-based Link

**Data Quality and Standard Management System**

Establishing a System for Setting Quality Standards and Applying Systems for Coastal Big Data, as well as Anonymizing Sensitive Information.


Standard and Quality Compliance Rate 100%

**Data Processing and Fusion**

To Turn Raw Data into Marketable Products, Data Processing and Integration Tasks Are Necessary

- Data Cleansing
- Data Fusion
- Custom Data Processing

**Innovation Services**

Establishment of four types of innovative services up to 2023
Related to coastal flooding, pollution, Erosion and etc.


162 Types of Data Disclosure

**Data distribution and transaction system**

Establishing Governance for the Distribution and Trading System, as well as Price Calculation.

Distribution and Trading System
- Customer·Member Management
- Data Search
- Online payment
- Work management system

Distribution Transaction Operation Governance
Pricing system

**Data Analysis and Learning Environment**

Spatial Analysis | Visualization Service | Big Data Analysis


**Cloud Infra**

Naver Cloud Public Service Zone (Cloud Security Certification)

- Security service (WAF, Anti DDOS, IDS/IPS , etc)
- Servers and Storage (WEB, WAS, GIS)
- Save Data (Hadoop, RDBMS , etc)

11

# 2 ◦ Strategies to Promote the Use of Bigdata

바다에서 찾는 국민의 행복, 인류에 공헌하는 해양과학기술

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## Establishment and Activation of Self-Sustaining Big Data Eco-system

### Past Situation (2022)

- Data Integration, Collection, and Storage System Successfully Established
- Data Standardization and Quality Management System Successfully Established
- Establishing a Service Framework for Coast Bigdata Distribution and Transactions
- 162 Data Types Opened in 7 Categories, including Coastal Climate Change
- 5 Types of Integrated Data Produced by Opening the Bigdata Center
- Development of Environment Targeted at General and Expert Users, including Spatial Analysis
- Development of 2 Innovative Services in Coastal Flooding and Coastal Pollution

### Requiring Improvement (2023)

1. Limitations in Providing Online Data Download Services
2. Need for Customized Data to Meet Various Private enterprise Demands
3. Expanding Scope for Integrated Data Provision of Coastal Inland and Seawater Surfaces
4. Discount and Promotion Policies Required to Activate Distribution and Transactions
5. Innovative Services and Best Practices Discovery Needed for Achieving Results
6. Strategies Required for Activating the Platform and Exploring Business Models

### Strategies in 2023

01 **Development of Advanced Distribution System** to Support Customized Data Distribution and On-/Off- Transactions

02 **Recruitment of New Voluntary Data Centers** for One-Stop Data Provision in Coastal Areas

03 **Development of Innovative Services** Based on a Revenue-Generating Business Model

04 **Expansion of Network** to Promote and Activate the Big Data Platform

12

## 2 ◦ Strategies to Promote the Use of Bigdata

바다에서 찾는 국민의 행복, 인류에 공헌하는 해양과학기술

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### Development of Voluntary Data Center Management Functionality

**Application to Join**

Voluntary Data Center — Center Registration

Company, Research Institution → Information Input

**Review of Data Center and Products**

- Data Similarity, Redundancy, and Uniqueness Review
- Data Quality, Copyright, and Marketability Assessment

**Standards and Quality Management**

SMETA SDQ

**Data Load and Sales**

Data Registration → Data Product Sales

### Development of Customized Trade Support Functionality

Customized Product Request → Customized Product Bidding

**Customized Product Creation and Registration**

| Data Manufacturing | Data Quality Control | Custom Product Registration |
|---|---|---|
| Refining | SMETA SDQ | |
| Processing | | |
| Custom Processing | | |

Customized Product Distribution → Customized Product Sales Management

13

## 2 ◦ Strategies to Promote the Use of Bigdata

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### Cloud-based Data Analysis and Machine Learning

Supporting Automated ML Data Analysis using **AutoML**

AutoML Use Plan Request

Review and Approval by Platform

AutoML Log-in

ML Analysis and Prediction

Use in Businesses

**AutoML Service Use**

Submit a Service Application with the Specified Usage Period and Details

Approval details for your application can be checked under My Page > Analysis Service Application

### Data Product Distribution Boosting Functionality

Discounting for Promotions, Coupon Issuance
**Advancement of Distribution Functionality**

**Applying discount and coupons to boost transactions**

e.g. Example of Discount Application

- Provider/Product Disc.
- Disc. By Promotion Period
- Disc. Prev. Year's Data Sets

e.g. Example of Coupon Management

- Voucher For Free Purchase
- 10% Disc. Coupon
- 2,000KRW Disc. Coupon

- **Development of Disc./Coupon Policies and Service Functionality**
- **Enabling Paid Data Product Transactions**

14

## 2 ◦ Strategies to Promote the Use of Bigdata

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### Activities to Foster the Coastal Big Data Ecosystem through Data Utilization Support and Expert Workforce Development

**Consulting and Technical Support**

- Internal and External Big Data Expert Pool Development and Technical Support for Achieving Results
- Setup and Management of a Big Data Environment Where Innovative Ideas are Transformed into Tangible Results

**Sharing Big Data Utilization Technologies and Success Stories**

- Operation of an Online Communication Space for Technical and Business Knowledge Sharing among Big Data Platform, Centers, Demand Companies, and Experts
- Implementation of a One-on-One Matching System between Demand Companies and Expert Professionals, Facilitating Outcome-Linked Mentorship

**Development of Expert Workforce for Activating Big Data Business**

- Development of Educational Programs and Content based on Big Data Trends and Coastal Big Data Platform Services and Data
- 2023 Education Catalog:
  Coastal Data Analysis and Artificial Intelligence Education,
  Coastal Big Data Resource Utilization Education,
  Cultivation of Coastal Data Research Personnel Using Python

**Discovery of Demand Organizations/Companies and Development of New Business Models and Products**

- Development of New Business Models and Products Through the Discovery of Demand Organizations/Companies and Support for Data Sharing and Utilization
- Conducting In-depth Demand Research Based on Focus Group Interviews (FGI) Targeting Potential Real Demand Users

**Optimized Data Utilization and Technical Support for Customized Purposes**

15

## 2 ◦ Strategies to Promote the Use of Bigdata

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### Coast Bigdata Platform Exemplary Case Discovery/Dissemination Process

**Exemplary Case Discovery/Dissemination Framework**

Demand Analysis → Industry-Specific Utilization Analysis → Exemplary Case Identification → Exemplary Case Dissemination → Performance Monitoring

**Development of Exemplary Use Cases**

Industry-Specific Utilization Analysis Model (Example)

| | |
|---|---|
| Marine Information Services Industry | Analysis of Pollution Sources and Water Quality Change Prediction Scenarios |
| Smart Shipbuilding Industry | Autonomous Route Recommendations for Carbon Emission Reduction |

Procedure for Developing Analytical Models

- Definition of Analytical Objectives
- Data Planning and Preparation
- Data Analysis
- Formulation of Application Strategies

**Dissemination Strategy**

Promotion of Coast Big Data Platform and Integrated Data Map

[Coast Big-Data Platform Use Case Page]

Identification of Demand Companies through Data Voucher Support Program

K data

Data Voucher Support Program

Expansion Through the NIA Big Data Platform Consortium, BigSquare Union


16

## 2 ◦ Strategies to Promote the Use of Bigdata

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☑ Coast Bigdata Platform Major Clients and Applications


17

## 3 ◦ Innovation Services in the CBP

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**Innovate = In + nov(new) + ate**

**Coast Bigdata Platform**

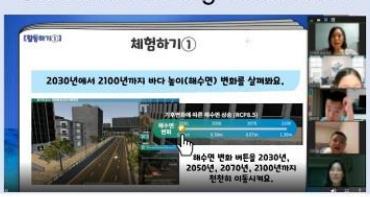
Providing an analysis dataset for **storm and tsunami observatory**


**Innovation Service**

Development of a 3D simulator for coastal flooding **"City in Crisis"**

**Value Creation**

Creation and Sale of **Climate Change Environmental Education Content** Utilizing Simulators




**Realizing Social and Economic Value through the Provision of Bigdata Based Services**

## Development Completed : Two Types in 2022

### City in Crisis
Coastal City Flooding Simulator for Climate Change

### The day of Beach Care
Coastal Revitalization Activity Community Based on Crowd Sourcing


## Development in Progress: Two Types in 2023

### Coast ON
Multifaceted Coastal Erosion Analysis Services

### Coast Big-Map
Coastal Bigdata Thematic Mapping Service




3 ◦ Innovation Services in the CBP
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# Coastal Erosion is an Issue that Requires Continuous Management and Response

## A Growing Concern: Coastal Erosion on the Rise

### The Escalating Coastal Erosion

The Escalating Severity of Coastal Erosion Due to Climate Change-Induced Sea Level Rise, High Waves, and Changes in Ocean Currents

Including Haeundae, Busan, 43 Areas Classified as 'Severe'
(Based on the 2021 Coastal Erosion Survey


**부산 지역 연안 침식 실태**

자료: 해양수산부

| | 공사 완료 | 지난해 (2020년) | |
|---|---|---|---|
| 임랑 | 18년 C등급 | C등급 | 유지 |
| 일광 | 12년 B등급 | C등급 | 하락 |
| 해운대 | 17년 B등급 | D등급 | 하락 |
| 광안리 | 17년 B등급 | C등급 | 하락 |
| 영도 중리 | 20년 B등급 | B등급 | 유지 |
| 영도 감지 | 17년 B등급 | B등급 | 유지 |
| 송도 | 15년 A등급 | B등급 | 하락 |
| 다대포 | 19년 C등급 | C등급 | 유지 |

## Digital Transformation of Coastal Erosion Management

Implementation of Pre- and Post-Coastal Erosion Management and Pre-Damage Prevention System


Interview with Companies Related to Coastal Erosion

Coastal erosion management can only be verified in the form of reports, causing operational inconvenience


05.18 Meeting with Local Government in Gyeongbuk (Consultation with Coastal Management Authorities)

## Insights from Coastal Management Officials Responsible for Coastal Erosion Task

"The current management is solely **report-based**, which makes it time-consuming to retrieve past reports when issues arise. I'd also like to have access to information on factors affecting coastal erosion, such as **typhoons and storms**."

"I'd like to **check erosion-related complaints immediately** and **record information or opinions** about related issues."

"The **handover process encounters problems** every time there's a change in the responsible party."





## Creating Service Information Based on Coastal Erosion Bigdata and Project Deliverables

### Coastal Erosion Bigdata

(Utilizing Geo-System Research(Ltd.) Center's Data)

- Coastal Erosion Classification
- Video Monitoring of Coastal Erosion
- Video Monitoring for Erosion Area
- Coastal Beach Sectional Area by Baseline
- Coastal Beach Inlet Width by Baseline
- Video Monitoring
- Coastal Beach Erosion Images

+

### Related Additional Data

(Disaster Information and Reports)

- Coastal Erosion Survey Project Report
- Coastal Erosion Survey Spatial Information
- Coastal Erosion Survey Field Photographs
- Press Release on Coastal Erosion
- Coastal Disaster Information (Typhoons, Heavy Rainfalls, Tsunamis, etc.)
- Coastal Erosion Response Facilities and Construction
- ⋮

## 3 ◦ Innovation Services in the CBP

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### Efficient Service Needed for Analyzing and Managing Coastal Erosion-Related Information

**Coastal Erosion History Data**

Providing Coastal Erosion History Data

- Coastal Erosion Detailed Information
- Coastal Disaster Information
- Project Progress History Information

**Encouraging Participation**

Regional Usage Frequency Ranking

**Comparison & Analysis**

Yearly/Regional Coastal Erosion Information Comparison

**Issuing PDF Report**

Providing Coastal Erosion Detailed Information in Report

- Paid Service Version

**Issue Analysis**

Providing Headline and Issue Keyword Analysis

**User Bulletin Board**

User Business Support

- Field Photographs, Attached Reports, and Other Notes for User Task Execution
- Recording and Sharing Yearly-Related Information in User Accounts

23

## 3 ◦ Innovation Services in the CBP

바다에서 찾는 국민의 행복, 인류에 공헌하는 해양과학기술

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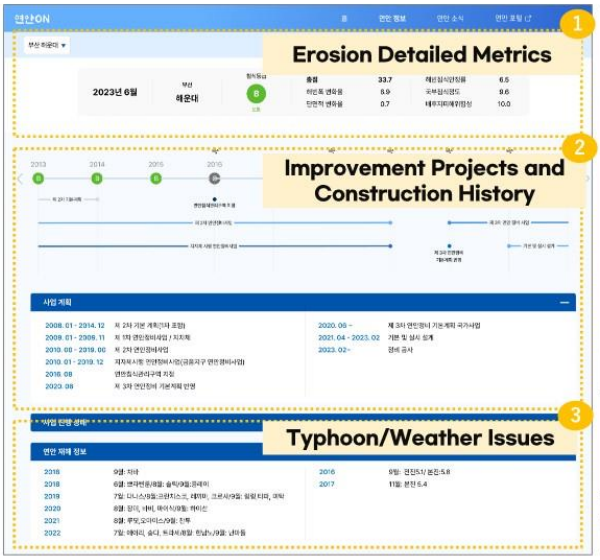
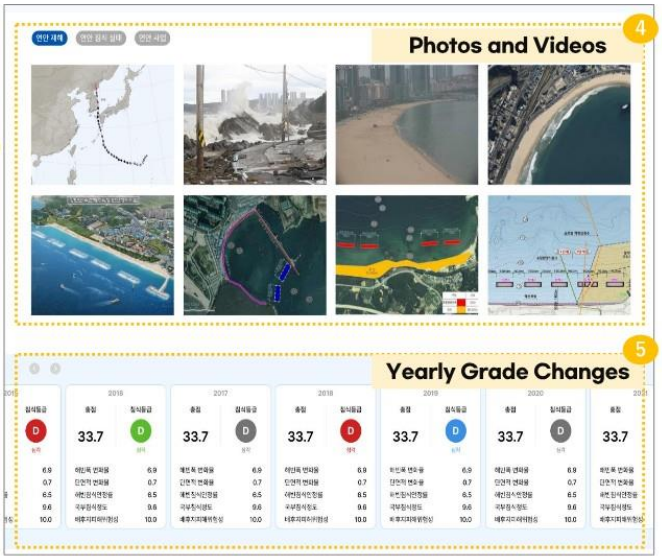
### A Service for Integrated Provision of Coastal Erosion-Related Issues and Information


24

## Report-Style Coastal Erosion Detailed Pages and PDF Issuance

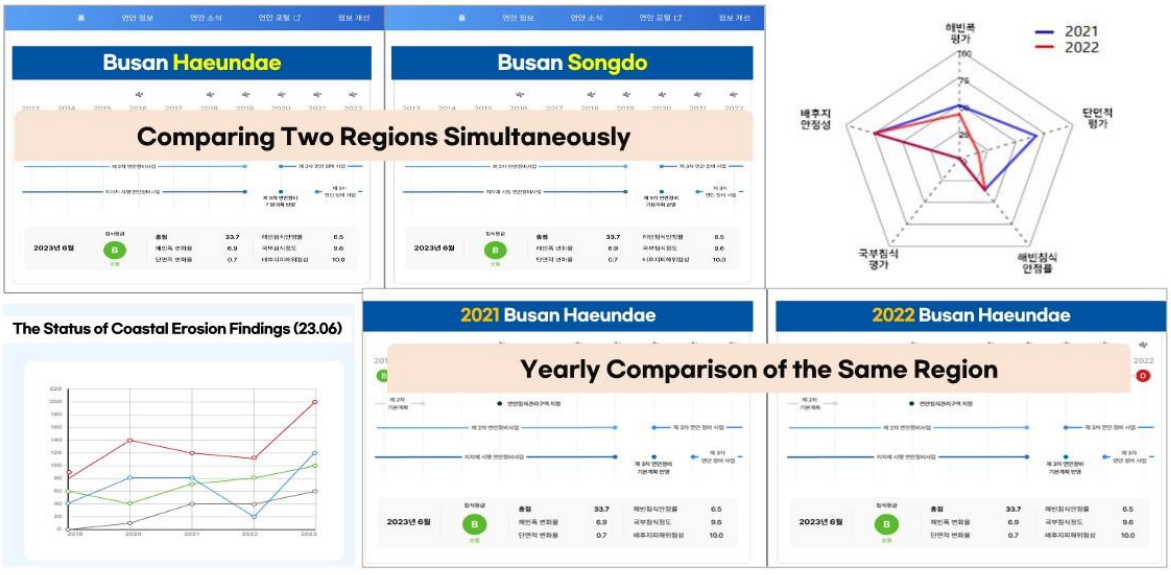


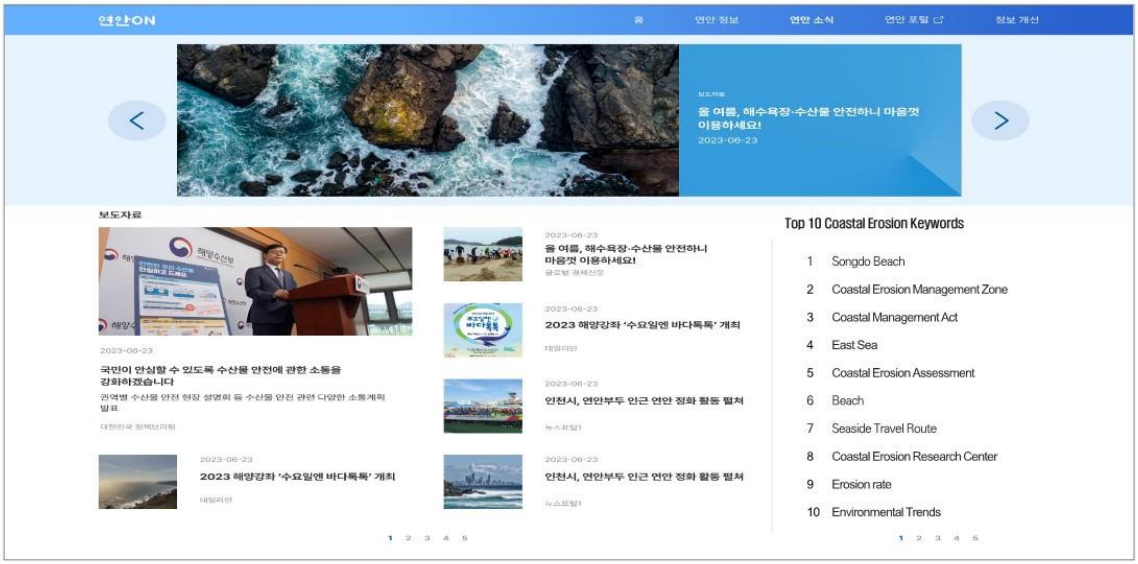





## Comparative Analysis of Coastal Erosion Information by Region and Year



## Provide Relevant Press Releases on Coastal Erosion for Real-time Issue Monitoring








## Providing Premium Account Users with Datum line Detailed Information and User Discussion Board Features

### Search Detailed Datum Line

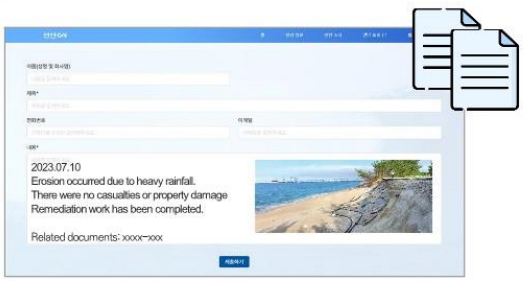
#### Area by Datum Line and Shoreline Width

- Provision of Information by Datum Line Number, Including Shoreline Width, Cross-Sectional Area, Shoreline Erosion Stability Rate, Local Erosion Degree, and Hinterland Damage Risk


### User Board (Only for Official)

#### Function to Record and Share User Opinions

- Providing a Bulletin Board Function for Users to Record Needed Information, Reports, Field Photos, and Other Feedback
- Shareable within the same account users



## Key Function of Coast ON Service by Pricing Tier

### CoastON

**1. Search Coastal Erosion History**

- Check annual coastal erosion grade changes, history information, weather and disaster information

**2. Provide Detailed Page Report (Temporary)**

- View detailed page REPORT
- Provide detailed page REPORT PDF
  (Basic issuance cost incurred per case)

**3. Compare Region & Year Information (Temporary)**

- Selecting Two Regions for Information Comparison
- Comparing Information for Two Different Years in the Same Region

### CoastON Premium

**1. Search Coastal Erosion History**

- Search into Annual Changes in Coastal Erosion Ratings, Historical Information, Weather, and Disaster Data

**2. Provide Detailed Page REPORT (Unlimited)**

- View detailed page REPORT
- Provide detailed page REPORT PDF (Unlimited)

**3. Compare Region & Year Information**

- Selecting Two Regions for Information Comparison
- Comparing Information for Two Different Years in the Same Region

**4. Search Datum Line- Specific**

- Search Datum Line-Specific Details by Category: Shoreline Width, Cross-Sectional Area, Erosion Stability Rate, Erosion Degree, etc.

**5. User Board**

- Recording and Sharing through User Board





## Data Provision Remains Supplier-Centric, but Purposes have Diversified,

### Diversification of Coastal Utilization Range

**Diversification of Coastal Activities and Industries**

Broadening and diversification of coastal usage result in specialized regulations and industries, leading to a wider array of purposes and methods for utilizing coastal data


Coastal Leisure


Marine Healing


Marine Debris


Coastal Safety Management


Coastal Flooding

Coastal tourism, leisure, ocean healing, coastal ecosystem, coastal erosion, coastal trash, blue carbon, disasters, coastal safety, climate change, etc.

### Demand for User-Centric Curation Services

**Provider-Centric Data Provision Poses Utilization Challenges**

Non-coastal and marine professionals may face difficulties in comprehending data nomenclature, detailed information, and usage methods


**Offering Curation Services to Assist User Utilization**

To provide users with tailored information amid the vast sea of data, offer curated map services


KAKAO theme map service

NAVER theme map service

## Selecting Data Suitable for Coastal Disaster Themes and Assembling into Package

Coast Bigdata Platform
162 types of first year open data

Coastal Hazard Zone | Sand Dune Migration Information
Erosion Rating by Location | Estuarine Marine Environment | Freshwater Inflow
Typhoon | Hypoxia water mass | Vessel Traffic data
Wave spatial | Transport of Suspended Sediments | Average Wave Period
Sea surface wind | Undersea topography | El Nino/La Nina
Tidal wave monitoring | High temperature | Dipole Mode Index
Tsunami | V-pass data | Video monitoring
Tidal currents | Ship operation data | Shoreline area
High-temperature occurrence frequency | Estuarine Depositional Environment
Low salinity | 3D Terrain Information | Shoreline width
Virtual coastal city | Low temperature | Datum Line-specific Cross-Sectional Area
Datum Line-specific particle size | Anomaly | Significant wave

**Coastal Disaster Themes**
(Examples)

- Coastal Hazard Zone
- National Coastal Erosion Rating by Location
- Coastal Hazard Zone Sea Level Rise Rate
- Coastal Hazard Zone Storm Tidal Wave
- High Temperature Forecast Data
- Tidal Wave Occurrence Wave Environment
- Coastal Hazard Zone Steep Slope





## Fostering Data Utilization and Business Growth by Offering Thematic Coastal Maps Customized to User Interests and Purposes

### Coastal Theme

**Coastal Big Data Thematic Map**

- Selection of Coastal Theme Topics Considering User Interests and Utilization Purposes

Coastal Disasters | Coastal Tourism | Coastal Energy

### Data Curator

**Data Composition by Theme**

- Selection and Packaging of Data Relevant to the Theme
- In 2023, the creation and production of a single type of 'Coastal Disaster' thematic map
- Review of climate change, coastal environment, and coastal safety

### Background Map

**Utilizing Background Maps for Data Integration**

- Utilized as background maps in various sectors such as disasters, ports, tourism, and leisure
- Enhancing and expanding services by combining user data with thematic maps, allowing for customization to meet user needs

### Map-Based Visualization

**View Coastal Theme Data on Map-Based Platform**

- Visualize packaged data on a map-based platform
- Providing a viewer that allows data inspection without the need for data downloads
- Supports various formats such as NetCDF, CSV, and SHP

### API Service

**Theme Map API**

- Offering a data package structured as thematic maps of coastal disasters through an API

### Enhanced Accessibility

**Role of Priming Water**

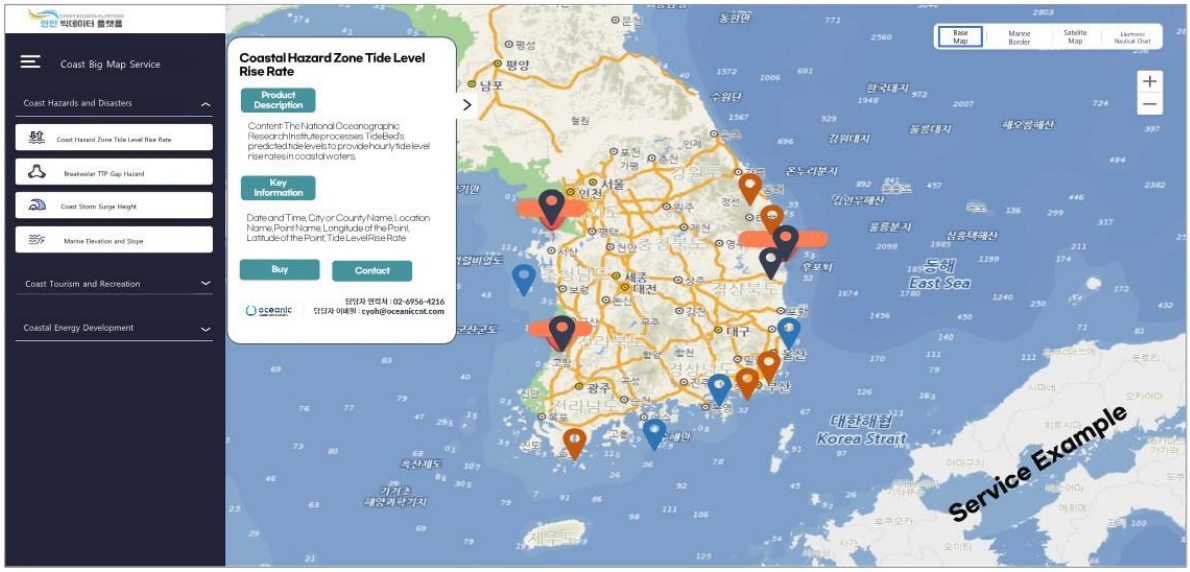
- Role of priming water for enhancing accessibility and building a business model through thematic maps

## Offering Curated Data Tailored to Users through Themed Package Composition

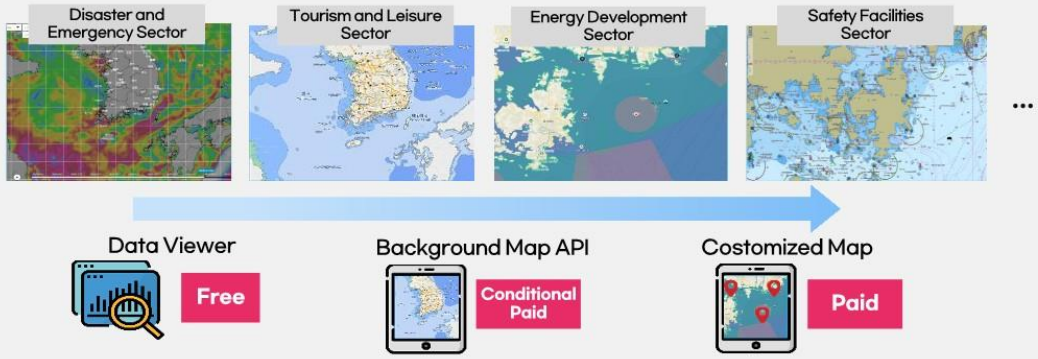





## Configuration of Coast Disaster and Hazard Data Package and Map-Based Visualization



## Expansion of Customized Theme Map Production and Provision of Free/Paid Services by Tiers

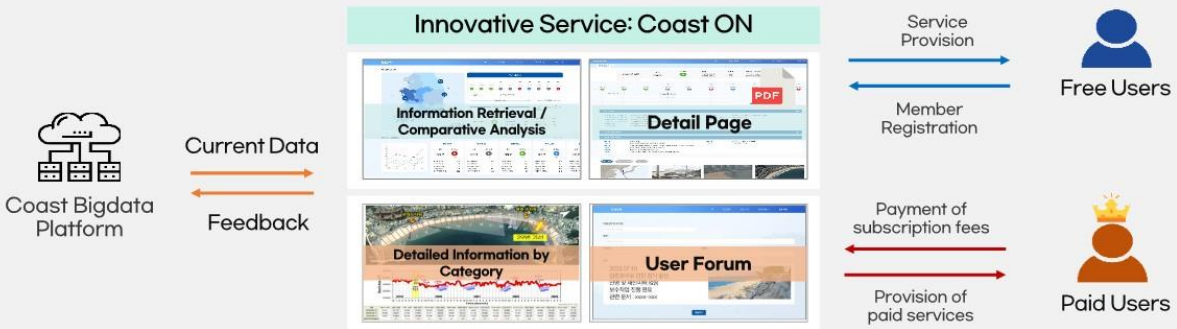



- [Free] Data Viewer : Viewer Provided as a Data Visualization Service for Configuring Theme Maps.
- [Conditional Paid] : Offering Background Map API Service Based on Theme Map Data
  (Non-commercial Use: Free, Commercial Use: Paid)
- [Paid] Customized User Maps: Support for Creating Customized User Maps by Combining User Data.

35



## Selling subscription-based services to coastal management local governments and expanding service coverage nationwide




- Service provided through organization-specific account issuance, with an annual subscription fee of 3 million won per account (example).
- Expanding nationwide services targeting 74 coastal management local governments to increase revenue.
  283 coastal business zones in 11 metropolitan cities and provinces nationwide (coastal conservation and eco-friendly coastal projects).
- Upon request, building a database using local government data and developing additional support functions (separately costed).

36

## 3 ◦ Innovation Services in the CBP

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**Comprised of Free services for Non-Commercial purposes and Paid services for Commercial purposes.**


- Offering theme maps for free, with partial paid services applied when users require custom environments and data integration.
- Providing temporary free access to the service to offer users an experience, and then encouraging them to switch to paid services.

37

## 4 ◦ Future Plans for Self-Sustainability

바다에서 찾는 국민의 행복, 인류에 공헌하는 해양과학기술

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**Innovation Service's Strategy of Expanded Scope and Multifaceted Expansion**


**Promoting the Utilization and Sale of Data and Establishing a Business Model with Institutions/Companies**

38

## 4 ◦ Future Plans for Self-Sustainability

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COAST BIGDATA PLATFORM
연안 빅데이터 플랫폼

### 2022 Establishment

- Collect data, perform analysis
- Establishment of distribution service to create data open environment with platform and center
- Configuration of big data environment

### 2023 Advancement

- Enhancement of distribution functions, including customized products and attracting voluntary data center
- Enhancement of data analysis capabilities
- Development of innovative services based on a business model
- Discovery of outstanding coastal bigdata utilization cases

### 2024 Activation

- Coming up with the foundation for service expansion and continuous operation
- Securing a foundation for self-sustainability by preparing new services and acquiring multiple distribution channels
- Expanding services through multiple distribution channels by increasing the number of demand companies

### After 2025 Self-Sustainability

- Establishing a coastal big data market and promoting demand from organizations
- Diversification of services, including the introduction of new services, provision of customized data, and consulting products
- Enhancing self-sustainability through policy support

Diversifying Revenue/Income Structure and Enhancing Stability in Coastal Big Data Platform

39

6th Symposium | Seoul, South Korea | OCT 31 ~ NOV 2, 2023

GEO BLUE PLANET

# Thank You.

**Contact:**
cylee82@kiost.ac.kr

# Appedix. Configuration of Data Centers in CBP

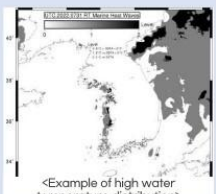
## Center 1 - Korea Hydrographic and Oceanographic Agency

Korea Hydrographic and Oceanographic Agency

KEY Data : Oceanographic observation · Ocean forecast and research · GOCI-II

### Abnormal Water Temperature

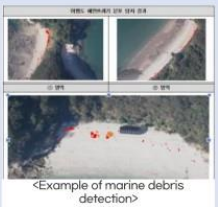
Daily distribution data of low/high water temperature using KHOA's SST(synthesis field data)



<Example of high water temperature distribution>

### Marine Debris

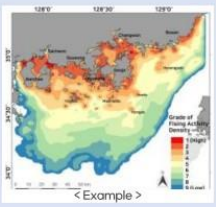
Distribution of marine debris on unmanned islands using a machine learning model based on high-resolution optical satellites



<Example of marine debris detection>

### Coastal safety

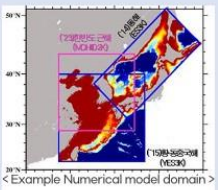
Density data based on the distribution of marine space using multi-satellite-based ship extraction data



< Example >

### Ocean forecast information

Statistical data on tidal current and water temperature prediction



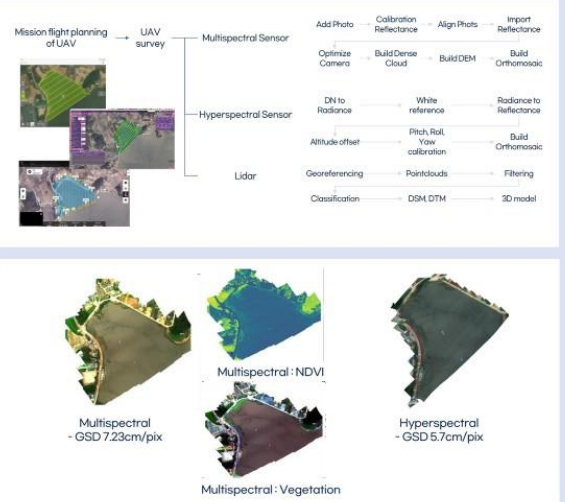
< Example Numerical model domain >

# Center 2 - National Institute of Fisheries Science

National Institute of Fisheries Science

Key Data : Real-time fishing environment data in coastal waters, Fishery disaster monitoring, coastal observation with UUV, Hyperspectral survey data with UAV

## UAV Survey Data _Haebomdata Inc.





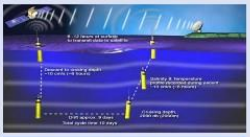





## Quality Control Processed data _KYUNGPOOK National University

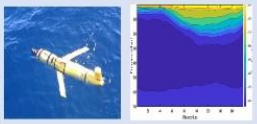
### Argo float data set

Delayed mode quality control processing data for temperature and salinity

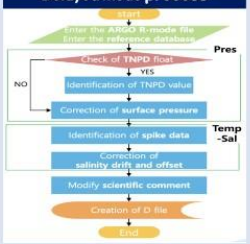


### Underwater Glider sound velocity structure data set

Data obtained from underwater gliders are analyzed and processed into sound velocity structures

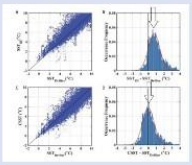


### Delayed mode process




### OISST data set

Data using East Sea Argo float data to correct deflection



# Center 3 - Inha University

INHA UNIVERSITY

Key data : costal ocean in-situ monitoring & numerical model data set

**Assessment of coastal environmental change**
(Coast and harbor sedimentation, freshwater influence, artificial discharge etc.)

## Core data set 1
Costal ocean in-situ monitoring data

### Hydrodynamics monitoring

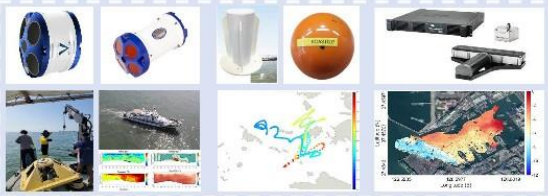
TRBM system & Bottom tracking observation

### Buoy tracking

GPS with temperature buoy observation

### Seabed mapping

Multibeam sonar observation



## Core data set 2
Numerical model-based secondary processed data

### FVCOM (Hydrodynamics)

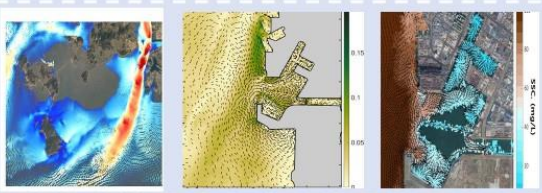
Water level, Tide current, temperature, salinity etc.

### SWAN (Wave analysis)

Wind, significant wave height, wave direction etc.

### CSTMS (Sediment analysis)

Seabed variation, suspended sediment flux etc.



**Coastal data farm develop and coastal ocean issue response**

# Center 4 - Marine Information Technology Corp

**Coastal Disaster Section**

- Organization Name : (Lead Organ.) Marine Information Technology Corp
  (Participating Organ.) Coast and Ocean Technology Research Institute
- Center Introduction: Big Data Analysis and Information Provision for Coast Risk Assessment
- Key Data : Tsunami, Surge, Ocean Wind, Wave, Overtopping, Typhoon

## Key Business Areas

- Numerical modeling of ocean currents, sediment transport, Suspended Sediment Dispersion, and seawater exchange rates.
- Numerical modeling of wave transformation and tranquility.
- Modeling and coastal structural risk assessment for storm surges and tsunami events.
- Evaluation of marine renewable energy and assessment of power plant recycling.
- Development of ocean prediction systems, coastal disaster prevention systems, and marine artificial intelligence models.
- Development of image data analysis technologies, marine big data analysis, artificial intelligence learning data, and software development.

## Roles of Each Implementing Organ

(주)해양정보기술 Marine Information Technology Corp

- Building of Sea Surface Wind and Sea Level Data
- Building of Tsunami and Surge Data
- Building of Overtopping Monitoring Data
- Building of Wave and Wave Environmental Analysis Data
- Building of Typhoon Information Data

COAST and OCEAN Technology Research Institute

- Building of Wave observation Data
- Building of Wave Environmental Analysis Data
- Building of Typhoon Information Data

# Center 4 - Marine Information Technology Corp

## List of Key Data

### 1 Sea Surface Wind Dataset

- 5km Spatial Resolution Long-Term Sea Surface Wind Dataset
- Frequency-Based Sea Surface Wind for Coastal Meteorological Stations on the West, South, and East Coasts Dataset
- Frequency-Based Sea Surface Wind with 5km Spatial Resolution for the North, South, and East Seas on Hindcast Data Dataset

### 2 Tsunami Dataset

- Hypothetical Tsunamis on the East Coast Dataset

### 3 Surge Dataset

- Tidal observations Storm Surge Analysis Dataset
- Storm Surge by Scenario Dataset
- Storm Surge Hindcast based Asymmetric Typhoon Characteristics Dataset
- Frequency-Based Coastal Tide Level Dataset with Intervals of 1km for the West, South, and East Coasts

### 4 Sea Level Dataset

- Frequency-Based Sea Level for Tidal observations on West, South, and East Coasts Dataset

Ocean Observation Equipment | ANN(Artificial Neural Network) | Numerical Prediction Model

**Generating Data for Coastal Disaster Response through Hindcast, Analysis, Prediction, and Detection**

### 5 Overtopping Monitoring Dataset

- CCTV-Based Wave Monitoring Dataset
- Wave Environment Analysis on Overtopping Dataset

### 6 Wave Dataset

- Offshore and Coastal Wave Observation Dataset
- Offshore and Coastal Frequency-Based Wave Dataset
- Storm Wave byScenario Dataset

### 7 Wave Environmental Analysis Dataset

- Long-Term wave Hindcast Over Korean Peninsular Dataset
- High Wave Event Dataset by Ports
- Coastal Wave Risk Index Dataset
- Wave Energy Distribution Over Korean Peninsular Dataset
- Wave energy Resources Over Korean Peninsular Dataset
- Wave Power Resources Analysis Over Korean Peninsular Dataset

### 8 Typhoon Information Dataset

- Typhoon Statistical Analysis by Ports Dataset
- Non-Typhoon Statistical Analysis Dataset
- Future Typhoon Information Considering Climate Change Dataset

## Center 5 - BNT Inc. & Neighbor System Inc.

B&T

### Key Data : Satellite-based Sea Surface Temperature(SST) Analysis Data

**Long-term SST data From 10 OverseasOrganizations**

Australian Government Bureau of Meteorology

National Centers for Environmental Information

Remote Sensing Systems

Met Office

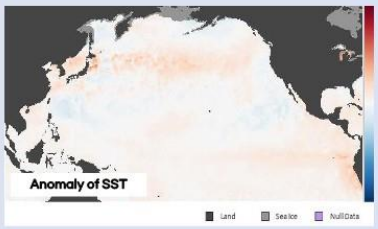
Canadian Meteorological Centre

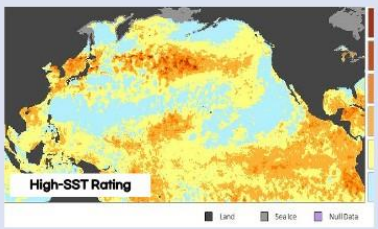
Danish Meteorological Institute (DMI)

NOAA OFFICE OF SATELLITE AND PRODUCT OPERATIONS

Jet Propulsion Laboratory California Institute of Technology | podaac Physical Oceanography Distributed Active Archive Center

**Anomaly analysis of SST based on 30-year average**




**55,614 cases to be produced as of the end of 2023**

| No. | Data Name | Qty |
|---|---|---|
| 1 | AVHRR OISST | 4,774 |
| 2 | CMC SST (0.1) | 3,193 |
| 3 | DMI OISST | 4,163 |
| 4 | GAMSSA SST | 5,902 |
| 5 | NAVO K10 SST | 2,181 |
| 6 | MUR SST (0.25) | 8,059 |
| 7 | MW IR OISST | 9,430 |
| 8 | MW OISST | 8,152 |
| 9 | OSPO SST | 3,737 |
| 10 | OSTIA SST | 6,023 |
| | Total | 55,614 |

## Center 6 - Oceanic

oceanic CONSULTING & TRADING

### Data to reduce the occurrence of casualties in coastal area

mudflat drowning | rock·port falling | breakwater falling | Water level rise

### Key Data

**1 Coastal digital elevation model(DEM) data**

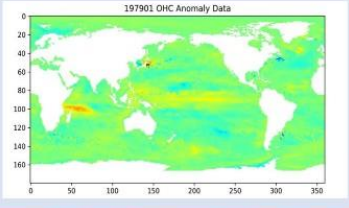
- High resolution(0.1m) aerial survey data captured by drone
- Produce highly accurate data through installation of GCP and GPS-RTK field surveying
- Data is produced for areas where coastal safety accidents have occurred or where there is a high risk of safety accidents.


**2 TTP(Tetrapod) orthophoto analysis data**

- Risk Assessment through Unsupervised Classification and Grading using drone imagery
- Risk level is determined based on a five-grade classification, taking into account the area ratio of gaps between tetrapods within a 1x1m grid area.


**3 Reanalysis Ocean heat content(OHC) data**

- 3 New and updated reanalysis OHC production and construction
- Obtained OHC data provided by CMCC
- Obtained OHC renewal data provided by ECMWF
- Production of 30-year climate average, anomaly and spatial distribution of OHC data



## Center 7 - GeoStory

GEOSTORY

### Key Data : Coastal Erosion Monitoring using LIDAR , Underwater Facilities

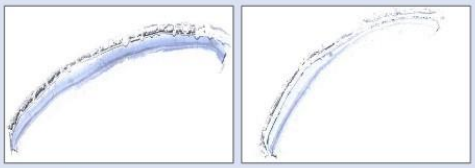
**3 types of Mooring facilities Dataset**

Berth facility | Floating Mooring facility | Yacht Mooring facilities

- Installation of mooring facilities due to the shallow depth of water causing a lot of stranding
- Providing shortest-distance mooring facilities
- Use it as data for various institutions
- Equipped with ship GPS plotter and fishing application

**6 types of coastal erosion Dataset**

- Survey are conducted on 6 places with D grade coastal erosion (2times)
- Survey using LIDAR and process the data (*.txt)
- Supporting coastal erosion policies and research



## Center 7 - GeoStory

Cway7

### Key Data : Underwater Facilities , Red Tide Statistical Data by GOCI-II

**2022~**


Offshore Wind Turbine | Submarine Cable | Submarine Pipeline

- Plan to achieve 25% of renewable energy generation by 2030
- More than 90% of new facilities will be supplied with clean energy such as wind power and solar power.
- Underwater facilities are difficult to detect, so damage occurs mainly during anchoring or trawl fishing.
- Information on about 900 underwater facilities

**2023**

Low Sea Surface Salinity | Red Tide Index | Chlorophyll-a Concentration

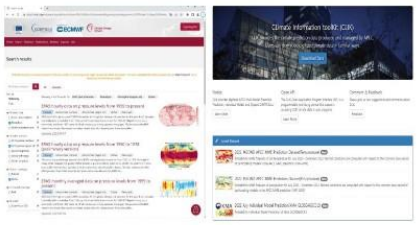
- Red tide causes enormous property damage to coastal fisheries.
- Collect Red tide-related products observed with GOCI-II (2022-2023)
- Production of daily statistical data by 30"x30" grid
- Partial opening of Q1-3 2022 data

# Center 8 - ElecOcean

Key data: Marine Wind(ERA5 reanalysis, climate average),
Marine Debris(high-risk marine debris that affects ship navigation and the marine environment.)

## Marine Wind Climate Averages

- Marine Wind Climate Average Data
  - Elecocean Co., Ltd. specializes in building systems that utilize various data in the marine and environmental fields and possesses technologies in various linkages such as collecting and processing core data
  - Through Copernicus CDS (Climate Data Store), we collect and process ERA5 reanalysis data to produce and secure core marine wind data



<Obtaining Marine Wind Climate Average Data>

## Marine Debris

- Marine Debris Data
  - The Our Sea of East Asia Network (OSEAN) provides marine litter data on quantitative changes and spatial distribution of items through beach litter monitoring surveys over the past 15 years.

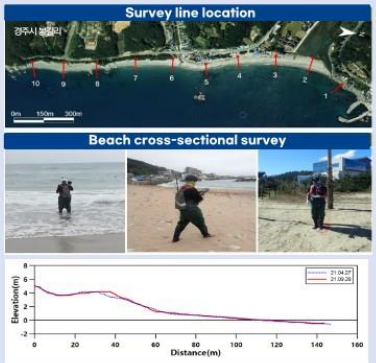

<Beach Litter Monitoring Survey Data>

# Center 9 - GeoSystem Research

Key Data: Coastal erosion (beach area, sediments, erosion grade, etc.), Ocean (circulation, wave) reanalysis, Typhoon/Strom surge data

## Line Dataset

Line data of beach, section, particle size, facility, etc., at 360 places (3 new + 5 updated = 8 types produced)

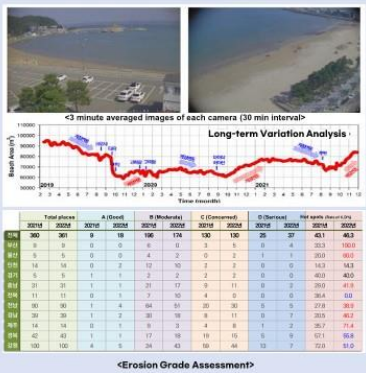



<Beach width and cross-sectional area of each line>

- Line Dataset: 3 new and 5 updated data types produced

## Video Monitoring and Erosion Grade Data

Sandy beach videos/beach width/erosion grade at 40 places (2 new + 4 updated = 6 types produced)



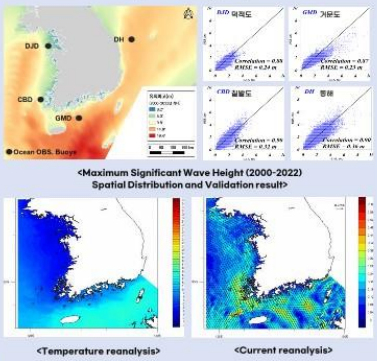

<3 minute averaged images of each camera (30 min interval)>

<Erosion Grade Assessment>

- Video Monitoring: 1 new and 4 updated data types produced
- Erosion·Deposition analysis result: 1 new data type produced

## Storm Surge/Wave/Ocean Reanalysis Data

Major factors affecting coastal erosion:
Strom Surge/Wave/Ocean Reanalysis data
(5 new + 2 updated = 7 types produced)



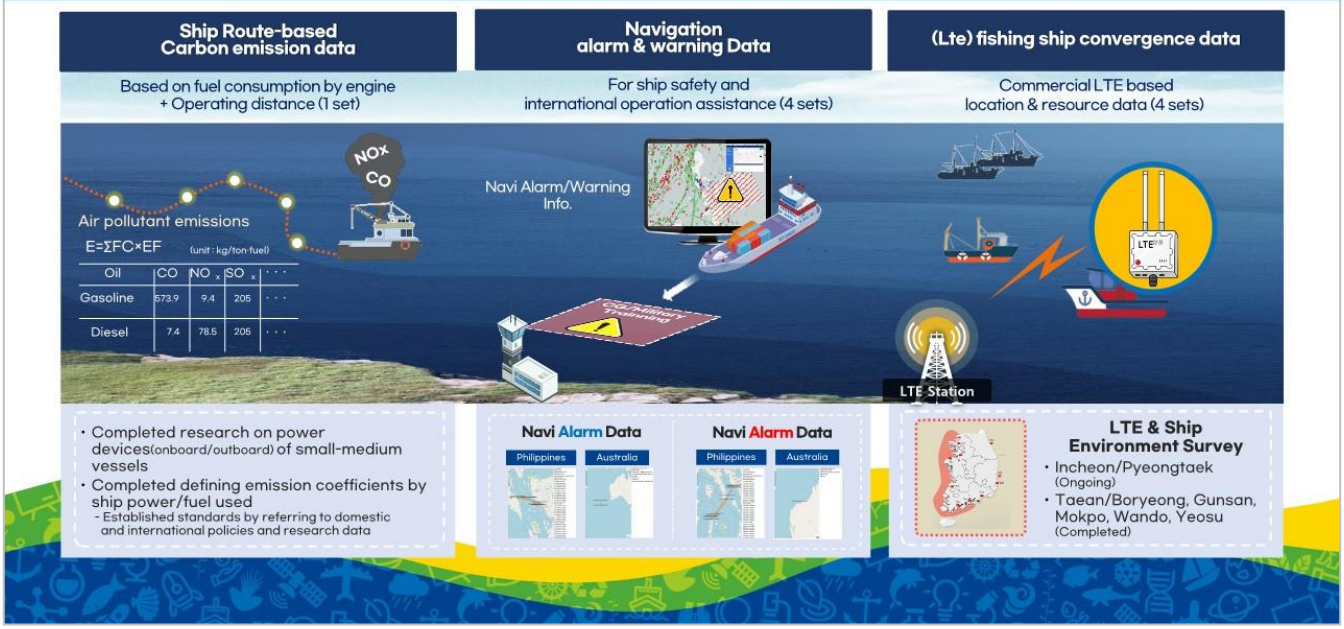

<Maximum Significant Wave Height (2000-2022)
Spatial Distribution and Validation result>

<Temperature reanalysis> <Current reanalysis>

- Coastal disaster data: 2 updated data types produced
- Statistical analysis and ocean reanalysis: 5 new data types produced

# Center 10 - NSONESOFT

Key Data: Ship Operation Data, Ship Navigation Data, Ship Convergence Data, Fishing-ship Location & Resource Data




- Completed research on power devices(onboard/outboard) of small-medium vessels
- Completed defining emission coefficients by ship power/fuel used
  - Established standards by referring to domestic and international policies and research data

**Navi Alarm Data**

Philippines | Australia

**Navi Alarm Data**

Philippines | Australia



**LTE & Ship Environment Survey**

- Incheon/Pyeongtaek (Ongoing)
- Taean/Boryeong, Gunsan, Mokpo, Wando, Yeosu (Completed)

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# The development of Electronic Monitoring in the western and central Pacific

**Leontine Baje and Malo Hosken**

Fisheries Ecosystems Monitoring and Analysis
Oceanic Fisheries Program
Pacific Community

## Outline

- What data is needed
- What is electronic monitoring
- Why electronic monitoring is important
- Progress and outcome of trials
- Advantages and challenges
- Progress towards implementation
- Summary

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Solomon Islands Senior Observer Harold Vila reviewing EM records.
Image credit: Malo Hosken – SPC

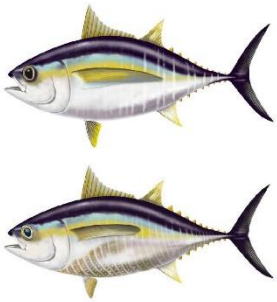
# Managing tuna fisheries in the WCPO. What we need to know.

Primary information

- Species / catch totals
- Catch and vessel position
- Vessel activity
- Length of fish
- Biological samples
- Verify that fishing was done according to regulations

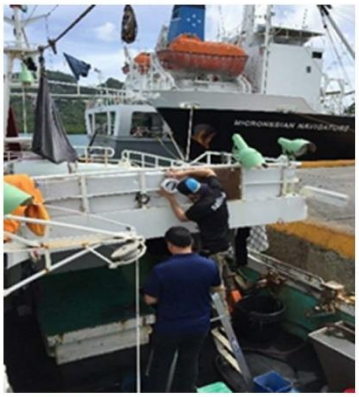
Sources

- Vessel's logsheet
- Vessel Monitoring systems
- Fisheries Observer
- Unloading data
- Transhipment monitoring
- Independent research



The Pacific Community's role – regional scientific service provider supporting national fisheries administrations of Pacific Island countries and territories.

**Electronic monitoring (EM) is the use of equipment such as cameras, sensors on a vessel to record video footage of fishing activities to be reviewed by EM analysts.**



Installation

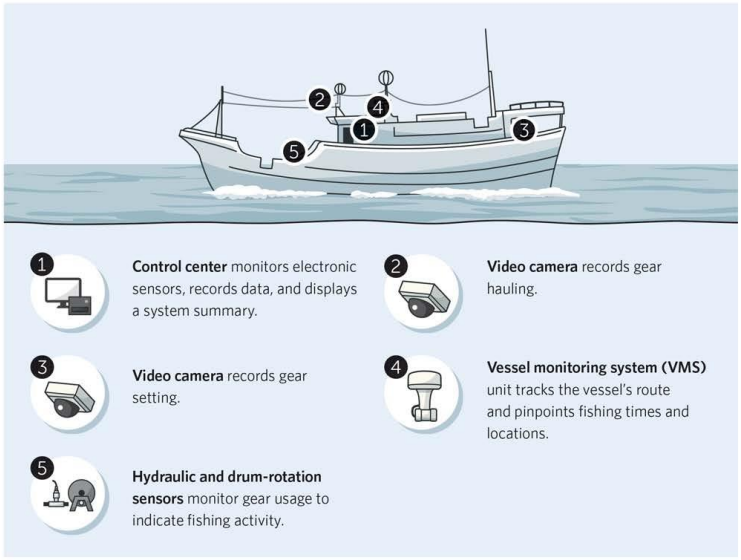
Collection/Recording

Analysis

Photos credit: Dan Gilmete FSM NORMA

Figure 1

**Electronic Monitoring Uses Technology To Collect Timely and Verifiable Catch Information**



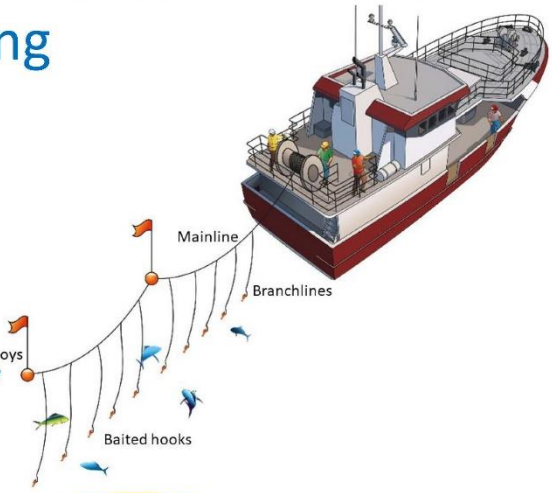



Source: https://fisheries.groupcls.com/sustainable-fisheries-administrations/electronic-monitoring-systems/

Source: https://fisheriesem.com/

# Longline fisheries in WCPO needs increased and more timely monitoring

- About 2000 Longline vessels (largest group of licensed vessels)
- Captain's or vessel logsheet is the main source of catch and effort data
- Paper based logsheet submission can take months to be submitted after a trip.
- Limited additional data sources to verify vessels reports. Observer coverage (5% or less)
- Safety and comfortability concerns for observers and crew
- Significant data gap
- Increased risk of illegal, unreported and unregulated fishing (IUU)



# EM trials in 6 countries and 2 territories since 2014

Country level

- Built data review centres
- Trained and developed EM data analysis capacity
- Produce EM data
- Test the data transmission process
- Exposure to Artificial Intelligence and machine learning development

Regional (Pacific Community & Pacific Islands Forum Fisheries Agency)

- Draft regional minimum data fields
- Interim guidelines for EM standards, specifications and procedures
- Draft JSON format for data transmission
- EM data repository

## ADVANTAGES

- Greater species composition
- Better reporting of species of special interest (notably sharks and rays)
- Ability to review species identification
- Provides data for verification and validation
- Timely and high precision catch data
- Improves stock assessments and fisheries management
- Addresses longstanding data gap
- Supports ecosystem and climate change modelling
- Supports sustainability certification for industry
- Allows participation of women

## CHALLENGES

- Initial cost and resource is high
- Sustainable funding post trials
- Industry cooperation
- Poor footage due to weathering
- Extensive review time for long trips
- EM cannot collect all observer data fields
- Data quality to be improved
- Crew privacy
- Implementing EM in the high seas

# Opportunities

- EM for transhipment monitoring
- Port monitoring
- Advancement in technology reduce cost
  - Artificial intelligence
  - Wireless transmission of data
- Regional image library database to support the development of Artificial Intelligence
  - Be a tool developed by PICTs for use by EM service providers

EM analyst in the Federated States of Micronesia, Caleson Smith reviewing EM footage using Satlink review software.
Photo Credit: Dan Gilmete – FSM NORMA

# Progressing forward

- Continue trials exploring service providers, develop national objectives for EM, infrastructure, policies and regulations etc
- Progress collective agreement on regional standards and processes
- Strengthen industry engagement


View from EM camera on a vessel docked in Pohnpei, Federated States of Micronesia.
Photo Credit: Dan Gilmete – FSM NORMA

# Implementing E-monitoring in WCPO Longline fisheries

- Compliments existing data collection processes (logsheets, obsever data, unloading's data) and addresses a significant data gap.
- Leads to timely data for stock assessments and other regional and national assessments such as for climate change modelling.
- Strengthens food security, livelihoods, and long-term economic gains.

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GEO BLUE PLANET

# Thank You.

**Contact:**
leontineb@spc.int
maloh@spc.int

# Plenary session III

## : Introduction to K-MSP

## DR. Hee-Jung Choi

### Korea Maritime Institute

Hee-Jung Choi is a research fellow at the Marine Research Division of the Korea Maritime Institute (KMI). She earned her Ph.D. in geography and geographical information systems from Kyung Hee University in South Korea. During her tenure at KMI, she has played a key role in the development of national coastal and marine policies, as well as the formulation of various management plans at both national and local levels. Her current focus involves the development of national policies related to marine spatial planning (MSP), coastal management, and marine environment management. Additionally, she actively participates in activities related to the national coastal basic survey and the development of coastal information systems. Notably, she has been instrumental in introducing MSP in Korea, leading MSP research efforts since 2011. Recently, her interests have extended to coastal and marine spatial management and planning, tools for ecosystem-based marine spatial management (such as spatial decision support systems), and ocean sustainability assessment.

Email: chj1013@kmi.re.kr

## Ph.D. Myeong-Won Kim

### Head of the Department of Marine Spatial Convergence at GeoSystem Research Corp.

Myeong-Won Kim earned his Ph.D. in the Department of Ocean Engineering at Chonnam National University in 2014. His Ph.D. research focused on assessing the environmental impact of thermal effects emanating from power plants and delved into modeling techniques to enhance prediction accuracy in response to these effects.

Currently, Ph.D. Kim serves as the head of the Department of Marine Spatial Convergence at GeoSystem Research Corp, actively engaging in various aspects of ocean engineering. His primary expertise lies in identifying the potential for marine activities through the integration of marine and meteorological forecast information.

With 18 years of experience in the marine environment and numerical modeling analysis, he plays a crucial role in generating essential data for natural disaster response and in formulating marine spatial management policies, drawing from coastal information and climate change data.

Email: mwkim@geosr.com

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# Marine Spatial Planning of RO Korea

BLUE PLANET

Hee-Jung Choi (Presenter)

Sung-Jin Cho, Hyeyeong Lee, Sunmi Kim, Jongseo Yim, Jungho Nam

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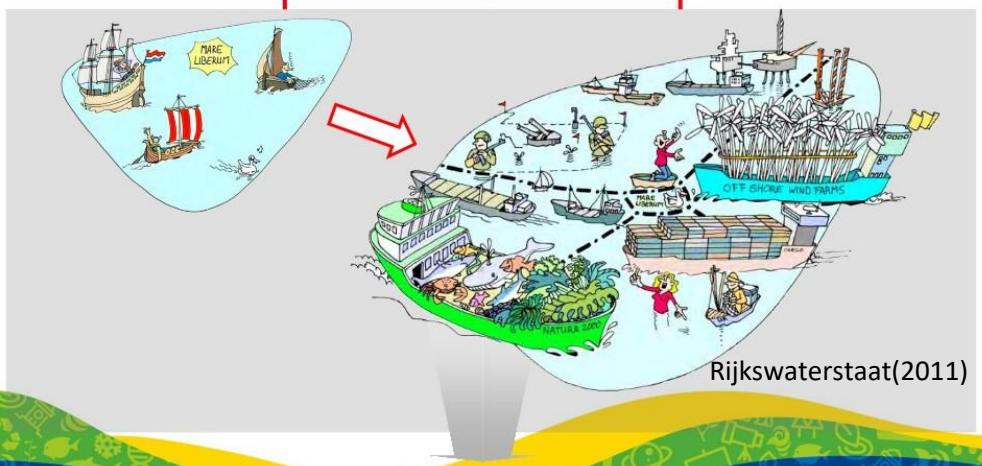
## Background

Changing Ocean Uses : Bigger, Deeper, Multiple




Rijkswaterstaat(2011)

A Framework to manage Marine Spaces has Required

# Types and Objectives of MSPs

| Type of planning | Key objective | Types of planning documents |
|---|---|---|
| Information-based planning | The principal objective of this type of MSP is to identify marine resources (including their mapping), and to assess their robustness(sensitivity analysis) along with associated pressures and demands.<br>Conflict analysis is also part of the objectives, as well as risk analysis (planning actions in the event of threats). | • Studies<br>• Spatial analyses<br>• Reports<br>• Conflicts matrixes<br>• Risk maps |
| Strategic and vision-based (indicative) planning | The principal objective is to inspire other actors that are shaping spatial development through their actions.<br>Spatial planning has no or insufficient authority over these actors and is therefore unable to enforce desirable actions | • Pilot plans<br>• Scenarios<br>• Visions, Strategies<br>• Other policy-related documents of the indicative character |
| Regulatory planning | Planners have causative power resulting from legal regulations or economic instruments and can enforce desirable actions. The plan is a means of implementing publicly agreed objectives and priorities - for example, in relation to using marine resources, environmental protection or limiting conflicts. | • Plans in the character of a local law<br>• Other binding documents of this type |

(Zaucha , 2018)

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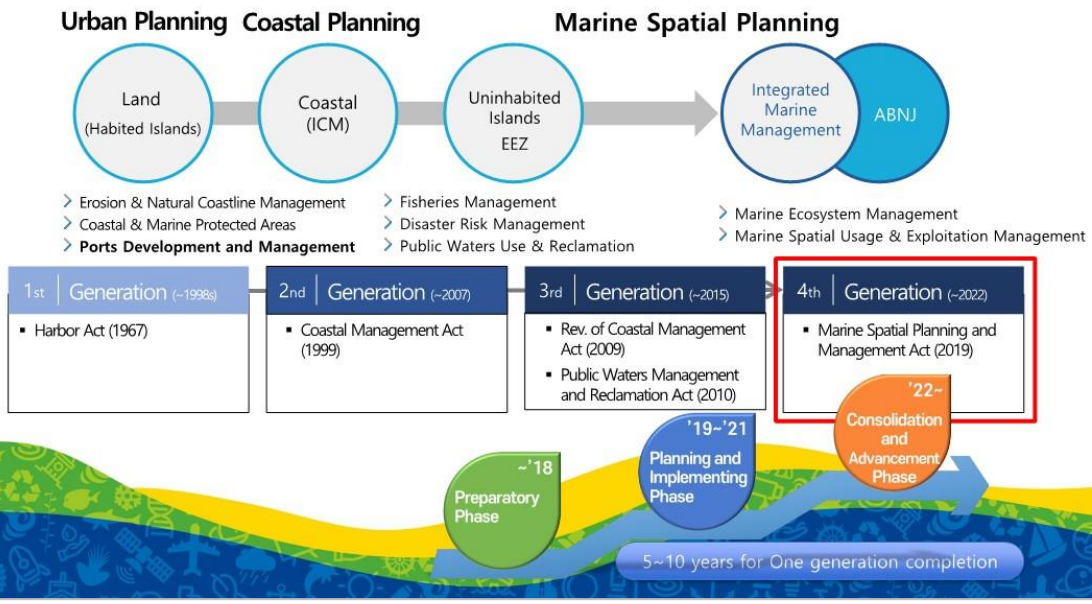
# Development of MSP



# History of MSP Establishment

**2015** **Adoption of the Policy Re-arrangement Strategy** for the Integration of MSP Concerns into Institutional Discourse

**Formation of Collaborative Teams**: Ministry of Ocean & Fisheries, Government-Funded Research Institutes (KMI, KIOST), along with Public Institutions and Private Companies Specializing in Relevant Technologies. The Comprehensive Planning Process has led by KMI.

**Commencement of Pilot Projects** to Ensure Successful Re-arrangement: 2.5 years.

**2017** **Incorporation** of the "Establishment of an Integrated Marine Spatial Management System" into the **Domestic Policy Agenda**

**2018** **Development of MSP Planning Roadmap and Formulation of MSP Plans** for Two Regional Areas (Busan, Gyeongnam)

Enactment of the Marine Spatial Planning and Management Act

**2019** **Creation of the Initial 10-Year MSP Framework Plan** Outlining Long-Term Policy Direction

Drafting of MSP Management Plans for Six Regional Areas (Gyeonggi, Incheon, Ulsan, Jeonnam, Jeju, and South Exclusive Economic Zone)

**Formulation of MSP Management Plans** for Two Additional Regional Areas (Chungnam, Jeonbuk)

Implementation of MSP Management Plans for the Busan Region

Development and **Implementation of MSP Management Plans** for a Total of Eleven Regional Areas

**2023** **Promotion of Advancement** in MSP Framework & Management Plans

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# 5W1H of MSP in RO Korea

**2015** **Adoption of the Policy Re-arrangement Strategy** for the Integration of MSP Concerns into Institutional Discourse

Why

**Formation of Collaborative Teams**: Ministry of Ocean & Fisheries, Government-Funded Research Institutes (KMI, KIOST), along with Public Institutions and Private Companies Specializing in Relevant Technologies. The Comprehensive Planning Process has led by KMI.

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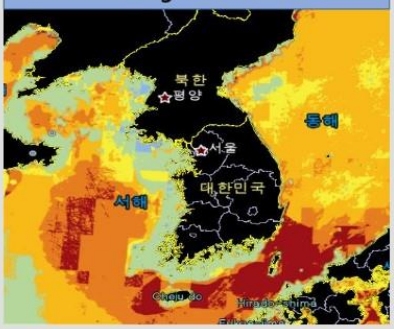
**2023** **Promotion of Advancement** in MSP Framework & Management Plans

# Issues to solve through MSP

Changing Ocean Uses : Bigger, Deeper, Multiple

**Degradation**




http://www.nceas.ucsb.edu/globalmarine

**Conflict of interests**

A Framework to manage Marine Spaces has Required



# 5W1H of MSP in RO Korea

**2015** **Adoption of the Policy Re-arrangement Strategy** for the Integration of **MSP** Concerns into Institutional Discourse

**Formation of Collaborative Teams**: Ministry of Ocean & Fisheries, Government-Funded Research Institutes (KMI, KIOST), along with Public Institutions and Private Companies Specializing in Relevant Technologies. The Comprehensive Planning Process has led by KMI.
**Commencement of Pilot Projects** to Ensure Successful Re-arrangement: 2.5 years.

Who

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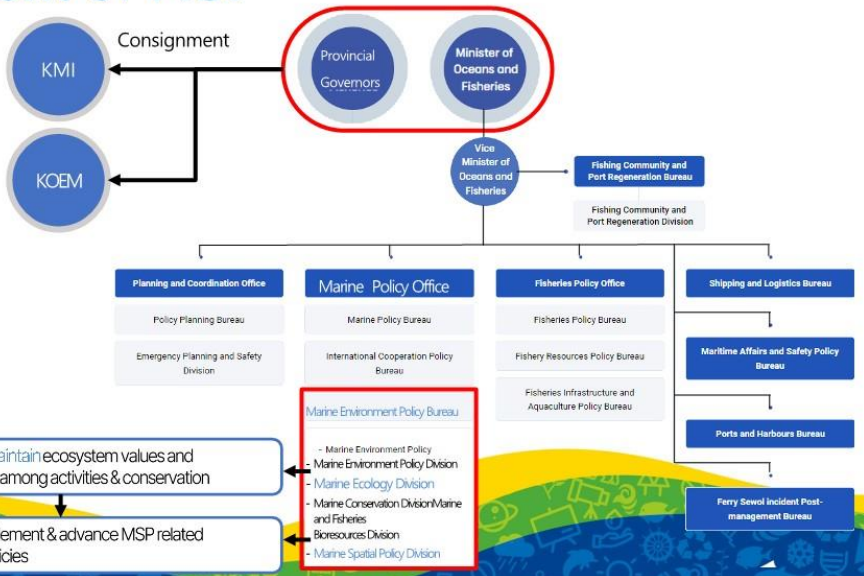
# Authorities for establishment of MSP

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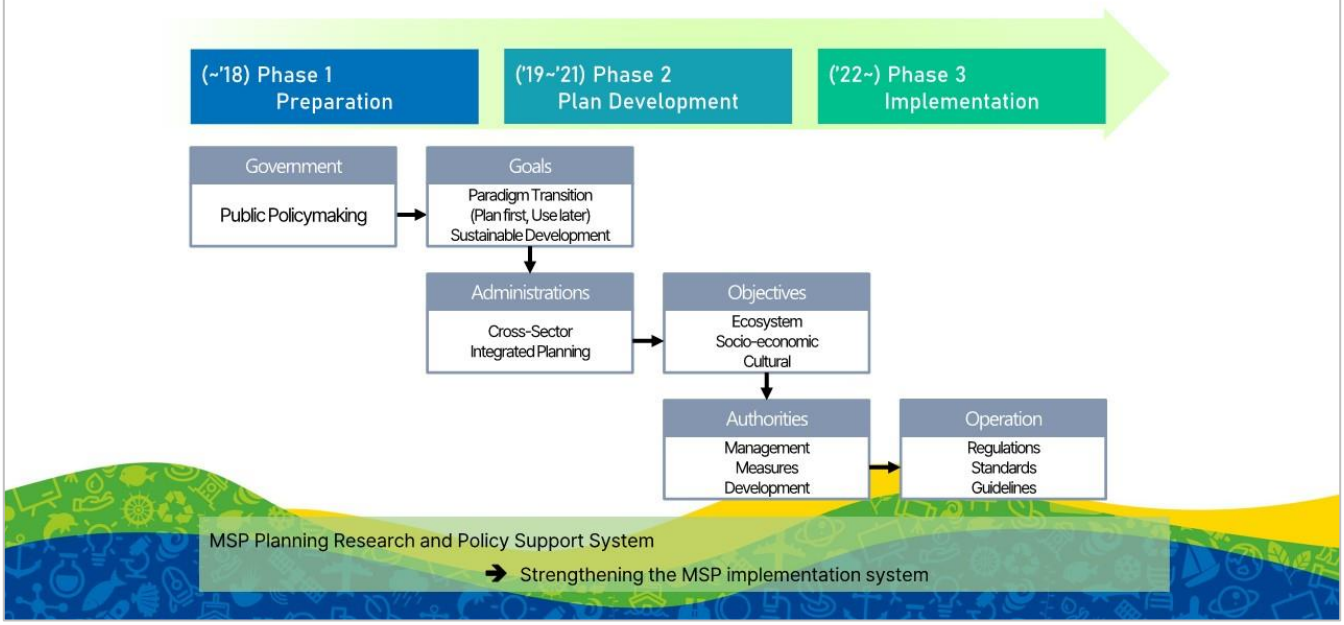
**2023** **Promotion of Advancement** in MSP Framework & Management Plans

# Development of MSP

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# MSP Planning Strategy

"Managing desirable uses of
marine space (territorial sea, EEZ) in advance"


- Establishment of marine spatial policy division in MOF('19)
- Designation of specialized institutions for evaluating marine spatial plans : KOEM, KIOST, KMI, FIRA ('19) → KOEM('23)

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Development and **Implementation of MSP Management Plans** for a Total of Eleven Regional Areas

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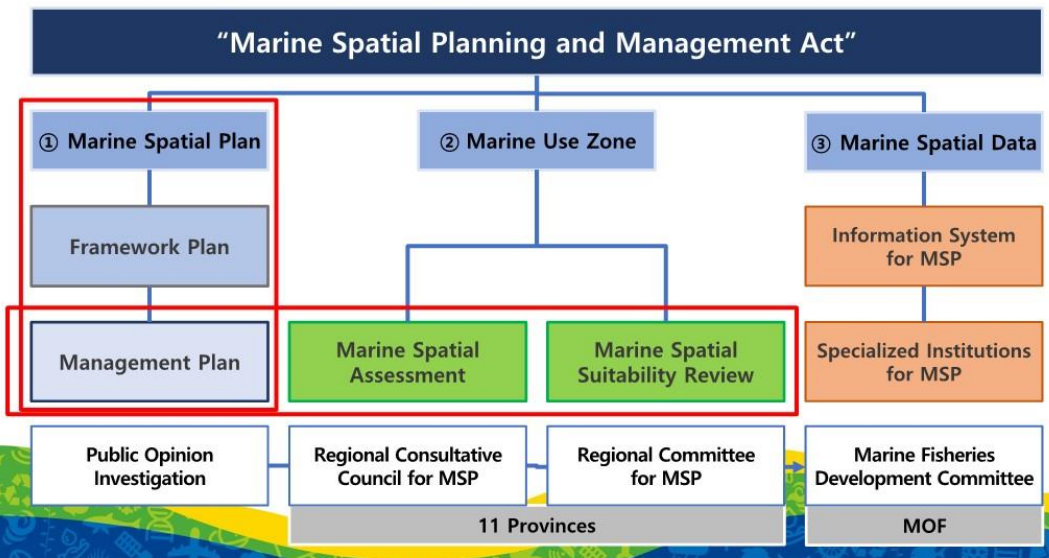
# Marine Spatial Planning System



# MSP Planning Process

## Marine Spatial Planning and Management Act of 2019


- Long-term Policy Direction (10 years)
- Spatially explicit Regional Management Measures including Zoning Mechanism
- Compatibility Consultation between Development Plans and MSP

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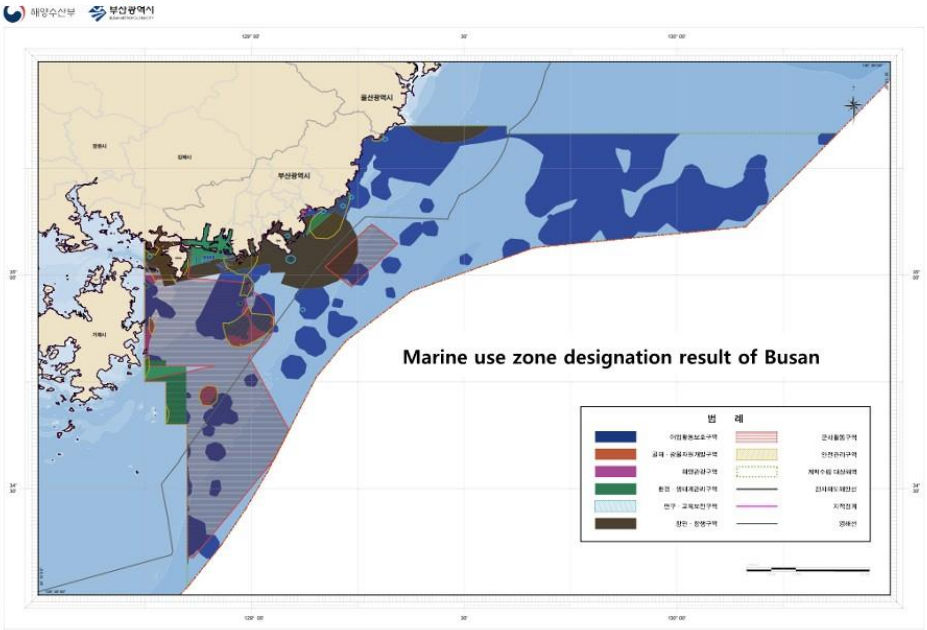
# 1st MSP Framework Plan

| | | | |
|---|---|---|---|
| Vision | Seas of Co-prosperity and Embrace, Balancing Economy and Ecological values | | |
| Goal | Implementation of MSP contributing to Marine Industry and Economic Development | Achieving Sustainable Use of Marine Space Based on Marine Ecosystem Values | Customized Marine Spatial Management Steering by Local Governments |

1. Implementation of Proactive and Adaptive Marine Spatial Planning System
2. Establishment of Scientific and Integrated Marine Spatial Management Foundation
3. Enhancement of Marine Spatial Data and Information Cloud Platform
4. Improvement of Governance for Participatory and Collaborative Marine Spatial Management
5. Strengthening Institutional Infrastructure for Support of Marine Spatial Management Implementation

# MSP Management Plan




Marine use zone designation result of Busan



# Marine Use Zones

**Types of Marine Use Zone in the Marine Spatial Planning and Management Act of Korea**

| Marine Use Zone | Definition |
|---|---|
| Fishery activity protection | Sea area necessary for the protection and promotion of fishery activities, such as licensed fishery and permitted fishery, and for the sustainable production of fishery products |
| Aggregate and mineral resource development | Sea area necessary for the efficient and stable supply of aggregate and mineral resources from the sea |
| Energy development | Sea area necessary to develop and produce marine energy |
| Marine tourism | Sea area requiring maintenance and development of marine tourism functions |
| Environment and ecosystem management | Sea area requiring the conservation and management of the marine environment, ecosystem and landscape |
| Research and education conservation | Sea area necessary for marine fisheries research and education activities |
| Port and navigation | Sea area necessary for maintaining port functions, safe operation of ships, etc. |
| Military action | Sea area necessary to protect national defense and military activities |
| Safety management | Sea area necessary to protect marine installations and for marine safety |

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Where

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# Marine Use Zones

## Designation Status of Marine Use Zones

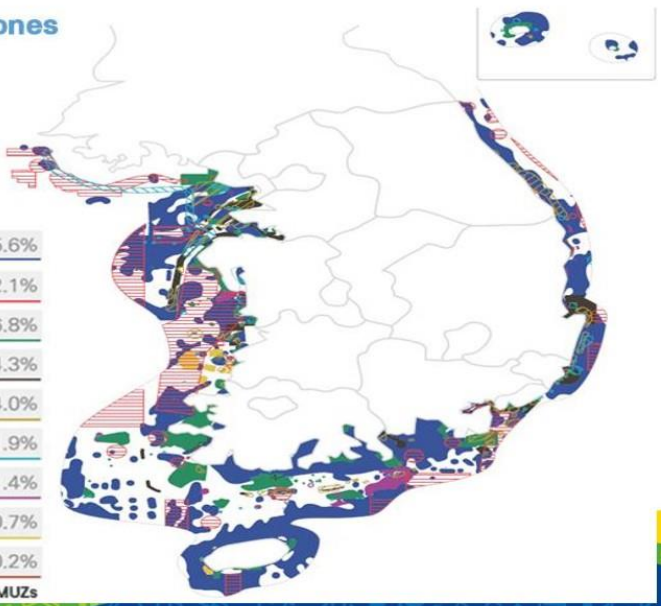

Suspended

Designated

## Area rate of types of MUZ

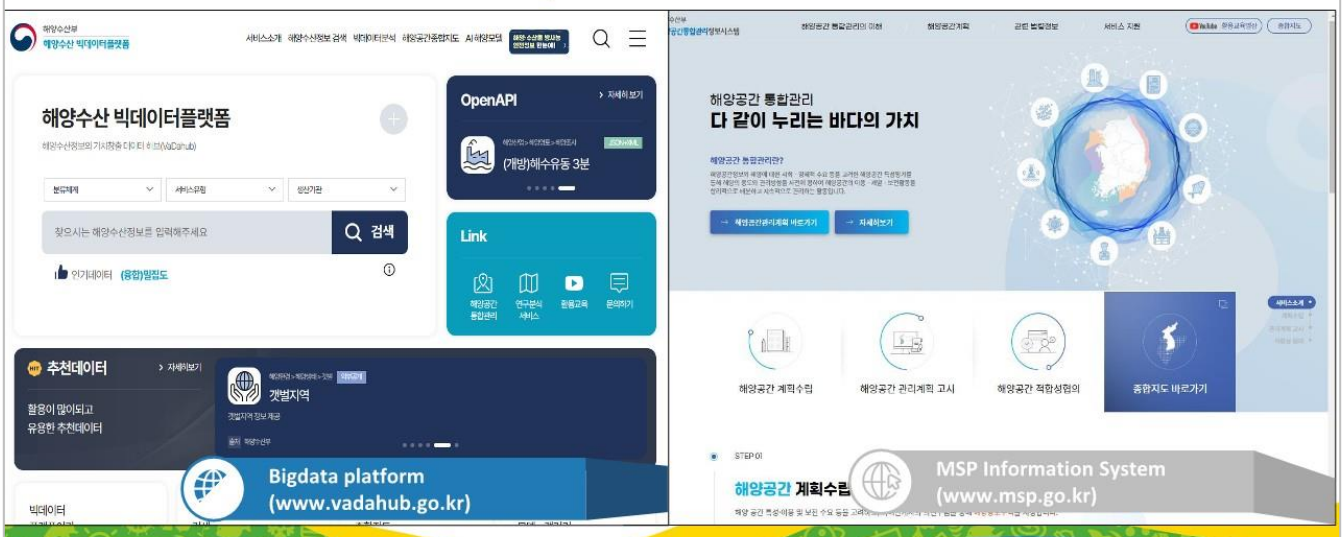
| | |
|---|---|
| Fishery activity protection zone | 45.6% |
| Military action zone* | 22.1% |
| Env. & ecosystem management zone | 6.8% |
| Port & navigation zone | 4.3% |
| Safety management zone* | 4.0% |
| Research & education conservation zone* | 1.9% |
| Marine tourism zone | 1.4% |
| Energy development zone | 0.7% |
| Aggregate & mineral resource dev. zone | 0.2% |

*Possible to designate in conjunction with other types of MUZs



# MSP Planning Process (establishment)


# MSP Information system



# Marine Spatial Assessment

Marine Spatial Assess-ment

- Progress to identify key activities in a marine area by using quantitative data comprehencing ecosystem, resources, and utilization activities
- MSA progress involves selecting and categorizing key indicators to compare and evaluate the conservation and/or utilization (development) value of the unit of marine space
- MSA results are essential to derive draft of MSP for designating or modifying MUZs, that are reviewed in the next process participation fostering stakeholders and experts

| Data Collection | Indicators Selection | Value Normalization | Indctr. Integration | Conflict Analysis |
|---|---|---|---|---|
| • Activities, Conditions, Spatial depends, etc.<br>• Transformed into GIS layer | • Data availability, representativeness, completeness, irreplaceability, etc. | • Classify indicator values in common scales<br>e.i. Areal weighting | • Estimates spatial characteristics of each MU types (Aptitude score) | • Identify key area for participation based MUZ decision making |

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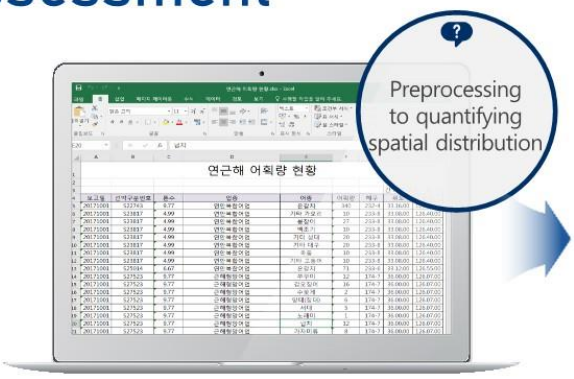
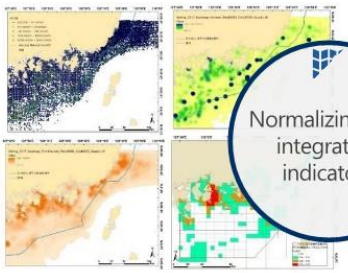
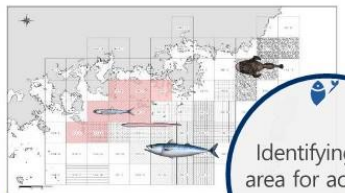
# Marine Spatial Assessment




Preprocessing to quantifying spatial distribution



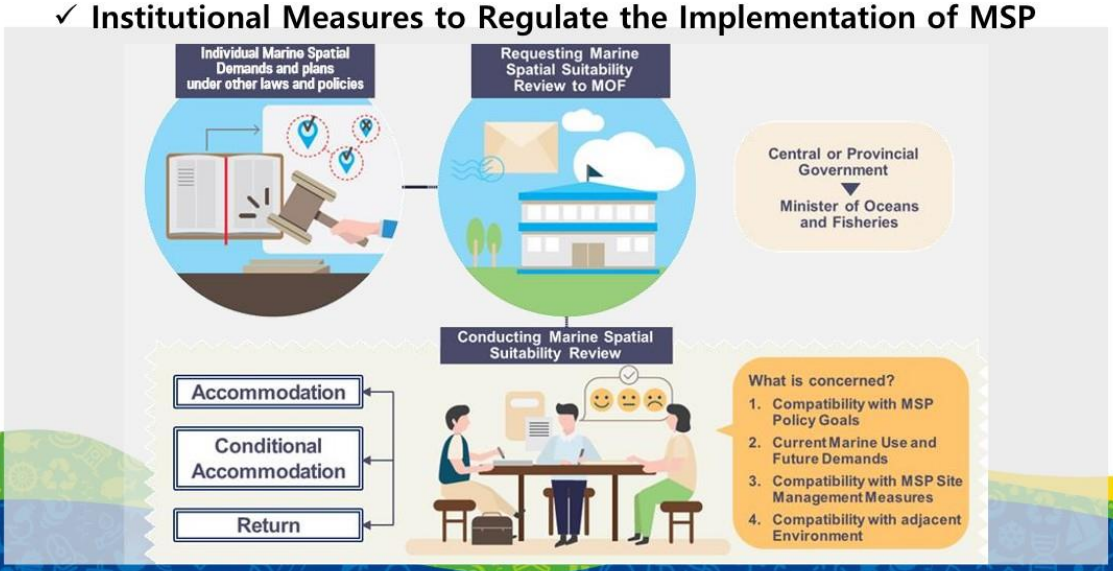
Normalizing and integrating indicators



Identifying kea area for activities related to each MUZ

# Marine Spatial Suitability Review

✓ **Institutional Measures to Regulate the Implementation of MSP**

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# (A study on) Evaluation and Enhancement of MSP

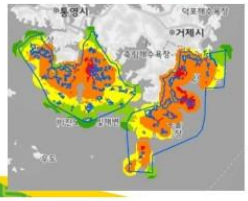
**4th Generation (~2022)**

- Marine Spatial Planning and Management Act (2019)

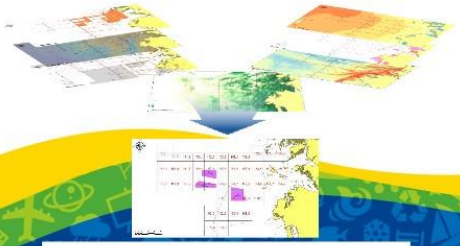

**5th Generation (2023~)**

(Goal) Strengthening Premeditated Utilization of Marine Spaces through Strengthening the Effectiveness of MSP

- Diagnosis of the Current State and Changes in Institutional and Policy Management Conditions
- Implementation Evaluation of MSP Framework and Management Plans
- Enhancement of Strategy for Regionally Tailored Spatial Management
- Strengthening the Integration between Specific Site Selection (Allocation) Plans and MSP



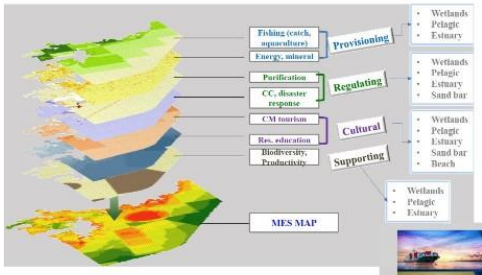
EBSAs (MPA) classification



Suitable site exploration for OWF



# (A study on) Integration of EBM to MSP




✓ **Data Production, Methodology Development, and Cloud Platform Construction for Marine Spatial Planning and Management Based on Marine Ecosystem Services**

# List of ongoing MSP related studies in RO Korea

| Name | Organization | Goals |
|---|---|---|
| Enhancement of MSP Framework Plan | Korea Maritime Institute | Strengthening Premeditated Utilization of Marine Spaces through Strengthening the Effectiveness of MSP |
| MSP Management Plan Amendment | Korea Marine Environment Management Corporation | Establishment of Institutional System to Support MUZ based Local Government-Led MSP and Management |
| Marine Jurisdictional Zonation System | Korea Maritime Institute | Exploration of Maritime Jurisdictional Boundaries and Investigation of Marine Cadastre Adoptation Strategies |
| Marine Spatial Monitoring | Korea Marine Environment Management Corporation | Development of Spatial Data, Statistics, and Metrics for Efficient Ocean Spatial Management |
| Government-led OWF Suitable Site Exploration | Korea Electric Power Research Institute | Identification of Suitable OWF Sites Considering economic feasibility, Environmental Sustainability, and Social Acceptance based on Data and Stakeholder Engagement |
| Construction of Digital OWF Location Information Map | Korea Marine Environment Management Corporation | Development of OWF Location Information Map and OWF Feasibility Evaluation Assessment Guidelines |
| Assessment for Marine Ecology and Usage in National Parks | Geosystem Research | Proposal of Specific Management Plans for Offshore and Coastal National Parks through Spatial Ecological and Utilization Data Analysis |

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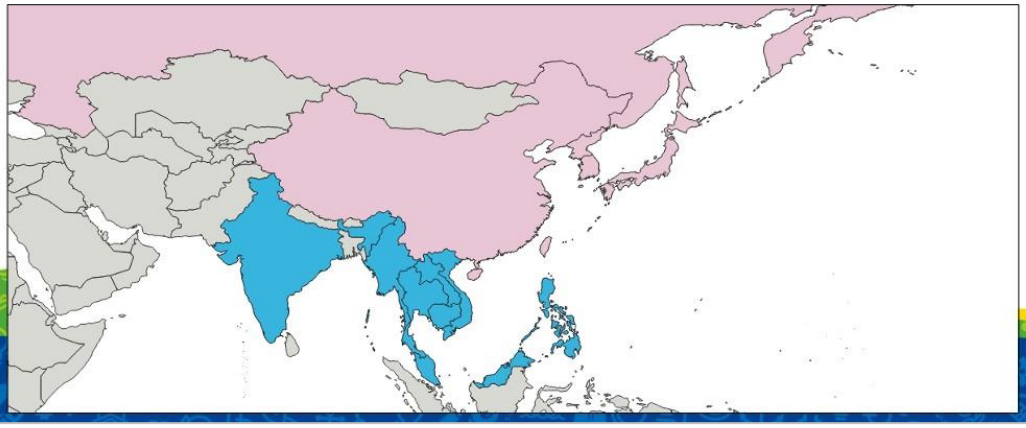
# Enhancing MSP Cooperation in Asia

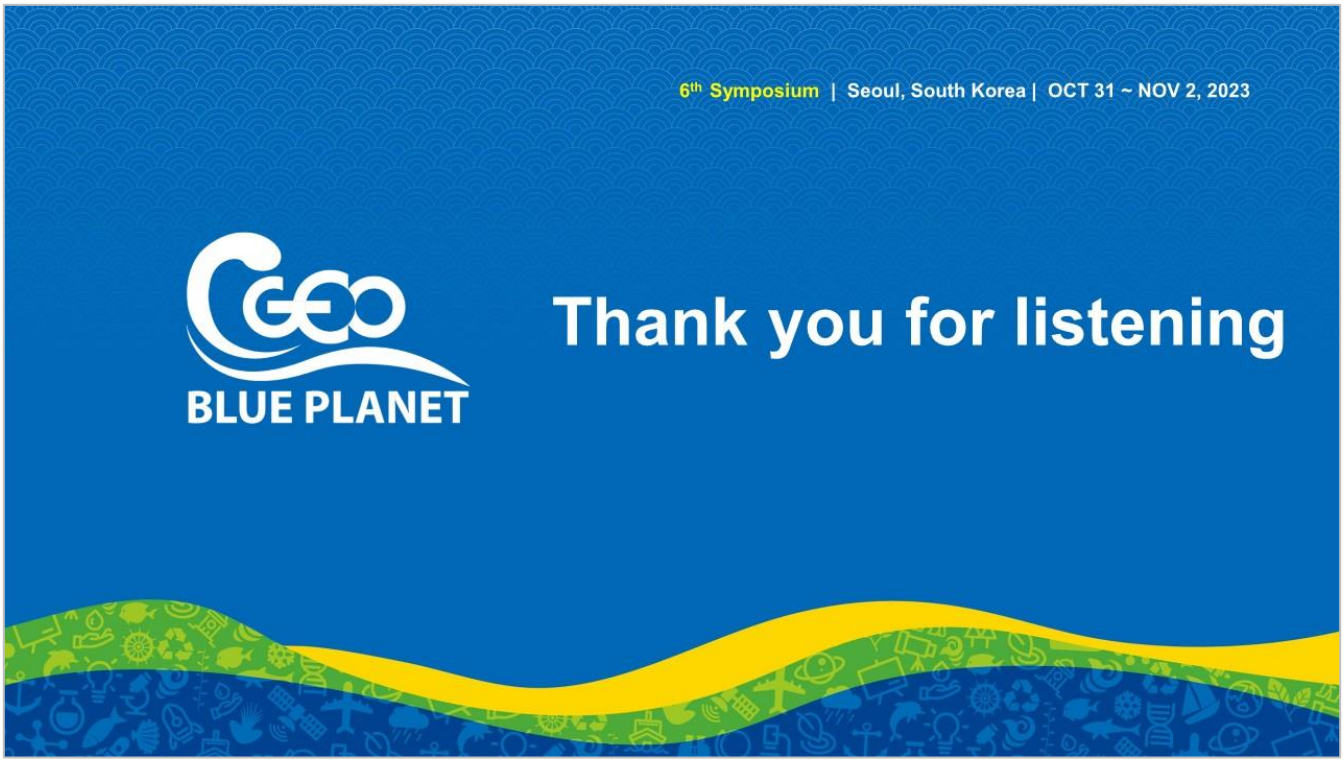
## Transboundary MSP : Korea, China, Japan, Russia

Cooperation for Regional Joint Ocean Management

## MSP Cooperation in Asia

Support for MSP Development and Coherent Management

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GEO
BLUE PLANET
Thank you for listening

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BLUE PLANET

# Marine Spatial Assessment Procedure and Improvement

**Myeong Won Kim**
GeoSystem Research Corporation

## Outline

1. Background
2. Marine Use Data Collection and Spatial Information
3. Marine Spatial Assessment Procedure
4. Marine Spatial Assessment Results
5. Marine Spatial Assessment Improvement
6. Concluding Remarks

# Background

## What is the Marine Spatial Assessment?

- Marine Spatial Assessment is the process of scientifically evaluating the development and conservation value of the ocean to select and grade of marine uses
- Developed to evaluate key activities in the ocean based on information on the ocean's environment, ecology, resources, and uses
- The Marine Spatial Assessment results are used to designate and change Marine Use Zones

What is Marine Use Zones?

**Marine use zones have been delineated into 9 categories based on marine utilization data**

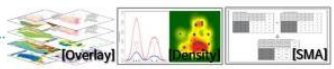
Ref. : Marine Spatial Planning and Management Act(2019)

## Workflow of Assessment

| | |
|---|---|
| Factor selection of Marine Spatial Assessment by Marine Use Zones | ▪ Review and Selection of Evaluation Criteria for each of the nine designated land-use zones. (Ex: Fisheries Protection Zones - Fishing Density, Catch Volume, and Artificial Reefs, etc.) |
| Data collection of the Marine Spatial Assessment factor by Marine Use Zones | ▪ Collection of Data for Selected Evaluation Criteria for Each Marine Use Zones. (Ex: Gathering spatial data(shapefiles) and document data) |
| Data Standardization | ▪ Spatial Data Processing for Collected Data to make it suitable for spatial analysis. (Ex: Converting coordinate information from document data into point or polygon data) |
| Set the criteria of Marine Spatial Assessment | ▪ Establishment of Spatial Analysis Evaluation Standards. (Ex: Grading Fishing Density and Catch Volume, etc.) |
| Spatial Analysis and Gridding | ▪ Spatial Characteristic Evaluation and Grid Generation Based on Established Standards. (Current grid size: 3 minutes / 15 minutes) |
| The Assessment Score Mapping by Marine Use Zones | ▪ Assignment of Evaluation Scores (0-1) Based on the Presence and Attribute Value Distribution of Evaluation Criteria.<br>▪ Creation of Evaluation Criteria and Composite Score Maps. |

# Data Collection and Spatial Information

## Procedure of Marine Spatial Assessment Construction

| Process | Detailed Contents | |
|---|---|---|
| GIS Based Data Collection | Marine Characteristics, Utilization Status, Water Depth, Ship Traffic, etc. |   |
| Spatial Information Processing | TEXT, KML(Z), JPG file → ESRI Shape file |  |
| Spatial Information Processing | Grid-Based Data Establishment(3') |   |
| Spatial Statistical Analysis | Density, Overlay, Buffering, Proximity, etc. |   |
| Update of Marine Use Zones Data | GIS based Data Update Data History Management |   |

# Data Collection and Spatial Information

## Marine Spatial Assessment Data collection

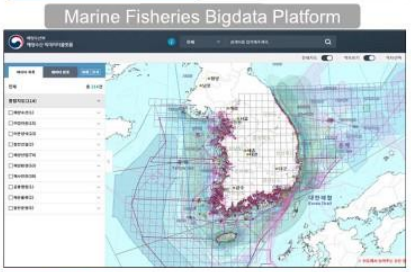
- Basic data is collected through various channels such as the Electronic Gazette of the Republic of Korea, Public Data Portal, Korea Ocean data Market Center and National Territory Information Platform

| Platform | Data |
|---|---|
| 국가해양정보마켓센터 | National Port, Maritime Gunnery Training Area, etc. |
| 마리나포털 | Marina, etc. |
| 국가공간정보포털 | New Harbor Area(Planned), etc. |
| 대한민국전자관보 | Government Gazette Data |
| 국토정보플랫폼 | Digital Cadastral Maps, etc. |

| Platform | Data |
|---|---|
| 한국보호지역통합DB관리시스템 | Marine Resource Protection Zone, etc. |
| 바다누리해양정보서비스 | Marine Observation Buoy, etc. |
| 해양수산부 공동활용체계 | Anchorage, etc. |
| 기관 | Mining Area, etc. |

Korea Ocean data Market Center

Marine Fisheries Bigdata Platform

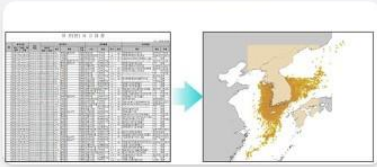


# Data Collection and Spatial Information

## Make a spatial data of Marine Spatial Assessment Data

- Data collection in various forms such as vector, raster, text, and images
- Creating standardized spatial information through spatial data processing and mapping based on QGIS
- Creating a Database with Location-based unit data sets

Raw Data Standardization



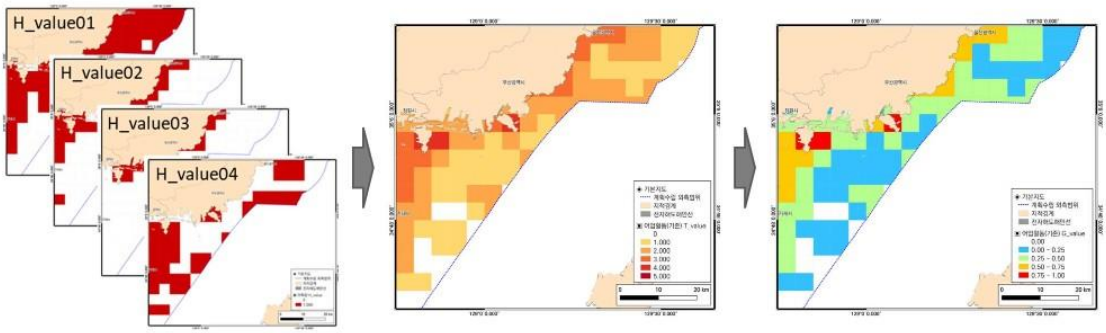
Coordinate System Unification

Geo-Referencing

Digitizing

# Marine Spatial Assessment Procedure

- **Scoring procedure of Marine Spatial Assessment**




**H_value**
**(Score map by factors)**

H_value =
Data Absence: 0
Data exist: 1

**T_value**
**(Sum of assessment score for factors)**

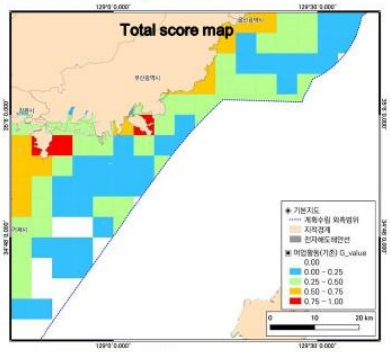
T_value =
H_value01 + H_value02
+ H_value03 + H_value04

**G_value**
**(Standardization of assessment score for factors)**

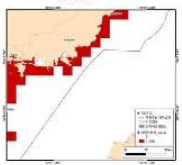
$$G\_value = \frac{x(T\_value)-Min(T\_value)}{Max(T\_value)-Min(T\_value)}$$

# Marine Spatial Assessment Results

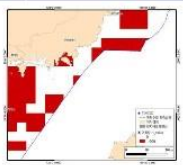
- **Fisheries Priority Zone**




| Factors | Data | Method | Score |
|---|---|---|---|
| Aquaculture | Licensed Fishing | Absence | 0 |
| | | Exist | 1 |
| Fishing Port | Nationa Port<br>Regional Port<br>Coastal Village Development Port | Absence | 0 |
| | | Exist | 1 |
| Protect Area | Marine Resource Protection Zone<br>Marine Resource Management Area<br>Protected Area | Absence | 0 |
| | | Exist | 1 |
| Functional Zone | Fishing Ground<br>Fishing Port | Absence | 0 |
| | | Exist | 1 |
| Marine Ranching | Sea Ranch<br>Sea Forest | Absence | 0 |
| | | Exist | 1 |
| Characteristics Zone | Total Catch Volume<br>Fishing Density Area | Standardization | 0~1 |


[Licensed Fishing]

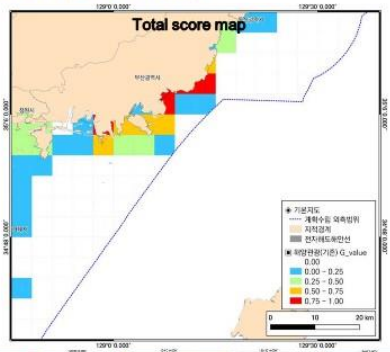

[Fishing Ground]


[Total Catch Volume]

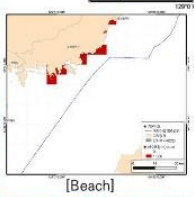

[Fishing Density Area]

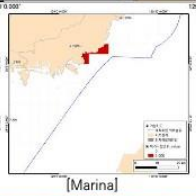
# Marine Spatial Assessment Results

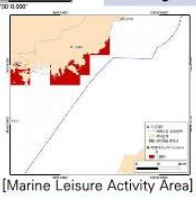
## ● Marine Tourism Zone




| Factors | Data | Method | Score |
|---|---|---|---|
| Beach | Beach | Absence | 0 |
| | | Exist | 1 |
| Marina | Marina(Including Planned) | Absence | 0 |
| | | Exist | 1 |
| Recreation Zone | Marine Leisure Activity Area | Absence | 0 |
| | | Exist | 1 |
| Fishery Village | Fishing Experience Village | Absence | 0 |
| | | Exist | 1 |
| Fishing Zone | Rocky Outcrops, Offshore Fishing Points, Fishing Ground | Absence | 0 |
| | | Exist | 1 |
| Functional Zone | Leisure Tourism Zone<br>Seaside Bathing Area<br>Marine Cultural Facilities Zone | Absence | 0 |
| | | Exist | 1 |
| Fishing Boats Density | Fishing Vessel Density(V-pass) | Standardization | 0~1 |

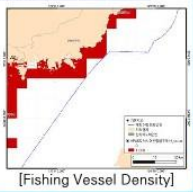

[Beach]


[Marina]


[Marine Leisure Activity Area]

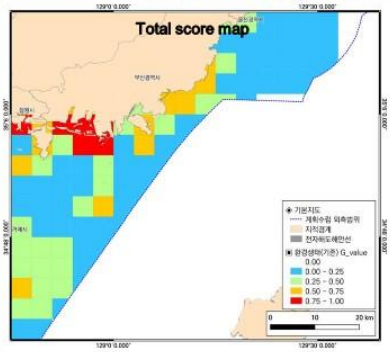

[Fishing Experience Village]


[Fishing Zone]

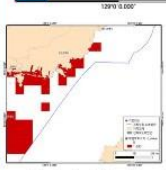

[Fishing Vessel Density]

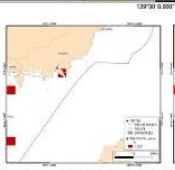
# Marine Spatial Assessment Results

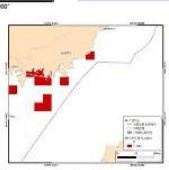
## ● Environment and Ecosystem Management Zone



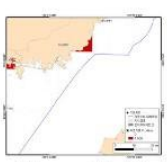

| Factors | Data | Method | Score |
|---|---|---|---|
| Park | National Park, Provincial Park, County Park | Absence | 0 |
| | | Exist | 1 |
| Protect Area | Marine Protected Area, Protected Wildlife Habitat<br>Wetland Conservation Area,<br>Protected Area for Flora and Fauna<br>Ecological Landscape Conservation Area<br>Marine Landscape Zone, Environmental Conservation Zone | Absence | 0 |
| | | Exist | 1 |
| Heritage | Cultural Heritage Conservation Area<br>Natural Monument, Natural Conservation Area | Absence | 0 |
| | | Exist | 1 |
| Functional Zone | Marine Water Quality Management Area<br>Marine Environmental Restoration Area<br>Fisheries and Aquatic Resource Conservation Area | Absence | 0 |
| | | Exist | 1 |
| Characteristics Zone | Submerged Aquatic Plants: Seagrasses / Algae / Seaweeds<br>Mudflat | Absence | 0 |
| | | Exist | 1 |
| | Marine Ecology Map | 1st grade | 1 |
| | | 2nd grade | 0.5 |
| | Marine Biodiversity Index | Standardization | 0~1 |


[Protected Area]

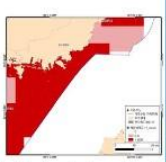

[Protected Wildlife Habitat]


[Protected Lands]


[ Wetland ]

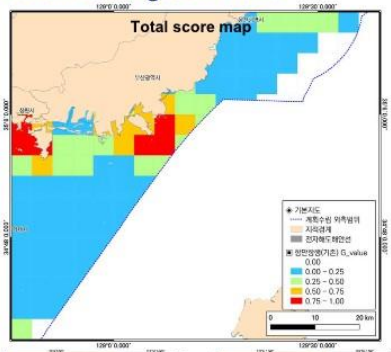

[Submerged Plants]


[Marine Biodiversity Index]


[Marine Ecology Map]

# Marine Spatial Assessment Results

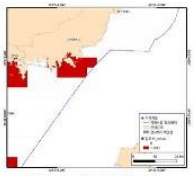
## Harbor and Navigation Zone



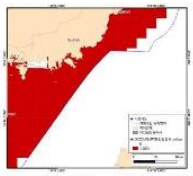

| Factors | Data | Method | Score |
|---|---|---|---|
| Harbor Zone | Trading Port<br>Coastal Port | Absence | 0 |
| | | Exist | 1 |
| New Harbor Zone | New Harbor Area(Planned) | Absence | 0 |
| | | Exist | 1 |
| Navigation Zone | Navigational Route, Anchorage,<br>Maritime Traffic Safety Zone | Absence | 0 |
| | | Exist | 1 |
| Functional Zone | Harbor Area<br>Shipping Lane Zone | Absence | 0 |
| | | Exist | 1 |
| Characteristic Zone | Large Ships Density(GICOMS) | Standardization | 0~1 |


[Harbor Zone]


[New Harbor Area(Planned)]


【Navigational Route】

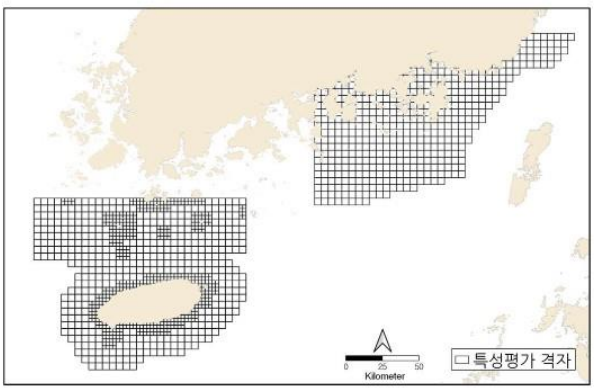

【Maritime Traffic Safety Zone 】


[Large Ships Density(GICOMS)]

# Marine Spatial Assessment Improvement

## Target area of Marine Spatial Assessment planning

- A grid of 3′×3′ (approximately 5km) is used to produce marine spatial analysis and assessment maps
- A grid of 1.5′×1.5′(under 10m depth) is used to analyzed considering the characteristics of the sea area and the density of marine use

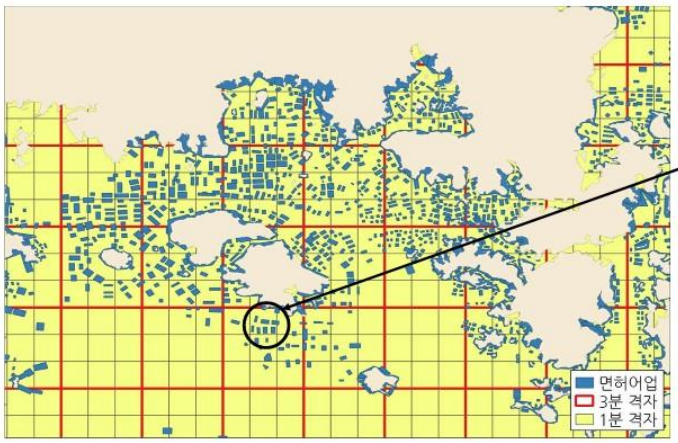



| District | Grid size | | Area (㎢) |
|---|---|---|---|
| | 3′ | 1.5′ | |
| Busan | 130 | - | 3,292 |
| | Total 130 | | |
| Gyeongnam | 402 | - | 10,223 |
| | Total 404 | | |
| Jeju | 430 | 528 | 14,459 |
| | Total 958 | | |

# Marine Spatial Assessment Improvement

## Application of grid subdivision of Marine Spatial Assessment planning (1)

- Aquaculture: Comparison of application of 3' (present) and 1' (improvement) grid
- In comparison to the Raw data, there is an overestimation of 11.7 times for the 3' grid and 6.3 times for the 1' grid



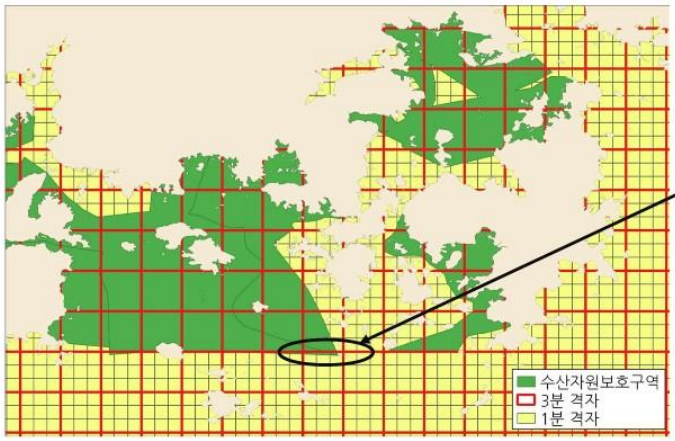

The area through gridding becomes larger compared to the area of the raw data
: causes of overestimation based on 3' grid

| Data | Grid area (㎢) | Overestimation Ratio |
|---|---|---|
| Raw data | 535 | 1 |
| 3' grid | 6,263 | 11.7 times the raw data |
| 1' grid | 3,351 | 6.3 times the raw data |

# Marine Spatial Assessment Improvement

## Application of grid subdivision of Marine Spatial Assessment planning (2)

- Fisheries Resources Protection Area: Comparison of application of 3'(present) and 1'(improvement) grid
- In comparison to the Raw data, there is an overestimation of 2.3 times for the 3' grid and 1.6 times for the 1' grid



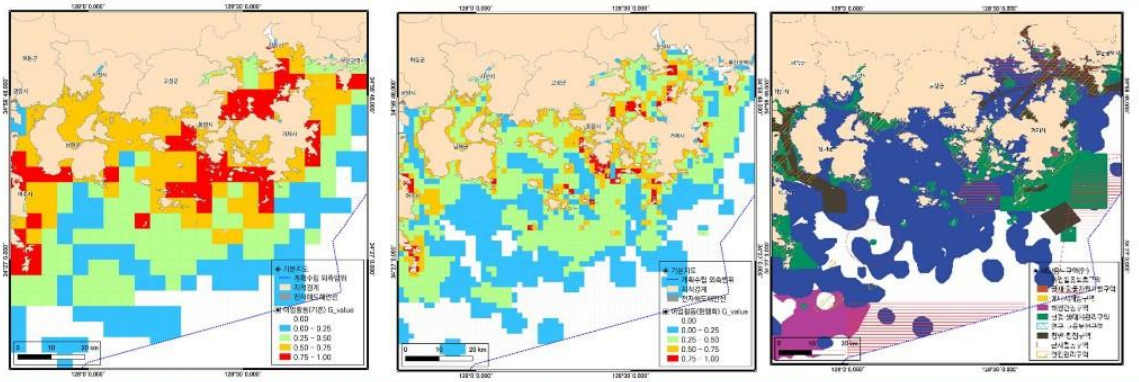

The area through gridding becomes larger compared to the area of the raw data
: causes of overestimation based on 3' grid

| Data | Grid area (㎢) | Overestimation Ratio |
|---|---|---|
| Raw data | 1,045 | 1 |
| 3' grid | 2,434 | 2 times the raw data |
| 1' grid | 1,674 | 1.6 times the raw data |

# Marine Spatial Assessment Improvement

- **Result of Grid subdivision of Marine Spatial Assessment planning - Fisheries Priority Zone(Gyeongnam)**
  - Grid subdivision (Present : 3' grid → Improvement : 1' grid)
  - Ability to identify detailed distribution status by factors and classes of assessment
  - The area is reduced by approximately 18% when applying the improved (6,914 ㎢) compared to the present (8,411 ㎢)

| Grade | Gyeongnam | |
|---|---|---|
| | 3' grid area(%) | 1' grid area(%) |
| 1 | 2,088(24.8) | 2,801(40.5) |
| 2 | 2,289(27.2) | 2,546(36.8) |
| 3 | 2,841(33.8) | 1,370(19.8) |
| 4 | 1,193(14.2) | 197(2.9) |
| **Total** | **8,411** | **6,914** |



# Marine Spatial Assessment Improvement

- **Marine Big Data Analysis**

| Data | Duration | Contents |
|---|---|---|
| AIS | 2018~2021 (4 years) | · Static Information: Ship ID, Ship Type, Area ID, Ship Size (Based on AIS Sensor)<br>· Dynamic Information<br>– Raw Data : ID, Date and Time, Latitude, Longitude, Speed Over Ground, Course Over Ground, Bow Heading, Ship's Heading<br>– Fusion Data : ID, Date and Time, Speed Over Ground, Course Over Ground, Bow Heading, Grid Number, Distance Traveled, Ship's Speed |
| V-PASS | 2018~2021 (4 years) | · Static Information: rfid_ID, Ship ID, Length, Width, Tonnage<br>· Dynamic Information<br>– Raw Data : ID, Date and Time, Latitude, Longitude, Speed Over Ground, Course Over Ground, Bow Heading, Ship's Heading<br>– Fusion Data : ID, Date and Time, Speed Over Ground, Course Over Ground, Bow Heading, Grid Number, Ship Type, Distance Traveled, Ship's Speed |

Speed Over Ground: the vessel's speed in one hour concerning the land or any other fixed object such as buoys

**AIS DATA**

Static Information

| ship_id | ship_kind | area_id | dima_val | dimb_val | dimc_val | dimd_val | duf_val |
|---|---|---|---|---|---|---|---|
| NDEyMzIwMDk4 | 30 | 4403310 | 20 | 10 | 4 | 4 | 0 |
| NDEyNDM4NDY1 | 30 | 4403705 | 25 | 13 | 4 | 2 | 0 |
| OTAwMDIzMTA2 | 0 | 4403703 | 0 | 0 | 0 | 0 | 0 |

Dynamic Information
-RAWdata

| id | Date | Lat | Lon | SOG | COG | Heading |
|---|---|---|---|---|---|---|
| MA== | 2018-01-01 000 | 32.03948 | 125.5767 | 0 | 0 | 0 |
| MA== | 2018-01-01 001 | 32.03952 | 125.5767 | 0 | 0 | 0 |

-Fusion data

| id | recv_dt | SOG | COG | Heading | grid_no | ship_kind | distance(m) | knot |
|---|---|---|---|---|---|---|---|---|
| MA== | 2018-01-01 001 | 0 | 0 | 0 | GR5_F4N43_V24 | 0 | 3.696 | 0.088704 |
| MA== | 2018-01-01 002 | 0 | 0 | 0 | GR5_F4N43_V24 | 0 | 1.848 | 0.057024 |
| MA== | 2018-01-01 004 | 0 | 0 | 0 | GR5_F4N43_V24 | 0 | 1.848 | 0.037036 |
| MA== | 2018-01-01 005 | 0 | 0 | 0 | GR5_F4N43_V24 | 0 | 10.798 | 0.233237 |

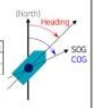
**V-PASS DATA**

Static Information

| rfid_id | ship_id | len_val | wdtha_val | ton_val |
|---|---|---|---|---|
| MzYzMDI0NjM= | MDUwMzAwNTY0Njg5MDU= | 6.93 | 2.42 | 1.57 |
| MzYxMDEzMTQ= | MTMwNTAxODY0NjkxMDQ= | 4.65 | 1.8 | 0.62 |
| MzUyMDAwODM= | MDMwNTAwNDY0ODIyMDI= | 20.5 | 4.88 | 29 |

Dynamic Information
-RAWdata

| rfid_id | Date | Lat | Lon | SOG | COG | Heading |
|---|---|---|---|---|---|---|
| MzEwMDAwMzE= | 2018-01-01 601 | 34.741 | 128.5143 | 4 | 142 | |
| MzEwMDAwMzE= | 2018-01-01 602 | 34.74017 | 128.5152 | 6 | 144 | |




-Fusion data

| rfid_id | recv_dt | SOG | COG | Heading | grid_no | distance | knot |
|---|---|---|---|---|---|---|---|
| MzEwMDAwMzE= | 2018-01-01 602 | 6 | 144 | | GR5_G3E23_A15 | 119.875 | 3.884 |
| MzEwMDAwMzE= | 2018-01-01 605 | 1 | 150 | | GR5_G3E23_A15 | 151.031 | 3.262 |
| MzEwMDAwMzE= | 2018-01-01 606 | 1 | 78 | | GR5_G3E23_A15 | 30.526 | 0.989 |
| MzEwMDAwMzE= | 2018-01-01 607 | 0 | 34 | | GR5_G3E23_A15 | 35.689 | 1.156 |

# Marine Spatial Assessment Improvement

## Marine Big Data Analysis

- Development of processing methods improvement by identifying the appropriateness of distance and speed calculation results of present fusion data
- In the case of Marine Big Data, data is collected in seconds-based, so the file size is approximately 4.6GB per month and 55.2GB per year (It takes approximately 2 weeks to calculate the density data based on the high-performance server)

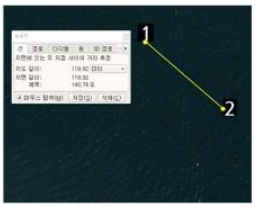
-RAWdata

| 구분 | 식별번호(암호화) | 일시 | 위도 | 경도 | SOG | COG | Heading |
|---|---|---|---|---|---|---|---|
| 1 | MzEwMDAwMzE= | 2018-01-01 06:01:58 | 34.741 | 128.5143 | 4 | 142 | |
| 2 | MzEwMDAwMzE= | 2018-01-01 06:02:58 | 34.74017 | 128.5152 | 6 | 144 | |
| 3 | MzEwMDAwMzE= | 2018-01-01 06:03:58 | 34.73883 | 128.5162 | 0 | 130 | |

-Fusion data

| 식별번호(암호화) | recv_dt | SOG | COG | Heading | grid_no (New) | distance (New) | knot (New) |
|---|---|---|---|---|---|---|---|
| MzEwMDAwMzE= | 2018-01-01 06:02:58 | 6 | 144 | | GR5_G3E23_A15 | 109.301 | 3.541352 |
| MzEwMDAwMzE= | 2018-01-01 06:03:58 | 0 | 130 | | GR5_G3E23_A15 | 144.764 | 4.690354 |

Calculating Distance and Speed (Knots) Based on Latitude and Longitude Changes between Two Points

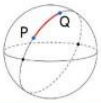


Straight-line Distance Between Two Locations

- Appropriateness of distance and speed calculations
  - Fusion Data: Distance 109.3m, Speed 3.54knot
  - Haversine*: Distance 119.9m, Speed 3.89knot
  - Google Earth: Distance approx. 119.9m

→ Re-estimating ship distance and speed is considered appropriate by using Haversine Formula

Results of improvement methods



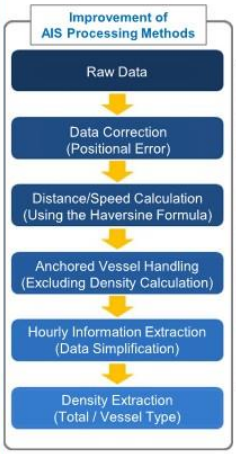

Haversine formula: the great-circle distance between two points on a sphere given their longitudes and latitudes.

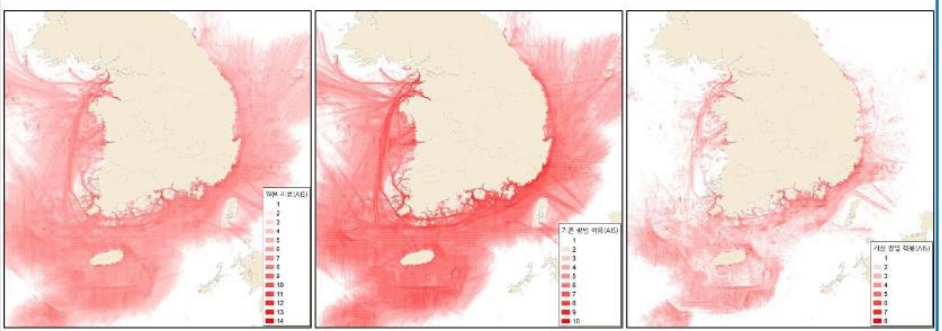
$$d = 2r \times \arcsin\left(\sqrt{sin^2\left(\frac{Q_x - P_x}{2}\right) + \cos(P_x) \times \cos(Q_x) \times sin^2\left(\frac{Q_y - P_y}{2}\right)}\right)$$

# Marine Spatial Assessment Improvement

## Results of Marine Big Data Analysis

- Marine big-data analysis through correction of raw data, calculation of moving distance/speed, anchoring ships, extraction of time-based information, and density calculation

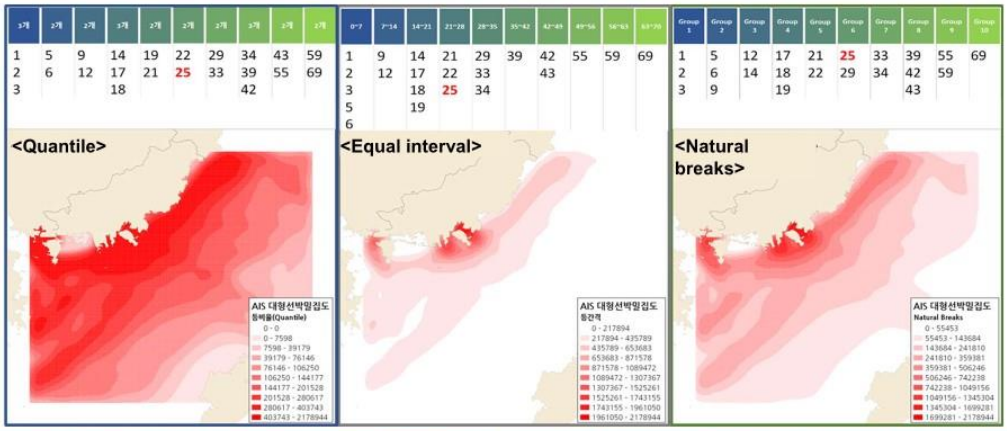


<Raw data of AIS> <Result of present method> < Result of improvement method >

# Marine Spatial Assessment Improvement

- **Comparison of classification methods Marine Spatial Assessment**
  - Quantile : Classify the entire range of values into the same number of samples for each class
  - Equal interval : Classify the entire range of values at equal intervals
  - Natural breaks : Classify to groups of similar values, Identify the distribution of overall values (similar to the K-means method)




# Concluding Remarks

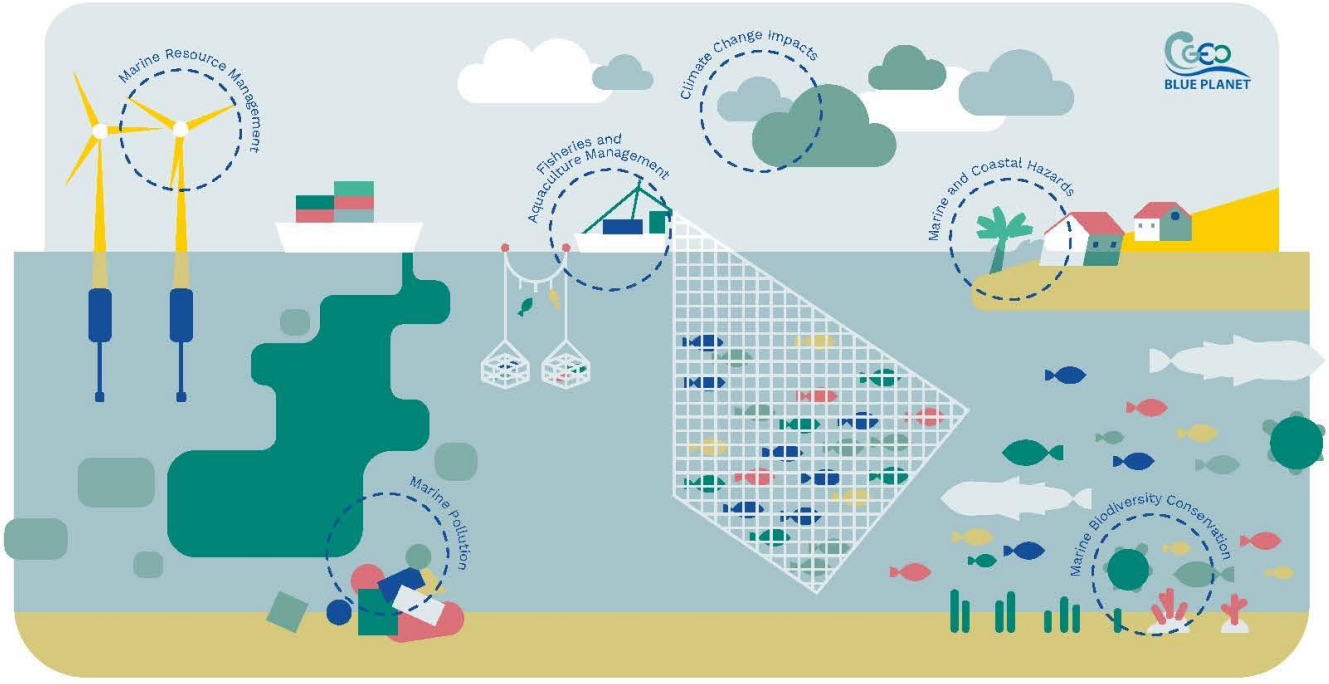
- **Marine Spatial Assessment can be employed for the scientific and objective formulation of Marine Spatial Planning through the utilization of various marine activity data**
- **Marine Spatial Assessment is constrained by the absence of diverse and comprehensive data**
- **A review of grid size configuration is essential to evaluate diverse forms of data across different Marine Use Zones**

# BRIDGING THE GAP

## between ocean and coastal observational data and societal needs to deliver actionable information

**Who we are** The GEO Blue Planet Initiative is the coastal and ocean arm of the Group on Earth Observations (GEO) that aims to ensure the sustained development and use of ocean and coastal observational data for policy and decision-making. We do this by working with stakeholders to understand their information needs and connecting them with available data and products.

**GEO Blue Planet is an open community and all who share the interests of the GEO Blue Planet community are welcome to join.**




**The GEO Blue Planet Secretariat is currently supported by the United States, the European Union and Korea.**

# What we do

**GEO Blue Planet works with stakeholders to identify their ocean and coastal information needs, co-design responsive tools and products, and build capacity to strengthen and transfer capabilities.**


**Activities are selected based on stakeholder needs and currently focus on ocean and coastal observations for the following topics:**

- Marine Litter
- Eutrophication
- Oil Spills
- Coastal Geomorphology Changes
- Fisheries
- Sargassum
- Flooding & Inundation
- Marine Policy

**All activities support and contribute to the UN Decade of Ocean Science for Sustainable Development**

# Join us

**If you are interested in being a part of GEO Blue Planet, please contact the Secretariat via info@geoblueplanet.org.**

geoblueplanet.org

@GEOBluePlanet

GEO Blue Planet