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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (of UNESCO)

Fifteenth Intergovernmental Session of the IOC Sub-Commission for the Western Pacific (WESTPAC-XV)
Tokyo, Japan, 11-13 March 2025

Agenda item 5.1

Consolidation of current effort in ocean-based solutions to climate change

(Unedited text for further inputs and comments)

This document provides a consolidated overview of current efforts and outlines the strategic direction for future collective efforts. **Member States are encouraged to share their national priorities, ongoing efforts, and insights to strengthen international cooperation in this field.**

1. Background

1. Oceans play a fundamental role in regulating climate, absorbing about 30% of carbon dioxide emissions and over 90% of the excess heat generated by human activities. As climate change accelerates, ocean warming, acidification, deoxygenation, and rising sea levels, threaten marine ecosystems and coastal communities. Therefore, leveraging ocean-based solutions can be instrumental in mitigating its effects and building climate resilience.

2. The Indo-Pacific region is one of the regions with the highest sea surface temperatures on Earth, primarily due to the strong solar irradiance at the equator and accumulation of warm water by the large-scale atmospheric and oceanic circulation. The presence of this extensive warm-water region significantly impacts global atmospheric and oceanic patterns, thereby influencing the global and regional climate system.

3. For example, the movement of warm ocean waters directly affects El Niño-Southern Oscillation (ENSO) events in the equatorial Pacific and Indian Ocean Dipole (IOD) phenomena in the Indian Ocean, both of which are interannual variability events with widespread climatic effects. In addition, these oceanic processes is strongly associated with regional ocean climate patterns, such as the Asian-Australian monsoon, and influence intra-seasonal variability like the Madden-Julian Oscillation (MJO). They also contribute to extreme weather events with shorter time scales, such as typhoons and cyclones. The interplay of these phenomena results in significant climate variability across the region, with extreme meteorological impacts on both adjacent and distant landmasses.

4. In recent years, the Kuroshio Current has exhibited prolonged meandering- one of the longest recorded periods – leading to weather anomalies in Japan. Furthermore, ocean heat waves, characterized by abnormally high sea temperatures, have become more frequent. These changes disrupt local weather patterns, marine ecosystems, fisheries, and biodiversity, highlighting the urgent need for effective ocean-based solutions to climate change.

5. Ocean-based solutions to climate change are strategies that use the ocean's natural systems and resources to mitigate or adapt to climate change. Generally, these solutions fall into four main categories: climate mitigation, adaptation, ecosystem protection, and sustainable ocean management.

2. An overview of current efforts

6. Monitoring the ocean is a crucial ocean-based solution to climate change. Alongside efforts to conserve biodiversity and restore degraded ecosystems, the IOC Sub-Commission for the Western Pacific (WESTPAC) plays a vital role in promoting, developing and coordinating ocean observations, facilitating data collection and information sharing, conducting research and analysis, advancing model development, and providing ocean forecasting to support mitigation, adaptation, and conservation efforts.

7. Under the thematic area of actions: Ocean based solutions to climate change, seven programmes/projects/working groups (WGs) have been identified (Table 1), including distinctive research and operational activities in the two regional GOOSs, scientific issues on ocean deoxygenation, ocean upwelling, oceanic variability in the marginal seas, observational studies of the atmosphere and ocean in the Kuroshio Sub-basin, and environmental changes recorded in sediments from the South China Sea.

Table 1 List of Programmes/Projects/Working Groups for the Ocean Solutions for Climate Change

	WESTPAC Programme/Project/WG	**Inception year**	**Status**
A	North-East Asian Regional-GOOS	1996	Active
B	Ocean Forecasting System of SEAGOOS	2010	Active, in synergy with the UN Ocean Decade Program- CoastPredict
C	Monitoring the Ecological Impact of Ocean Acidification on Coral Reefs of SEAGOOS	2015	Active, and integrated as part of the WESTPAC Led Decade Action: Ocean Solutions in the East Asian Seas
D	Air-Sea Interaction in the Kuroshio Extension and Its Climate Impact	2015	Active, merged into the WESTPAC Led Decade Action Programme: CSK 2
E	South China Sea Fluvial Sediments and Environmental Changes	2010	Active
F	Upwelling Studies through Ocean Data Integration towards Sustaining Ocean Health and Productivity	2015	Inactive, to be terminated
G	Changing Asian Marginal Seas and Their Response to Climate Change	2019	Active
F[#]	UN Ocean Decade Action – *Explore the Strongest Ocean Current in the Western Pacific (CSK-2)*	2021	Active

#: The progress of this project is reported in the agenda 4.3.2

a. North-East Asian Regional-GOOS (NEAR-GOOS)

8. NEAR-GOOS, a long-term operational initiative established in 1996, is jointly implemented by China, Japan, South Korea, and Russia under WESTPAC. The activities have been well coordinated among four member states, through continuous communication with the WESTPAC office.

b. Ocean Forecasting System of SEAGOOS

9. Ocean Forecasting System (OFS) as one of SEAGOOS pilot projects was initiated in 2010 at its eighth Intergovernmental Session in Bali, Indonesia. The OFS (formerly as an ocean forecasting demonstration system as of 2015) aimed at improving Member States' capacities for ocean forecasting, and developing an operational ocean forecasting system for the Southeast Asia region and its adjacent seas. This project is also expected to demonstrate the value of ocean forecasting and predictions in scientific research, ocean management, resource exploitation, disaster risk reduction and management, climate change mitigation and adaptation. It is recommended that, in synergy with the UN Ocean Decade Programme- CoastPredict and in cooperation with the other UN Ocean Decade Actions, SEAGOOS OFS project will further advance observing and modeling technology to improve forecasting and prediction capacity of Member States for climate variability, trends and extreme events for coastal hazards.

c. Monitoring the Ecological Impact of Ocean Acidification on Coral Reefs of SEAGOOS

10. Anthropogenic CO2 emissions have continued to rise and were reported reaching the highest recorded levels in Earth's history in 2024. The ocean absorbs approximately one-third of these emissions, causing a chemical reaction between CO2 and seawater that increases seawater acidity and changes its carbonate system, thereby impacting marine organisms and ecosystems. Recognizing the urgency of this issue, SDG-14.3 underscores the critical need to address rising

seawater acidity to protect marine life, seafood production, and socioeconomic development. The "Monitoring of the Ecological Impacts of Ocean Acidification on Coral Reefs" project began in 2015, prioritizing the establishment of the regional ocean acidification (OA) network and improving the capacity building for monitoring seawater acidity and its associated impacts on coral reefs. The significant efforts have been made thus far. It is recommended that the project be continued and integrated as part of the newly registered WESTPAC UN Ocean Decade Action: Ocean Solutions in the East Asian Seas, to strengthen multi-disciplinary approach to understand multiple stressors in coastal ecosystem and co-develop, with relevant stakeholders, ocean science solutions that benefit people, economy and nature.

d. Air-Sea Interaction in the Kuroshio Extension and Its Climate Impact

11. The Kuroshio and Oyashio are the major western boundary currents in the North Pacific Ocean. These currents flow eastward, and after separating from Japan at approximately 35°N and 42°N, these currents form Kuroshio and Oyashio Extensions (KOE). The KOE region has been recognized as a "hotspot" for various oceanic processes, including fronts, eddies, and meanders, all of which significantly influence ocean dynamics, air-sea interactions, climate systems, and marine ecosystems. Notably, the KOE region contributes to over a quarter of the global fish catch, offering substantial opportunities for nearby countries to expand their distant-water fisheries. Given this significance, the project aims to establish a comprehensive, long-term, multidisciplinary observation system in the KOE region. WESTPAC acknowledges the various activities conducted and scientific outputs produced in their report. This project has been transformed into the UN Decade Action 24, as part of the 2nd Cooperative Study of Kuroshio and Its Adjacent Region (CSK-2).

e. South China Sea Fluvial Sediments and Environmental Changes

12. The South China Sea offers an excellent natural laboratory for studying the source-to-sink transport process of fluvial sediments in the global marginal seas. These sediments have recorded detailed climatic and environmental changes occurring in land source regions both naturally and anthropogenically. Collaboration among all surrounding member states (a total of 9 countries) is necessary for gaining a comprehensive understanding of fluvial sediment transport, its source-to-sink process, and the impacts of both natural and anthropogenic factors. During the past inter-sessional period, the group successfully organized two workshops, two research cruises, and multiple bilateral visits and cooperations. WESTPAC recommends continuing this project to explore new horizons, particularly expanding research on river mouth areas in the South China Sea.

f. Upwelling Studies through Ocean Data Integration towards Sustaining Ocean Health and Productivity

13. The pressing challenges of overfishing, marine habitat degradation, and declining fish landing and production highlight the urgent need to improve our understanding of ocean health and productivity. A comprehensive understanding of the upwelling system is vital to address these concerns, as it enables more effective planning of resource management and fish stock assessments. Improving knowledge of these systems will not only contribute to fisheries resource management but also improve our ability to assess the health of ocean ecosystems amid changing climate. Despite efforts to establish a collaborative network to achieve these objectives, recent activity within the group has been minimal. Given the lack of progress, it is recommended that the Sub-Commission terminate the project at the 15th intergovernmental session (11-13 March 2025, Tokyo, Japan).

g. Changing Asian Marginal Seas and Their Response to Climate Change

14. The Asian Marginal Seas (AMS) are highly important regions for human society due to their high productivity, rich fishery resources, and dense human population in adjacent land areas. However, these marginal seas face significant environmental challenges, including marine heatwaves, hypoxic waters, and declining fishery resources. Addressing these issues requires

urgent and cooperative studies to improve our understanding of the environment, its variability, and impacts on primary production, marine ecosystems, fisheries, and society to ensure healthy and productive marginal seas in Asia. It is recommended that the Sub-Commission continue this project into the next inter-sessional period and consider transforming it into a WESTPAC-led UN Ocean Decade Action.

3. Summary

15. The overview revealed that most activities align with the UN Ocean Decade, and reflect the priority interests. However significant efforts are needed to translate data, information and knowledge into actional suggestions to better serve the needs of society.

16. The two current SEAGOOS projects- Ocean Acidification (OA) Project and the Ocean Forecasting System (OFS) Project - will continue and be further developed with relevant UN Decade Actions. It is recommended that OA will be integrated as part of the newly established WESTPAC-led UN Ocean Decade Action: Ocean Solutions in the East Asian Seas, while OFS project will work together with CoastPredict - UN Decade Program. Additionally, it was recommended that the Sub-Commission, in close consultation with Member States, identify and designate a new SEAGOOS Coordinator, and endeavor to coordinate and develop more SEAGOOS initiatives.

17. In addition to these specific recommendations, it was further recommended that the Sub-Commission shall:

1. Strive to strengthen scientific foundation, promote data sharing and management, facilitate the transfer ocean technology, and further generate actionable scientific results, and knowledge products to benefit society.

2. Develop innovative, cost-effective monitoring methods and systems, Enhance long-term observations, with a stronger focus on biogeochemical and biological parameters, alongside physical parameters.

3. Advance contributions to the UN Ocean Decade and other international frameworks or agreements, in particular the UNFCC, and the Kunming-Montreal Global Biodiversity Framework (GBF)