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**INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)**

**Eleventh Intergovernmental Session of the IOC Sub-
Commission for the Western Pacific (WESTPAC-XI)**
Qingdao, China, 21-23 April 2017

Item 6.1 of the Provisional Agenda

**PROJECT PROPOSAL ON
DISTRIBUTION, SOURCE, FATE AND IMPACTS OF MARINE MICROPLASTICS IN
THE ASIA PACIFIC REGION**

WESTPAC has been furthering himself as a key catalyst, advocate, coordinator and facilitator in the region to promote ocean knowledge, sustained observations and services for the improvement of ocean governance towards a healthy ocean and coasts for prosperity.

This action, among others, aims to encourage scientists in the region with strong willingness to lead regional efforts in addressing the most ocean-related compelling issues. Due to financial restrictions, WESTPAC may only be able to provide some "seed" fund, and/or assist in leveraging support/fund to catalyze/implement the adopted projects.

I. PROPOSED PROJECT:

1. Distribution, source, fate and impacts of marine microplastics in the Asia Pacific region

II. PROJECT PROPOSER AND OTHER RECOMMENDED MEMBERS FOR THE PROJECT STEERING GROUP IF AVAILABLE:

Daoji Li, East China Normal University, China;
Zainal Arifin, Indonesian Institute of Sciences, Indonesia;
Huahong Shi, East China Normal University, China;
Somkiat Khokiattiwong, Phuket Marine Biological Center, Thailand;
Noo Azhar M. Shazili, Institute of Oceanography and Environment (INOS), University Malaysia Terengganu, Malaysia

(Please feel free to add more who are willing to join)

III. PROJECT IMPLEMENTATION PERIOD:

2. 3 years, from May 2017 to May 2020

IV. JUSTIFICATIONS FOR THIS PROJECT:

3. Engineered to be durable and inexpensive, plastics are of immense utility and fully integrated in our daily lives. Global plastic production has increased from 1.5 million tonnes in the 1950s to 311 million tonnes in 2014 (PlasticEurope 2015). Up to 10% of plastic production (by mass) entered the marine environment, with estimated inputs as much as 12.7 million metric tons of plastic waste from land into the ocean in 2010 (Jambeck et al. 2015). Plastic marine debris has been ranked as a new addition to the list of global threats, including climate change, ocean acidification and ozone depletion (Amaral-Zettler et al. 2015).

4. In the past decade, a new type of plastic contaminant, termed microplastics (<5 mm), has attracted attention (Thompson and Russell 2004). Microplastics are omnipresent and have been found from Polar regions to the equator, from coastal zone to the open ocean, and the surface to abyssal sediments of the ocean (Zhao et al. 2016). Microplastics, fragmented from larger plastic debris or engineered, occupy a small size range, thus elevate the possibility of ingestion by low trophic fauna (Andrady 2011). Adverse effects of microplastic ingestion by biota include physical damage (Wright et al. 2013), chemical toxicity (persistent, bioaccumulative, and toxic chemicals) (Rochman 2015) and biological effects (Amaral-Zettler et al. 2015). These negative impacts of microplastics are transferred along the marine food web, thus threaten human health (Bouwmeester et al. 2015).

5. Microplastic concentrations have been proved to be statistically and positively correlated with population density and proportion of urban/suburban development (Yonkos et al. 2014; Zhao et al. 2015). The East Asia is one of the most populous regions in the world. Approximately 75% of the population in the East Asian region, which is close to 2 billion people, live in the coastal areas. The region has experienced rapid population growth with economic development in coastal areas, putting pressure on coastal and marine ecosystems. The region is also known for one of the

world's highest concentration of shipping and fishing vessels activities. The ongoing rate of urban and industrial development along the coastlines in the region suggests that marine litter will continue to be a major problem in marine pollution. Asian coastlines have been considered as one of the major contributions to the largest mass of plastic marine debris in the North Pacific Ocean (Jambeck et al. 2015).

6. Considering the status of microplastic pollution in the West Pacific region, it's urgent to comprehensively understand the distribution, source, fate and effects of marine microplastics in the Western Pacific and provide guidance for remediation measures. Meanwhile, standardized and internationally accepted sampling and analyzing procedures to compare spatiotemporal microplastic pollution across marine environments, must be included in this proposal.

V. OBJECTIVES AND EXPECTED OUTPUTS/OUTCOMES:

1. Investigation of sampling and analysis methodologies for microplastics in the WESTPAC (Asia Pacific region)

- a. Sampling methods for microplastics in the marine environment
 - Standardizing field microplastic sampling and laboratory analyzing methods for samples from different marine environmental compartments such as seawater, sediments and beaches
 - Optimizing the microplastic extraction procedures from various marine biotas
- b. Microplastic analysis protocols
 - Constructing internationally accepted marine microplastic category and analysis approaches
 - Developing more efficient microplastic identification method

2. Distribution, source, transportation and fate of microplastics in the marine environment

- a. Occurrence and distribution of microplastics in the WESTPAC (Asia Pacific region)
 - Microplastic pollution status of primary estuaries and marine environment in WESTPAC (Asia Pacific region)
 - Building microplastic data platform in WESTPAC (Asia Pacific region)
- b. Source of microplastics
 - Constructing fingerprint repository of microplastics and the methodology for its origin apportionment based on collecting both sea- and land-based microplastics,
 - Loads of land sourced microplastics into the marine environments
- c. Dynamics and fate of microplastics
 - Revealing reaction and sinking mechanisms of microplastics in the coastal water column
 - Developing numerical models to predict microplastic transportation in the coastal areas

3. Effects of microplastics on the marine ecosystems

- a. Field and laboratory evidence of microplastics transfer from lower-trophic-level organisms to higher-trophic-level organisms
 - Occurrence of microplastics in different field trophic levels
 - Uptake, transition and excretion of microplastics ingested
 - Physical damages on marine biotas such as seabirds, fish, bivalves
- b. Mixture, fate and toxicity of chemicals associated with microplastics
 - Mixture: compositions of chemicals added or produced during manufacturing and those present in the marine environment that accumulate onto the debris from surrounding seawater
 - Fate: chemical contaminants partition onto various environmental media; chemical bioavailability and its metabolisms to different marine fauna; dynamics of chemicals in the marine food chains
 - Toxicity: adverse impacts on biological hierarchy structures namely genetic, cellular, individual, population, community and systems
- c. Ecological Risk Assessment of microplastic pollution in the regional seas
 - Based on the laboratory and field data, develop ecological risk assessment model to evaluate the impacts of microplastics on sensitive biological population and marine ecosystems

VI TERMS OF REFERENCE OF THE PROJECT STEERING GROUP:

7. The Project Steering Committee is established to meet the scientific, managerial implementation, and resource needs of the WESTPAC- Marine Microplastics Project. It has overall responsibility for the formulation of strategy, and for the planning and coordination of WESTPAC- Marine Microplastics Project.

8. The Group will carry out the following functions:

1. Review the regional concerns on Marine Microplastics, and identify the project requirements;
2. Promote efficient and cost-effective implementation of the WESTPAC Project and prepare recommendations on this implementation to the IOC Sub-Commission for the Western Pacific and the IOC's Intergovernmental Panel for Marine Microplastics;
3. Identify the resources necessary to meet Marine Microplastic project needs;
4. Report to the IOC Sub-Commission for the Western Pacific.

VII. MAIN ACTIVITIES TO BE CARRIED OUT

1st Year (May 2017 - May 2018)

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| May - July 2017: | Investigating the sampling and analyzing methods of microplastic research |
| August - October 2017: | Conducting the first field sampling in selected marine areas and performing analysis |
| November - December 2017: | Building the microplastic data platform and analyzing the data from the working group |

January - March 2018: Constructing the fingerprint database based on the microplastic surveys

April - May 2018: Summarizing current research results and discussing future work

2nd Year (May 2018 - May 2019)

May - October 2018: Studying sinking mechanisms of microplastics in the coastal water column; Assessing the microplastic pollution in selected marine fauna and exploring its physical damages to the biota

November 2018 - February 2019: Conducting the second field sampling in selected marine areas and analyzing the samples; Quantifying the total microplastic inputs of selected rivers in the studied region

March - May 2019: Based on previous results, developing numerical models to predict microplastic behavior in the studied areas; Summary and discussion of the project

3rd Year (May 2019 - May 2020)

May - October 2019: Based on the preserved samples from two field sampling, decomposing the complex mixture of chemical related to microplastics

November - December 2019: Investigating the partition, dynamics and biological metabolism of chemicals associated microplastics in the laboratory

January - March 2020: Toxicological research of microplastics and its associated chemicals impacting on different biological hierarchy structures; constructing risk assessment model

April - May 2020: Completing ecological risk assessment; Discussing research results and finishing the final project report

VIII. PROPOSED WORK PLAN AND BUDGET FOR MAY 2017 - MAY 2019:

Project	Activities	Objectives	Expected outputs/outcomes	Date and Place	Funding required	
					IOC	Other sources (i.e. from national/international sources)
WESTPAC-Marine Microplastics	Discuss methods	Standardization	An unified protocols	May 2017		
	Data platform	Build internet database	Data platform building memorandum	December 2017		
	Summary	Summary and discussion	A report for the first year study and arrangement of the coming job	May 2018		
	Communication	Communication and resolving problems	An exchange report	December 2018		
	Model building	Numerical model	A paper work for the applicable numerical model	May 2019		

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