

## **Outline for the progress report on Upwelling studies through ocean data integration towards sustaining ocean health and productivity (UPWELL)**

### **1. Introduction and justification**

Upwelling is an oceanographic feature that is very important to the ocean ecosystem. It brings high nutrient water to the surface and the impact is noteworthy to the ocean productivity. This nutrient-rich water will encourage a phytoplankton bloom that is ultimate base for large animals population in the food chains, including fish, mammals and sea birds. Although this coastal upwelling region covers relatively small area of the ocean surface, they contribute roughly 50 percent of the world's fisheries landings.

Unique physical settings of SCS and its surrounding seas allow many sites to become upwelling favorable during different monsoon season. Within the South China Sea basin and surrounding ocean, there are numbers of well-established sites of upwelling region, i.e. Hainan Island and Vietnam coast. Nonetheless, recent study discovered few upwelling area within SCS which never been studied before. Amongst them are the region along the east coast of Peninsular Malaysia and area at south of Java. There are many other sites which is believed to have similar upwelling dynamics that either has not been discovered or not well explored.

These new discovery of upwelling site shows that our understanding on this vast ocean that surround us are very limited. It is even more concerning when the system we are referring is very important to our food sources. A reason contributing to this deficiency is lack of scientific data that subsequently limit our understanding of the upwelling dynamics in the region. Monsoon season, shallow continental shelf and large marginal seas is one of the unique characteristics of SCS, thus data collection will allow us to focus on this unique local setting which usually different from other upwelling region.

The challenging issues of overfishing, degradation of marine habitat and reduction in fish landing and production demonstrate the urgent need of understanding our ocean health and productivity. An understanding of upwelling system is vital to address these concern where better understanding of the system will allow better planning for resource management and estimation of fish stock assessment. It will be noteworthy contribution not only in managing fisheries resources but also to better prepare us in understanding the health of ocean ecosystem and also enhancing knowledge of emerging ocean science issue of ocean productivity in this changing climate.

It is the right time for us to concentrate our effort on the health and productivity of the ocean particularly in our East Asia Seas. We are facing many threats in the ocean nowadays. Climate change, ocean acidification, pollution, overfishing, HAB, and endangered and charismatic species extinction has always been our primary concern regarding the ocean. Nevertheless, upwelling dynamics in other perspective holds a very important values that require special treatment if we are serious in managing our ocean resources. Every aspect of the ocean are interconnected, both managing resources and understanding threat hold similar importance that will help us provide solution for the ocean.

### **2. Timeframe and objectives**

The main objectives of this group are;

1. To establish scientific information of upwelling sites within South China Sea and adjacent sea in a form of database, website and scientific reference to enhance accessibility of the scientific information to various stakeholders.
2. To produce data analysis technique on the investigation of productivity of upwelling site with emphasis on dynamics, biogeochemistry and climate change through observation data and numerical modeling data products.

2023-2025: Data compilation, Capacity building and website upgrade and compilation of scientific information

2025-2026: Chapter in Book publications

2024-2026: Establishment of new data analysis for productivity i.e. biogeochemistry and climate change effect on upwelling site.

2026-2027: Capacity building for early career scientist through data analysis methods for upwelling that involve BGC data and climate change.

### **3. Major activities, outputs & outcomes over the last intersessional period (May 2021- April 2023).**

- a. Preparation for journal publications – 2 papers in preparations
  - i. Upwelling in Marginal Seas and its Association with Climate Change Scenario – A Comparative Review. (Nature Portfolio) Submitted, Feb 2023
  - ii. Coastal Upwelling in Asia-Pacific Regional Seas: Scientific Progress and Regional Collaboration – under preparation (will be submitted to Frontiers in Marine Science)
- b. Online training for Integrated Data Analysis Approach for Coastal Upwelling Studies. Co-organize by UMT and IODE – Dec 2022, postponed to June 2023

### **3.A summary of key achievements since its establishment**

1. 2 WESTPAC Workshop on Upwelling and Its Dynamics in the South China Sea and adjacent areas.
  - Enhance partnership with various country in the region. This has increase communication and support for the program
2. Integrated data analysis for upwelling studies Training Course, 12-17 Nov 2017. Terengganu, Malaysia
  - This program has supported young scientist from the region to explore existing site and new site of upwelling in their countries. 14 Participants from 6 countries (Indonesia, Fiji, Brazil, India, Ukraine, and Malaysia)
3. Development of UPWELL website to disseminate info on upwelling in the region, based on publications and scientific findings.
4. Establishment of upwelling site compilation in the region.
  - This compilation has allowed us to establish details and uniqueness of each site within the South China Sea and adjacent seas.

### **4. Self-assessment on implementation against objectives**

- I. Objective were achieved but always behind schedule because of various factors.
- II. Most of the work are being done by few numbers of people. More collaborated partnership should work on the objectives and project outcome to reflects regional partnership and inclusive outcome.

### **5. Problems encountered and recommended actions**

One of the biggest challenges is the communication. Yes, we able to perform online program, however details communication that require more commitment from team members are sometimes not efficient. For example, we need to postpone our book chapter project, because it is hard to get response, although early commitment has been given. Thus, we hope next workshop can be f2f meeting which hopefully will provide better commitment and impactful outcomes.

- a. **Objectives to be achieved, if applicable, over the next intersessional period (May 2023- April 2025)**

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1. To establish scientific information of upwelling sites within South China Sea and adjacent sea in a form of database, website and scientific reference to enhance accessibility of the scientific information to various stakeholders.
  - a. 3<sup>rd</sup> UPWELL Group workshop
  - b. Book publication with compilation of chapters from team members
  - c. website update, with more compilation of reviews, journals and information

## **6.Planned activities for May 2023- April 2025**

[provide, in tabular form, the action items that should be included in the work plan and budget]

Program					Funding Required		Remark
	Activities	Objectives	Expected outputs/outcomes	Date and place	IOC	Other sources (i.e., from national or international)	
	3 <sup>rd</sup> Upwelling Workshop in 2023	<p>To gather experts can present and discuss the progress of understanding of upwelling studies, productivity and its dynamics within the region of South China Sea and surrounding seas</p> <p>To develop plan for collaboration studies and training to synergize effort in exploring the possibility for joint studies and knowledge transfer among countries</p>	<ol style="list-style-type: none"> <li>1. Establishment of new framework that will support new new parameters such as nutrients, biology and biogeochemistry</li> <li>2. Setup of new partnership of using new approach of global climate modeling data for upwelling studies</li> </ol>	Nov, 2023 Malaysia	Travel support	UMT (accommodation and event venue)	
	Online training for Data Exploration of New Upwelling Sites. Co-organize by UMT and IODE	<p>To explore existing upwelling site using available datasets and increase understanding of the physical-biological interaction dynamics of upwelling regions</p> <ul style="list-style-type: none"> <li>• To construct integrated data gathering which involve field data, satellite data and wind-data at any particular upwelling site</li> <li>• To conduct simple</li> </ul>	<ol style="list-style-type: none"> <li>1. Young scientist with new knowledge of using existing data to explore upwelling site and provide detail analysis</li> <li>2. New networks with various partners and</li> </ol>	June, 2023 Malaysia		UMT IODE	

<b>Program</b>					<b>Funding Required</b>		<b>Remark</b>
	<b>Activities</b>	<b>Objectives</b>	<b>Expected outputs/outcomes</b>	<b>Date and place</b>	<b>IOC</b>	<b>Other sources (i.e., from national or international)</b>	
		analysis from the integrated data in determining special characteristic of any particular upwelling site	country that can provide more information on upwelling information from different sites and countries				
	Publication of books with chapter contribution from upwelling team members and invited researchers	To develop a group that will plan, support and execute the publications effort for upwelling books  To publish scientific output of upwelling studies in the region of Asia-Pacific in a form of chapters in book.	Published Book with at least 10 chapters, by highly reputed publisher (i.e. Springer, Elsevier or MDPI)	Online Discussion			