

**SCHEDULE E**  
**END OF PROJECT REPORT**

A. Description of the Project			
<b>Project Title</b>	Benthic Ecosystem Function under Different Climate Conditions in Polar Region		
<b>Project Leader</b>	Wan Mohd Rauhan bin Wan Hussin		
<b>Industrial Partnership</b>	-		
<b>National / International Collaborator</b>	Korea Polar Research Institute (KOPRI)		
<b>Project Duration</b>	24 months	<b>Budget Approved</b>	RM 100,000.00
B. Objectives			
Objectives of the Project	<ul style="list-style-type: none"> <li>i. To determine the response of benthic macrofauna on the organic enrichments following climate change using both structural and functional approaches.</li> <li>ii. To identify the main ecological characteristics that distinguishes the benthic communities in terms of climate differences.</li> <li>iii. To identify the 'keystone' species that influences the structure of the macrofaunal community composition.</li> </ul>		
Objectives achieved	<p><u>Objective i</u> Achieved – Both structural and functional aspects of benthic communities were adversely affected by climate change in West Antarctic Peninsula</p> <p><u>Objective ii</u> Achieved – In different climatic conditions, the benthic communities are distinguished by different feeding mechanisms. Filter feeders seemed to be more in the climate-driven impacted station than the deposit feeders.</p> <p><u>Objective iii</u> Achieved – Species such as <i>Molgula pedunculata</i> and <i>Ascidia challenger</i> (both are Ascidian) were the species that had a significant impact on the whole communities in Marian Cove</p>		
Objectives not achieved (Please state reason contribute to the unachievable objectives)			

C. Technology Transfer / Commercialization Approach, if any
<p><b>D. Assessment of Research Approach</b></p> <p><i>(Please highlight the main steps actually performed and indicate any major departure from the planned approach or any major difficulty encountered)</i></p>
<p>The first part of the project was carried out in West Antarctic Peninsula from December 2013 to February 2014, where Wan Mohd Rauhan (WMR) worked in collaboration with the <b>Korean Polar Research Institute (KOPRI)</b>. The work was carried out in Marian Cove, located near King Sejong Station which is managed by KOPRI. A substantial portion of expenditure (e.g. flight tickets to and from Antarctica, fees during stay in the station) during this project was covered by KOPRI. Before came to agreement to collaborate, WMR was requested to present his research plan in KOPRI, Incheon, Korea in July 2013 (financially supported by KOPRI). In Antarctica, the approach of sampling was based on WMR's proposal, hence no major departure from original plan. In this sense, glacier melting in Marian Cove was used a proxy for different climate conditions, where stations near the glacier indicated the warmer climate while the opposite for the station further from the glacier. Samples were physically collected by the professional divers, and some photos were also taken for identification of the organisms. WMR's main works was to process the samples and identify the benthic organisms, as well as carried out the analysis for sediment characteristics. In addition, the focal point of this study, the functional aspect of organisms was used in data analyses. This approach</p>

was led by WMR, who suggested this during the meeting in KOPRI's office. Other analyses related to sediment characteristics and water quality were partially carried out in King Sejong Station's lab. In the early of February 2014, WMR and the Korean collaborators left Antarctica. All samples were brought back to KOPRI by ship. In KOPRI, WMR's collaborators continued to carry out the unfinished analyses while WMR worked on the statistical analyses, especially the functional analysis which took a substantial amount of time. After a few months, all analyses were completed and all members were then worked on writing an article for publication. The article was then published in Ecological Indicators journal.

The original plan was to return to Antarctica. However, since the Korean collaborators had no more funding to return. WMR also did not manage to get another collaborator to work with in Antarctica. Therefore, in WMR's progress report review, a reviewer suggested to carry out a study in Tropical region. This second part of the project was carried out in Bidong Island from October 2014 to March 2015 to investigate the difference in the way how Polar and Tropical benthic communities respond towards environmental changes. This part of the project utilised very minimum amount of money as the location of study area is near to WMR's institution, and a lot of resources were available to be used. Samples were collected by the aid of SCUBA diving at different stations during pre- and post-monsoon seasons. Works from these two parts of the project were combined and presented in Aquatic Biodiversity conference held in Liverpool in September 2015.

After conducting two parts of study, WMR only used approximately half of the funding provided. Then, came a call to join the Malaysian Antarctic Scientific Expedition 2016 which was organised by YPASM itself. WMR was granted a permission to join this expedition using the remaining fund. This third part of the study was also conducted in West Antarctic Peninsula, but it was different from the first part as it involved much bigger spatial scale. Sampling were done at 8 stations at different latitude to determine the distribution and diversity of benthic organisms in relation of latitudinal difference. Sampling were carried out on board a yacht named Australis. Initially, samples were collected on the shore using a special-made scoop. This method was selected after a series of discussion in the expedition's meeting and also literature search with regard to sample collection method in Antarctica. However, after 4 stations, WMR's came into conclusion that this sampling method was not effective as from early observation, the samples collected were very low in diversity. Therefore with the help of Australis' captain who built a special-made mini scoop to be used in deeper subtidal area, the remaining stations were sampled using this new method. WMR spent 2 days in King Sejong Station to process the samples and identify the organisms before the remaining were brought back to Malaysia. Works on this final part took a lot longer than expected as after returning to work, WMR has been asked to take a lot of teaching load (to compensate the 1 month away from work) as well as involved in a few outreach programmes which took a lot of time. All samples were now analysed and it is found that the diversity of benthic communities was not related to the latitudinal change. However, this study is still important as it provide the baseline information on a wide scale of benthic distribution.

In general, this fellowship project has experienced a fairly major departure from the original plan. However, the original objectives were all achieved although it might be much better if the first part of the project could be repeated so that a sounder conclusion in terms of polar benthic communities' response towards climate change can be made.

#### **E. Assessment of Project Schedule**

*(Please make any relevant comment regarding the actual duration of the project and highlight any significant variation from plan)*

The changes in project schedule happened due to the changes in project approach. WMR was given an extension of project duration up until 28 February 2016 (from the original end date of 31 October 2015). However, since the expedition ended in mid of February 2016 and with the subsequent works that need to be done, this project was finally finished in end of October 2016.

#### **F. Assessment of Project Cost**

*(Please comment of the appropriateness of the original budget and highlight any major departure from the planned budget)*

The budget was initially under used but was appropriately used after changes in project approach.

#### **G. Assessment of Project Cost**

*(In case of involvement of other sources, please indicate the source and total funding provided)*

Additional budget was provided by KOPRI. This was provided by means of travel (airline tickets only and

hospitality at King Sejong Station.

#### H. Benefits of the Project

1. WMR has gained knowledge on Antarctic environment and this also means the increase number of Malaysian scientist work on Antarctic science.
2. A collaboration with KOPRI. In fact, during the Antarctica Expedition, the Malaysian team was given a great helps and hospitality by KOPRI at King Sejong Station. This was received through WMR's initiative with KOPRI.
3. This project has added a great deal of information on the functional diversity of benthic communities in Antarctica. The functional approach in analysing benthic community is still scarce in this region compared to Europe and North America regions.
4. Considering his experience and knowledge on the Polar region, WMR also involved in several outreach programmes as speaker organised by YPASM. WMR also took part in Polar Science Camp (to select Malaysian school students for Arctic expedition) in 2015 and 2016.

#### I. Contribution of the Project to the Knowledge

1. How has the output of the project been documented

- Detailed project report
- Product / Process specification
- Other (please specify) - publications

2. Did the project create an intellectual property stock?

- Patent obtained
- Patent pending
- Patent application will be filled
- Copyright

3. What publications are available?

- Article(s) in scientific publications  
(Please provide paper(s) title, publisher and year of publication)

- i. Moon, H.Y., Wan Hussin, W.M.R., Kim, H.C., Ahn, I.Y. 2015. The impacts of climate change on Antarctic nearshore mega-epifaunal benthic assemblages in a glacial fjord on King George Island: Responses and implications. *Ecological Indicators*, 57: 280-292.
- ii. Wan Hussin, W.M.R. 2016. Comparing the structure and function of the Antarctic and Tropic benthic communities following environmental changes. (*Submitted to AACL Bioflux journal*)

- Paper(s) delivered at conferences/seminars  
(Please provide paper(s) title, conference/seminar title and date of the conference/seminar)

- i. Wan Hussin, W.M.R. 2015. The resilience of benthic organisms in Polar and Tropical regions following environmental changes. *Presented at the Aquatic Biodiversity and Ecosystems Conference from 30<sup>th</sup> August to 4<sup>th</sup> September 2015 in Liverpool, UK*



(Please specify)

Linkages with domestic research institution / universities  
(Please specify)

/ Linkages with international research institution / universities  
(Please specify) - Korea Polar Research Institute (KOPRI)

**2. What is the nature of the linkages?**

Staff exchanges

/ Inter-organisational project team

Research contract with a commercial client

/ Informal consultation

Other (please specify)

**Date:** 27.10.2016

**Signature:**

