

**UNIVERSITI SAINS MALAYSIA
GERAN PENYELIDIKAN UNIVERSITI PENYELIDIKAN
LAPORAN AKHIR**

**IMPACT ON AQUATIC ENVIRONMENTAL ASSETS:
AFTERMATH OF DECEMBER 2014 EAST COAST STATES OF
MALAYSIA FLOOD. A STUDY ON IMPACT ON CORAL REEF
ECOSYSTEMS AND INTERTIDAL BENTHOS POPULATION ECO-
SUSTAINABILITY – 'THE MANAGEMENT TIME'**

PENYELIDIK

PROFESOR MADYA DR. FARID B. CHE GHAZALI

PENYELIDIK BERSAMA

**PROFESOR DR. SITI AZIAH BT. MOHD NOR
PROR. MADYA DR. K.N.S. SIRAJUDEEN
DR. MALIKI HAPANI
SURIANI BT. ADDULLAH**

2017



KEMENTERIAN
PENDIDIKAN
MALAYSIA

FINAL REPORT
GERAN PENYELIDIKAN PENGURUSAN BENCANA BANJIR
Laporan Akhir Skim Geran Penyelidikan Fundamental (FRGS)
Tahun 2015

A RESEARCH TITLE: IMPACT ON AQUATIC ENVIRONMENTAL ASSETS: AFTERMATH OF DECEMBER 2014 EAST COAST STATES OF MALAYSIA FLOOD. A STUDY ON IMPACT ON CORAL REEF ECOSYSTEMS AND INTERTIDAL BENTHOS POPULATION ECO-SUSTAINABILITY – ‘THE MANAGEMENT TIME’

YEAR: 2015/2016

THEME CODE: 1.0
(Please refer attachment)

SUBTHEME CODE:

Please Tick (✓)

PHASE:	01: Pre-Disaster	<input type="checkbox"/>	02: During Disaster	<input type="checkbox"/>	03: Post-Disaster	<input checked="" type="checkbox"/>
AREA:	01: Preventive	<input type="checkbox"/>	02: Preparedness	<input checked="" type="checkbox"/>	03: Rescue and Recovery	<input type="checkbox"/>
	04: Adaptation	<input type="checkbox"/>	05: Mitigation	<input type="checkbox"/>		

START DATE: 30/06/2015

END DATE: 31/03/2016

PROJECT LEADER: Associate Prof. Dr. Farid Bin Che Ghazali.

I/C / PASSPORT NUMBER: 601007-03-5075

PROJECT MEMBERS:

1. Profesor Dr Siti Azizah Binti Mohd Nor
2. Associate Prof. Dr. K.N.S. Sirajudeen
3. Dr Maliki Hapani
4. Suriani Binti Addullah

PROJECT ACHIEVEMENT (Prestasi Projek)

B

ACHIEVEMENT PERCENTAGE			
Project progress according to milestones achieved up to this period	0 - 50%	51 - 75%	76 - 100%
Percentage (please state #%)			100 %
RESEARCH OUTPUT			
Number of articles/ manuscripts/ books <i>(Please attach the First Page of Publication)</i>	Indexed Journal		Non-Indexed Journal
	1- Submission of full paper for Jurnal Teknologi (Scopus)		1- Submission of full paper for conference 'Kajian Banjir 2014'
Conference Proceeding <i>(Please attach the First Page of Publication)</i>			National
Intellectual Property <i>(Please specify)</i>			
Number and title of Policy Paper / SOP / Technology Solution <i>(Please specify)</i>	1. 2. 3.		

HUMAN CAPITAL DEVELOPMENT					
Human Capital	Number				Others (please specify)
	On-going		Graduated		
Citizen	Malaysian	Non Malaysian	Malaysian	Non Malaysian	
No. PHD STUDENT					
Student Fullname: IC / Passport No: Student ID:					
No. MASTER STUDENT					
Student Fullname: IC / Passport No: Student ID:	Suriani Bt Abdullah 860723-29- 5288 Std ID: P- SKM0019/15(R)				
No. RA/RO					
Student Fullname: IC / Passport No: Student ID:					
Total	1				

EXPENDITURE (Perbelanjaan) as Borang K1 (RMC)

C Budget Approved (Peruntukan diluluskan) : **RM 70,000.00**
 Amount Spent (Jumlah Perbelanjaan) : **RM 49,816.64**
 Balance (Baki) : **RM 20,183.36**
 Percentage of Amount Spent : **71.2 %**
 (Peratusan Belanja)

ADDITIONAL RESEARCH ACTIVITIES THAT CONTRIBUTE TOWARDS DEVELOPING SOFT AND HARD SKILLS
 (Aktiviti Penyelidikan Sampingan yang menyumbang kepada pembangunan kemahiran insaniah)

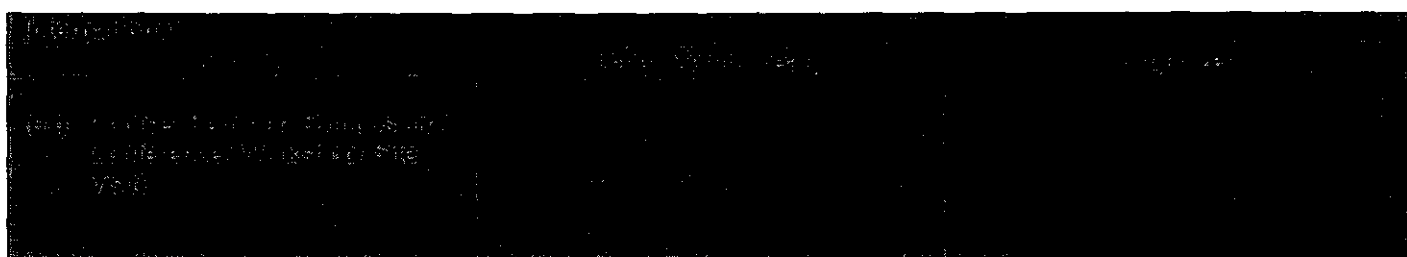
D

No	Activities	Dates
1.	Letter from RMC - Grant Grant write up revision & time gant chart Redit resubmit to RMC (USM) Grant Awarded	5/5/2015 8/5/2015 18/5/2015
2.	Grant Account opening	25/5/2015 FRGS bangir 203 PPSK 6171180
3.	Appointment of research assistant (RA)	15 June 2015. Name: Suriani Binti Abdullah
4.	Preparation & Proposal writing of Master Studentship	Start planning and writing proposal from 18 June 2015
5.	Attendance at 'Dialog bencana banjir; PWTC Kula lumpur	28 May 2015
6.	Meeting with Marine Park Department Putrajaya (For licensing and collorative measures – monitoring acitvies at sanctuary islands under Marine Park DEPT especialy Pahang /Johor borders)	29 May 2015
7.	Licensing for Marine Park Department approval acquired	JTLM-630-Jld.6(11) 01 Jun 2015
8.	Initiate cross reference literatures review pertaining to of water quality parameters study / logistics (10 years retrospective review) in relation to coastal and cross reef linked to flood scenario within East-Coast Malaysia: Parameter pursued:	Starts : 20 June 2015 - on going

	-Sedimentation -Salinity -Colliform, BOD -pH -Temperature	
9.	Pursue of quotations for purchasing of a underwater Video camera	
10.	Achieving of GPS Map of East Coast islands	JUPEM (25 June 2015)
11.	Archiving flood information from kelantan rivers - Hydrology Dept	2 June 2015 Department of Irrigation and Drainage Kelantan division of water resources and hidrology. Kelantan
12.	Achieving the water quality parameter information of flood 2014 in Kelantan, trengganu and Pahang Letters drafted and visit made	Department of Enviroment (DOE) Kelantan 2-5 July 2015. (Parameters for 5 years are being studied)
13.	Planned coastal field monitoring 2-6 June 2015	Checklist prepared Water quality. BOD colloforms and sedimentation analysis Postpone. High tide. Strong wind and heavy rainfall Next sechedule based on Weather / Meteorology Dept Proposed sechedule dates 10-13 July 2015
14	First sampling of water quality - Pengkalan Datu & Kuala Besar (Kelantan) - Sg. Dungun, Sg. Maran & Sg. Kemaman (Terengganu) Sampling were done in 2 days	20/8/2015 & 21/8/2015
15	Lab Analysis of water samples - BOD -COD -e.coli -Total Coliform	25/8/2015 - 26/8/2015
16	Archiving flood information fromTerengganu rivers - Hydrology Department, JPS Terengganu (Parameters for 5 years are being studied)	30/8/2015

17	Sample preparation for sediment analysis by using Inductively coupled plasma mass spectrometry (ICP-MS)	7/9/2015
18	Approval of purchasing Underwater Video camera Go Pro Hero 4 Silver ED complete with accessories	9/9/2015
19	Attending and presenting of progress in workshop 1 FRGS Banjir at Everly Hotel, Putrajaya	14/9/2015 & 15/9/2015
20	Sand analysis of samples from Kelantan and Terengganu by using Scanning Electron Microscopy (SEM)	10/5/2015
21	Archiving flood information from Pahang rivers - Coastal river Department, JPS Pahang (Parameters for 5 years are being studied)	15/10/2015
22	Submit the application of extend the grant period until 2016	29/10/2015
23	Approval of VOT-HEPG - F1012	16/11/2015
24	Getting The ICP result from analytical Lab	23/11/2015
25	EDX analysis of samples from Kelantan and Terengganu by using Scanning Electron Microscopy (SEM)	24/11/2015
26	Submission of Jurnal Teknologi (scopus)	3/12/2015

27	Field Monitoring and sampling in Perhentian Island	3/3/2016- 5/3/2016
28	Approval of second VOT-HEPG -	22/03/2016
29	Field Monitoring and sampling in Kapas and Rawa Island	23/3/2016 - 25/3/2016
30	EDX analysis of samples from Kelantan and Terengganu by using Scanning Electron Microscopy (SEM)	29/3/2016
31	Submission of Full Paper <i>Kajian Banjir 2014</i>	31 March 2016
32	"Persidangan Kajian Bencana Banjir 2014	4 – 6 April 2016



National		
Activity	Date (Month, Year)	Organizer
Attending and presenting of progress in workshop 1 FRGS Banjir at Everly Hotel, Putrajaya	14/9/2015 & 15/9/2015	UTM Research Alliance
Conference of Kajian Bencana Banjir 2014	4 – 6 April 2016	UTM Research Alliance

E	PROBLEMS/ CONSTRAINTS IF ANY (Masalah/ Kekangan sekiranya ada)
	<p>Some constraints to the conduct of the research miletones and activities include;</p> <ol style="list-style-type: none"> 1. High tides and strong wind hindering sechduled field survey activities 2. University final examinations and examiners report exercise for undergraduates and postgraduates at principle researchers faculty. 3. Difficulties to get an approval for budget doing research thus the monitoring activities planned delayed and cause to late data analysis.
F	RECOMMENDATION (Cadangan/Perambahbaikan)
G	RESEARCH ABSTRACT – Not More Than 200 Words (Abstrak Penyelidikan – Tidak Melebihi 200 patah perkataan)
	<p>The impact on coastline and aquatic ecosystem from the worst ever North East monsoonal flooding event in Malaysia history in years, December 2014 to January 2015 ‘Tsunami mud-like’ flood, in east coast Malaysia can range from unnoticeable to devastating. Floods can accelerate fluxes; destroy drainage and reverine systems causing raw sewage, nutrients and sediments to spill out into bodies of water that may have detrimental influence to east coast Malaysia coral reef structure and dynamics, especially of its benthic populations and marine ecosystems. The plumes effect coral reefs by burying decreasing light levels of depleting oxygen supplies by introduction of large amounts of organics settlements. In pertinent to this the link <i>between</i> water quality parameters and its plankton species composition and prevalence into the system is also unknown.</p> <p>Globally, floods destroy drainage and reverine systems causing raw sewage to spill out into bodies of water. As such nutrients and sediments from east coast coastal rivers may have detrimental influence and be harmful to the majestic east coast Malaysia marine park coral reef especially on the structure and dynamics of benthic populations and marine</p>

ecosystems. In Pertinent to Kelantan, its Kelantan river system flows northward thus passing through such major towns as Kuala Krai, Tanah Merah, Pasir Mas and Kota Bharu, before finally discharging into the South China Sea. The 2014 flood was purported as the most significant natural disaster in Malaysia in terms of frequency, area extent, population affected bad damage.

Coral reefs are often referred to as the 'rainforests of the sea', although, although one could points out equally well and call rainforests the coral reefs of the land (Davidson, 1998). Regardless, these two ecosystems do indeed share several important attributes, most notably high diversity and severe declines worldwide over the last several decades.

Over the past 30 years coral bleaching has become a widespread phenomenon and is now seen by many as one of the most distinct manifestations of climate change impacts on natural ecosystems.

Coral bleaching can be a short-lived phenomenon; and its spatial appearance can vary considerably. Some bleaching events are comprehensive and tightly synchronised (i.e., most species fully bleached at the same time) and these are likely to be easier to detect, particularly in areas of high coral cover. Where only some colonies are bleached, or where the loss of colour in bleached colonies is only partial, detection becomes increasingly challenging.

Date : 30 May 2016
Tarikh

Project Leader's Signature:
Tandatangan Ketua Projek




COMMENTS IF ANY (ENDORSEMENT BY RESEARCH MANAGEMENT CENTER (RMC)
(Komen sekiranya ada/Pengesahan/da) Pusat Pengurusan Penyelidikan)

Name:
Nama:
Date:
Tarikh:

PROF. DR LEE KEAT TEONG
Pegawai
Pejabat Pengurusan & Kreativiti Penyelidikan
Universiti Sains Malaysia

Signature:
Tandatangan:


9/2/16

UNIVERSITI SAINS MALAYSIA
JABATAN BENDAHARI
KUMPULAN WANG PENYELIDIKAN FUNDAMENTAL
PENYATA PERBELANJAAN SEHINGGA 30 APRIL 2016

Jumlah Geran	RM70,000.00	Ketua Projek	PROF MADYA DR. FARID CHE GHAZALI
		Tajuk Projek	IMPACT ON A AQUATIC ENVIRONMENTAL ASSETS: AFTERMATH OF DECEMBER 2014 EAST COAST STATES OF MALAYSIA FLOOD. A STUDY ON IMPACT ON CORAL REEF ECOSYSTEMS AND INTERDAL BENTHOS POPULATION ECO-SUSTAINABILITY-"THE MANAGEMENT TIME"
		Tempoh	24 BULAN (1 DISEMBER 2014 - 30 NOVEMBER 2016)
		No. Akaun	203/PPSK/6171180

Kwgan	Akaun	PTJ	Projek	Peruntukan Projek	Perbelanjaan Terkumpul sehingga Tahun lalu	Peruntukan Semasa	Tanggung Semasa	Bayaran Tahun Semasa	Belanja Tahun Semasa	Baki Projek
203	11000	PPSK	6171180	17,300.00	10,147.53	7,152.47	-	5,490.88	5,490.88	1,661.59
203	14000	PPSK	6171180	-	-	-	-	-	-	-
203	15000	PPSK	6171180	-	-	-	-	-	-	-
203	21000	PPSK	6171180	11,130.00	2,985.79	8,144.21	582.40	2,912.35	3,494.75	4,649.46
203	23000	PPSK	6171180	-	-	-	-	-	-	-
203	24000	PPSK	6171180	12,500.00	-	12,500.00	-	7,520.00	7,520.00	4,980.00
203	25000	PPSK	6171180	-	-	-	-	-	-	-
203	26000	PPSK	6171180	-	-	-	-	-	-	-
203	27000	PPSK	6171180	5,890.00	434.00	5,456.00	-	150.00	150.00	5,306.00
203	28000	PPSK	6171180	570.00	-	570.00	-	270.00	270.00	300.00
203	29000	PPSK	6171180	16,680.00	4,570.00	12,110.00	1,440.00	9,445.00	10,885.00	1,225.00
203	35000	PPSK	6171180	3,430.00	3,229.25	200.75	-	-	-	200.75
203	52000	PPSK	6171180	2,500.00	-	2,500.00	-	639.44	639.44	1,860.56
203	A11559	PPSK	6171180	-	-	-	-	-	-	-
				70,000.00	21,366.57	48,633.43	2,022.40	26,427.67	28,450.07	20,183.36

IMPACT ON AQUATIC ENVIRONMENTAL ASSETS: AFTERMATH OF DECEMBER 2014 EAST COAST STATES OF MALAYSIA FLOOD. A STUDY ON IMPACT ON CORAL REEF ECOSYSTEMS AND INTERTIDAL BENTHOS POPULATION ECO-SUSTAINABILITY – ‘THE MANAGEMENT TIME’

Farid Che Ghazali^a, Siti Azizah Mohd Nor^b, Maliki Haqani^c, K.N.S. Sirajudeen^c, Suriani Abdullah^d

^a School of Health Sciences, Universiti Sains Malaysia, Kubang Kerian, 16150, Kota Bharu, Kelantan DN

^b School of Biological Sciences, Main Campus, Universiti Sains Malaysia, Penang.

^c School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, 16150, Kota Bharu, Kelantan DN

^dCorresponding author: farid@usm.my and hasya121@gmail.com

Abstract

Recent flood episodes within the east coast states of Malaysia had raised aftermath concerns over outpouring of its plumes (that consist of sedimentations and nutrients) to coral reefness well-being and its ecosystem viability. Globally there are reports of these flood plumes detrimental influence to coral reef whitening and deforestation. Ultimately the sustainability, dynamics of its benthic populations and other marine ecosystems will also be affected. The plumes are believed to affect these coral reefs by burying and decreasing photosynthesis levels thus depleting oxygen supplies by introducing a large amounts of organics matter settlements. The plumes may also contained harmful compounds such as pesticide and fertilizers. In pertinent to this concern, for Malaysia, a evidence database study needs to be conducted thus prioritise as national actionlines - guidelines and strategise reactions to sustain Malaysia east coast marine park coral reef biodiversities and vegetation. Thus, this paper present a study to fundamentally extrapolate and enhance scientific knowledge, of how coral reef and its ecosystem can be a integral disaster-risk related issues (coral whitening, bleaching or deforestation) of portment orchestrated by reverse flood via possible outpouring to nearby coastal islands. Thus a pilot in-situ water parameters field monitoring (salinity, coliforms, COD) and sedimentation analysis is presented. These analysis will also be cross-reference and backtracked check with other available local governmental agencies database monitoring data. Ultimately vediotaxsects assessments from coral reefness viability will be conducted and reported to understand processes and mechanisms for bleaching and bleaching avoidance. Its hope that this research findings will provide advice and solution towards a management strategy to minimize soil/sediment movement into the catchment thus reduce the nutrients and sediments load discharge into the east coast states coral reef parks and elsewhere in Malaysia marine park sanctuaries.

Keywords: Flood, Coral Reef, Ecosystems, Bleaching, Impact, Water Quality, East Coast, Malaysia, Sustainability.

1.0 INTRODUCTION

In late December 2014 to January 2015, Tsunami mud-like flood in east coast Malaysia brought intense rainfall to the state of Kelantan and Terengganu coastal catchments. The said North East monsoonal event was considered as the worst flooding event in Malaysia history in years. *Per se*, east coast states of Malaysia have characteristic geographic features that urge the need for concern in pertinent to annual monsoonal and flood episodes. Floods destroy drainage and reverse systems causing raw sewage to spill out into bodies of water. As such nutrients and sediments from east coast coastal rivers may have detrimental influence and be harmful to the majestic east coast Malaysia coral reef and its benthic populations and marine ecosystems dynamics especially those located at its marine park sanctuaries. Of these said east

coast rivers, the Kelantan River is approximately 250 kilometres long and if left alone is a naturally evolving river system. The river drains an area of 11,100 km², occupying more than 85% of the state of Kelantan. As such the Kelantan river system flows northward passing through such major towns as Kuala Krai, Tanah Merah, Pasir Mas and Kota Bharu, before finally discharging into the South China Sea. The flood is the most significant natural disaster in Malaysia in terms of frequency, area extent, population affected and damage. It has been estimated that 9% of land area (29, 800 km²) in the country is prone to flooding, 22 % of the population (4.82 million) is affected by floods and the average annual flood damage is about RM 1 billion. While in December 2006, the Mail (newspaper) question: 'Is Kelantan ready for the next "Bah Merah" (The Red Flood)?' The question was raised as that month of the year (December 2006) marks the

IMPACT ON AQUATIC ENVIRONMENTAL ASSETS: AFTERMATH OF DECEMBER 2014 EAST COAST STATES OF MALAYSIA FLOOD. A STUDY ON IMPACT ON CORAL REEF ECOSYSTEMS AND INTERTIDAL BENTHOS POPULATION ECO-SUSTAINABILITY – ‘THE MANAGEMENT TIME’.

- A. Multivariate Water Quality and Plankton Assemblages Analysis in East Coast Reverine.

Assoc. Prof. Dr. Farid Che Ghazali¹, Prof. Dr Siti Azizah Mohd Nor², Dr Maliki Hapani³, Associate Prof. Dr. K.N.S. Sirajudeen⁴, Ms Suriani Abdullah⁵.

^{1,3 & 5}School of Health Sciences, Universiti Sains Malaysia, Kelantan, MALAYSIA
(¹farid@usm.my, ⁵hasya121@gmail.com)

²School of Biological Science, ⁴School of Medical Sciences,
Universiti Sains Malaysia, Penang, MALAYSIA

Keywords: Flood, Coral Reef Ecosystems, Sediments, Water Quality, East Coast.

1. Abstract

1.1 Introduction

The impact on coastline and aquatic ecosystem from the worst ever North East monsoonal flooding event in Malaysia history in years, December 2014 to January 2015 ‘Tsunami mud-like’ flood, in east coast Malaysia can range from unnoticeable to devastating. Floods can accelerate fluxes; destroy drainage and reverine systems causing raw sewage, nutrients and sediments to spill out into bodies of water that may have detrimental influence to east coast Malaysia coral reef structure and dynamics, especially of its benthic populations and marine ecosystems. The plumes effect coral reefs by burying decreasing light levels of depleting oxygen supplies by introduction of large amounts of organics settlements. In pertinent to this the link *between* water quality parameters and its plankton species composition and prevalence into the system is also unknown.

1.2 Methodology

In-situ field based monitoring was conducted to identify dissolved oxygen, water quality, pH, nutrients and sediments load discharge to nearby aquatic ecosystem. Sediment cores was collected, analyzed (FESEM and ICP-MS "footprint") to test for coliform diatoms and sediment-associated pathogens incidence that may coincided with increasing nutrient suggesting a cause-effect relationship.

1.3.1 Results and Discussion

The level of dissolved oxygen varies from 6.16 mg/l to 9 mg/l. These reduced DO levels readings may relate to water warming. The increased molecular activity of the warm water pushes the oxygen molecules out of the spaces between the moving water molecules. ICP-MS revealed heavy metals such Zn Cd, Cr, Cu, Fe, Ni and Pb was detected. While FESEM EDX spectra reveal grains of silica and Zn phosphate. All FESEM micrograph fragments do not reveal harmful algal blooms associated to coastal eutrophication.