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**Unleashing Potentials
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Monitoring Benthic Classification: A Comparative study of pixel-based and object-based using satellite imagery

INTRODUCTION

Coral reef is one of the most complex marine environmental system, biodiverse, and productive ecosystem on the planet, which play important role for millions of people in major social, economic, and cultural especially for future generation. They only cover 0.1% from the sea, but they support 25% of other marine life species in the ocean, as they are widely known as the "rainforest of the sea". These ecosystems provide benefits to the country as it gives income through marine based industry, fisheries and from the tourism activities, as they are not just beautiful underwater fixture that make the ocean more colourful and vibrant. The island that have clear blue water with beautiful beach will have coral reef ecosystem and rich of diversity of marine flora and fauna (Spalding et al. 2017).

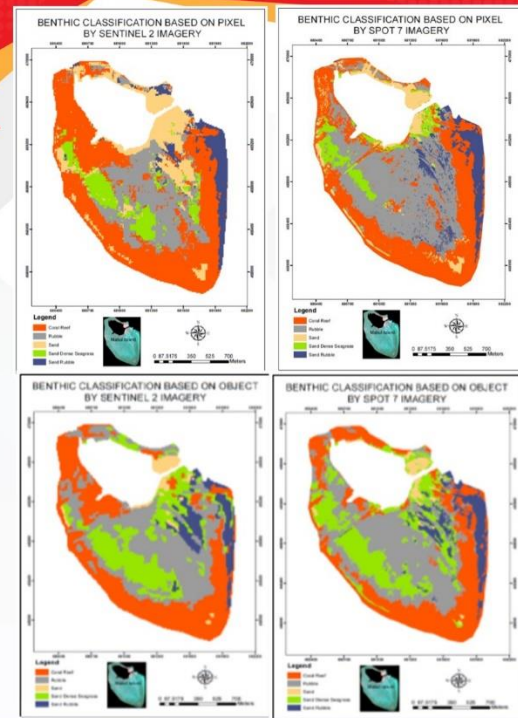
ISSUES/ PROBLEM STATEMENT

Benthic habitats such as coral reef, seagrass, and algae are ecologically and economically important. They provide various support such as nursery and feeding ground for marine life, and supports marine production especially for fishery (Green et al. 2000). Their beautiful underwater landscape trigger tourists to have activity indirectly support local people and country economy. However, despite their value, coral reef globally are facing crisis (Bellwood et al. 2004). With increase of tourist arrivals, it led to pressure coral reef ecosystem. Large swathes of coral reef have been degrade by increasing of coastal construction, shipping around the world, rising of global temperature, overfishing and climate change (Burke et al. 2011). It estimated 33 percent of coral reef now in danger of extinction. By using pixel-based and object-based classification technique, it can monitor the presence coral reef substrates. From the satellite images of Sentinel 2 and SPOT 7 will be know the classification of benthic habitats and with the accuracy from the result of the technique, it will be used for better planning and management of coral reef area in the future

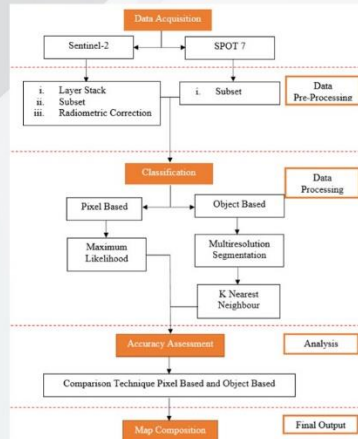
OBJECTIVES

- To compare the differences of technique between pixel-based and object-based image analysis method.
- To generate benthic classification map using SPOT 7 and Sentinel 2 imagery.

Result of Benthic Classification using pixel-based and object-based for both SPOT 7 and Sentinel 2 imagery



METHODOLOGY



The study involves five stage. The first stage required a project planning in defining problem statement, aim, objectives, study area and software to use. The collect the data required. The next stage involves data processing for the acquired data. For current condition analysis, ERDAS 2014 and eCognition Developer 9.0 are used to support the remote sensing techniques in identifying coral reef. Then, based on the result from both data, there will a comparison between two data with two different method.

NOVELTY

Different techniques have been introduced to identify the presence of benthic using different methods and different satellite imagery. This methods can be applied and help local authority especially for Department of the Marine to monitor the presence of benthic from above using satellite imagery.

CONCLUSION

The summaries of finding in this study are to identify the comparison between pixel-based and object-based image analysis in monitoring benthic classification by applying Remote Sensing technique. This study concludes that both SPOT 7 and Sentinel 2 image data can used to map benthic habitats in the shallow water of Mabul Island, Sabah by using pixel-based and object-based classification approach. Through a comparison analysis, pixel-based classification by using KNearest Neighbour is significantly outperformed the object-based method, although it still has a classification error with an accuracy value above 85%. Spatial information generated from Sentinel 2 and SPOT 7 for object-based classification image data lower accuracy than pixel-based. However, these results can provide an overview of the condition of the shallow water of Mabul Island, Sabah. The overall accuracy for pixel-based is 97.55% for SPOT 7 and Sentinel 2 is lower which 90%. Meanwhile for objectbased classification method, SPOT 7 produced 87.05% and only 82.81% for Sentinel 2 overall accuracy assessment. This project study assuredly concludes that not all object-based method is would be increasing the accuracy of classification compared with the pixel-based method.

FINDINGS

Benthic Habitats Class	SPOT 7		Sentinel 2	
	Producer Accuracy	User Accuracy	Overall Accuracy	User Accuracy
Sand	100%	100%	66.67%	50%
Coral Reef	100%	91.67%	75%	100%
Sand Rubble	66.67%	100%	100%	80%
Sand Dense	100%	100%	100%	85.71%
Seagrass	100%	100%	100%	100%
Rubble	100%	100%	100%	100%
Overall Accuracy	97.5%		90%	
Kappa Accuracy	0.9655		0.8698	

Benthic Habitats Class	SPOT 7		Sentinel 2	
	Producer Accuracy	User Accuracy	Overall Accuracy	User Accuracy
Sand	64.70%	95.65%	77.78%	100%
Coral Reef	98.18%	98.18%	100%	83.33%
Sand Rubble	30.77%	47.06%	88.89%	80.00%
Sand Dense	93.33%	66.67%	58.82%	90.90%
Seagrass	87.10%	100.00%	92.86%	72.22%
Rubble	87.10%	100.00%	92.86%	72.22%
Overall Accuracy	87.05%		82.81%	
Kappa Accuracy	0.8252		0.7823	

COMMERCIALIZATION

Potentially by:
Department of Marine Life, Malaysia and also for Institut Maritim Malaysia
NGO in preservation of Coral Reef in Malaysia

RECOGNITIONS

Thanks to the agencies that involved in this study for their willingness to allow their agencies to be involved in this project study, which Malaysian Space Agency (MYSA) for provide their data of SPOT 7 of Mabul Island, Sabah
Thanks to Perpustakaan Tun Abdul Razak UTM Shah Alam for helping provide data from MYSA.

Accuracy assessment is an important process in the classification procedures that been performed by comparing by map created by remote sensing analysis to a reference map based on different information sources. Tables below shows the accuracy user accuracy (UA), overall accuracy (OA), producer accuracy (PA), and the value of Kappa statistic for both methods. The accuracy assessment for pixel-based image analysis classification method have been made by created 40 samples for both classifications. Random method is used in this study. Overall accuracy for SPOT 7 is 97.5% and 90% for Sentinel 2 is 90% respectively. The SPOT 7 Kappa coefficient statistic is 0.9655 and 0.8698 for Sentinel 2. For the accuracy assessment of object-based, there have four method can be used which classification stability, best classification result, error matrix based on TTA mask and error matrix based on sample. In this method, error matrix based on sample is used and 139 sample been created for the classification accuracy. Overall accuracy for SPOT 7 is 87.05% and 82.81% for Sentinel 2 respectively.