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**13<sup>TH</sup> INDES 2024**  
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THE 13<sup>TH</sup> INTERNATIONAL INNOVATION, INVENTION & DESIGN COMPETITION 2024

**EXTENDED ABSTRACTS**

**e-BOOK**

# EXTENDED ABSTRACTS e-BOOK

THE 13th INTERNATIONAL  
INNOVATION, INVENTION &  
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# UNVEILING THE CORAL REEF LANDSCAPE: A MULTI-APPROACH EXPLORATION USING MBES, REMOTE SENSING, AND SEA SURFACE TEMPERATURE TO MAP CORAL HABITATS

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## ABSTRACT

In the present climate, coral reefs are facing serious threats. Thus, preservation actions must be taken seriously. With the goal to map coral habitats, this thesis investigates a multi-approach methodology that combines sea surface temperature (SST) analysis, remote sensing imaging, and high-resolution Multibeam Echosounder (MBES) data. There are three objectives for this study; to extract information from MBES data and satellite image analysis, to determine the correlation between sea surface temperatures and coral habitat, and to generate coral habitat map. The study area chosen is Redang Island. It is located about 45km north-northeast of Kuala Terengganu, the capital state of Terengganu. For the first goal, MBES will produce detail bathymetric maps of reef terrain to provide information on the seabed. Then, using remote sensing imagery, several pre-processing methods such as atmospheric correction, cloud/land masking and spectral analysis will be done to identify and classify the types of coral reef. SST data will also be integrated as to see whether the shifts in temperature could affect distribution pattern of coral. Mapping the habitat of coral reefs is an important tool for sustainable development, which supports economic growth, environmental preservation, adaptation to climate change, and community empowerment. It guarantees a healthy future for our oceans and the communities that depend on them, while also helping to achieve several SDGs.

**Keyword:** Coral Reef, Habitat Mapping, Remote Sensing

## 1. INTRODUCTION

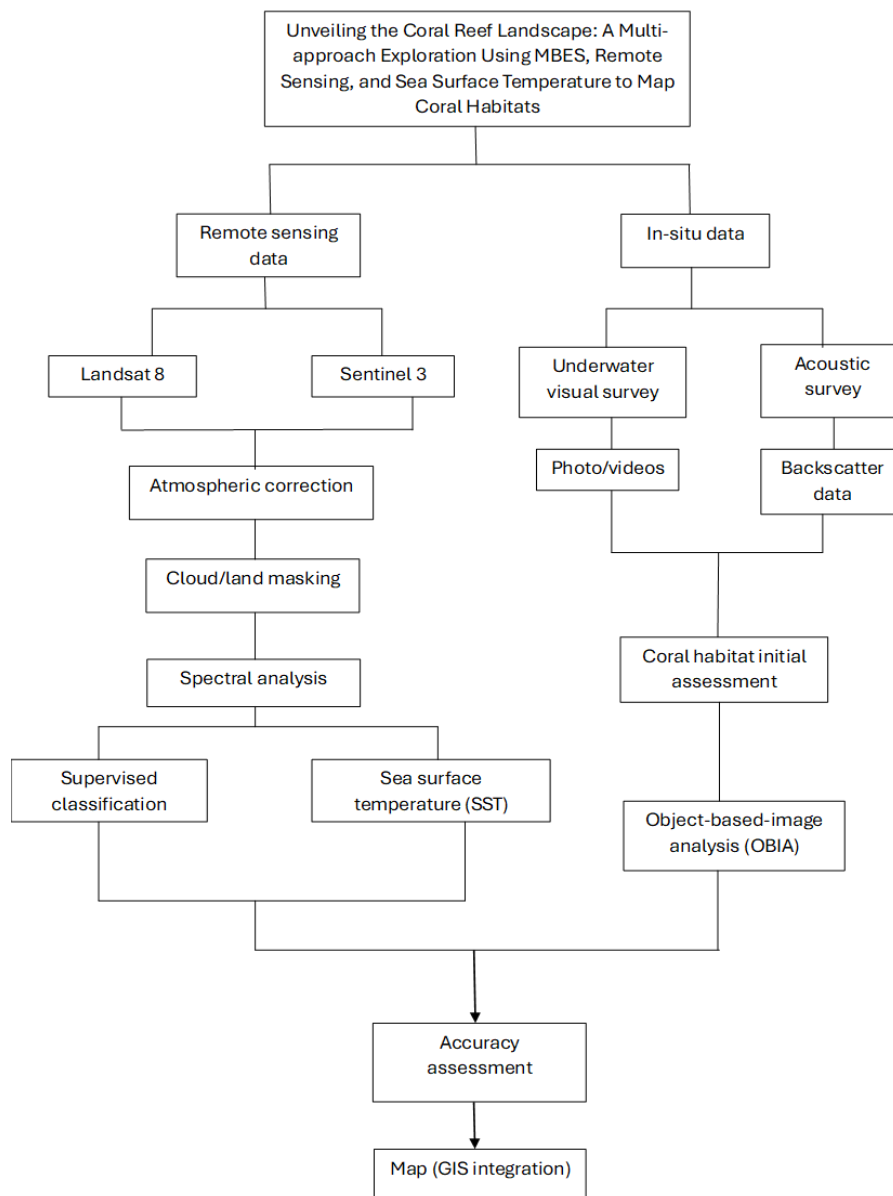
Because of their exceptional richness, coral reefs are known as the "rainforests of the sea" and are amazing underwater ecosystems (Hoegh-Guldberg et al., 2007). At least 25% of marine organisms find home on coral reefs, although making up only 0.1% of the ocean floor (Wilkinson, 2008). The intricate interactions among the symbiotic algae, the surrounding environment, and the coral itself are what drive this amazing variety. But there are several dangers to these important ecosystems, chief among them being climate change and human activity. The symbiotic relationship between coral polyps and algae (zooxanthellae) within their tissues is disrupted by rising sea temperatures brought on by climate change. Stress causes coral bleaching, a condition in which the coral pushes out algae and eventually becomes white and dies (Hoegh-Guldberg et al., 2007). Another factor is pollution. Land-based pollutants can damage coral reefs by lowering water quality and suffocating corals. Examples of these sources include sewage and wastewater, plastic waste, and agricultural runoff.

Coral reef mapping is required to monitor coral health, habitat characterization, and conservation. Mapping allows user to keep track of the changes happen to the coral. Coral with health issue could be identified and thus creating a better management strategy for the problematic area. Moreover, it helps point out different species of coral and differentiate the marine life around them. By utilizing satellite and aerial image, the spectral reflectance properties of the coral reef by its wavelength, and the various coral habitat can be recognized. In addition, MBES also provides detailed map of seafloor which helps characterize the area.

## 2. METHODOLOGY

### 2.1 Research Flow Chart

This research has 3 main processes which are data collection, data processing and accuracy assessment. They are important to create a good habitat mapping for the coral reef.



**Figure 1.0** Research Flow Chart

### 3. FINDINGS

Since this research is still in progress and, the result has not been acquired yet. However below is the expected outcome that will be generated.

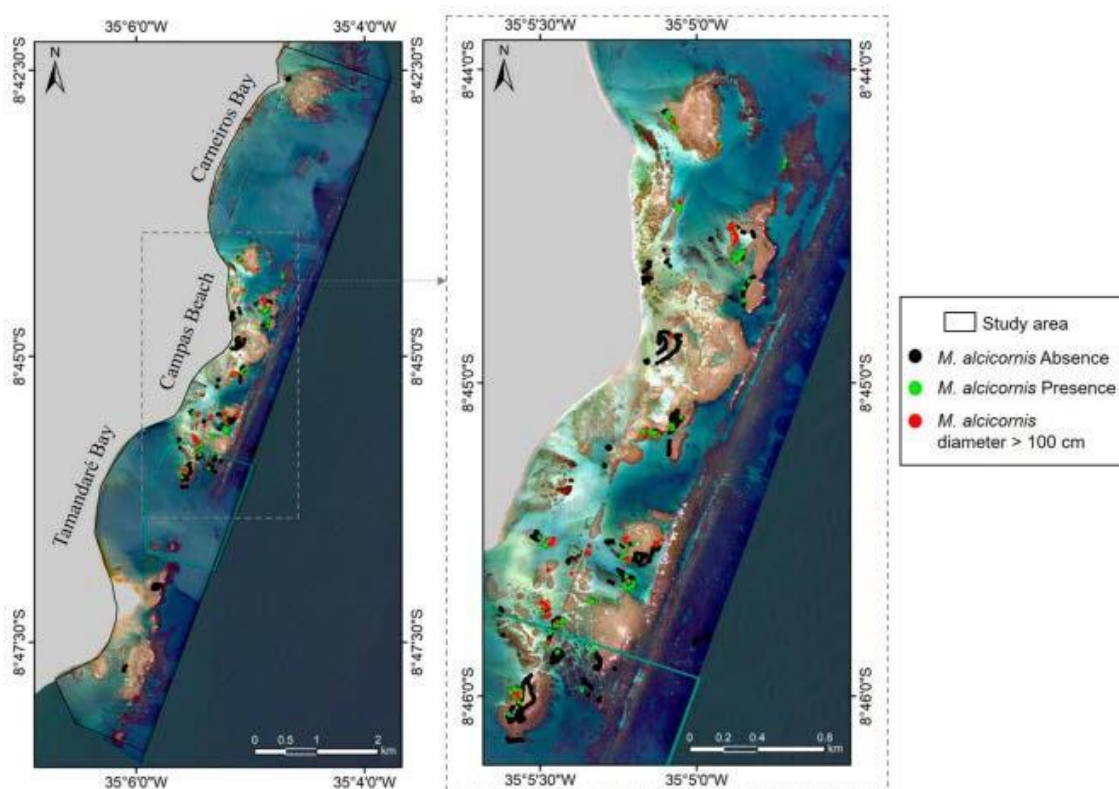


Figure 2.0 Expected outcome (da Silveira et al., 2021)

### 4. CONCLUSION

Mapping the habitat of coral reefs is an important tool for sustainable development, which supports economic growth, environmental preservation, adaptation to climate change, and community empowerment. It guarantees a healthy future for our oceans and the communities that depend on them, while also helping to achieve several SDGs. Thus, this study delves into the potential of remote sensing and GIS technologies as powerful tools for addressing this challenge. It intends to create and assess approaches for precise and effective coral habitat mapping by utilizing satellite imagery, advanced image analysis tools, and spatial modelling capabilities. By integrating these technologies with field validation and local knowledge, detailed maps can be produced, thereby increasing public awareness which later empowering communities to save these precious ecosystems.

Moreover, this research also serves as an educational model by demonstrating the application of cutting-edge technology for environmental monitoring and sustainable resource management. By tackling this critical problem statement, the researcher hopes to contribute to a future where vibrant coral reefs continue to thrive, and benefit both the environment and humanity.

### ACKNOWLEDGEMENTS

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