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Coral reef ecosystem monitoring using remote sensing data: case study in Owi Island, Biak, Papua

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Abstract

Coral reef ecosystem is a typical ecosystem in tropical marine and important for coastal island communities, including in Owi Island. This study aims to know a condition of coral reef covered area in Owi Island using Rapideye imagery satellite. This study used the "depth invariant index" method using bands 1 and bands 2 is Y = ln (bands 1) – ki/kj ln (bands 2) with unsupervised classification and field observation directly using manta tow method. The results show that area or percent cover of live coral is 23 ha (22%) and dead coral 21.46 ha (20%). Meanwhile, percent cover live coral using manta tow method between 11%-30% and dead coral between 31%-50%. The overall accuracy satellite imagery for mapping benthic habitats is 73.42% and coefficient kappa is 0.67.

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Keywords: coral reef ecosystem; depth invariant index algorithm; remote sensing; kappa coefficient.

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1. Introduction

Coral reef ecosystems is a unique ecosystem found in the tropics. This ecosystem has a very high organic productivity, as well as the diversity of biota inside [1]. Coral reef ecosystems is one of the ecosystems that provide abundant marine products both organic and non-organic materials. This ecosystem is home to marine biota that has economic value for reef fish but being often exploited. Coral reefs in Indonesia has an area of 50,875 km^2 which is 18% of the total world's coral reefs [2]. However, in 2012 the total area of coral reefs in Indonesia has reduced to 39,500 km^2 which is 16% of the total world's coral reefs [3]. Monitoring the condition of coral reef ecosystems can be conducted directly and indirectly. Direct monitoring conducted by field survey, such as LIT (LinIntercept Transect) or transect line, manta tow, belt transects [4] and PIT (Point Intercept Transect) [5]. Meanwhile, indirect observation can be conducted by utilizing satellite imagery capabilities.

Owi Island is an island located off the coast of East Biak Subdistrict, Noemfoor Biak District, Papua Province. Owi Island is one of the target area Coremap II Noemfoor Biak in the management of Marine Protected Areas (MPAs) along with a cluster of Padaido Islands (GPP Padaido), Coastal East Biak, and Oridek. There are two locations of DPL on Owi Island located in the North and Northeast of the island. Formation of DPL aims to protect the coral reef ecosystems in the islands [6]. Monitoring the condition of coral reef ecosystems directly was mostly conducted in Owi Island. While indirect monitoring has not been conducted by processing the satellite images of Owi Island.

2. Methods

This study was divided into several stages consist of preliminary data processing stage in December 2014 and data collection stage in the Owi Island, Noemfoor Biak, Papua Province, on February 18th to 19th 2015. The study site is located geographically between 1º13'40"- 1º15'20"S and 136º11'00" - 136º14'00"E. Stage data processing was conducted in the Computer and Remote Sensing Laboratory, Department of Marine Science and Technology, Bogor Agricultural University in February-March 2015. The study location can be seen in Fig. 1.

Fig. 1. Study location in Owi Island, East Biak Papua