Water Quality Changes Using GIS-Based Approach at Seagrass Meadows Along the Straits of Johor

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Abstract. Industrialization and urbanization promote socio-economy development but they unwittingly cause environmental problems. Land use change always brings about the changes of ecological components including water quality and richness of marine communities. Rapid alteration in coastal landscape, increasing density of residential area and intensive reclamation since 2013 in Merambong coast area causes subtle changes of water quality compared to 2009 where coastal development is relatively moderate. Interaction between water quality changes and seagrass biomass changes in tropical water remains intriguing and indistinct. Thus, this study focuses to analyze water quality changes that cause intensive pollution and changes in water quality that lead to the gradual changes in seagrass biomass within a 4-year interval along the Straits of Johor. Water quality checker of the Horiba U-52 model is used during field sampling to measure seven main water quality parameters from 35 sampling points. Using Landsat 8 OLI image, each water quality parameter is visualized and interpolated using the GIS system on known points of water sampling and the accuracy is assessed. The study found that the changes of water quality of tropical water is directly proportional with the changes of seagrass biomass, primarily due to increasing turbidity from the consecutive flows of pollutant as the consequence of coastal alteration for urbanization and industrial expansion. The increment of >30% in total dissolved solids content, turbidity and dissolved oxygen is the most obvious changes in the reclamation area. Heavy load of sediment in parallel with coastal development is the most potential threat to water quality maintenance. Findings from the study are very important to support SDG 14 and as a reference for the governance of stakeholders and policy makers in providing excellent services to the coastal community, sustainable coastal planning and estimation of natural resource productivity in local scale.

INTRODUCTION

In recent years, the coastal area is populated by residential infrastructure and an increasing number of residents. Industrial waste and land use changes unwittingly cause environmental problems when pollutants enter soil, water and air through various pathways. Coastal alteration gradually shows degradation of water quality, which creates less favorable habitat for myriad aquatic organisms including seagrass. The clarity of coastal water is highly influenced by chemical compounds from various sources which are transported via different mechanisms in a hydrologic cycle including river discharge and atmospheric deposition [1]. The various types of pollutant flows into the coastal systems will be incorporated into biota and may interfere with the chemical and biological processes in the water column, mangrove ecosystem, sediment and biota. Seagrass which is prone to coastal alteration always shows quick response to the dynamic changes of the seawater. Seagrass are vulnerable to the changes of water and very sensitive to other environmental quality [2]. Hence, seagrass densities which inhabit the place where the people are fervent in urbanization and tourism have potential to bring remarkable impact on environmental health in quick or snowballing responses.

Vulnerability of seagrass towards the changes of coastal development are increasingly threatened by human activities resulting in declining trend of its global coverage [3, 4, 5]. Moreover, seagrass bed has proven to be natural engineer of coastal environment to maintain water quality [6, 7], weakening wave impact to the shoreline and reduce

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