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Analysis of Klorofil-a Concentration in the Coastal Flows of Pangkep District Using Aqua Modis Satellite Data

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Abstract

Coastal areas are areas that are often used intensively by humans for various activities and activities, including transportation, agribusiness, tourism, and also for human settlements. Pangkep Regency is one of the coastal areas with high human activities, one of which is seaweed cultivation and crab fishing. The purpose of this study was to determine the spatial distribution of chlorophyll-a content in the waters of Pangkep Regency using remote sensing technology. The images obtained were analyzed using Algorithm Theoretical Basic Document Modis 19 (ATBD 19) algorithm: $C = 10^{(0,2881 - 2,783R + 2,783 R^2 - 2,783 R^3)}$. The results showed that the distribution of Chlorophyll-a in Pangkep Regency was classified as low (oligotrophic) to medium (mesotrophic) fertility.

Introduction

The coast is where land and ocean meet (Fabianto and Berhitu, 2014) [3]. Coastal areas are areas that are very intensively utilized for human activities (Marlian *et al*., 2015) [7]. Coastal areas are used as a place to find food, but in addition they are also used for transportation and ports, industrial areas, agribusiness and agro-industry, recreation and tourism, as well as residential areas and waste disposal sites (Gultom *et al*., 2011) [5]. The intensive utilization of developed coastal areas has resulted in exceeding the carrying capacity or sustainable capacity of coastal ecosystems, such as pollution (Fransisca, 2011) [4]. The impact of pollution not only endangers marine biota, especially phytoplankton which plays an important role in the productivity of these waters. In addition, it impacts the water quality of the marine environment (Dahuri *et al*., 2001) [2].

The distribution of chlorophyll-a in the ocean varies according to geographical location and water depth. This variation is caused by differences in sunlight intensity and nutrient concentrations contained in the waters. The distribution of chlorophyll-a concentration is higher in coastal and coastal waters, and the concentration of chlorophyll-a is low in offshore waters, but in certain areas in offshore waters there is a fairly high concentration of chlorophyll-a. This situation is caused by the high concentration of nutrients produced through the process of lifting nutrients from the bottom layer of water to the surface layer (Valiela, 1984 in Masrikat, 2009) [9].

Phytoplankton are indicators of environmental change and are primary producers in the waters (Marendy *et al*., 2017) [6]. The presence of phytoplankton in the waters can be detected from its chlorophyll-a content because it is needed by phytoplankton to survive and photosynthesize (Nuriya *et al*., 2010) [11]. Phytoplankton pigments (especially chlorophyll-a) are the main components that affect the optical/biooptical properties of seawater (Susilo, 2000) [15]. Therefore, remote sensing methods can be used in estimating chlorophyll-a concentrations in waters. Chlorophyll-a measurements can be done in two ways, namely conventional and using remote sensing technology. The utilization of sensing technology does not require a long time and relatively low cost (Merendy *et al*., 2017).

Pangkep Regency is one of the beaches where there are many human activities that can cause changes in water quality. Based on this background, an effort is needed to monitor the spatial distribution of Chlorophyll-a in the Coastal Waters of Pangkep Regency considering the importance of the existing potential. One of the monitoring that can be done is using remote sensing satellite data.

Research Objectives

Based on the description of the problem formulation, this study aims to determine the distribution of chlorophyll-a in the coastal waters of Pangkep district using remote sensing technology.

Research Methods

This research uses remote sensing image interpretation and GIS methods. Remote sensing image interpretation was carried out to determine information on chlorophyll-a content in the coastal waters of Pangkep Regency based on digital values recorded in remote sensing data.

Data Collection

Image data collection is done by downloading Aqua Modis satellite images from the site www.oceancolour.gsfc.nasa.gov, downloaded data is data that represents along the coastal waters studied and processed using Seadas and QGIS software.

Data Processing

Image Correction

Geometric correction is a correction to adjust the position on the image to the position on the map. Next, radiometric correction is carried out to change the digital number value of an object to the reflectance value of the object. Finally, atmospheric correction is performed to remove path radiance (space noise).

Masking Layer

Masking Layer is the process of separating a certain object (desired) from other objects (unwanted) based on the spectral value of the digital data.

Data Analysis

Raw image data obtained directly from satellite recording does not provide the required information. Information is generated when the raw data has been processed and input algorithms. In this study, Aqua MODIS images were analyzed using an algorithm, the algorithm being Modis 19 Algorithm Theoretical Basic Document (ATBD 19) (Budiyanto, 2014) [1].

$$C = 10^{(0,2881 - 2,783R + 2,783\,R^2 - 2,783\,R^3)}$$

$$R = Log(\frac{Rrs\ 488}{Rrs\ 551})$$

Description:
  C: Chlorophyll-a Content Value
  Rrs 488: Surface reflectance value at a wavelength of 488 nm (represented by channel 10)
  Rrs 551: Surface reflectance value at 488 nm wavelength (represented by channel 12)
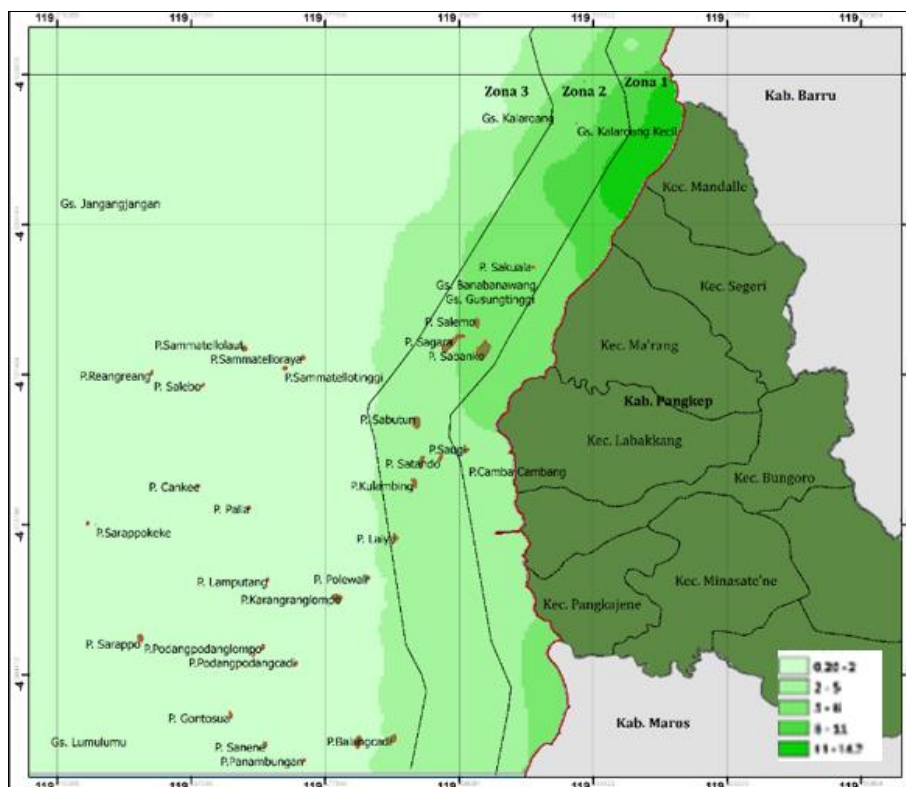
Result and Discussion

Fig 1: Chlorophyll-a distribution in coastal waters of Pangkep district

Based on Fig 1 above, it can be seen that the distribution of Chlorophyll-a in Pangkep waters has a range of values between 0.26 to 14.7 mg/m³. The highest concentration of Chlorophyll-a occurs in areas adjacent to the coast or coastal waters, while the concentration value tends to decrease along with the distance further from the coast. This indicates a distribution pattern of Chlorophyll-a where areas close to the coast have higher concentrations than areas further from the coast. Some physico-chemical parameters that affect chlorophyll-a distribution are light intensity and nutrients. Differences in these parameters cause variations in primary productivity in several places in the sea (Samawi, 2007) [13]. When compared to the chlorophyll-a content in Sorong waters, Kelabat Bay waters and Balikpapan coastal waters,

then the chlorophyll-a content in Pangkep waters has a higher value. The higher chlorophyll-a content in Pangkep waters is due to its location around the mouth of the river which receives a lot of nutrient supply while other waters are further from the estuary to the sea so that the content received is less.

Based on the results of data analysis, it is known that the chlorophyll-a content of phytoplankton in Pangkep waters is divided into 3 categories based on trophic status according to Parslow *et al.* (2008) [12], namely the oligotrophic category in water areas with chlorophyll-a concentration values ranging from 0.26 - 2 mg/m3, meso oligotrophic category with a range of 2 - 5 mg/m^3, and mesotrophic category in areas close to the coast with chlorophyll concentrations ranging from 5 - 14.7 mg/m^3.

According to Sihombing *et al.* (2013) [14] that the higher the pH and nitrate, the higher the chlorophyll-a phytoplankton content. The degree of acidity (pH) and nitrate has an important role for the condition of the aquatic environment. Changes in pH affect the chemical and biological processes of organisms in the waters. pH affects the toxicity of a chemical compound in the waters. The pH value greatly affects the biochemical processes of waters, for example nitrification will end if the pH is low (Tarsim and Wardiyanto, 2004) [8]. While nitrate is an important compound in primary productivity, namely as an element utilized by phytoplankton and needed in the process of photosynthesis (Mulyadi, 1999) [10].

Conclusion

Based on the results of the study, it can be concluded that the chlorophyll-a content in Pangkep waters is divided into three categories based on trophic status, the first category is oligotrophic found in the outer water area with chlorophyll-a concentrations ranging from 0.26 to 2 mg/m^3. The second category is meso oligotrophic with a concentration range of 2 to 5 mg/m^3, and the last category is mesotrophic which is found in the zone located in the era close to the coast with chlorophyll concentrations ranging from 5 to 14.7 mg/m^3.

References

1. Budiyanto DM. Studi Persebaran Klorofil-A Menggunakan Aqua Modis Dan Landsat 8 Di Pantai Surabaya–Sidoarjo Dampak Lumpur Lapindo. Jurusan Teknik Geomatika Fakultas Teknik Sipil dan Perencanaan Institut Teknologi Sepuluh Nopember Surabaya, 2014.
2. Dahuri R, Jacub Rais, Ginting SP, Sitepu MJ. Pengelolaan Sumber Daya Wilayah Pesisir dan Lautan Secara Terpadu. Edisi Kedua. PT Pradnya Paramita, Jakarta, 2001.
3. Fabianto MD, Dan PT, Berhitu. Konsep Pengelolaan Wilayah Pesisir Secara Terpadu 2055 Dan Berkelanjutan Yang Berbasis Masyarakat. Jurnal Teknologi. 2014; 11(2):2054-2058.
4. Fransisca A. Tingkat Pencemaran Perairan Ditinjau Dari Pemanfaatan Ruang di Wilayah Pesisir Kota Cilegon. Jurnal Perencanaan Wilayah dan Kota. 2011; 22(2):145-160.
5. Gultom J, Amin B, Ikhwan Y. Kandungan Logam Berat Timbal (Pb) dan Tembaga (Cu) Pada Air Laut dan Sedimen di Perairan Batubara Provinsi Sumatera Utara. Jurnal CWNS Provinsi, 2011.
6. Marendy F, Hartoni, Dan Isnaini. Analisis Pola Sebaran Konsentrasi Klorofil-A Menggunakan Citra Satelit Landsat Pada Musim Timur Di Perairan Sekitar Muara Sungai Lumpur Kabupaten Oki Provinsi Sumatera Selatan. Maspari Journal. 2017; 9(1):33-42.
7. Marlian N, Damar A, Effendi H. Distribusi Horizontal Klorofil-A Fitoplankton Sebagai Indikator Tingkat Kesuburan Perairan Di Teluk Meulaboh Aceh Barat. Jurnal Ilmu Pertanian Indonesia (Jipi). 2015; 20(3):272-279.
8. Tarsim dan Wardiyanto. Studi Kualitas Air dan Produktivitas Tambak Udang di Wilayah Pesisir Teluk Lampung, Kecamatan Padang Cermin, Lampung Selatan. Jurnal Laporan Penelitian Univetsitas Lampung. Lampung, 2004.
9. Masrikat JAN, Jaya I, Iskandar BH, dan Soedharma D. Estimasi Standing Stock Sumber Daya Ikan Berdasarkan Kandungan Klorofil-a. Jurnal Penelitian Perikanan Indonesia. 2009; 15(3).
10. Mulyadi A. Pertumbuhan dan Daya Serap Nutrien dari Mikroalgae yang Terpelihara pada Limbah Domestik. Jurnal Natur Indonesia (II). Fakultas Perikanan dan Ilmu Kelautan Riau. Riau, 1999.
11. Nuriya H, Hidayah Z, Nugraha WA. Pengukuran Konsentrasi Klorofil-A Dengan Pengolahan Citra Landsat Etm-7 Dan Uji Laboratorium Di Perairan Selat Madura Bagian Barat. Jurnal Kelautan. 2010; 3(1):60-65.
12. Parslow J, Hunter J, Davidson A. Estuarie Eutrophication Models. Final Report Project E6 National River Health Program. Water Servicesn Assosiation of Australian Melborne Australia. CSIRO Marine Research. Hobarth, Tasmania, 2008.
13. Samawi MF. Hubungan Antara Konsentrasi Klorofil-a dengan Kondisi Oseanografi di Perairan Pantai Kota Makasar. Unhas, 2007.
14. Sihombing SW, Yuswani P, Mena UT. Perangkap Warna Perekat Terhadap Hama Capside (Cyrtopeltis tenuis Reut) (Hemiptera: Miridae) Pada Tanaman Tembakau. J. Agroteknologi. 2013; 1(4):1352-1359.
15. Susilo SB. Penginderaan Jauh Kelautan Terapan. Penerbit Institut Pertanian Bogor. Bogor, 2000.