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Distribution of seagrass in the waters of Bontosua Island, Mattiro Bone Village, Liukung Tupabiring Sub-District, Pangkep District, South Sulawesi province

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Abstract

This study aims to determine the distribution area of seagrass using sentinel 2 imagery. The research was carried out for two months from March to April 2023. Data processing techniques to see the distribution and extent of seagrass used the lyzenga method to improve image quality and image composites used, namely 432, in conducting data validation using the random sampling method, namely sampling in several random ground check points. From the results of the discussion, it can be concluded that the distribution of seagrass on Bontosua Island spreads to the north, west and south of Bontosua Island with an area of 4.26 Ha. The results of the distribution of seagrass which have been interpreted by imagery and the results of the ground check, it can be seen that the accuracy value of sentinel imagery in making maps the distribution of seagrass on Bontosua Island is 72%. This shows that the level of classification results for shallow seabed objects, namely seagrass class, is correct, namely 72%, the resulting accuracy test value can be influenced by several factors including image resolution. The higher the image resolution, the better the classification accuracy value.

Keywords: Distribution Map, seagrass area, Bontosua Island

Introduction

The seagrass ecosystem plays a very important role in maintaining the survival of marine biota, making seawater clear, and being a stabilizer for aquatic sediments. Indonesia itself is the center of seagrass biodiversity and has 5% -10% of the world's seagrass meadows. Research (Kordi & Ghufron, 2011)^[6] shows that the role of seagrass beds is so great, but there is still little information about seagrass ecosystems in Indonesian waters, so that their existence is not paid much attention to. The total area of seagrass beds in Indonesia was originally estimated at 30,000 km², but it is estimated that now it has shrunk by 30-40% due to human activities. The diverse and abundant seagrass ecosystems associated with seagrass ecosystems are used as fishing grounds (Putri, 2019)^[9]. Remote sensing is the study of analyzing an object to obtain information about the object without touching the object. This seagrass mapping uses sentinel imagery and tests the accuracy of this satellite image by utilizing Lyzenga analysis in determining seagrass distribution areas. Along with the development of science and technology in the field of remote sensing, the results of recording this remote sensing vehicle are the best alternative to be able to help detect the distribution of seagrass in a very wide area with a shorter time and relatively inexpensive cost (Rosalina *et al.*, 2022)^[11]. Remote sensing technology that offers a synoptic perspective with repeated recording capabilities can be used as a tool in mapping and assisting ecosystem changes in coastal areas, especially seagrass beds (Roelfsema *et al.*, 2013)^[10]. Besides that the images contained in remote sensing imagery can also give a three-dimensional effect when viewed using a stereoscope (Nurmalasari & Santosa, 2018)^[12]. Research on mapping shallow water ecosystems (Corals, Mangroves and Seagrasses) has been carried out using satellite imagery data. The technique commonly used for water column correction is based on an algorithm developed by (Lyzenga, 1981)^[7]. However, in Indonesia, especially for seagrass mapping, the use of satellite imagery data is still rarely done and only a few locations have had seagrass mapping done.

So the authors decided to conduct research on mapping the distribution of seagrass beds on Bontosua Island, Mattiro Bone Village, Pangkep Regency, South Sulawesi Province.

Research purposes

This study aims to determine the distribution of seagrass in the waters of Bontosua Island, Mattiro Bone Village, Liukang Tupabbiring District, Pangkep Regency, South Sulawesi Province. This research is expected to be able to increase knowledge in remote sensing applications and mapping in the field of marine and fisheries regarding seagrass distribution. Besides that, it can also be used as material for consideration for policy makers in preserving seagrass ecosystems in the future.

Research Methods

This research was conducted for two months from March to April 2020, located on Bontosua Island, Mattiro Bone Village, Liukang Tupabbiring District, Pangkep Regency, South Sulawesi Province. Making seagrass distribution maps was carried out at the GIS Laboratory of the Muslim University of Indonesia, Faculty of Fisheries and Marine Sciences.

Work procedures

The data collection used is the Lyzenga analysis method and image interpretation, where the results of image interpretation and shallow water column correction will be ground checked against the presence of seagrass in the field. Lyzenga analysis aims to detect shallow water columns, one of which is the seagrass ecosystem, according to Fauzi *et al.*, 2018^[5] states that various seabed information methods have been developed and can be utilized, one of which is using the Lyzenga algorithm. In conducting a ground check using the random sampling method to see the accuracy of the image interpretation of the distribution of seagrass in the waters of Bontosua Island.

Data analysis

Making a seagrass distribution map using Sentinel 2 imagery can be downloaded on the Sentinel Hub site. According to (Dimara *et al.*, 2020)^[4], stated that the satellite imagery used for mapping shallow water bottom habitats is Sentinel-2 satellite imagery. The sentinel image has 12 bands consisting of several wavelengths. Bands 2, 3, 4 visible light channels were used in the detection analysis of seagrass distribution. The downloaded images were then processed using er-mapper software and arcgis software. The image processing process is as follows:

Image Cropping

Image cropping was carried out using er-mapper software which aims to limit the research area, namely Bontosua Island with the consideration that the research area does not cover the entire image scan and the image file capacity is too large.

Composite Bands

Composite Band, performed to clarify the information to be obtained from the image to be processed. The combination of sentinel image bands that have a resolution of 10x10 meters, namely bands 2,3,4. The three light channels are then combined to be analyzed and get an image display like the original state (Fauzi. *et al.*, 2018)^[5]. The composite image

used in this study is a combination of the Red, Blue, and Green bands (as RGB).

Lyzenga's Algorithm

Lyzenga analysis is an analysis used to detect shallow water columns. This method is very important to do to clarify the appearance of objects in shallow waters in the image, including the seagrass ecosystem which is one of the ecosystems in shallow waters. Previous research explained that this application is intended to obtain a better visual fig of objects below the surface of the water including seagrass (Aulia, 2015)^[2]. The application of the Lyzenga algorithm in image data processing first calculates the value of the water attenuation coefficient (k_i/k_j) in the Bontosua island area as a research area. To determine the value of k_i/k_j which is determined by the value of α , the value of α is obtained by extracting the digital values in the blue channel and green channel, through the process of training sample areas in the form of polygons. In this study, a training sample area of 50 polygons or Ragonis was used which was taken in shallow water areas. According to Suwargana., 2013^[14], the calculation algorithm used is influenced by the pair of channels i (blue channel) and j (green channel).

Guided classification

Guided classification is a stage that aims to classify objects in shallow water that appear in the image. In the book CRITC COREMAP II LIPI 2014^[3] explains that guided classification is a grouping of image pixels based on an example of the class area to be made. The classification process in this study was carried out by selecting objects believed to be seagrass beds.

Seagrass Distribution Map

Laying the seagrass distribution map Making a seagrass distribution map which is used as a reference in conducting ground checks measuring the accuracy of the image interpretation results compared to conditions in the field.

Ground Checks

Ground Check Determination of Ground Check in this study uses a random method or random sampling. According to Setiawan *et al.*, 2012^[13] Field checks were carried out to complement and prove the results of interpretation of satellite imagery. This method is used in carrying out random sampling with the assumption that the samples taken are representative of all areas in the research location. Ground Check is carried out to observe the real conditions of the field by re-checking with interpretation results from satellite imagery (Pratama *et al.*, 2016)^[8]. Ground check or accuracy test is carried out to assess the quality of the map produced. The acceptable accuracy limit for shallow water bottom habitat maps is based on SNI 7716:2011 concerning mapping of shallow sea bottom habitat, which is 60% (LIPI 2014). To get the value of image accuracy is done by comparing the results of image interpretation with the ground check results.

Results and Discussion

Image Interpretation Results

The map of seagrass distribution in the Bontosua Island area which is used as a reference for the ground check in Figure 1 was obtained by utilizing technology, namely GIS software, Er-Mapper software, a fine map of Indonesia's earth and using sentinel imagery which has a resolution of 10x10

meters. Mapping the distribution of seagrass begins with downloading sentinel images. After downloading the image, the image will be processed using the Er-Mapper software. The results of the image interpretation of the seagrass

distribution map of Bontosua Island can be seen in Figure 1. From the results of the image interpretation, there is anything evenly distributed in the waters of Bontosua Island, with a seagrass area of 6.82 ha, an area of 17.73 ha of sand.

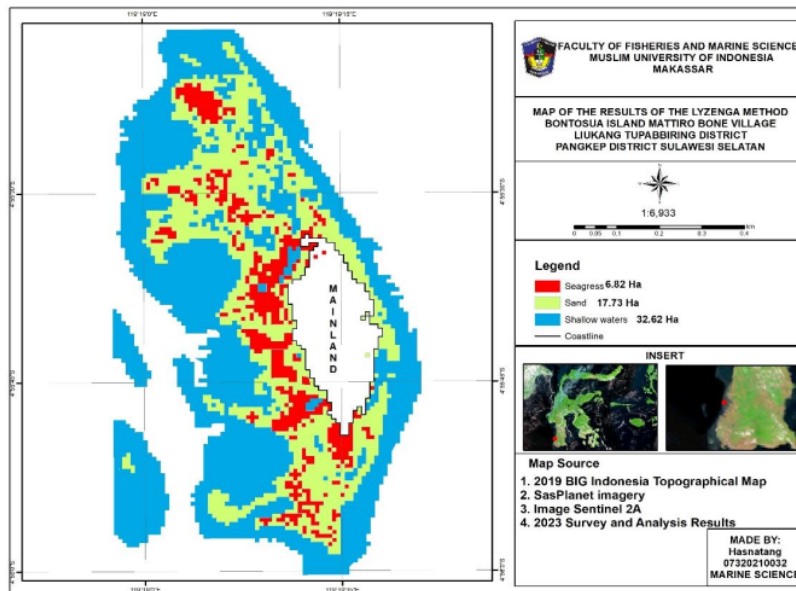


Fig 1: Seagrass Distribution Map

Ground Check results

The accuracy test is intended to measure the level of accuracy in image interpretation. This accuracy test in the form of image interpretation results will be compared with the actual conditions in the field with a reference of 50 points taken from images that are considered to represent all categories of the study area and a ground check will be carried out for the truth of the image interpretation results and the fact of seagrass presence in the field. Anggraeni *et al.*, 2017^[1] that

the image detection analysis carried out still has drawbacks including seagrass data collection points that are used as references in the analysis are still few so that field data reference points are needed. Ground Check is carried out to observe the real conditions of the field by re-checking with the classification results from satellite imagery (Pratama *et al.*, 2016)^[8]. The ground check results can be seen in Table 1 below.

Tabel 1: Accuracy test

No	Coordinate Point		Seagrass	
			Yes	No
1	119°19'11.3"E	4°55'43.7"S	√	
2	119°19'11.8"E	4°55'43.7"S	√	
3	119°19'11.7"E	4°55'43.6"S		√
4	119°19'11.2"E	4°55'43.6"S	√	
5	119°19'11.0"E	4°55'43.1"S	√	
6	119°19'10.8"E	4°55'42.2"S	√	
7	119°19'11.09"E	4°55'41.7"S		√
8	119°19'10.3"E	4°55'42.0"S	√	
9	119°19'10.7"E	4°55'41.9"S	√	
10	119°19'10.8"E	4°55'41.7"S	√	
11	119°19'11.8"E	4°55'41.7"S	√	
12	119°19'11.6"E	4°55'41.6"S		√
13	119°19'11.9"E	4°55'41.9"S		√
14	119°19'11.1"E	4°55'41.6"S	√	
15	119°19'11.4"E	4°55'41.7"S	√	
16	119°19'11.7"E	4°55'45.2"S		√
17	119°19'11.6"E	4°55'41.5"S	√	
18	119°19'11.08"E	4°55'41.2"S		√
19	119°19'10.1"E	4°55'39.3"S	√	
20	119°19'10.4"E	4°55'39.5"S	√	
21	119°19'10.7"E	4°55'39.1"S	√	

22	119°19'6.72"E	4°55'39.76"S		√
23	119°19'8.59"E	4°55'43.12"S		√
34	119°19'10.8"E	4°55'38.8"S	√	
25	119°19'10.8"E	4°55'38.3"S	√	
26	119°19'10.8"E	4°55'37.8"S	√	
27	119°19'11.6"E	4°55'35.8"S	√	
28	119°19'15.63"E	4°55'33.83"S		√
29	119°19'11.8"E	4°55'35.4"S	√	
30	119°19'12.0"E	4°55'35.1"S	√	
31	119°19'12.9"E	4°55'34.5"S	√	
32	119°19'13.06"E	4°55'39.74"S		√
33	119°19'13.5"E	4°55'34.3"S	√	
34	119°19'14.0"E	4°55'34.5"S	√	
35	119°19'11.9"E	4°55'43.6"S	√	
36	119°19'13.19"E	4°55'27.03"S		√
37	119°19'10.08"E	4°55'40.1"S	√	
38	119°19'10.8"E	4°55'42.6"S	√	
39	119°19'11.6"E	4°55'43.6"S	√	
40	119°19'11.09"E	4°55'49.14"S		√
41	119°19'11.1"E	4°55'43.7"S	√	
42	119°19'10.0"E	4°55'43.1"S	√	
43	119°19'10.8"E	4°55'42.6"S	√	
44	119°19'0.66"E	4°55'33.05"S		√
45	119°19'15.1"E	4°55'48.4"S	√	
46	119°19'13.1"E	4°55'46.8"S	√	
47	119°19'1.75"E	4°55'25.32"S		√
48	119°19'11.3"E	4°55'44.88"S	√	
49	119°19'11.4"E	4°55'44.84"S	√	
50	119°19'11.0"E	4°55'37.1"S		√
Total			36	14
50 Sample			72%	28%

The results of image detection analysis using shallow water correction and ground check results produce an overview of seagrass distribution in the waters of Bontosua Island with an area of 4.26 Ha. 11 grass beds on Bontosua Island predominantly grow in the western, northern and southern

areas of the island based on 2023 survey data. Where in the west around the pier, the area is a place for boat storage for the fishermen of the island community. The ground check results map can be seen in Figure 2 below.

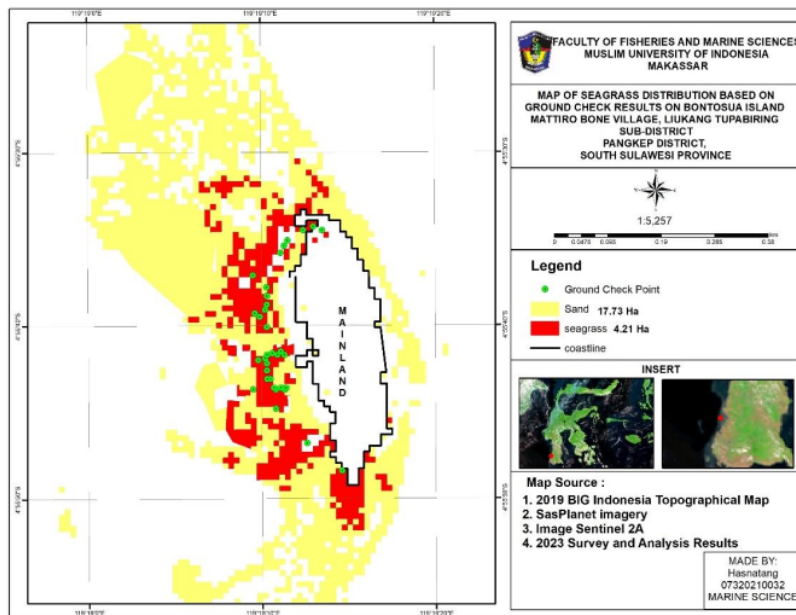


Fig 2: Seagrass Distribution Map

Get the accuracy value for the image interpretation and after the ground check is done, it can be seen the value of the level of truth and error, with a sample of 50 points that have image interpretations that are assumed to be seagrasses, but after ground checks there are only 36 points where seagrasses exist, so the accuracy value is 72% and the error rate is 28%. The resulting accuracy test value can be influenced by several factors, including image resolution. The higher the image resolution, the better the classification accuracy will be. Based on SNI 7716:2011, the accuracy limit for research on shallow water bottom habitats that can be recognized and accepted is 60% (LIPI 2014).

2 Conclusion

Based on the results of the discussion, it can be concluded that the distribution of seagrass on Bontosua Island spreads to the north, west and south of Bontosua Island with an area of 4.26 Ha. Made a seagrass distribution map on Bontosua Island, namely 72%.

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