

The Fitness of high economic culture area with the Geographic Information System(GIS) Method in Dudepo Island, North Gorontalo District. Indonesia

ABSTRACT

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North Gorontalo Regency with a huge fishery potential, including sea cucumbers in Dudepo Village, District of Ponelo such as *Holothuriascabras* and cucumber, and several other types of sea cucumbers, this becomes an exciting thing to be developed as a sea cucumber cultivation area. This research was conducted for four months (March - June 2020) on Dudepo Island, Ponelo Islands, North Gorontalo Regency, Gorontalo Province. This research aims to map the High Economic Sea Cucumber Potential Area's suitability with the *Geographic Information System* Method(GIS). This research has conducted the method of determining the suitability level of the cultivation area based on the Conformity Matrix of the Sand Sea Cucumber Cultivation. The Criteria, Weight determine the area in producing a Conformity Map of the Sand Sea Cucumber Cultivation Area, and Score of each parameter (depth, underwater conditions, brightness, salinity, degree of acidity, protection, and sea surface temperature). This study is devoted to the Conformity of Sea Cucumber Cultivation Area with the Penculture method. Based on the analysis results, the waters of Dudepo Island are waters with a suitable percentage of suitability as a sea cucumber cultivation area with the Penculture method. Very Appropriate Class (S1) covering 137 Ha, with a percentage of 9%, and the rest Suitable Area (S2) covering 1340 Ha, with a percentage of 90.72%.

Keywords: Dudepo Island, GIS, Conformity of sea cucumber cultivation area

Introduction

North Gorontalo Regency has many fish and seaweed farming businesses. However, sea cucumber cultivation has not been found, especially in the Ponelosubdistrict, namely Dudepo Village, especially those often found in several species or species of sea cucumbers. Sea cucumbers (Holothuroidea) and international commerce by the name "*bechedemer*" one source of animal protein from marine products of high economic value worldwide contained in it are essential for the human body as plasma, immune system, vital medicines, beauty, and other health benefits.

Efforts to preserve resources through stock enrichment preservation efforts through *restocking*/cultivation activities need to be done to reduce excessive natural stock taking. For this reason, an assessment is needed to determine the carrying capacity of the environment so that it will be known what level of suitability of the area for sea cucumber cultivation (in this case, sea cucumber sand).

Research Method

This research was conducted in the waters of Dudepoand Ponelo Island. District, Gorontalo Province for four months (March 2020 - June 2020)

Tools and Materials This research is presented in the following table

Table 1. Tools and materials used in the study

| No. | Tools / Materials | Description / Function |
|-----|--|---|
| 1 | Ship | The transportation to Dudepo Island is also a place to collect data at each sampling point. |
| 2 | <i>Refractometer</i> | Measuring salinity |
| 3 | <i>Seichi Disc</i> | Measuring Brightness |
| 4 | <i>Current meter</i> | Measuring Temperature |
| 5 | <i>Global Positioning System (GPS)</i> | Determine the position of the current location in the field |
| 6 | ArGis Software | To make a map of land suitability of sea cucumber cultivation areas. |
| 7 | Ms. Word 2010 and Ms. Excel | To make a discussion of research and data processing. |
| 8 | Asus Notebook | Inputting and Processing Data |
| 9 | Digital camera | Taking Pictures / Documentation |
| 10 | Hard drive | Saving data |
| 11 | Scanner / Printer | Print the resulting <i>hardcopy</i> |

Research procedure

Determination of Research Locations

1. Coastal Protection. Sea cucumber cultivation land must be protected from the influence of currents, waves, and large winds because it will damage the cultivation facilities and make it challenging to manage the culture.
2. Underwater conditions. The bottom should be sandy waters or muddy sand mixed with coral fragments, and there are many water plants such as seaweed or seaweeds.
3. Physical Parameters. Very appropriate salinity range between 33-35⁰ / 00, which is very appropriate depth ranges between 1 - 1,50m, which is very appropriate for the pH range between 8 - 8.50, which is very appropriate brightness ranges between 100 - 150cm, temperature very appropriate range between 26 - 31.6⁰ C.
4. Limiting Factor.

Limiting factor is a factor that makes a location/area that cannot be used as a location for cultivation, such as designation or function such as shipping lines, ports, water structures (houses and kelong), and waste disposal.

Determination of Sampling Points

Sampling points are taken at random at each stop of the ship so that the chosen location can represent the area to be investigated with the assumption that the more points taken, the better the results of interpolation. At this research location, 16 sampling points were taken at 16 ship stops.

Sampling

We performed starting from 10:00 to 17:00 WITA. Measurement or sampling conducted in the field (in-situ) is a measurement of the waters' chemical and physical parameters.

Data analysis

Database Analysis

This study's database analysis is to collect field data on location conditions according to location parameters in sea waters on Dudepo Island.

Spatial analysis (Weighting and scoring matrix)

Data field measurements are processed and analyzed spatially by interpolating to transform data to the form of points into areas (polygons); the interpolation technique uses the Inverse Distance Weighted (IDW) approach produces polygon data, then Raster data is converted to vector data.

The result of weight multiplication and the highest score is 300, while the lowest weight and score multiplication value are 100. To classify the suitability of waters into three categories, namely Very Suitable (S1), Suitable (S2), and Unsuitable (S3), can be seen from the results of the multiplication of weight values with a score. Multiplication weights with a score ranging from > 200-300, including the Very Suitable category (S1), while the multiplication of weights with a score ranging from > 100-200 including the appropriate category (S2). Meanwhile, the multiplication of weights with a score with a value of 100 includes the category Not Corresponding (S3).

3.3.3 Overlay analysis

After the database and spatial data have been formed as above, the next step of analysis is the *Overlay* method.

For more details, the stages of Land Suitability Analysis are presented in Figure 1:

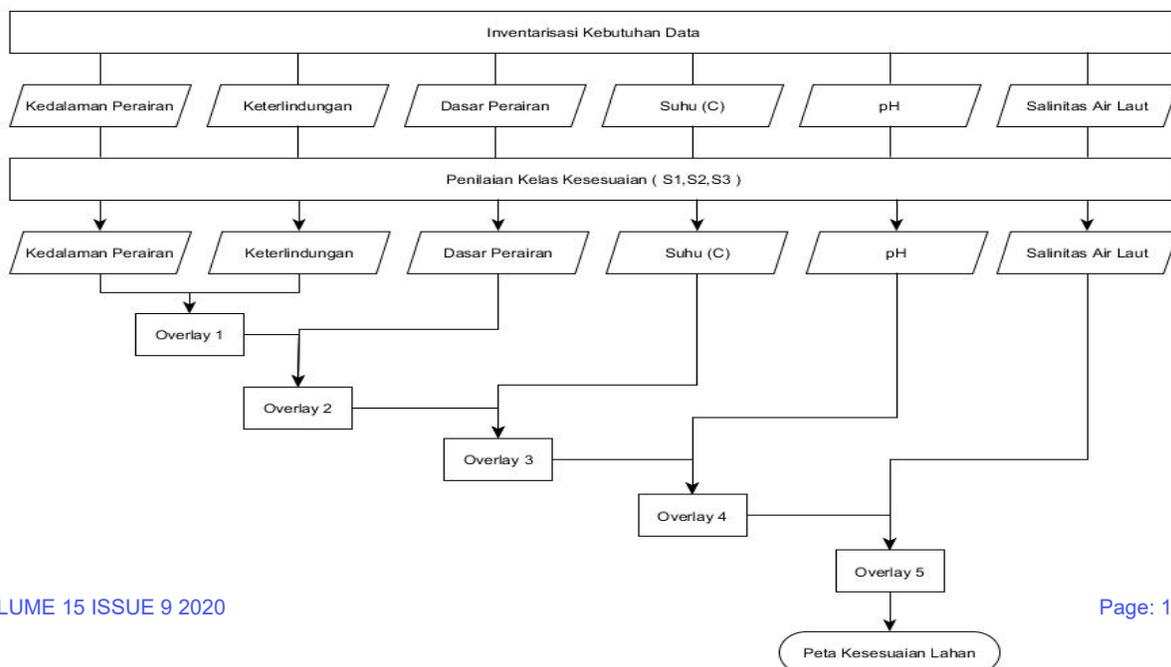


Figure 1. Stages of land suitability analysis

Result And Discussion

Data from the field measurements are processed spatially, by interpolating first to transform data of points into areas (polygons); Interpolation technique uses the Inverse Distance Weighted (IDW) approach it produces polygon data in the form of raster then Raster data is converted to vector data. After all data of each parameter has become a vector data, the next step is to assess the suitability class based on the existing criteria.

Depth Map

At the research location, namely Dudepo Island, the depth that is included as a Very Suitable class (S1) covering an area of 137 Ha for an appropriate Class (S2) is 113 hectares, while for the Non-Conforming Class (S3) is the most extensive, which is an area of 1227 Ha. The extent of the suitability of water depth is presented in Table 2.

Table 2. Table area of the suitability of water depth class

| Depth Compatibility Table | | | | |
|---------------------------|---------------------|-------------|-------------|----------------|
| No | Class of Conformity | Information | Area (Ha) | Large (%) |
| 1 | It is not by | S3 | 1227 | 83.07% |
| 2 | Corresponding | S2 | 113 | 7.65% |
| 3 | Very appropriate | S1 | 137 | 9% |
| Total | | | 1477 | 100.00% |

Location suitable for sea cucumber cultivation should be in the water depth range between 0.5-1.5 m at the lowest ebb tide (Firdausi, 2010). The spatial analysis process results that have been done for depth parameters can be seen in Figure 2.

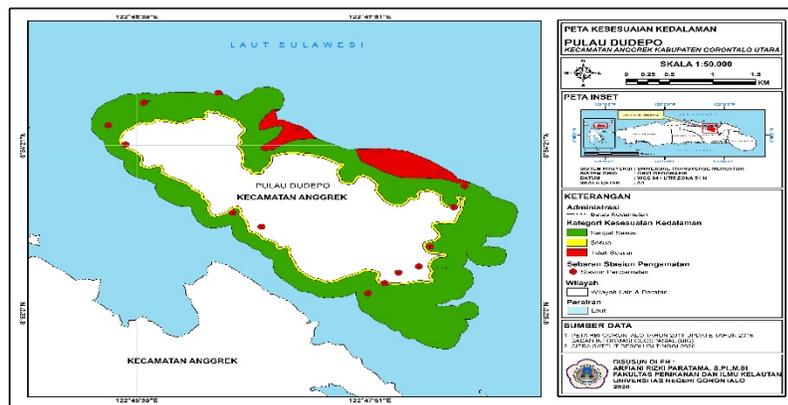


Figure 2. Depth Map

Watershed Condition Map

According to the Ministry of Maritime Affairs and Fisheries (2012), one factor that needs to be considered for sea cucumber cultivation is the bottom of the water. The extent of suitability of the bottom waters in the spatial analysis results is presented in Table 3

Table 3. An extensive table of suitability classes for necessary water conditions

Water Base Conformity Table

| No | Class of Conformity | Information | Area (Ha) | Large (%) |
|--------------|---------------------|-------------|-------------|----------------|
| 1 | It is not by | - | 0 | 0.00% |
| 2 | Corresponding | S2 | 470 | 31.83% |
| 3 | Very appropriate | S1 | 1007 | 68% |
| Total | | | 1477 | 100.00% |

The results of direct data collection at the research location, the area with the necessary muddy sand conditions, is 1007 Ha; this condition is a Very Suitable class (S1). The sampling point with sand and mud's primary conditions is 470 ha; this condition is the bottom of the waters with the appropriate class (S2). In the category of Unsuitable (S3) are waters with primary conditions of sand or mud and Coral Faults; for this study's location, the S3 class was not found at the study site. The results of this analysis process can be seen in Figure 3.

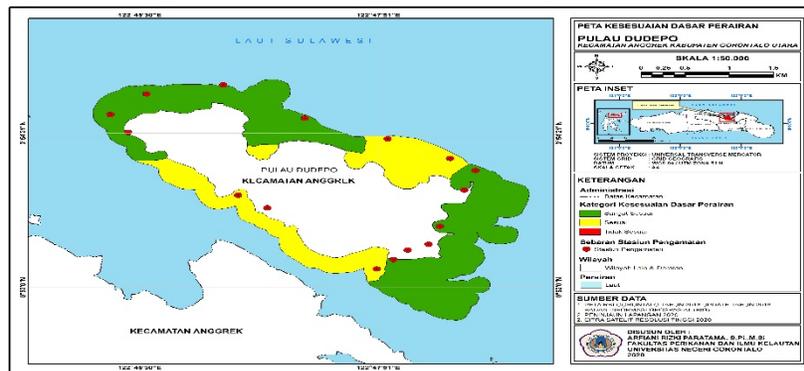


Figure 3 Watershed Condition Map

Salinity Map

The salinity class at the study site ie, at the appropriate class(S2) contour lines, has a vulnerable 29-31. So that the suitability of the salinity of the water can be known its value as presented in Table 4.

Table 4. An extensive table of water salinity suitability classes

| Salinity Conformity Table | | | | |
|---------------------------|---------------------|-------------|-------------|----------------|
| No | Class of Conformity | Information | Area (Ha) | Large (%) |
| 1 | It is not following | S2 | 290 | 19.65% |
| 2 | Corresponding | S2 | 614 | 42% |
| 3 | Very appropriate | S2 | 572 | 39% |
| Total | | | 1477 | 100.00% |

Based on the research data, the waters with Appropriate Salinity (S2) are waters with a salinity of 29% - 32% covering 1477 ha. In this part of the waters, salinity is said to be appropriate because the salinity held is not optimal. The results of this analysis process can be seen in Figure 4

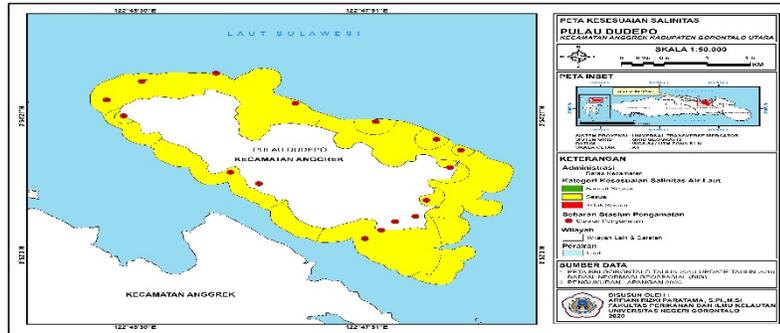


Figure 4. Salinity Map

Map of Acidity

According to Wibowo et al., In Augusta (2012), the value of a reasonable degree of acidity (pH) is 6.5 - 8.5, while at the research location, the pH ranges from 7.8 to 8.3. The extent of conformity to the acidity of the waters is presented in Table 5.

Table 5. Table of class-wide suitability of waters acidity

| PH Conformity Table | | | | |
|---------------------|---------------------|-------------|-------------|----------------|
| No | Class of Conformity | Information | Area (Ha) | Large (%) |
| 1 | It is not following | - | 0 | 0.00% |
| 2 | Corresponding | - | 0 | 0.00% |
| 3 | Very appropriate | S1 | 1447 | 100% |
| Total | | | 1447 | 100.00% |

The interpolation and spatial analysis results stated that Dudepo Island is in the Very Suitable Status (S1) for sea cucumber cultivation. The results of this analysis process can be seen in Figure 5.

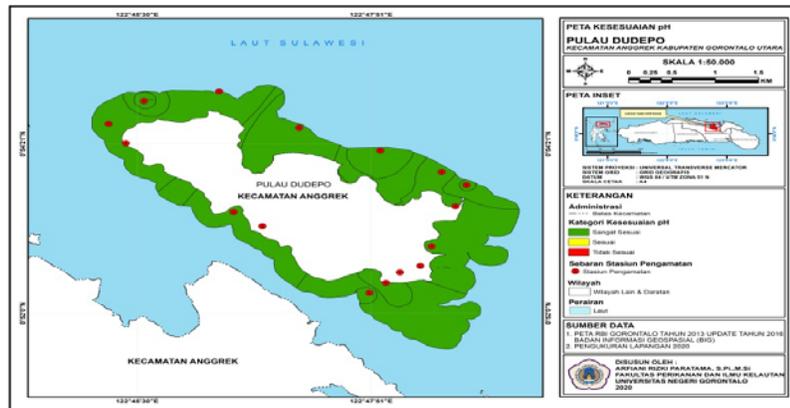


Figure 5. Map of Acidity

Protection Map

Protection for sea cucumber cultivation land is needed to maintain the survival of sea cucumbers to be cultivated. This protection map, shown in Figure 6, shows that almost all of the waters in Dudepo Island are protected and can be identified by area based on Table 6.

Table 6. An extensive table of suitability classes for waters protection

| Protection Suitability Table | | | | |
|------------------------------|---------------------|-------------|-------------|----------------|
| No | Class of Conformity | Information | Area (Ha) | Large (%) |
| 1 | It is not following | - | 0 | 0.00% |
| 2 | Corresponding | S2 | 437 | 29.59% |
| 3 | Very appropriate | S1 | 1040 | 70% |
| Total | | | 1477 | 100.00% |

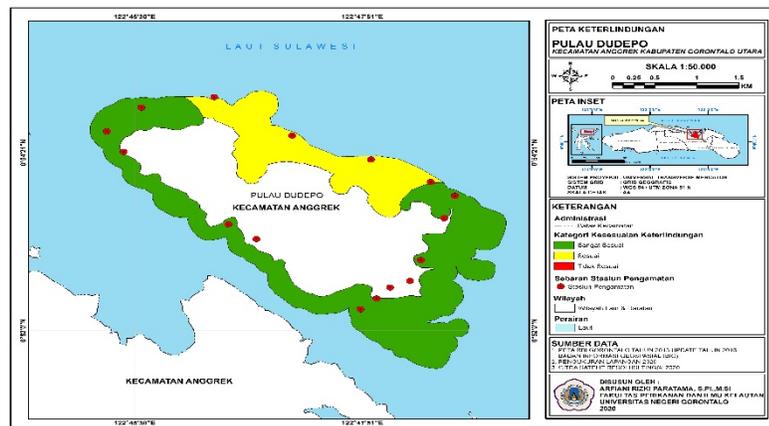


Figure 6. Protection Map

Flow in this study is not used as the main parameter of weighting and scoring in determining cultivated land. However, the current is used as a reference in determining the protection of Dudepo Island's waters, so the data taken will be valid. From the data collection results at each

sampling point, the lowest current of Dudepo Island Waters is 0.10 m / sec and the highest current is 0.15 m / sec.

Sea Surface Temperature Map

According to Juniantoet *al.* (2013), the optimum temperature for sea cucumber larvae is 28°C - 29°C, while the adult sea cucumber temperature that can be tolerated is 28°C - 31°C. Figure 7 shows that overall, Dudepo Island waters have a very appropriate temperature range (S1) for sea cucumber cultivation, mainly sea cucumber sand (Holothuriascabra). The extent of the suitability of surface water temperature can be known and is presented in Table 7

Table 7. Table of the area of the suitability of surface water temperature class

| Temperature Suitability Table | | | | |
|-------------------------------|---------------------|-------------|-------------|------------|
| No | Class of Conformity | Information | Area (Ha) | Large (%) |
| 1 | It is not following | - | 0 | 0 |
| 2 | Corresponding | - | 0 | 0 |
| 3 | Very appropriate | S1 | 1447 | 100 |
| Total | | | 1447 | 100 |

Primary data, 2020

It was concluded that the temperature of all parts of the location of this study, namely the waters of Dudepo Island, is in a very suitable status as shown in Figure 7

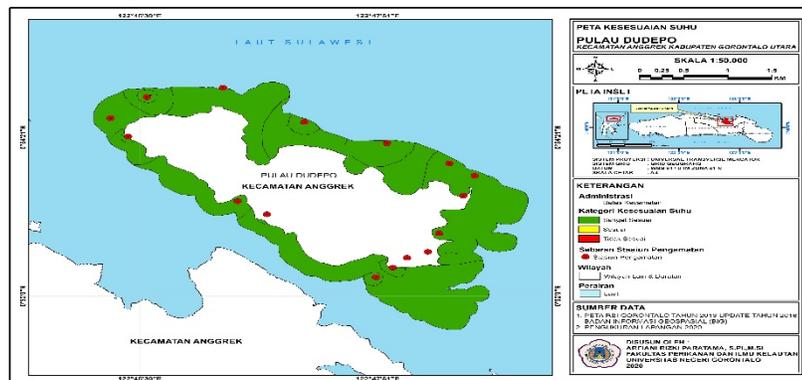


Figure 7. Sea Surface Temperature Map

Results of Conformity Analysis of Cultivation Areas

Cultivation Area Suitability Map in this study is a map of the overlay analysis results of the seven parameters measured. The attribute data of each parameter is then summed and divided by the total value of the total weight used so that it will produce a Total Value that makes the area divided into three classes, namely Very Suitable (S1), Matched (S2), and Unsuitable (S3). The suitability area of the Sea Cucumber Cultivation Area is presented in Table 8. The results of spatial analysis can be seen in Figure 8.

Table 8. Table of area suitability for cultivation area

| Land Suitability Analysis Table | | | | |
|---------------------------------|---------------------|-------------|-------------|----------------|
| No | Class of Conformity | Information | Area (Ha) | Large (%) |
| 1 | It is not following | S3 | 0 | 0.00% |
| 2 | Corresponding | S2 | 1340 | 90.72% |
| 3 | Very appropriate | S1 | 137 | 9% |
| Total | | | 1477 | 100.00% |

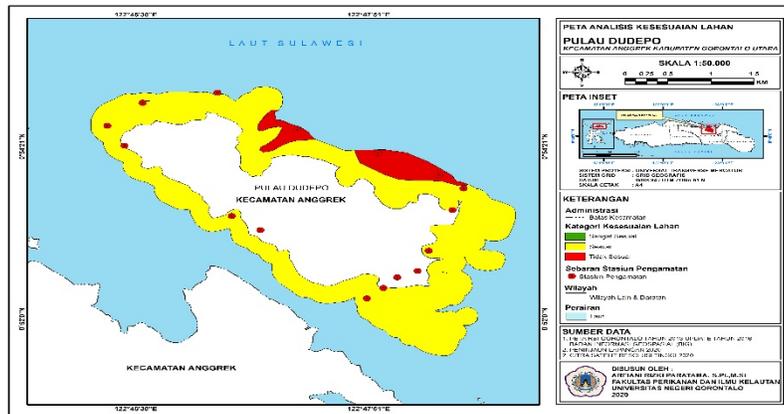


Figure 8. Conformity Map of Sea Cucumber Cultivation Area

Conclusion

Based on the analysis results, Dudepo Island Coastal Waters has a very suitable area (S1) to be used as a Sea Cucumber Cultivation Area covering 137 Ha, with a percentage of 9%. Fit Area (S2) covers 1340 Ha, with a percentage of 90.72%, and the Unsuitable Area (S3) covers an area of 0 Ha, with the largest percentage, ie, 0%. This area is an area with a depth of 0.5-1.5 meters, so cultivation areas with this method of cultivation are very appropriate.

Suggestion

Further research is needed with more sampling points. The results of interpolation will be smoother with better accuracy. Data collection parameters are expected to be more so that assessment will be complete, research is carried out for other functions cultivation area.

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