Analysis of relationship between mangrove ecology to fish cultivator in Kertomulyo, Pati

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Abstract. Kabupaten Pati is located at north coast of java which has abundant fishery potential. This potential is built by too many factors, and one of them is mangrove ecosystem. Mangrove ecosystem are complex and dynamic. The purposes of this study is to analyze the relationship of mangrove ecosystems on ecological between fish production by fish cultivator at Kertomulyo Pati. The research is located at Kerto mulyo Village, Pati. This study uses a quantitative descriptive approach with questionnaire and interview, observation and documentations methods and the target is fisherman who lives near the mangrove ecosystem. The data needed by this research were devied into two sources, primary data and secondary data. Primary data includes the production from fish cultivator and their perception about mangrove, secondary data is image from Google Earth and Landsat 8 for vegetation which is needed to know the changes of mangrove’s thickness and growth. The next step is running the data using ArcGis. Then the result of this analysis can be associated with fish cultivator’s production. So, there will be results which is answering the purposes.

1. Introduction
Kabupaten Pati is located at north coast of java which has abundant fishery potential. This potential is built by too many factors, and one of them is mangrove ecosystem. Mangrove ecosystem are complex and dynamic. The condition of mangrove ecosystem can be seen from density, thickness and mangrove's growth.

Poedjirahajoe et al. (2017), mangroves are a tropical resources which has some benefits both from social, economic, and ecological aspects, its habitat is more specific than mainland forest because of the interaction between their components are complex and intricate, whereas according to Rahim et al. (2017), mangrove forests can be said to be tropical and sub-tropical coastal vegetation which is dominated by several mangrove species that can grow and develop in muddy, low tide and sandy areas [1, 2]. So that not all coastal areas can be overgrown by mangroves, generally mangroves can live and growth if the coastal conditions are protected, relatively calm, and receive sediment from river estuaries.

Kertomulyo Village is located north of the city of Pati, in Trangkil District. The northern part is directly bordered by the Java Sea, the south is bordered by Rejoagung Village, the east is bordered by Guyangan Village, and the west is bordered by Tutup Village. The area of this village is 460.5870 ha with an area of wet land in the form of fish ponds covering an area of 369.3070 ha. Mangroves have several species, where the mangroves found in Kertomulyo, Trangkil are Rhizopora and Avicennia. The difference between these two plants lies in their roots. Mangroves have many functions as follows:
spawning grounds, shelter, foraging areas, protection against abrasion, and are natural habitats that form an ecological balance.

2. Methods
This research uses descriptive quantitative method. The research location is located on Kertomulyo Beach, Trangkil District, Pati Regency. The research was conducted in August. The data sources are primary data, namely the results of interviews with farmers and related agencies, and secondary data in the form of Landsat 8 imagery data, Google Earth images, and production data and data on milkfish and shrimp cultivators around Kertomulyo Beach.

Kertomulyo Beach mangrove area data is obtained from calculating the width and thickness of the mangroves using Google Earth. Data repeating was carried out from 2017 to 2019. Measurement of mangrove width was calculated from the eastern to the westernmost river estuary. Meanwhile, the thickness of the mangroves is drawn from the deepest line of growing mangroves to the shoreline, the measurement uses the toolbar ruler on Google Earth. Mangrove thickness will be given weight to find the category of mangrove development. The mangrove development score is obtained from the multiplication of mangrove weight by mangrove thickness then divided by 100. The weight values based on mangrove thickness are presented in table 1, and the classification of mangrove development is presented in table 2.

![Figure 1. Research location](image)

According to Prayitno (2017), the table below is the value based on mangrove’s thickness and table of mangrove’s growth classification
Table 1. Table of mangrove’s value based on its thickness.

| No | Mangrove Thickness | Value |
|----|-------------------|-------|
| 1  | 1-20              | 5     |
| 2  | 21-40             | 4     |
| 3  | 41-60             | 3     |
| 4  | 61-80             | 2     |
| 5  | 81-100            | 1     |

Table 2. Table of mangrove’s growth classification

| No | Classification | Interval   | Score |
|----|----------------|------------|-------|
| 1  | Baik           | 2,01-3,00  | 3     |
| 2  | Sedang         | 1,01-2,00  | 2     |
| 3  | Buruk          | 0,00-1,00  | 1     |

Then, from these two tables the value of mangrove’s growth at Kertomulyo will be determined.

3. Results and discussion

3.1. The mangrove’s growth

According to the manager of Kertomulyo Beach, mangrove forest began with the youth in the village were doing beach clean-up activities which were continued in collaboration with the local government where it turned out to direct into reforestation activities, using mangrove. Until now, there have been many states likes university, local government, school, and companies help in the mangrove’s growth activitie on Kertomulyo Beach.

Based on the image-obtained from Google Earth above, in 2017 the coverage of the mangrove area was not evenly distributed, this is because the mangrove forests of Kertomulyo Beach are still in the early stages of growth, followed by 2018 the difference has been seen, and the progress is clearer. In 2019 as being seen from Google Earth as well, the mangrove coverage of Kertomulyo Beach can also be seen from Landsat 8 imagery.

![Figure 2. Mangrove distribution at 2017.](image)
Figure 3. Mangrove distribution at 2018

Figure 4. Mangrove distribution at 2019

Figure 5. Mangrove distribution at 2017 using Landsat 8

Figure 6. Mangrove distribution at 2018 using Landsat 8
Table 3. Calculation of thickness, value, and score for the mangrove’s growth.

| No | Years       | Mangrove’s Thickness | Value | Score |
|----|-------------|----------------------|-------|-------|
| 1  | 2017-2018   | 9                    | 5     | 0.45  |
| 2  | 2018-2019   | 5                    | 5     | 0.25  |
| 3  | 2017-2019   | 13.5                 | 5     | 0.675 |

Source: Data processing, 2020.

Based on data processing in table 3, the thickness of the mangroves from 2017 to 2018 grew to 9 meters, categorized into a weight of 5, with a progression score of mangrove is 0.45. The thickness of the mangroves from 2018 to 2019 is only 5 meters with a weight of 5 and a score of 0.25. So, mangrove development based on the traps that occurred in 2017 to 2019 is 13.5 meters long with a weight of 5 and a score of 0.675. This shows that the growth of mangroves on Kertomulyo Beach is still bad. To reach the best growth efforts are needed, one of the efforts that can be made is planting mangrove seeds in a sustainable manner.

The development of mangroves which is said to be bad can be caused by several factors such as abrasion which can erode the shoreline that has been planted with mangrove seeds. Embedded mangrove seeds will easily be carried away by the waves that come from the sea to the beach. Waves in the Java Sea are friendly, but when the weather is extreme it can affect waves and caused beach abrasion. Kertomulyo Beach mangroves are also mangrove beaches that are being developed or are included in the early stages of development. According to Prayitno (2017), there is a need for defense and improvement in developing mangrove forests on the coast of Pati. According to Nisa et al. (2019), there is a need for safeguarding the mangrove ecosystem by means of effective rehabilitation and enforcement of mangrove protection regulations, in this case there is a need for collaborative efforts between the village government and the surrounding community [4].
3.2. Relationship between mangrove forest and milkfish and vaname shrimp cultivators.

The potential for fisheries in Kertomulyo Village, Trangkil District, is in the form of milkfish cultivation and also vaname shrimp and salt ponds. For now, according to the interview results, because the price of raw salt has decreased, farmers prefer to cultivate milkfish and shrimp.

### Table 4. Production of milkfish and vaname shrimp [5, 6, 7].

| No | Tahun | Vaname (Ton) | Milkfish (Ton) | Total (Ton) | Vaname Value (Rp) | Milkfish Value (Rp) | Total Value (Rp) |
|----|-------|--------------|----------------|-------------|-------------------|---------------------|------------------|
| 1  | 2017  | 132.52       | 3,331.52       | 3,464.04    | 5,300,731         | 56,635,758          | 61,936,489       |
| 2  | 2018  | 124.8        | 3,236.40       | 3,361.20    | 6,864,000         | 64,728,000          | 71,592,000       |
| 3  | 2019  | 124.8        | 3,452.16       | 3,576.96    | 6,864,000         | 69,043,200          | 75,907,200       |

*Source:* Dinas Kelautan dan Perikanan Pati, 2020.
Based on table 4 and figures 10, 11 it can be seen that Trangkil District has good potential for milkfish and vaname shrimp aquaculture. This fishery potential is compared to 20 other sub-districts, Trangkil District is in the third position in the production of vaname shrimp and milkfish. When viewed from the development of mangrove forests in line with the production of milkfish and vaname shrimp cultivation. However, this does not indicate that mangrove forests can affect the production of milkfish and vaname shrimp cultivation. Based on the results obtained in the field, mangrove forests that live in the environment around their ponds are useful in mediating sediment or reducing sedimentation that occurs in the ponds, besides that mangrove forests can also withstand waves that can enter the pond, so that the pond is not inundated by water that is Lots. This condition needs attention, because the quality of water that enters the pond is very vulnerable to milkfish and also vaname shrimp that are being cultivated. According to Damayanti (2012), the function of greenbelt or mangrove is as a coastal protector to protect shoreline from waves that caused abration [8]. Wardhani (2011) said that mangrove area provides an environmental service means protect from storms and erosion [9].

4. Conclusion
According to this research, the conclusions are the growth of mangrove at Kertomulyo belongs to bad condition, it can be caused by abration, the production of milkfish and vaname from fish cultivator increases each year, balanced with the growth of mangrove, and the increases in production is not necessarily influenced by the mangrove’s growth.

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