Plankton Diversity at Rice Field-Pond in Glagah Village, Lamongan

VRA Zahroh and Sueb
Department of Biology, Universitas Negeri Malang,
Jl. Semarang 5 Malang 65145, INDONESIA
(sueb.fmipa@um.ac.id, vilda.rima.1803418@students.um.ac.id)

Abstract. This research aimed to describe plankton diversity at rice field-pond in Glagah Village, Lamongan that can be used for fish culture. Sampling was done by purposive sampling with 5 sampling points at each end of the pond and in the middle, the place of rice field-pond around of the school. Each sampling point is divided into 2 depth variations, surface (0 cm) and base (70 cm). The results showed in the first point found 1 type of phytoplankton and 1 type of zooplankton, the second point found 9 types of phytoplankton and 2 type of zooplankton, the third point found 10 types of phytoplankton and 3 types of zooplankton, in the fourth point found 2 types of zooplankton while in the fifth point found 1 type of phytoplankton and 1 type of zooplankton. From the observation concluded that phytoplankton diversity of H' 2.27 (medium) and zooplankton of H' 1.543 (medium). So it can be concluded that the diversity of phytoplankton in rice field-pond is greater than zooplankton. Physical and chemical characteristics at rice field-pond water affect the plankton diversity so that it must be maintained.

1. Introduction
Pond is one of the means that helps in the development of aquaculture and plays an important role in the hydrological system [1]. Lamongan Regency is one of the areas in East Java which has great potential in developing fish farming in ponds. The 2015 Lamongan District Accountability Report [2] shows that Lamongan Regency has significant fishery resource potential, both from aquaculture (which includes cultivation in ponds, ponds, ponds and cages) and capture fisheries which include fishing in the sea, swamps and reservoirs and rivers. The potential of fishery resources, both for capture fisheries and cultivation, has made Lamongan Regency determined by the Governor of East Java as the largest fish producer in East Java which must be maintained.

The success of the cultivation of milkfish and tiger prawns or vanamei in ponds (and rice field-pond), brackish or fresh is determined by the quality of the water and the cultivation of the pond land as internal accumulation of the pond. For rice-pond farmers, leftover feed, biota dung and residual pesticides used when the land is planted with rice can be a problem in itself [3] so that proper water quality control is needed because water quality is also related to human activities [4] Water quality parameters for the survival of living things consist of physical, chemical (abiotic) and biological (biotic) parameters. Abiotic and biotic factors in freshwater ecosystems affect the abundance and composition of living things in it [5]. Biotic factors include competition between space and food, predation, reproduction,
preference and substrate uptake while abiotic factors consist of temperature, air, sunlight, dissolved oxygen and external conditions that affect [6][7].

Ponds are located in lowlands with water supply from rainwater and production depends on plankton abundance and species [8][9]. Plankton is an important microorganism for fish and other aquatic organisms, so its existence will determine the ecosystem concerned [10]. A pond is said to be fertile if there are many primary producers (quality and quantity) found in it. Phytoplankton is a natural food source and acts as a producer of oxygen through photosynthesis and forms the basis of an aquatic food web that supports zooplankton and fish [11][12][13] while zooplankton acts as a consumer of phytoplankton [13]. The purpose of this study was to determine the diversity of plankton in the rice fields-pond of Glagah District, Lamongan.

2. Materials and Methods

2.1. Type of Research
The study was conducted by testing water samples taken from rice fields-pond of Glagah District, Lamongan. Water samples were tested for temperature, turbidity, pH level, salinity level and oxygen level. The research method used in this research is descriptive method and data was taken in Maret, 2020.

2.2. Sampling Technique
Sampling was done by purposive sampling at 5 points of collection, namely at each end of the pond and in the middle. Each sampling point is divided into 2 variations in depth, namely surface and bottom (70 cm) in the rice fields-pond. The tools and materials used consist of a thermometer, turbidimeter, pH meter, handrefractometer, DO meter, alcohol and bottles. Plankton was identified using various reference sources, including books, articles, journals [14][15][16].

2.3. Data Analysis
The data from temperature, pH, salinity, oxygen content and turbidity were match or categorized by book and article [17][18][19][20][21][22][23][24] and plankton diversity is calculated using the Shannon Wiener [25] for knowing diversity index as follows

\[ H' = -\sum (\frac{n_i}{N}) \ln (\frac{n_i}{N}) \]

Information

H' = Shannon-Wiener Diversity Index
ni = number of individuals / species
N = total number of individuals.

3. Results and Discussion
Measurement of physical characteristics includes temperature and turbidity of water, while measurement of chemical characteristics includes water pH, oxygen content and salt content. The results of measurements of the physical and chemical characteristics of the rice field-pond could be seen in Table 1 below.

| Table 1. The results of measurements |
|------------------------------------|
| Physics parameters | Temperature | 25,6°C |
|                     | Water Turbidity | 3 NTU |
| Chemistry parameters | Water pH | 5,39 |
|                      | Salinity Level | 0,2 ppt |
|                      | Oxygen Level | 8,3 mg/L |
3.1. Temperature
Temperature changes affect the behaviour, reproduction, metabolic rates, movement, and respiratory of most aquatic organisms [17]. The water temperature in the pond is 25.6 °C, this temperature is considered stable for the life of plankton in the pond. Temperatures that can be tolerated by aquatic organisms and good for zooplankton abundance in the tropics range from 20 °C ± 35 °C [18] [19].

3.2. Water Turbidity
The water turbidity is known to be 3 NTU which indicates that the water is not too cloudy. The water turbidity considered stable [20] aquatic life (fresh water) change from 2 NTU at any one time for a duration (30 day). The turbidity of clean water must have a maximum level of 25 NTU [21].

3.3. Water pH
The pH of pond water is known to be 5.39, a pH range of 5.0 – 9.0 is needed so that fish life and food remains (plankton) take place naturally [22] [23]. Organisms can die at a pH of 9.5-10 for a long time [17].

3.4. Salinity Level
The salt content obtained in this study in freshwater ponds was around 0.2 ppt. In fresh water, water salinity levels range <0.5 ppt.

3.5. Oxygen Level
Oxygen as one of the main components for the metabolism of aquatic living things is produced from the photosynthetic process of Algae in it. In this study, the oxygen level obtained was 8.3 mg / L, the oxygen level in the waters intended for fisheries purposes should have an oxygen level of not less than 4 mg / L so that an oxygen level of 8.3 mg / L could support life living things in it [24].

The data on the distribution of phytoplankton found in rice fields-pond can be seen in Table 2 below.

| Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 |
|--------|--------|--------|--------|--------|
| Species a | 2      |        |        |        |
| Species b | 1      | 1      |        |        |
| Species c | 1      |        |        |        |
| Species d | 1      | 1      |        |        |
| Species e | 1      | 5      |        |        |
| Species f | 1      | 1      |        |        |
| Species g | 1      |        |        |        |
| Species h | 2      | 6      |        | 2      |
| Species i | 2      | 2      |        |        |
| Species j | 1      | 1      |        |        |
| Species k | 1      |        |        |        |
| Species l |        | 1      |        |        |
| Species m |        | 1      |        |        |
| **Total** | **2** | **11** | **21** | **2** |

The results of the calculation of the phytoplankton diversity index based on the data above are $H' = 2.27$. This value indicates that the index of phytoplankton species diversity is in the medium category, the community stability is medium with a range of $1 < H' < 3$ [26]. The plankton diversity index is
strongly influenced by water quality [27] with the appropriate physical and chemical parameters. Phytoplankton as primary productivity, so it is very important in the food chain [11]. Phytoplankton productivity is influenced by the availability of abiotic factors in it. Phytoplankton can only live in places that have sufficient light, this is related to the photosynthesis process so that phytoplankton is more commonly found in water surface areas, or areas that are rich in nutrients [12]. Zooplankton distribution data found in rice fields-pond-ponds can be seen in Table 3 below.

| Table 3. Zooplankton distribution |
|----------------------------------|
|   | Plot 1 | Plot 2 | Plot 3 | Plot 4 | Plot 5 |
| Species a | 3      | 1      | 1      |
| Species b  | 5      | 1      |
| Species c  | 1      | 1      |
| Species d  | 5      |
| Species e  | 1      |
| Species f  | 1      |
| Total      | 3      | 2      | 7      | 2      | 1      |

The results of the calculation of the zooplankton diversity index of $H = 1.543$, this value indicates that the zooplankton species diversity index is in the medium category, the community stability is medium with a range of $1 < H^* < 3$ [26]. Zooplankton use phytoplankton as food [13] so that the food chain in the ponds is normal. The existence of zooplankton and fish as consumers is important in controlling biomass and controlling phytoplankton [28] [29] [30] [31].

4. Conclusion

The plankton diversity index found in pond rice fields-pond in Glagah, Lamongan sub-district is in the medium criteria with a phytoplankton diversity index of $H = 2.27$ and a zooplankton diversity index of $H = 1.543$. Physical and chemical characteristics or conditions in rice field-pond water affect the plankton diversity so that it must be maintained. Based on this results we recommend other researchers to develop research in order to determine the effect of plankton diversity in rice fields-ponds on fish yields.

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