The distributional pattern of zooplankton community in beratan lake, bali

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Abstract. Zooplankton is an important component in water ecosystem that has a distribution in spatial and time scale. The distribution and diversity of zooplankton as one biological indicator of quality of the water way. This study was aimed at looking at the description of the distributional pattern and the abundance of zooplankton and Beratan Lake. Five sampling stations were determines based on the deeps of the lake using the field survey method, i.e., LB 1, LB 2, LB 3, LB 4 and LB 5. The zooplankton sample was taken from each stations by using Chaoborus net NXX 10 (the eye of the net size was 132 µ, then the zooplankton was preserved with 4% formalin solution. After being identified, there was five species, 4 Cladocera species and 8 rotifera species. The highest of abundance for copepod group was Thermocyclops. Diaphanosoma was Cladocera group which was mostly found. Conochilus unicornis was the most dominant rotifer.

1. Introduction
Beratan lake is an ecologically most important source of surface water, because of its role as rainfall water collector in Bedugul Highland. Economically, the lake has a very vital role, because it function as the source of water for the people around the lake for drinking, agriculture, fishery and tourist object [1]. As one of tourist destination lake Beratan has given some benefits both to the government and the surrounding community. The development activity to support tourism sector is usually done by the local government very intensively, so that the condition of the environment is often neglected directly and indirectly which will have and impact on the condition of the lake, especially its water way condition. The water way quality can be seen from some existing components in the ecosystem such as chemical, physical, Biological factors. Zooplankton is one of the Biological factor in which its present in the water way ecosystem can influence the ecosystem quality [2].

Studies on ecology in relation to the characteristic of lake Beratan have been done numerously in the previous studies such as the potential of the water resource of Beratan as the support for the local community social-economy factor [3], a distributional study of Phytoplankton in spatial scale [4]. However, there have been very view studies that are related to zooplankton in Beratan Lake. Zooplankton is an important component in water way ecosystem. Zooplankton has a distribution in spatial and temporal scale, starting from some matters up to the water bed [5-6]. Some factors such as physical, Chemical and Biological factors that influence the zooplankton distribution have been largely
known, but a similar study on the zooplankton distribution both horizontal and vertical in a tropical fresh water way, especially in Indonesia, is still rare. The zooplankton distribution and diversity are the biological quality indicator of water way, in which the depend on the availability of food, the variability of the environment, the present of pressure from predator fish, water temperature pollutant, dissolved oxygen, win that trigger water movement and interaction between biotic factor and abiotic factor [7]. Turbidity, pH and temperature also influence the zooplankton community. This study was aimed finding out the distributional pattern and abundance of the zooplankton community in Lake Beratan Bali.

2. Methods
The study was conducted in Beratan Lake, Tabanan Regency, Bali. Five stations for collecting the sample were determined, i.e., LB 1, LB 2, LB 3, LB 4 and LB 5 as shown in the map (Figure 1). The determination of the sampling points was done by using GPS (Figure 1). Zooplankton was collected using Chaoborus net NXX 10 with 132 μ the eye of the net size. The sample that has been taken was done preserved with 0.4% formalin solution. As the supporting data the parameters of water quality such as dissolved oxygen, pH, temperature, conductivity and turbidity were measured in the field using water quality checker Horiba U 10, water brightness, chlorophyll-α and phosphate total were measured using keeping Secchi. The identification of zooplankton was done by using a light microscope with 100-200 time. The identification was done by using [8] and [9] books. While the value of zooplankton abundance was counted by using [10].

Figure 1. Sample location zooplankton in Beratan Lake
3. Results and Discussion

The water quality of Beratan Lake show a normal water temperature range, acidity (pH) tend to be base, the turbidity in some observation point was high, the conductivity was still below water quality standard, the dissolve oxygen content et al observation points was low. The measurement of the surveys water temperature and the deeps stratum of Beratan range 25-28.5°C, the dissolved oxygen concentration at the deeps of 0-10m ranged between 4.5-6.8 mg/L, while at the deeps of 20 m (the lakebed) dissolved oxygen content was very low done to 1.5 mg/L. The highest chlorophyll-a content was found at the deeps between 0-10m was 17.453 mg/L exactly at 5m deeps and the lowest at 20 m deeps (lakebed) which was 2.524 mg/L at point LB5. The distribution of zooplankton community is influence by the condition of water quality, basic sedimen, water plant abundance and distribution [7,11].

**Table 1. General water quality parameter at each sampling site.**

| Depth (m) | LB1 pH | DO (mg/l) | Tem (°C) | LB2 pH | DO (mg/l) | Tem (°C) | LB3 pH | DO (mg/l) | Tem (°C) | LB4 pH | DO (mg/l) | Tem (°C) | LB5 pH | DO (mg/l) | Tem (°C) |
|-----------|--------|-----------|----------|--------|-----------|----------|--------|-----------|----------|--------|-----------|----------|--------|-----------|----------|
| 0         | 8.52   | 5.1       | 27.8     | 7.61   | 5.4       | 27.4     | 8.67   | 5.3       | 27.9     | 8.58   | 4.8       | 28       | 8.36   | 5.1       | 27.6     |
| 5         | 8.05   | 5.2       | 27.4     | 7.38   | 5.6       | 27.1     | 8.41   | 5.4       | 27.5     | 8.32   | 5.2       | 27.1     | 8.19   | 5.3       | 27.2     |
| 10        | 7.17   | 5.7       | 26.5     | 8.2    | 5.5       | 27.1     | 8.17   | 5.2       | 27.1     | 8.21   | 5.5       | 28       | 8.55   | 5.5       | 26.9     |
| 15        | 8.06   | 5.6       | 26.1     |         |           |          |        |           |          |        |           |          |        |           |          |
| 20        | 7.6    |           |          |         |           |          |        |           |          |        |           |          |        |           |          |

Based on the result of observation in the field in the aquatic ecosystem of Beratan, there were 17 zooplankton species which was successfully identified, divided into three groups, i.e., Copepod (5 species), Cladocera (4 species), and rotifer (8 species). Copepod and Cladocera were horizontally distributed almost to all sampling stations, while the rotifera distribution was limited to some stations only. The abundance of each zooplankton group variety in each stations in LB1 (the north part of the lake) and LB4 (the western part of the lake) the highest abundance was in Cladocera group followed by copepod and rotifer, in LB 2, LB 3 and LB 5 the highest. Abundance was in copepod group followed by Cladocera and rotifer (Figure 2). Horizontally the maximal abundance of zooplankton was found in stations of LB4 with the abundance value of 24621.3 individu/L (Figure 3). The study of he vertical distribution was based on the deeps stratum of stations LB5, the highest abundance was at the 10 m deeps, i.e., 56.3% of the abundance total (Figure 4). According to [12] and [2] the environmental factor can play an important role in determining the composition of zooplankton community are the quality and quantity of its feed. The main source of feed for the zooplankton, especially for copepod and cladocera group is phytoplankton such as Scenedesmus, Pandorina, Chlamidomonas, Chlorella, Pediastrum, Nitzschia etc, while the species from the rotifer group are generally particuat iiter or shredders [13]. The chlorophyll-a content can be assumed as the source of feed for zooplankton, the
highest chlorophyll value will be followed by high zooplankton abundance in that place. In this study the highest chlorophyll -a value was generally found in the 0-10m deeps which ranged between 9.130-17.453 mg/L. This pattern was followed by the high plankton abundance at the 0-10m deeps compared to other deeps, in which more than 52% of the zooplankton abundance total was found in that deeps (Figure 4).

![Graph showing zooplankton composition and abundance](image)

**Figure 2.** Percentage of zooplankton composition.

**Figure 3.** Total abundance zooplankton at each sampling site

The chemical quality of waterway in relation to zooplankton distribution and abundance shows that the maximal distribution and abundance was found in the 0-10m deeps, in which the range of temperature and the dissolve oxygen content still supported the zooplankton survival. The decrease in dissolve oxygen content was in proportion to the addition of the deeps which was followed by a decrease in zooplankton abundance, this is cause by the fact that the dissolve oxygen content become one of the factors that influence the distributional pattern and abundance of zooplankton in water way, beside a the factors such as the availability, sunlight, the effect of wind, etc. [14]. The same thing is true for the nutrient content of the water way, i.e., Nitrat and Fosfat, which also influence the distributional pattern and abundance of zooplankton, because both Nutrient factors which limit the growth of phytoplankton as the main nutrient sour e for the zooplankton.

4. Conclusion

The composition of zooplankton community in Lake Beratan is variety enough with the identification of 17 zooplankton species which were divided into rotifer (8 species) *Copepoda* (5 species) and *Cladocera* (4 species). The abundance of each zooplankton community divers in each sanctions, the highest abundance of zooplankton community was found in stations LB4 with the total abundance value of 24621.3 individual/L. Based on the deeps stratum, the highest zooplankton community abundance is found in the 0-10m deeps, i.e., about 56.3% of the zooplankton abundance total.

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