



## Diversity of Odonata and Aquatic Environmental Conditions in Lake Areas (Water Ski and OPI) Jakabaring Palembang-South Sumatra

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### Abstract

Odonata are considered to be good indicators of environmental health and water quality with its presence and diversity in the Jakabaring lake area (Water Ski and OPI). The research location (Water Ski and OPI) utilized by the community as water catchment areas (flood control), recreation and habitat. The Activity in the lake area can affect the benefit of the lake, affecting the quality of the lake waters as a living habitat for animals and plants. However, to describe the diversity of odonata as indicator of the waters in the area of Water Ski and Lake OPI lakes, there is no such thing, therefore the researchers to look at odonata diversity in the area of Water Ski Lake and Lake OPI Jakabaring Palembang-South Sumatera. The location of the study was determined using the purposive sampling method conducted in April 2018. The species found to identified at the FMIPA Animal Taxonomy Laboratory of Sriwijaya University. Sampling in the morning (07.00 – 10.00 AM) and afternoon (15.00 – 18.00 AM). The results of research in the lake area found 2 suborder, 2 families, 11 genere, and 18 species, the total number of all 984 individual species. Odonata species data obtained in the analysis using Past3 software. The diversity index in the Water Ski lake is 1.992 and the diversity index in the OPI lake is 1.758. Diversity index value (2.014), dominance index (0.7922) and evenness index (0.4165). Odonata and enviromental conditions of the lake (Water Ski and OPI) still have relationship, the condition of lake water quality is still below water quality criteria threshold. This is what makes the diversity on both lakes has a moderate value.

Keywords: Diversity, Odonata, Enviromental Condition of the Lake (Water Ski and OPI)

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### 1. Introduction

Jakabaring–South Sumatera region has low topography with areas of land in the form of lebak swamp [1]. Jakabaring area has experienced developments both from infrastructure, economy, commercial and housing. One form of land development in the form of a Water Ski Lake geographically located at latitude: -3.019942 and longitude: 104.795408 and OPI (Ogan Permata Indah) lake geography the location is at latitude: -3.04957 and longitude: 104.786525. Swampland ecosystems that become a living habitat for various organisms are transformed into lake areas, so the survival of organisms that inhabit ecosystems depends on environmental conditions [2]. Results research conducted by [3] the diversity and abundance of insects in the Jakabaring area is moderate

diversity. Research in the Jakabaring area needs to be done more specifically, because there are organisms whose lives depend on environmental quality conditions. Suppose that the presence of Odonata and the level of species diversity that shows a decrease in environmental quality, this is because Odonata is sensitive to changes in the environment [4]. Odonata is recommended as one animal that can assess habitat quality [5].

Odonata chooses a place to breed ecologically around the aquatic environment, even they have a habitat around the waters that are still clean [6]. Odonata features a slim body with two pairs of wings, blood vessels, short antenna in the form of hair, legs that develop well, mouth chewing tools, large compound eyes, long and slender abdomen [7], [8]. Adult odonata live in a clean aquatic environment with moderate sunlight intensity such as under the shade of a tree [7]. Odonata is a group of insects that are

medium to large and often attractive in color, in the Odonata environment can help control harmful insects. Odonata acts as a predator for other insects and small-sized animals and guards food chain balance [6], [9]. Odonata prey on small insects such as beetles, but some Odonata also prey on insects the same size as their bodies and even eat same-sex [10].

The diversity of Odonata species will be high in areas that have water sources and natural and uncontaminated habitat conditions. The environmental quality affects existence of Odonata [4], an area with good water resources and vegetation is very suitable for the conservation of Odonata [11][12]. The Japanese state conserves Odonata wetlands by making 500 ponds as habitat for Odonata. Generating concern for the environment is the goal of Odonata preservation [13]. Knowledge of the diversity of an Odonata species in an environment can see whether the area is well preserved. Odonata in Indonesia is noted to have around 700 species spread throughout Indonesia [7]. According to [14] research on the composition of Odonata at Sriwijaya University, Indralaya education 22 species, 5 families, with the composition of Libellulidae species (77.65%) followed by Coenagrioni (17.86%). Good environmental conditions are indicated by the pattern of Odonata distribution. The research of [15] found that the biodiversity index value of the University of Lampung showed a moderate scale (2.26), meaning that dragonfly life is still supported by good habitat conditions. Odonata not only designs habitats, but also environment related to air bodies [16]. In addition according to the [17], the Odonata has a good adaptation rate, abundant in aquatic environments as well as high morphological specialization that distinguishes it from other winged insects. Therefore, the Odonata Study on the lake (Water Ski and OPI) of the Jakabaring-Palembang region in the swampland area is an indicator of conservation conditions.

## 2. Materials and Methods

The study was conducted in April - May 2018 in the dry season, in the wetland reclamation area in the Jakabaring region Palembang-South Sumatra. The research method uses descriptive methods (qualitative and quantitative), the sampling technique uses purposive sampling method that determines the sampling location based on the results of surveys and observations. Sampling was carried out at two stations, namely Water Ski Lake (WSL) and OPI lake. The two lakes are in the same location, the Jakabaring swap area, while the conditions between the two lakes are very different. Sampling time was taken once a week for one week in the morning 07.00-10.00 WIB and in the afternoon 15.00-18.00 WIB, this was because Odonata was active in the morning and evening. Analysis of research data was carried out using Past3 software to see diversity index, dominance index, and

evenness index.

Odonata species retrieval at each station uses five plots with a visual observation method using a camera to take pictures, direct capture using a cone-shaped net with a height of 60 cm, a diameter of 30 cm and a stick length of one meter, sticky trap using a tree branch for 1, 5 m and given an adhesive in the form of sap derived from jackfruit, and observing behavior. Species found were identified using identification books [7], [18], [19], [20] and the identification of the Math and Sciences Faculty Animal Taxonomy Laboratory of Sriwijaya University. Odonata samples that have been identified in the laboratory were analyzed using the index diversity analysis ( $H'$ ) or the Shannon-Wiener index, dominance index (D) with the Shimphson formula, evenness index (e) with. The following is a Figure 1. Maps of lake research locations in Jakabaring-Palembang Area, South Sumatra:

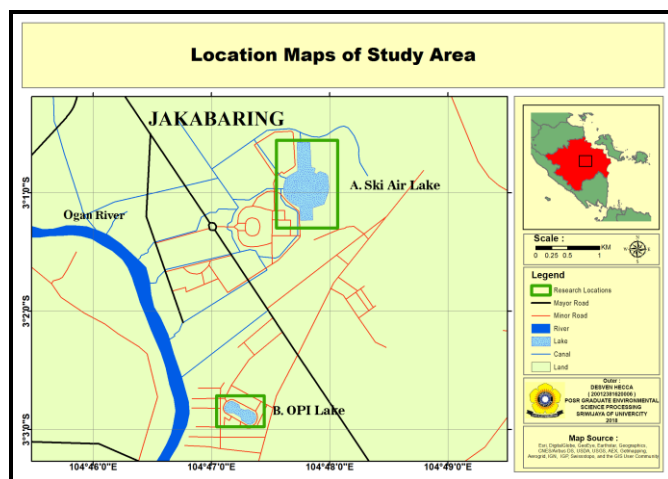


Figure 1. Maps of lake research locations in the Jakabaring-Palembang area of South Sumatra: Location A (Water Ski Lake) geographically located at latitude: -3.019942 and longitude: 104.795408 and Location B (OPI lake) geography the location is at latitude: -3.04957 and longitude: 104.786525.

## 3. Results And Discussion

The research that has been carried out in the Jakabaring area of Palembang-South Sumatra in two lake locations, namely the Water Ski Lake and the OPI lake, has a total of 984 individuals. Odonata species found can be seen in (Figure 2) with 18 species with 11 genera (Agriocnemis, Ischnura, Pseudagrion, Brachythemis, Crocothemis, Neurothemis, Orthetrum, Pantala, Urothemis, Rhyothemis, Tholymis) which is found through the identification of the characteristic of the species morphology (body color, wing shape, eye color, size, Terminal abdominal appendages), 2 families (Coenagrionidae, Libellulidae), and 2 suborder (Zygoptera, Anisoptera). Odonata results were obtained from each sampling location. Location A (Water Ski Lake) had 339 individuals with 13 species, and location B (OPI Lake) had 645 individuals with 16 species.

The results of the study can be seen in (Figure 3),

which shows that the average diversity in the two lakes of the Jakabaring region has a diversity index value ( $H'$ ) = 1-3 that is 2.014. The results of the diversity index based on criteria index are medium diversity (number of species and moderate individuals with varying numbers of individuals). Species diversity index in a place with values above 2.0 can mean that the condition of an environment is not polluted [21]. If species diversity in an area is showing, the condition of the ecosystem is still fairly balanced with low ecological pressures [4], [5]. The following (Figure 2). Odonata species found in Water Ski Lake and OPI Lake Jakabaring-Palembang South Sumatra:

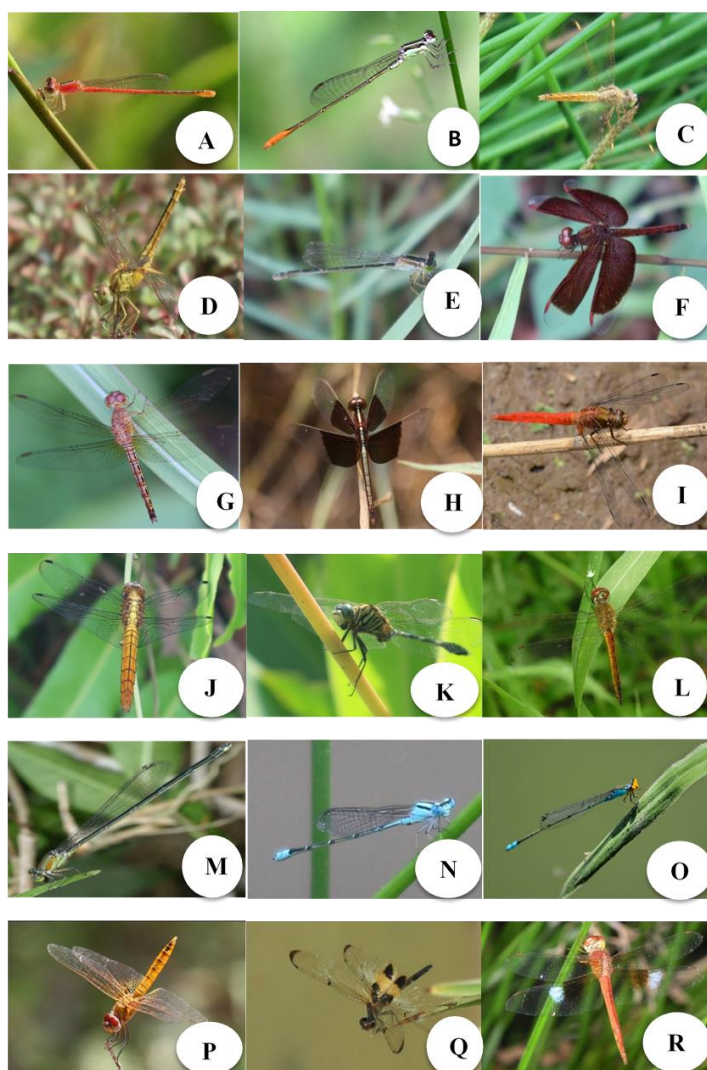


Figure 2. Odonata species found on both lakes (Water Ski Lake and OPI Lake, Jakabaring-Palembang South Sumatra; A. *Agriocnemis femina*, B. *Agriocnemis pygmaea*, C. *Brachythemis contaminata*, D. *Crocothemis servillia*, E. *Ischnura senegalensis*, F. *Neurothemis ramburii*, G. *Neurothemis fluctuans*, H. *Neurothemis tullia*, I. *Orthetrum testaceum*, J. *Orthetrum chrysis*, K. *Orthetrum sabina*, L. *Pantala flavescens*, M. *Pseudagrion pruinosum*, N. *Pseudagrion pruinosum*, O. *Pseudagrion microcephalum*, P. *Pseudagrion rubriceps*, Q. *Rhyothemis phyllis*, R. *Tholymis tillarga*.

Diversity index values are seen from each lake lo-

cation in Figure 3, the value of the Water Ski lake diversity index is higher (1.992) than lake OPI (1.758). This is because location A (Water Ski Lake) has a different environment with more vegetation cover around the lake, while location B (lake OPI) has a lot of land around an open lake without vegetation cover as shade. According to [22], differences in diversity in several research locations can be caused by differences in environmental conditions such as vegetation cover conditions in the surrounding environment. Based on the environmental conditions of lakes A and B (Table 1) Characteristics of air temperature, humidity, water temperature, pH, DO, BOD, COD, because Odonata are able to move from contaminated habitat to clean habitat so that the odonata species persist [4]. All environmental parameters in both lakes (Water Ski and OPI) were still below the class II water quality criteria threshold (PP no. 82 of 2001), except for DO levels. Values given at standard water quality limits, on Water Ski Lake (4.5865) > 4 and OPI Lake (5.810563) > 4, influence the larvae while in the waters [2].

The calculation of the average dominance index value in the research location (D) > 0.5 is 0.7922 so that according to criteria the dominance index value contains species that dominate other species or labile community structures, due to ecological pressure or stress [23]. Species that dominate in a location can master food sources so that competition between species occurs for the same resources [24]. The condition of the dominance index values in both lakes when compared, is higher the location index value of A (Water Ski) than location B (OPI). At location A (Water Ski Lake) (0.8028) > 0.5 so that there are dominating species namely *Pantala flavescens* and *Orthetrum sabina* species, this makes these two species dominate and control the community in the ecosystem. Whereas location B (OPI Lake) (0.6989) > 0.5, there are still species that dominate, namely *Brachythemis contaminata* and *Orthetrum sabina* species. *Brachythemis contaminata* species have the highest number of individuals in location B, it is suspected that this species has a high and frequent or commonly found life ability [17], [25], and *Brachythemis contaminata* species are species that can reflect unfavorable environmental conditions (tabel1) [26].

Diversity index values are related to the dominance index value, if the diversity index is moderate (the number of medium species with varying numbers of individuals and low ecological pressure conditions) then when associated with a dominance index > 0.5 indicates the presence of species dominating in that location. Species that dominate cause competition for food fulfillment and ecosystem control [5]. According to [6], population reduction of predatory organisms can stimulate the growth of other organisms in the habitat.

Table 1. Aquatic environment conditions of Water Ski Lake and OPI Lake Jakabaring Palembang-South Sumatra sustainability [27].

Environmental Parameters	Sampling Location		Criteria for Water Quality Base Class II (PP No. 82 of 2001)
	Location A (Water Ski Lake)	Location B (OPI Lake)	
Air Temperature (°C)	29.9775	32.07	Deviasi 3
Humidity (%)	69.7425	66.05525	-
pH (unit)	4.4155	8.933834	6-9
Water Temperature (°C)	31.3825	32.83041	Deviasi 3
DO (Dissolved Oxygen) (mg/L)	4.5865	5.810563	4
BOD (mg/L)	1,9305	2,02425	3
COD (mg/L)	6,2	6,45	25

Location A: Water Ski Lake (WSL) Jakabaring Palembang-South Sumatra

Location B: OPI Lake Jakabaring Palembang-South Sumatra

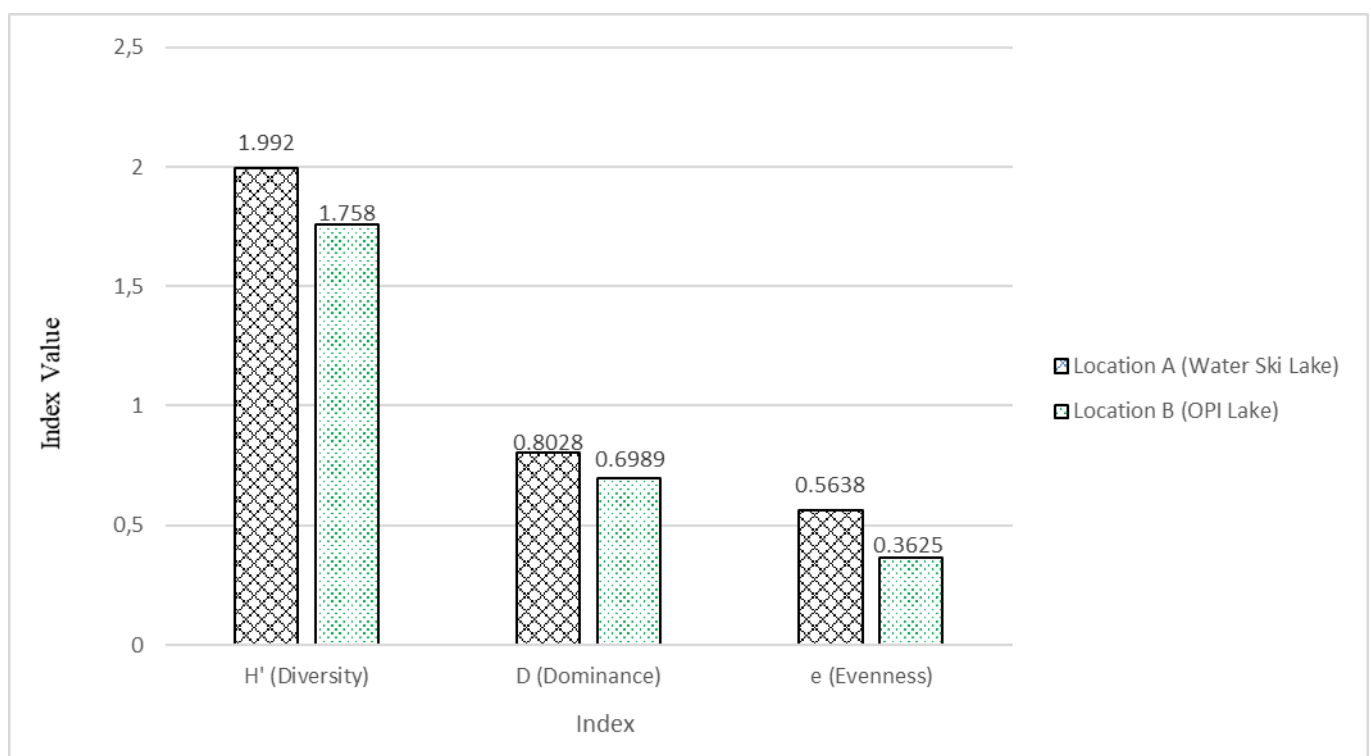


Figure 3. Odonata Diversity Index at Location A (Water Ski Lake) and Location B (OPI) Jakabaring Palembang-South Sumatra

The Table 1 it can be seen that the evenness index value ( $e$ )  $< 0.5$  is 0.4165 so that according to criteria the evenness index between species is low, meaning that the individual wealth possessed by each species is very different. Evenness of species is influenced by the dominance of species in an area, if the dominant species control resources, behavior patterns, and space, there will be competition between species so that other species become weak and eliminated [4], [5], [14]. In location A (Water Ski) evenness index  $> 0.5$  so that the evenness index is high even though it is associated with the number of individual species that dominance, the environment still stable enough with vegetation cover and water quality can support for the existence of a community to maintain its sus-

The location B (OPI) evenness index  $< 0.5$  this is due to the number of individuals species dominating the *Brachythemis contaminata* and *Orthetrum sabina* species so that the number of individuals of each other species is not the same or uneven. *Brachythemis contaminata* has a high tolerance of life ability [26], while *Orthetrum sabina* has the ability to fly, commonly found every year, and has a high tolerance and wide distribution [28] [17], although the amount is not as much as *Brachythemis contaminata* [14]. The higher the evenness value, the higher the diversity of species, and the stability of the ecosystem in the environment [29]. If linked, the three indices in two locations

(Water Ski Lake and OPI lake) are diversity index, dominance index and evenness index value have one relationship. This is because the presence of odonata taken as a study sample at the Jakabaring lake location is influenced by the ability to survive (tolerance limit) on the environmental conditions of the lake which are still under the criteria of environmental quality.

#### 4. Conclusion

1. Diversity index in two Lake locations (Water Ski lakes and OPI lakes) have a moderate diversity index (number of species and moderate individuals with varying numbers of individuals), with environmental conditions experiencing low ecological pressure.
2. The index value of diversity, dominance, and evenness has a relationship with environmental conditions. Odonata influenced by the condition of the two lakes (Water Ski and OPI) which are still good enough to be used as habitat, only DO values exceed the water quality criteria threshold.

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