



DIVERSITY OF ODONATA IN INDONESIA

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ABSTRACT

Data analysis was carried out by calculating diversity, abundance, and evenness indices. Research conducted in the Pattunuang River with the dragonhunter (*Hagenius brevistylus* Selys) revealed that the dominant species (48%) Mahaka river revealed dominant of Zygoptera (*Libellago rufescens* Selys to an extent of 58%. The greatest dragonfly diversity index was on the Mahaka river at 1.18 ± 0.14 , the highest abundance index was on the Pattunuang river at 23.40 ± 4.61 , the highest evenness index was on the Mahaka river at 1.24 ± 0.29 . All species obtained from the results are classified as predators in river habitats.

Key words: Abundance, diversity, dragonfly, forest, habitat, *Hagenius brevistylus*, *Libellago rufescens*, Odonata, predator, richness, river, Zygoptera, dominance, Mahaka river, Pattunuang river

Dragonflies belong to the phylum Arthropoda in one of their orders, Odonata. They are medium to large in size and often attractively colored. Dragonflies also have a slender body with two pairs of wings and blood vessels. Also, dragonflies also have short hair-shaped antennae, chewing-type mouthparts, and large compound eyes (Rachmawati et al., 2024). Dragonflies are aquatic insects that are very sensitive to environmental changes. Studying the diversity of dragonfly species can indicate the health of the freshwater ecosystems in which they live. This is because dragonfly nymphs are very sensitive to pollutants, and dragonflies are predators of mosquito larvae (Ilahi et al., 2019). Dragonflies have a dual and important role in the food chain of freshwater ecosystems, namely as predators that prey on small insects and larvae in the water, as well as a food source for other predators. Research into the diversity of dragonfly species helps us understand complex interactions and how freshwater ecosystems function (May, 2019). Dragonflies can be classified into two types, namely dragonflies (Anisoptera) and dragonflies (Zygoptera). And dragonflies is susceptible to human presence (Koneri et al., 2022). Species diversity studies help classify and identify various species of dragonflies, so it is important to know the differences in the types of dragonfly diversity found in the Pattunuang and the Mahaka rivers. A basic understanding of dragonfly diversity contributes to species conservation and the environment, especially in river basins (Kalkman et al., 2018).

MATERIALS AND METHODS

Sampling was carried out at three location points, namely the upstream Mahaka river ($-4^{\circ}58'25''S$ $119^{\circ}46'38''E$; 640 masl), the middle 534 and the downstream 419. The Pattunuang river ($5^{\circ}03'18.3''S$ $119^{\circ}43'04.6''E$)- has an altitude, namely, upstream 284 masl, middle 178 masl and downstream 106 masl. The specimens were collected by sweep net using a stereomicroscope (Stem 2000 with phototube camera Erc 5S) and then matched with iNaturalist (Valan et al., 2021). Data analysis was carried out by identifying types. Data were analyzed using one-way ANOVA in the SPSS 29.0 application. Calculating species diversity and abundance uses the Shanon-Wiener formula, while the species evenness index is calculated based on Simpson (Odum, 2007).

RESULTS AND DISCUSSION

The highest diversity index in the Pattunuang and Mahaka rivers was with the *Libellago rufescens* (0.36 and 0.31) (Table 1). This is in line with the ability of this species to adapt to various types of habitat and have a more diverse role (Kartini et al., 2022). The lowest richness index in the Pattunuang River was 0.43 for *Heliochypha bisignata*, while in the Mahaka river for the *Hagenius brevistylus*. This is consistent with the fact that the *Heliochypha bisignata* species is one of the endemics in the Indian region and generally has a habitat that is limited to undisturbed river ecosystems

Table 1. Composition of dragonflies (Pattunuang and Mahaka rivers)

Species	Family	Role	Diversity index		Abundance index		Evenness index	
			P	M	P	M	P	M
<i>Neurothemis terminata</i>	Libellulidae	Predator	0.296	0.230	3.829	1.465	0.102	0.129
<i>Hagenius brevistylus</i>	Gomphidae	Predator	0.352	0.073	11.275	0.269	0.089	0.769
<i>Argia tibialis</i>	Coenagrionidae	Predator	0.098	0.299	0.638	2.442	0.089	0.130
<i>Libellago rufescens</i>	Libellaginidae	Predator	0.363	0.314	7.233	8.548	0.103	0.088
<i>Heliochypha bisignata</i>	Chlorocyphidae	Predator	0.073	0.269	0.425	1.954	0.105	0.129

Diversity, abundance, and evenness indices

River	Diversity index	Abundance	Evenness
Pattunuang	1,18±0.14 ^{ns}	23,40±4.61 ^{ns}	0,49±0.01 ^{ns}
Mahaka	1,19±0,98 ^{ns}	14,67±3.24 ^{ns}	1,24±0,29 ^{ns}

P= Pattunuang river; M= Mahaka river; ns= not significant in DMRT, p<0.05

or narrow habitat ranges (Bose et al., 2021). The highest evenness index was in the Pattunuang and Mahaka rivers, respectively, namely *Heliochypha bisignata* (0.11) and *Hagenius brevistylus* (0.77). A high evenness index can be used to indicate good environmental quality (Dong et al., 2023). Table 1 shows the results of the diversity index analysis for the two rivers in the low category at 0.24 ± 0.14 and 0.24 ± 0.98 . The low diversity is bioindicator of river environments and thus rivers are in poor condition (Golfieri et al., 2016). Both rivers have a moderate richness index- Pattunuang river at 4.68 ± 4.61 and a low category and for the Mahaka river at 2.94 ± 3.24 . The moderate abundance indicates that the river has the characteristics of an even ecological community (Cunningham-Minnick et al., 2019). Evenness index from research results on the Pattunuang River is categorized as unstable with a value of 0.10 ± 0.01 , and the Mahaka River is 0.25 ± 0.29 , which is in the stable category. Stable evenness indicates that the river has a suitable habitat for the species living there (Pander et al., 2018).

The species most commonly found in the Pattunuang River is *H. brevistylus*, at 48%. Some dragonfly species tolerate poor water conditions or pollutants (Perron and Pick, 2020). The species most commonly found in the Mahaka River is *Libellago rufescens*, at 58% (Fig. 1). The presence of dragonflies in an ecosystem can be used as an indicator of environmental conditions (Johansson et al., 2019). Dragonflies look for prey during the day when the *Aedes aegypti* emerges (Vatandoost, 2021). Small insects such as ants, stingless bees, or small beetles are the food Siddiqui (2024) also stated that dragonfly food includes small insects. Plant vegetation as part of a habitat has shown differences in the types of dragonflies that use plants and interact with their environment (Buczynska and Buczynski, 2019). The larval phase of dragonflies, which live in waters, also

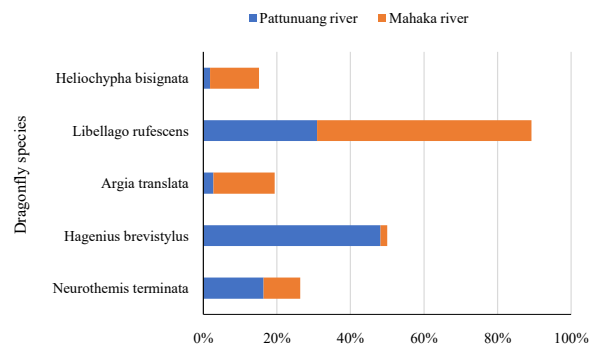


Fig. 1. Distribution of species-Pattunuang and Mahaka rivers

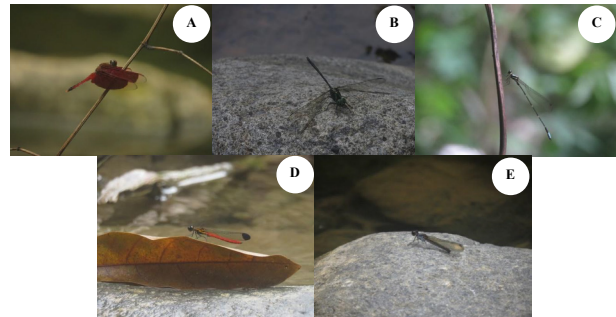


Fig. 2. Dominant dragonflies in Pattunuang and Mahaka rivers: A: *N. terminata*, B: *H. brevistylus*, C: *A. tibialis*, D: *L. rufescens*, E: *H. bisignata*

contributes to the decomposition of organic matter and the circulation of nutrients (Guimaraes et al., 2021). These dragonfly larvae consume detritus, dead insects, and other organic materials that play an important role in the river's nutrient cycle. Images of the species that inhabit the Pattunuang and Mahaka rivers can be seen in Fig. 2.

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AUTHOR CONTRIBUTION STATEMENT

All authors contributed to the manuscript's research and writing, including concepts, methods, and results. All authors have read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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