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ORIGINAL ARTICLE

Ecological Significance of Aquatic Insects in Wetlands

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ABSTRACT

Biodiversity is fundamentally linked to the productivity of natural ecosystems, with wetlands serving as a primary example. The biological diversity within any given wetland is contingent upon its water quality, vegetation and the overall survival rates of its inhabitant species. Among these, aquatic insects represent is a significant taxonomic group essential to the ecosystem's structure. As the dominant group of organisms in the environment, aquatic insects serve as essential ecological engineers and primary drivers of ecosystem function. Their presence and activity are critical for maintaining the overall ecological integrity and health of wetlands.

Keywords: *Aquatic insects, Wetlands, Ecological significance*

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INTRODUCTION

Biodiversity is a foundational aspect of nature, encompassing the variety of life across different scales. Ecosystems are composed of both biotic (living organisms) and abiotic (non-living components such as organic and inorganic matter, and gases) components that are fundamentally interdependent. The survival of all living beings relies on the interactions within these systems. Terrestrial and aquatic ecosystems are prevalent in nature, providing essential habitats that support diverse life forms. The interactions and collectively contribute to maintain ecological balance.

Wetland ecosystems are vital components of the Earth's natural environment, providing numerous critical functions and supporting rich biodiversity. Wetlands serve as natural water purifiers., often referred to as the "kidneys" of the landscape, by filtering pollutants and recycling nutrients. They are a primary source of freshwater replenishment. They also support a vast array of biodiversity, with various aquatic insects and other organisms thriving within their complex, intertwined habitats. The rich biodiversity and essential functions of wetlands contribute significantly to the overall balance and health of the global ecosystem.

Aquatic insects reflect the ecological health of wetlands because they support biodiversity and function as bio indicators of water quality. Specifically, species belonging to the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Tricoptera (caddisflies) are sensitive to pollution and their presence is used to monitor environmental changes and anthropogenic impacts on aquatic systems (Bonada *et al*., 205). Some aquatic insects facilitate bioturbation, while others, such as midges, contribute to the reproduction of aquatic and riparian plants. These insects are integral to the food web, serving as the food source for various aquatic organisms like fish and amphibians, as well as birds. (Tachet *et*

al., 2003). Furthermore, they feed on detritus, decompose organic matter, and return essential nutrients to the wetland ecosystem. The different functional feeding groups of aquatic insects, including shredders, scrapers, filter feeders, and predators, represent important links in nutrient cycling (Subramanian and Sivaramakrishnan, 2007., Collins,2012).

ECOLOGICAL SIGNIFICANCE

Wetlands harbor significant biodiversity, specifically within aquatic insect populations. These organisms play a pivotal role in the environment by providing essential ecosystem services that are fundamental to maintaining overall ecological integrity.

FOOD WEB LINKER: Hemipterans are commonly found in freshwater wetlands, where they serve as a primary food source for a variety of aquatic organisms, including fishes and amphibians (Tara and Kour,2014). Aquatic dipteran also provide a significant food source, particularly for birds (Aldes and Courtney,2019). Additionally, mayflies are a favored food item for birds, mammals, and certain amphibians (Jacobus *et al*., 2019). Dragon fly nymphs also contribute to the food web dynamics within these ecosystems.

REGULATOR OF NUTRIENT CYCLES: Aquatic insects play a significant role in regulating natural nutrients cycles, also known as biogeochemical cycles. They contribute to the decomposition of organic matter to regulate these cycles. For example, water diving beetles (Dytiscidae), which act as scavengers and giant hydrophilic beetles, decompose both plant and animal matter (Ramin *et al*., 2022). Additionally, caddisflies (Trichoptera) contribute to the regulation of nitrogen and phosphorus cycles, which in turn helps control the growth of algae. Furthermore, aquatic insects such as alderflies and dobsonflies (Megaloptera) function as natural cleanser within aquatic ecosystems (Geonka, 2023).

BIO INDICATORS: Aquatic insects serve as bio indicators of water quality, with their attendance often reflecting the overall health of wetland ecosystem. Certain species, such as mayflies, exhibit high sensitivity to environmental fluctuations (Jumaat and Hamiot, 2011). Changes in their morphology, behavior, and function can signify specific environmental stressors. For example, observed changes may indicate shifts in pH levels (Peterson *et al*., 1987) or increases in water temperature (Sweeney *et al*., 2008). This sensitivity makes them valuable tools for monitoring environmental changes in aquatic habitats. Plecoptera (stoneflies) are recognized as indicators of pollution. Furthermore, certain Corixidae species are sensitive and serve as effective indicators of water quality (De Walt and Ower, 2019).

PREDATORY CONTROL

The order Odonata, encompassing both dragonflies and damselflies are recognized as formidable generalist predators that play a critical role in the biological control of small organisms, specially mosquito populations (River- Gasperian *et al*., 2019). In aquatic ecosystems, odonate nymphs serve as effective biocontrol agents., for instance, a single nymph can consume an average of 40 mosquito larvae daily, representing reduction in local larval population per day. Further evidence suggests that the biodiversity of aquatic habitats enhances natural vector suppression. In addition to Odonata, other organisms such as water scorpions (Nepidae), backswimmers (Notonectidae) and various water striders contribute to the regulation of mosquitoes larvae and other minute organisms (Kulkarni and Zade, 2020). These taxa function as integral components of the freshwater food web, with their presence and abundance directly influencing the the ecological integrity of reservoir (Kulkarni and Zade., 2020).

CONCLUSION

Both aquatic insects and wetland habitats are of paramount ecological significance. They are fundamental to maintaining global biodiversity and driving essential biogeochemical cycles. The aquatic insects are the backbone of the aquatic food web, their conservation is critical; the stability of higher trophic levels and the overall resilience of the ecosystem inherently depend upon their continued survival.

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