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A brief study of semi-aquatic ecosystem biodiversity and photographic documentation in Taman Tasik Titiwangsa, Kuala Lumpur

Abstract

This study assesses the ecological health and biodiversity of Titiwangsa Lake Gardens, an urban recreational park in Kuala Lumpur, Malaysia. Field observations documented 14 species across six classes, reflecting a relatively intact ecological state despite its urban location. Notable findings include the adaptability of species such as *Passer montanus* and *Copsychus saularis* to moderate pollution, while biomonitor organisms like *Cornu aspersum* and *Typha latifolia* provided crucial insights into pollution levels and ecosystem conditions. The presence of invasive species, such as *Sphagneticola trilobata*, highlights ecological disturbances and the need for targeted habitat management. Avian species, including *Leptocoma zeylonica* and *Acridotheres javanicus*, demonstrated the dual impact of urbanization on bird diversity, with some species thriving while others preferred less disturbed habitats. The study also noted the presence of reptiles such as *Varanus salvator*, *Calotes versicolor*, and *Trachemys scripta*, which favor semi-aquatic and aquatic habitats. The park's low pollution levels, attributed to regular maintenance and isolation from major contamination sources such as factories and landfills, further reinforce its role as an ecological refuge. However, the findings emphasize the importance of continuous biodiversity monitoring, habitat restoration, and sustainable management practices to preserve the park's ecological integrity amidst urbanization pressures.

Keywords: urban biodiversity, titiwangsa lake gardens, pollution tolerance, biomonitoring, habitat management, ecological health

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Introduction

The Titiwangsa Lake Gardens, located in the northeastern part of Kuala Lumpur beside Jalan Tun Razak, is a prominent recreational park known for its family-friendly atmosphere and as a popular gathering spot for city residents. Covering 46.13 hectares (114 acres), the park has a large artificial lake in the middle. It also has a number of outdoor features, such as tennis courts, water sports, jogging, walking, and cycling routes, an exercise area, and a floating café. Notable locations like the National Theatre (Istana Budaya), Sutra Dance Theatre, National Art Gallery, National Library, and Restaurant Nelayan are also all close to the park. The site's high level of human activity has the potential to have a major impact on the distribution and abundance of organisms within the ecosystem.[1]

Despite its recreational appeal, the Titiwangsa Lake faces significant environmental challenges due to pollution from various activities.[2] Water pollution poses a considerable threat to aquatic life, potentially leading to contamination of the food chain and adverse effect to the organism lived there.

Freshwater bodies often serve as catchment areas for various influences, making them highly sensitive to multiple anthropogenic stressors.[3] Recreational activities, in particular, can directly impact the environment by disturbing wildlife, compacting or degrading soil,[4] and damaging plant life. These activities can lead to habitat degradation or loss, ultimately affecting the diversity, composition, and abundance of organisms. The objective of this study was to provide a documentation on the organism present in Taman Tasik Titiwangsa and review the pollution level in the area cause by human recreational activity.

Materials and methods

The study area is situated in the Titiwangsa Lake Gardens (N 3° 10' 49.26", E 101° 42' 26.5536"). The gardens are located approximately 5 km northeast of Kuala Lumpur's city center, adjacent to Jalan Tun Razak. This large recreational park encompasses 46.13 hectares (114 acres) and features an artificial lake at its center. The park's landscape includes a variety of facilities and notable landmarks (Figure 1). The park's diverse environment and high level of human activity (Figure 2) make it an ideal location for studying the impact of recreational activities (Figure 3) on freshwater ecosystems and the abundance and distribution of aquatic organisms.

Figure 1 The Observation site outlook.

Figure 2 The human activities conducted at the observation site.

Figure 3 The pollution present at the observation site.

The Titiwangsa Lake Gardens' trails were used for the observation and documentation operations in order to cover the whole area and see as many organisms as possible. The 8-megapixel Xiaomi Redmi 9 smartphone camera was used to record the observations. During the field visit, the observed creatures were identified in part; full-depth taxonomic and categorization studies were then carried out. Table 1, which presents a list of 15 species arranged according to their class, order, and species, contains the findings of these investigations.

Results

The biodiversity assessment of the study area revealed a diverse assemblage of species across various classes, orders, and families, indicating the ecological complexity of the Gombak River ecosystem (Table 1; Figure 4). The findings encompassed 14 species distributed among six classes: *Aves*, *Reptilia*, *Gastropoda*, *Equisetopsida*, and *Liliopsida*. These species were identified based on their taxonomic classification, including order, family, and scientific name.

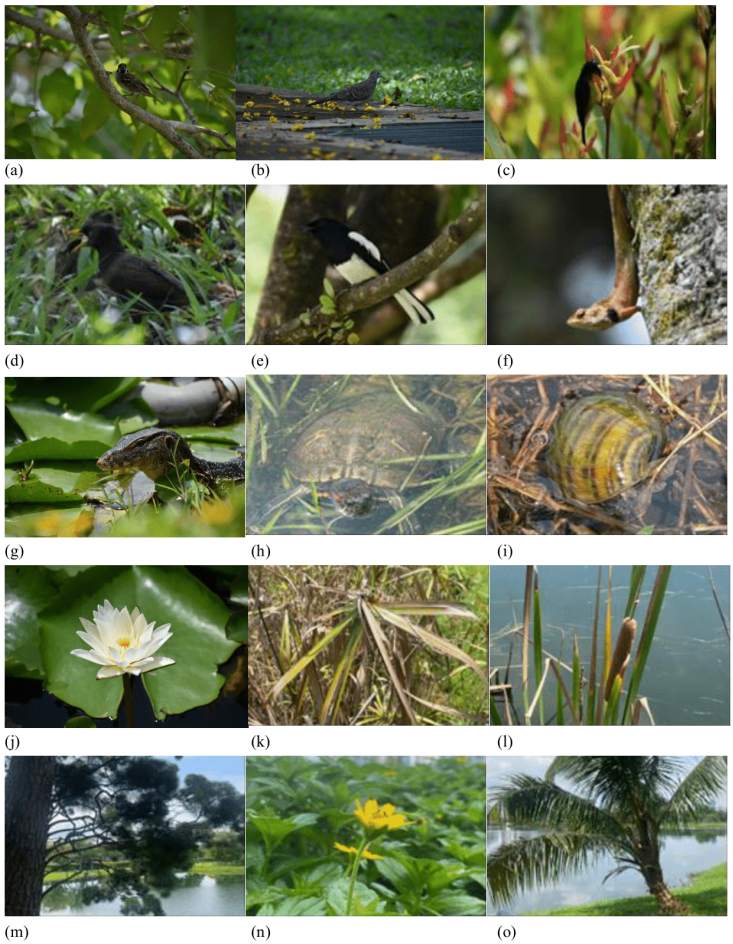

Figure 4 Organism documented at Taman Tasik Titiwangsa. (a) *Passer montanus,* (b) *Leptocoma zeylonica,* (c) *Acridotheres javanicus,* (d) *Copsychus saularis,* (e) *Geopelia striata,* (f) *Calotes versicolor,* (g) *Varanus salvator*, (h) *Trachemys scripta*, (i) *Cornu aspersum,* (j) *Nymphaea tetragona,* (k) *Cyperus alternifolius*, (l) *Typha latifolia*, (m) *Pinus caribaea*, (n) *Sphagneticola trilobata,* (o) *Cocus nucifera.*

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Table 1 Organism identification and classification

Class	Order	Family	Scientific name
Aves	Passeriformes	*Passeridae Nectariniidae Sturnidae*	*Passer montanus Leptocoma zeylonica Acridotheres javanicus*
	Columbiformes	*Muscicapidae Columbidae*	*Copsychus saularis Geopelia striata*
Reptilia	Squamata	*Agamidae Varanidae*	*Calotes versicolor Varanus salvator*
	Testudines	*Emydidae*	*Trachemys scripta*
Gastropoda	Stylommatophora	*Helicidae*	*Cornu aspersum*
Equisetopsida	Nymphaeales Poales Pinales Asterales	*Nymphaeaceae Cyperaceae Typhaceae Pinaceae Asteraceae*	*Nymphaea tetragona Cyperus alternifolius Typha latifolia Pinus caribaea Sphagneticola trilobata*
Liliopsida	Arecales	*Arecaceae*	*Cocus nucifera*

The avian species were represented by five species across two orders: *Passeriformes* and *Columbiformes*. Within the order *Passeriformes*, families such as *Passeridae* (*Passer montanus*), *Nectariniidae* (*Leptocoma zeylonica*), *Sturnidae* (*Acridotheres javanicus*), and *Muscicapidae* (*Copsychus saularis*) were identified. Additionally, the order *Columbiformes* was represented by the species *Geopelia striata* from the family *Columbidae*. These birds highlight the richness of avian diversity and their adaptation to urbanized environments.

Two reptilian species were recorded, spanning two orders: *Squamata* and *Testudines*. The order *Squamata* included *Calotes versicolor* (Agamidae) and *Varanus salvator* (Varanidae). The order *Testudines* was represented by *Trachemys scripta* (Emydidae). The presence of these reptiles indicates their ability to adapt to polluted and human-disturbed habitats.

The gastropod *Cornu aspersum* (family *Helicidae*, order *Stylommatophora*) was the sole invertebrate species identified. This species reflects the ecological presence of mollusks in the river environment, potentially serving as indicators of habitat quality.

The aquatic and terrestrial plant diversity was highlighted by four species within the class *Equisetopsida*. These included *Nymphaea tetragona* (*Nymphaeaceae*, order *Nymphaeales*), *Cyperus alternifolius* (*Cyperaceae*, order *Poales*), *Typha latifolia* (*Typhaceae*, order *Poales*), and *Pinus caribaea* (*Pinaceae*, order *Pinales*). These plants contribute to the ecosystem's structural and functional diversity.

The single representative of the class *Liliopsida* was *Cocus nucifera* (*Arecaceae*, order *Arecales*). This species reflects the adaptability of certain plants to urbanized and disturbed riverine environments.

Discussion

The presence of species at the Titiwangsa Lake Gardens serves as a bioindicator of the park's ecological health. Species such as *Passer montanus* and *Copsychus saularis*, known for their adaptability and moderate pollution tolerance, indicate a relatively resilient ecosystem. However, the presence of invasive species like *Sphagneticola trilobata* suggests ecological disturbances and underscores the need for proactive habitat management. The invasive species, *S.a trilobata*, pose significant ecological challenges due to their aggressive growth patterns and ability to outcompete native species. Their proliferation often leads to a decline in local biodiversity and disrupts the delicate balance of ecosystems.[5,6] For instance, *S. trilobata* can alter soil quality and nutrient cycling, impacting the growth of indigenous plant species and the organisms that depend on them.[7] This invasive species' resilience and adaptability to various environmental conditions make it particularly problematic in regions with high human activity. By integrating these insights, our study highlights the importance of targeted management strategies to mitigate the ecological impacts of invasive species on native ecosystems.[8]

Human activities, particularly recreational activities, also play a critical role in shaping the dynamics of local biodiversity. Activities such as hiking and camping can disturb wildlife habitats, including nesting grounds of avian and terrestrial species, while fishing directly impacts aquatic ecosystems by depleting species populations and altering food chains. Comparative studies from other tropical and temperate regions have shown similar patterns, where high recreational activity correlates with biodiversity stress.[9,6] By juxtaposing our findings with these studies, we provide a broader context that underscores the urgency of balancing human recreation with conservation efforts. These findings advocate for sustainable tourism practices and enhanced regulatory measures to protect vulnerable species while maintaining the ecological integrity of these regions.

Biomonitor organisms, such as *Cornu aspersum* and *Typha latifolia*, provide critical insights into the ecosystem's overall condition and pollution levels. Their ability to thrive in contaminated environments highlights areas requiring cleanup and restoration. However, during the site observations, the low abundance of these species indicates that pollution levels in Titiwangsa Lake Gardens are likely minimal. As a recreational area, the park benefits from regular maintenance of cleanliness and water quality, ensuring safety for visitors and supporting a healthy ecosystem.

The class *Aves* was the most represented among the documented organisms, with five species recorded. Certain species, such as *Acridotheres javanicus* and *Passer montanus*, have adapted well to urban areas, utilizing human infrastructure and food supplies. These species reflect the ecological impacts of urbanization on avian diversity while also acting as indicators of moderate environmental resilience. Conversely, species like *Copsychus saularis* and *Leptocoma zeylonica* display preferences for less disturbed environments, highlighting the importance of habitat preservation to maintain biodiversity. Birds are particularly sensitive to air quality due to their highly efficient respiratory systems, which enable rapid uptake of airborne compounds.[10] Air pollution can cause respiratory distress, illness, increased detoxification effort, elevated stress levels, immunosuppression, behavioral changes, and impaired reproductive success in avian species.[11] These impacts often result in migration or mortality, reducing avian populations. However, the high number of bird species recorded at the site suggests that the air and water quality at Titiwangsa Lake Gardens are favorable and largely non-polluted.

Pollution from recreational areas typically involves physical waste as well as chemical contaminants such as fertilizers, pesticides, and hydrocarbons from vehicles. Heavy metals, including lead, mercury, cadmium, and arsenic, are of particular concern as they can originate from urban runoff, industrial discharges, and atmospheric deposition. These contaminants persist in sediments, posing long-term risks to benthic organisms, which are critical components of the aquatic

food web. Should such pollutants accumulate, the lake could become uninhabitable for many species, as toxicants inevitably end up in the water bodies. However, the study site, despite being in an urban area, is relatively distant from significant pollution sources such as factories and landfills, which likely contributes to its overall environmental health.

The abundance and distribution of organisms in Titiwangsa Lake Gardens are influenced by the interplay of these stressors. Sensitive species may decline or disappear entirely, while more tolerant species could dominate, reducing biodiversity. For instance, three species of reptiles, including *Calotes versicolor*, *Varanus salvator*, and *Trachemys scripta*, were observed at the site. These reptiles favor semi-aquatic and aquatic habitats, underscoring the suitability of the environment. Shifts in community structure caused by pollution or other stressors can lead to cascading effects on ecosystem functions such as nutrient cycling and energy flow.[12] The findings emphasize the importance of maintaining proper management practices and monitoring biodiversity to safeguard the ecological integrity of Titiwangsa Lake Gardens.[13]

Conclusion

In conclusion, the findings from Titiwangsa Lake Gardens highlight the relatively healthy ecological state of the park, as evidenced by the presence of diverse species across multiple classes, including adaptable species such as *Passer montanus* and *Copsychus saularis*, as well as pollution-tolerant biomonitor organisms like *Cornu aspersum* and *Typha latifolia*. The minimal presence of invasive species such as *Sphagneticola trilobata* and the absence of major pollution sources like factories or landfills further affirm the park's low pollution levels. However, the presence of sensitive species, such as *Leptocoma zeylonica* and *Copsychus saularis*, underscores the importance of continued habitat preservation and ecological monitoring to safeguard biodiversity. The study emphasizes the need for sustainable management practices, pollution control, and public awareness to maintain the ecological integrity of Titiwangsa Lake Gardens as an important recreational and ecological asset in an urban setting.

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None.

Conflicts of interest

The author declares there is no conflict of interest.

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