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Faunal Diversity and the Ecological Aspects of a Community-Based Fragmented Lowland Rainforest Patch in Western Province, Sri Lanka

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ABSTRACT

Wawekale Rainforest Reserve (WRR) is a primary lowland tropical rainforest area in the Western Province of Sri Lanka, established with diversity, but disturbed by human activities such as rubber cultivation, logging, poaching, chemical release, and the collection of firewood. Visual Encounter Surveys (VES) were conducted for 100 hours in the year 2022, which covered wide habitat distribution. The herpetofaunal diversity was measured in the WRR which can indicate broader ecological shifts, environmental changes, or habitat degradation. Water quality was measured in the WRR area to determine the ecosystem health and human impact. The study reports 171 species in 73 families, including two Critically Endangered (1.17%), six Endangered (3.51%), 16 Vulnerable (9.36%), and 14 Near Threatened (8.19%) species according to the IUCN Red List. The study area showed 51 endemic faunal species in Sri Lanka, which represented 29.83% of endemism. Based on the observations conducted on the herpetofauna diversity, the Shannon-Wiener diversity index (H) was calculated and the overall herpetofauna (H'_H) showed high diversity within the forest premises. The water quality of the forest fragment had an influence from anthropogenic activities such as removing forest cover, bathing, washing vehicles, and releasing agro-chemical compounds resulting in high water temperature, basic pH level, high electrical conductivity, and high total dissolved solid conditions. The WRR, designated under protection, exhibits the need for immediate remedial actions to mitigate human-induced pollution and deforestation, emphasizing the critical importance of implementing proactive conservation measures to sustain ecological integrity and preserve biodiversity.

1. INTRODUCTION

Sri Lanka is a tropical island situated in the Indian Ocean with a total land area of 65,610 km^2 (Weerakoon, 2012; Manawaduge et al., 2020). It is considered a global diversity hotspot along the Western Ghats (Bossuyt et al., 2004; Narayanan et al., 2021). The abundant biodiversity in Sri Lanka is a consequence of the diverse climatic, topographical, and soil conditions present on the island, which have given rise to a wide range of aquatic and terrestrial habitats. This region comprises a natural forest that still accounts for slightly more than 12% of the total land area (Premakantha et al., 2021). Environmental factors, including substantial rainfall, humidity, and dense undergrowth, are prevalent in these areas, providing a conducive environment for a diverse array of fauna (Karunarathna and Amarasinghe, 2011; Ranagalage et al., 2020). Nonetheless, the island's

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native forests are rapidly declining due to the expansion of settlements and agricultural land, resulting in detrimental effects on its rich biodiversity (Rodrigo and Manamendra-Arachchi, 2020). The loss of natural forests and other causes over the past 100 years, has led to the extinction of lots of fauna species.

Over 60% of Sri Lanka's native fauna find habitat within the Wet Zone forests (Rodrigo and Manamendra-Arachchi, 2020). Additionally, the southwest lowland forests exhibit a significant level of endemism, with nearly 90% of endemic vertebrate species concentrated in this region (Rodrigo and Manamendra-Arachchi, 2020). The wet zone forest reserves are scattered through the Central and Rakwana Mountain ranges. So from the inter-monsoon rain, Southwest-monsoon Season and Northeast-monsoon Season provide plenty of water and maintain a precious climate to the fauna habitat in this area. For example, 59 freshwater fish species have been recorded in these wet zone forest areas and 27 of them are endemic to Sri Lanka (Sudasinghe et al., 2021).

However, efforts to conserve forests are severely hampered by the existing state of forest fragmentation. Large, continuous forest regions can be broken up into smaller, isolated parts as a result of human activities like logging, farming, and urbanisation. This process is known as forest fragmentation. The interconnection of forest habitats is disrupted by this fragmentation, which results in a loss of biodiversity, decreased genetic variety in plant and animal populations, and greater susceptibility to invading species and diseases (De Matos et al., 2021). The fragmented forest sections are also more vulnerable to environmental stressors like climate change and severe weather. Numerous plant and animal species may experience growth and survival issues due to these fragmented areas' changed microclimates, which may result in population decreases and local extinctions. Whole ecosystems may be adversely affected by changes in wildlife migration patterns, pollination dynamics, and nutrient cycling, which can undermine their adaptability and resilience to environmental change (Valenzuela-Aguayo et al., 2020).

Wewekele Rainforest Reserve (WRR) is located in the Avissawella area in Sri Lanka, one of the fragmented forest patches in the lowland Wet Zone of Sri Lanka (Abeyrathne et al., 2020). The forest is situated in a dense community area that is frequently affected by anthropogenic interactions. Fragmentation can be seen by separating this forest from contacting Labugama-Kalatuwawa, Meethirigala or Yatiyanthota lowland rainforest areas. This study reports the data on faunal diversity, ecological aspects, community interactions and the threats posed to the animal species of Wewekele. It aims to enhance the current knowledge of biodiversity and conservation implications in this unique forest habitat.

2. METHODOLOGY

2.1 Study area

The WRR is situated within the Northern boundary of Ratnapura District in Sabaragamuwa Province and belongs to Western Province, Sri Lanka. It is located 1 km away from Avissawella Town. The study area is located between 06°56'30"-06°56'50"N and 80°12'30"-80°12'50"E (Figure 1), and also in the elevation 94 m-111 m a.s.1 (Ranatunga et al., 2019). The forest ecosystem, which also forms an important part of the forest cover within the Avissawella area, covers an area of more than 45 acres within the Seethawakapura Urban Council area and can be categorised as a lowland evergreen rainforest. The forest is situated in the Kotahera Grama Niladhari (GN) division surrounded by 1,465 population. This lowland wet forest consists of dominant tree species *Mesua* sp., *Doona* sp., *Dipterocarpus* sp., *Trichadenia zeylanica*, *Calamus thwaitesii*, *Entada pursaetha*, and *Coscinium fenestratum* (Ministry of Environment in Sri Lanka, 2012). The general forest floor is covered with cascading large boulders and leaf litter. The area is supported by rich waterways. Two main streams start from the mountain in the middle of the forest and finally, it terminates with the creation of Seetha Ella near the Avissawella Town. There is a rich water reservoir at the entrance of the forest with 4.05×10^{-3} km^2. The annual rainfall averages approximately 3,662 mm, with the majority of precipitation falling between November and May. From April to December, the weather undergoes a gradual transition to dry conditions, coinciding with the period of highest recorded temperatures. The WRR experiences an average annual temperature of 27.2°C, ranging from a maximum of 32.9°C to a minimum of 21.6°C. Access to the study area can be attained via either the Colombo-Rathnapura Road or the Kagalle-Avissawella Road.

2.2 Data collection

Dates of the field works were conducted in random numbered tables. A total of 15 field visits were conducted including day and night visiting, of a total of 100 hours in the year 2022. Visual encounter surveys (VES) were conducted in 200 m line transects through 10 pathways. Night visits were conducted with the help of headlamps. Visual observations were conducted by searching 20 cm deep into the leaf litter (Figure 1). A comprehensive exploration was conducted across diverse habitats, encompassing water bodies, rock crevices, logs, trees, decaying vegetation, and bushes up to 5 metres in height, as well as the tree canopy, to detect reptiles, birds, mammals, fish, butterflies, dragonflies, snails, and amphibians (Karunarathna and Amarasinghe, 2011). The identification process involves the comparative method which allows a systematic approach used in faunal diversity studies especially compares the physical characteristics, behaviours and genetic details (Early-Capistrán et al., 2020; Munari and Mistri, 2008), and all species and colour variations were documented in live photographs using digital single-lens reflex cameras (Canon 80D and 600D). Three sites were identified and water samples for identifying the water quality variation in the WRR. Site 01: aquifer and a natural pool inside the WRR, Site 02: Reservoir of the WRR, and Site 03: Water-consuming pool for human use as follows. Onsite water quality measurements were conducted on water pH, temperature, total dissolved solid (TDS), electrical conductivity (EC), and relative dissolved oxygen (RDO) using a Thermo Scientific multimeter. Surface water samples were collected within the period of April-June, 2022 for the water quality analysis.

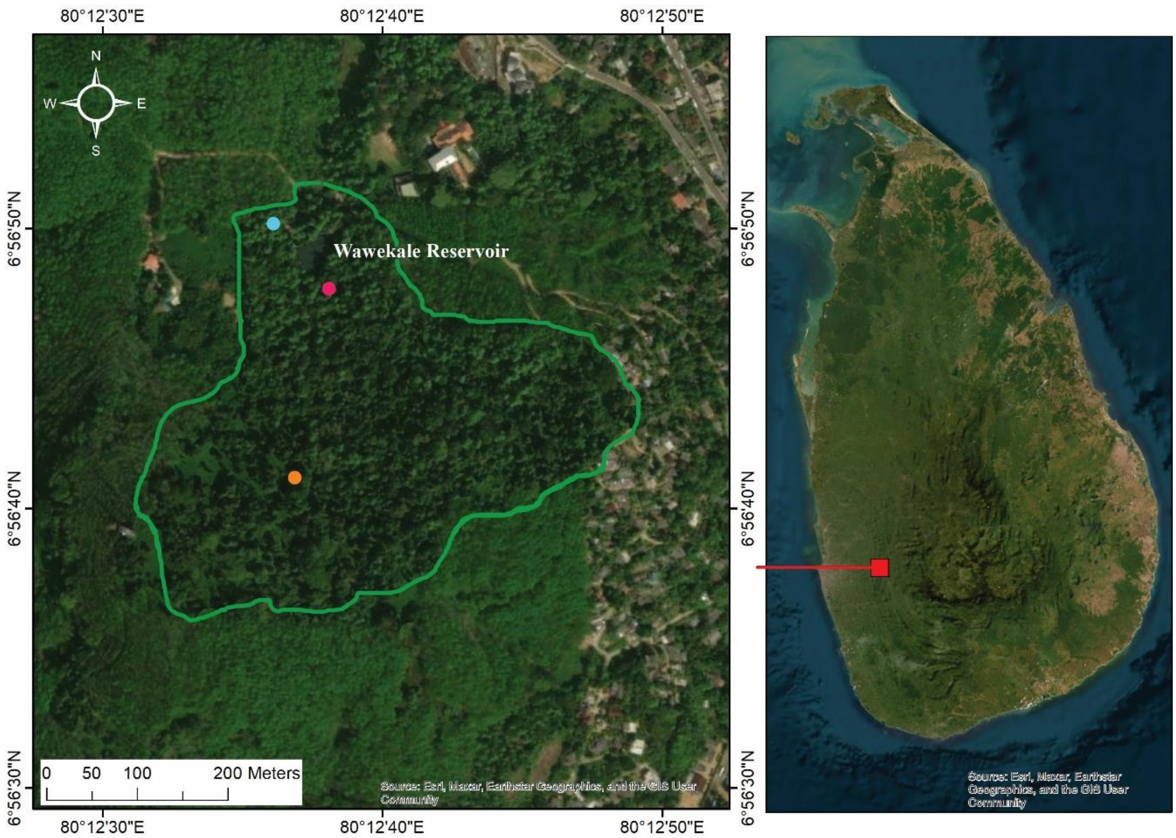

Figure 1. Geographical location and map of WRR (● Site 1: source of the stream and the natural pool, ● Site 2: the reservoir of WRR, ● Site 3: natural water pool with human activities and consumption)

2.3 Data analysis

The Shannon-Wiener Index [$H' = -\sum (p_i \ln p_i)$] was used to determine the herpetofauna diversity of species heterogeneity using the data about reptiles and amphibians (where, H'=species diversity, and pi=proportional frequency of the i^{th} species). Herpetofauna are the indicators of the ecological system functioning and can be used to create ecological indices (Trimurti et al., 2020). All the percentage values were calculated and graphed using Microsoft Excel 2013. The Geographical map was created using ArcGIS 10.8 software. One-way ANOVA was used to find out the variation in water quality measurements. When ANOVA was significant, the Tukey Pairwise post hoc comparison test was used to determine which means were significantly different. All statistical analyses were performed in Minitab 19™: statistical software for Windows (Minitab Inc, USA.)

2.4 Species identification

All the species identifications and classifications were conducted using standard guidebooks, expertise ideas and social media platforms. The standard guidebooks included Ukuwela and De Silva (2021), De Silva et al. (2015), De Silva (2009), Chathuranga et al. (2022), De Silva (2021), De Silva (2008), Warakagoda et al. (2012), Gamage (2013), Sumanapala (2017), Somaweera et al. (2023), Gunathilaka (2007), and the lists of Threatened species were based on the national Red List (Ministry of Environment in Sri Lanka, 2012). Also, the expertise group and page formed on Facebook named "Reptiles and Amphibians of Sri Lanka, and Snakes of Sri Lanka" contributed to identifying some reptile and amphibian species.

3. RESULTS AND DISCUSSION

3.1 Faunal species diversity

During this survey, 171 different fauna species were recorded in 73 families (Table 1) at the WRR. From the total number of recorded species, there were 51 species endemic to Sri Lanka.

During this survey, there were 68 (39.77%) different bird species recorded in 34 different families and 6 of them were endemic to Sri Lanka. Among them, *Dinopium benghalense*, *Megalaima flavifrons*, *Megalaima rubricapillus*, *Ocyceros gingalensis*, *Loriculus beryllinus*, and *Argya rufescens* were listed as endemic to Sri Lanka. Five species of birds were migrants. They were *Muscicapa muttui*, *Muscicapa latirostris*, *Pitta brachyura*, *Phylloscopus trochiloides*, and *Lanius cristatus.* During this study, the endemism of the birds of WRR was 8.82% and the endemism of birds in Sri Lanka was 2.50% (BirdLife International, 2023) respectively. Five migrant bird species were identified during the study.

From the recorded number of the reptiles, 33 (19.30%) species were recorded in 9 different families and 18 of them were endemic to Sri Lanka. From them *Otocryptis wiegmanni*, *Fowlea asperrima*, *Peltopeler trigonocephalus*, *Ahaetulla nasuta*, *Lycodon carinatus*, *Boiga ceylonensis*, *Boiga ranawanei*, *Bungarus ceylonicus*, *Calotes liolepis*, *Oligodon sublineatus*, *Aspidura guentheri*, *Hypnale zara*, *Hemidactylus depressus*, *Lankascincus fallax*, and *Lankascincus dorsicatenatus* are endemic to Sri Lanka. Furthermore, two diurnal geckoes were identified in the WRR and they were possibly *Cnemaspis tropidogaster* and *Cnemespis pava.* The endemism of reptiles in WRR was 54.55% and the endemism of reptiles in Sri Lanka was 8.53% accordingly (Ministry of Environment in Sri Lanka, 2012).

From this survey 11 (6.43%) amphibians have been recorded with 5 different families. There were 10 endemic species are among them as follows, *Indosylvirana temporalis*, *Hydrophylax gracilis*, *Indosylvirana serendipi*, *Indosylvirana serendipi*, *Minervarya kirtisinghei*, *Polypedates cruciger*, *Pseudophilautus folicola*, *Pseudophilautus popularis*, *Pseudophilautus stictomerus*, *Pseudophilautus schneideri*, and *Nannophrys ceylonensis*. In the WRR 90.91% of the amphibians were endemic to Sri Lanka. Furthermore, 9.01% of the Amphibians in Sri Lanka are endemic (Ministry of Environment in Sri Lanka, 2012).

During this survey, 13 (7.60%) freshwater fish species were recorded in six different families. Six of them were endemic to Sri Lanka as follows, *Channa orientalis*, *Belontia signata*, *Schistura notostigma*, *Puntius kelumi*, *Roshanella titteya*, and *Aplocheilus dayi*. Endemism of fish in WRR was 46.15% and endemism in Sri Lanka was 6.59% (Ministry of Environment in Sri Lanka, 2012) appropriately.

From the mammal records of 10 (6.06%) different species with 8 different families. Four species have been recorded endemic to Sri Lanka as follows, *Macaca sinica*, *Semnopithecus vetulus* ssp. *nestor*, *Loris tardigradus* ssp. *tardigradus*, *and Paradoxurus zeylonensis*. Altogether 40% of the mammal species were endemic to WRR. According to the Ministry of Environment in Sri Lanka (2012), 3.2% of the mammals in Sri Lanka have been recorded as endemic.

In this study, 22 (12.87%) different butterfly species were recorded in 4 different families with 2 endemic records as follows, *Pachliopta jophon* and *Troides darsius*. The endemism of the butterfly species at the WRR is 9.09%. Entirely 0.82% (Ministry of Environment in Sri Lanka, 2012) of the butterflies are endemic to Sri Lanka. From this survey, 11 dragonfly species were recorded in 5 different families. In the WRR 18.18% of the dragonflies are endemic. Altogether 1.69% (Ministry of Environment in Sri Lanka, 2012) of the dragonflies in Sri Lanka are endemic.

There were 3 (1.75%) air-breathing snail species recorded that belong to the *Acavidae* and *Ariophantidae* families. They are *Acavus superbus*, *Acavus phoenix*, and *Ariophanta chenui*. All the species were endemic to Sri Lanka. Endemism of the land snails in Sri Lanka was 1.19% according to the Red List (Ministry of Environment in Sri Lanka, 2012).

Out of the 171 species recorded during this study, 14 (8.19%) species were in the Near Threatened (NT) category, 16 (9.36%) species were in the Vulnerable (VU) category and 6 (3.51%) species were in the Endangered (EN) category, and 2 (1.17%) species were in the Critically Endangered (CR) species among them according to the IUCN Red Data List.

Table 1. Summary of Faunal species recorded during this survey

Faunal group	No. of families	No. of species	No. of endemic species	Endemism to the WRR (%)	Endemism to the Sri Lanka (%)
Birds	34	68	6	8.82	2.50
Reptiles	9	33	18	54.55	8.53
Amphibians	5	11	10	90.91	9.01
Fish	6	13	6	46.15	6.59
Mammals	8	10	4	40.00	3.20
Butterflies	4	22	2	9.09	0.82
Dragonflies	5	11	2	18.18	1.69
Snails	2	3	3	100.00	1.19
Total	73	171	51	29.82	3.66

3.2 Diversity of the forest with herpetofauna distribution

Herpetological diversity was measured with the amphibian and reptile distribution throughout the WRR. According to the classification scheme for the Shannon-Wiener Diversity Index (Table 2), overall herpetofauna (H'_H) was 3.29, indicating high diversity. The Shannon-Wiener Index for amphibian diversity (H'_A) was 2.56 and this value shows moderate diversity. The diversity value of the reptiles (H'_R) 3.15 shows high diversity inside the WRR. Most of the amphibian distribution was identified beside the walking paths and the stream banks. Most of the *Ranidae* and *Dicroglossidae* family amphibians dwelled through the steam channels and *Rhacophoridae* family amphibians were found at the shrub forest areas above the ground level 0.3-1.6 m.

Table 2. The Classification scheme for the Shannon Diversity Index (Baliton et al., 2020)

Relative values	Shannon-Wiener diversity index (H')
Very high	3.50 and above
High	3.00-3.49
Moderate	2.50-2.99
Low	2.00-2.49
Very low	1.99 and below

Reptile distribution was high in the area, especially *Peltopeler trigonocephalus*, *Hypnale hypnale*, *Hypnale zara*, and *Daboia russelii* were in high abundance in the WRR (Figure 2), and *Naja naja* in the forest entrance area. These species belong to the *Elapidae* and *Viperidae* families that hold venom that can do potential damage to humans. So, the villagers used to catch and relocate these species into WRR after rescuing these snakes within their livelihood or household premises. That may result in the moderate diversity level of amphibians within the WRR due to the high predator capacity for the prey. Most of the *Gekkonidae* family species were found in the walls of the research centre building and the large tree trunks.

Edge effects resulting from forest fragmentation can significantly impact faunal diversity. As forests are broken into smaller, isolated patches, the boundaries between these fragments become critical zones of change. These edges often exhibit altered microclimates, increased vulnerability to predation, and disruptions in habitat structure (Andriatsitohaina et al., 2020). Some species may thrive in these edge habitats, while others struggle to adapt. The overall result is a complex interplay of species shifts, reduced genetic diversity, and potential declines in animal populations. To conserve and enhance faunal diversity in fragmented landscapes, it is essential to understand and mitigate these edge effects through thoughtful conservation planning and habitat management strategies (Andriatsitohaina et al., 2020). In the study of WRR, edge effects were particularly pronounced, revealing how herpetofauna diversity suffered along the forest edges. These edges, intertwined with rubber plantation areas and those adjacent to the nearby village around 50 m away, showcased the profound ecological transformations resulting from forest fragmentation. Most of the forest edges are separated 2 m away from the rubber state boundary and are mostly affected by chemical exposure and wood cuttings for human consumption. The altered microclimates and increased human activity near these edges disrupted the delicate balance between amphibians and reptiles, leading to declines in species richness and population numbers. This research underscores the critical importance of understanding and addressing edge effects in forest fragmentation scenarios, emphasising the need for holistic conservation strategies to safeguard the diverse and often fragile herpetofauna communities that inhabit these ecosystems.

Figure 2. Most abundant *Viperidae* family snake species in WRR [(a) *Peltopeler trigonocephalus*, (b) *Hypnale hypnale*, (c) *Daboia russelii*, (d) *Hypnale zara*]

3.3 Water quality study and fish ecology in WRR

The water quality of the WRR was analysed by identifying three major sites related to the WRR water stream. Water quality significantly affects the growth, reproduction, and overall ecosystem balance of aquatic organisms, making it crucial for their health and well-being. pH, TDS, and EC levels are three important variables that have a big impact on water quality (Sarda and Sadgir, 2015). A good environment for aquatic life is ensured by adequate pH levels within the ideal range, often between 6.5 and 8.5, by preventing severe acidity or alkalinity that can stress or injure species (Asante et al., 2008). The preservation of proper TDS levels, which indicate the concentration of dissolved minerals, aids in maintaining osmotic balance and guarantees that organisms' physiological processes are not jeopardised. A balanced electrical conductivity is also essential since it measures the water's electrical conductivity and shows whether or not it has the necessary ions for aquatic life (Jordan and Benson, 2015). These sensitive aquatic habitats can be disturbed by pollution-induced changes to these characteristics, which can result in a loss in species diversity, hampered reproduction, and unstable ecosystems. To protect aquatic environments and maintain the diversity and health of aquatic creatures, it is crucial to regularly monitor and adjust pH, TDS, and EC levels. Regular monitoring of the water quality in the resources is necessary to determine the overall health of the ecosystems (Jiang et al., 2020). Poor water quality, caused by factors such as water contamination and pollution effects can directly impact aquatic ecosystems, with the destruction of habitats and their well-being (Odume, 2017).

Site no 1 was the initial water aquifer fountain that initiated the water stream, which appeared as a natural pool with swallowed water with slow-moving water flow. Moreover, the water body was filled with leaf debris, especially from the trees *Artocarpus nobilis*, *Ochlandra stridula*, and *Dipterocarpus zeylanicus*. According to the results site, No. 1 showed the acidic condition of the water that may be an effect of the leaf debris degradation and black water formation. Therefore that was an ideal place for fish ecology by forming small microhabitats. Specifically *Channa orientalis*, *Channa kelaartii*, *Roshanella titteya*, *Aplocheilus dayi*, and *Schistura notostigma* were abundant in this water body. The offspring were well distributed throughout the leaf debris which indicated that the pile of leaf debris provided a breeding ground for the fish species. These fish species prefer the high quality of water for the continuation of their breeding habitats, especially the *Roshanella titteya* presence in this area (Ranatunga and Abeyrathne, 2019; Abeyrathne et al., 2022). Site No. 2 is described as the reservoir that was a man-made water lake continuing from the British colonial era. That reservoir provided a home for aquatic reptiles, amphibians and some fish species. As fish species *Channa orientalis*, *Belontia signata*, *and Heteropneustes fossilis* frequently occurred in the lake banks. The lake was filled with leaf debris and soil weathered from the forest streams. As introduced and become invasive fish species *Oreochromis mossambicus* and *Osphronemus goramy* were highly identified in the lake area which may affect less native fish species occurrence in the observed water body. It is believed that invasive species are a major cause of the current decline in biodiversity. They can directly reduce native species' variety through predation or the spread of pathogens, but they can also have an indirect impact on native species by altering the distribution and accessibility of vital biological resources, such as food and breeding sites (Gracida-Juárez et al., 2022). Invasive species like *Oreochromis* sp. and *Osphronemus* sp. pose a significant threat to native fish and their ecosystems worldwide. They compete for vital resources, such as food and habitat, often outcompeting native species due to their adaptability. Invasive fish also act as aggressive predators, harming native populations and disrupting ecosystem balance. Their habitat alterations, disease transmission, and potential hybridization further jeopardize native fish. This disruption extends to ecosystem dynamics, impacting food webs and nutrient cycles. Economically, invasive species reduce native fish stocks, affecting livelihoods and availability. Mitigation efforts involve early detection, control, education, habitat restoration, and regulation. Addressing invasive species comprehensively is crucial to safeguard native fish populations and their habitats (Sunarto et al., 2022).

Site 3 is an anthropogenic consuming area that is frequently used for bathing, washing vehicles and less drinking purposes. The location was less covered with a tree canopy as a result of human influence in deforestation and with clear water flowing. There was a lack of presence of native fish species in this area but it was highly incorporated with schools of *Oreochromis mossambicus*.

According to the water quality variations throughout the stream (Table 3), there was a huge parameter variation that occurred in the water pH, TDS, and EC levels. From site 1 to site 3 water pH varied from acidic condition to basic condition with mainly effect from human interaction. There was particle contamination that occurred at site 3, which was highly affected by anthropogenic activities. Moreover, that water body is frequently polluted by polyethene, detergents, vehicle lubrication and oils. Water temperature (ANOVA $F=98.43$, $P<0.001$), Water pH (ANOVA $F=43.21$, $P<0.001$) and total dissolved solids (ANOVA $F=19463.36$, $P<0.001$) of the three sites were significantly different. These values were significantly higher in site 3 (ANOVA $F=144.61$, $P<0.001$). The electric conductivity of site 3 was significantly higher than the other two sites. Electric conductivity did not vary between site 1 and site 2. The lowest water temperature was recorded on site 2. The lowest water pH and total dissolved solids were recorded in site 1.

Table 3. Water quality variations in WRR

Water quality measurement	Site 1	Site 2	Site 3
Water temperature (°C)	29.70±0.64^{b}	26.38±0.36^{c}	31.12±0.73^{a}
Water pH	4.95±0.10^{c}	6.83±0.06^{b}	8.00±0.98^{a}
Electrical conductivity (µS/cm)	14.33±1.51^{b}	22.00±2.61^{b}	194.80±35.9^{a}
Total dissolved solids (ppm)	7.17±0.75^{c}	12.33±1.03^{b}	220.00±3.46^{a}

*Means that do not share a letter are significantly different.

3.4 Anthropogenic influence and conservation needs

A considerable land area of the WRR has been lost due to habitat fragmentation, and plant and animal pest invasion. Especially *Oreochromis mossambicus*, *Osphronemus goramy*, and *Trachemys scripta* through human involvement and hunting animals for flesh and engaging in irresponsible human actions. This may disrupt the balance of plant and animal ecosystems, potentially causing harm to various species and even leading to the degradation of the environment. This can occur notably through activities like deforestation for firewood and the indiscriminate collection of medicinal plants such as *Coscinium fenestratum*. Moreover, the WRR is surrounded by plantations of *Hevea brasiliensis* that provide economic stability to the area that may be influenced by excess run-off of sediment, fertiliser, industrial waste, chemicals and pesticides. Moreover, the extensive use of agrochemicals poses a significant menace to the local biodiversity, particularly impacting environmentally fragile amphibian species. The chronic overapplication of agrochemicals in agriculture can result in fatalities, deformities, and irregularities among amphibians (Rout et al., 2016). This poses a grave threat to the numerous endemic and endangered species confined to closed forests, placing them in imminent danger of extinction within the region. A specific concern is the practice of vehicle washing within the Western Rainforest Reserve (WRR) forest stream, which leads to the leakage of materials into local waterways. This not only exacerbates the adverse effects on biodiversity but also jeopardises the health of communities residing downstream. Materials such as non-biodegradable polyethene bags are indiscriminately dispersed within the monastery premises and along forest footpaths, causing disruptions to the delicate ecological equilibrium within the forest ecosystem (Fu et al., 2023). The WRR is a community-based forest fragment that mainly provides a water supply for the nearby villagers. As Seethawakapura Urban Council records 1465 villagers are staying in the nearby area of the WRR, especially because they rely on drinking, bathing and their day-to-day water usage through WRR water streams. Within the study, some of the common issues that occur in a forest were observed. In the Wawekale forest area, there were no proper forest boundaries. So illegal entrances, deforestation and illegal specimen collecting were observed within this study period. Also, the reservoir is filled with leaf debris and sand. Habitat loss and deterioration remain the dominant threat to all faunal populations at present.

These suggestions can keep the forest maintained at best as are they, developing the current building as a research station with a dormitory and lecture hall to provide facilities for research and education activities, maintaining a trail through the forest, providing identification checklist boards for birds, butterflies, and snakes, establishing a security point and ticket counter to stop illegal entering and finally carrying out awareness programs for people and students about the biodiversity of Wewekele and importance of protecting this hotspot. Habitat loss and deterioration remain the dominant threat to all faunal populations at present.

4. CONCLUSION

Based on the comprehensive findings of the present study, a firm conclusion can be drawn regarding the WRR as an exceptionally biodiverse region characterised by the highest levels of endemism and remarkable diversity across various taxonomic groups. The substantial presence of aquatic environments within the reserve fosters ideal habitats for a wide array of fauna. However, this study also brings to light a critical concern, indicating the forest's vulnerability to human encroachment primarily due to its proximity to anthropogenic areas. The burgeoning expansion of the town of Avissawella, driven by the textile industry and the establishment of the Seethawaka Export Promotion Zone (an industrial precinct), amplifies this threat. Consequently, the imperative arises for the formulation and implementation of comprehensive and integrated management strategies aimed at rationalising the protection of this invaluable natural asset. To achieve this, competent authorities must develop a well-structured strategy and action plan specifically designed to curtail human intrusion into the protected areas. Furthermore, the introduction of ecotourism initiatives should be considered, as they have the potential to yield long-term societal benefits, transcending short-term gains. By harmonising conservation efforts with sustainable human activities, the WRR can continue to thrive as an exemplar of biodiversity preservation and ecological stewardship.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary material related to this article can be found starting from Tables S1 to S8.

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