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Research Article

Ecological Assessment of Limestone Caves of Meghalaya, India: Baseline Study of Microclimate and Water Quality for Faunal Conservation

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ABSTRACT

This study assesses the seasonal variation in microclimate and water quality of six limestone caves across four districts of Meghalaya, India—Siju and Nakama Caves (South Garo Hills), Arwah and Maw Tynghiang Caves (East and South West Khasi Hills), and Rupasor and Shuki Caves (West Jaintia Hills)—to evaluate their ecological suitability for cave-dwelling herpetofauna. Field surveys conducted between July 2023 and November 2024 recorded consistently low light intensity (100–355 lux), negligible wind speeds (0.05–0.1 m/s), stable cave temperatures (21.9°C to 26.7°C), and high humidity levels (76% to 98%), creating ideal conditions for amphibians and reptiles sensitive to environmental fluctuations.Water quality analysis revealed high dissolved oxygen (DO) levels across sites (10.64–18.6 mg/L), low biological oxygen demand (BOD) in most caves (1.08–1.5 mg/L), with localized elevations in Nakama (6.68 mg/L) and Shuki (4.4 mg/L), indicating minor organic contamination. Sulphate concentrations were generally low during both seasons (summer: 2.2–7.4 mg/L; winter: 0.5–2.77 mg/L), except in Maw Tynghiang, which showed a pronounced increase in summer (34.2 mg/L) and remained comparatively elevated in winter (5.4 mg/L). Nitrate (NO_3^-) levels also showed seasonal variability, with summer concentrations ranging from 1.375 mg/L (Rupasor) to 3.125 mg/L (Nakama), while winter values dropped markedly across all sites (0.25–0.75 mg/L), indicating reduced surface runoff and organic leaching in the dry season. Electrical conductivity (EC) mirrored this seasonal trend, with higher values in summer (140–429 µS/cm) and lower in winter (84–375 µS/cm); Shuki recorded the highest EC (429 µS/cm in summer), while Arwah had the lowest (140 µS/cm in summer). Total dissolved solids (TDS) ranged from 56 ppm (Arwah) to 214.5 ppm (Shuki), and pH remained slightly alkaline (7.2–8.7), supporting a stable aquatic environment. These findings confirm that Meghalaya's karst caves offer largely favourable and stable microhabitats for fauna, though site-specific deviations point to early signs of anthropogenic impact. The study underscores the need for regular ecological monitoring and targeted conservation efforts to preserve the biodiversity of these sensitive subterranean ecosystems.

Key words: Siju, Nakama, Arwah, Maw Tynghiang, Rupasor, Shuki