



Functional Structure and Trophic Polarisation of the Waterbird Community in a Mangrove Lagoon in Mannar, Sri Lanka

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Mannar is a rapidly industrialising island, yet with tremendous waterbird diversity. Our study site is the shallow, mangrove-dominated ‘Keeri Lagoon’, located in the immediate vicinity of a recent construction facility. The study aimed at investigating how dietary niche partitioning drives the community architecture of waterbirds, to understand the functional diversity and health of this threatened, still understudied ecosystem. Sampling was carried out within the bird migratory season, from December 2025 to March 2026 (18 visits, rarefaction curve flattened), at five point-count stations observed from 06:30h to 09:30h and from 15:30h to 18:30h. The wetland supported a rich waterbird community with 38 species (Shannon-Wiener $H' = 2.37$). Eleven feeding guilds comprising different combinations of seven dietary preferences (e.g., aquatic invertebrates, plants, seeds) were identified within the community. All statistical analyses were conducted using R. Berger-Parker Index (d) showed a highly skewed community structure, with a hyper-dominance of the Brown-headed Gull (*Chroicocephalus brunnicephalus*, $d = 0.34$). Rank-abundance modeling supported this observation, producing a steep decay curve. Chi-square testing revealed a significant departure from a random equitable resource usage distribution ($\chi^2 > 7000$, $p < 0.001$), with a profound effect strength (Cramér’s $V = 0.50$). A sensitivity analysis was carried out by repeating the test, excluding the hyper-dominant population. Yet, the highly non-random functional structure remained with moderate changes ($\chi^2 > 4000$, $p < 0.001$, Cramér’s $V = 0.50$, $d = 0.19$), confirming the significance was not due to them. The results pointed to a specialised functional pathway involving aquatic invertebrates and fish (>47% of bird species), indicating that the energy flow of the ecosystem was funneled through a narrow niche, despite the high baseline taxonomic and functional diversity. The extreme trophic polarisation towards predatory guilds suggested a high-energy, top-down (trophic cascade) dynamic for community architecture. This signaled the sustained availability of aquatic prey species, indicating a healthy ecosystem and potential nutrient cycling via guano, highlighting the need for its proper management amidst local constructions. The implementation of long-term monitoring programmes is recommended hereby to ensure ecologically sound development in the region.

Keywords: *Aquatic prey, Energy flow, Feeding guilds, Functional diversity, Hyper-dominance, Niche partitioning*