



Evaluating Relationship Patterns Between Ichthyoplankton and Zooplankton Communities Across Natural, Degraded, and Restored Mangrove Habitats with Emphasis on Habitat Complexity

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Despite the recognised importance of mangrove ecosystems as fish feeding and breeding grounds, their role in supporting larval stages in tropical regions remains understudied. In particular, how this role is mediated by varying habitat complexity represents a significant knowledge gap. This study aims to use remote sensing to evaluate the mangrove habitat status and to examine how habitat conditions and zooplankton communities affect ichthyoplankton in natural, degraded and restored mangroves. Gangewadiya (matured), Waikkala (degraded), Anawilundawa and Pubudugama (restored) were selected from the Northwestern Province of Sri Lanka. Using Sentinel-2 satellite data and 14 multispectral indices in Google Earth Engine, mangrove condition and habitat complexity were assessed. Plankton nets with mesh sizes of 500 µm and 200 µm were used to collect ichthyoplankton and zooplankton, respectively, at 12 sub-sites within these four zones. Sampling was conducted during the southwest monsoon season. Fish eggs, larvae and zooplankton were sorted and counted. Gangewadiya and Pubudugama contain 70.4% and 6% of healthy mangroves, respectively. In Waikkala, 62.9% of the area was classified as degraded, whereas in Pubudugama and Anawilundawa, 57.5% and 99.4% respectively, were identified as being in nursery condition. Copepods, crustaceans, jellyfish, annelids, and chaetognaths were identified as the dominant zooplankton groups, with copepods being the most abundant among them. A higher density of zooplankton (382.96 ind./m³) was estimated in Anawilundawa than in the other zones ($p < 0.05$). Anawilundawa has a highest ichthyoplankton density (83.95 ind./100m³), compared to Pubudugama (4.96 ind./100m³), Gangewadiya (13.27 ind./100 m³), and Waikkala (1.5 ind./100m³) ($p < 0.05$). A significant relationship ($\rho = 0.585$) was found between zooplankton and ichthyoplankton populations ($p < 0.05$). The results confirm the effectiveness of multi-index analysis and the dynamics of plankton communities in mangroves.

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