



RESPONSES OF FISH ASSEMBLAGES TO MACROPHYTE STRUCTURAL COMPLEXITY ARE SHAPED BY LATITUDE AND BY FISH AND MACROPHYTE METRICS: A GLOBAL META-ANALYSIS

Bárbara Angélio Quirino^{1,2}, Rosemara Fugli^{1,2}, Jean Carlo Gonçalves Ortega³, Sidinei Magela Thomaz^{1,2}

¹ Programa de Pós-Graduação em Ecologia de Ambientes Aquáticos Continentais (PEA), Departamento de Biologia (DBI), Centro de Ciências Biológicas (CCB), Universidade Estadual de Maringá (UEM), Maringá, Brazil

² Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura (Nupélia), Universidade Estadual de Maringá, Maringá, Brazil.

³ Agricultural Catchments Programme, Department of Environment Soils and Land-Use, Teagasc, Johnstown Castle, Co. Wexford Y35 TC97, Ireland.

E-mail: baquirino@uem.br

Aquatic macrophytes are widely recognized for increasing the heterogeneity and complexity of aquatic environment habitats. However, the global effect of these plants on fish assemblages and the factors driving this relationship remain unclear as studies present evidence for positive, negative or null effects and are conducted with different designs. Through a systematic meta-analytic review, we quantified the effect of macrophyte-derived structural complexity (inferred from different metrics) on fish density and diversity. We screened 4,122 studies, with 108 articles being retained in our meta-analysis. Our results showed a consistently positive response of fish metrics to increased macrophyte structural metrics. The strength of this relationship is independent of macrophyte origin (native vs. non-native) and ecosystem type (marine, brackish, or freshwater). However, effect sizes were higher in lower latitudes and were significantly modulated by the fish and macrophyte metrics. The latitudinal variation may be explained by the predominance of smaller-bodied species in tropical and subtropical regions (allowing greater use of fine-scale habitat complexity), their higher vulnerability to predation (increasing reliance on macrophyte refugia), and the prevalence of omnivorous species (intensifying the use of these habitats for foraging). Fish-macrophyte relationships were stronger for fish diversity than for fish biomass, suggesting that environmental heterogeneity primarily promotes species coexistence by increasing the availability of habitats, shelters, and resources. Furthermore, macrophyte biomass was a superior predictor compared to percent cover, as it represents three-dimensional architectural complexity more closely associated with greater microhabitat availability. We suggest that integrating functional traits and higher taxonomic resolution will be fundamental to further unravel the mechanistic drivers of fish-macrophyte relationships.

Palavras-chave: *Habitat complexity, Habitat heterogeneity, Latitudinal gradient, Aquatic plants, Systematic review*



Financiamento: Bárbara Angélio Quirino recebeu uma bolsa de pós-doutorado júnior do CNPq (Número do processo 150701/2024-1).