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Integrating Morphological and eDNA Approaches for Diatom Community Monitoring to Support Sustainable Aquaculture in Lake Buluan, Maguindanao, Philippines

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Abstract: Lake Buluan, the third-largest lake in the Philippines, sustains rich aquatic biodiversity and supports extensive aquaculture. However, decades of anthropogenic pressures, including domestic wastewater, aquaculture effluents, and agricultural runoff, have degraded water quality. This study assessed morphologically, the composition and distribution of freshwater diatoms across six stations inside and outside fish pens to evaluate their potential as bioindicators of ecological change. Nineteen species were recorded, with 11 present in both inside (IFB) and outside (OFB) fish pens. Dominant taxa—*Nitzschia serpentiraphe*, *Gomphonema montanum*, and *Aulacoseira islandica*—occurred at nearly all stations and are linked to nutrient-rich sediments and organic pollution. Site-specific patterns emerged: *Nitzschia liebenthulii* dominated IFB1 and IFB3 but was absent in IFB2 and most OFB sites, whereas *Nitzschia inconspicua* showed the opposite trend. The exclusive occurrence of *Eunotia monodon* and *Cymbella tumida* in OFB stations suggests more acidic or oligotrophic conditions outside enclosures. Rare taxa (*Sellaphora* sp., *Grammatophora angulosa*) contributed to richness in non-enclosed areas. Moreover, next-generation sequencing (NGS) data confirmed the dominance of *Nitzschia* spp., indicating mild environmental stress and ecological plasticity which is, typical for tropical shallow lakes. Findings underscore diatom monitoring as a sensitive, cost-effective tool for assessing aquaculture impacts and advocate its integration into freshwater ecosystem management.

Key Words: diatom, lake, bioindicators, aquaculture

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