

AN ECOLOGICAL ANALYSIS OF LACUSTRINE DIATOMS IN COSTA RICA

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Diatom communities vary in species composition on subcontinental scales, and their component taxa may vary in their ecological preferences. We sought to develop ecological relationships for freshwater diatoms in Costa Rica. Seventy-eight lakes were visited a total of 135 times, and each lake was evaluated for up to 27 parameters. Principle Components Analysis confirmed previous work in which many chemical parameters co-varied, including Mg^{++} , Na^+ , K^+ , Ca^{++} , Si, pH, and alkalinity; a secondary axis was related to the physical environment (e.g. lake depth, area, transparency, and landscape position). In the surface sediments of the 78 lakes we identified 149 species (in 47 genera) of diatoms that reached at least 5% relative abundance in at least one sample. Canonical Correspondence Analysis revealed that variation in the distribution of diatoms was significantly ($p < 0.05$) related to Mg^{++} , Si, pH, elevation, alkalinity, Cl^- , and lake depth. However, because down-core assemblages often have no modern analogs (i.e. share too few taxa with the CCA training set), we also developed transfer functions for individual taxa. We used SPSS to evaluate species-specific relationships of the 20 most widespread diatoms to the 15 best-documented environmental parameters, and found that each environmental parameter was significantly ($p < 0.032$) related to at least 2 species. Similarly, we used LABFit for Gaussian (normal) regressions with the 10 most widespread diatoms, omitting lakes from which each species was absent. This analysis revealed at least one significant relationship ($p < 0.012$) for 14 of the 15 environmental parameters. Among these relationships, we found that species diversity (as measured by Hill's N_2 index) was significantly related to lake depth, Mg^{++} , K^+ , Si, and Cl^- (for each, $p < 0.0052$). The relative abundance of *Frustulia saxonica* was significantly related to macrophyte cover, alkalinity, Ca^{++} , and Na^+ (for each, $p < 0.024$) and that *Eunotia minor* abundance was related to pH, conductivity, and total Fe (for each, $p < 0.029$). Absolute valve abundance was related to Cl^- , temperature, Ca^{++} , conductivity, and alkalinity (for each, $p < 0.030$), while total relative abundance of *Pinnularia* was related to alkalinity, conductivity, and macrophyte cover (for each, $p < 0.029$). Overall, the results are consistent with ecological preferences for these taxa in temperate areas, but this study expands our understanding of diatom distribution relative to many environmental parameters in the neotropics. Because several taxa can be used to estimate each parameter, whether by CCA or by transfer function, this analysis may be quite powerful in paleolimnological reconstructions.

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