COMPARING THREE METHODS FOR DETERMINING PHOSPHORUS THRESHOLDS FOR EVERGLADES DIATOMS

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Diatom-based detection of phosphorus enrichment in aquatic ecosystems has received decades of scientific attention, generating dependable methodologies for applying diatom-based tools in adaptive water quality management. In highly oligotrophic ecosystems, detecting low-level phosphorus exposure with high accuracy is essential to preventing undesirable, and in some cases, irreversible changes. Here we compare the accuracy of three diatom-based methodologies for detecting above-ambient phosphorus exposure in diverse wetlands of the Florida Everglades. These wetlands are no stranger to diatom-based assessment due to their highly oligotrophic nature, ubiquitous presence of diverse benthic diatoms, and decades of exposure to and remediation of phosphorus enriched inflows. These diatom-based assessments of the oligotrophic status of the Everglades are so useful that they are reported, together with 8 other organism-based indicators, directly to the U.S. Congress on a biennial basis. Now that engineering projects to restore freshwater flow to Everglades wetlands are occurring in earnest, attention to ensuring these projects maintain the distinctive oligotrophic status of these ecosystems has redoubled. Here we compare the diatom-based phosphorus detection probabilities of three different methodologies. The first ("experimental approach") uses a combination of experimental and natural enrichment gradients to establish cautionary and impacted thresholds based on deviation from measured baselines. The second ("survey approach") utilizes 12 years of data from a synoptic survey of 150 sites representing all condition states and establishes thresholds based on diatom-inferred phosphorus distribution data and Threshold Indicator Taxa ANalysis. The third ("network approach") utilizes 10 years of synoptic survey data to build diatom species association networks and determines thresholds based on change-points of key network properties. All three approaches identified a significant low and high phosphorus threshold. The experimental approach had high detection accuracy limited to regions of study. The survey approach improved the accuracy of detection for these underrepresented regions. The network approach incorporated species inter-dependencies into thresholds but does not account for sensitive changes in relative abundances. Recommendations are made for applications based on adaptive management goals and spatial scales.