



## Phytoplankton species diversity control through competitive exclusion and physical disturbances

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**ABSTRACT:** Competitive exclusion theory suggests that phytoplankton species number in an assemblage at equilibrium will be limited to the number of simultaneously limiting resources, generally three or fewer. However, natural phyto-plankton assemblages usually exhibit high species diversity, hence the concept of Hutchinson's "paradox of the plankton." Recent works have suggested that this apparent paradox is a result of disturbances intermediate in frequency relative to the time period necessary for species succession to lead to equilibrium conditions (sensu Connell's intermediate disturbance hypothesis [IDH]). Moreover, evidence indicates that disturbances of intermediate intensities are also conducive to maintenance of high species diversity in phytoplankton communities. Using a long-term data record from hypereutrophic subtropical Hartbeespoort Dam (South Africa) that was typically dominated by a single species, but annually subjected to physical disturbance, we demonstrate here that disturbances can indeed enhance phytoplankton species diversity. However, these data fail to support Connell's IDH *per se*, as moderate- and high-intensity disturbances yielded similarly high species diversity. These data also suggest that community resilience (the ability or time to return to predisturbed conditions) is negatively related to disturbance intensity, such that higher intensity disturbances maintained high diversity for longer periods of time relative to lower intensity disturbances.

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