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The effect of initial community composition on phytoplankton succession under continuous and pulsed-flow conditions

Three pulsed vs. continuous nutrient loading experiments were conducted to investigate phytoplankton competition in mixed assemblages from the Rincon Delta, Texas, in March, June and September 2001. Flow-through incubators received the same amount of nutrient loading and hydraulic flushing over the course of each experiment, as well as identical photoperiod and irradiance. Initial conditions in the incubators were assumed identical because water samples were drawn from the same well-mixed carboy that contained the field sample. Our findings showed that in one experiment pulsed flows supported greater secondary productivity with less accumulated phytoplankton biomass, and greater phytoplankton diversity, than continuous flow, while another experiment showed the opposite trend, and a third experiment, as yet, shows no trend. In one of the experiments the variability within a treatment was also high. We anticipated our observed results between treatments, but we did not anticipate the differences sometimes observed within treatments comprising an experiment, or the differences between experiments. This raised the question of what might be causing these differences in phytoplankton succession patterns. Differences between the experiments may be due to the initial presence or absence of phytoplankton species characteristic of minimum cell quotas that are below grazer food-quality thresholds, i.e., when in a starved state are unsuitable food sources. In turn, this would allow phytoplankton blooms of low diversity. However this does not explain the differences observed within treatments of the same experiment. It may be that phytoplankton succession in these assemblages behaves chaotically. In which case, minute variations in the initial phytoplankton community composition would have a profound impact on secondary productivity, phytoplankton standing biomass, and species diversity.