Temporal Dynamics of Periphyton Exposed to Tetracycline in Stream Mesocosms

By

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Significant amounts of antibiotics enter the environment via point and nonpoint sources. We examined the temporal dynamics of tetracycline exposure to stream periphyton and associated organisms across a logarithmically dosed-series of experimental mesocosms, designed to mimic natural conditions. Target in-stream tetracycline exposures were based on environmentally relevant concentrations in aquatic ecosystems throughout the United States (<1–100 μg L^{-1}). Significant changes in the stream biotic community were observed within 7 days with in-stream tetracycline concentrations as low as 0.5 μg L^{-1}, including significant changes in antibiotic resistance, bacteria abundance and productivity, algae biomass, cyanobacteria, organic biomass, and nematodes. These effects were magnified with increased exposure time and dosing concentration. Recovery of the periphyton community after 28 days of exposure was dependent upon the tetracycline dose. At the highest doses, 10 and 100 μg L^{-1}, bacteria productivity recovered; however, bacteria, algae, and nematode abundance did not recover at the same rate and remained low even after a 28-day recovery period (of nondosing). This study demonstrates that tetracycline exposure under near-natural conditions and at concentrations currently observed in aquatic environments may have important consequences for the structure and function of stream periphyton and, potentially, public health via increasing resistance of naturally occurring bacteria.

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