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Widespread prevalence of cyanotoxin production and toxin transfer at the land-sea interface in Southern California coastal waterbodies

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Abstract

Cyanobacterial blooms and associated toxins have become increasingly problematic globally and have far reaching effects downstream of their origin, creating issues in brackish and marine waters. The transfer of toxins at the land-sea interface has been largely overlooked, however recent studies in Southern California have shown there are multiple loading sources of cyanotoxins to downstream waters from a wide variety of waterbody types including streams (benthic algae), depressional wetlands, lakes, reservoirs, coastal lagoons and estuaries. Statewide surveys of benthic algal samples from wadeable streams detected microcystins in one-third of wadeable stream reaches, and multiple cyanotoxins were detected at a subset of sites, indicating the potential for other cyanotoxins to be prevalent.

Intensive targeted studies conducted in San Diego successfully used passive samplers, Solid Phase Adsorption Toxin Tracking (SPATT), to capture the prevalence of microcystins in a diverse array of waterbodies and results indicated microcystins are pervasive, and missed by traditional sampling approaches. Specific studies to evaluate the transfer of cyanotoxins from freshwater streams to estuarine waterbodies will be discussed.

Regional surveys of lentic waterbodies revealed the presence of numerous harmful cyanobacteria species, simultaneous detection of multiple cyanotoxins, and several previously undocumented cyanotoxins in Southern California.

The results from these surveys suggest there are multiple sources of cyanotoxins, including benthic cyanobacteria, as loading sources to downstream waterbodies which has implications for the management of drinking water, wildlife, and recreational resources and highlights the need to expand HAB monitoring to include both freshwater and marine toxins at the land-sea interface.