

Spatial and Seasonal Variability of Dissolved Organic Matter and Nitrogen in Lake Erie Tributaries

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Dissolved organic matter (DOM) is an important constituent of the global carbon cycle and plays a critical role in many biogeochemical processes. The biogeochemical function of DOM is dependent on both its concentration and chemistry, which varies between watersheds and over time. For example, watershed characteristics such as watershed area, land use, soil type, and bedrock type can all influence DOM. To better understand how watershed characteristics and seasonality drive the concentration and chemistry of DOM in watersheds that drain into Lake Erie, we synoptically sampled 82 tributaries along the US coast of Lake Erie in fall, early spring, late spring, and summer to target different hydrologic domains. We chose tributaries with a range of watershed sizes and land uses to try to identify watershed controls on DOM exported into Lake Erie. Water samples and sensor measurements were taken near each stream's point of discharge to the lake. We measured the concentration of dissolved organic carbon (DOC), total nitrogen, and anions, and used UV-Vis and fluorescence spectroscopy to measure DOM chemistry. Spatial and seasonal variability were observed between watersheds of individual streams in the eastern and western portions of the broader Lake Erie watershed. Watersheds in the western half are largely dominated by intensive agricultural land use, while land use in the eastern portion has higher forest cover. DOC concentrations were generally higher, with greater seasonal variation, in streams in the agricultural western half of Lake Erie watersheds than eastern watersheds. BIX, a fluorescence index which indicates more freshly produced DOM from autochthonous sources, trends lower with a greater percentage of forest cover in a watershed. This means there is a smaller proportion of microbially created DOM in streams with greater forest cover, potentially due to lower availability of nutrients and light limiting photosynthesis. Samples collected in the western half of Lake Erie watersheds also exhibited highest total nitrogen concentrations in May, followed by March, while samples collected in the east had relatively consistent total nitrogen concentrations regardless of season. These results indicate that land use heavily controls the export of both carbon and nitrogen from watersheds in the Lake Erie basin and could be used to guide predictions of future nutrient export in the changing Anthropocene.