SOURCES AND SINKS OF NITROGEN IN THE CAPE FEAR RIVER ESTUARY, SOUTHEASTERN NORTH CAROLINA

Leslie C. Bradshaw

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Approved by

Advisory Committee

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Co-Chair Co-Chair

Accepted by

_____

Dean, Graduate School

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ABSTRACT

Fluxes of NH_4^+, NO_3^-, free amino acids, total nitrogen (TN), and organic nitrogen (ON) were measured in core incubation and particle exchange experiments between September 2002 and April 2004. These data were combined with other measurements of nitrogen species in river water, atmospheric deposition and wastewater discharge in order to determine nitrogen (N) speciation and loading to the Cape Fear River Estuary (CFRE), Southeastern North Carolina, and to ascertain why NH_4^+ concentrations in the estuary have more than doubled in the past 8 years.

River fluxes are the primary source of N into the estuary, contributing >90% of TN input. The majority of N in river fluxes was ON (84%), with the remainder being inorganic N, primarily NO_3^- (11%) and NH_4^+ (5%).

Sediments are also a source of the various N species to the estuary although they are much smaller than riverine inputs. The majority of TDN in benthic fluxes is dissolved inorganic N (50 to 90%) with NH_4^+ generally dominating the fluxes. Benthic fluxes of dissolved organic N are somewhat smaller (-1500 to 200 μmols DON$\cdot m^{-2}\cdot d^{-1}$) and are primarily taken up by sediments in contrast to inorganic N, which is generally released by sediments.

Wastewater treatment discharge is a secondary source to river fluxes for TN where it contributed <5% to the annual TN input. Inorganic N was a major portion in discharge fluxes, with NH_4^+ making up 65% of TN. Although wastewater inputs are not important for TN, they are an important source of NH_4^+, contributing 33% to the total NH_4^+ input in the CFRE.

Atmospheric deposition may provide significant episodic additions of N to the CFRE but is relatively unimportant on an annual basis. Particle exchange is a small source of NH_4^+ and free amino acids.

In summary, although episodic additions of NH_4^+ from wastewater and benthic fluxes may be important to estuarine inputs of NH_4^+, it appears that increasing NH_4^+ concentrations in the estuary are coming from increasing concentrations of NH_4^+ in rivers, perhaps due to increasing inputs from agriculture, residential, and industrial activity in the upper river basin.

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DEDICATION

I would like to dedicate this to my fabulous husband, Matthew Bradshaw, for insisting I follow my dreams.

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