

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

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TABLE OF CONTENTS

ABSTRACT.....	vii
ACKNOWLEDGEMENTS.....	ix
DEDICATION.....	x
LIST OF TABLES.....	xi
LIST OF FIGURES.....	xii
INTRODUCTION.....	1
Relevance.....	2
Pathways.....	3
Riverine Input.....	6
Atmospheric Deposition.....	7
Benthic Fluxes.....	9
Sediment Resuspension.....	9
Particles/Exchangeable NH_4^+	10
Photochemical Production.....	10
Point Sources.....	11
Purpose.....	12
METHODS.....	12
Study Site.....	12
Cape Fear River Estuary (CFRE).....	12
Sample Collection and Storage.....	13
Water Column.....	13
Bottom Sediments.....	15

Suspended Particles	15
Experimental Methods	16
Sediment Cores	16
Exchangeable Experiments.....	16
Photochemical Production Experiments.....	17
Reagents and Standards	18
Analytical Methods.....	19
NH ₄ ⁺ and Dissolved Free Amino Acids.....	19
Total Nitrogen Determination.....	21
Nitrate + Nitrite (NO _x ⁻) Determination.....	21
Organic Nitrogen Determination	22
Detection Limits and Standard Error.....	22
RESULTS	22
Benthic Fluxes.....	23
Exchangeable Experiments.....	27
Photochemistry.....	31
Atmospheric Fluxes.....	31
Riverine Fluxes	31
Wastewater Treatment.....	37
DISCUSSION	37
Ammonium.....	40
Rivers	40
Wastewater Treatment	40

Benthic Fluxes	43
Atmospheric Fluxes	46
Exchangeable Ammonium.....	47
Estuary Discharge.....	49
Nitrate.....	50
Rivers	50
Wastewater Treatment	52
Benthic Fluxes	53
Atmospheric Fluxes	53
Estuarine Discharge	54
Organic Nitrogen	54
Rivers	54
Benthic Fluxes	56
Atmospheric Fluxes	57
Estuarine Discharge	57
Amino Acids.....	57
Rivers	57
Benthic Fluxes	59
Atmospheric Fluxes	59
Exchangeable Amino Acids.....	59
Estuarine Discharge	60
Total Nitrogen.....	60
Rivers	60

Wastewater Treatment	62
Benthic Fluxes	63
Atmospheric Fluxes	63
Estuarine Discharge	64
SUMMARY AND CONCLUSIONS	64
REFERENCES	70
APPENDIX.....	82

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 $200 \mu\text{mols DON}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$) 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.

LIST OF TABLES

Table	Page
1. Seasonal summary of water column parameters for Cape Fear estuarine transects.....	24
2. Seasonal summary of sediment parameters for Cape Fear estuarine transects.....	25
3. Seasonal benthic flux measurements for nitrogen species.....	26
4. Average seasonal exchangeable NH_4^+ from bottom sediments and suspended sediments in surface water.....	29
5. Average seasonal exchangeable amino acids from bottom sediments and suspended sediments in surface water.....	30
6. Seasonal photochemical production of NH_4^+	32
7. Seasonal photochemical production of amino acids.....	33
8. Seasonal summary of nitrogen species measured in atmospheric wet deposition.....	34
9. Seasonal river contributions.....	36
10. Seasonal summary of nitrogen species measured in wastewater treatment.....	38
11. Ammonium fluxes in moles per season.....	41
12. Nitrate fluxes in moles per season.....	51
13. Organic nitrogen fluxes in moles per season.....	55
14. Amino acid fluxes in moles per season.....	58
15. Total nitrogen fluxes in moles per season.....	61

LIST OF FIGURES

Figure		Page
1.	Concentrations of NH_4^+ from monthly data at M61 in the Cape Fear River Estuary	4
2.	Concentrations of NO_3^- and TN from monthly data at M61 in the Cape Fear River Estuary	5
3.	Atmospheric NH_4^+ deposition at Clinton and Lewiston, NC	8
4.	Cape Fear River Estuary sampling stations from Navassa to M18.....	14
5.	Box model for the Cape Fear River Estuary.....	39
6.	Distributions of NH_4^+ and NO_3^- in the Cape Fear River Estuary	42
7.	Distribution of NH_4^+ and amino acids for a laboratory-simulated salinity gradient	48
8.	Annual loading of total nitrogen into the Cape Fear River Estuary (moles per year)	65
9.	Concentrations of NH_4^+ from monthly data in tributary rivers to the Cape Fear River Estuary	68
10.	Monthly data in tributary rivers to the Cape Fear River Estuary.....	69