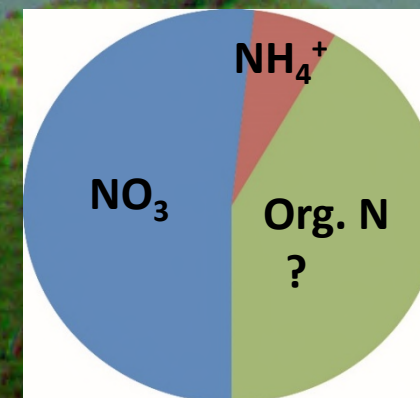
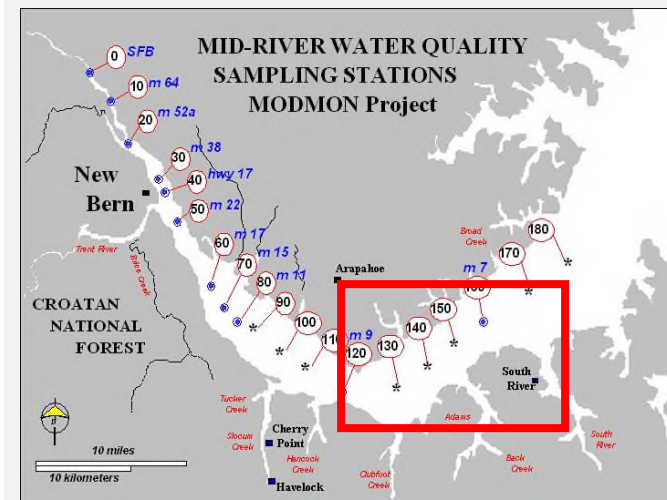


Organic N dynamics in the Neuse River Estuary what we know and need to know

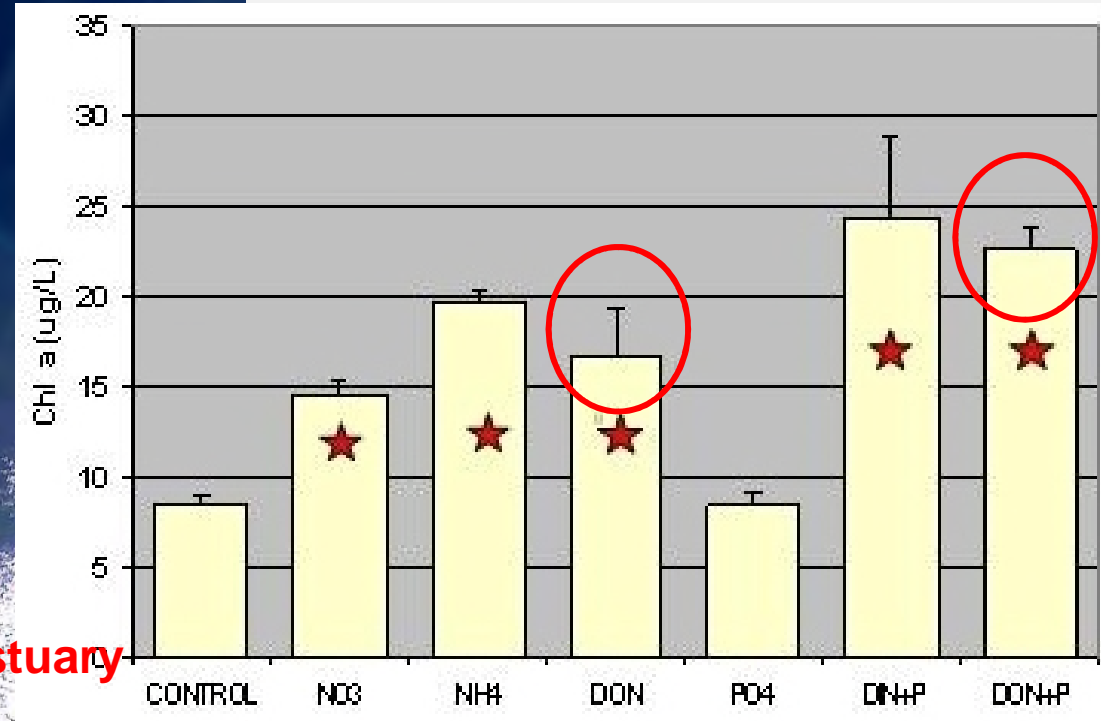
Hans Paerl¹, Alexandria Hounshell¹ & Christopher Osburn²

¹UNC-Chapel Hill Institute of Marine Sciences, Morehead City, NC
²NCSU, Dept. of Marine, Earth & Atmospheric Sciences, Raleigh, NC



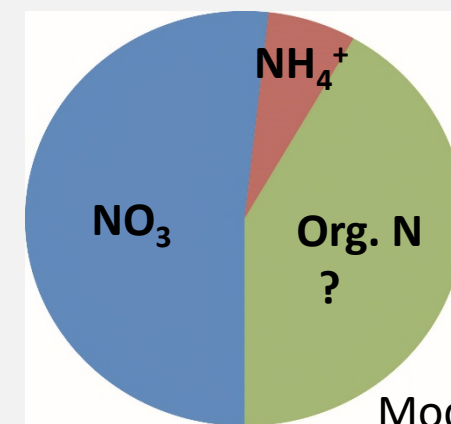
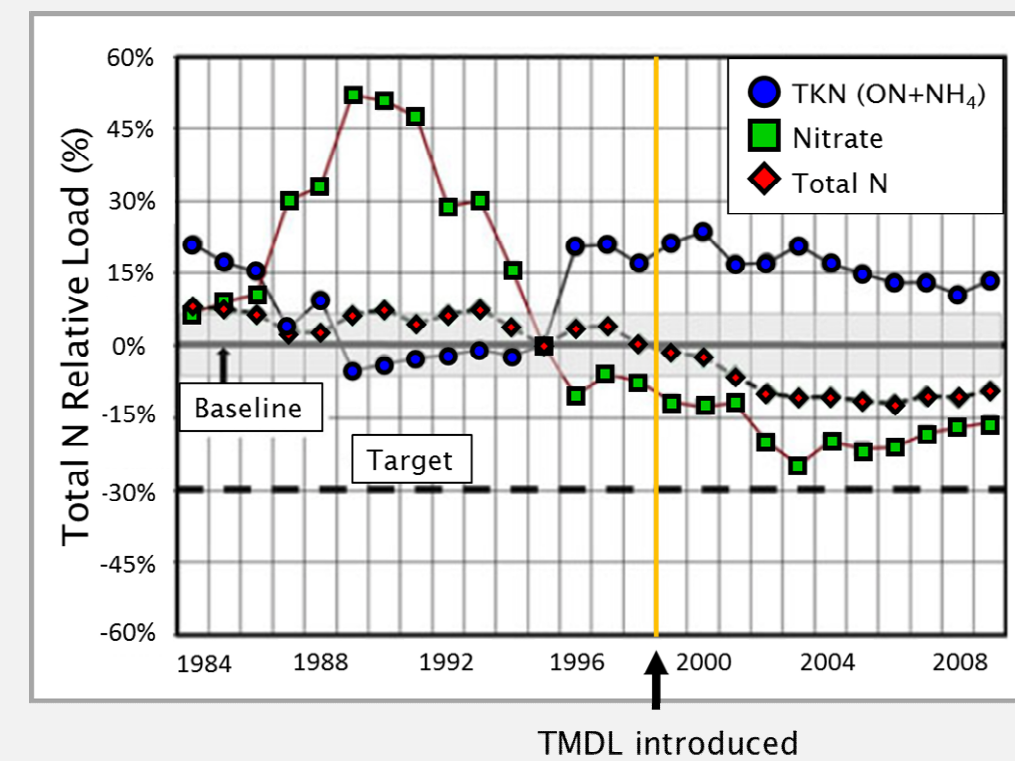


Nutrient limitation in the Neuse R. Estuary, NC
Nitrogen is the name of the game



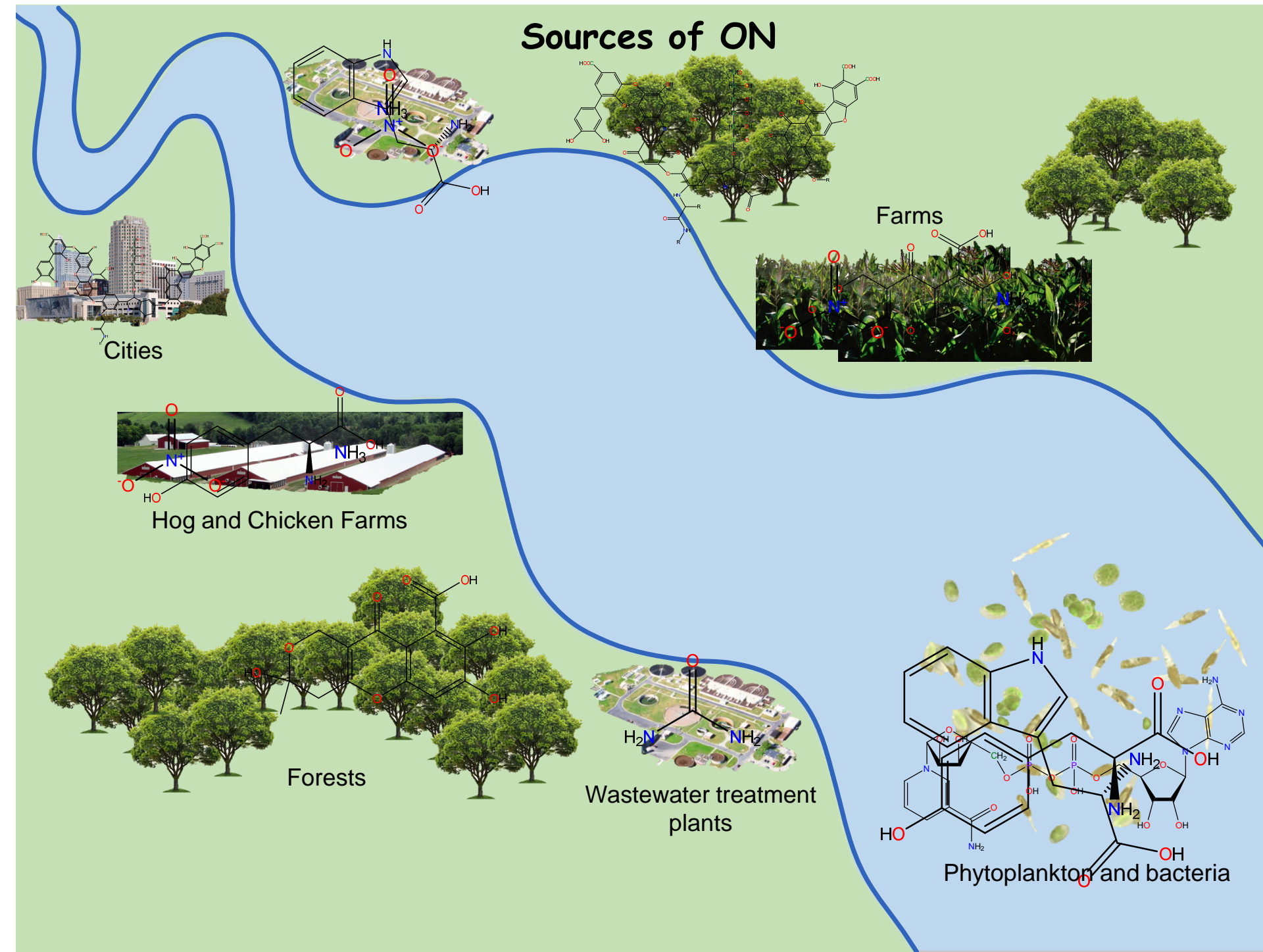
Paerl et al., 1995; 2007; 2014 Gallo 2006

Organics on the rise

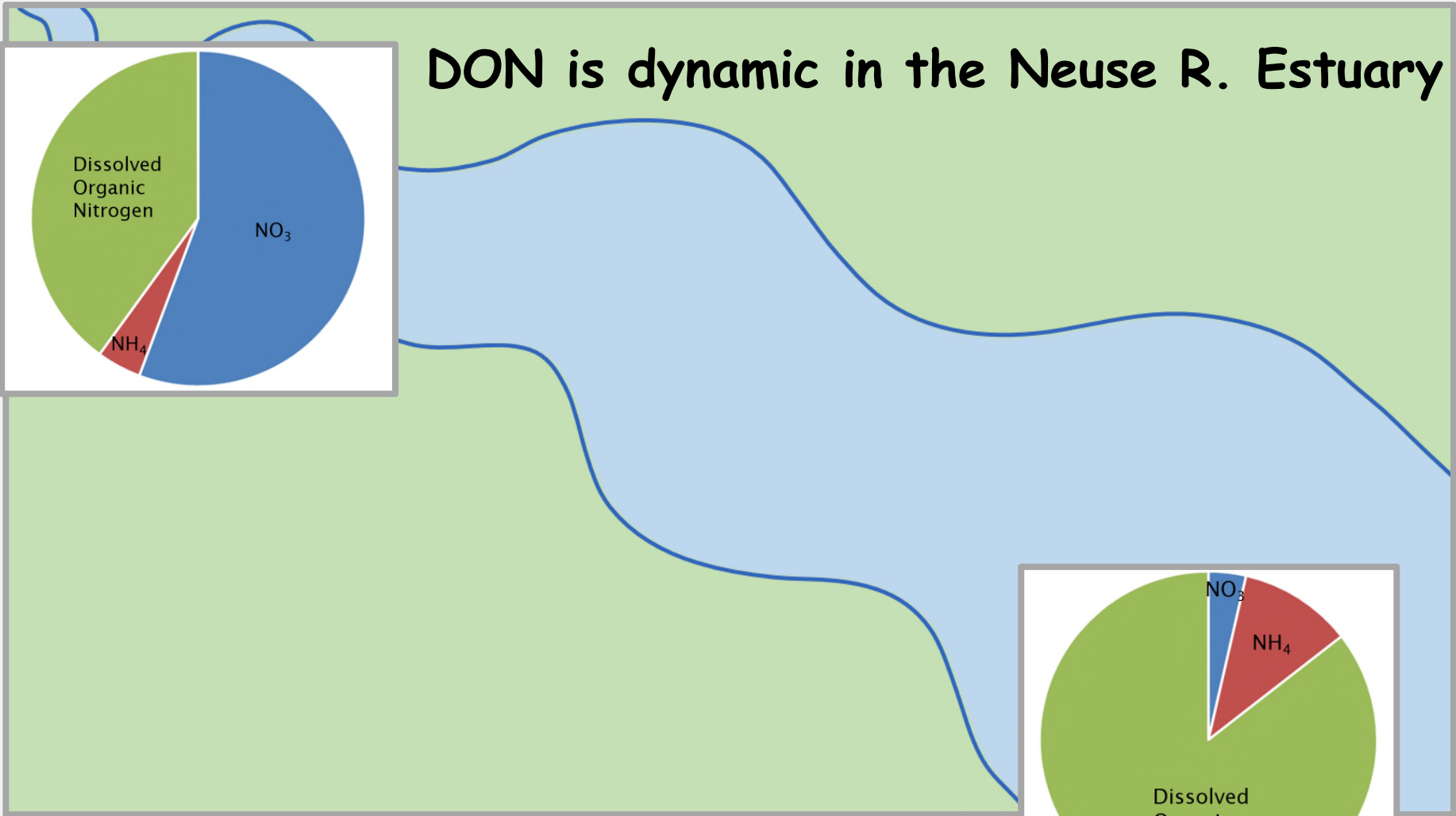


ModMon 1998-2016 data

- Introduction of Total Maximum Daily Load (TMDL)
- Reduction in inorganic nitrogen (N)
- Increase in organic N (ON)
- **Can phytoplankton and bacterial assemblages use ON?**



DON is dynamic in the Neuse R. Estuary



Proportion of DON in the upper vs. lower estuary (as part of TDN)

Pellerin et al., 2006; Lebo et al., 2012; Coble et al., 2014; Qin et al., 2015

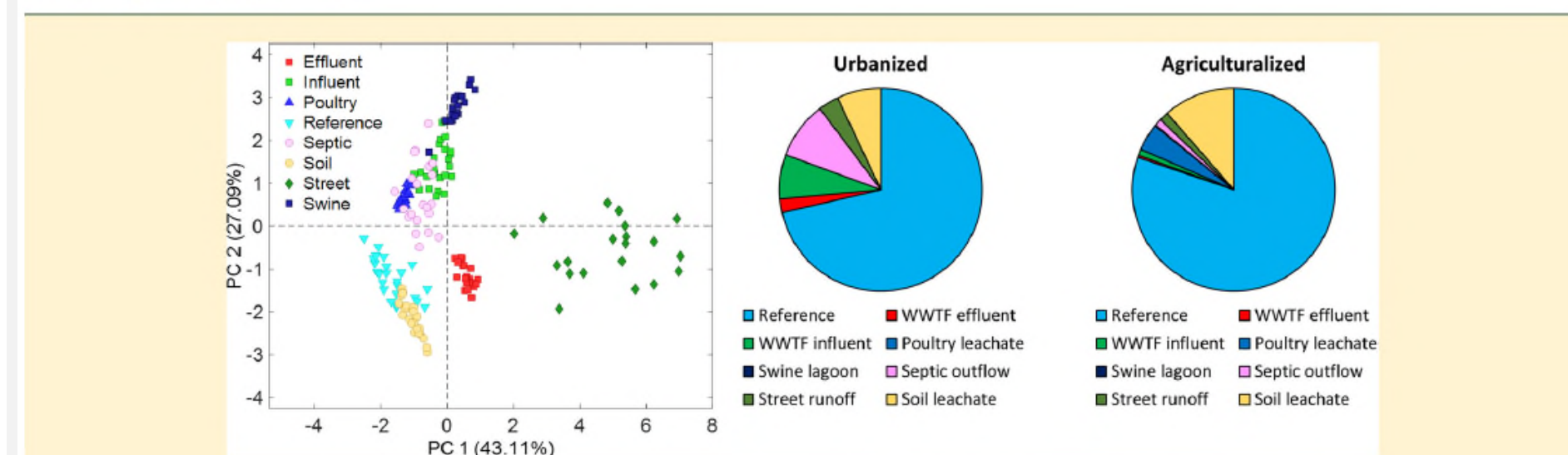
Predicting Sources of Dissolved Organic Nitrogen to an Estuary from an Agro-Urban Coastal Watershed

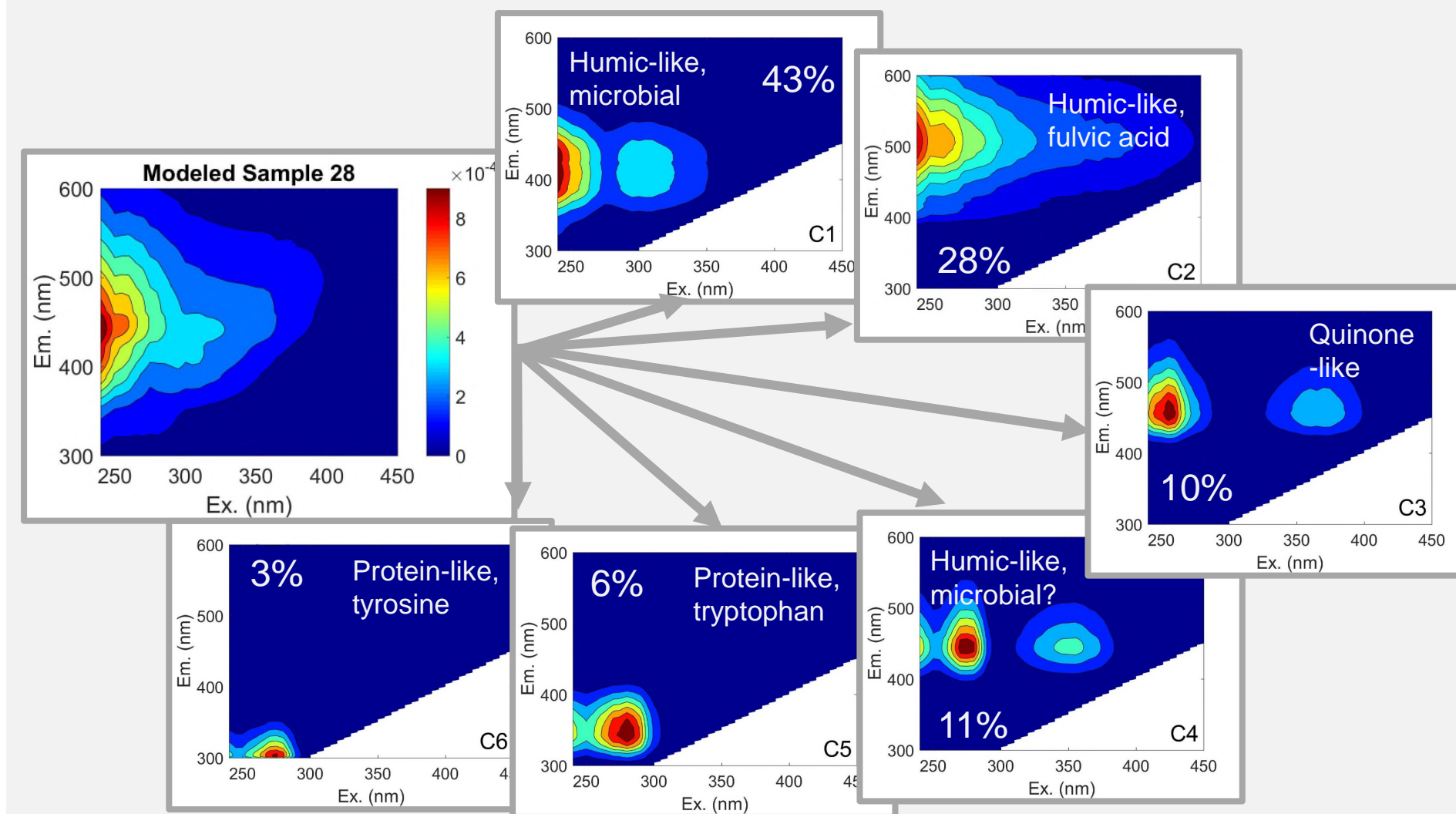
Christopher L. Osburn,^{*,†} Lauren T. Handsel,^{†,§} Benjamin L. Peierls,[‡] and Hans W. Paerl[‡]

[†]Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, Raleigh, North Carolina 27695 United States

[‡]Institute of Marine Sciences, University of North Carolina at Chapel Hill, Morehead City, North Carolina 28557 United States

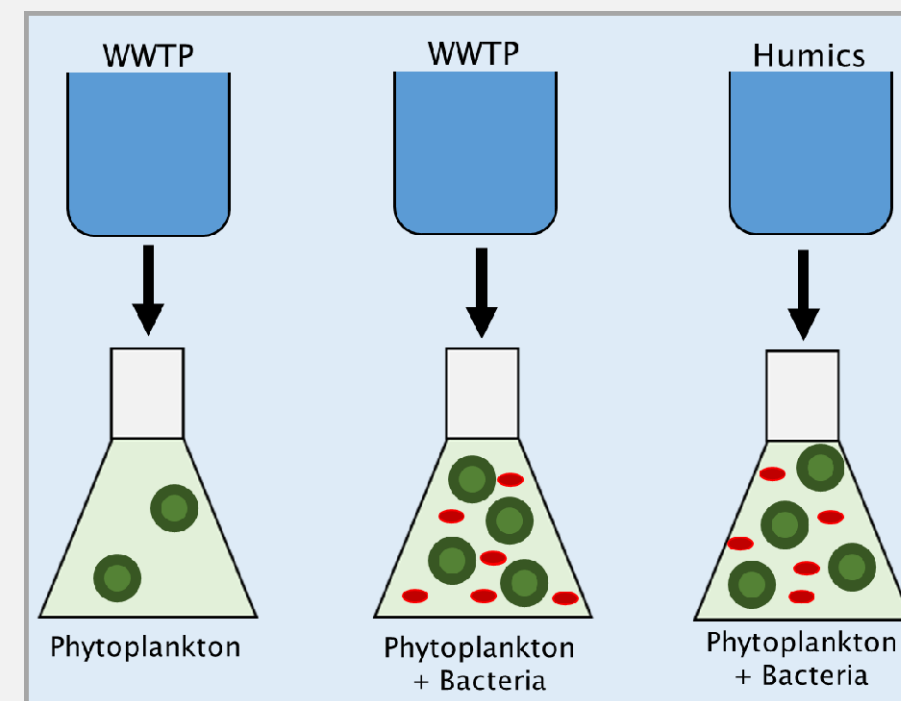
S Supporting Information





Using EEM-PARAFAC to separate different organic matter classes: – We can track these different OM classes through the estuary to see if they are either produced or used by microbes (algae and bacteria) (Osburn et al., ES&T, 50:8473-8484 (2016))

Using ON



- Phytoplankton growth in response to wastewater treatment plant effluent (WWTP) (Qin et al., 2015; Bronk et al., 2010)
 - Greater stimulation with phytoplankton + bacterial communities (Mesfioui et al., 2012; Liu et al., 2011)
- Growth using humic-acids as a nutrient source (Bronk et al., 2007; See et al., 2006)

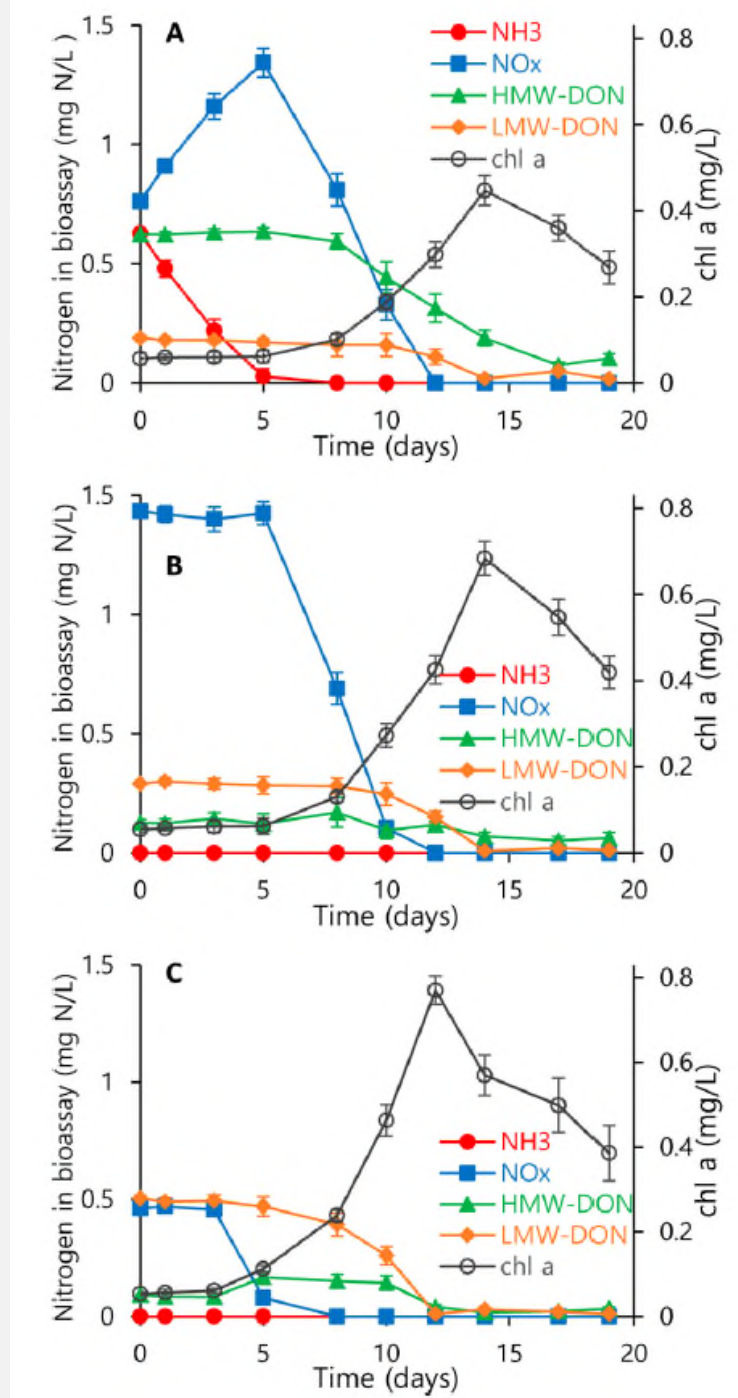
**Formation of Low-Molecular-Weight Dissolved Organic Nitrogen in
Predenitrification Biological Nutrient Removal Systems and Its
Impact on Eutrophication in Coastal Waters**

Heonseop Eom,[†] Douglas Borgatti,[‡] Hans W. Paerl,[§] and Chul Park^{*,†,Ⓞ}

*Conventional activated sludge (CAS) vs. Biological nutrient
removal (BNR) as sources of biologically-available organic N*

Consumption of N and generation of phytoplankton biomass (Chl *a*) in bioassays on effluents from: (A) CAS-1, (B) CAS-2, and (C) Predenitrification BNR. Bioassay water was from Long Island Sound

(Eom et al., ES&T 2017)



**Summing things up:
Dissolved Organic Nitrogen (DON)
as a biologically-available source of N**

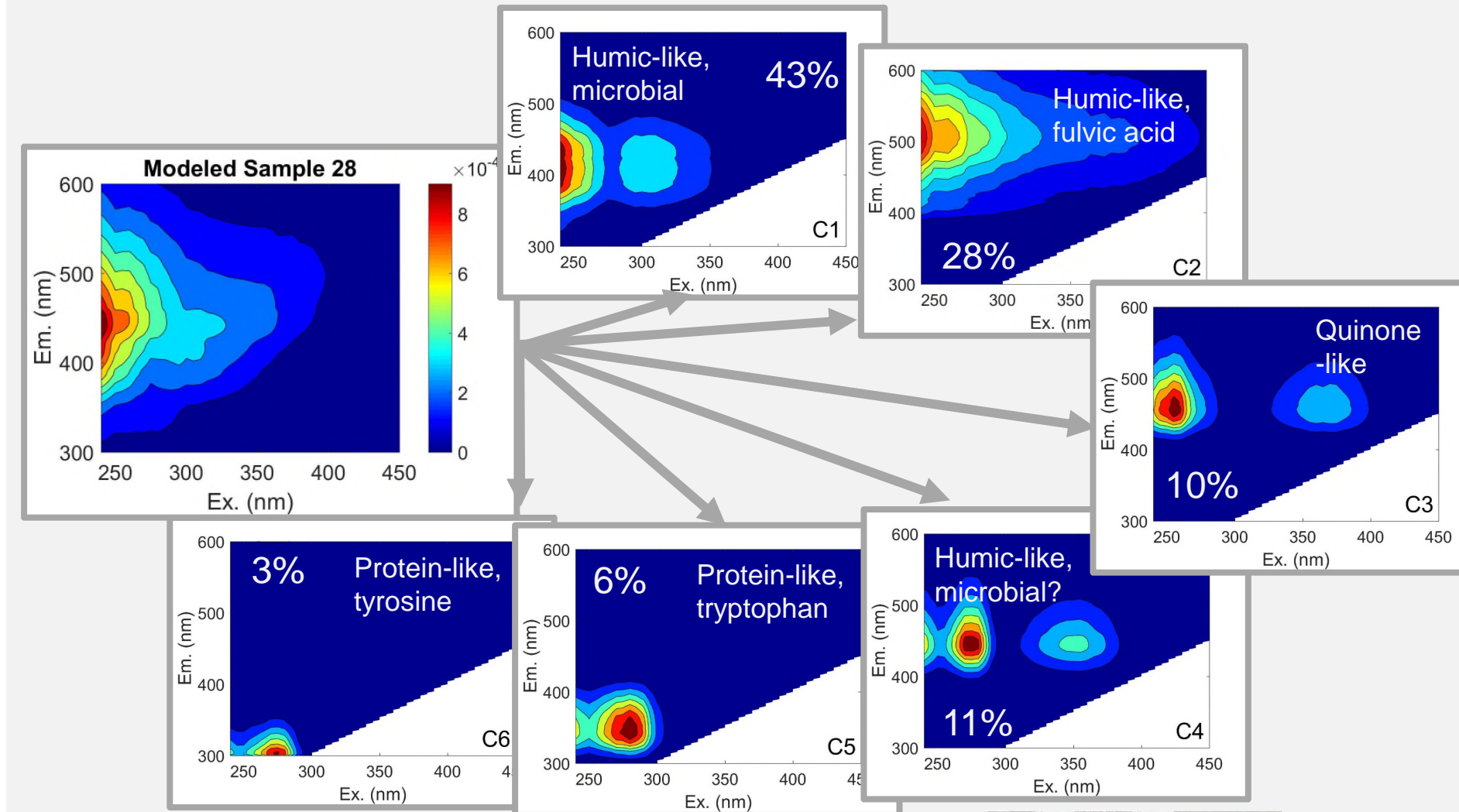
What we know:

1. Increase in DON in aquatic systems (Lebo et al., 2012; Pellerin et al., 2006)
2. There are ample sources of DON in watersheds (Coble et al., 2014; Pellerin et al., 2006)
3. Phytoplankton and bacterial assemblages can use DON as a nutrient source (Qin et al., 2015; Mesfioui et al., 2012; Bronk et al., 2007)

What we need to know:

1. If natural phytoplankton and bacterial assemblages use DON **in-situ**
2. What fraction of DON is available to phytoplankton **in-situ**
3. Seasonal and temporal distribution of broad classes of DON in estuarine systems

Next phase of research



Apply EEM-PARAFAC to track different OM classes during *in situ* bioassays in conjunction with Indicators of algal growth (diagnostic photopigments).

