

SUMMER NUTRIENT LIMITATION OF PHYTOPLANKTON IN THE CAPE FEAR RIVER PLUME

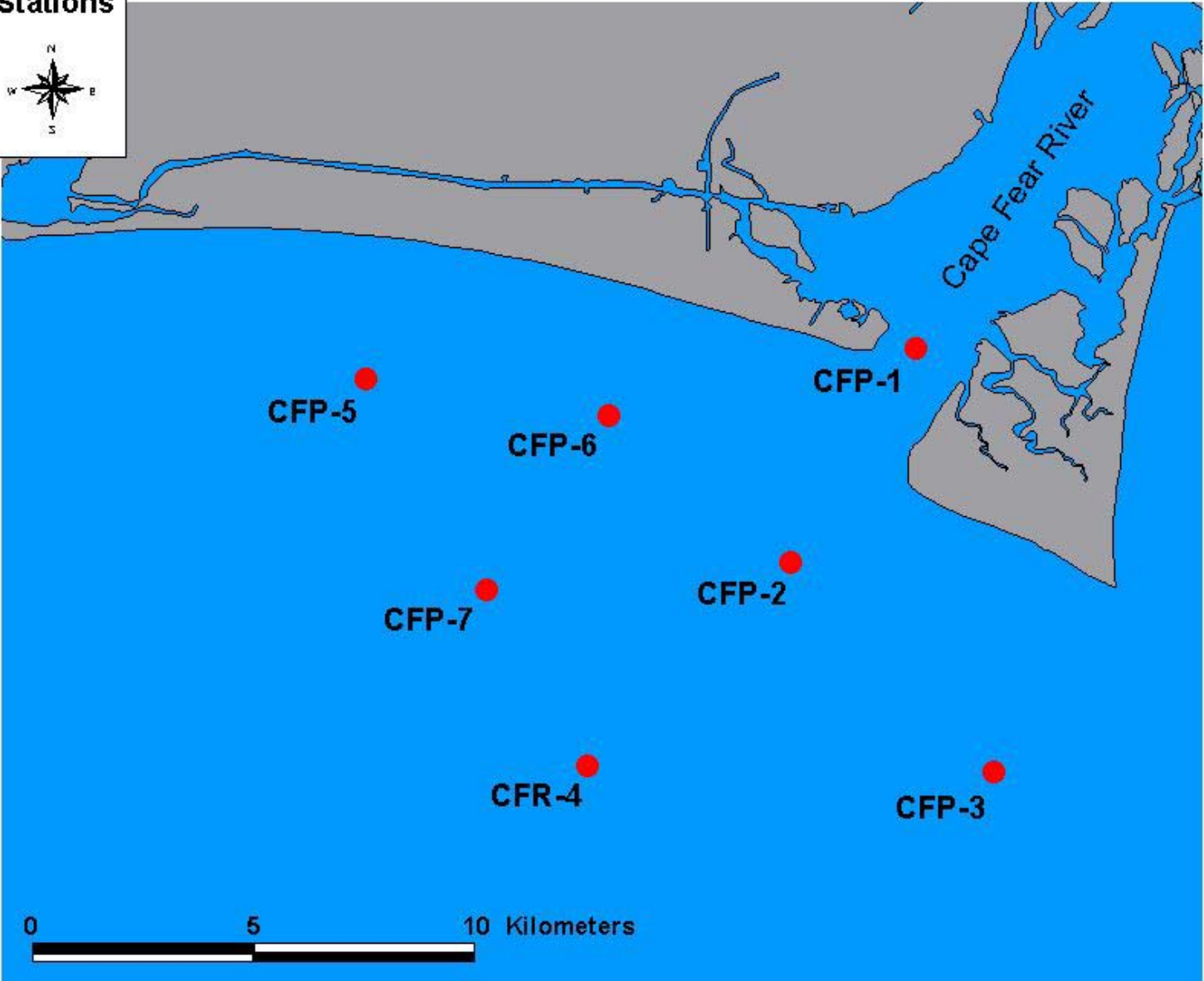

**Michael A. Mallin, Sarah W. Kehoe,
Matthew R. McIver and Douglas C. Parsons
Center for Marine Science
University of North Carolina at Wilmington**

OVERALL PROJECT APPROACH

- **Conduct monthly sampling cruises to seven stations located within the lower estuary and coastal ocean within and outside of the plume**
- **Sample temperature, dissolved oxygen, salinity, turbidity, solar irradiance, chlorophyll, nitrogen, phosphorus, silicate, holoplankton and meroplankton**
- **Perform regression/correlation analyses to determine meteorological and hydrological influence on the plume and its chemistry**
- **Assess seasonal patterns of water quality within the plume influence area**

UNCW-COMP Plume Sampling Stations

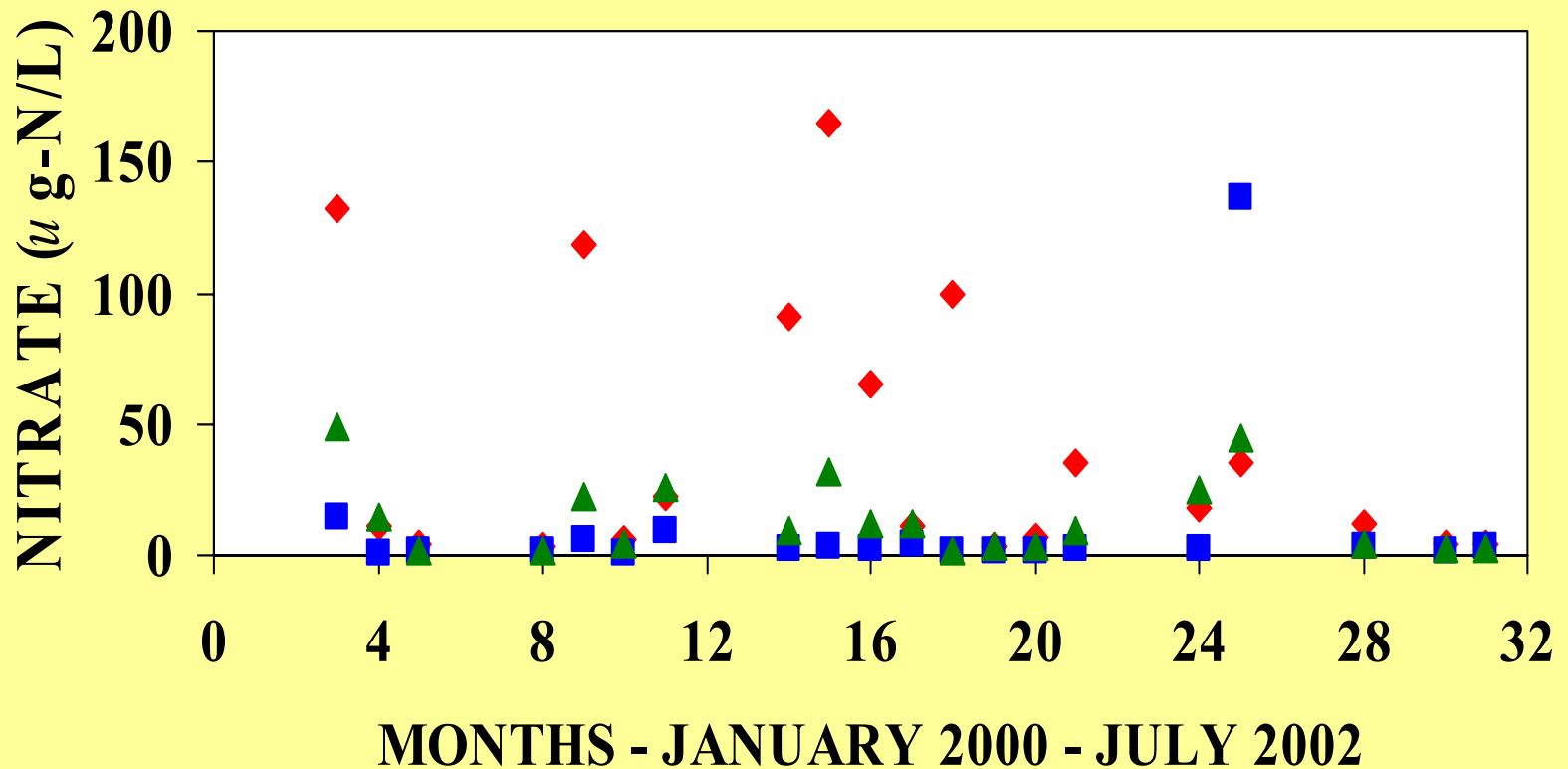
● **Sampling Stations**



NITRATE VARIABILITY ASSOCIATED WITH THE CAPE FEAR RIVER PLUME

(2=NEAR ESTUARY, 3=CONTROL, 6=IN PLUME PATH)

◆ St. 2 ■ St. 3 ▲ St. 6



CORRELATION ANALYSES

ALL STATIONS COMBINED

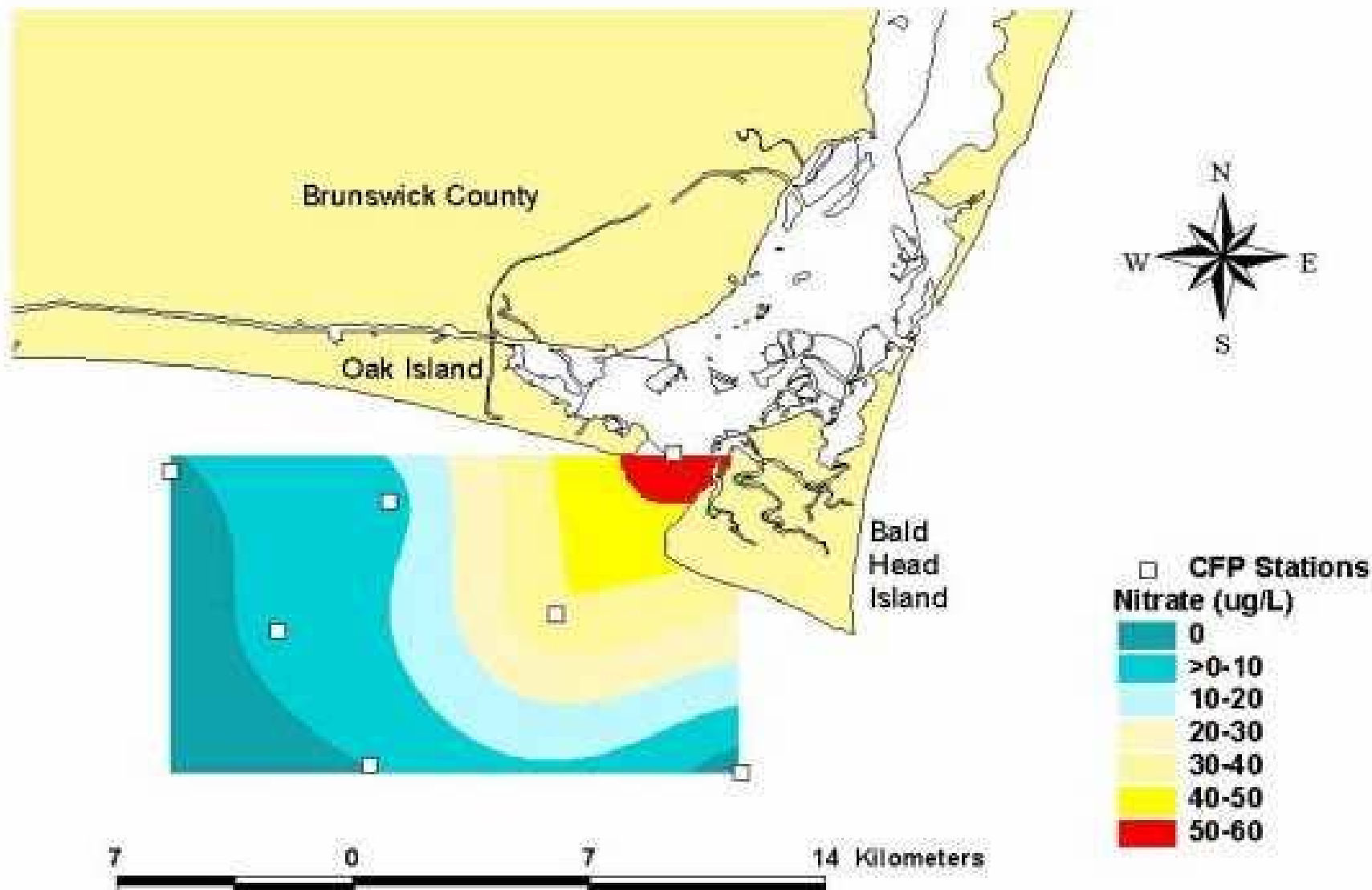
- **Turbidity positively correlated with light attenuation coefficient k_d**
- **Salinity negatively correlated with all nutrients**
- **River flow positively correlated with nitrate and chlorophyll a**
- **Chlorophyll a positively correlated with dissolved oxygen concentrations**

CORRELATION ANALYSIS

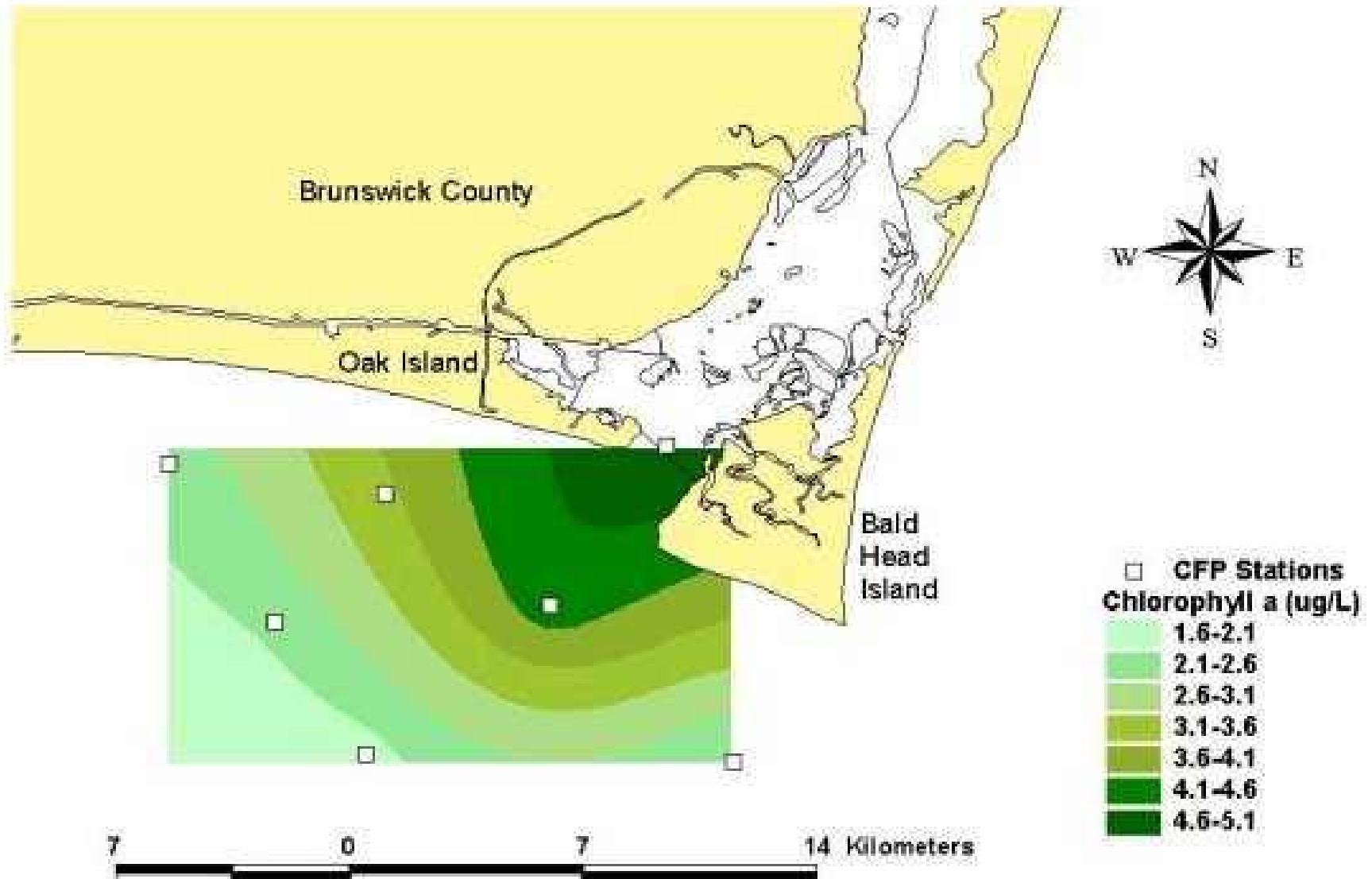
SPATIAL EFFECTS

- OUTER STATIONS - Positive correlation between river flow and nitrate, total nitrogen, and turbidity (but these relationships non-significant for inner stations)
- INNER STATIONS - Negative correlation between salinity and all nutrients (but only for nitrogen at outer stations)

UNCW/NOAA Coastal Monitoring Program



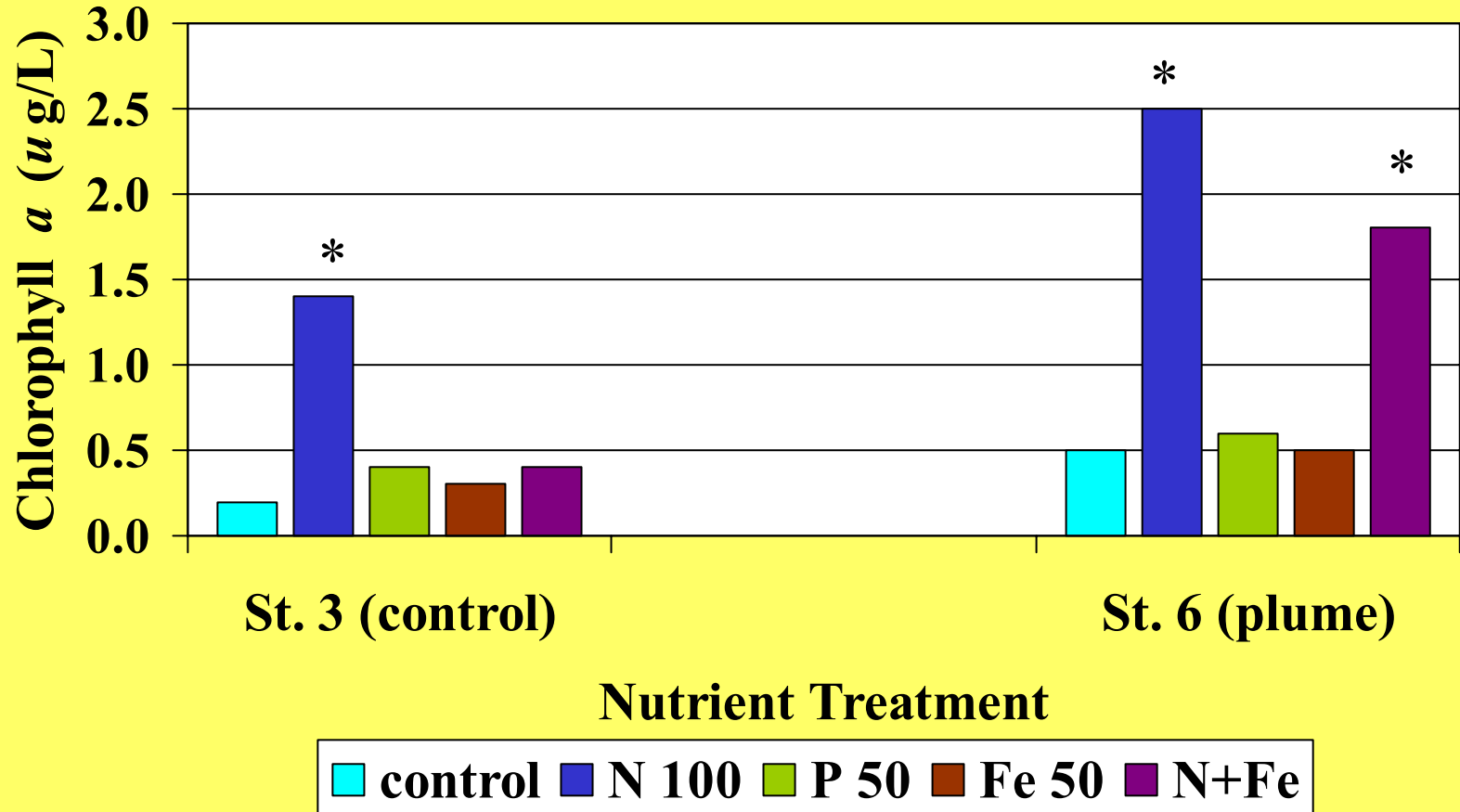
UNCW/NOAA Coastal Monitoring Program



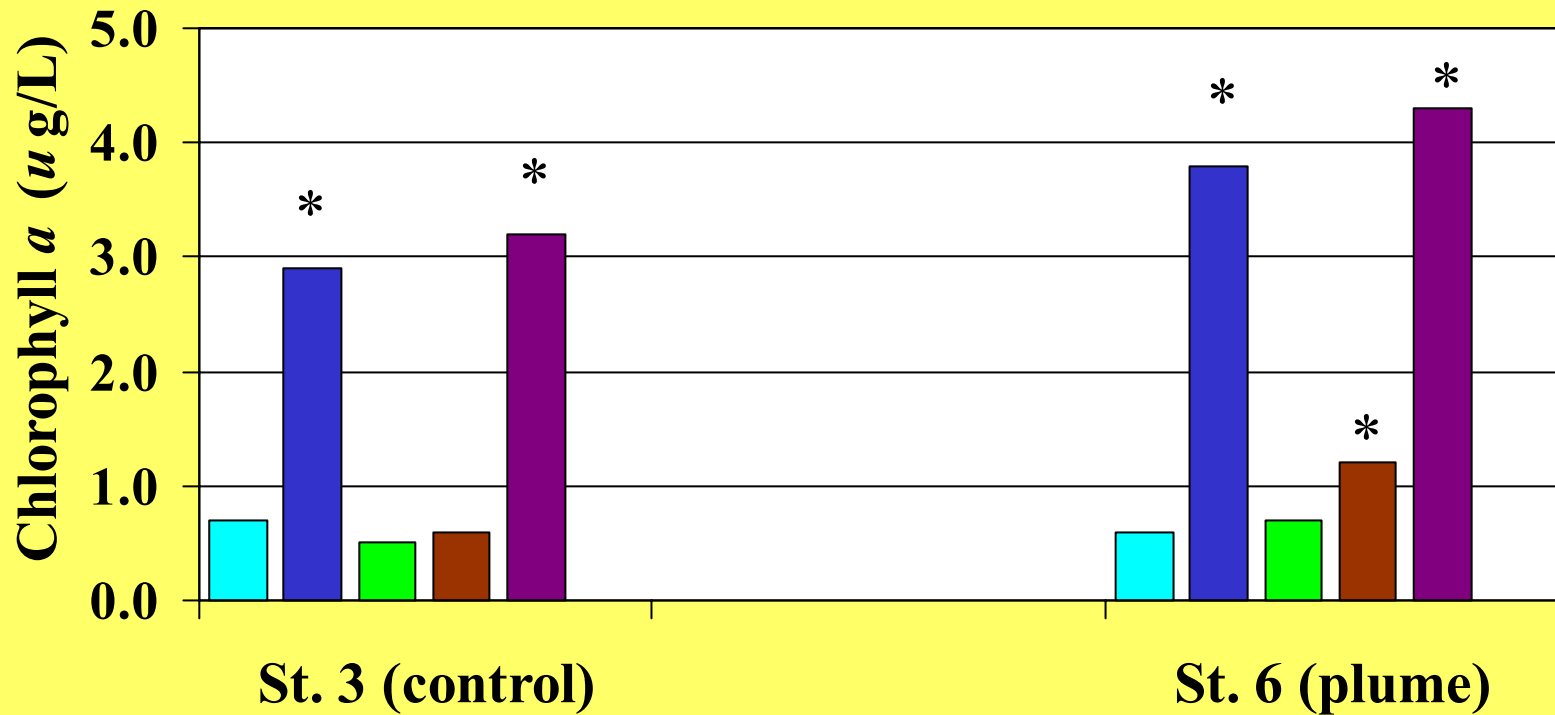
BIOASSAY METHODS

- Seawater was collected in 20-L carboys at plume-influenced (Station 6) and control (Station 3) locations
- Water was placed in triplicate 4-L cubitainers with nutrient treatments added
- Treatments were nitrate-N (100 $\mu\text{g/L}$ or 7 μM), phosphate (50 $\mu\text{g/L}$ or 1.6 μM), iron (50 $\mu\text{g/L}$ or 1 μM) nitrate+iron, and control of no additions
- Incubated for 3 days in outdoor pool under 50% irradiance reduction neutral density screening
- Sampled daily for chlorophyll *a* production
- Experiments conducted three times in summer 2002

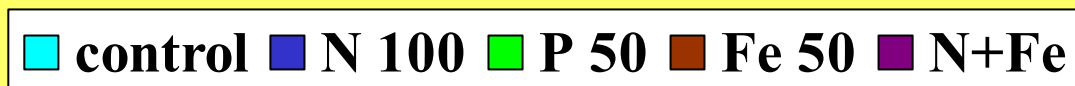
Cape Fear Plume Nutrient Limitation Experiment June 2002



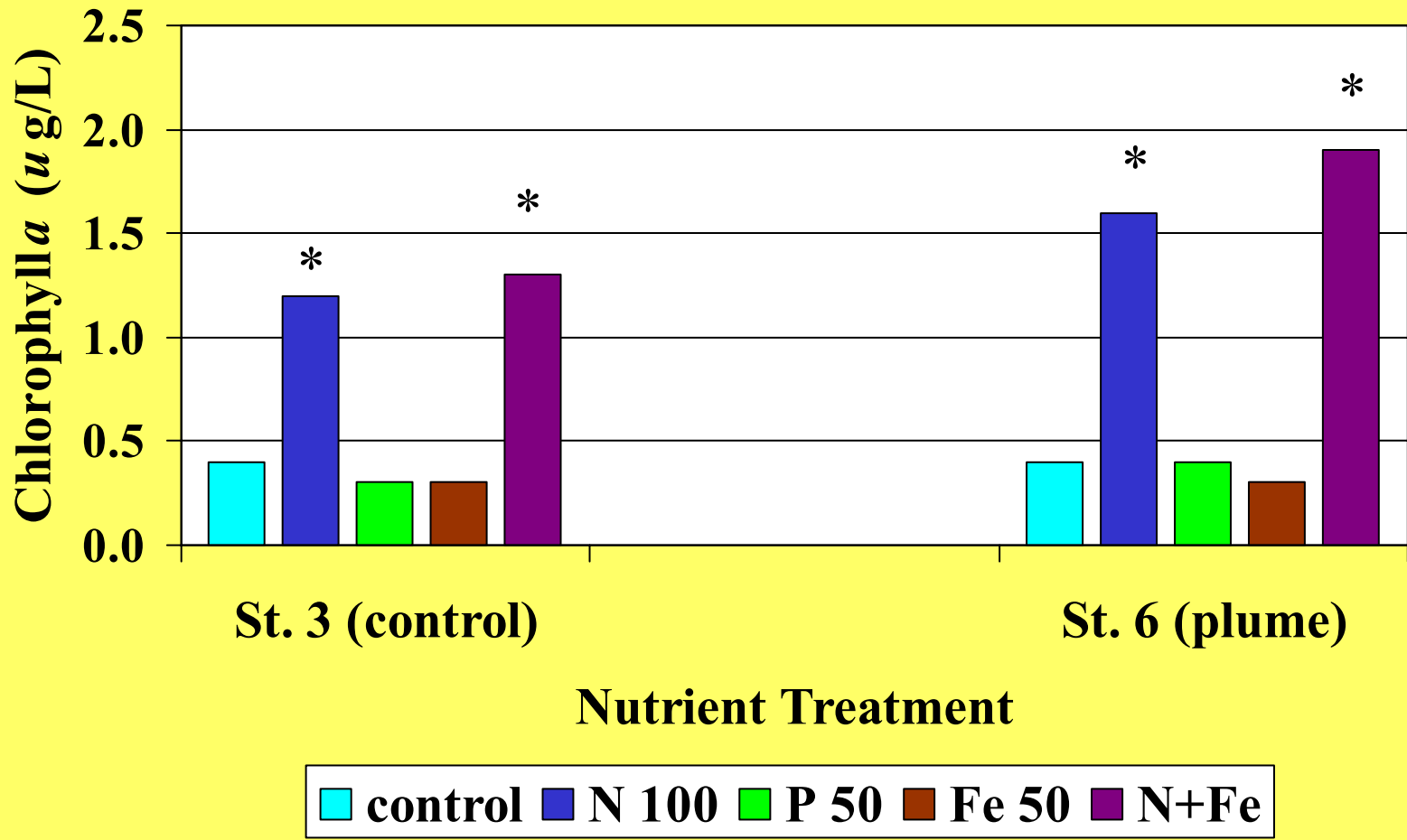
Cape Fear Plume Nutrient Limitations Experiment July 2002



Nutrient Treatment



Cape Fear Plume Nutrient Limitation Experiments August 2002



RESULTS

- **During all three experiments both stations showed nitrate stimulation of chlorophyll *a***
- **Most experiments also showed N+Fe stimulation – at times this was > than N alone**
- **Iron alone showed stimulation on one occasion in the plume, although much less than nitrate stimulation**
- **Chlorophyll *a* yield in the plume water was always greater than chlorophyll *a* yield in control station water**

IMPLICATIONS

- Chlorophyll *a* yield in modest (100 $\mu\text{g/L}$ or 7 μM) nitrate treatments ranged from 3-7X control, demonstrating potential of short-term enrichment of the food chain base following a nitrogen pulse
- Nitrate concentrations at the outer plume edge are significantly correlated with river flow
- Thus, watershed rainfall and river flow may exert significant control over the plume as a plankton-rich area, through nitrate delivery