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TO RECIPIENTS OF THIS REPORT

Executive Summary

This study was undertaken because of the excessive nutrient levels in North Carolina rivers and nuisance algal blooms in many of our coastal rivers. The lack of understanding of the relationships between nutrient dynamics and nuisance algal blooms hampers efforts to protect coastal water quality. This study addresses the transfers (among the air, water, sediments, and microorganisms) and transformations (from one form of the nutrient to another) of nitrogen nutrients as they travel through the Neuse River. Two sampling sites were chosen, but there was not as much difference in nitrogen kinetics between the upriver station and downriver station as had been anticipated. This probably stemmed from the fact that river flows were relatively high during the study, and the downriver area experienced riverine conditions (high dissolved inorganic nitrogen, low algal productivity), rather than the estuarine conditions (low dissolved inorganic nitrogen, high algal productivity) typical of other years.

During this study in 1982, blue-green algal blooms did not occur in the downriver area. Phytoplankton biomass in the river was found to be closely correlated (inversely) with river discharge rate. About 80 percent of the dissolved inorganic nitrogen assimilated by algae and bacteria in the river is ammonia, even though nitrate concentrations are usually 5-10 fold higher than ammonia. This preferential assimilation seems to be the rule in aquatic nitrogen kinetics. Significant nitrate utilization can be expected to occur only if the ammonia becomes depleted.

During this study, ammonia did not become depleted in the Neuse because ammonification rates usually were high enough to provide enough dissolved inorganic nitrogen to supply the assimilation needs. Given the rapid recycling of ammonia and large reservoirs of nitrate in the Neuse, it appears that dissolved inorganic nitrogen inputs will need to be reduced greatly before nitrogen limitation can act to control algal production in the river.

UNC-WRRI-83-204

Nitrogen Cycling and Phytoplankton Growth in the Neuse River, North Carolina

by

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The work upon which this publication is based was supported in part by funds provided by the United States Department of the Interior, Washington, D.C., through the Water Resources Research Institute of The University of North Carolina as authorized by the Water Research and Development Act of 1978. Funds were also provided by the North Carolina Department of Natural Resources and Community Development.

Project No. A-126-NC, Agreement No. 14-34-0001-2135
NRCD Project No. 50092

August 1983

ACKNOWLEDGMENTS

This study was made possible by funds provided through the Water Resources Research Institute of The University of North Carolina and the N.C. Department of Natural Resources and Community Development, Division of Environmental Management. Many people assisted in the laboratory and field work. In the laboratory at East Carolina University, Loede Harper was responsible for execution of the ^{15}N experiments. Deborah Daniel, Ronald Grady, Carolyn Pories, Mitch Landen, Will Sanderson, Roger Barnaby, and Judy Heath performed various analyses. Sandy Tomlinson typed and edited the manuscript. Dr. Hans Paerl at the UNC Institute of Marine Sciences provided facilities for the ^{15}N emission spectrometry analyses.

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SUMMARY AND CONCLUSIONS

1. Blue-green algal blooms did not occur in the Cowpens area during this study in 1982. Algal densities and biomass were comparable to those in other North Carolina estuaries in 1981 and 1982 under non-bloom conditions. Small numbers of blue-green algae were seen occasionally, but generally, diatoms and green algae were dominant. Dinoflagellates appeared in relatively large quantities on several sampling dates.
2. Dissolved inorganic nitrogen (DIN) levels at Cowpens do not appear to be greatly higher than at corresponding locations in other coastal rivers such as the Tar. However, upriver at Clayton the impact of sewage plant discharge in the Piedmont is very evident, especially in terms of elevated NO_3-N levels.
3. About 80 percent of the DIN assimilated by algae and bacteria in the Neuse is NH_4-N, even though NO_3-N concentrations are usually 5-10 fold higher than NH_4-N. This is a phenomenon not peculiar to the Neuse, but rather seems to be the rule in aquatic nitrogen kinetics. Significant NO_3-N utilization can be expected to occur only if the NH_4-N becomes depleted. This phenomenon could complicate the interpretation of nitrogen bioassay experiments unless the NO_3 and NH_4 concentrations and ammonification rates are followed during the course of the experiment.
4. However, in the Neuse in 1982, NH_4-N did not become depleted because ammonification rates (the production of NH_4-N from organic nitrogen by means of decomposition) usually were high enough to provide enough DIN to supply the assimilation needs. In other words, recycling of DIN was more than adequate to met the phytoplankton needs. It could be

argued that in this case, the high NO_3 levels were irrelevant, since the system appeared capable of maintaining itself on regenerated NH_4-N.

5. There was not as much difference in nitrogen kinetics between the upriver (Clayton) station and downriver (Cowpens) station as had been anticipated. This probably stemmed from the fact that river flows were relatively high during the study. Thus, the Cowpens area behaved more like a "river" (high DIN, low algal productivity) than during other years when low flows resulted in more "estuarine" conditions there (low DIN, high algal productivity).
6. Given the rapid recycling of NH_4-N and large reservoirs of NO_3-N in the Neuse, it appears that DIN inputs will need to be reduced greatly before nitrogen limitation can act to control algal production in the river.
7. Readers of this report are advised to consult the results of continuing (1983-1984) research on nitrogen cycling and phytoplankton growth in the Neuse. At the time of this writing (August 1983), it is already clear that the 1982 results are very different from those of 1983, when the river experimented a very intense summer bloom of blue-green algae. For example, preliminary analysis of 1983 data has led to the following conclusions.
   a) There were very strong upriver-downriver gradients in nitrogen kinetics during the bloom period.
   b) River flow seems to play an important role. The blooms are susceptible to wash-out if flows rise above 500-1000 cfs (at Kinston, N.C.). At this time, we don't understand the mechanism. It may be simply a matter of travel time: i.e., at high flows, the

algae are swept downriver into the unfavorable saline environment before cell numbers reach high ("bloom") levels.

c) The blue-green algae biomass peaked in the Kinston - Ft. Barnwell area (up to 1700 μg chlorophyll _a_ · liter^{-1}) and then declined drastically in the vicinity of the Weyerhaeuser mill above New Bern. This is also the zone where salt and freshwater meet, and at this time it is not clear whether nutrient limitation, Weyerhaeuser wastewater, or salinity is primarily responsible for the decline. In any case, the blue-greens did not penetrate this zone after mid-July. However, substantial concentrations (30-50 μg chlorophyll _a_ · liter^{-1}) of other algae did develop below New Bern, perhaps as a consequence of intense nutrient remineralization (NH_4 and PO_4 production) from the decomposing blue-green bloom. This hypothesis is being pursued.

INTRODUCTION

There is general agreement that excessive nutrient levels are one of the major coastal water quality problems in North Carolina (NCDNRCD, 1982; Paerl, 1982; Kuenzler et al., 1982; NCDNRCD, 1983). Growth of population, intensified agriculture, and industrialization have increased the quantities of nitrogen, phosphorus, and other nutrients entering the state's rivers. The result is that nuisance algal blooms now are more frequent and more severe than before, especially near the river mouths where fresh water and saline sound waters meet. In these estuarine areas the uncontrolled algal growth has produced side effects (e.g., odor and taste, low dissolved oxygen, fish kills) which pose a serious threat to the coastal region. Several state and federal agencies have responded to this threat in a variety of ways, including the organization of a large-scale research effort aimed at finding the causes and means of controlling the algae in the Chowan River, where the first nuisance-level blooms were reported nearly a decade ago. So far, this research effort, along with others carried out in the nearby Pamlico and Neuse Rivers, has provided some understanding of the problem and has tended to support the early suspicion that excess nutrients are the primary causal agent. However, most agree that more knowledge is needed before a long-term plan to control the nutrients can be developed. The research results reported here are intended to help fill this knowledge gap. Specifically, it addresses the transfers and transformations of nitrogen nutrients as they travel through the Neuse River.

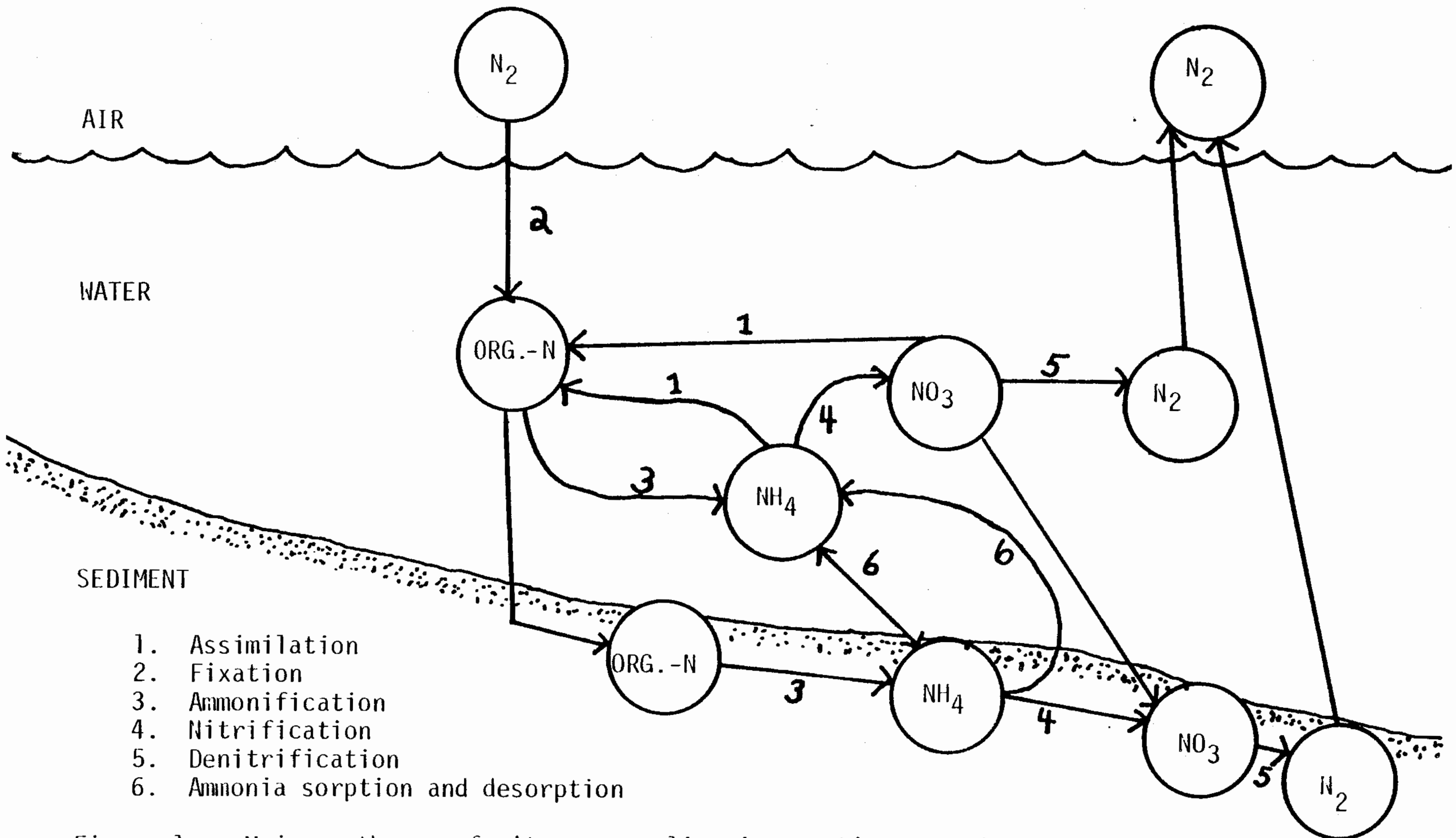
Agencies charged with cleaning up the polluted coastal rivers of North Carolina are struggling to develop criteria and standards to regulate the nutrients discharged into the river systems. At the moment, however, there are no criteria due to our lack of understanding of the relationships between nutrient dynamics and nuisance algal blooms. Among the major problems that need to be solved are: (1) the concentrations of nitrogen and phosphorus necessary to promote a bloom, and (2) the effects of different rates of nutrient loading upstream on downstream concentrations. A number of other related questions must be addressed. For example, would it be wise to emphasize reduction in the loading of one form of the nutrient more than another form (e.g., NH_4-N vs. NO_3-N), and are there advantages in a strategy that adjusts loading to seasons of year? Should the discharge standards be based on quantities released per unit time; or on resulting water concentration of the nutrient in the vicinity of the release; or on resulting water concentration of the nutrient, calculated by dilution, further downstream (for example, near the mouth where most of the algal blooms occur); or on some other criteria such as the concentration of chlorophyll or algal biomass?

The underlying difficulty is a result of the dynamic behavior of nutrients in the river ecosystem. If rivers were simply conduits void of biological activity, we would expect nutrients input from the surrounding watershed to be transported and dumped into the receiving estuary without any changes in form or quantity. This would greatly simplify the task of linking upriver inputs to downriver concentrations. But rivers are not so simple; instead there is continuous biochemical activity which acts to alter both the forms and total quantities of nitrogen and phosphorus present in a traveling water mass. There are both transformations (from one form of the nutrient to another) and transfers (among the air, water, sediments, and microorganisms). The patterns of transfer, or nutrient cycles, are complex, especially for nitrogen (Figure 1).

Further complication results from the fact that the nutrient transformations vary depending on the types of organisms present and the physical-chemical environment. For example, under one set of circumstances, nitrogen fixation may be favored, so that there is accumulation of nitrogen in the system. Conversely, another set of circumstances may favor denitrification, a process that would tend to reduce the nitrogen nutrient level. Therefore, the pattern of transfer cannot be expected to remain constant from one time to another or from one place to another unless the biological and physical-chemical environment remains constant. This condition is seldom met in a river ecosystem.

Instead, rivers tend to exhibit gradients of physical, chemical, and biological features from the headwaters downstream. This concept was first illustrated by the longitudinal zonation (in streams and rivers) of fish species (Odum, 1971) and some obvious physical and chemical features such as current velocity, temperature, and pH. More recently, ecologists have become aware that other less visible, but extremely important, gradients exist. Thus, Vannote, et al. (1980) have proposed a conceptual model, which they call the "River Continuum Concept," to emphasize that all components of the ecosystem structure and functions are subject to downstream gradients. As these researchers suggest, one aspect of function that may vary in pattern is nutrient cycling.

However, studies that would clearly demonstrate such differences have not been made. This is due in large part to the fact that techniques for directly measuring the nitrogen and phosphorus transfer processes were developed only during the past five to ten years. Meanwhile, other well established but less appropriate techniques have been used to get at the



1. Assimilation
2. Fixation
3. Ammonification
4. Nitrification
5. Denitrification
6. Ammonia sorption and desorption

Figure 1 . Major pathways of nitrogen cycling in aquatic ecosystems.

problem indirectly. Most of these have involved making comparisons of nutrient levels at various times and places, a procedure which at best provides only some general clues about the ongoing nutrient transformations. It has very limited application to problems such as that being addressed here because it tells us nothing about reasons for nutrient level changes in time or space. Thus, it gives us limited ability to predict these changes.

On the positive side, nevertheless, several studies, some recently completed and others ongoing, in the North Carolina coastal river basins have moved beyond the nutrient level collection stage. For example, a few projects have quantified the amounts of nitrogen coming into the headwaters from agricultural runoff (Gambrell et al. 1974), investigated how agricultural practices affect this input (Gilliam, et al. 1978; Skaggs, et al. 1980), and determined the best ways to sample the nutrient inflow (Humenik, et al. 1980). At the other end of the system, work in the estuaries has provided some understanding of the exchange of nitrogen and phosphorus between the algae and water (Stanley and Hobbie, 1977; Kuenzler, et al. 1979; Paerl, 1982; Kuenzler et al. 1982; Matson et al. 1983).

The Neuse River (Figure 2) is an important water-supply, and a valuable recreational and ecological resource for North Carolina. The river drains 5,710 km^2 or about 12 percent of the land area of North Carolina, and within its basin live about 710,000 people, approximately 14 percent of the State's population (1970 estimate). While the majority of the land mass within the basin is agricultural and forested (approximately 65 percent), there are 34 major municipal and industrial wastewater dischargers. Most of these point-sources are from municipal wastewater

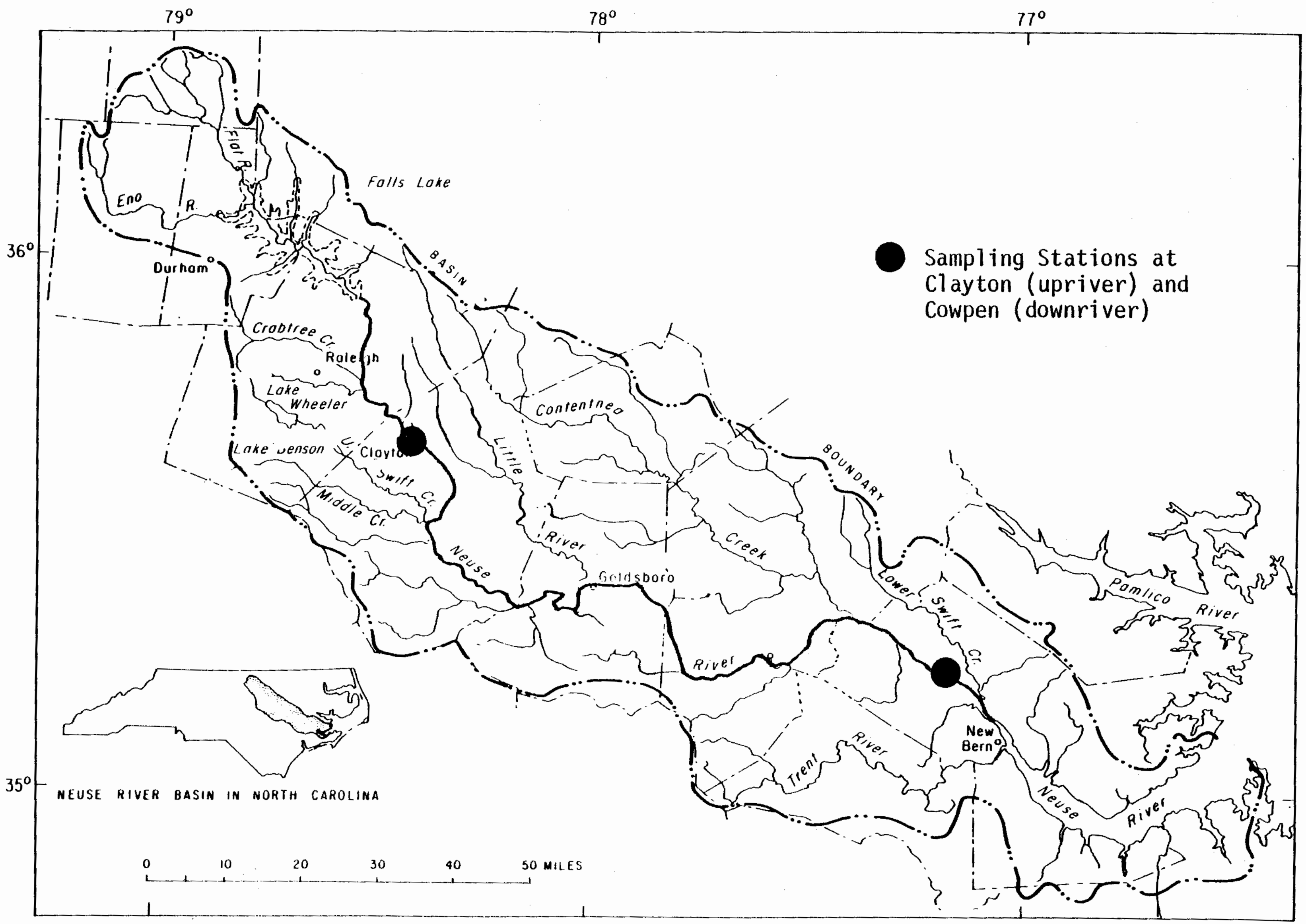


Figure 2. Neuse River Basin in North Carolina.

treatment facilities, but the largest single discharge is from a paper pulp mill near the river's mouth at New Bern, North Carolina (NCDNRCD, 1983). The area in the upper Neuse basin has one of the fastest population growth rates in the state, showing almost a 70 percent increase from 1960 to 1970 (Harned, 1980).

Like the mouths of other major coastal rivers in North Carolina (Roanoke, Chowan, Tar-Pamlico, and Cape Fear), the lower Neuse River is a large and economically important estuary. Their varied uses for industry, recreation, and commercial and sport fishing make these irreplaceable estuaries valuable natural resources that must be both used by man and preserved close to their natural state for future generations. Thus, it has become apparent that in this way estuaries are like national forests that must be carefully managed (Hobbie and Smith, 1975). The goal of estuarine management is to retain their recreational and aesthetic values and their normal productivity, leading to abundant fish and shellfish harvests, without permitting excessive nutrient loadings which would result in eutrophic conditions, nuisance algal blooms, anoxic waters, fish kills, and other problems (Kuenzler, 1980).

Unfortunately, however, the management schemes for estuaries are still being developed, even though the need for their implementation has increased greatly in recent years as a result of rapid changes in the estuaries. Most changes have resulted from increased algal productivity associated with increased nutrient loading. For example, in the Neuse, nuisance algal blooms (dominated by the blue-green alga (Microcystis) have developed each summer in recent years throughout the lower 75 km of the river. During the 1980 summer, the bloom was especially severe. Coincident with these blooms, there have been numerous complaints from area residents about other eutrophication symptoms in the river: accumulation of excessive organic material on fishing nets, a decline in fishing success in waters around New Bern, and decaying organic matter on the river's shores. In addition, oxygen depletion in the estuary seems to be more serious in recent years. In an earlier study, Hobbie and Smith (1975) showed that oxygen depletion developed for short periods in the deeper waters under low-flow, stratified conditions. But during the summer of 1980, the oxygen concentration even near the water surface remained low (3 to 5 ppm); anoxic conditions were present the whole summer in the bottom waters (Stanley, 1981).

Two sampling stations on the Neuse were chosen for use in this study (Figure 2). One is located 5 km east of Clayton, N.C. (35°38'50"N - 78°24'22"W) in Johnston County on the downstream side of the bridge on State highway 42, 3.7 km upstream from Mill Creek (USGS, 1982). This location was chosen to represent the Piedmont reach of the Neuse, an area where water quality is of particular concern because of expanding water-supply needs. The U.S. Geological Survey has collected discharge data at this station on a continuous basis since 1927, and chemical data have been collected there from 1956 to 1958, 1964 to 1967, and since 1973. Periodic measurements of organic substances, nutrients, toxic materials, suspended materials, metals, and biota were also made in recent years (Harned, 1980). The other station is located downriver at Cowpen's Landing, N.C., approximately 15 km upstream from New Bern and 6 km above the Streets Ferry-Weyerhaeuser pulp mill area. In this area, blue-green algal blooms have been intense in some recent years (but not in 1982). Unfortunately, this station is too estuarine to be gauged for flow. However, there is in an area that has been - and continues to be monitored by the N.C. Division of Environmental Management (NCDNRCD).

METHODS

Sampling

The two sampling stations described above were visited once each week or every other week during the study period in 1982. At each location water temperature was recorded and a 6-gallon polyethylene carboy was filled with surface water. These samples were returned to the laboratory at East Carolina University for processing within four hours following the collection. In the laboratory, subsamples were taken from the carboy for nitrogen kinetics experiments (uptake and ammonification), carbon-14 productivity, nutrient chemistry, bacterial density, and algal biomass.

Nitrogen Assimilation and Ammonification

Nitrate and ammonium assimilation, as well as ammonium regeneration by microorganisms in the Neuse samples were measured using the stable isotope ^{15}N as a tracer (Harrison, 1978; Stanley and Hobbie, 1981). First, a known amount of ^{15}N-labeled Na $^{15}NO_3$ or $^{15}NH_4$ Cl was added to 150 ml water samples in screw-capped glass bottles. One ml (14 ug N) of isotope solution was added to 100 ml of sample water for the NO_3-N and NH_4-N uptake measurements. Typically, this addition resulted in a ^{15}N enrichment of about 60%. In the NH_4 experiments, a sample was withdrawn from the bottle immediately after the isotope was added. This subsample, which was one-half the original sample, was filtered and the filtrate was kept for determination of ^{15}N enrichment in the NH_4-N pool. This time-zero enrichment valve was used for both the NH_4-N uptake calculation and the ammonification rate calculation (see below). Next, the NO_3- and NH_4-

enriched samples were incubated in ambient light and temperature conditions for approximately four hours. At the end of the incubation, the contents of the bottles were filtered through Whatman (GF/C) glass-fiber filter pads, which were then dried and stored in a dessicator. The NH_4 filtrate was kept for later determination of ^{15}N enrichment.

NH_4-N in the sample filtrates was concentrated onto glass-fiber filters by means of diffusion (Blackburn 1979). Two ml of strong base (50% NaOH) was added to the sample filtrates in an Erlenmeyer flask. The flask was then quickly closed with a silicone rubber stopper from the bottom of which was suspended a 25 mm diameter Whatman (GF/C) glass-fiber filter. Before insertion of the stopper, two drops of 1N HCl had been spotted onto this filter pad. This flask as then left undistrubed for 48 hours so that NH_3 gas in the sample moved by diffusion to the filter pad suspended above the water and was trapped there as NH_4Cl. Tests using known amount of NH_4 in water samples showed that ammonium recovery by this method exceeded 90% (for this ^{15}N ammonification technique, 100% recovery of the NH_4 is not necessary, but the recovery must be reasonably high and consistent). At the end of the diffusion period, the filter pads were dried and stored in a dessicator for later analysis of the ^{15}N enrichment.

Particulate nitrogen and ammonium salts on filter pads saved from the uptake and ammonification experiments were analyzed for ^{15}N enrichment by emission spectrometry (Fiedler and Proksch, 1975). First, individual filters were placed inside specially-constructed Pyrex glass combustion tubes which had been sealed at one end. Next, small amounts of copper oxide and calcium oxide were added to the tube. The tube was then evacuated to less than 10^{-3} mm of Hg by means of a combination mechanical-diffusion pump equipped with a liquid nitrogen cold trap. The tube was then sealed off with a hand torch, and combusted in a muffle furnace for at least four hours. In this modified Dumass method, organic matter and ammonium salts are oxidized and the generated gases, except for nitrogen, are absorbed by the calcium oxide. Finally, the sealed tubes were placed one at a time into the sample compartment of a Jasco (Model N1A-a) emission spectrometer. When the machine is turned on, a radio frequency field excites the entrapped N_2 molecules, causing them to emit light. There is a small difference in the wavelengths of the light emitted by the excited ^{28}N, ^{29}N, and ^{30}N molecules. A monochromator measures the intensities of wavelengths corresponding to the three nitrogen molecules, and from these recorded peak heights the ^{15}N enrichment in the sample can be calculated in a similar way to mass spectrometry (Fiedler and Proksch, 1975).

The rate of NO_3 or NH_4 assimilation by microorganisms in the sample was calculated as follows:

$$\mu g\ NH_4\text{-}N \text{ or } NO_3\text{-}N.liter^{-1}.h^{-1} = \frac{(PN).(PN\ at.\%\ exc.)}{(t) \cdot (x)}.$$

PN is the total amount of particulate nitrogen on the filter, as determined by a method described below. PN at. % exc. is the atom percent excess ^{15}N in the particulate nitrogen (PN) at the end of the experiment. The length of the incubation in hours is t and x is the atom-% excess ^{15}N of the aqueous ammonium or nitrate fraction in the sample. For ammonium uptake measurements, x is the average enrichment during the course of the experiment, which is calculated as the mean of measurements made at the beginning and end of the incubation. For nitrate uptake, x is the initial enrichment calculated as:

$$\text{at. \% excess } ^{15}N\text{-}NO_3 = \frac{\mu g\ ^{15}\text{added} \times 100}{\mu g^{15}N \text{ added} + \mu g\ ^{14}N \text{ present}}$$

Rates of regeneration of ammonium (ammonification) were calculated by the following equation:

$$\mu g\ NH_4\text{-}N.liter^{-1}.h^{-1} = \frac{\bar{s}}{\bar{x}} . \left(\frac{\Delta at\%}{t} \right),$$

where $\bar{s}$ and $\bar{x}$ are the average ammonium concentration ($^{15}N\text{-}NH_4$ plus $^{14}\text{-}NH_4$) and the average $^{15}N\text{-}NH_4$ enrichment in the water during the course of the experiment, respectively. The length of the incubation in hours is t and Δat % is the change in $^{15}NH_4\text{-}N$ atom percent excess during the incubation. This change is always from higher to lower, because ammonification is the production of $^{14}N\text{-}NH_4$ which dilutes the $^{15}N\text{-}NH_4$ in the sample water, causing the ^{15}N atom percent value to fall. This equation for calculating ammonium production is discussed by Glibert et al. (1982). It assumes that only $^{15}NH_4$ is regenerated during the experiment and that the dilution rate is constant.

Carbon-14 Productivity

Phytoplankton photosynthesis was estimated by the carbon-14 technique of Steeman-Nielsen (1952). Samples of Neuse water were incubated (along with the ^{15}N samples) in 150-ml screw-capped glass bottles until 2 ml of a solution of $NaH^{14}CO_3$. After incubation the algae were filtered onto Metricel membrane filters (0.45 μm). The filters were dried and stored until their radioactivity could be determined with a liquid scintillation counter. Total inorganic carbon (TIC) was measured by means of an infrared analyzer (Oceanography International Model 524C). Photosynthesis rates were calculated as follows:

$$\mu g\ C.l^{-1}.h^{-1} = \frac{^{14}C_{assim} \cdot (1.06) \cdot (TIC)}{^{14}C_{added} \cdot h \cdot 1},$$

where $^{14}C_{assim}$ is the corrected counts per minute (dpm) on the filter, $^{14}C_{added}$ is cpm of isotope added to the bottle, and h is the length of the incubation period in hours. The factor 1.06 corrects for discrimination against the heavier carbon-14 isotope.

Algal Biomass

A membrane filtration method was used to concentrate algae in Neuse water samples for phytoplankton numbers and biomass determination (APHA, 1975). Samples were first taken from the carboys and preserved in Lugol`s solution (1 ml per 100 ml sample). Later, subsamples were filtered through Millipore membrane filters (0.45 μm) under gentle vacuum. The filter was cleared with immersion oil, mounted on glass slides with a cover slip, and counted at 400x under a compound microscope. Cells were identified to species when possible and reported as numbers of individuals per liter. These counts were converted to volume (μm^3) by estimating the volume of an average individual of each species with geometric formulae. Then, the total volume of the algae for a liter of sample was converted to a wet weight of assuming a specific gravity of unity.

Bacteria Density

Direct counts of bacteria in the samples were made using the acridine orange direct count (A.O.D.C.) method (Hobbie et al., 1977). Briefly, the procedure is begun by preserving a water sample with 5% formalin solution (up to 14 days). To prepare a sample for counting, a small amount of the preserved sample is incubated with 1 ml of a filtered 0.01% solution of acridine orange for 60 seconds. The sample is then drawn onto a black Nucleopore (0.22 μm pore size) membrane filter by vacuum filtration.

Finally, the filter is placed on a slide with immersion oil, covered with a cover slip, and viewed with oil immersion and epifluorescent illumination at 1250x. The bacteria in several randomly-chosen fields are counted (cells fluoresce green as red-orange, depending on their health); from a knowledge of the sample volume, microscope magnification, counting area, and dilution factors, the number of bacteria cells per ml can be calculated.

Chemical Measurements

A number of other chemical and physical measurements were made because they were necessary for the rate methods described above or were likely to be correlated with the processes under study. Methods used for these parameters are outlined in Table 1.

Table 1. Summary of techniques to be used for chemical and physical measurements

Parameter	Technique	Reference
Nutrient Analyses:		
Total Phosphorus	Persulfate Digestion	EPA (1979)
PO_4-P	Molybdate	EPA (1979)
NH_4-N	Colorimetric	Solorzano (1969)
NO_3-N	Cadmium Reduction	Strickland and Parsons (1972)
Particulate Nitrogen	Coleman Nitrogen Analyzer	
Total Nitrogen	Kjeldahl	APHA (1975)
Filterable Nitrogen	Kjeldahl	APHA (1975)
Hydrographic Data:		
Salinity, Temperature	YSI meter	
Dissolved Oxygen	YSI meter or Winkler Titration	APHA (1975)
Underwater Light Intensity	Quantum Sensor	

RESULTS AND DISCUSSION

Phytoplankton Density and Biomass

Blue-green algae were not a significant part of the algal density or biomass at either sampling station during the study period in 1982. At Cowpens, cell number ranged widely from 0.2 - 49.6 x $10^6.1^{-1}$. Highest densities occurred during early September and early October. At Clayton, the numbers were much lower, as would be expected. Interestingly, however, the highest densities there (5-7 x $10^6.1^{-1}$) coincided with the Cowpens density maxima. The density maxima at Cowpens also coincided very closely with maxima in photosynthesis rates (14-carbon) measured both in the laboratory (see below) and *in situ* by Paerl (1982). Nitrogen (NH_4 and NO_3) assimilation rates were also highest at these times (see below). Algal biomass (Table 2) ranged from 0.1 - 14.8 $mg.1^{-1}$ at Clatyon. Peak biomass occurred in early October at Cowpen, with a minor peak in early September. Usually, species of diatom (Class Bacillariophyceae) and green algae (Class Chlorophyceae) dominated the biomass at both stations (Table 2 and Appendix 1). These two groups often comprised more than 75 percent of the total algal biomass. In some samples, large numbers of dinoflagellates (Class Dinophyceae) were present. When present, they tended to dominate the biomass. In fact, the sample with the highest biomass (14.8 $mg.1^{-1}$) was from Cowpens on 13 October and contained 78% (by weight) dinoflagellates. These organisms were not very numerous but were relatively large so that they dominated in terms of biomass but not in terms of density.

Overall, the 1982 algal biomass (and chlorophyll a concentrations) at

Table 2. Phytoplankton biomass (mg wet wgt./liter) at Cowpens and Clayton sampling stations.

Date	COWPEN Biomass (mg.l^{-1})	COWPEN Millions of Cells.l^{-1}	COWPEN Dominant Classes (% of Total Biomass) BAC	CHL	CRY	CYA	DIN	CLAYTON Biomass (mg.l^{-1})	CLAYTON Millions of Cells.l^{-1}	CLAYTON Dominant Classes % of Total Biomass) BAC	CHL	CRY	CYA	DIN
24 JUN	0.1	3.2	18	35										
15 JUL								0.3	0.9	13	44			
21 JUL	3.3	1.2					91							
27 JUL	0.7	1.3	51	12										
4 AUG								0.1	0.6	40	10			
9 AUG	0.2	0.4	38	55				0.1	<.1		27	55		
19 AUG	0.1	0.4	44	44										
20 AUG	0.4	3.1	42	17										
25 AUG	0.2	0.8		90				0.6	0.4	52	46			
1 SEP	0.5	2.5	16	75				0.7	3.8	33	47			
3 SEP	1.6	49.6		42				1.9			30			45
8 SEP	3.4	25.3		52				<0.1	5.6					
17 SEP	1.8	5.4	14	78				0.8	2.8	30	51			
24 SEP	0.6	2.2		58				0.7	1.7	46	26			
5 OCT	5.4	19.4	42	13				1.6	7.5		34			
13 OCT	14.8	18.3					78	0.4	1.1	62	23			
20 OCT	1.1	1.8	90	7				0.5	4.6	18	61			
4 NOV	0.1	0.6	25		40			0.1	0.1	44		44		
11 NOV	0.4	0.7	77					0.1	0.5		13			
18 NOV	0.1	10.3	50	35				0.1	0.8	25	69			
23 NOV	0.2	0.4	38	35				0.1	0.9	30	30			
3 DEC	1.8	0.8					75							
13 DEC	1.7	0.2					82							

Cowpens were not outstanding in comparison to other nearby estuaries. Chlorophyll _a_ fell in the range <1-24 $\mu g.1^{-1}$ except on 13 October when the value was 60 $\mu g.1^{-1}$. At Clayton, the highest value was 18 $\mu g.1^{-1}$ - most were <10 $\mu g.1^{-1}$. In the Chowan, chlorophylla _a_ ranged from 5-30 $\mu g.1^{-1}$ in 1981, a "non-bloom" year, and in the Pamlico River Estuary, chlorophylls were mostly 2-20 $\mu g.liter^{-1}$ in 1982 (Stanley, 1983). Algal biomass in the Pamlico in 1982 was usually 2-20 $mg.1^{-1}$, except during several short-lived blooms when the biomass rose to several hundred $mg.1^{-1}$ (Stanley, 1983).

Bacteria Density

Acridine orange direct counts (AODC) of bacteria averaged around 3.5 x 10^6 $cells.ml^{-1}$ at Clayton and Cowpens. The highest counts, 5-7 x $10^6.ml^{-1}$, occurred at Cowpens in June and July, and the lowest values, 1-2 x 10^6 $cells.ml^{-1}$, were in October and November at both stations (Table 3). However, there was no clear temporal or spatial pattern in this variability.

In another study concurrent with this one, Stanley and Christian (1983) found that in the lower Neuse River and Neuse Estuary in 1982 bacteria densities (AODC) were strongly positively correlated with salinity. Densities there ranged from 2 to 17 x 10^6 $cells.ml^{-1}$ over a salinity range from 0 up to around 10 ppt. This trend fits the pattern seen by Palumbo and Ferguson (1978) and Ferguson and Rublee (1976) in the nearby Newport River Estuary near Morehead, N.C. There bacteria numbers were low in the fresh water portion of the system (2.25 x 10^6 $cells.ml^{-1}$), but rose downstream to a peak of 4.33 x 10^6 $cells.ml^{-1}$ in the 3-10% salinity region. Further seaward, the densities decreased steadily so that in the Atlantic Ocean offshore from the estuary mouth these were only 0.66 x 10^6 $cells.ml^{-1}$. Palumbo and Ferguson (1978) hypothesized that the reason for the decrease is that in water above 5 ppt net changes in the bacteria due to biological factors such as growth and predation are not significant. Instead, the numbers are controlled by dilution as estuarine water mixes with seawater.

Table 3. Bacteria density (millions of cells.ml^{-1}) at Clayton and Cowpens sampling stations.

Date	Clayton	Cowpens
1 JUN	-	7.6
24 JUN	-	5.1
21 JUL	-	5.2
27 JUL	-	5.9
19 AUG	-	2.4
25 AUG	5.2	5.5
1 SEP	1.8	0.6
3 SEP	-	3.8
8 SEP	4.2	5.0
17 SEP	1.8	-
24 SEP	3.8	1.9
5 OCT	3.2	1.5
13 OCT	4.2	5.0
20 OCT	1.5	2.0
4 NOV	2.1	1.9

Nitrogen Kinetics

At Cowpens NO_3-N averaged 49.3 μM (summer) and 52.4 μM (winter) while NH_4-N mean concentrations were 7.8 and 5.5 μM (Tables 4 and 6). Clayton nitrate levels were much higher than at Cowpens - 97.5 μM in summer and 76.7 μM in winter (Tables 5 and 6). NH_4-N was also higher there then at Cowpens in summer (21.8 μM), but not in the winter (4.6 μM). NO_3-N levels at Cowpens do not appear to be drastically different from those in corresponding locations in other coastal rivers. For example, in 1982 NO_3-N near Washington, N.C., on the Tar River averaged around 40 μM (Stanley, 1983). Further downriver in both the Tar-Pamlico and in the Neuse, NO_3-N tends to decrease rapidly, so that near the mouths of the estuaries` concentrations are often less than 1 μM (Stanley, 1983; Hobbie and Smith, 1975). The decrease is especially noticeable in the summer when river flows are lowest and assimilation rates are relatively high. The pattern is typical for estuaries and results from both dilution of NO_3-N rich river water by seawater and from NO_3-N assimilation and/or denitrification rates in excess of NO_3-N production (nitrification) from NH_4-N. The Clayton NO_3-N levels, nearly double those at Cowpens, undoubtedly are influenced by discharge from the Raleigh and Durham wastewater treatment plants upstream (1383 and 562 kg total N d^{-1}, respectively), the two largest point sources of N in the upper Neuse basin. Summer NH_4-N concentrations at Clayton are also high, compared to winter levels there and downstream at Cowpens. Perhaps the wastewater plants discharge more NH_4-N in summer than winter. The summer concentrations at Clayton vary greatly (Table 5), suggesting that slugs of high NH_4-N water may be released periodically. NH_4-N concentrations at

Table 4. Nitrogen concentrations, assimilation rates, and ammonification rates at Cowpens sampling station.

Date	NO_3-N $\mu g.l^{-1}$	NH_4-N μM	PN $\mu g.l^{-1}$	DKN μM	TP μM	TDP μM	PO_4-P μM	CHLa $\mu g.l^{-1}$	NH_4 Uptake $\mu g\ N.l^{-}.h^{-1}$	Ammon $\mu g\ N.l^{-1}.h^{-1}$	NO_3 Uptake $\mu g\ N.l^{-1}.h^{-1}$
15 APR	60.0	21.4	300	65.7	5.2	5.2	1.9	-	4.83	8.39	0.88
1 JUN	45.7	4.7	161	60.8	8.06	10.2	7.3	<1.0	6.71	17.4	2.13
24 JUN	24.6	3.6		62.1	7.7	3.9	4.7	<1.0	-	-	-
7 JUL	65.7	6.4	-	50.0	7.7	5.16	4.19	7.2	-	-	-
21 JUL	100.0	5.7	128	25.7	5.8	5.2	3.6	2.7	1.77	5.00	1.13
27 JUL	66.4	8.6	-	77.8	11.0	8.4	6.8	4.0	-	-	-
29 JUL	42.9	6.4	99	48.6	9.8	7.4	5.5	4.0	4.17	7.72	0.51
4 AUG	44.3	12.1	177	25.7	7.1	-	4.8	5.0	4.05	32.60	0.08
9 AUG	30.0	7.1	158	42.9	9.7	-	7.7	2.0	4.94	2.41	0.14
19 AUG	27.9	3.6	137	53.6	13.9	9.7	5.2	<1.0	2.24	12.05	0.09
20 AUG	20.7	6.1	-	-	17.1	7.7	4.8	1.0	-	-	-
25 AUG	40.0	5.7	120	78.6	5.2	4.8	3.2	1.6	1.08	13.0	0.28
1 SEP	64.3	2.1	256	52.1	6.2	6.1	3.2	7.2	6.55	7.23	0.83
3 SEP	57.1	3.6	-	-	34.8	6.1	5.2	4.0	-	-	-
8 SEP	50.0	6.0	590	30.0	6.1	-	5.2	24.0	8.56	4.80	2.84
17 SEP	40.0	7.9	360	65.0	5.2	4.0	3.6	17.0	11.34	7.43	1.63
24 SEP	68.6	13.6	142	65.7	-	8.0	5.0	4.0	2.38	3.54	1.46
5 OCT	71.4	3.6	462	47.9	-	9.4	3.6	-	10.26	17.88	3.95
13 OCT	25.7	7.1	549	51.4	19.4	17.4	13.6	60.1	5.75	6.85	1.33
20 OCT	78.6	5.7	139	58.6	10.0	7.1	7.1	3.0	4.04	1.70	1.08
4 NOV	42.9	5.7	140	24.3	6.1	12.6	9.7	3.0	2.16	8.14	0.38
11 NOV	45.0	3.6	175	26.4	2.6	5.2	3.2	<0.1	1.56	4.36	0.21
18 NOV	57.1	7.1	130	27.1	30.3	21.9	21.6	<0.1	0.54	2.47	0.10
23 NOV	51.4	5.7	144	30.7	8.7	5.2	3.6	2.0	1.98	6.58	0.22
3 DEC	54.3	5.7	150	30.0	14.2	7.7	6.1	<0.1	1.54	2.98	0.47
13 DEC	45.0	5.0	165	32.1	5.2	2.9	2.9	<0.1	1.18	3.93	0.24

Table 5. Nitrogen concentrations, assimilation rates, and ammonification rates at Clayton sampling station.

Date	NO_3-N µM	NH_4-N µM	PN µg.l^{-1}	DKN µM	TP µM	TDP µM	PO_4-P µM	CHLa µg.l^{-1}	NH_4 Uptake µg N.l^{-1}.h^{-1}	Ammon µg N.$l^{-1}h^{-1}$	NO_3 Uptake µg N.$l^{-1}h^{-1}$
15 JUL	45.7	8.6	-	28.6	8.4	5.2	3.6	-	-	-	-
29 JUL	88.6	6.4	271	48.6	28.4	22.2	2.7	14.0	9.78	5.55	3.35
4 AUG	67.8	58.6	160	47.1	16.1	-	11.6	2.0	13.64	12.2	0.29
9 AUG	100.0	67.8	154	42.8	23.5	-	3.5	-	18.62	4.41	1.20
19 AUG	55.7	4.3	148	56.4	21.6	9.7	8.7	4.0	3.22	6.41	0.15
25 AUG	92.8	7.1	144	60.7	19.7	14.5	9.0	4.8	2.79	10.71	0.10
1 SEP	145.0	6.4	445	57.9	27.4	24.2	18.1	18.0	9.28	2.30	6.28
8 SEP	102.9	20.0	350	24.3	28.4	-	41.3	14.0	18.59	11.01	1.42
17 SEP	96.4	33.6	289	62.9	31.3	34.5	33.2	7.0	16.89	32.96	2.41
24 SEP	180.0	5.0	217	63.6	-	28.7	26.8	14.0	2.34	2.96	2.90
5 OCT	92.9	5.7	455	40.0	-	30.3	22.6	-	13.19	14.85	2.24
13 OCT	71.4	5.0	99	47.1	32.3	32.3	31.6	3.0	0.90	<1.00	0.52
20 OCT	107.1	5.0	183	34.3	32.3	30.3	30.6	9.0	4.48	3.13	1.44
4 NOV	60.0	3.6	77	19.3	22.6	23.2	21.3	3.0	0.66	2.92	0.24
11 NOV	71.4	4.3	76	20.7	23.2	26.5	21.6	<0.1	0.94	4.07	0.09
18 NOV	60.0	3.6	67	26.4	18.7	16.1	16.1	<0.1	0.31	1.06	0.09
23 NOV	74.3	5.0	167	29.3	12.3	11.6	11.0	3.0	1.76	2.37	0.71

Table 6. Summary of nitrogen kinetics data under "summer" (June-September) and "winter" (October-December) conditions at Cowpens and Clayton sampling stations.

Station	DIN Concentrations (μM)		DIN Assimilation (μM)			Ammonification ($\mu M.h^{-1}$)
	NO_3-N	NH_4-N	NO_3-N	NH_4-N	Sum	
Cowpens						
JUN-SEP	49.3	7.8	.07	.35	.42	.74
OCT-DEC	52.4	5.5	.06	.23	.29	.44
Clayton						
JUN-SEP	97.5	21.8	.14	.75	.89	.70
OCT-DEC	76.7	4.6	.06	.24	.29	.30

Cowpens were about the same as in the lower end of the Tar River during 1982 (ICMR, 1983).

The 1982 Cowpens and Clayton DIN concentration data can be viewed in broader perspective by examination of Figure 3. Here 4 years worth of NH_4-N and NO_3-N data for a number of stations on the river are summarized (as annual mean concentrations). Nitrate concentrations are obviously increased by inputs in the Raleigh-Durham area. Upstream of these inputs NO_3-N averages around 0.3-0.4 mg N.liter^{-1} (25 μM). Below Raleigh the averages increase to 0.8-1.5 mg N.liter^{-1} (55-107 μM). NO_3-N seems to peak near the Clayton sampling station, suggesting that (a) the Raleigh wastewater treatment plant several km upstream discharges large quantities of NO_3-N, and/or (b) oxidation of discharged NH_4-N to NO_3-N (nitrification) occurs at a rapid rate in this vicinity. The NO_3-N and NH_4-N peaks in Figure 3 are slightly out of sync, with the NH_4-N peak upstream of the NO_3-N peak, which is evidence for nitrification in the river.

Below Smithfield, the NO_3-N levels drop quickly to around 0.8 mg. N.liter^{-1} (57 μM) and change little between Goldsboro and the Cowpens vicinity. Below Cowpens, another steep decline begins and continues through the New Bern area so that at the mouth of the Neuse Estuary near Pamlico Sound the NO_3-N average concentration is down to less than 0.1 mg N.liter^{-1} (7 μM). As noted above, this decline is caused both by seawater dilution and by biological assimilation. In fact, the concave shape of the NO_3-N curves below New Bern (Figure 3) is typical for the expected concentration-salinity distribution of a substance for which the estuary is a sink (i.e., losses exceed gains along the estuary). This nonconservative behavior can be contrasted to the so-called conservative

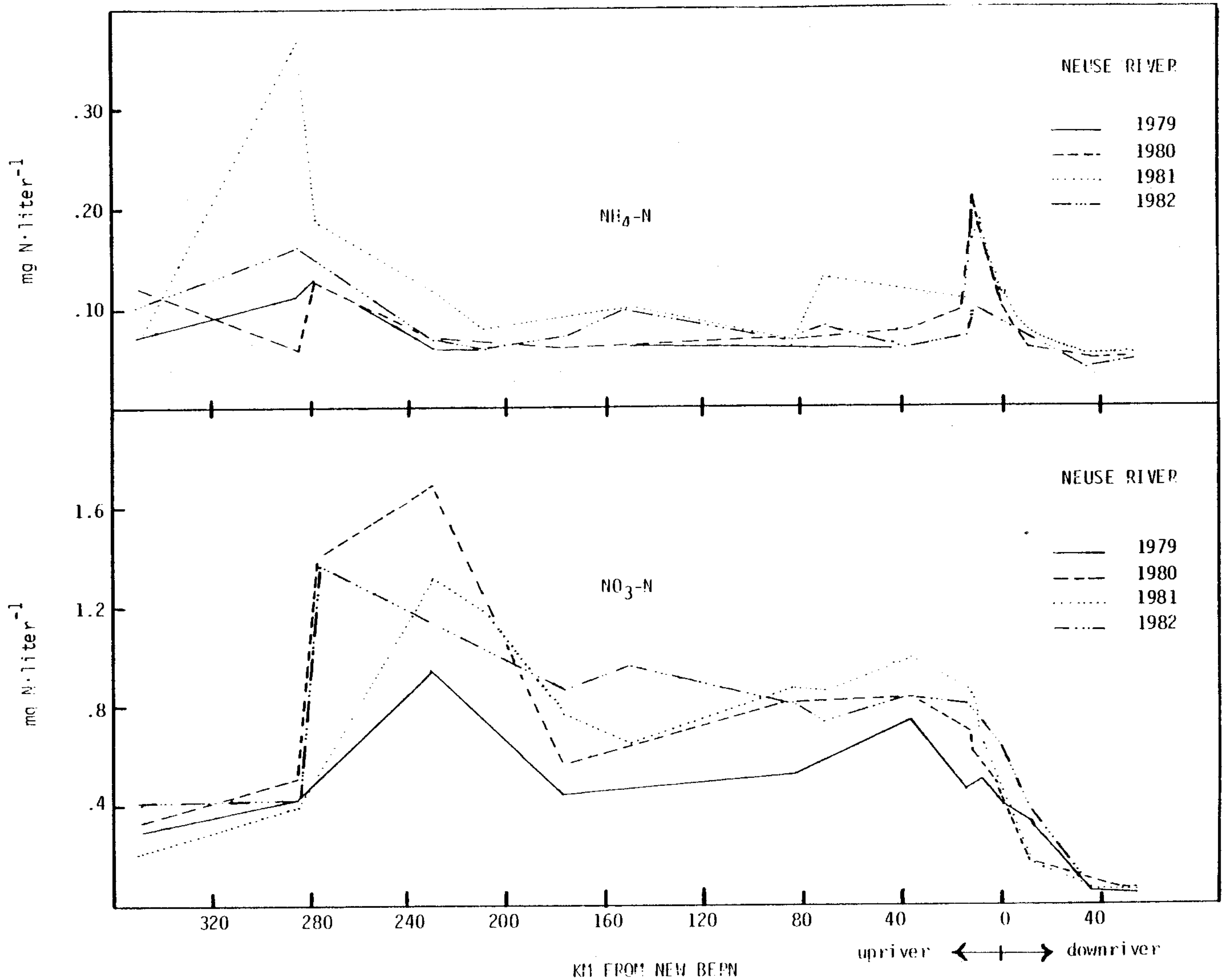


Figure 3. Annual mean concentration of NO_3-N and NH_4-N in the Neuse River (1979-1982). Data are from this study and from U.S. Geological Survey studies (USGS 1979; 1980; 1981; 1982) and from North Carolina Division of Environmental Management studies (NCDNRCD, 1980, 1981) accessed through the STORET system at WRRI, N.C. State University, Raleigh, N.C. Station locations are given in Appendix II.

behavior of substances (e.g. chloride) which do not participate in biogeochemical cycles. For these substances, the concentration-salinity curve is a straight line (Biggs and Cronin, 1981).

Ammonia nitrogen levels are not as variable as NO_3-N in the Neuse. NH_4-N averages around 7 µM in the upper Neuse, rises slightly in the Durham-Raleigh area (to 11 µM except in the very dry year 1981, when it rose to 25 uM), then falls back to around 7 µM and remains nearly constant until just below the Weyerhaeuser mill between Cowpens and New Bern (Figure 3). There the concentrations rise, especially in low flow years such as 1980-81 when it nearly doubled, before falling back to around 5 µM in the Neuse estuary. The NH_4-N increase below the Weyerhaeuser discharge is believed to result from ammonification of organic nitrogen in the mill's effluent. To illustrate this, NH_4-N data from five summer samples sets collected in 1980 are presented in Figure 4. At that time NH_4-N above the outfall averaged around 4 uM, whereas the levels below the outfall were up to three to four times higher, or around 15 µM. However, there was a gradual buildup in the downriver NH_4-N levels, rather than a sudden rise at the discharge pipe. This implies that ammonification, rather than the direct discharge of high levels of NH_4-N, was responsible for the high concentrations downriver. In addition, concentration measurements in effluent samples collected at the discharge point have shown that effluent NH_4-N levels are not high enough to account for these observed downstream increases in NH_4-N concentration.

In many instances, ammonification (the production of NH_4-N from organic nitrogen) exceeded NH_4-N assimilation, both at the Cowpens and Clayton station. The rate data for all sample dates are given in Tables 4 and 5, and the data are summarized in Table 6 as mean values for

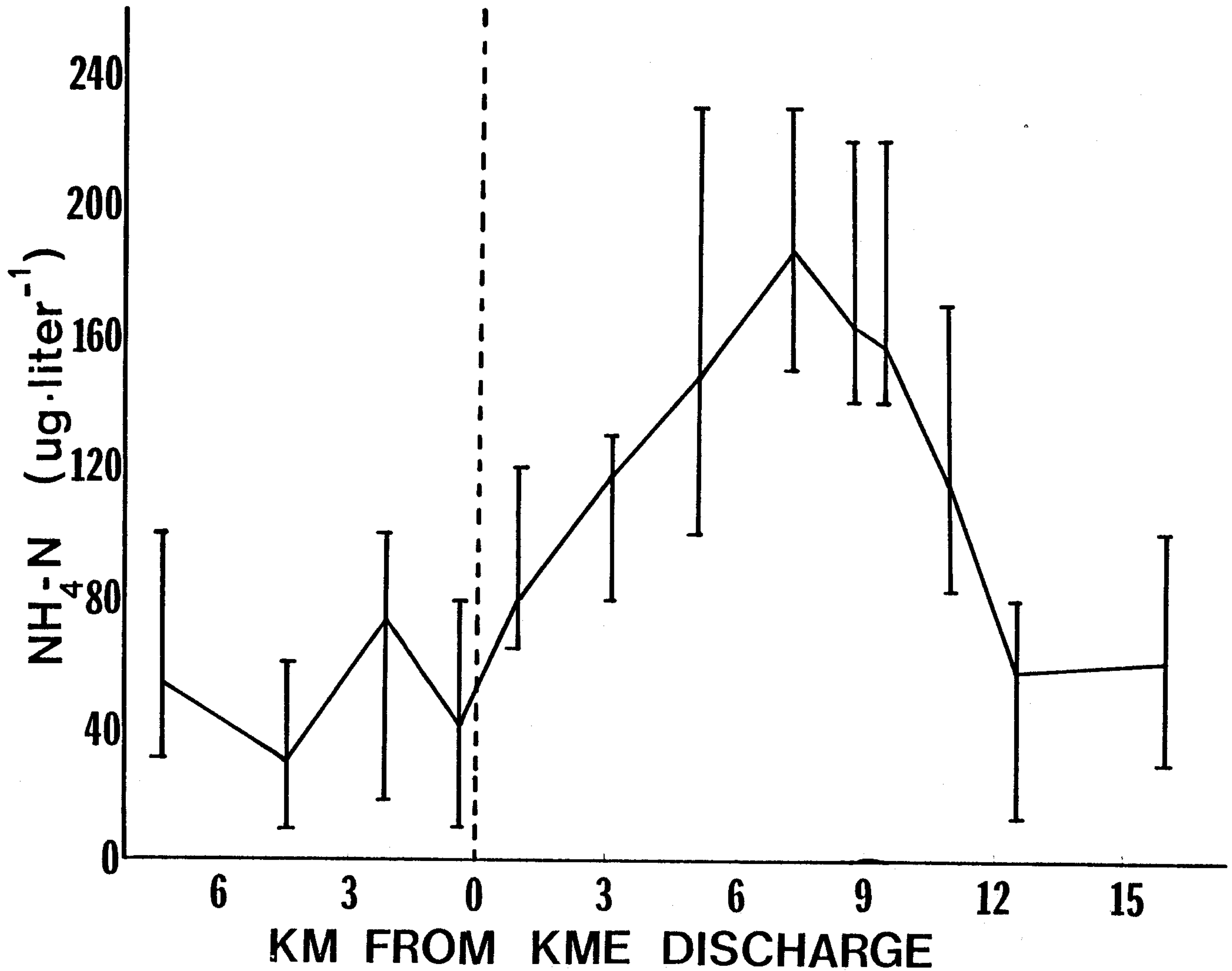


Figure 4. NH_4-N concentrations above and below the Weyerhaeuser (kraft) pulp mill effluent discharge near Streets Ferry, N.C.

"summer" (June-September) and "winter" (October-December) conditions. Total DIN (dissolved nitrogen - includes NO_3-N plus NH_4-N) assimilation averaged .42 $\mu M \cdot h^{-1}$ (summer) and .29 $\mu M \cdot h^{-1}$ (winter) at Cowpens and .89 $\mu M \cdot h^{-1}$ (summer) and .29 $\mu M \cdot h^{-1}$ (winter) at Clayton. Ammonification rates were also higher in summer than winter at both stations; .74 $uM \cdot h^{-1}$ vs. .44 $\mu M \cdot h^{-1}$ at Cowpens and .70 $uM \cdot h^{-1}$ vs. .30 $uM \cdot h^{-1}$ upriver at the Clayton site (Table 6).

About 80 percent of the DIN assimilated at both Clayton and Cowpens stations was NH_4-N, even though NO_3-N concentrations were usually 5-10 fold higher than NH_4-N. In other words, microorganisms showed a preference for NH_4 over NO_3. Preferential assimilation of NH_4 over NO_3 has been observed in so many different instances that it is now referred to as a "nearly universal" phenomenon in aquatic nitrogen cycling (McCarthy et al., 1977). Marine phytoplankton grown in laboratory culture used NH_4 in preference to NO_3 (Eppley et al., 1969; Eppley and Rogers, 1970; McCarthy and Eppley 1972; Conway 1977). The same result was observed in field studies of marine phytoplankton in the Peru Current (MacIsaac and Dugdule, 1969), and off the coasts of California and northwest Africa (Conway 1977). McCarthy et al. (1977), and Kuenzler et al. (1979) concluded that NH_4 is the preferred form of nitrogen for phytoplankton in the Chesapeake Bay and Pamlico River estuaries, respectively. Finally, Stanley and Hobbie (1977) and Liao and Lean (1978) demonstrated the preference in freshwater plankton communities.

It is believed that the NH_4 preference is related to the fact that NO_3 utilization requires an energy expenditure for both induction of the nitrate reductase enzyme system and for the chemical reduction of NO_3 to NH_4 (Eppley et al., 1969). In laboratory experiments Kuenzler et al.

(1979) demonstrated that for Pamlico River water the nitrate uptake falls very rapidly when NH_4 exceeds 1 uM. In these experiments NO_3 uptake was measured in a series of bottles in which the NH_4 concentration was increased serially. Increasing the NO_3 levels had no effect on NH_4 uptake. It must be mentioned that no one has shown that plankton algae grown at slower rates on NO_3 than on NH_4.

Certainly the NO_3-NH_4 interaction must be considered by those who utilize the bioassay technique to determine N effects on algal growth. For example, growth rates might not correlate very well with NO_3 levels, if even small amounts of NH_4 are present (especially if NH_4 is also being regenerated - see below). It would seem to be difficult to interpret the results of these kinds of experiments unless one had detailed knowledge of the NO_3 and NH_4 concentrations and the rate of NH_4 regeneration within the sample.

On average, ammonification provided more than enough DIN to supply the assimilation needs at both Cowpens and Clayton stations in 1982 (Table 7). At Cowpens, the rate of regeneration as a percentage of assimilation was 176 in summer and 151 in winter. At Clayton regeneration averaged 78% and 103% of assimilation in summer and winter, respectively.

Another indication of the rapid rate of nitrogen recycling was obtained by calculating the turnover times of both NO_3-N and NH_4-N (Table 7). These results show that the turnover of NH_4-N is very rapid (<1 day) due to the high rates of uptake relative to the ambient concentration in the water column. The turnover of NO_3-N is much slower (29-53 days) because of high ambient NO_3 levels and the preference of NH_4 over NO_3 as a nitrogen source.

Table 7. NO_3 and NH_4 turnover times (days)*, and NH_4 regeneration rates as the percentage of total DIN assimilation.

Station	Turnover Time (days) NO_3-N	NH_4-N	Regeneration as % of Assimilation
Cowpens			
JUN-SEP	29.3	0.92	176
OCT-NOV	36.4	1.00	151
Clayton			
JUN-SEP	29.0	1.21	78
OCT-NOV	53.3	0.80	103

*Calculated as μM NH_4-N or NO_3-N/μm.d^{-1} NH_4-N or NO_3-N.

Effect of River Discharge Rate

There is evidence that phytoplankton biomass in the river is closely correlated (inversely) with river discharge rate. This is suggested by a comparison of DIN (NO^3-N and NH^4-N) uptake, photosynthesis, and algal biomass at the Cowpens and Clayton stations (depicted in Figures 5 and 6) with river discharge at Kinston (Figure 7), about midway between the two stations. Usually, as would be expected, the higher DIN uptake and phytosynthesis rates were associated with peaks in algal biomass. At Cowpens, the biomass peaks were in late July, early September, and early October (Figure 6). The September and October peaks also occurred at Clayton (Figure 5). The flow rates were 2-3 times normal in June 1982, and algal biomass in the Neuse was very low during that month. Flow subsided to near normal rates in July, and biomass began to increase. Then in August, flow picked up again to about twice the normal rate, and algal biomass dropped off at Cowpens. Next, in September and October, flow declined to levels about 50% below normal, and algal biomass began to climb rapidly. Finally, flow increased again in late October, and biomass fell to very low levels. Although this evidence is only circumstantial, it does suggest (as does common-sense reasoning!) phytoplankton, whose lateral movement is controlled by water currents, are subject to being washed out of a riverine environment. This should not be taken to mean that low flows are the primary factor responsible for bloom development. Instead, it is probably best to emphasize that even under favorable bloom conditions (e.g., high temperature and nutrient levels), blooms cannot develop and/or persist if flow is high. The question then becomes how

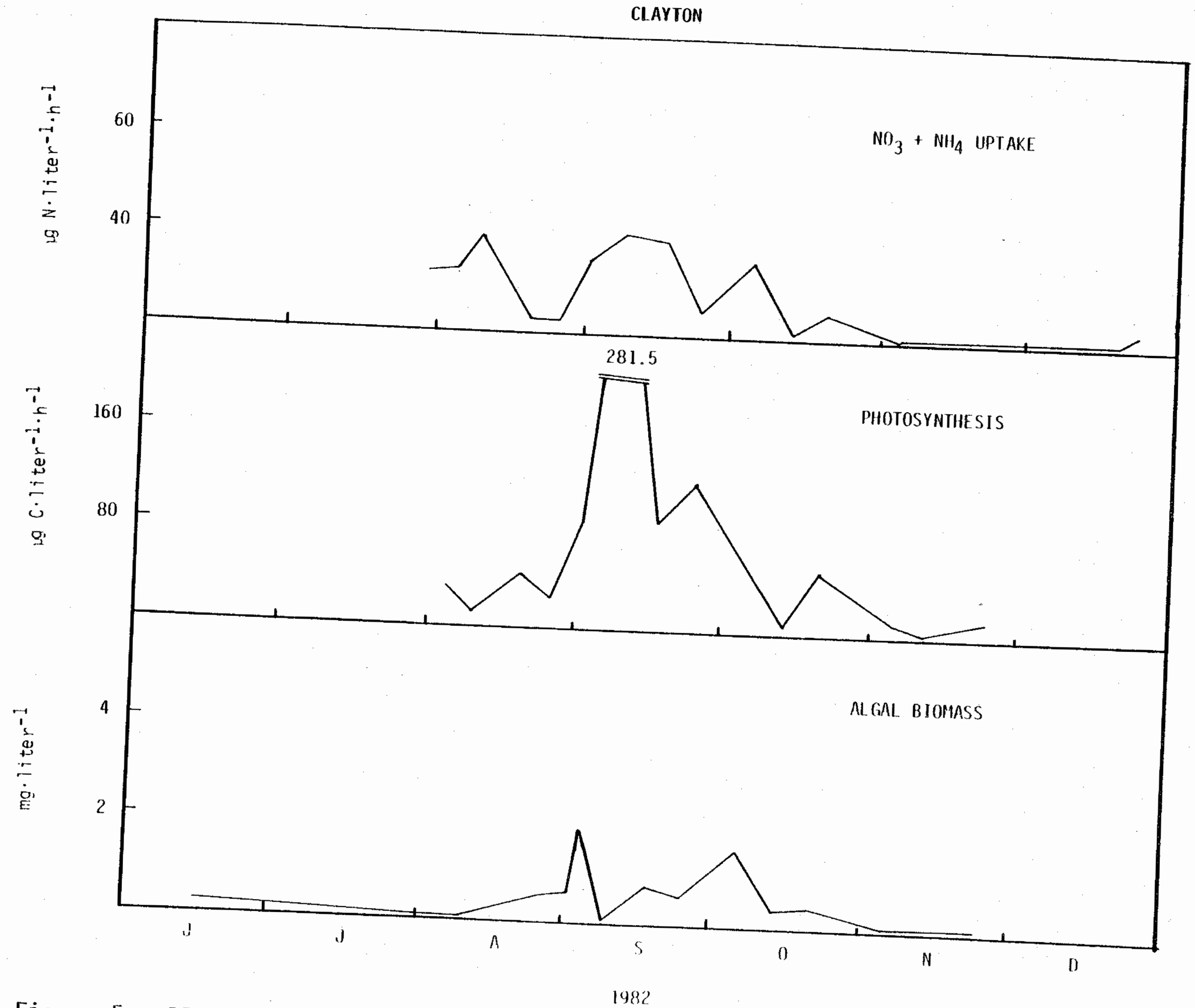


Figure 5. DIN uptake, photosynthesis rates, and phytoplankton biomass at the Clayton sampling station.

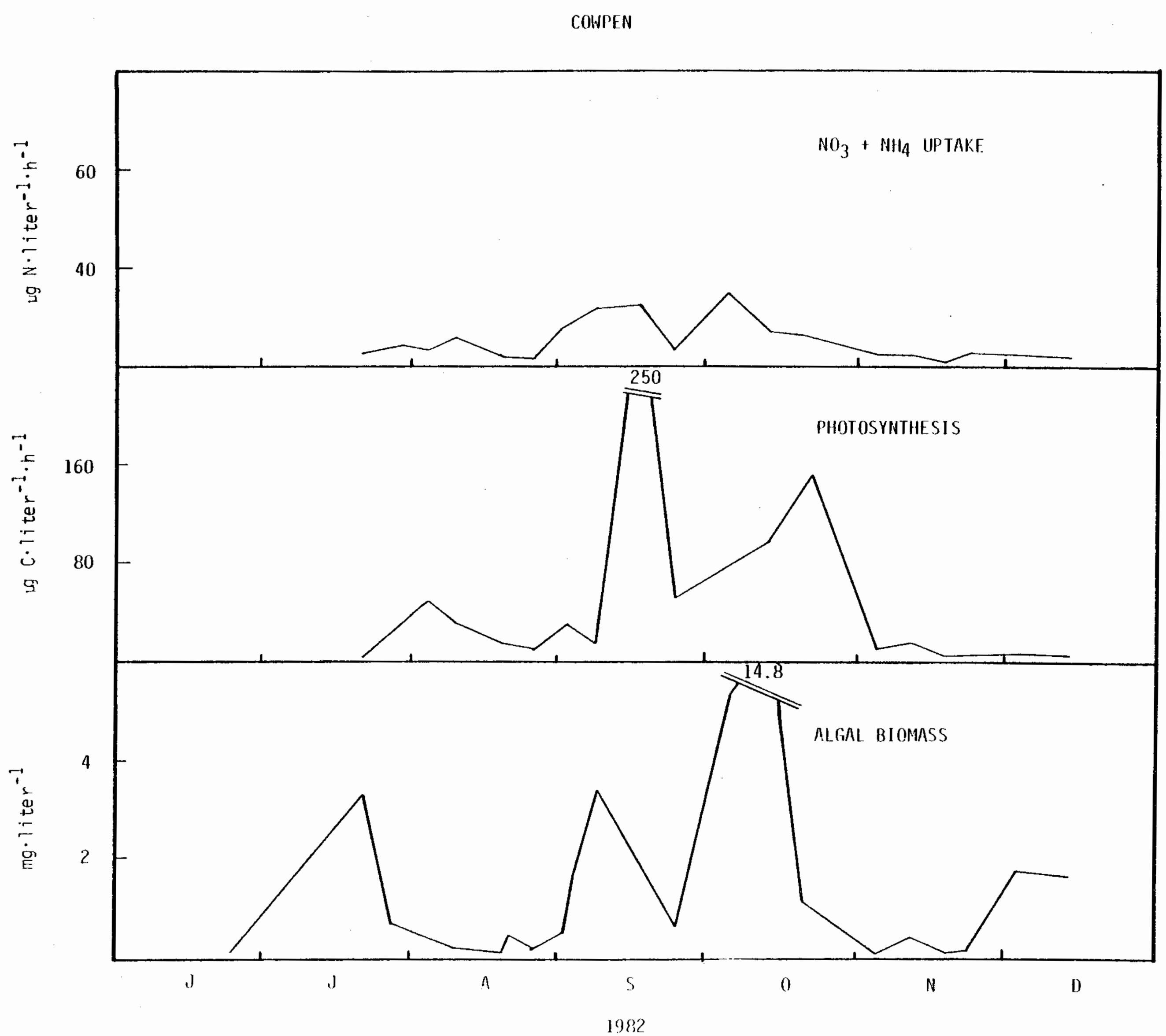


Figure 6. DIN uptake, photosynthesis rates and phytoplankton biomass at the Cowpens sampling station.

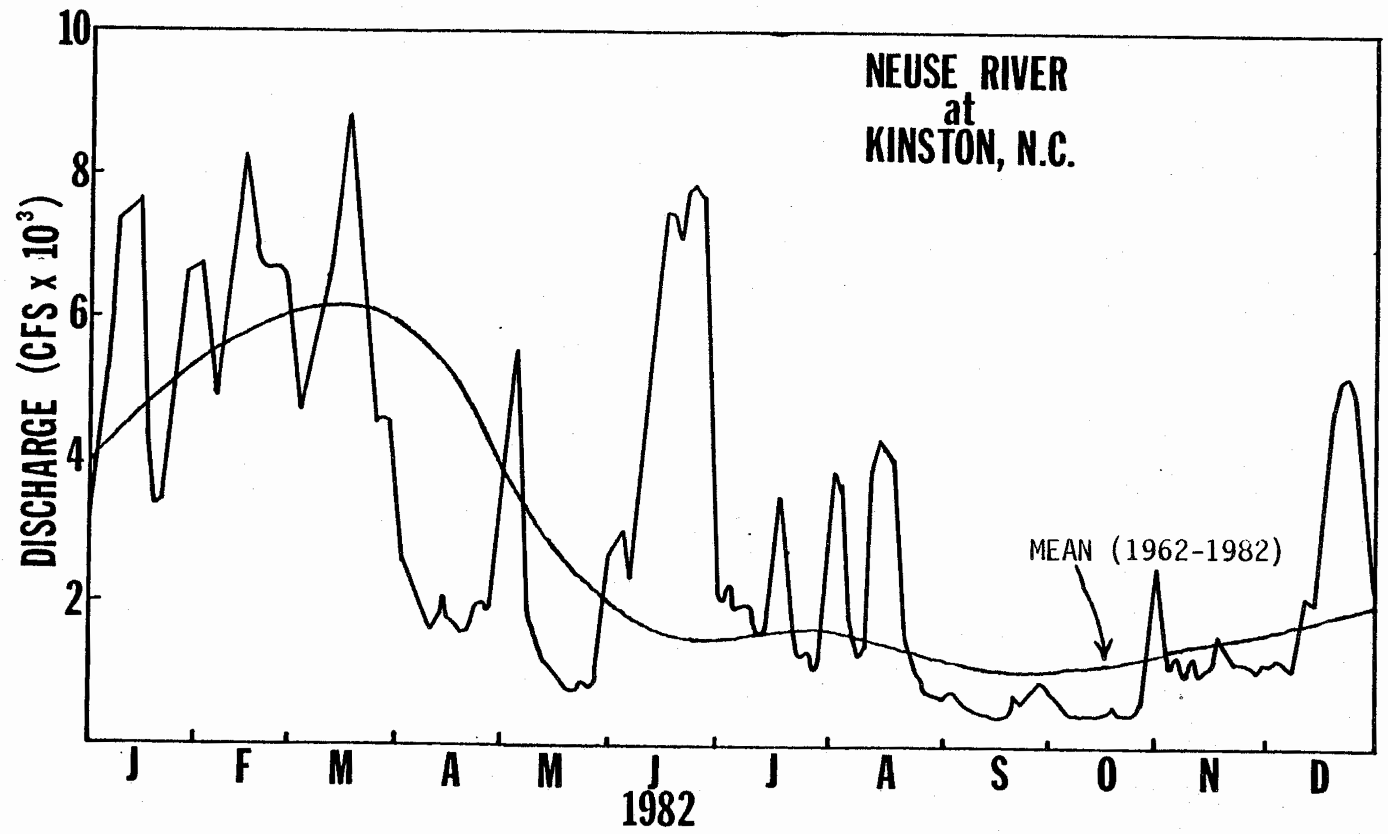


Figure 7. Discharge (CFS) of the Neuse River at Kinston, N.C. in 1982.

high must flow be to cause washout in the Neuse? The 1982 data would suggest that summertime flows twice the normal rate are more than sufficient.

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APPENDIX I. Neuse River phytoplankton density and biomass data (1982).

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
24 JUNE, 1982
COWPEN, N.C. SURFACE SAMPLE

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Stichococcus sp.	11,063	0.001
2	Unknown coccoid cell,dia.=6um	129,433	0.023
2	Schizogonium murale	23,010	0.000
10	Unknown #74	2,738,460	0.044
10	Unknown #26	84,690	0.002
1	Acnanthes sp.	2,397	0.000
2	Selenastrum sp.	38,350	0.001
1	Cyclotella sp.,dia.=16um	2,397	0.000
2	Crucigenia sp.	16,778	0.007
1	Navicula sp.	2,397	0.003
1	Cyclotella sp.,dia.=8um	2,397	0.000
1	Navicula sp.	2,397	0.003
1	Eunotia sp.	2,397	0.002
1	Stauroneis sp.	2,397	0.001
1	Nitzchia sp.	2,397	0.003
10	Unknown green coccoid cell	129,433	0.000
10	Unknown #62	2,397	0.000
2	Scenedesmus sp.	9,588	0.006
4	Chroococcus sp.	23,969	0.003
1	Navicula sp.	2,397	0.001
10	Unknown #45	2,397	0.000
1	Cyclotella dia.= 20um	4,794	0.008
	TOTALS	3,235,930	0.107

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	26,366	0.81	0.020	18.47
2. Chlorophyceae	228,222	7.05	0.038	35.30
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	23,969	0.74	0.003	2.92
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	2,957,380	91.39	0.046	43.32
TOTALS	3,235,930	100.00	0.107	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
15 JULY, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Scenedesmus sp.	5,892	0.001
2	Unknown coccoid cell,dia.=6um	70,709	0.012
2	Pediastrum sp.	47,139	0.020
1	Navicula sp.	29,462	0.029
2	Scenedesmus quadricauda	5,892	0.004
2	Schizogonium murale	296,976	0.003
7	Trachelomonas smiewiki	11,785	0.009
10	Unknown #75	126,686	0.008
10	Unknown #88	5,892	0.081
10	Unknown #60	5,892	0.011
1	Cyclotella ,dia.=16um	17,677	0.007
1	Eunotia sp.	5,892	0.004
2	Pediastrum duplex	100,170	0.100
1	Navicula sp.	5,892	0.004
10	Actinastrum hantzchii	17,677	0.005
10	Unknown #139	23,570	0.012
2	Scenedesmus sp.	17,677	0.010
4	Chroococcus sp.	70,709	0.009
10	Unknown #120	5,892	0.010
1	Navicula sp.	5,892	0.001
	TOTALS	877,375	0.343

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	64,816	7.39	0.045	13.26
2. Chlorophyceae	544,456	62.06	0.151	44.11
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	70,709	8.06	0.009	2.68
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	11,785	1.34	0.009	2.70
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	185,610	21.16	0.128	37.25
TOTALS	877,375	100.00	0.343	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
21 JULY, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Crucigenia rectangularis	27,196	0.011
1	Unknown #103	3,022	0.006
10	Unknown #18	15,109	0.021
2	Crucigenia sp.	12,087	0.005
1	Navicula sp.	3,022	0.003
4	Chroococcus sp.	21,152	0.003
1	Eunotia sp.	3,022	0.015
10	Unknown #135	15,109	0.005
2	Navicula sp.	3,022	0.001
2	Pediastrum sp.	48,348	0.021
1	Cyclotella sp.,dia.=12um	3,022	0.003
1	Navicula sp.	3,022	0.003
5	Unknown #104	3,022	0.002
5	Unknown #104	3,022	0.002
5	Unknown #104	3,022	0.002
7	Euglena sp.	3,022	0.003
10	Unknown #77	3,022	0.001
5	Unknown #100	15,109	2.990
8	Chrysochromulina sp.	9,065	0.002
1	Stauroneis sp.	3,022	0.002
10	Unknown #139	6,043	0.003
1	Navicula sp.	6,043	0.007
2	Scenedesmus sp.	15,109	0.009
10	Actinastrum hantzchii	6,043	0.002
1	Cyclotella ,dia.=16um	3,022	0.001
1	Unknown #84	27,196	0.000
2	Fragillaria sp.	3,022	0.002
2	Fragillaria sp.	3,022	0.000
1	Navicula sp.	3,022	0.003
2	Pediastrum biradiatum	3,022	0.001
1	Cyclotella dia.= 20um	6,043	0.009
5	Dinophis sp.	3,022	0.031
10	Unknown #39	3,022	0.134
5	Gyrodinium sp.	3,022	0.000
1	Navicula sp.	3,022	0.004
1	Acnanthes sp.	3,022	0.001
10	Unknown #102	30,217	0.005
2	Stichococcus sp.	112,734	0.012
10	Unknown #95	226,630	0.000
2	Schizogonium murale	137,791	0.001
10	Unknown #75	87,630	0.006
10	Unknown #74	302,173	0.005
	TOTALS	1,193,310	3.334

COWPEN, N.C.
21 JULY, 1982
Continued

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	69,500	5.82	0.057	1.72
2. Chlorophyceae	365,351	30.62	0.062	1.86
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	21,152	1.77	0.003	0.08
5. Dinophyceae	30,217	2.53	3.026	90.77
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	3,022	0.25	0.003	0.08
8. Haptophyceae	9,065	0.76	0.002	0.06
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	694,999	58.24	0.181	5.44
TOTALS	1,193,310	100.00	3.334	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
27 JULY, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
1	Navicula sp.	4,135	0.006
10	Actinastrum hantzchii	16,540	0.005
10	Unknown #77	8,270	0.002
2	Unknown coccoid cell,dia.=6um	115,780	0.020
10	Unknown green coccoid cell	20,675	0.000
2	Crucigenia rectangularis	33,080	0.013
10	Unknown #137	8,270	0.001
1	Nitzchia sp.	4,135	0.001
1	Navicula sp.	8,270	0.009
1	Navicula sp.	8,270	0.009
1	Acnanthes sp.	4,135	0.003
10	Unknown #139	4,135	0.002
1	Surirella sp.	4,135	0.336
2	Crucigenia sp.	28,945	0.013
2	Scenedesmus bijuga	8,270	0.004
1	Acnanthes sp.	4,135	0.001
1	Diploneis sp.	4,135	0.003
1	Cyclotella ,dia.=16um	4,135	0.002
2	Scenedesmus sp.	4,135	0.005
2	Pediastrum sp.	33,080	0.014
1	Navicula sp.	16,540	0.012
2	Selenastrum sp.	119,915	0.003
2	Fragillaria sp.	4,135	0.000
10	Unknown #71	4,135	0.004
10	Unknown #140	4,135	0.266
2	Stichococcus sp.	125,640	0.013
10	Unknown #41	11,027	0.000
2	Schizogonium murale	198,480	0.002
10	Unknown #95	537,550	0.001
	TOTALS	1,348,220	0.742

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER *	BIOMASS (MG/LITER) *	PERCENT BIOMASS
1. Bacillariophyceae	62,025	4.60	0.381	51.38
2. Chlorophyceae	671,461	49.80	0.087	11.73
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10. Unknown	614,737	45.60	0.274	36.89
TOTALS	1,348,220	100.00	0.742	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
4 AUGUST, 1982
CLAYTON, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Schizogonium murale	328,088	0.003
2	Stichococcus sp.	13,054	0.001
10	Unknown #75	35,354	0.002
10	Unknown #139	21,213	0.011
8	Chrysochromulina sp.	7,071	0.001
2	Scenedesmus sp.	7,071	0.004
10	Actinastrum hantzchii	21,213	0.006
1	Navicula sp.	21,213	0.016
10	Unknown #120	14,142	0.024
1	Cyclotella ,dia.=16um	7,071	0.003
1	Navicula sp.	14,142	0.002
7	Trachelomonas smiewiki	21,213	0.017
1	Cyclotella dia.= 20um	7,071	0.011
10	Unknown #137	49,496	0.005
1	Cyclotella sp.,dia.=16um	14,142	0.003
2	Unknown coccoid cell,dia.=6um	28,283	0.005
1	Didimosphenia sp.	7,071	0.020
	TOTALS	616,905	0.135

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	70,709	11.46	0.054	40.13
2. Chlorophyceae	376,496	61.03	0.014	10.13
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	21,213	3.44	0.017	12.32
8. Haptophyceae	7,071	1.15	0.001	1.07
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	141,417	22.92	0.049	36.34
TOTALS	616,905	100.00	0.135	100.00

NEUSE RIVER
PHYTOPLANKTON NUMBERS AND BIOMASS
4 AUGUST, 1982
COWPEN

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Pediastrum duplex	3,722	0.058
1	Navicula sp.	3,722	0.008
10	Actinastrum hantzchii	3,722	0.002
2	Unknown coccoid cell,dia.=6um	253,062	0.044
2	Crucigenia sp.	33,494	0.015
2	Scenedesmus sp.	22,329	0.013
1	Cyclotella dia.= 20um	3,722	0.003
1	Cyclotella ,dia.=16um	3,722	0.001
5	Unknown #15	3,722	0.005
5	Gymnodinium sp.	3,722	0.009
10	Unknown #18	7,443	0.010
10	Unknown #18	3,722	0.005
1	Cyclotella sp.,dia.=8um	3,722	0.000
4	Chroococcus sp.	107,924	0.014
2	Pyramimonas sp.	7,443	0.000
10	Unknown green coccoid cell	364,707	0.000
2	Selenastrum sp.	7,443	0.000
1	Gomphonema sp.	3,722	0.004
2	Ankistrodesmus falcatus	3,722	0.001
1	Cymatopleura sp.	3,722	0.020
2	Scenedesmus sp.	3,722	0.000
1	Diploneis sp.	7,443	0.013
10	Unknown #88	3,722	0.000
1	Netrium sp.	14,886	0.006
1	Navicula sp.	3,722	0.005
2	Ankistrodesmus sp.	3,722	0.001
10	Unknown #81	3,722	0.007
1	Navicula sp.	3,722	0.005
10	Unknown #77	81,873	0.096
2	Scenedesmus oahuensis	7,443	0.010
2	Pediastrum sp.	3,722	0.002
2	Pediastrum sp.	96,759	0.034
10	Unknown #137	3,722	0.002
1	Cocconeis sp.	3,722	0.006
2	Scenedesmus sp.	3,722	0.017
2	Crucigenia rectangularis	74,430	0.029
2	Frustulia sp.	3,722	0.002
1	Navicula sp.	104,202	0.152
2	Schizogonium murale	29,772	0.000
10	Unknown 141	4,962	0.000
10	Unknown #78	865,249	0.002
2	Stichococcus SP.	104,345	0.011
	TOTALS	2,280,800	0.613

COWPEN
4 AUGUST, 1982
Continued

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	160,025	7.02	0.223	36.40
2. Chlorophyceae	662,570	29.05	0.237	38.63
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	107,924	4.73	0.014	2.29
5. Dinophyceae	7,443	0.33	0.015	2.39
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	1,342,840	58.88	0.124	20.29
TOTALS	2,280,800	100.00	0.613	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
9 AUGUST, 1982
CLAYTON, N.C. INITIAL SAMPLING TIME

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
1	Navicula sp.	11,785	0.012
2	Scenedesmus sp.	11,785	0.016
1	Gomphonema sp.	11,785	0.012
2	Crucigenia rectangularis	35,354	0.014
3	Pinnularia sp.	11,785	0.074
2	Scenedesmus sp.	11,785	0.007
	TOTALS	94,278	0.134

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	23,570	25.00	0.024	17.87
2. Chlorophyceae	58,924	62.50	0.036	26.97
3. Chrysophyceae	11,785	12.50	0.074	55.16
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	0	0.00	0.000	0.00
TOTALS	94,278	100.00	0.134	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
9 AUGUST, 1982
COWPEN, N.C. INITIAL SAMPLING TIME

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Scenedesmus sp.	11,785	0.007
2	Selenastrum sp.	23,570	0.000
2	Scenedesmus sp.	35,354	0.047
2	Unknown coccoid cell,dia.=6um	200,341	0.035
1	Cyclotella ,dia.=16um	11,785	0.005
1	Cyclotella ,dia.=16um	11,785	0.005
2	Stichococcus sp.	38,074	0.004
10	Actinastrum hantzchii	11,785	0.003
2	Crucigenia rectangularis	23,570	0.009
10	Unknown #77	11,785	0.004
10	Unknown #75	70,709	0.005
1	Cymatopleura sp.	11,785	0.062
	TOTALS	462,325	0.185

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER *	BIOMASS (MG/LITER) *	PERCENT BIOMASS
1. Bacillariophyceae	35,354	7.65	0.071	38.61
2. Chlorophyceae	332,693	71.96	0.102	55.25
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10. Unknown	94,278	20.39	0.011	6.14
TOTALS	462,325	100.00	0.185	100.00

NEUSE
PHYTOPLANKTON NUMBERS AND BIOMASS
19 AUGUST, 1982
CLAYTON

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Stichococcus SP.	4,533	0.000
10	Unknown #18	5,892	0.008
2	Schizogonium murale	103,706	0.001
2	Scenedesmus sp.	5,892	0.003
10	Unknown #75	309,350	0.020
10	Unknown #139	5,892	0.003
1	Navicula sp.	11,785	0.026
2	Crucigenia rectangularis	17,677	0.007
1	Cyclotella dia.= 20um	5,892	0.004
1	Cymatopleura sp.	5,892	0.079
1	Pinnularia sp.	5,892	0.031
1	Navicula sp.	29,462	0.022
1	Navicula sp.	5,892	0.012
10	Unknown #18	5,892	0.008
2	Ankistrodesmus falcatus	5,892	0.001
1	Navicula sp.	5,892	0.001
2	Unknown coccoid cell,dia.=6um	194,449	0.034
10	Unknown green coccoid cell	200,341	0.000
2	Crucigenia sp.	5,892	0.003
10	Actinastrum hantzchii	17,677	0.009
	TOTALS	953,795	0.274

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	70,709	7.41	0.176	64.33
2. Chlorophyceae	338,041	35.44	0.049	17.96
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	545,045	57.14	0.048	17.71
TOTALS	953,795	100.00	0.274	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
19 AUGUST, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Unknown green coccoid cell	141,417	0.000
2	Unknown coccoid cell,dia.=6um	70,709	0.012
1	Navicula sp.	17,677	0.018
1	Cyclotella ,dia.=16um	23,570	0.009
10	Unknown #139	5,892	0.003
2	Schizogonium murale	44,782	0.000
2	Scenedesmus quadricauda	5,892	0.004
2	Crucigenia rectangularis	17,677	0.007
10	Unknown #137	17,677	0.002
4	Chroococcus sp.	17,677	0.002
2	Scenedesmus sp.	5,892	0.003
	TOTALS	368,863	0.061

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	41,247	11.18	0.027	43.55
2. Chlorophyceae	144,953	39.30	0.027	44.30
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	17,677	4.79	0.002	3.74
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	164,987	44.73	0.005	8.41
TOTALS	368,863	100.00	0.061	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
20 AUGUST, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
1	Acnanthes sp.	8,839	0.005
10	Unknown #137	8,839	0.001
10	Unknown green coccoid cell	123,740	0.000
1	Navicula sp.	8,839	0.006
2	Scenedesmus quadricauda	17,677	0.012
10	Unknown #77	8,839	0.003
1	Navicula sp.	8,839	0.009
10	Unknown #69	8,839	0.021
1	Cymatopleura sp.	8,839	0.119
2	Crucigenia tetrapedia	17,677	0.001
10	Unknown #118	8,839	0.085
2	Unknown coccoid cell,dia.=6um	220,964	0.038
10	Unknown #97	26,516	0.001
1	Nitzchia sp.	8,839	0.017
2	Selenastrum sp.	17,677	0.000
10	Unknown #74	2,518,990	0.040
2	Stichococcus sp.	122,380	0.013
	TOTALS	3,145,170	0.373

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	44,193	1.41	0.157	42.02
2. Chlorophyceae	396,376	12.60	0.065	17.50
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	2,704,600	85.99	0.151	40.48
TOTALS	3,145,170	100.00	0.373	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
25 AUGUST, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
1	Cyclotella dia.= 20um	14,142	0.022
2	Unknown coccoid cell,dia.=6um	56,567	0.010
1	Cymbella sp.	14,142	0.035
1	Navicula sp.	7,071	0.005
1	Navicula sp.	14,142	0.014
2	Crucigenia rectangularis	98,992	0.039
2	Schizogonium murale	135,760	0.001
2	Stichococcus sp.	16,317	0.002
1	Gyrosigma sp.	7,071	0.222
1	Cyclotella ,dia.=16um	14,142	0.006
10	Actinastrum hantzchii	14,142	0.004
2	Selenastrum sp.	42,425	0.001
2	Scenedesmus sp.	7,071	0.009
1	Navicula sp.	7,071	0.006
2	Oocystis sp.	7,071	0.211
	TOTALS	456,125	0.587

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	*BIOMASS (MG/LITER)	*PERCENT BIOMASS
1. Bacillariophyceae	77,779	17.05	0.310	52.86
2. Chlorophyceae	364,203	79.85	0.273	46.48
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	14,142	3.10	0.004	0.66
TOTALS	456,125	100.00	0.587	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
25 AUGUST, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Crucigenia sp.	17,677	0.008
2	Oocystis sp.	5,892	0.176
2	Schizogonium murale	75,422	0.001
2	Stichococcus sp.	63,456	0.007
4	Anabaena sp.	441,928	0.001
10	Unknown #75	85,439	0.005
10	Unknown #18	5,892	0.008
2	Selenastrum sp.	23,570	0.000
2	Crucigenia rectangularis	11,785	0.005
2	Scenedesmus quadricauda	5,892	0.004
1	Cyclotella dia.= 20um	5,892	0.009
2	Unknown coccoid cell,dia.=6um	41,247	0.007
2	Scenedesmus sp.	11,785	0.016
	TOTALS	795,879	0.247

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	5,892	0.74	0.009	3.75
2. Chlorophyceae	256,726	32.26	0.223	90.35
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	441,928	55.53	0.001	0.36
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	91,332	11.48	0.014	5.54
TOTALS	795,879	100.00	0.247	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
1 SEPTEMBER, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Crucigenia rectangularis	235,695	0.092
10	Actinastrum hantzchii	392,825	0.108
10	Unknown #139	31,426	0.016
2	Crucigenia sp.	31,426	0.014
2	Scenedesmus sp.	62,852	0.037
10	Unknown #77	15,713	0.005
1	Nitzchia gracilis	15,713	0.072
2	Scenedesmus quadricauda	15,713	0.011
2	Schizogonium murale	1,659,290	0.017
2	Stichococcus sp.	48,348	0.005
10	Unknown #75	78,565	0.005
2	Unknown coccoid cell,dia.=6um	377,112	0.066
10	Unknown green coccoid cell	314,260	0.000
2	Scenedesmus sp.	15,713	0.008
1	Cyclotella dia.= 20um	31,426	0.049
2	Scenedesmus sp.	15,713	0.012
1	Cyclotella ,dia.=16um	157,130	0.061
1	Navicula sp.	47,139	0.035
2	Scenedesmus sp.	31,426	0.041
2	Scenedesmus bijuga	15,713	0.007
2	Selenastrum sp.	204,269	0.004
	TOTALS	3,797,470	0.666

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	251,408	6.62	0.217	32.63
2. Chlorophyceae	2,713,270	71.45	0.314	47.11
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	832,790	21.93	0.135	20.26
TOTALS	3,797,470	100.00	0.666	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
1 SEPTEMBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Stichococcus sp.	297,339	0.031
2	Schizogonium murale	131,989	0.001
7	Trachelomonas smiewiki	11,785	0.009
10	Actinastrum hantzchii	11,785	0.003
2	Crucigenia rectangularis	94,278	0.037
10	Unknown #18	11,785	0.016
1	Cyclotella dia.= 20um	11,785	0.019
2	Unknown coccoid cell,dia.=6um	1,202,050	0.209
2	Scenedesmus sp.	11,785	0.007
1	Cyclotella sp.,dia.=12um	35,354	0.040
10	Unknown #77	11,785	0.004
10	Unknown #137	23,570	0.003
2	Unknown #82	70,709	0.014
2	Scenedesmus sp.	11,785	0.009
2	Scenedesmus sp.	11,785	0.002
2	Crucigenia sp.	58,924	0.026
1	Navicula sp.	11,785	0.012
10	Unknown green coccoid cell	223,910	0.000
10	Unknown #97	11,785	0.001
2	Selenastrum sp.	200,341	0.004
2	Scenedesmus sp.	11,785	0.007
1	Navicula sp.	11,785	0.005
10	Unknown #139	11,785	0.006
2	Scenedesmus quadricauda	23,570	0.017
	TOTALS	2,515,230	0.481

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	70,709	2.81	0.076	15.72
2. Chlorophyceae	2,126,330	84.54	0.363	75.54
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	11,785	0.47	0.009	1.92
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	306,404	12.18	0.033	6.82
TOTALS	2,515,230	100.00	0.481	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
3 SEPTEMBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Crucigenia sp.	35,354	0.016
2	Selenastrum sp.	813,148	0.017
10	Unknown #139	70,709	0.037
10	Unknown #71	35,354	0.031
10	Unknown #98	282,834	0.012
10	Unknown #74	41,629,700	0.666
2	Scenedesmus sp.	35,354	0.021
2	Schizogonium murale	311,118	0.003
10	Unknown #77	35,354	0.011
1	Cyclotella ,dia.=16um	106,063	0.041
10	Unknown 141	441,928	0.012
1	Navicula sp.	35,354	0.040
2	Unknown coccoid cell,dia.=6um	2,510,150	0.437
4	Chroococcus sp.	530,314	0.069
2	Scenedesmus quadricauda	106,063	0.075
2	Selenastrum sp.	318,188	0.019
10	Unknown green coccoid cell	1,414,170	0.001
2	Crucigenia rectangularis	212,126	0.083
10	Unknown #75	300,511	0.019
10	Actinastrum hantzchii	70,709	0.020
1	Navicula sp.	35,354	0.005
10	Unknown #137	318,188	0.035
	TOTALS	49,648,000	1.607

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	176,771	0.36	0.086	5.38
2. Chlorophyceae	4,341,510	8.74	0.670	41.68
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	530,314	1.07	0.069	4.29
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	44,599,400	89.83	0.782	48.65
TOTALS	49,648,000	100.00	1.607	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
8 SEPTEMBER, 1982
CLAYTON, N.C. TOTAL

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Actinastrum hantzchii	854,395	0.236
1	Navicula sp.	58,924	0.043
2	Crucigenia sp.	88,386	0.039
2	Scenedesmus sp.	117,848	0.069
2	Pediastrum sp.	235,695	0.047
2	Pediastrum duplex	26,516	0.027
1	Cyclotella dia.= 20um	29,462	0.046
2	Unknown coccoid cell,dia.=6um	1,944,480	0.338
2	Selenastrum sp.	176,771	0.011
2	Stichococcus sp.	151,842	0.016
3	Pavlova sp.	265,157	0.024
10	Unknown #139	58,924	0.031
10	Unknown #139	117,848	0.062
2	Schizogonium murale	824,933	0.008
1	Navicula sp.	29,462	0.004
1	Navicula sp.	29,462	0.004
10	Unknown #77	147,309	0.044
2	Crucigenia rectangularis	88,386	0.034
10	Unknown green coccoid cell	294,619	0.000
5	Dinophis sp.	88,386	0.900
	TOTALS	5,628,810	1.984

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	147,309	2.62	0.098	4.94
2. Chlorophyceae	3,654,860	64.93	0.589	29.70
3. Chrysophyceae	265,157	4.71	0.024	1.22
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	88,386	1.57	0.900	45.34
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	1,473,090	26.17	0.373	18.81
TOTALS	5,628,810	100.00	1.984	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
8 SEPTEMBER, 1982
CLAYTON, N.C. 3UM

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
7	Euglena sp.	11,785	0.010
10	Unknown #139	11,785	0.006
	TOTALS	23,570	0.016

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	0	0.00	0.000	0.00
2. Chlorophyceae	0	0.00	0.000	0.00
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	11,785	50.00	0.010	61.81
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	11,785	50.00	0.006	38.19
TOTALS	23,570	100.00	0.016	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
8 SEPTEMBER, 1982
COWPEN, N.C. TOTAL

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Unknown coccoid cell,dia.=6um	9,231,390	1.606
10	Actinastrum hantzchii	5,106,730	1.409
7	Euglena sp.	39,283	0.154
2	Schizogonium murale	9,899,200	0.099
3	Pavlova sp.	510,673	0.046
1	Unknown #84	432,108	0.003
2	Crucigenia tetrapedia	39,283	0.057
2	Crucigenia rectangularis	78,565	0.031
	TOTALS	25,337,200	3.407

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER *	BIOMASS (MG/LITER)*	PERCENT BIOMASS
1. Bacillariophyceae	432,108	1.71	0.003	0.10
2. Chlorophyceae	19,248,400	75.97	1.793	52.63
3. Chrysophyceae	510,673	2.02	0.046	1.36
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	39,283	0.16	0.154	4.53
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	5,106,730	20.16	1.409	41.37
TOTALS	25,337,200	100.00	3.407	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
8 SEPTEMBER, 1982
COWPEN, N.C. 3UM

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Ankistrodesmus falcatus	11,785	0.002
	TOTALS	11,785	0.002

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	0	0.00	0.000	0.00
2. Chlorophyceae	11,785	100.00	0.002	100.00
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	0	0.00	0.000	0.00
TOTALS	11,785	100.00	0.002	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
17 SEPTEMBER, 1982
CLAYTON, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Schizogonium murale	1,112,480	0.011
2	Stichococcus sp.	29,009	0.003
3	Pinnularia sp.	11,785	0.074
1	Navicula sp.	11,785	0.025
2	Crucigenia rectangularis	70,709	0.028
2	Ankistrodesmus falcatus	11,785	0.002
2	Unknown coccoid cell,dia.=6um	565,668	0.098
2	Crucigenia tetrapedia	11,785	0.001
2	Scenedesmus sp.	11,785	0.007
1	Navicula sp.	153,202	0.112
10	Unknown #97	23,570	0.001
1	Cyclotella ,dia.=16um	94,278	0.037
2	Scenedesmus sp.	23,570	0.014
2	Scenedesmus quadricauda	70,709	0.050
2	Scenedesmus sp.	23,570	0.031
10	Unknown #60	11,785	0.023
2	Selenastrum sp.	94,278	0.002
10	Actinastrum hantzchii	164,987	0.046
2	Pediastrum sp.	271,049	0.117
2	Scenedesmus oahuensis	11,785	0.016
1	Cyclotella dia.= 20um	11,785	0.019
10	Unknown 141	982	0.000
2	Scenedesmus bijuga	11,785	0.005
1	Navicula sp.	35,354	0.035
	TOTALS	2,839,480	0.755

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER *	BIOMASS (MG/LITER) *	PERCENT BIOMASS
1. Bacillariophyceae	306,404	10.79	0.228	30.14
2. Chlorophyceae	2,319,970	81.70	0.384	50.88
3. Chrysophyceae	11,785	0.42	0.074	9.81
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	201,323	7.09	0.069	9.17
TOTALS	2,839,480	100.00	0.755	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
17 SEPTEMBER, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Pediastrum duplex	942,781	0.943
10	Actinastrum hantzchii	530,314	0.146
2	Schizogonium murale	848,503	0.008
2	Unknown coccoid cell,dia.=6um	1,708,790	0.297
2	Schizogonium murale	848,503	0.008
1	Cyclotella sp.,dia.=12um	58,924	0.067
1	Cyclotella dia.= 20um	117,848	0.185
2	Crucigenia rectangularis	412,467	0.161
	TOTALS	5,468,130	1.816

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	176,771	3.23	0.252	13.86
2. Chlorophyceae	4,761,040	87.07	1.418	78.08
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	530,314	9.70	0.146	8.06
TOTALS	5,468,130	100.00	1.816	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
24 SEPTEMBER, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Crucigenia sp.	41,593	0.018
2	Unknown #82	24,956	0.005
4	Chroococcus sp.	16,637	0.002
2	Crucigenia rectangularis	33,275	0.013
2	Selenastrum sp.	16,637	0.001
1	Navicula sp.	199,648	0.146
1	Cyclotella dia.= 20um	24,956	0.039
3	Pinnularia sp.	24,956	0.157
2	Scenedesmus sp.	8,319	0.011
2	Scenedesmus quadricauda	41,593	0.029
1	Cymbella sp.	16,637	0.041
2	Staurastrum sp.	8,319	0.008
10	Actinastrum hantzchii	41,593	0.011
2	Unknown coccoid cell,dia.=6um	357,702	0.062
2	Pediastrum sp.	33,275	0.007
1	Navicula sp.	16,637	0.005
10	Unknown #139	24,956	0.013
1	Diploneis sp.	8,319	0.007
1	Diploneis sp.	8,319	0.007
1	Navicula sp.	8,319	0.008
1	Navicula sp.	8,319	0.079
2	Schizogonium murale	372,676	0.004
2	Stichococcus sp.	79,987	0.008
10	Unknown #97	8,319	0.000
10	Unknown #137	108,142	0.012
2	Scenedesmus sp.	8,319	0.005
2	Selenastrum sp.	83,187	0.002
2	Pediastrum sp.	33,275	0.006
10	Unknown #77	8,319	0.003
	TOTALS	1,667,190	0.710

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	291,153	17.46	0.332	46.77
2. Chlorophyceae	1,143,110	68.57	0.179	25.28
3. Chrysophyceae	24,956	1.50	0.157	22.10
4. Cyanophyceae	16,637	1.00	0.002	0.30
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	191,329	11.48	0.039	5.54
TOTALS	1,667,190	100.00	0.710	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
24 SEPTEMBER, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Scenedesmus sp.	17,677	0.009
10	Actinastrum hantzchii	194,449	0.054
4	Chroococcus sp.	141,417	0.018
2	Unknown #82	35,354	0.007
1	Cyclotella ,dia.=16um	53,031	0.021
2	Schizogonium murale	537,385	0.005
1	Navicula sp.	17,677	0.019
2	Scenedesmus oahuensis	17,677	0.023
10	Unknown #75	335,866	0.021
2	Crucigenia rectangularis	70,709	0.028
10	Unknown #119	17,677	0.114
2	Scenedesmus sp.	106,063	0.053
2	Scenedesmus sp.	176,771	0.178
10	Unknown #97	35,354	0.002
10	Unknown green coccoid cell	282,834	0.000
2	Scenedesmus quadricauda	17,677	0.012
2	Unknown coccoid cell,dia.=6um	123,740	0.022
2	Scenedesmus sp.	17,677	0.010
	TOTALS	2,199,040	0.596

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	70,709	3.22	0.039	6.58
2. Chlorophyceae	1,120,730	50.96	0.347	58.30
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	141,417	6.43	0.018	3.09
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	866,180	39.39	0.191	32.03
TOTALS	2,199,040	100.00	0.596	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
5 OCTOBER, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Unknown #139	88,386	0.046
2	Crucigenia rectangularis	235,695	0.092
2	Scenedesmus sp.	29,462	0.030
2	Pediastrum biradiatum	58,924	0.013
2	Pediastrum sp.	117,848	0.051
2	Unknown coccoid cell,dia.=6um	766,009	0.133
2	Schizogonium murale	2,498,370	0.025
2	Scenedesmus sp.	58,924	0.078
10	Actinastrum hantzchii	1,708,790	0.472
1	Navicula sp.	117,848	0.086
10	Unknown #97	88,386	0.004
1	Cyclotella dia.= 20um	29,462	0.046
2	Stichococcus sp.	67,989	0.007
2	Selenastrum sp.	677,624	0.014
1	Cyclotella ,dia.=16um	88,386	0.034
10	Unknown 141	4,910	0.000
10	Unknown #137	147,309	0.016
1	Navicula sp.	29,462	0.029
2	Scenedesmus quadricauda	58,924	0.041
2	Scenedesmus bijuga	88,386	0.040
10	Unknown #77	29,462	0.009
2	Scenedesmus sp.	29,462	0.017
6	Friedmannia israelensis	441,928	0.089
2	Crucigenia tetrapedia	29,462	0.002
5	Peridinium sp.	29,462	0.185
	TOTALS	7,520,870	1.561

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	265,157	3.53	0.196	12.58
2. Chlorophyceae	4,717,080	62.72	0.544	34.83
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	29,462	0.39	0.185	11.86
6. Euchlorophyceae	441,928	5.88	0.089	5.69
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	2,067,240	27.49	0.547	35.05
TOTALS	7,520,870	100.00	1.561	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
5 OCTOBER, 1982
COWPEN N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Scenedesmus oahuensis	47,139	0.062
2	Scenedesmus sp.	47,139	0.062
1	Navicula sp.	47,139	0.047
2	Selenastrum sp.	188,556	0.004
2	Scenedesmus quadricauda	47,139	0.033
1	Cyclotella ,dia.=16um	1,932,700	0.754
2	Pediastrum sp.	329,973	0.066
4	Anabaena sp.	3,299,730	0.007
2	Selenastrum sp.	47,139	0.003
2	Crucigenia tetrapedia	47,139	0.003
2	Crucigenia rectangularis	188,556	0.074
2	Unknown coccoid cell,dia.=6um	1,979,840	0.344
10	Actinastrum hantzchii	8,720,720	2.407
2	Schizogonium murale	2,451,230	0.025
1	Gyrosigma sp.	47,139	1.481
	TOTALS	19,421,300	5.372

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	2,026,980	10.44	2.282	42.48
2. Chlorophyceae	5,373,850	27.67	0.676	12.59
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	3,299,730	16.99	0.007	0.12
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	8,720,720	44.90	2.407	44.81
TOTALS	19,421,300	100.00	5.372	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
13 OCTOBER, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Schizogonium murale	494,960	0.005
10	Actinastrum hantzchii	94,278	0.026
1	Navicula sp.	17,677	0.018
1	Eunotia sp.	5,892	0.032
1	Navicula sp.	17,677	0.003
2	Unknown coccoid cell,dia.=6um	141,417	0.025
2	Crucigenia rectangularis	17,677	0.007
1	Navicula sp.	47,139	0.035
2	Scenedesmus oahuensis	5,892	0.008
2	Scenedesmus sp.	5,892	0.008
2	Scenedesmus quadricauda	47,139	0.033
2	Crucigenia tetrapedia	5,892	0.000
10	Unknown #18	23,570	0.033
10	Unknown #97	11,785	0.001
10	Unknown #139	5,892	0.003
2	Selenastrum sp.	5,892	0.000
1	Gyrosigma sp.	5,892	0.185
10	Unknown #75	44,193	0.003
2	Scenedesmus bijuga	5,892	0.003
1	Navicula sp.	5,892	0.000
2	Pediastrum biradiatum	47,139	0.011
1	Unknown #84	47,139	0.000
	TOTALS	1,104,820	0.438

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	147,309	13.33	0.273	62.39
2. Chlorophyceae	777,794	70.40	0.099	22.69
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	179,718	16.27	0.065	14.93
TOTALS	1,104,820	100.00	0.438	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
13 OCTOBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Actinastrum hantzchii	5,126,370	1.415
2	Schizogonium murale	6,788,020	0.068
2	Unknown coccoid cell,dia.=6um	1,237,400	0.215
2	Scenedesmus sp.	58,924	0.046
5	Unknown #100	58,924	11.662
1	Cyclotella dia.= 20um	58,924	0.093
1	Cyclotella ,dia.=16um	3,122,960	1.218
10	Unknown green coccoid cell	707,085	0.001
2	Pediastrum sp.	353,543	0.071
2	Stichococcus sp.	824,933	0.086
	TOTALS	18,337,100	14.875

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	*BIOMASS (MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	3,181,880	17.35	1.311	8.81
2. Chlorophyceae	9,262,820	50.51	0.486	3.27
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	58,924	0.32	11.662	78.40
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	5,833,450	31.81	1.416	9.52
TOTALS	18,337,100	100.00	14.875	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
20 OCTOBER, 1982
CLAYTON N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Actinastrum hantzchii	222,601	0.061
1	Navicula sp.	39,283	0.029
2	Schizogonium murale	3,079,750	0.031
2	Unknown coccoid cell,dia.=6um	641,615	0.112
2	Scenedesmus quadricauda	52,377	0.037
1	Cyclotella ,dia.=16um	26,188	0.010
2	Scenedesmus bijuga	13,094	0.006
2	Scenedesmus sp.	26,188	0.015
2	Stichococcus sp.	6,043	0.001
10	Unknown #139	13,094	0.007
4	Chroococcus sp.	104,753	0.014
1	Cyclotella ,dia.=16um	52,377	0.020
2	Pediastrum sp.	104,753	0.045
1	Didimosphenia sp.	13,094	0.037
10	Unknown green coccoid cell	78,565	0.000
10	Unknown #139	13,094	0.007
2	Scenedesmus sp.	13,094	0.017
2	Crucigenia sp.	26,188	0.011
6	Friedmannia israelensis	52,377	0.011
2	Crucigenia rectangularis	13,094	0.005
10	Unknown #77	26,188	0.008
2	Scenedesmus quadricauda	13,094	0.009
2	Scenedesmus sp.	13,094	0.030
	TOTALS	4,644,000	0.523

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	130,942	2.82	0.096	18.45
2. Chlorophyceae	4,002,390	86.18	0.319	61.03
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	104,753	2.26	0.014	2.60
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	52,377	1.13	0.011	2.01
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	353,543	7.61	0.083	15.90
TOTALS	4,644,000	100.00	0.523	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
20 OCTOBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
1	Diploneis sp.	39,283	0.925
2	Schizogonium murale	1,257,040	0.013
2	Stichococcus sp.	111,804	0.012
2	Scenedesmus quadricauda	39,283	0.028
1	Navicula sp.	78,565	0.058
2	Unknown coccoid cell,dia.=6um	157,130	0.027
1	Navicula sp.	39,283	0.039
10	Actinastrum hantzchii	117,848	0.033
	TOTALS	1,840,240	1.134

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	157,130	8.54	1.022	90.15
2. Chlorophyceae	1,565,260	85.06	0.079	6.98
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	117,848	6.40	0.033	2.87
TOTALS	1,840,240	100.00	1.134	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
4 NOVEMBER, 1982
CLAYTON, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
3	Pinnularia sp.	5,892	0.037
1	Navicula sp.	11,785	0.012
10	Actinastrum hantzchii	11,785	0.003
2	Schizogonium murale	75,422	0.001
1	Navicula sp.	5,892	0.006
10	Unknown #139	5,892	0.003
2	Stichococcus sp.	15,864	0.002
1	Navicula sp.	5,892	0.004
1	Cymbella sp.	5,892	0.015
	TOTALS	144,318	0.083

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	*BIOMASS (MG/LITER)	*PERCENT BIOMASS
1. Bacillariophyceae	29,462	20.41	0.037	44.55
2. Chlorophyceae	91,287	63.25	0.002	2.91
3. Chrysophyceae	5,892	4.08	0.037	44.86
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	17,677	12.25	0.006	7.68
TOTALS	144,318	100.00	0.083	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
4 NOVEMBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
3	Pinnularia sp.	5,892	0.037
1	Navicula sp.	11,785	0.009
2	Schizogonium murale	494,960	0.005
10	Unknown 141	491	0.000
4	Chroococcus sp.	23,570	0.003
2	Stichococcus sp.	22,663	0.002
1	Cyclotella ,dia.=16um	5,892	0.002
10	Unknown #139	5,892	0.003
10	Actinastrum hantzchii	64,816	0.018
1	Gomphonema sp.	11,785	0.012
	TOTALS	647,746	0.092

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	*BIOMASS (MG/LITER)	*PERCENT BIOMASS
1. Bacillariophyceae	29,462	4.55	0.023	25.33
2. Chlorophyceae	517,623	79.91	0.007	7.98
3. Chrysophyceae	5,892	0.91	0.037	40.43
4. Cyanophyceae	23,570	3.64	0.003	3.35
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	71,200	10.99	0.021	22.92
TOTALS	647,746	100.00	0.092	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
11 NOVEMBER, 1982
CLAYTON, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Schizogonium murale	353,543	0.004
2	Crucigenia sp.	5,892	0.003
10	Unknown #77	5,892	0.002
1	Navicula sp.	11,785	0.009
10	Actinastrum hantzchii	11,785	0.003
10	Unknown #119	11,785	0.076
2	Scenedesmus sp.	5,892	0.008
1	Cyclotella sp.,dia.=16um	5,892	0.001
1	Unknown #84	47,139	0.000
	TOTALS	459,606	0.105

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	*BIOMASS (MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	64,816	14.10	0.010	9.69
2. Chlorophyceae	365,327	79.49	0.014	13.23
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	29,462	6.41	0.081	77.08
TOTALS	459,606	100.00	0.105	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
11 NOVEMBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
1	Stauroneis sp.	17,677	0.009
1	Diploneis sp.	5,892	0.139
1	Navicula sp.	23,570	0.023
10	Unknown #119	5,892	0.038
1	Didimosphenia sp.	5,892	0.017
1	Navicula sp.	29,462	0.022
3	Pinnularia sp.	5,892	0.037
1	Nitzchia sp.	17,677	0.003
2	Stichococcus sp.	23,570	0.002
2	Schizogonium murale	212,126	0.002
1	Cyclotella ,dia.=16um	29,462	0.011
1	Navicula sp.	5,892	0.007
10	Unknown #71	17,677	0.016
1	Cymatopleura sp.	5,892	0.031
1	Navicula sp.	5,892	0.003
10	Unknown #75	244,534	0.016
10	Unknown #139	5,892	0.003
2	Scenedesmus sp.	11,785	0.007
1	Pinnularia sp.	11,785	0.045
1	Navicula sp.	11,785	0.002
1	Cyclotella ,dia.=16um	5,892	0.002
1	Navicula sp.	5,892	0.004
1	Didimosphenia sp.	5,892	0.017
10	Actinastrum hantzchii	17,677	0.005
	TOTALS	733,601	0.429

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	188,556	25.70	0.334	77.97
2. Chlorophyceae	247,480	33.73	0.011	2.67
3. Chrysophyceae	5,892	0.80	0.037	8.63
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	291,673	39.76	0.046	10.73
TOTALS	733,601	100.00	0.429	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
18 NOVEMBER, 1982
CLAYTON, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Unknown #41	15,713	0.000
2	Schizogonium murale	527,957	0.005
2	Crucigenia tetrapedia	5,892	0.000
1	Navicula sp.	11,785	0.009
2	Crucigenia sp.	5,892	0.003
2	Scenedesmus sp.	5,892	0.003
2	Crucigenia rectangularis	29,462	0.011
10	Unknown green coccoid cell	94,278	0.000
10	Unknown #139	5,892	0.003
1	Navicula sp.	5,892	0.006
2	Crucigenia fenestrata	5,892	0.001
2	Scenedesmus sp.	5,892	0.005
2	Unknown #82	35,354	0.007
2	Unknown coccoid cell,dia.=6um	29,462	0.005
	TOTALS	785,258	0.058

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	17,677	2.25	0.015	24.94
2. Chlorophyceae	651,697	82.99	0.040	69.36
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	115,883	14.76	0.003	5.70
TOTALS	785,258	100.00	0.058	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
18 NOVEMBER, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Stichococcus sp.	5,439	0.001
10	Unknown #139	5,892	0.003
1	Navicula sp.	5,892	0.001
10	Unknown #18	5,892	0.008
2	Scenedesmus sp.	23,570	0.014
2	Schizogonium murale	122,561	0.001
10	Unknown #139	5,892	0.003
10	Actinastrum hantzchii	5,892	0.002
1	Navicula sp.	29,462	0.022
2	Scenedesmus sp.	17,677	0.023
10	Unknown 141	982	0.000
1	Navicula sp.	5,892	0.009
10	Unknown #71	5,892	0.005
1	Nitzchia sp.	5,892	0.012
4	Chroococcus sp.	23,570	0.003
1	Cyclotella ,dia.=16um	17,677	0.007
1	Unknown #92	5,892	0.004
1	Nitzchia sp.	5,892	0.001
1	Navicula sp.	5,892	0.003
10	Unknown #75	29,462	0.002
	TOTALS	335,216	0.111

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	82,493	24.61	0.057	50.93
2. Chlorophyceae	169,247	50.49	0.039	34.87
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	23,570	7.03	0.003	2.75
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	59,906	17.87	0.013	11.45
TOTALS	335,216	100.00	0.111	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
23 NOVEMBER, 1982
COWPEN, N.C.

**CLASS	***** CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Stichococcus sp.	56,657	0.006
1	Navicula sp.	41,247	0.030
1	Eunotia sp.	11,785	0.008
2	Schizogonium murale	28,283	0.000
4	Chroococcus sp.	23,570	0.003
1	Cyclotella sp.,dia.=16um	5,892	0.001
4	Chroococcus sp.	58,924	0.008
2	Scenedesmus sp.	5,892	0.008
2	Scenedesmus sp.	11,785	0.007
1	Navicula sp.	11,785	0.012
10	Unknown 141	491	0.000
3	Pinnularia sp.	5,892	0.037
2	Crucigenia sp.	35,354	0.016
2	Unknown coccoid cell,dia.=6um	82,493	0.014
1	Nitzchia sp.	5,892	0.012
2	Scenedesmus quadricauda	5,892	0.004
1	Navicula sp.	17,677	0.008
10	Unknown #77	5,892	0.002
2	Pediastrum biradiatum	35,354	0.008
2	Fragillaria sp.	5,892	0.003
1	Nitzchia sp.	5,892	0.001
	TOTALS	462,544	0.187

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	100,170	21.66	0.071	38.17
2. Chlorophyceae	267,605	57.85	0.066	35.35
3. Chrysophyceae	5,892	1.27	0.037	19.79
4. Cyanophyceae	82,493	17.83	0.011	5.73
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	6,383	1.38	0.002	0.96
TOTALS	462,544	100.00	0.187	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
23 NOVEMBER, 1982
CLAYTON, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
2	Schizogonium murale	824,933	0.008
10	Unknown #77	11,785	0.004
1	Navicula sp.	17,677	0.018
1	Navicula sp.	5,892	0.006
1	Navicula sp.	5,892	0.004
2	Scenedesmus sp.	11,785	0.007
1	Nitzchia sp.	11,785	0.002
1	Acnanthes sp.	5,892	0.001
2	Stichococcus sp.	6,799	0.001
2	Crucigenia sp.	17,677	0.008
1	Navicula sp.	5,892	0.001
2	Scenedesmus sp.	5,892	0.008
3	Pinnularia sp.	5,892	0.037
	TOTALS	937,795	0.104

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER *	BIOMASS (MG/LITER)*	PERCENT BIOMASS
1. Bacillariophyceae	53,031	5.65	0.032	30.56
2. Chlorophyceae	867,086	92.46	0.031	30.28
3. Chrysophyceae	5,892	0.63	0.037	35.73
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	0	0.00	0.000	0.00
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	11,785	1.26	0.004	3.43
TOTALS	937,795	100.00	0.104	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
3 DECEMBER, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Unknown 141	1,768	0.000
10	Unknown #127	14,142	0.171
2	Crucigenia rectangularis	28,283	0.011
10	Actinastrum hantzchii	56,567	0.016
1	Navicula sp.	7,071	0.004
5	Unknown #100	7,071	1.399
1	Cyclotella,dia.=18um	7,071	0.007
3	Pavlova sp.	35,354	0.003
10	Unknown #77	7,071	0.002
10	Unknown #137	49,496	0.005
2	Scenedesmus sp.	7,071	0.004
2	Unknown coccoid cell,dia.=6um	176,771	0.031
2	Unknown coccoid cell,dia.=6um	14,142	0.002
1	Navicula sp.	28,283	0.021
2	Unknown #85	7,071	0.010
1	Cyclotella dia.= 20um	14,142	0.022
1	Eunotia sp.	7,071	0.004
2	Stichococcus sp.	19,581	0.002
1	Diploneis sp.	7,071	0.006
1	Diploneis sp.	7,071	0.006
2	Scenedesmus quadricauda	14,142	0.010
1	Navicula sp.	21,213	0.031
2	Schizogonium murale	192,327	0.002
10	Unknown #151	21,213	0.017
10	Unknown #152	7,071	0.065
	TOTALS	758,132	1.851

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	98,992	13.06	0.100	5.42
2. Chlorophyceae	459,388	60.59	0.072	3.87
3. Chrysophyceae	35,354	4.66	0.003	0.17
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	7,071	0.93	1.399	75.61
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	157,327	20.75	0.276	14.93
TOTALS	758,132	100.00	1.851	100.00

NEUSE RIVER ESTUARY
PHYTOPLANKTON NUMBERS AND BIOMASS
13 DECEMBER, 1982
COWPEN, N.C.

CLASS ***	CELL NAME ***************	CELLS/LITER ***	BIOMASS (MG/LITER)
10	Actinastrum hantzchii	14,142	0.004
1	Navicula sp.	7,071	0.009
1	Cyclotella dia.= 20um	7,071	0.011
10	Unknown #153	7,071	0.003
1	Navicula sp.	21,213	0.022
1	Navicula sp.	14,142	0.008
5	Unknown #100	7,071	1.399
1	Navicula sp.	7,071	0.010
1	Navicula sp.	7,071	0.008
2	Crucigenia sp.	7,071	0.003
10	Unknown #129	7,071	0.031
1	Didimosphenia sp.	7,071	0.020
2	Schizogonium murale	84,850	0.001
10	Unknown #153	7,071	0.003
10	Unknown #154	7,071	0.003
1	Cocconeis sp.	7,071	0.024
10	Unknown #152	7,071	0.065
1	Navicula sp.	7,071	0.005
1	Acnanthes sp.	7,071	0.004
10	Unknown #118	7,071	0.068
	TOTALS	247,480	1.702

*** CLASS *********	CELLS/LITER *	PERCENT CELLS/LITER	BIOMASS *(MG/LITER)	PERCENT *BIOMASS
1. Bacillariophyceae	91,921	37.14	0.122	7.16
2. Chlorophyceae	91,921	37.14	0.004	0.23
3. Chrysophyceae	0	0.00	0.000	0.00
4. Cyanophyceae	0	0.00	0.000	0.00
5. Dinophyceae	7,071	2.86	1.399	82.22
6. Euchlorophyceae	0	0.00	0.000	0.00
7. Euglenophyceae	0	0.00	0.000	0.00
8. Haptophyceae	0	0.00	0.000	0.00
9. Xanthophyceae	0	0.00	0.000	0.00
10.Unknown	56,567	22.86	0.177	10.39
TOTALS	247,480	100.00	1.702	100.00

APPENDIX II. Locations of USGS and NCDNRCD-DEM sampling stations along the Neuse River

Station Name	Storet Number	KM Above New Bern
South Flat River at Hurdle Mills	J0970000	350
Neuse River Falls	J1890000	285
Neuse River Near Wake Crossroads	J2290000	278
Neuse River Near Clayton	J4170000	230
Neuse River at Smithfield	J4370000	209
Neuse River Near Stevens Mill	J5450000	177
Neuse River at Goldsboro	J5970000	150
Neuse River at Kinston	J6150000	85
Neuse River Near Graingers	J6260000	72
Neuse River Near Fort Barnwell	J7850000	37
Neuse River at Streets Ferry	J7930000	14
Neuse River Near Askin	J8250000	11
Neuse River Near Washington Forks	J8290000	9
Neuse River Near New Bern	J8530000	0
Neuse River Near Thurman	J8902500	-11
Neuse River Near Oriental	J9810000	-35
Neuse River at Mouth Near Pamlico	J9930000	-53