

DUKE POWER COMPANY  
CATAWBA NUCLEAR STATION  
INTERIM MONITORING STUDY

June 1980 - July 1981

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## INTRODUCTION

Lake Wylie, located in North and South Carolina, is the third largest of eleven reservoirs impounding the Catawba River by Duke Power Company. This reservoir extends north 28 miles from the Wylie Dam up to the Mountain Island Dam. At full pond elevation (569.4 feet above MSL) Lake Wylie has a surface area of approximately 5000 ha, and contains a total volume of approximately  $3.46 \times 10^8 \text{ m}^3$  with a mean depth of approximately 7 meters (Industrial Bio-Test Laboratories 1974; USEPA 1975). Lake Wylie has a drainage basin of 3020 square miles (Duke Power Company Data Manual 1980) with 630 square miles drained by the South Fork Catawba River (Industrial Bio-Test Laboratories 1974). The lake receives 50% of its water from the Catawba River via Mountain Island reservoir, 25% from the South Fork River and 25% from local tributary input and runoff (Industrial Bio-Test Laboratories 1974). Based on an average flow of 125 cms through Wylie Dam, the average theoretical retention time of the reservoir is 32 days (Industrial Bio-Test Laboratories 1974).

The reservoir serves the Wylie Hydroelectric Station (60 megawatts) which has an average generating discharge of 116 cms. During operation, water is withdrawn from a depth of 6 to 18 meters and discharged downstream. The lake also serves as a cooling water source for Plant Allen Steam Station, a 1155 megawatt fossil fired steam generating station. Plant Allen, located on the northern portion of Lake Wylie between the Catawba River and the South Fork River, draws cooling water from the Catawba River at a maximum rate of 38 cms. This water is used for once through condenser cooling and discharged into the South Fork River.

In addition, Lake Wylie will supply makeup water at an average flow of 10 cms for the Catawba Nuclear Station (CNS). Catawba Nuclear Station is located in York County, South Carolina, with the site being near the center of a peninsula lying between Beaver Dam Creek on the north, Big Allison Creek on the south, and the main body of Lake Wylie on the east (Figure 1). The cooling water will be withdrawn from the main body of the lake and will pass through a maximum of ten cycles of concentration in mechanical draft cooling towers with the blowdown to be discharged at a rate of 0.15 cms into the Allison Creek arm of Lake Wylie.

In August 1974, Duke Power Company, Environmental Services Section began a sampling program on Lake Wylie. This program constitutes the interim monitoring program for Catawba Nuclear Station. The interim study conforms to the 1977-1979 interim program stated in the Catawba Nuclear Station Environmental Report (CNSER Section 6.1.1.1.2 - Table 6.1.1-4). Data for the period 1974 through 1980 have been reported by Duke Power Company (1977a, 1978, 1979, 1980a). The data contained in this report cover the period July 1980 through June 1981. The objectives of the interim study for Catawba Nuclear Station are to:

- (1) document any long-term trends in the temporal variability of Lake Wylie water quality and,
- (2) compare long-term trends in the water quality data immediately above and below the CNS site.

#### MATERIALS AND METHODS

Sampling locations were monitored from July 1980 through June 1981 (Figure 1; Table 1). The sampling regime is listed in Table 2. A Hydrolab Model 6D

water quality surveyor was used for all in-situ measurements. Water samples were collected with a diaphragm pump. The analytical methods for chemical and physical constituents measured on Lake Wylie are listed in Table 3. Quality assurance practices adhered to USEPA (1972).

#### Data Analysis

Daily precipitation totals at Douglas Municipal Airport, Charlotte, North Carolina were plotted for July 1980 through June 1981 (National Oceanic and Atmospheric Administration: 1979-1980). Also, daily Lake Wylie forebay surface elevations were plotted to indicate lake levels for the period. Mean daily discharge at Wylie Hydroelectric Station and at Mountain Island Hydroelectric Station were also plotted to indicate daily discharges (Figure 2).

The water quality data were subjected to descriptive statistics (means, standard deviation, maximum and minimum values) as outlined in Barr et al. (1976). Also, the data were subjected to Pearson's correlation analysis (Helwig and Council 1970). Only results with  $p \leq 0.05$  were considered statistically significant. Standard deviation is denoted by "s". For statistical calculations, all analytical determinations recorded as less than the detection limit were assumed to be equal to the detection limit as listed in Table 3. Bicarbonate values were calculated from alkalinity values using factors found in Hem (1970). Water samples were not analyzed for iron during May 1981.

To summarize the large amount of data collected from July 1980 through June 1981 the following locations were grouped into specific regions as previously reported: Catawba River region (Locations 250.0 and 260.0), South Fork Catawba River region (Locations 240.0 and 249.0), Catawba Nuclear

Intake region (Locations 220.0 and 225.0) and Catawba Nuclear Station Discharge region (Locations 210.0 and 215.0). These groupings were based primarily on the geographic area of each location on Lake Wylie. Data obtained from Locations 220.0, 235.0, 242.0 and 272.0 were used to discuss annual lakewide variability. In discussing seasonal variability among quarterly data the following monthly divisions were made: summer (July), fall (November), winter (January) and spring (May).

The physicochemical data collected on Lake Wylie during the 1980 through 1981 interim period are available in Duke Power Company offices.

#### SUMMARY AND CONCLUSIONS

In-situ profile data were collected monthly and water samples for laboratory analyses were collected quarterly during the period July 1980 through June 1981. As noted in previous reports, local hydrology and meteorology exerted the primary influence upon chemical and physical parameters variability.

The South Fork Catawba River continued to be strongly influenced by surface runoff, municipal and industrial discharges, and thermal discharges from Plant Allen Steam Station. Receiving primary discharge from Mountain Island Lake, the Catawba River continued to exhibit trends of a well-mixed riverine system. The region of Lake Wylie immediately above and below Catawba Nuclear Station displayed characteristics of a warm monomictic lake (Hutchinson 1957).

Water temperatures throughout Lake Wylie generally followed seasonal variations. As observed in previous study periods, temperature profiles in the South Fork sector displayed stratification arising from heated discharge

water from Plant Allen. Temperatures in the Catawba River region indicated well mixed conditions. The maximum water temperature was measured in the South Fork Catawba River region which is influenced by thermal discharge from Plant Allen. The minimum temperature was measured during January at Location 249.0. Thermal stratification was apparent during the spring and summer. Isothermal conditions were observed in the regions immediately above and below CNS from November through March.

Dissolved oxygen (DO) concentrations generally reflected the relationship between oxygen solubility and water temperature. Lowest DO concentrations generally occurred from July through October resulting in anoxic or near anoxic conditions in the bottom waters. The maximum DO concentration was observed during January and February in the Catawba Nuclear Station discharge region.

Due to below normal precipitation levels during the period ending June 1981, turbidity values were generally less than 15 NTU. Lake Wylie is a soft water lake, exhibiting a hardness value of  $15 \text{ mg-CaCO}_3 \cdot \text{l}^{-1}$ .

Nutrient and mineral concentrations in Lake Wylie continued exhibiting trends similar to those observed during previous studies. As reported previously, the nutrient concentrations in the South Fork Catawba River were generally higher than any of the other regions of the lake. Total phosphorus concentrations were greatest in the South Fork Catawba River region. Total phosphorus concentrations were generally lower in the rest of the lake with no consistent uplake or downlake trends.

Analyses of cadmium, copper, and lead indicated concentrations and spatial variability similar to previous years (Duke Power Company 1977, 1978, 1979,

1980). Heavy metal concentrations were higher in the South Fork Catawba River region as previously reported.

Lake Wylie resembles other Piedmont reservoirs. The chemical and physical constituents measured on Lake Wylie continued exhibiting trends similar to those observed during previous studies. No significant changes were observed from the previous year interim period.

## RESULTS AND DISCUSSION

### Physical Variables (Temperature, Dissolved Oxygen, Turbidity)

Lake Wylie temperatures ranged from 2.3°C during January (Location 249.0) to 38.2°C during July (Location 242.0). Maximum temperatures were observed during the warmest months July (38.2°C) and August (36.4°C). The highest temperature each month was measured in the South Fork Catawba River region due to thermal discharges from Plant Allen Steam Station (Figure 3). Minimum temperatures were recorded lakewide during January (2.3°C, Location 249.0) and February (4.9°C, Location 215.0). With the exception of the low January temperature at Location 249.0, the water temperature was always above 4°C. Thermal stratification was apparent from May through August.

The South Fork Catawba River region was stratified each month as in past studies (Industrial Bio-Test Laboratories 1974, Duke Power Company 1977a, 1978, 1979, 1980a). As a result of thermal discharge from Plant Allen, a surface plume of heated water frequently extended upstream and downstream (approximately 1.5 miles) from the point of discharge (Industrial Bio-Test 1974). As indicated by the consistently small difference between maximum and minimum water temperatures, the Catawba River region is a thermally well-mixed riverine system. Surface to bottom temperature values at CNS intake and

discharge exhibited little vertical difference from July 1980 through June 1981 (Figure 5-6). The maximum difference in vertical temperature values ( $5^{\circ}\text{C}$ ) was observed at CNS intake and discharge during July 1980 and June 1981 (Figure 5-6). Previous studies reported temperature trends similar to those observed during this period (Duke Power Company 1977a, 1978, 1979, 1980a).

Following seasonal patterns typical of other Piedmont Carolina reservoirs (Duke Power Company 1977b; Industrial Bio-test Laboratories 1974), dissolved oxygen (DO) concentrations in Lake Wylie ranged from  $0.0\text{ mg}\cdot\text{l}^{-1}$  (July) to  $13.5\text{ mg}\cdot\text{l}^{-1}$  (January). Highest concentrations occurred in January and February and the lowest DO concentrations generally occurred from July through October (Figures 3, 4, 6). Dissolved oxygen concentrations in the water column began to decline in April with the bottom waters being less than  $5.0\text{ mg}\cdot\text{l}^{-1}$  from July through September 1980 and June 1981 (Figures 3, 4, 6). Surface DO concentrations were always above  $5.0\text{ mg}\cdot\text{l}^{-1}$ . These DO trends were similar to those observed in previous reports (Duke Power Company 1977a, 1978, 1979, 1980a).

The mean DO concentrations in both the Catawba River and the South Fork Catawba River regions were consistently higher during the warmest months than the regions immediately above and below Catawba Nuclear Station (Figures 3, 4). This was due to the more extensive oxygen depletion of the bottom waters in the deeper downlake regions during the stratified period. Mean monthly DO concentrations were nearly identical among the locations in the downlake regions throughout the study. Depletion of hypolimnetic oxygen occurred during the summer months (Figure 6), as previously observed (Duke Power Company 1977a, 1978, 1979, 1980a).

Turbidity, ranged from 3 to 105 NTU ( $\bar{x} = 11.9$ ,  $s = 16$ ). Turbidity values fluctuated about 15 NTU. Highest turbidity values were recorded in the Catawba River region and the South Fork Catawba River region during summer and fall (105 NTU, Location 240.0; July) (Figure 7) and were similar to spatial trends observed in previous reports (Duke Power Company 1977, 1978, 1979, 1980). Turbidity values in the downlake locations immediately above and below the Catawba Nuclear Station were 5 NTU during the winter and spring, with values of 15 NTU or less during other seasons. A general decrease in turbidity was observed during the period throughout the lake due to a decrease in rainfall (Figure 7).

#### Alkalinity and pH

Alkalinity values exemplified a soft water lake (Wetzel 1975). Monthly values ranged from 4 to 27 mg-CaCO<sub>3</sub>·l<sup>-1</sup> ( $\bar{x} = 15$ ,  $s = 4$ ). Lake Wylie was slightly acidic with 86% of the pH values less than 7.0 pH units. During this interim period, pH values ranged from 5 (Location 272; November) to 9 (Locations 210.0, 215.0, and 200.0; June) ( $\bar{x} = 7.0$ ,  $s = 0.5$ ). The higher summer pH values observed in the surface waters were attributed to photosynthetic activity. The seasonal pH trends were similar to those previously reported. Alkalinity and pH values exhibited little spatial differences.

#### Specific Conductance and Hardness

Specific conductance values ranged from 42 to 296  $\mu\text{mho}\cdot\text{cm}^{-1}$  ( $\bar{x} = 102$   $\mu\text{mho}\cdot\text{cm}^{-1}$ ,  $s = 34$ ). As observed in past years, specific conductance values were higher in the South Fork Catawba River region than in either the Catawba River region or the downlake regions in the vicinity of CNS. Previous studies of Lake Wylie reported slightly lower conductivity values

(range of 30 to 198  $\mu\text{mho}\cdot\text{cm}^{-1}$  during the period 1979-1980). No appreciable variation was observed between the conductivities of the lake regions immediately above and below CNS. Lake Wylie waters, exhibiting a hardness value of  $15 \text{ mg-CaCO}_3\cdot\text{l}^{-1}$ , exemplified a soft water lake (Wetzel 1975).

#### Mineral Composition

No substantial monthly or yearly variability was observed in mineral concentrations (Figure 8). Sodium and bicarbonate were the major ions in Lake Wylie. Calcium, chloride, magnesium, silica, and potassium were also abundant constituents in Lake Wylie (Figure 8). Minor mineral constituents included aluminum, iron, and manganese (Figure 8).

#### Aquatic Nutrients (Nitrogen and Phosphorus)

The mean nitrate plus nitrite concentration was  $0.21 \text{ mg-N}\cdot\text{l}^{-1}$  ( $s = 0.14$ ), with concentrations ranging from less than  $0.006 \text{ mg-N}\cdot\text{l}^{-1}$  (July 1980) to  $0.88 \text{ mg-N}\cdot\text{l}^{-1}$  (January 1981). The trends observed during the 1979-1980 study continued through the 1980 - 1981 period (Figure 9). Maximum concentrations of nitrate plus nitrite generally occurred in winter and spring. The lower nitrate plus nitrite concentrations occurred during July and were indicative of low DO concentration and low oxidation-reduction potential ( $-60 \text{ mv}$ ; July 1980) (Wetzel 1975) in Lake Wylie bottom waters.

Upstream loading along the South Fork River (Industrial Bio-Test Laboratories 1974) resulted in higher nitrate plus nitrite concentrations in the South Fork Catawba River region than any of the other three regions of the lake (Figure 9). The lake regions immediately above and below CNS continued to display previous observed seasonal patterns with slightly lower concentrations at the CNS discharge region. Nitrate plus nitrite concentrations were similar to those reported in previous studies (Figure 9).

The mean ammonia concentration for the study was  $0.22 \text{ mg-N}\cdot\text{l}^{-1}$  ( $s = 1.2$ ), with concentrations ranging from less than  $0.005 \text{ mg-N}\cdot\text{l}^{-1}$  (January 1981) to  $12 \text{ mg-N}\cdot\text{l}^{-1}$  (November 1980). Indicative of an upstream point source loading, the highest ammonia value ( $12 \text{ mg-N}\cdot\text{l}^{-1}$ ) was observed in November at the Catawba River region (Location 260.0) (Figure 10). Higher ammonia concentrations were observed in the uplake regions during November and January than observed in past years (Figure 10).

The temporal trends of total phosphorus and orthophosphate were similar. Orthophosphate concentrations ranged from less than  $0.005 \text{ mg-P}\cdot\text{l}^{-1}$  (26%) to  $0.22 \text{ mg-P}\cdot\text{l}^{-1}$  ( $\bar{x} = 0.022 \text{ mg-P}\cdot\text{l}^{-1}$ ,  $s = 0.03$ ). Orthophosphate concentrations were higher in the deeper water regions immediately above and below CNS during the fall and may have been due to the release of orthophosphate from the sediment during anoxic conditions (Golterman 1975). Orthophosphate concentrations in the South Fork Catawba River region were considerably higher than the concentrations in the Catawba River region. Orthophosphate concentrations in the lower lake regions were intermediate between the South Fork Catawba River and the Catawba River region. Previous studies reported orthophosphate trends similar to those observed during this period (Duke Power Company 1977a, 1978, 1979, 1980a).

During the study period, total phosphorus concentrations ranged from 0.01 to  $0.50 \text{ mg-P}\cdot\text{l}^{-1}$  ( $\bar{x} = 0.050$ ,  $s = 0.07$ ). Total phosphorus concentrations decreased with distance downstream from the South Fork Catawba River region. As in previous years, highest levels of total phosphorus were observed in the South Fork Catawba River region throughout the year with the greatest concentration ( $0.50 \text{ mg-P}\cdot\text{l}^{-1}$ ) measured during July (Figure 11).

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Table 1. Lake Wylie water quality monitoring locations and depths.

<u>Sampling Location #</u>	<u>Total Depth (m)</u>	<u>Description</u>
		Catawba River at Rt. 29-74 bridge, mid-channel
250.0	5	Catawba River, 25 m from Allen Steam Station intake screen
249.0	3-4	South Fork Catawba River at Upper Armstrong Bridge, mid-channel
240.0	11-12	South Fork Catawba River at Lower Armstrong Bridge, mid-channel
225.0	14-15	Lake Wylie at Route 49 Bridge, mid-channel
220.0	15	Lake Wylie near mouth of embayment near proposed intake to CNS, mid-channel
210.0	16-17	Lake Wylie near mouth of Big Allison Creek and Catawba River, due east of Goat Island, mid-channel
215.0	9-10	Big Allison Creek, near bridge over proposed discharge for CNS, mid-channel

Table 2. Lake Wylie Interim Monitoring Program

Location	210.0 <sup>+</sup>	215.0 <sup>+</sup>	220.0 <sup>+</sup>	225.0 <sup>+</sup>	240.0 <sup>+</sup>	249.0 <sup>+</sup>	250.0 <sup>+</sup>	260.0 <sup>+</sup>
<u>In-Situ Analyses</u>								
Temperature <sup>+</sup>	in-situ parameters are acquired monthly using the In-situ Water Quality Analyzer							
Dissolved oxygen <sup>+</sup>	at all locations at 1 m intervals from the surface (0.3 m) to 1 m above the bottom.							
pH <sup>+</sup>								
Specific conductance <sup>+</sup>								
<u>Laboratory Analyses</u>								
Alkalinity <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Turbidity <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Ammonia <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Nitrate-Nitrite <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Orthophosphate <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Total phosphorus <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Chloride <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Silica <sup>+</sup>	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1
Iron <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Manganese <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Magnesium <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Calcium <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Sodium <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Potassium <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Aluminum <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Cadmium <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Copper <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Lead <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Zinc <sup>+</sup>	Q/T,B/1	Q/T,B/1	Q/T,B/1		Q/T,B/1	Q/T/1*	Q/T,B/1	Q/T/1
Total organic carbon <sup>+</sup> *	Q/T,B/2	Q/T,B/2	Q/T,B/2	Q/T,B/1	Q/T,B/1	Q/T/1	Q/T,B/1	Q/T/1

+ - Required by commitment index

\* - Inhouse commitment

Codes

Frequency of Sampling / Depth Intervals / Number of Replicates

Frequency of Sampling:

Depth Intervals:

Number of Replicates:

M - Monthly

Q - Quarterly (Jan-Feb, April-May, Aug, Oct-Nov)

T - Surface (0.3 m)

B - Bottom (1 m above bottom)

1 (only a surface and a bottom sample)

2 (two surface and two bottom samples)

Table 3. Analytical methods for chemical and physical constituents measured on Lake Wylie.

Variables	Method	Preservation	Detection limit <sup>†</sup>	Limit of Determination <sup>†</sup>
Alkalinity, total	Electrometric titration to a pH of 5.1 <sup>1</sup>	4°C	1 mg-CaCO <sub>3</sub> ·l <sup>-1</sup> *	
Aluminum	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.2 mg·l <sup>-1</sup>	0.6 mg·l <sup>-1</sup>
Ammonia	Automated phenate <sup>1</sup>	4°C	0.006 mg-N·l <sup>-1</sup>	0.009 mg-N·l <sup>-1</sup>
Cadmium	Atomic absorption/HGA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.11 µg·l <sup>-1</sup>	0.17 µg·l <sup>-1</sup>
Calcium	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.06 mg·l <sup>-1</sup>	0.08 mg·l <sup>-1</sup>
Chloride	Automated ferricyanide <sup>1</sup>	4°C	0.2 mg·l <sup>-1</sup>	0.3 mg·l <sup>-1</sup>
Conductance, specific	Temperature compensated nickel electrode <sup>1</sup>	In-situ	1 µmho/cm <sup>-1</sup> *	
Copper	Atomic absorption/HGA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.7 µg·l <sup>-1</sup>	1.0 µg·l <sup>-1</sup>
Hardness (Ca, Mg)	Calculation <sup>2</sup>			0.1 mg-CaCO <sub>3</sub> ·l <sup>-1</sup>
Iron, total	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.1 mg·l <sup>-1</sup>	0.2 mg·l <sup>-1</sup>
Lead	Atomic absorption/HGA <sup>1</sup>	0.5% HNO <sub>3</sub>	2 µg·l <sup>-1</sup>	3.2 µg·l <sup>-1</sup>
Magnesium	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.007 mg·l <sup>-1</sup>	0.01 mg·l <sup>-1</sup>
Manganese	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.02 mg·l <sup>-1</sup>	0.06 mg·l <sup>-1</sup>
Nitrate + Nitrite	Automated cadmium reduction <sup>1</sup>	4°C	0.005 mg-N·l <sup>-1</sup>	0.008 mg-N·l <sup>-1</sup>
Orthophosphate	Automated ascorbic acid reduction <sup>1</sup>	4°C	0.005 mg-P·l <sup>-1</sup>	0.008 mg-P·l <sup>-1</sup>
Oxidation-reduction potential	Silver-silver chloride electrode <sup>3</sup>	In-situ	10 mv*	
Oxygen, dissolved	Temperature compensated polarographic cell <sup>1</sup>	In-situ	0.1 mg·l <sup>-1</sup> *	
pH	Temperature compensated glass electrode <sup>1</sup>	In-situ	0.1*	
Phosphorus, total	Persulfate digestion followed by automated ascorbic acid reduction <sup>1</sup>	4°C	0.004 mg-P·l <sup>-1</sup>	0.006 mg-P·l <sup>-1</sup>
Potassium	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.03 mg·l <sup>-1</sup>	0.006 mg-P·l <sup>-1</sup>
Silica	Automated molybdosilicate <sup>1</sup>	4°C	0.2 mg-Si·l <sup>-1</sup>	0.3 mg-Si·l <sup>-1</sup>
Sodium	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	0.03 mg·l <sup>-1</sup>	0.06 mg·l <sup>-1</sup>
Temperature	Thermistor thermometer <sup>1</sup>	In-situ	0.1°C*	
Turbidity	Nephelometric turbidity <sup>1</sup>	4°C	1 NTU*	
Zinc	Atomic absorption/DA <sup>1</sup>	0.5% HNO <sub>3</sub>	4 µg·l <sup>-1</sup>	7 µg·l <sup>-1</sup>

† = The detection limit is defined as:  $DL = \bar{X} + 2(s)$ , where  $\bar{X}$  = mean and  $s$  = standard deviation of a selected number of blanks. The limit of determination is defined as:  $LD = \bar{X} + 5(s)$ .<sup>4</sup>  
 \* = Detection limit and limit of determination were not determined on these variables; instead instrument sensitivity is given.  
 ND = Not determined.



Figure 1. Sampling locations for Catawba Nuclear Station Interim Monitoring. Locations required by the commitment index are underlined.

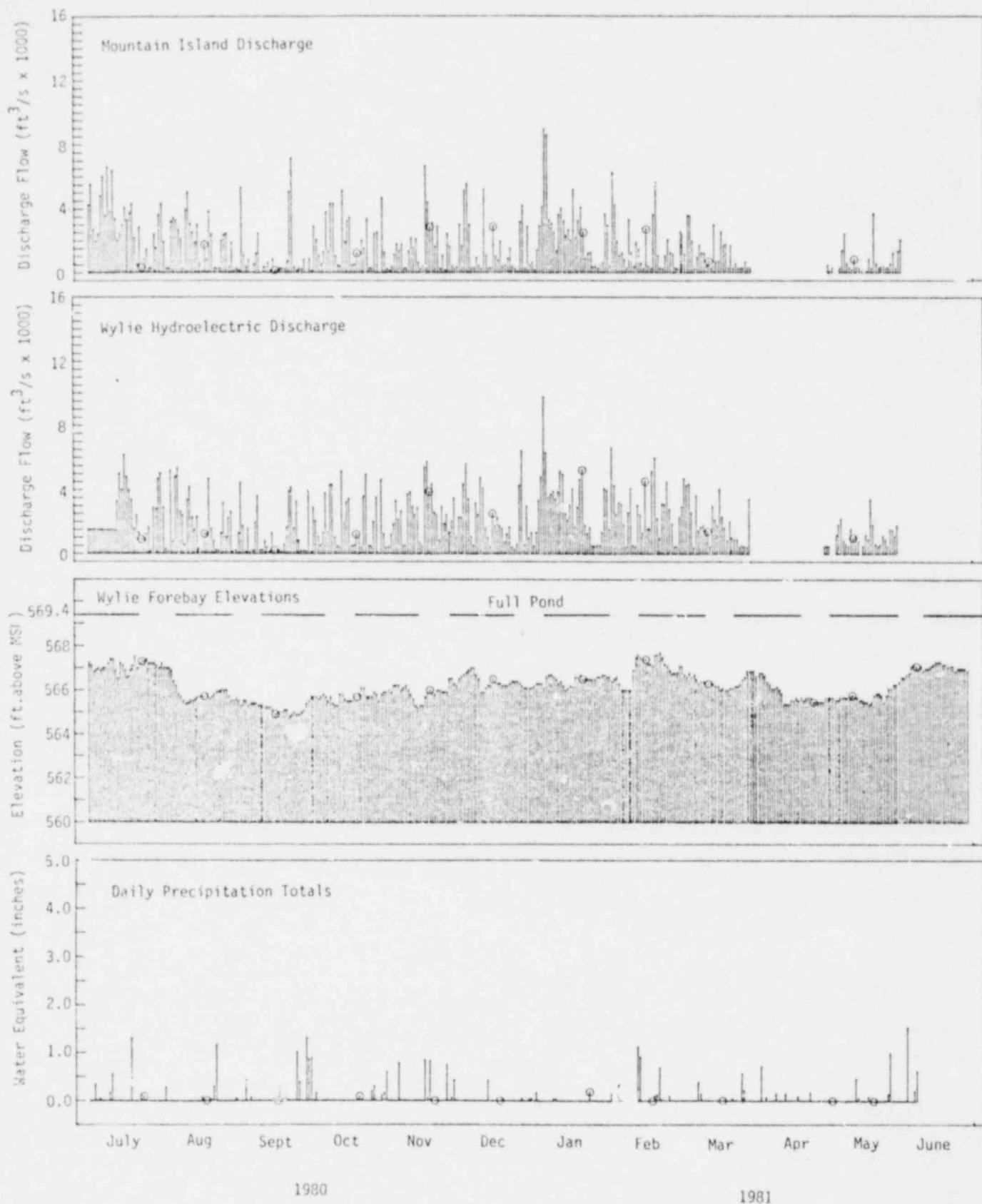


Figure 2. Summary of available hydrologic data for Lake Wylie for the period July 1980 - June 1981. The circle indicates monthly collection of water samples for analyses.



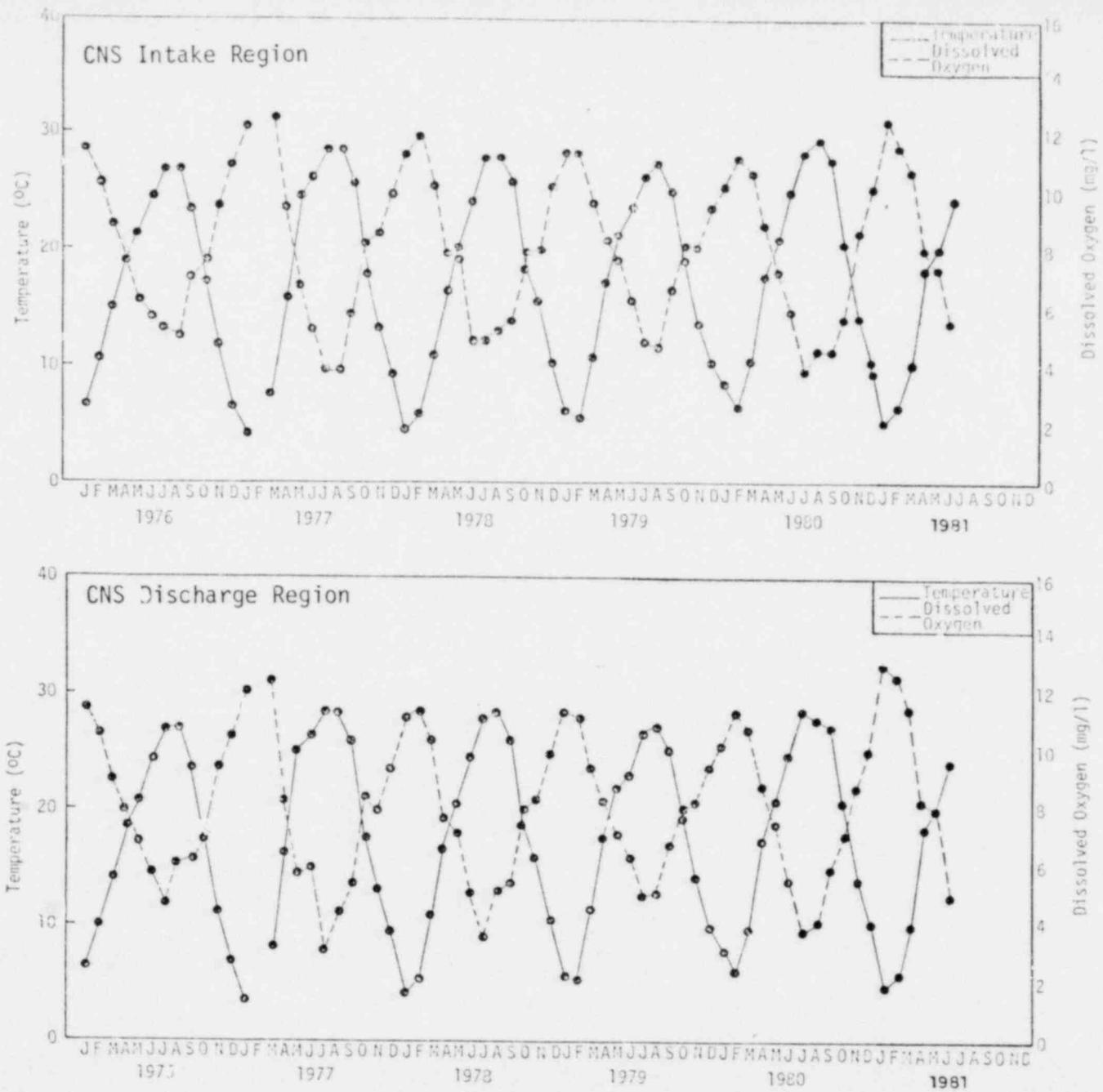


Figure 4. Monthly variations of mean temperature and dissolved oxygen for the CNS Intake and the CNS Discharge regions of Lake Wylie, 1976-1981.

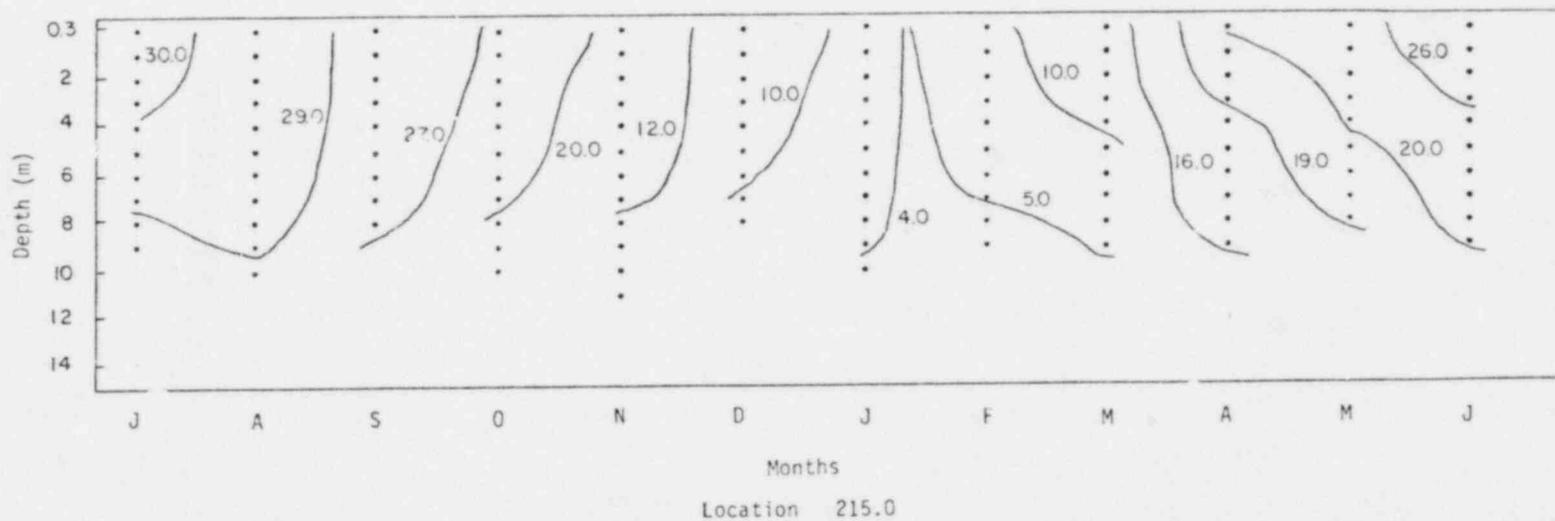
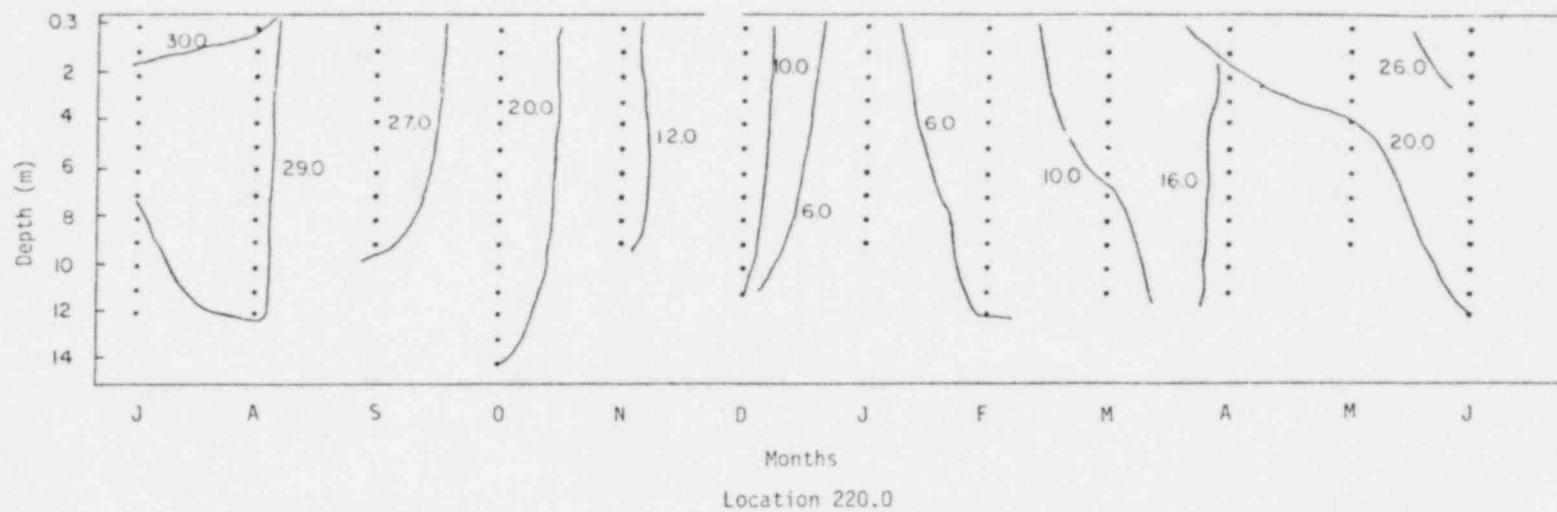


Figure 5. Thermal regimes ( $^{\circ}\text{C}$ ) at CNS Intake (Location 220.0) and CNS Discharge (Location 215.0), July 1980 through June 1981.

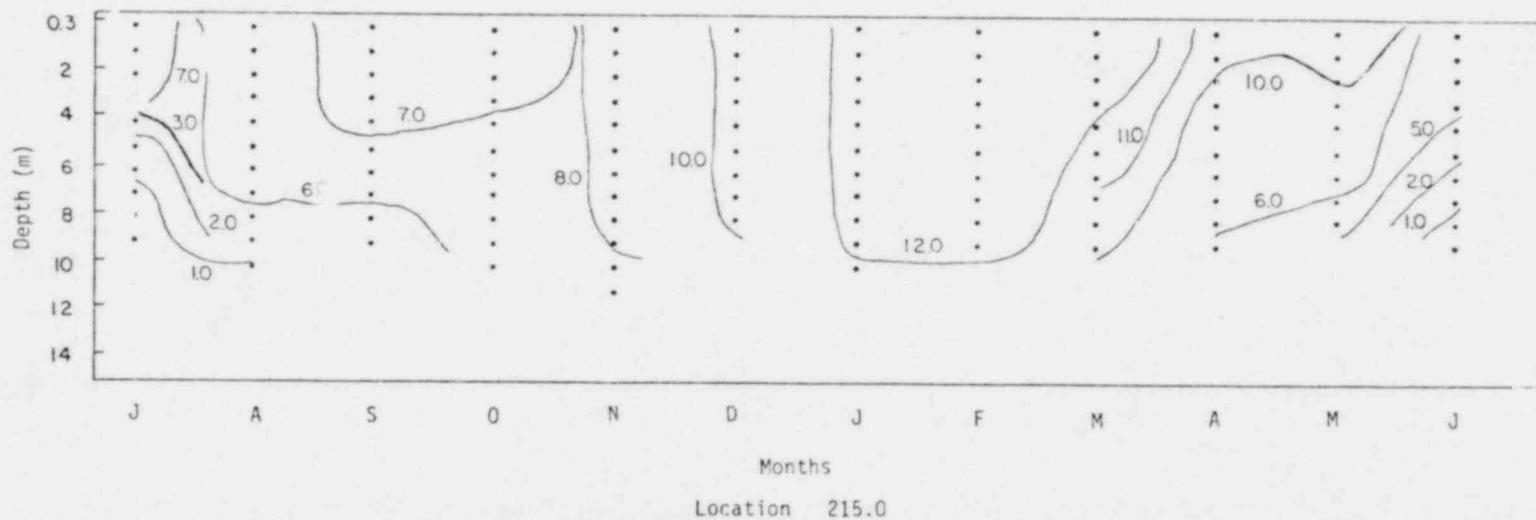
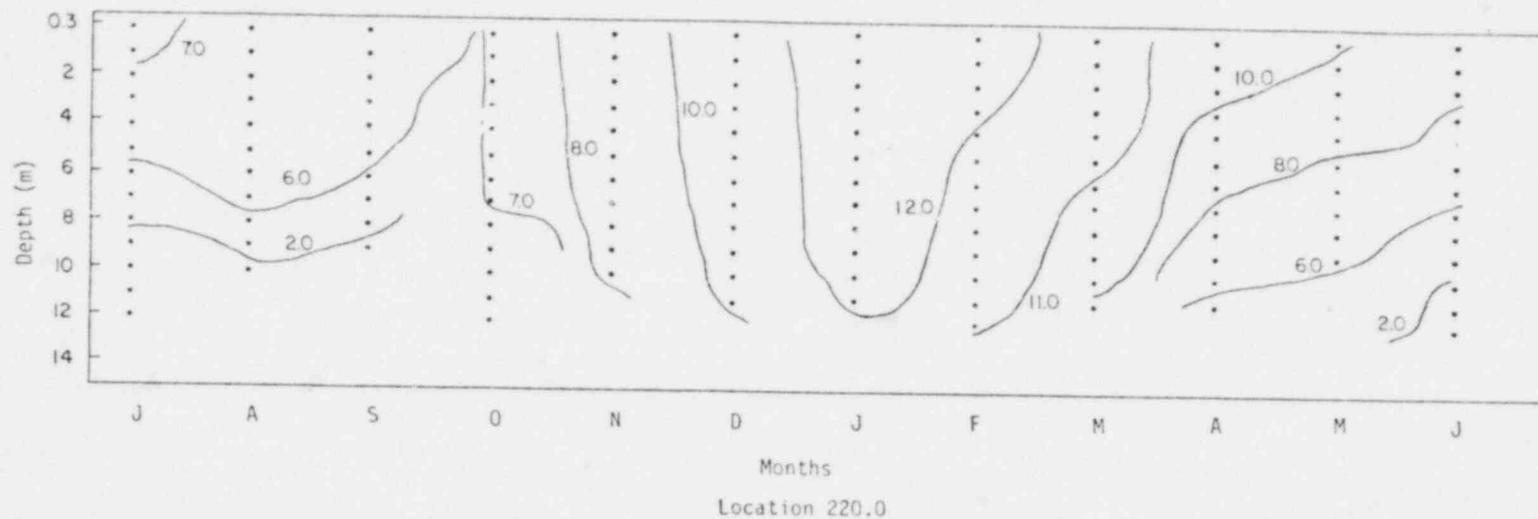


Figure 6. Dissolved Oxygen (mg/l) isopleths at the CNS Intake (Location 220.0) and the CNS Discharge (Location 215.0), July 1980 through June 1981.

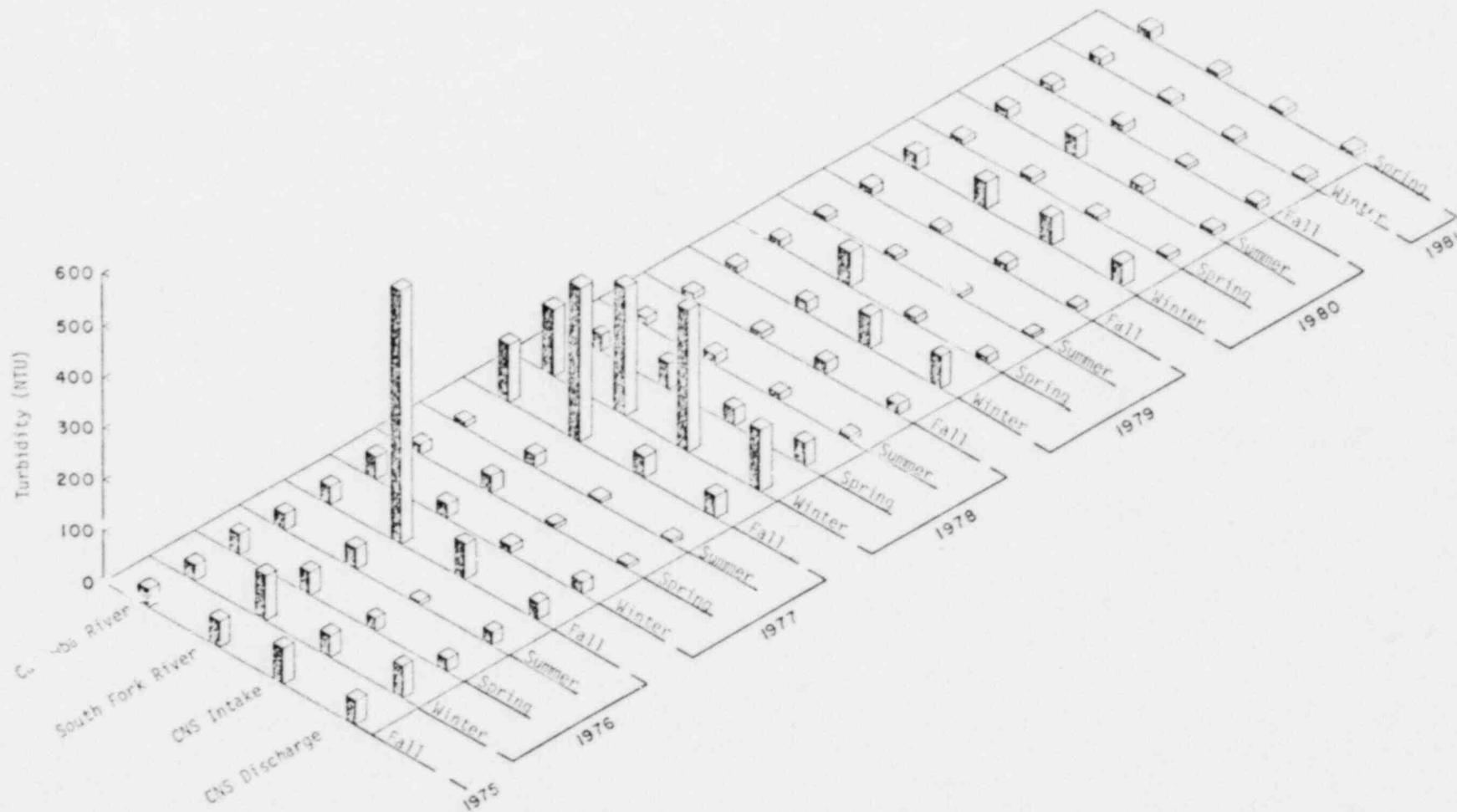


Figure 7. Seasonal variations of mean turbidity for Lake Wylie, 1975-1981.

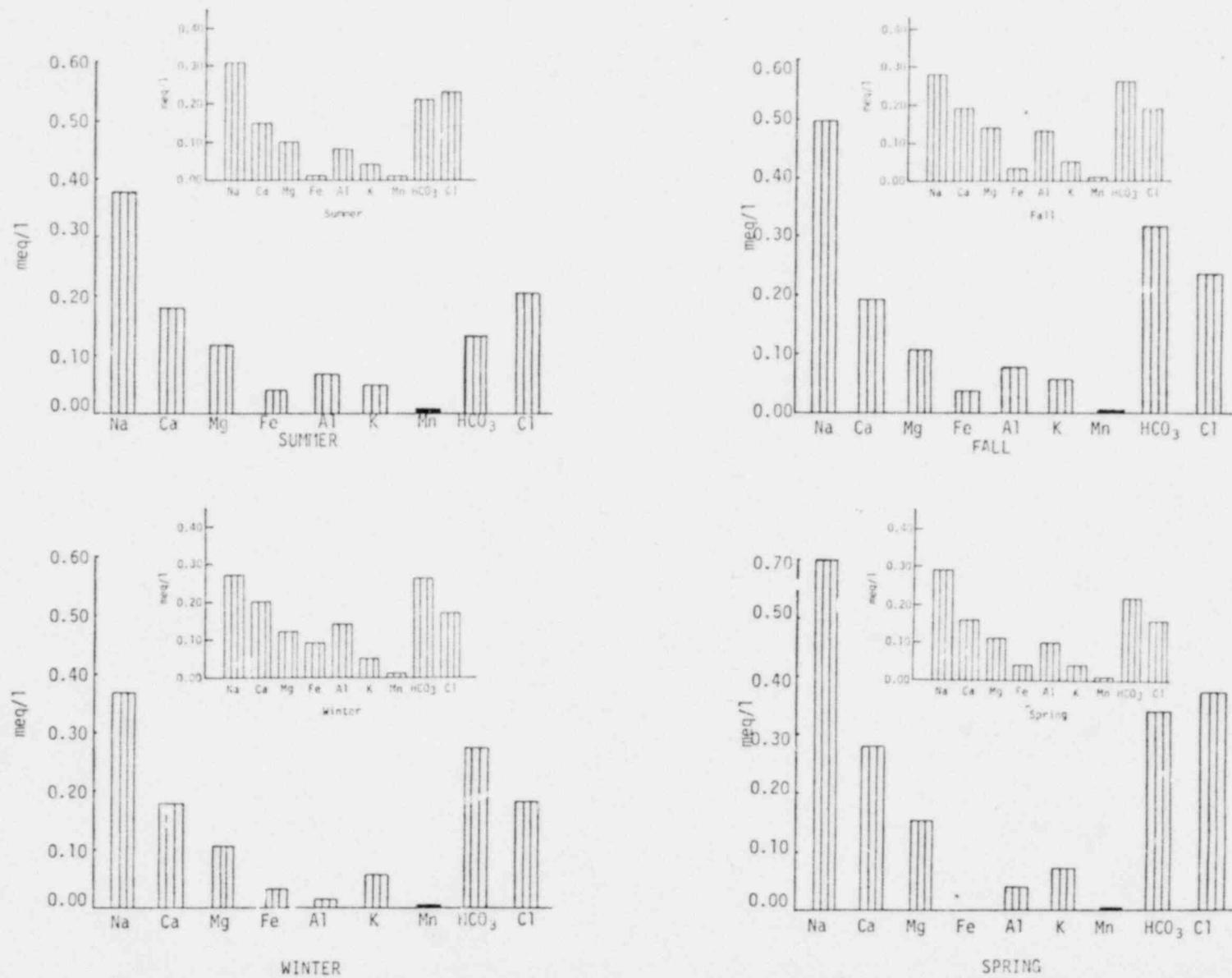


Figure 8. Variations (meq/l) in mineral compositions for Lake Wylie, July 1980 through June 1981. Graphs inset indicate variations for the period July 1979 - June 1980.

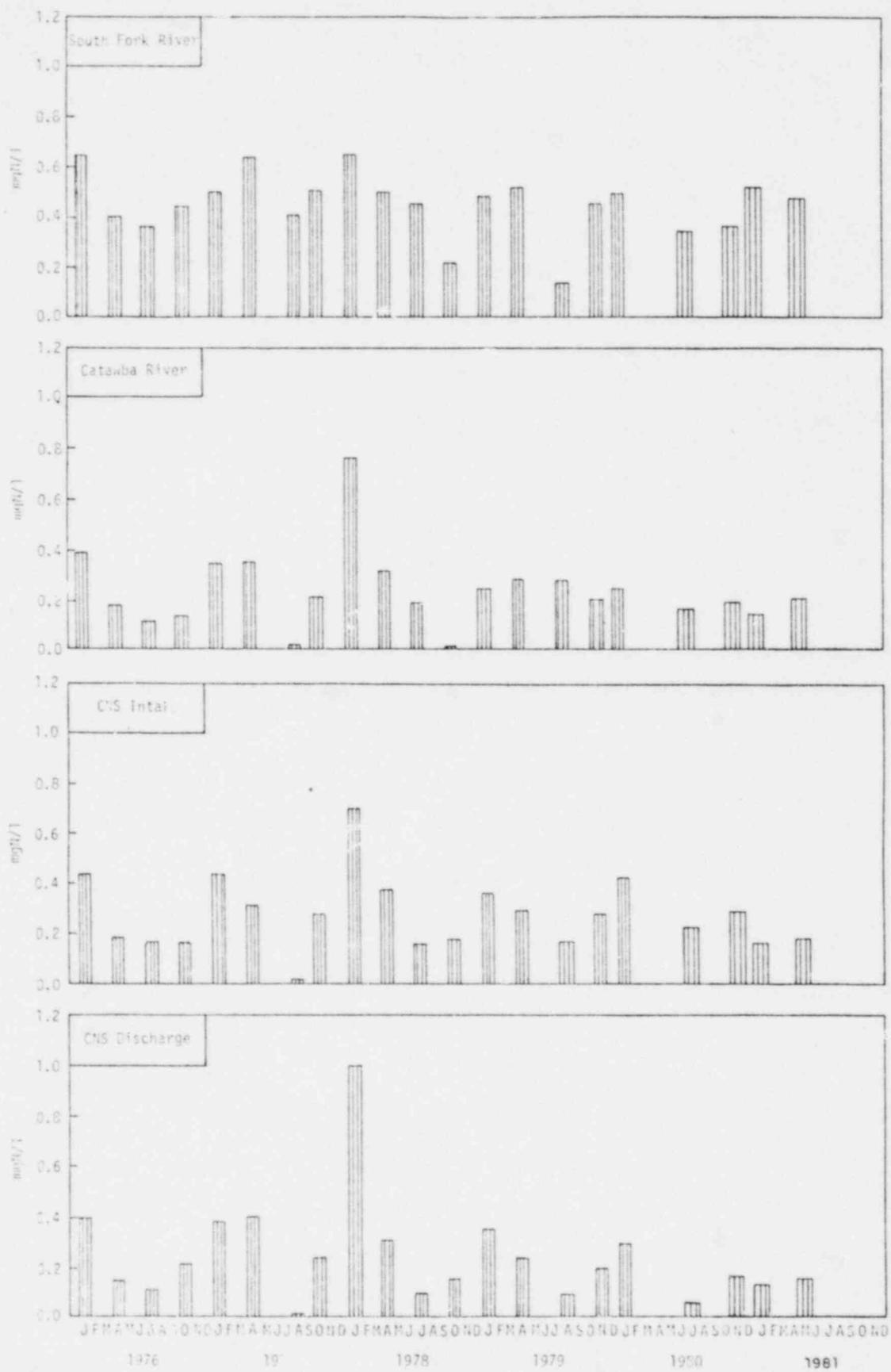


Figure 9. Variations of nitrate + nitrite concentrations for Lake Wylie, Wylie, 1976-1981.

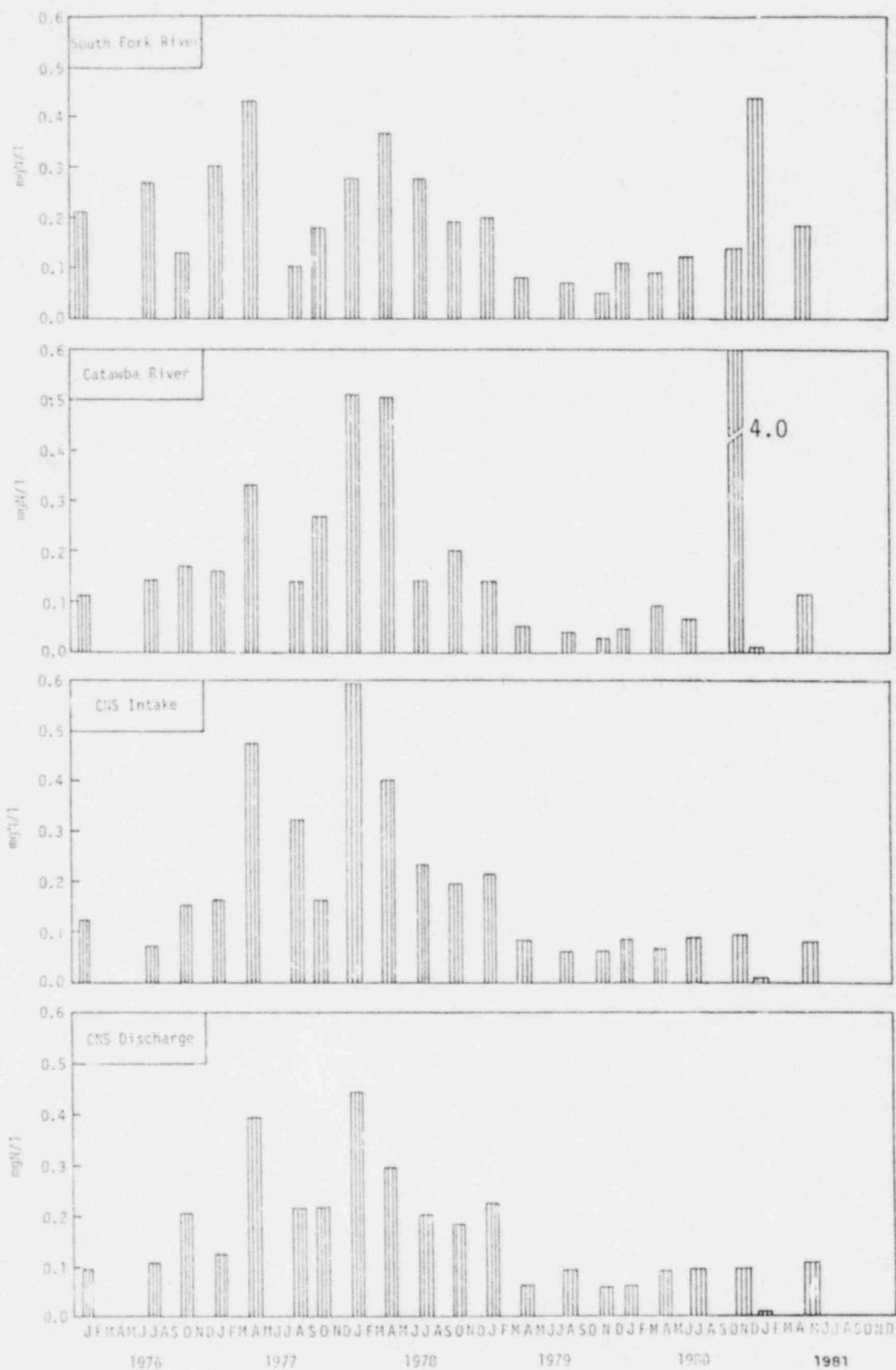


Figure 10. Variations of ammonia concentrations for Lake Wylie, 1976-1981.

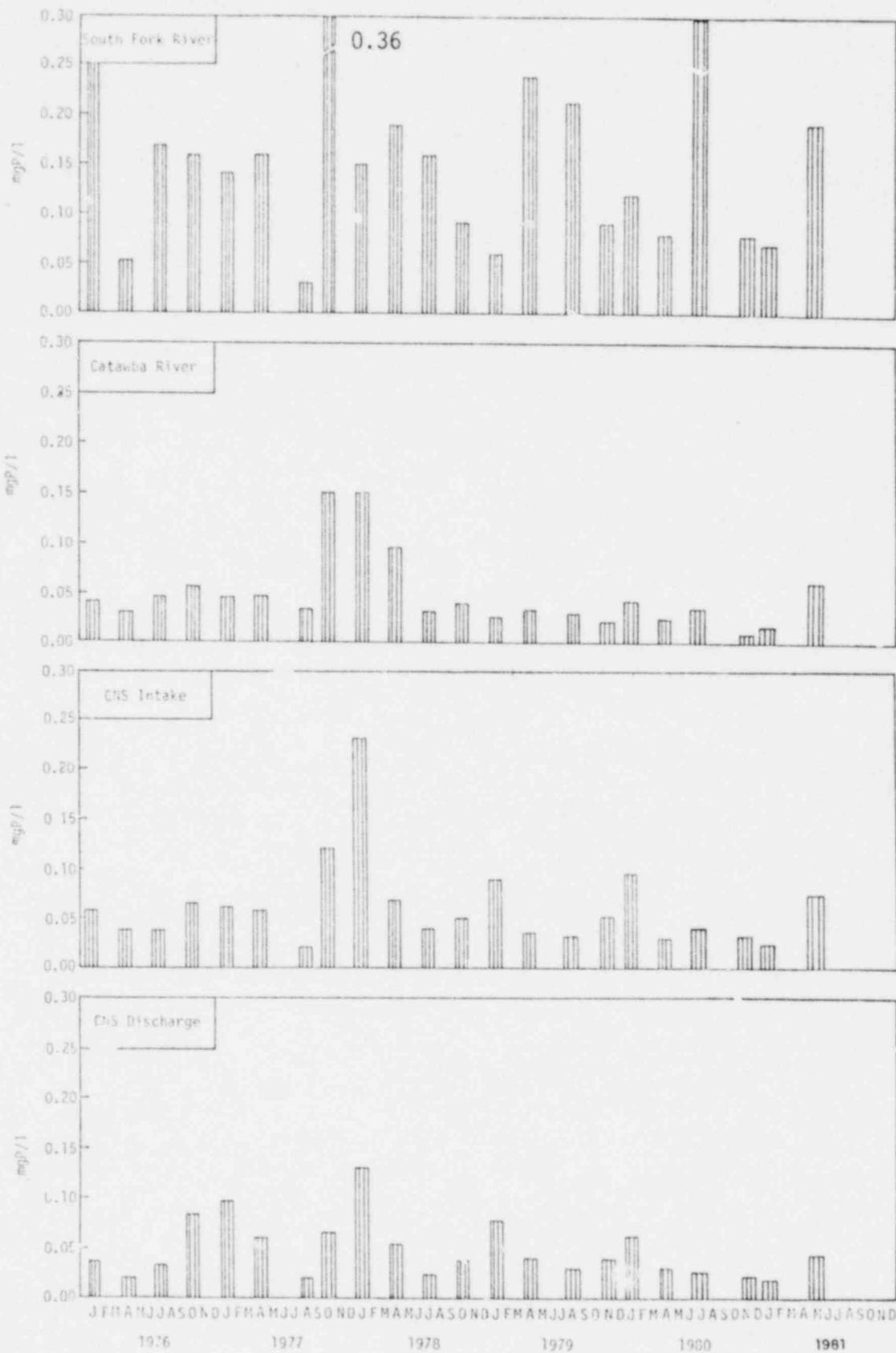


Figure 11. Variations of total phosphorus concentrations for Lake Wylie, 1976-1981.