TECHNICAL MEMORANDUM

March 1982

LAKE OKEECHOBEE
WATER QUALITY

APRIL 1980-MARCH 1981

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SUMMARY

This report evaluates the water quality of Lake Okeechobee and its inflows and outflows for the period of April 1980 through March 1981 (1980 study year). Data from this year are compared with data collected since 1973. The major conclusions are as follows:

(1) Surface inflows to the lake were the lowest of any of the eight years of study. Consequently, nutrient loading rates were also relatively small compared to previous years. Rainfall was the major source of nitrogen and phosphorus, as it contributed almost 70% of the water input. The Kissimmee River was also a significant contributor of nutrients, due to its being the largest surface discharge to the lake. The Taylor Creek-Nubbin Slough discharge through S-191 accounted for 25.7% of the phosphorus input even though it contributed only 2.9% of the water inflow. S-2, S-3, and S-4, significant contributors of nitrogen in the past, released only minor amounts of nitrogen into the lake this year becuase of a lack of backpumping activity.

(2) Among inflows, S-2 had the highest flow-weighted nitrogen concentration, followed by S-4, S-191, S-133, and S-3. Private pump stations (Culverts 10, 12 and 12A) and S-236 also showed relatively high total N levels. With regard to total phosphorus flow-weighted concentrations, the five highest-ranked inflows were S-191, S-127, S-133, S-4, and S-2. In this year, most inflows had higher flow weighted total N concentrations and lower flow-weighted total P concentrations compared to the period 1973-79.

(3) Low inflow resulted in an almost continuous decline in lake stage from April to March. The usual rise in lake level in the fall did not occur.

(4) Average annual total and ortho P concentrations in the lake were less than in the previous year, but were still the second highest of any year on record. The mean annual inorganic nitrogen concentration was also less than that of the year before, but an increase in organic nitrogen caused total N to be higher. Total nitrogen has increased since 1977.

(5) As in past years, phosphorus and inorganic nitrogen concentrations were low in the summer and high in the winter. The 1980 peak concentrations were less than those of 1979, although summer orthophosphorus concentrations were greater than in other years.

(6) Plots of total and orthophosphorus and inorganic nitrogen showed that very high concentrations in the winter of 1979-80 coincided with a lake stage sustained above 17.5 feet MSL. Federico et al. (1981) has suggested that the high concentrations were caused by internal nutrient loading resulting from the flooding of shore areas as well as large external nutrient inputs. The data collected in the 1980 study year can neither confirm nor deny this hypothesis, but do show that these nutrient concentrations were lower in a year with low lake stage and external loadings.

(7) The ratio of inorganic nitrogen to orthophosphorus (IN/IP) averaged 6.1. This is equal to the mean IN/IP ratio of 1979 and indicates that, on the whole, primary productivity would have been potentially limited by nitrogen. This ratio varied seasonally, ranging from 1.8 in August to 11.8 in January. The total nitrogen/total phosphorus ratio was 33.7, an increase over the 1979 ratio.

(8) Chlorophyll _a_, an indicator of algal biomass, averaged 19.0 mg/m^3 for the year, which is similar to mean values obtained in other years.

(9) Areal variations in some water quality parameters were noted, but no large differences existed between lake sampling stations.

(10) The modified Vollenweider (1976) nutrient loading model used by Federico et al. (1981) was tested for its ability to estimate 1980 phosphorus and nitrogen concentrations in the lake. The model performed well in a year when lake inflow was low.

(11) This report recommends that the relative impacts of internal vs. external nutrient loading on lake eutrophication be studied more intensively. Continued investigation of the factors affecting primary productivity is also necessary.

INTRODUCTION

In 1973, the South Florida Water Management District began a study of Lake Okeechobee to gather baseline water chemistry data; develop material budgets; determine systematic relationships among chemical, biological, and physical factors; and assess the trophic state of the lake. Eight water quality monitoring stations were established in the lake and have been routinely sampled from January 1973 to the present. Major inflows and outflows have been monitored since April 1973 and rainwater quality has been measured since October 1974.

Water quality data for the period of April 1973 to March 1980 were analyzed recently by Federico et al. (1981). The purpose of this report is to update the information contained in that publication using water quality data collected during the 1980 study year (April 1980 through March 1981). The report will include the following:

(1) Summary of tributary and rainwater quality.

(2) Calculation of 1980 nutrient budgets.

(3) Analysis of the lake water quality for the 1980 study year.

(4) Identification of seasonal, annual, and areal trends in lake water quality parameters, especially nutrients.

(5) Determination of the limiting nutrient in the lake from the N:P ratio.

(6) Assessment of the modified Vollenweider (1976) model used by Federico, et al. for estimating nutrient concentrations in the lake in 1980.

Before discussing the results of this report, it should be mentioned that 1980 was an unusual year with regard to lake hydrology. The beginning of a drought period resulted in low water inputs from surface inflows.

Lake stage, which is usually allowed to rise in the latter part of the year to provide greater available water storage in the dry season, declined throughout the year with only a small increase in September (Figure 1). This decline in 1980 contrasts with the high lake levels reached in 1978 and 1979 after the maximum stage regulation schedule was raised in May 1978.

It is important to note the decline in lake stage because Federico, et al. (1981) have suggested that the latest schedule change allowed the inundation of shore zones that were not subjected to flooding before, resulting in nutrient releases from these areas in 1979. If this high lake stage was a major factor responsible for observed increases in nutrients, then the relatively low lake stage observed in the fall and winter of 1980 should have resulted in lower maximum nutrient concentrations (assuming all other factors are held constant). This hypothesis will be examined in this report.

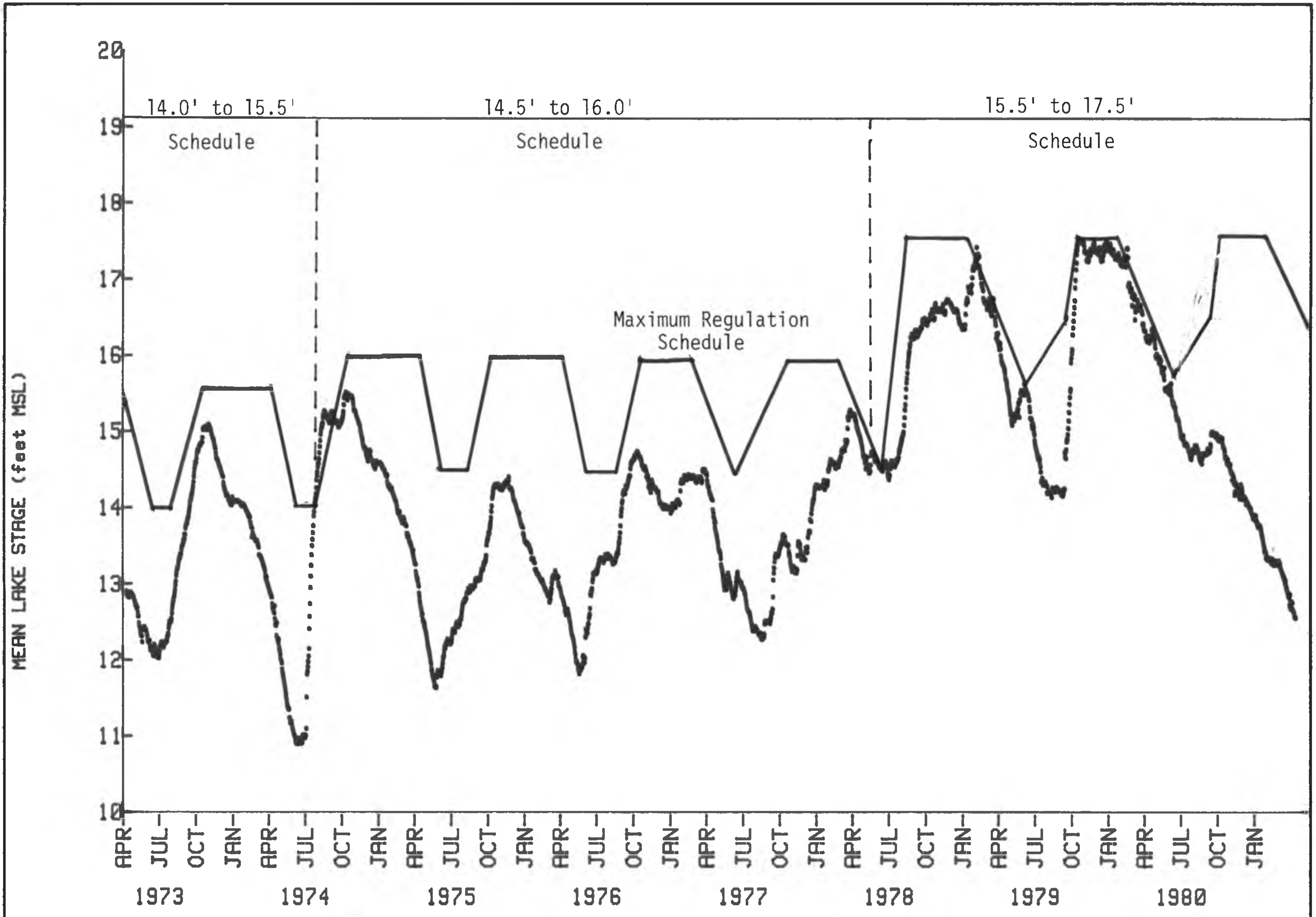

FIGURE 1. LAKE OKEECHOBEE STAGE

MATERIALS AND METHODS

Eight stations on Lake Okeechobee were sampled monthly during the 1980 year of study (Figure 2). Samples collected at the water surface were analyzed for the following parameters:

Total P	Total Organic Carbon (TOC)
Ortho P	Cl^-
NO_3^-	Alkalinity
NO_2^-	Turbidity
NH_4^+	Color
Total Kjeldahl N (TKN)	Chlorophyll _a_

Other parameters (Na^+, K^+, Ca^{+2}, Mg^{+2}, SO_4^{-2}, Fe, total suspended solids), which were sampled infrequently during the year are not discussed in this report but are included with the rest of the data in Appendix 2. Sampling and analysis procedures have been described by Federico et al. (1981).

Major inflows and outflows of the lake were sampled every two weeks and included analysis for all of the above parameters except chlorophyll _a_. Rainwater samples were composited daily over two-week periods and analyzed for the following constituents:

Total P	TOC	Fe
Ortho P	Cl^-	SO_4^{-2}
NO_3^-	Alkalinity	Total Suspended Solids
NO_2^-	Turbidity	
NH_4^+	Color	
TKN	Sp. Conductance	

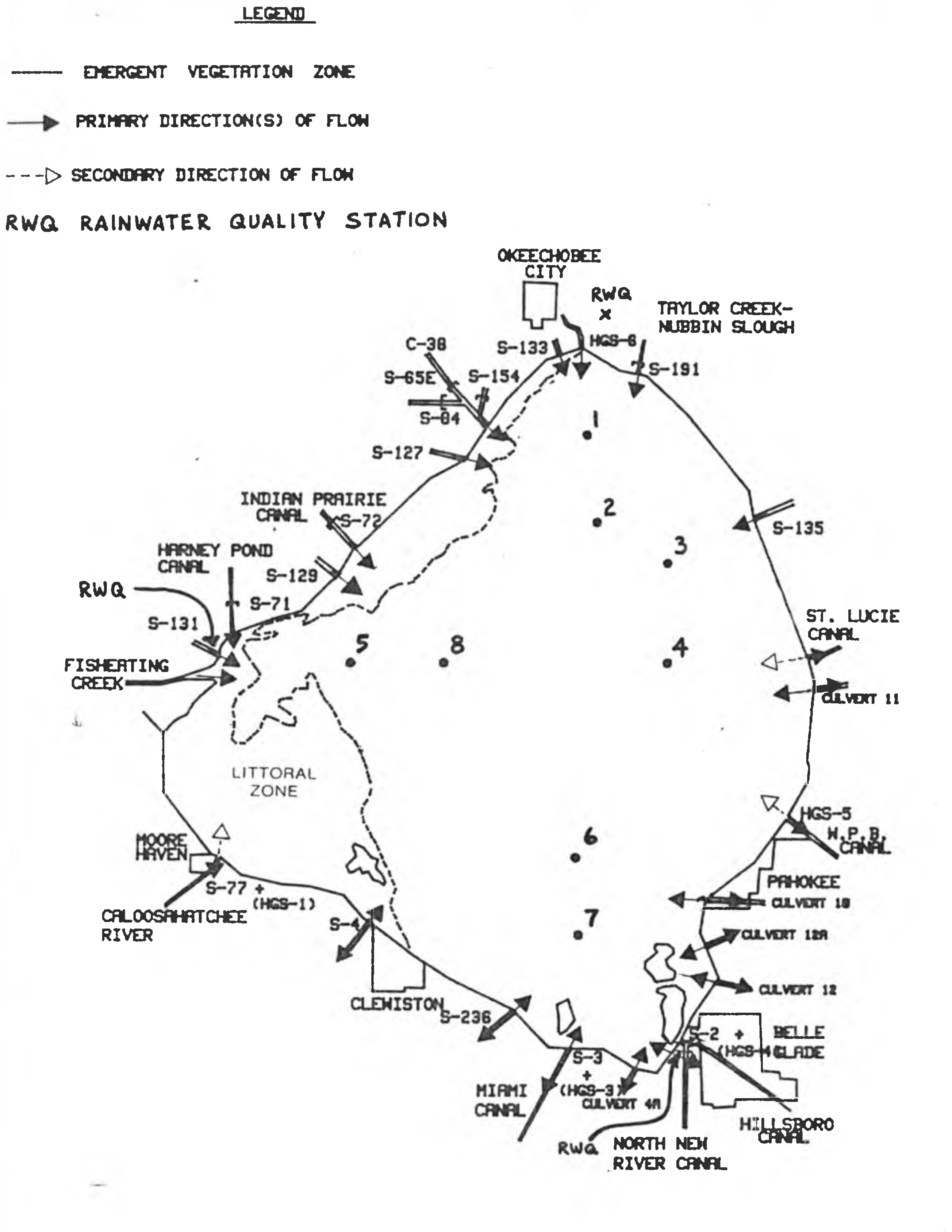

FIGURE 2. LAKE OKEECHOBEE INFLOWS AND OUTFLOWS AND WATER QUALITY STATIONS

The rainfall sampling sites were located at S-2, S-131, and the Okeechobee Field Station on the south, west, and north sides of the lakes, respectively. Inflows, outflows, and rainfall sampling sites are shown in Figure 2.

For the lake and tributaries, in situ measurements of dissolved oxygen, temperature, specific conductivity, and pH were recorded at 0.5 meters below the surface using a Hydrolab Series 8000(R). Secchi depth readings were made in the lake using a standard 8 inch disc.

To calculate material budgets for the lake, a water budget was first prepared which included inputs and outputs of surface waters, precipitation, evaporation, and groundwater seepage. Table 1 gives the sources of data for the water budget calculation. Daily material loadings[1] for the tributaries were calculated by averaging chronologically successive chemistry data points and multiplying this average by the daily flows within the time bounded by the two data points. Atmospheric loading was estimated by multiplying the average concentration of constituents in rainwater by the total amount of precipitation falling on the lake. Annual outflow from seepage was estimated from Shaw (1980) and multiplied by average annual concentration in the lake to obtain the loss of N, P, and Cl through the Hoover Dike.

All study years referred to in this report begin on April 1 and end on March 31 of the next calendar year.

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(1) Because no chemistry data was collected from the outlet to the St. Lucie Canal at S-308, data from station 4 in the lake was used in estimating the material outflow through this canal. Estimates of local runoff into the canal indicated significant inflows to the lake on several occasions during the year. For these periods, material loads to the lake were estimated by multiplying the average flow-weighted concentrations in the canal (1979 data) by the annual water inflow. Concentrations used were:

Total P =	0.194 mg P/L
Total N =	2.27 mg N/L
Chloride =	127.1 mg Cl/L

Because of the lack of chemistry data and the absence of actual discharge measurements at S-308, these are only rough estimates of material contributions from the St. Lucie Canal.

TABLE 1. LAKE OKEECHOBEE WATER INPUTS AND OUTPUTS AND SOURCES OF HYDROLOGICAL DATA

Station	Inflow/Outflow	Source of Data
N.N.R. & Hills. C. (S-2 + HGS-4)	inflow/outflow	USGS
Miami Canal (S-3 + HGS-3)	inflow/outflow	USGS
S-4	inflow/outflow	SFWMD
Harney Pond Canal (S-71)	inflow	USGS
Indian Prairie Canal (S-72)	inflow	USGS
Kissimmee River (S-65E)	inflow	USGS
S-84	inflow	USGS
Fisheating Creek	inflow	USGS
S-127	inflow	SFWMD
S-129	inflow	SFWMD
S-131	inflow	SFWMD
Taylor Creek (S-133)	inflow	SFWMD
S-135	inflow	SFWMD
Nubbin Slough (S-191)	inflow	SFWMD
WPB Canal (HGS-5)	inflow/outflow	USGS
St. Lucie Canal (S-308)	inflow/outflow	COE
Caloosahatchee River (S-77)	inflow/outflow	USGS
Seepage	outflow	Shaw (1980)
Precipitation	inflow	COE
Evaporation	outflow	COE

RESULTS

Tributary Water Quality

This section deals with the water quality of lake inflows and outflows. Rainfall, which is a principal input to the lake, is also included here. General water quality will be discussed first, followed by flow-weighted nutrient concentrations and nitrogen/phosphorus ratios.

General Water Quality

Appendix 1 presents the water quality of the tributaries and rainwater. In general, water quality was similar to that observed in past years. A brief summarization follows.

Dissolved oxygen levels averaged above 5 mg/L for all tributary stations except S-191 and Culverts 10, 11, and 12A. All tributaries had D.O. values less than the 5 mg/L standard for Class I receiving waters (FAC Chapter 17-3) sometime during the year. Oxygen averaged below saturation levels in almost all cases.

No extremes in pH were recorded. The pH range fell between 6 and 9.

Tributaries on the northwest side of the lake tended to have a somewhat different water chemistry than the others. These tributaries were Fisheating Creek, Harney Pond Canal (S-71), Indian Prairie Canal (S-72), C-41A (S-84), and the Kissimmee River (S-65E). Compared with other inflows, the water in these tributaries was relatively low in specific conductance and alkalinity and in concentrations of Na, K, Mg, Ca, and Cl ions. These tributaries also tended to be more highly colored and have greater iron concentrations.

S-2, S-236, and Culverts 10, 11, and 12A had mean conductivity values of over 1000 μmhos/cm. Culvert 12A was by far the highest in conductivity and alkalinity and in chloride, sulfate, major cations (Na, K, Ca, Mg), and total organic carbon concentrations.

All inflows and outflows had low turbidity and total suspended solids concentrations. The West Palm Beach Canal (HGS-5) was noticeably higher in turbidity (15.6 NTU) and total suspended solids (34.1 mg/L).

Mean total nitrogen concentrations in the canals ranged from 1.62 mg/L (S-84) to 6.30 mg/L (Culvert 12A). Culvert 12 also was high in total N (6.04 mg/L). Among all stations, from 2 to 35% of the nitrogen was inorganic. Those tributaries with relatively high inorganic nitrogen concentrations were Culvert 12A (2.23 mg/L), Culvert 12 (1.85 mg/L), Culvert 10 (1.38 mg/L), S-236 (1.30 mg/L), S-191 (1.12 mg/L), and S-2 (0.83 mg/L).

The highest orthophosphorus concentrations were measured at S-191 (Taylor Creek/Nubbin Slough). Historically, this station has had high phosphorus levels because of dairy farms and pastures in the watershed. The mean total P concentration at S-191 was 0.974 mg/L, 2.5 times higher than the next highest concentration of 0.336 mg/L measured at S-154. The mean orthophosphorus concentration at S-191 was 0.881 mg/L and averaged 88% of the total phosphorus. Phosphorus concentrations were consistently high at this station throughout the year.

Flow-weighted Nutrient Concentrations and N/P Ratios

Flow weighted nutrient concentrations for lake inflows were calculated by dividing the total mass of nutrients entering the lake by the annual discharge for the year (see Table 5 in the next section). In the past, flow-weighted concentrations have been somewhat higher than time-weighted values for many stations, indicating a relationship between concentration and water flow. This was also true for most of the tributaries in 1980, although the difference in values given by the two methods of calculation was usually small. However, the large difference at S-2 for total nitrogen (8.01 mg/L vs 4.04 mg/L for flow-weighted and time-weighted concentrations, respectively) indicated a strong relationship between total N concentration and discharge. S-2, S-4, and S-133 also had substantially higher flow-weighted phosphorus concentrations compared to time-weighted P concentrations. Tables 2 and 3 show flow-weighted total nitrogen and total phosphorus concentrations for 15 lake inflows. From these tables, one can compare 1980 concentrations with those of 1973 to 1979. Descriptions of increasing or decreasing trends for each station follow.

(1) S-2: The total nitrogen concentration of 8.01 mg/L ranked this station highest among all inflows. This station also had the highest nitrogen values for every other year of the study. Total phosphorus was 0.264 mg/L and ranked fifth among all stations. The 1980 nitrogen and phosphorus concentrations were much higher than values recorded for other years at this station, but since S-2 backpumped on only six days during the year, these increases cannot hold too much significance due to the small amount of data used to calculate the flow weighted averages.

(2) S-3: Total nitrogen (3.01 mg/L) ranked fifth among all inflows. Mean annual nitrogen concentrations at this station have decreased over the last four years. Total phosphorus (0.067 mg/L) ranked relatively low and also decreased from the previous year. However, again it must be noted that S-3 backpumped only six days during the year.

TABLE 2. FLOW WEIGHTED TOTAL NITROGEN CONCENTRATIONS FOR TRIBUTARY INFLOWS

Inflows	1973 Conc.1/	1974 Conc.	1975 Conc.	1976 Conc.	1977 Conc.	1978 Conc.	1979 Conc.	1980 Conc.
N.N.R. & Hills C. (S-2)	7.31	5.63	5.50	5.12	6.01	5.80	5.91	8.01
Miami C. (S-3)	6.59	4.69	5.04	4.96	5.36	4.56	3.90	3.01
S-4	-	2.42	2.42	2.52	3.19	3.43	3.29	3.75
Harney Pond C. (S-71)	2.37	2.10	2.24	2.26	1.90	2.21	2.59	2.18
Indian Prairie C. (S-72)	2.42	2.67	1.82	1.79	2.45	2.46	2.36	2.57
Kissimmee R. (S-65E)	1.50	1.26	1.24	1.36	1.80	2.01	1.35	1.96
S-84	1.25	1.05	1.37	1.50	1.67	1.49	1.39	1.81
Fisheating Creek	1.54	2.89	1.77	1.54	1.75	1.73	2.41	2.86
S-127 2/	1.72	2.15	2.15	2.15	2.15	2.15	2.58	2.95
S-129 2/	1.86	2.11	2.11	2.11	2.11	2.11	2.37	2.57
S-131 2/	1.55	1.83	1.83	1.83	1.83	1.83	2.10	2.37
Taylor Creek (S-133) 2/	1.61	1.84	1.84	1.84	1.84	1.84	2.07	3.04
S-135 2/	1.58	1.98	1.98	1.98	1.98	1.98	2.37	2.70
Nubbin Slough (S-191)	1.95	2.08	2.16	2.09	2.35	2.69	2.74	3.72
Rainfall 3/	1.06	1.06	1.06	1.10	1.12	1.18	1.05	1.12 4/
Flow Weighted Average	1.71	1.67	1.84	1.64	1.98	1.79	1.66	1.52

1/ Year represents period April 1st to March 31st.

2/ Concentrations from 1974 to 1978 were computed using average of flow weighted concentrations for 1973 and 1979.

3/ Time weighted.

4/ 1980 rainfall concentration assumed equal to 1974-79 average.

TABLE 3. FLOW WEIGHTED TOTAL PHOSPHORUS CONCENTRATIONS FOR TRIBUTARY INFLOWS

Inflows	1973 Conc. 1/	1974 Conc.	1975 Conc.	1976 Conc.	1977 Conc.	1978 Conc.	1979 Conc.	1980 Conc.
N.N.R. & Hills C. (S-2)	0.177	0.125	0.171	0.099	0.112	0.107	0.123	0.264
Miami C. (S-3)	0.173	0.140	0.094	0.059	0.108	0.056	0.082	0.067
S-4	-	0.211	0.210	0.227	0.370	0.336	0.427	0.282
Harney Pond C. (S-71)	0.346	0.263	0.241	0.154	0.212	0.226	0.322	0.144
Indian Prairie C. (S-72)	0.319	0.219	0.335	0.146	0.203	0.166	0.252	0.174
Kissimmee R. (S-65E)	0.081	0.088	0.073	0.083	0.084	0.107	0.115	0.094
S-84	0.070	0.067	0.069	0.055	0.074	0.057	0.073	0.048
Fisheating Creek	0.126	0.498	0.205	0.190	0.138	0.142	0.203	0.223
S-127 2/	0.384	0.459	0.459	0.459	0.459	0.459	0.533	0.386
S-129 2/	0.161	0.184	0.184	0.184	0.184	0.184	0.206	0.114
S-131 2/	0.150	0.139	0.139	0.139	0.139	0.139	0.153	0.070
Taylor Creek (S-133) 2/	0.281	0.329	0.329	0.329	0.329	0.329	0.377	0.296
S-135 2/	0.136	0.169	0.169	0.169	0.169	0.169	0.204	0.072
Nubbin Slough (S-191)	0.737	0.739	0.957	0.950	1.106	0.939	1.013	0.960
Rainfall 3/	0.057	0.058	0.049	0.063	0.093	0.052	0.053	0.062 4/
Flow Weighted Average	0.138	0.144	0.107	0.131	0.161	0.134	0.163	0.107

1/ Year represents period April 1st to March 31st.

2/ Concentrations from 1974 to 1978 were computed using average of flow weighted concentrations for 1973 and 1979.

3/ Time weighted.

4/ 1980 rainfall concentration assumed equal to 1974-79 average.

(3) S-4: Total nitrogen (3.75 mg/L) ranked second among all inflows. This was the highest mean annual concentration observed at this station which has shown generally increasing total N concentrations over the years. Total phosphorus (0.282 mg/L) also ranked high but had declined from the year before.

(4) S-71: This station ranked relatively low in both nitrogen and phosphorus. Both parameters also decreased from 1979. Total phosphorus has shown a distinct trend at this station, declining from 0.346 mg/L in 1973 to 0.154 mg/L in 1976 and increasing again until 1980 when it dropped to 0.144 mg/L.

(5) S-72: Nitrogen increased while phosphorus decreased from the previous year. No consistent trends have been apparent at this station.

(6) S-65E: Total nitrogen increased from 1979, although it still ranked only 13th among the 14 surface inflows. Total phosphorus ranked 10th and decreased slightly from 1979.

(7) S-84: The 1973-79 average flow-weighted N and P concentrations at this station ranked the lowest of any surface inflow. This was again true in 1980. The 1980 nitrogen concentration was the highest observed at this station, but phosphorus was lower than in any other year.

(8) Fisheating Creek: Nitrogen (2.86 mg/L) ranked seventh and phosphorus (0.223 mg/L) ranked sixth at this station. Both concentrations increased slightly from those of 1979.

(9) S-127, S-129, S-131, S-133, S-135: These pump stations, which drain water from small areas around the lake, have been sampled only in 1973, 1979, and 1980. Nitrogen concentrations have increased from 1973 to 1980 at each station. S-133 ranked fourth in total nitrogen

(3.04 mg/L) which was a large increase from the 2.07 mg/L concentration measured in 1979. The nitrogen concentration at S-127 was also moderately high. Total phosphorus was greater at each station in 1979 compared to 1973, but declined in 1980. Phosphorus concentratons at S-127 and S-133 ranked second and third, respectively.

(10) S-191: Nitrogen levels have increased at this station over the eight years of study. In 1980, this station had the third highest nitrogen concentration. This concentration of 3.72 mg/L was a large increase over the 2.74 mg/L concentration of the previous year. Total phosphorus was 0.960 mg/L, by far the highest of any inflow. Since 1975, total phosphorus concentrations have remained above 0.9 mg/L.

(11) Rainfall: Upon examination of the rainwater nutrient data, some samples were found to have extremely high concentrations of phosphorus and nitrogen. After deleting the obviously high values from the data set (which probably represented contamination), the mean concentrations of 0.062 mg/L and 1.52 mg/L were obtained for total P and total N, respectively. Although the 1980 total P average is identical to the mean value calculated from data for the period 1974-79, the 1980 mean total N concentration is somewhat higher than the mean values for other years (Table 2). Because of the uncertainty associated with the 1980 data set and the importance of accurate rain water concentrations for use in the nutrient budgets presented later, this data set was discarded. Instead, average rainwater N and P concentrations for the period of October 1974 to March 1980 (shown in Tables 2 and 3) are assumed to be equal to the actual 1980 concentrations and are the values used in calculating material loadings from rainfall later in this report.

An interesting comparison can be drawn between inflow nutrient levels in 1979 (a wet year) and in 1980 (a dry year). All surface inflows in Tables 2 and 3 discharged much less water in 1980 than in 1979. Coincidentally, flow-weighted nitrogen concentrations were greater at all inflow stations in 1980 than in 1979 except for S-3 and S-71. Conversely, phosphorus concentrations were lower in 1980 than in 1979 for all inflows except S-2 and Fisheating Creek. Similar relationships also exist when comparing 1980 concentrations to 1973-79 average concentrations. This suggests that during dry years, inflows have higher nitrogen and lower phosphorus concentrations than in wet years. The reason that dry years should favor higher N and lower P concentrations is unclear at this time.

The higher nitrogen and lower phosphorus concentrations in 1980 resulted in relatively higher TN/TP ratios for all inflows except S-2 and S-3 (Table 4). The reason for the lower TN/TP ratios at S-2 and S-3 was probably related to the lack of backpumping at these stations. During heavy backpumping, which was not experienced in 1980, nitrogen levels are usually extremely high. The average TN/TP ratio was 14.2 and ranged from 3.9 at S-191 to 44.9 at S-3.

TABLE 4. RATIO OF TOTAL NITROGEN TO TOTAL PHOSPHORUS FOR LAKE OKEECHOBEE INFLOWS

Inflows	1973 [1/]	1974	1975	1976	1977	1978	1979	1980
N.N.R. & Hills C. (S-2)	41.3	45.0	32.2	51.7	53.7	54.2	48.1	30.3
Miami C. (S-3)	38.1	33.1	53.6	84.1	49.6	81.4	47.6	44.9
S-4	-	11.5	11.5	11.1	8.6	10.2	7.7	13.3
Harney Pond C. (S-71)	6.9	8.0	9.2	14.7	9.0	9.8	8.0	15.1
Indian Prairie C. (S-72)	7.6	12.2	5.4	12.3	12.5	14.8	9.4	14.8
Kissimmee R. (S-65E)	18.5	14.3	17.0	16.4	21.4	18.8	11.7	20.9
S-84	17.9	15.7	19.9	27.3	22.6	26.1	19.0	37.7
Fisheating Creek	12.2	5.8	8.6	8.1	11.4	12.2	11.9	12.8
S-127	4.5	4.7	4.7	4.7	4.7	4.7	4.8	7.6
S-129	11.6	11.5	11.5	11.5	11.5	11.5	11.5	22.5
S-131	10.3	13.2	13.2	13.2	13.2	13.2	13.7	33.9
Taylor Creek (S-133)	5.7	5.6	5.6	5.6	5.6	5.6	5.5	10.3
S-135	11.6	11.7	11.7	11.7	11.7	11.7	11.6	37.5
Nubbin Slough (S-191)	2.7	2.8	2.3	2.2	2.1	2.9	2.7	3.9
Rainfall	18.6	18.3	21.6	17.5	12.0	22.7	19.8	18.1
Average	12.4	11.6	17.2	12.5	12.3	16.1	11.0	14.2

1/ Year represents period April 1st to March 31st

Water and Material Budgets

Table 5 presents the 1980 budgets for water, phosphorus, nitrogen, and chloride. These budgets include contributions and losses from surface inflows and outflows, precipitation and evaporation, and seepage. The budgets are expressed as percentages of the total inputs and outputs and compared to 1973-1979 averages in Table 6.

To check for accuracy, the water budget was tested for its ability to account for the net change in the lake's annual storage. The accountability of the water budget was calculated as percent error from the equation:

$$\%\ \text{error} = \frac{\text{Other sinks (ac-ft)}}{\text{Average lake volume (ac-ft)}} \times 100 \qquad (1)$$

where other sinks are inflows and/or outflows unaccounted for in the budget, and average lake volume (3,774,000 ac-ft) is calculated from average monthly stages and a stage/surface area/volume table (U. S. Army Corps of Engineers). The error in the 1980 water budget was calculated to be +9.8%, which indicates that inflows were overestimated and/or outflows were underestimated. This is one of the larger errors calculated for the period of study (eight year average = +4.8%; range = -5.6 to +12.6%).

Chloride was included in the material budgets as an accuracy check. Since chloride is a conservative element, the budget should theoretically account for all additions and losses of this ion over time. The percent error in the chloride budget was calculated in a manner similar to equation (1):

TABLE 5

1980 WATER, P, N, AND CL BUDGETS FOR LAKE OKEECHOBEE

Inputs	Q (Acre-Feet)	Total P (10^6 grams)	Total N (10^6 grams)	Cl (10^6 grams)
N.N.R. + Hills. C. (S-2)	7,182	2.3	70.7	1,875
Miami C. (S-3)	4,149	0.3	15.4	554
S-4	17,506	6.1	80.7	2,259
Harney Pond (S-71)	38,801	6.9	103.9	1,239
Indian Prairie C. (S-72)	3,842	0.8	12.2	107
Kissimmee R. (S-65E)	257,494	29.8	620.4	6,873
S-84	26,698	1.6	59.3	455
Fisheating Creek	17,592	4.8	61.8	909
S-127	7,539	3.6	27.4	1,456
S-129	9,434	1.3	29.8	956
S-131	2,156	0.2	6.3	290
Taylor Creek (S-133)	15,624	5.7	58.5	2,039
S-135	12,258	1.1	40.7	2,221
Nubbin Slough (S-191)	48,746	57.6	223.2	7,106
WPB Canal (HGS-5)	0	0.0	0.0	0
St. Lucie Canal (S-308)	47,415	11.3	132.4	7,413
Caloosahatchee R. (S-77)	0	0.0	0.0	0
Rainfall 1/	1,192,667	91.0	1,643.0	6,895
Total input (M_{in})	1,709,103	224.4	3,185.7	42,647
Outputs:				
N.N.R. + Hills. C (S-2)	95,623	8.7	390.8	15,914
Miami C. (S-3)	131,294	6.6	386.7	15,335
S-4	0	0.0	0.0	0
WPB Canal (HGS-5)	73,300	10.4	263.2	8,455
St. Lucie Canal (S-308)	252,866	37.2	814.0	27,627
Caloosahatchee R. (S-77)	388,022	24.2	1201.4	41,346
Seepage 2/	52,000	5.4	167.6	5,174
Evaporation 3/	1,912,588	-	-	-
Total output (M_{out})	2,915,564	92.5	3223.7	113,851
Total input (M_{in})	1,709,103	224.4	3185.7	42,647
Total output (M_{out})	2,915,564	92.5	3223.7	113,851
Change in storage (ΔM) 4/	-1,577,500	-163.0	-5083.7	-156,972
Other sinks 5/	371,039	294.9	5045.7	85,768
Areal loading rate (g/m^2-yr) 3/		0.127	1.80	24.1

1/ Using surface area of 500,000 acres and TP= 0.062 mg/L, TN= 1.12 mg/L, Cl= 4.7 mg
2/ Seepage = 0.72 cfs/mi X miles of dike (100 miles)
3/ Using COE surface area (avg. = 1767 km^2)
4/ ΔM = final storage - initial storage (using annual avg. conc. for P, N, and Cl)
5/ Other sinks = $M_{in} - M_{out} - \Delta M$

TABLE 6. PERCENTAGE WATER AND NUTRIENT BUDGETS FOR LAKE OKEECHOBEE

	Flow		Total P		Total N	
Inputs	1973-79	1980	1973-79	1980	1973-79	1980
N.N.R. + Hills. C. (S-2)	5.6	0.4	5.3	1.0	18.8	2.2
Miami C. (S-3)	1.6	0.2	1.1	0.1	4.5	0.5
S-4	1.0	1.0	2.2	2.7	1.7	2.5
Harney Pond (S-71)	4.9	2.3	9.0	3.1	6.3	3.3
Indian Prairie C. (S-72)	1.1	0.2	1.7	0.4	1.6	0.4
Kissimmee R. (S-65E)	30.9	15.1	20.3	13.3	24.6	19.5
S-84	4.0	1.6	1.9	0.7	3.1	1.9
Fisheating Creek	5.8	1.0	9.8	2.1	7.0	1.9
S-127	0.3	0.4	1.1	1.6	0.4	0.9
S-129	0.3	0.6	0.4	0.6	0.4	0.9
S-131	0.2	0.1	0.1	0.1	0.2	0.2
Taylor Creek (S-133)	0.5	0.9	1.1	2.5	0.5	1.8
S-135	0.5	0.7	0.6	0.5	0.6	1.3
Nubbin Slough (S-191)	4.4	2.9	28.5	25.7	5.8	7.0
WPB Canal (HGS-5)	0.3	0.0	0.3	0.0	0.5	0.0
St. Lucie Canal (S-308)	0.0	2.8	0.0	5.0	0.0	4.2
Caloosahatchee R. (S-77)	0.0	0.0	0.0	0.0	0.0	0.0
Rainfall	38.8	69.8	16.7	40.6	24.3	51.6
Total input	99.5	100.0	100.1	100.0	100.3	100.1
Outputs						
N.N.R. + Hills. C. (S-2)	7.5	3.3	21.5	9.4	24.6	12.1
Miami C. (S-3)	4.7	4.5	9.3	7.1	13.2	12.0
S-4	0.0	0.0	0.0	0.0	0.0	0.0
WPB Canal (HGS-5)	3.9	2.5	15.5	11.2	12.0	8.2
St. Lucie Canal (S-308)	3.9	8.7	15.4	40.2	12.2	25.3
Caloosahatchee R. (S-77)	12.4	13.3	34.3	26.2	34.1	37.3
Seepage	1.7	1.8	4.0	5.8	3.9	5.2
Evaporation	66.0	65.6	-	-	-	-
Total output	100.1	99.7	100.0	99.9	100.0	100.1

$$\% \text{ error} = \frac{\text{Other Cl sinks (tonnes) X 813}}{\text{Avg. lake Cl conc. (mg/L) X avg. lake volume (ac-ft)}} \text{ X } 100 \qquad (2)$$

The error in the chloride budget was estimated to be +22.8 percent. This value is outside the range of values for previous year (-18.2 to +16.8%) and suggests the possibility of significant error in the nutrient budgets due to overestimation of nutrient inputs and/or underestimation of outputs. Errors in the stage/volume relationship for the lake could also contribute to budget error.

Surface water inflows were the lowest of any year of study. The total input from surface waters was 516,436 acre-feet, compared with the 2,128,851 acre-feet annual average for the previous seven years. Because of the low surface water input, the total input (including rainfall) of 1,709,103 acre-feet was also the lowest calculated for any year of the study period.

Rainfall was the largest source of water to the lake, accounting for 69.8% of the total input. The Kissimmee River contributed 15.0% of the inflow followed by Nubbin Slough, St. Lucie Canal, and Harney Pond Canal with 2.9, 2.8, and 2.3% of the total input, respectively. S-2 and S-3 together accounted for only 0.6% of the inflow. This reflects the small amount of backpumping at these stations over the year and is partially the result of implementation of the SFWMD Interim Action Plan which is designed to reduce discharges through S-2 and S-3.

Evaporation accounted for 65.6% of water loss. The Caloosahatchee River (13.3%) and the St. Lucie Canal (8.7%) had the greatest surface outflows.

Some important hydrological and morphometric parameters are shown in Table 7. These include the average lake stage, surface area, volume, mean depth, water residence time, and hydraulic loading rate. The water residence

TABLE 7. HYDROLOGICAL AND MORPHOMETRIC PARAMETERS OF LAKE OKEECHOBEE

Year[1/]	Mean Lake Stage (ft)	Mean[2/] Depth $\bar{z}$, m	Surface Area A, km^2	Volume V, A-F	Water[3/] Residence Time τ_w, yrs	Hydraulic[4/] Loading Rate qs, m/yr
1973	13.58	2.46	1685	3,365,000	4.63	1.47
1974	13.86	2.54	1703	3,504,000	1.85	1.96
1975	13.16	2.40	1637	3,185,000	4.74	1.22
1976	13.81	2.48	1719	3,462,000	6.78	1.42
1977	13.65	2.47	1690	3,389,000	6.17	0.98
1978	16.01	2.99	1828	4,429,000	2.85	1.78
1979	16.15	3.03	1828	4,495,000	2.95	1.75
1980	14.54	2.63	1767	3,774,000	3.76	0.36
Average 1973-80	14.35	2.63	1732	3,700,000	4.22	1.37

1/ Annual period is from April through March

2/ Mean depth = volume/surface area

3/ Based on surface outflows (excluding evaporation)

4/ Based on surface inflows (excluding rainfall) time (τ_ω) and the hydraulic loading rate (q_s) are two values that will be used in the section on eutrophication modeling. The water residence time is equal to the lake water volume divided by the surface outflows (excluding evaporation). It represents the period of time that water is present in the lake with respect to nutrients, since nutrients are not lost via evaporation. The hydraulic loading rate is calculated by dividing the surface water inflows (excluding rainfall) by the surface area of the lake. It represents the height that surface inflows would raise the lake level during a year, assuming no loss of water through evaporation or outflow. The 1980 water residence time of 3.76 years was only slightly below that of the eight year average, but the hydraulic loading rate of 0.36 m/yr was very low compared to the record. Mean lake stage and related parameters (surface area, volume, and mean depth) were about average.

Rainfall was the most important source of nutrients to the lake, contributing 40.6% and 51.6% of the phosphorus and nitrogen, respectively. Although the concentration of nutrients in the Kissimmee River was relatively dilute, the large discharge from this river accounted for 13.3% of the phosphorus and 19.5% of the nitrogen. As in the past, the Taylor Creek/Nubbin Slough inflow through S-191 was a highly significant source of phosphorus, accounting for 25.7% of the P input, while contributing less than 3% of the water inflow. This inflow was also the third largest contributor of nitrogen (7.0%). S-2 and S-3, significant contributors of nitrogen in past years, accounted for only 2.7% of the N input in 1980.

The areal loading rates (total material load divided by average lake surface area) of P, N, and Cl are given at the bottom of Table 5.

Each of these values is lower than for any other year of study, due to the low surface water input. The low loading rates for phosphorus and nitrogen (0.127 g P/m^2-yr and 1.80 g N/m^2-yr) contrast especially with the high rates calculated for 1979 (0.443 g P/m^2-yr and 4.53 g N/m^2-yr).

Table 8 summarizes water and material inputs over the entire study period. One can readily note the low nutrient loads to the lake in 1980, particularly in comparison to 1978 and 1979.

Monthly inputs of water and nutrients in 1980 are shown in Figure 3. Most input occurred in the first half of the year, the traditional wet season.

Nutrient loadings from other pump stations at Culverts 10, 11, 12, 12A and 4A, and S-236 were not considered in the above budgets, but since most of these stations had water high in nitrogen, an analysis was done to determine how significant the nutrient contributions from these structures would have been if they had been included in the budgets. Culvert 11 was not included in this analysis due to a lack of chemistry data.

Rough estimates of nutrient inputs were calculated by averaging the nutrient data for each month and multiplying these average values by the monthly discharge. Since these structures are capable of moving water in either direction, nutrient data collected during discharge from the lake were ignored.

If they had been included in the water and nutrient budgets, the five pump stations together would have accounted for 1.3% of the water input, 1.6% of the phosphorus load, and 4.6% of the nitrogen load (Table 9). Thus, although water discharged from these structures was nutrient enriched, the contribution of nutrients to the lake was of only minor significance.

TABLE 8. ANNUAL EXTERNAL INPUTS TO LAKE OKEECHOBEE

Year	Water (acre-feet)	Total P (10^6 grams)	Total N (10^6 grams)	Cl (10^6 grams)
1973	3,220,252	547.5	6,792.6	91,531
1974	4,176,904	743.5	8,607.1	123,812
1975	2,824,883	371.4	6,410.3	126,443
1976	3,299,670	533.5	6,659.9	120,632
1977	2,647,930	524.4	6,475.9	109,022
1978	4,151,277	687.1	9,142.0	137,367
1979	4,033,791	810.4	8,277.0	116,045
1980	1,709,103	224.4	3,185.7	42,647

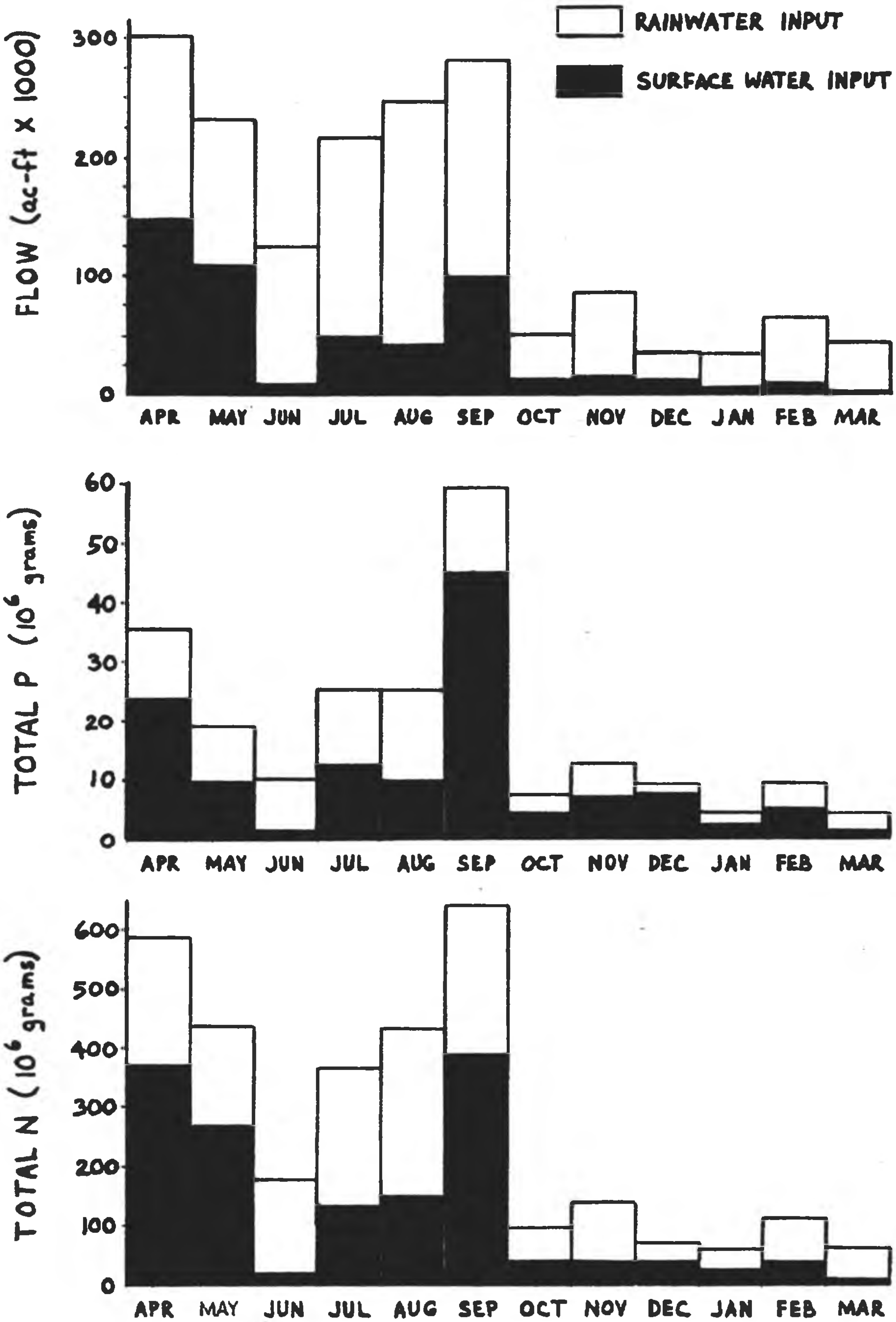

FIGURE 3. MONTHLY WATER, TOTAL P, AND TOTAL N INPUTS IN 1980 STUDY YEAR

TABLE 9. NUTRIENT INPUTS FROM SMALL PUMP STATIONS DISCHARGING INTO THE SOUTH END OF LAKE OKEECHOBEE

Station	Annual Discharge (ac-ft)	TP Load (10^6 grams)	% of Total TP Load 1/	TN Load (10^6 grams)	% of Total TN Load 1/
CULV. 10	4,743 2/	1.4	0.6	31.9	1.0
CULV. 12	4,568 2/	0.9	0.4	46.2	1.4
S-236	4,800 2/	0.4	0.2	30.6	0.9
CULV. 4A	6,071 3/	0.6	0.3	32.6	1.0
CULV. 12A	1,485 4/	0.4	0.2	12.6	0.4
Total	21,667	3.7	1.6	153.9	4.6

1/ Total Load = Total input from Table 4 plus input from the five small pump stations

Total TP Load = 228.1 tonnes

Total TN Load = 3339.6 tonnes

2/ Discharge estimated from stage, pipe diameter and pump operation logs from April through August 1980 and measured directly from September 1980 through March 1981.

3/ Discharge estimated from pump operation logs

4/ Discharge estimated from Culvert 4A pump operation logs and proportion of drainage areas serviced by Culverts 12A and 4A

Lake Water Quality

This section first describes water quality data averaged from among the eight lake stations. Table 10 gives the annual means of averaged data for each year of the study. Figures 4 through 7 illustrate seasonal trends in the 1980 data.

Specific conductance, an indicator of dissolved solids concentration, increased from 547 μmhos/cm in April 1980 to 697 μmhos/cm in March 1981 (Figure 4). This increase was more evident during the last three months of the year as lake stage continued to decline and dissolved solids became more concentrated due to evaporation, and low rainfall and tributary inflow. Chloride was one ion in higher concentration toward the end of winter. Levels increased to 93.9 mg/L in March and averaged 80.9 mg/L for the year.

Alkalinity also increased during the year, ranging from 1.8 meq/L to 2.4 meq/L in March with an average of 2.1 meq/L.

The pH level changed little over the year, averaging 8.22.

Turbidity continued to show the seasonal trend that has been exhibited in past years (Federico et al. 1981). The lowest turbidity values were recorded in the summer months, reaching a low of 3.6 NTU in August and increasing to 44.4 NTU in March (Figure 5). As stated by Davis and Marshall (1975), turbidity is primarily dependent on wintertime wind stress which mixes the entire water column and causes a resuspension of sediment.

The transparency of the water as measured by Secchi depth showed a seasonal trend inverse to that of turbidity. The greatest transparency was observed in the summer. Secchi depth averaged 0.6 meters for the year.

TABLE 10. SUMMARY OF MEAN ANNUAL LIMNETIC WATER QUALITY

Mean Annual Concentration

Parameter (1)	1973	1974	1975	1976	1977	1978	1979	1980	Avg. 1973-80
Ortho-P	0.005	0.014	0.013	0.016	0.013	0.019	0.045	0.033	0.020
Total P	0.049	0.049	0.058	0.055	0.063	0.067	0.097	0.084	0.065
Inorganic N	0.08	0.16	0.16	0.22	0.13	0.13	0.26	0.21	0.17
Organic N	1.55	1.29	1.44	1.81	1.53	1.63	1.74	2.41	1.68
Total N	1.63	1.45	1.60	2.01	1.64	1.77	2.02	2.62	1.84
Cond. (μmhos/cm)	574	570	594	621	617	614	545	603	592
Cl	85.6	79.1	87.4	90.5	98.0	91.8	83.0	80.9	87.0
Dissolved oxygen	8.2	8.2	8.4	8.8	8.9	8.7	8.8	8.4	8.6
Turbidity (NTU)	11.7	19.8	26.6	25.7	15.5	9.1	13.9	17.2	17.4
Color (Pt units)	-	55	47	46	38	35	40	35	42
Secchi Disc (M)	0.6	0.6	0.5	0.6	0.7	-	-	0.6	0.6
Chlorophyll a (μg/L)	-	24.0	27.0	26.1	-	-	-	19.0 (2)	24.0
Total Org. Carbon	-	-	-	-	13.1 (3)	17.1	14.8	15.7	15.2
Alkalinity (meq/l)	2.7	2.5	2.6	2.7	2.5	2.3	1.9	2.1	2.4

(1) Units in mg/L unless otherwise noted

(2) Data for August and September 1980 missing from annual average

(3) Period from Oct. 1977 through March 1978

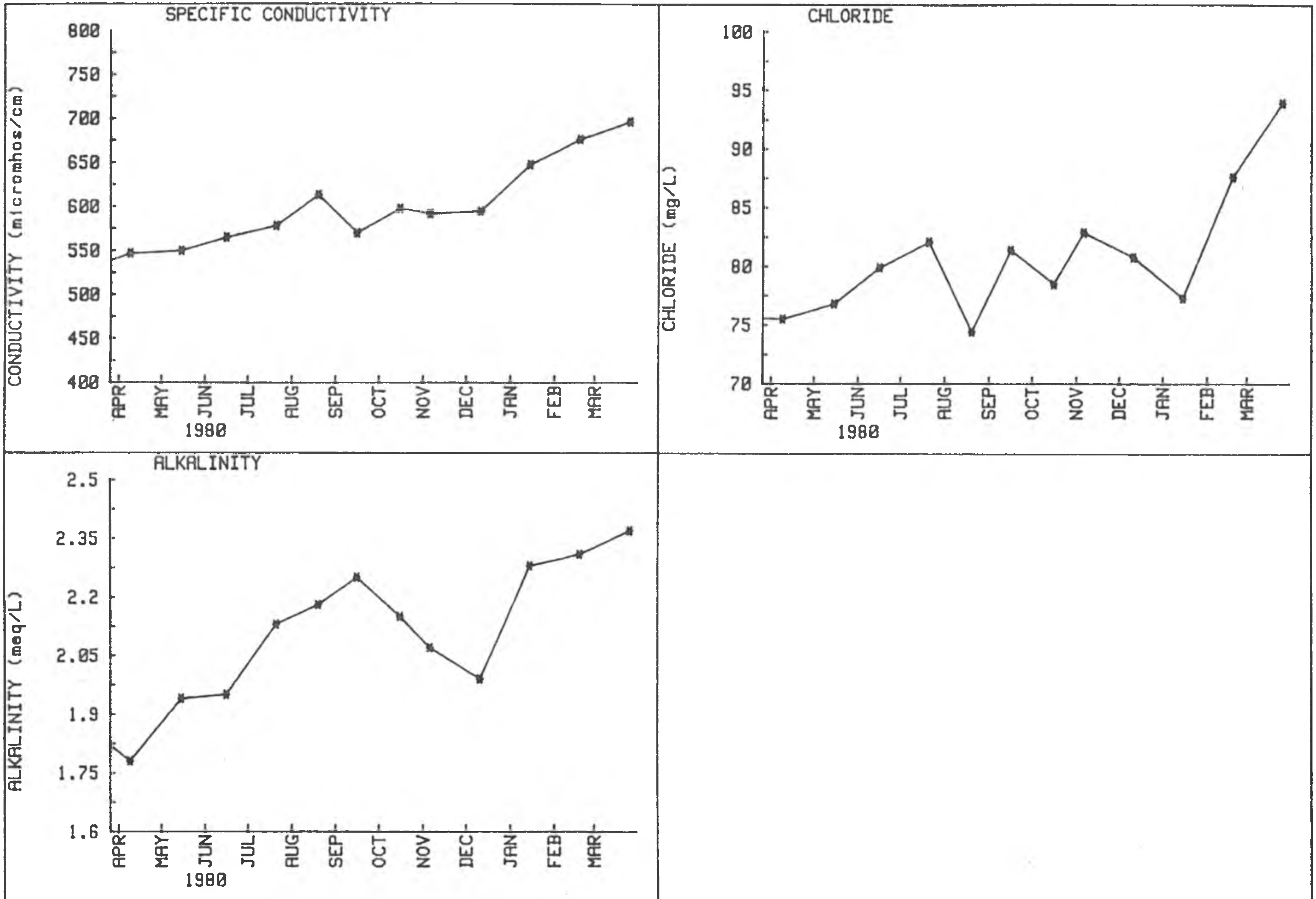

FIGURE 4 . SPECIFIC CONDUCTIVITY, CHLORIDE AND ALKALINITY IN LAKE OKEECHOBEE

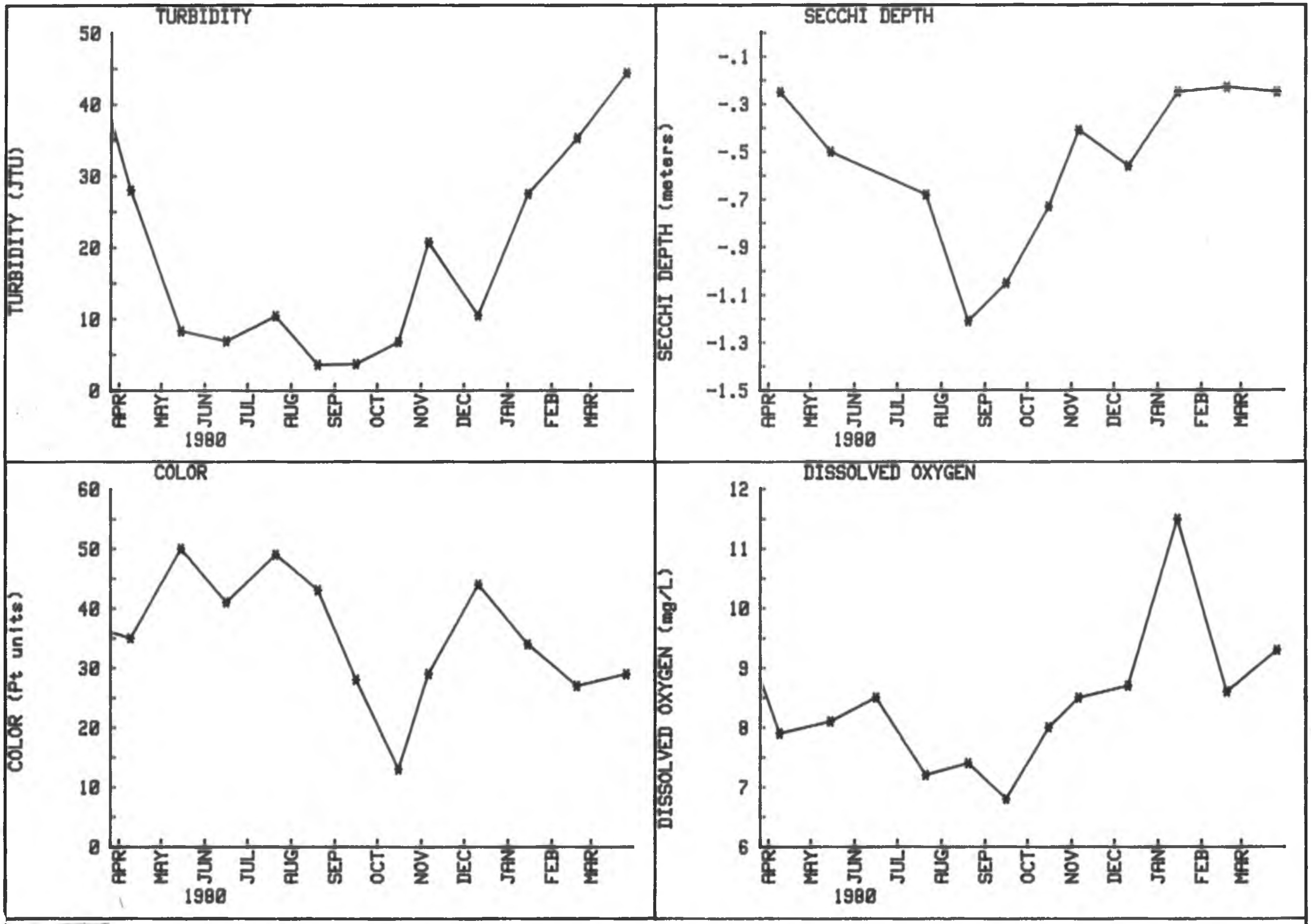

FIGURE 5. TURBIDITY, SECCHI DEPTH, COLOR, AND DISSOLVED OXYGEN IN LAKE OKEECHOBEE

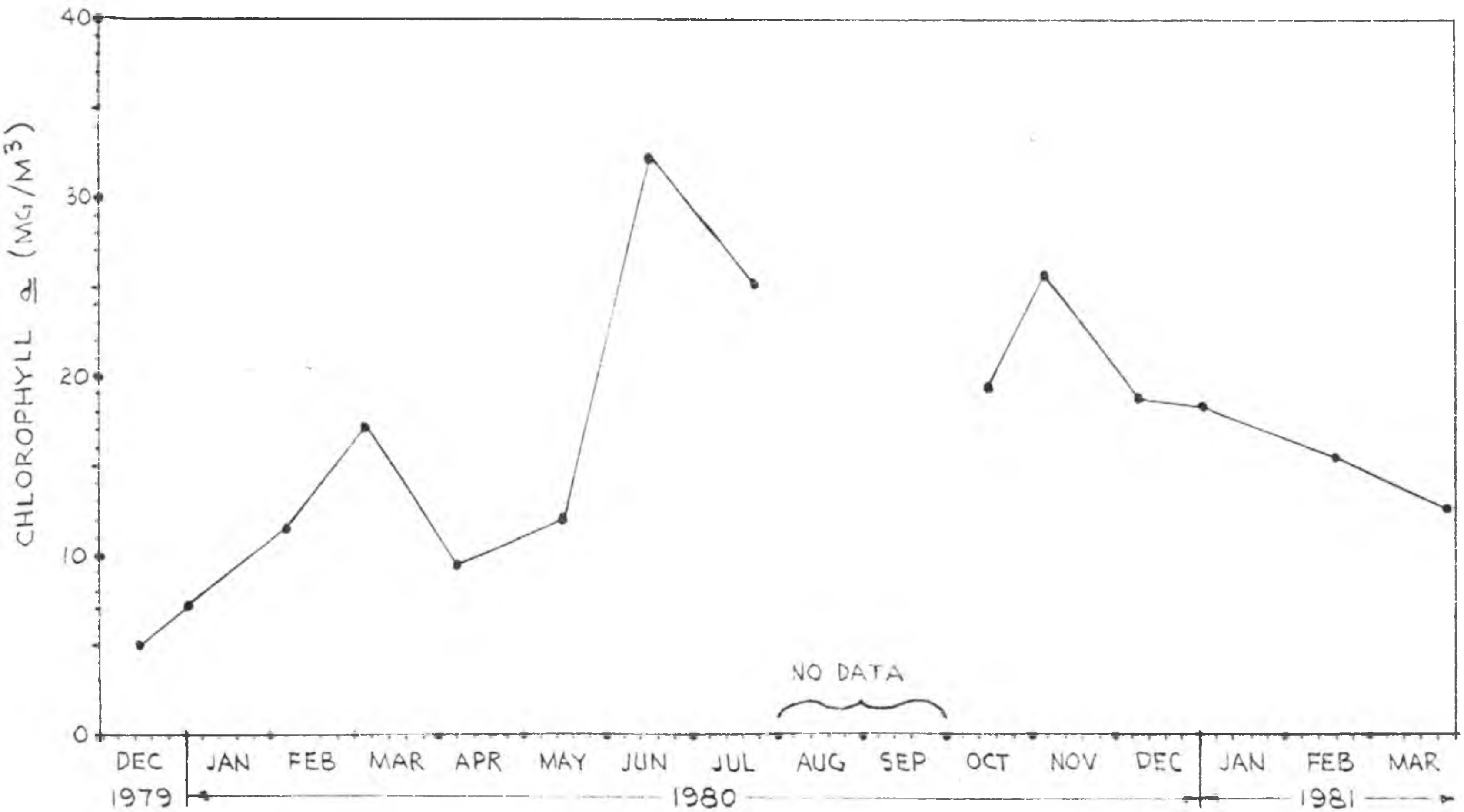

FIGURE 6. LAKE CHLOROPHYLL A CONCENTRATIONS - DECEMBER 1979 to MARCH 1981

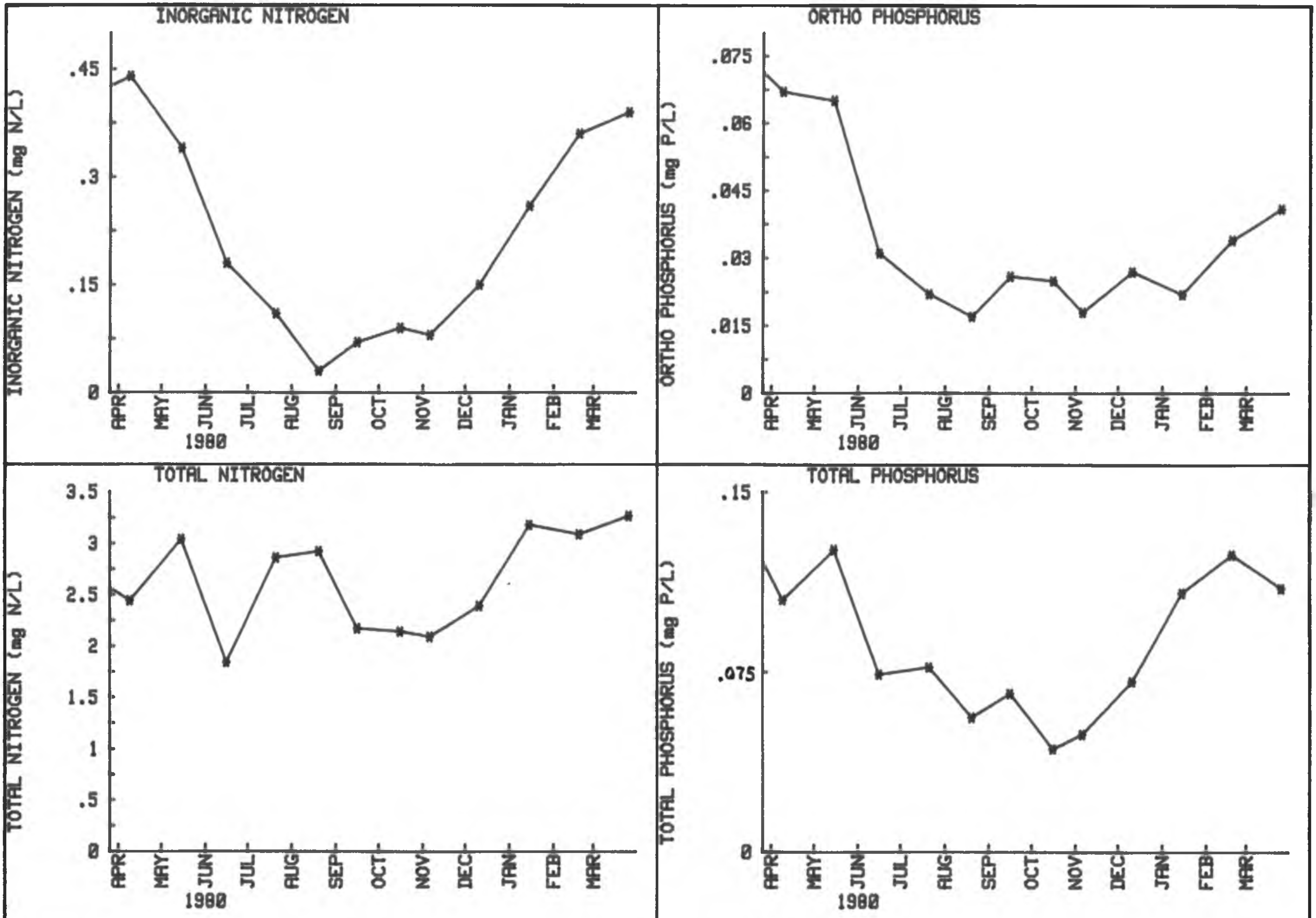

FIGURE 7. PHOSPHORUS AND NITROGEN IN LAKE OKEECHOBEE

Color exhibited no apparent seasonal trend, averaging 35 Pt units over the year.

Dissolved oxygen concentration varied seasonally in response to lake temperature. The mean concentration peaked at 11.5 mg O_2/L in January when a mean temperature of 10.7° C was recorded. The average D.O. concentration for the year was 8.4 mg/L and ranged from 86% to 106% of saturation levels.

Total organic carbon averaged 15.7 mg/L and varied little over the year.

Chlorophyll a, an indicator of algal biomass, was measured each month except August and September, two months which have shown large algal growth in the past (Marshall 1977). The graph of chlorophyll concentrations (Figure 6) also includes data from December 1979 to March 1980, since these data have not been presented before. Mean chlorophyll values ranged from 5.0 mg/m^3 in December 1979 to 32.1 mg/m^3 in June 1980. The mean annual concentration appears not to have changed significantly since 1974-1976.

The mean total and orthophosphorus concentrations for 1980 were 0.084 mg/L and 0.033 mg/L, respectively. These concentrations were less than the highest annual averages recorded in 1979 (0.097 mg/L and 0.045 mg/L) but were still greater than levels recorded in any other year. Concentrations declined in the summer and increased during the winter (Figure 7).

Total nitrogen in 1980 averaged 2.62 mg/L, higher than for any other year on record. Organic nitrogen, which accounted for 92% of the total concentration, was the nitrogen fraction responsible for this increase. Inorganic nitrogen averaged 0.21 mg/L, slightly less than the 1979 average of 0.26 mg/L. The inorganic fraction exhibited a distinct seasonal trend, with levels nearing detection limits in the summer and fall (Figure 7).

One of the most interesting phenomena revealed during the eight years of study has been the seasonal variations in N and P concentrations. Federico et al. (1981) previously observed that maximum inorganic N and P concentrations occurred in the winter while the lowest values occurred during the summer. They attributed these variations to a complex association between many factors including phytoplankton and littoral zone dynamics, internal nutrient cycling and hydraulic loading characteristics.

Federico et al. found orthophosphorus to be positively correlated with morphometric characteristics such as lake stage, mean depth, volume and surface area. A relationship was also found between ortho P and external inputs of orthophosphorus, but this relationship was not as well defined. Because external loading could not fully explain the seasonal variations in limnetic ortho P concentrations, an internal loading process was suggested.

Attention was focused on two areas where this internal loading process may have occurred: the large littoral zone and the agricultural islands on the west and south sides of the lake, respectively. At the end of the growing season in the fall, most macrophytes in the littoral zone senesce, collapse to the sediment,and decompose. This decomposition releases proportionally more phosphorus than nitrogen (Brezonik et al. 1979). Federico et al. proposed that the fall/winter flooding of the littoral zone facilitated the transport of these nutrients to the lake's limnetic zone, contributing to the fall/winter peaks in inorganic N and P levels. The agricultural islands (Ritta, Torry and Kreamer) were intensively farmed before the latest stage regulation schedule was put into effect. These islands were heavily fertilized with phosphorus and there is reason to believe that this phosphorus was relatively mobile in the soil. When the regulation schedule was raised to 17.5 feet MSL, these islands were flooded during the dry seasons of 1978 and 1979, and phosphorus was presumed to have been extracted from the soil and transported to the lake's limnetic zone. Federico et al. concluded that the record-high orthophosphorus levels observed in 1979 were caused, in part, by sustained flooding of the littoral zone and islands. However, it was noted that the large external inflow of phosphorus could have also factored in the high lake ortho P concentrations.

A plot of ortho P concentrations for the eight years of study shows that values decreased from the extremes recorded at the end of the 1979 study year (Figure 8). (However, it is important to note that summertime ortho P levels in 1980 were higher than those of any other year). A decline in lake stage coincided with the summer reduction in ortho P concentration. In the fall of 1980, the lake did not experience the rise in stage that occurred in the previous two years and by March, the ortho P concentration had increased to only half of what it was in March of the year before.

Looking at Figure 8, one could conclude that the 1980 data provide additional evidence that littoral zone flooding was at least partially responsible for the high ortho P levels in 1979 because both stage and ortho P were high in 1979 and low in 1980. However, a causal relationship between stage and ortho P cannot be proven from the data at hand because the 1979 external P input was also high (810.4 tonnes) and the 1980 external input was very low (224.4 tonnes). Consequently, the inclusion of the 1980 data neither strengthens nor weakens the hypothesis that

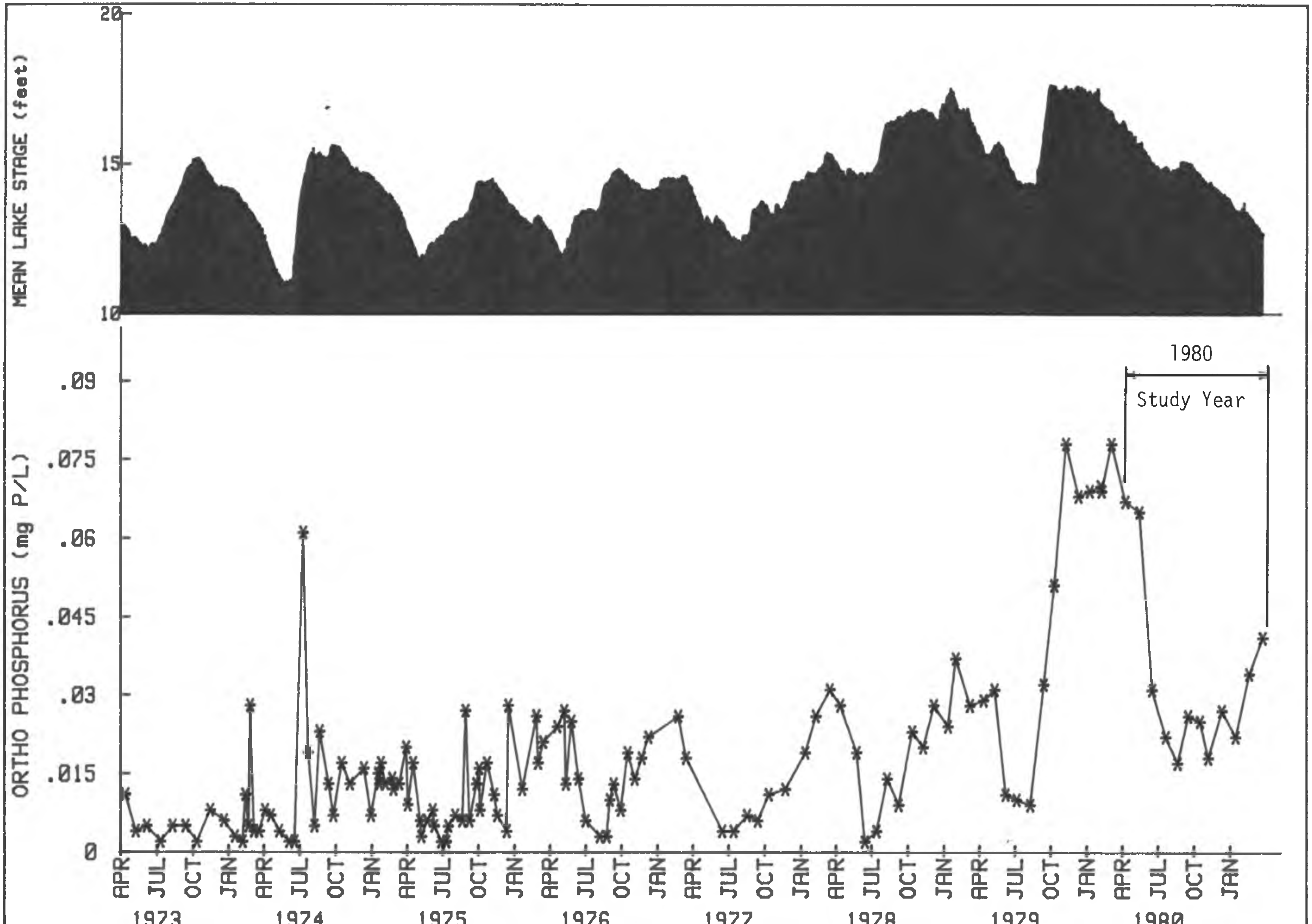

FIGURE 8. ORTHO PHOSPHORUS AND STAGE IN LAKE OKEECHOBEE - 1973 -> 1980

nutrient transport from littoral zones is an important internal loading mechanism at high lake stages. This hypothesis needs more intensive investigation.

Total phosphorus showed the same seasonal trend as orthophosphorus. The total P winter peak in 1980 was less than that of the year before (Figure 9).

The winter peak in inorganic nitrogen was also slightly less than that observed in 1979 (Figure 10). It has been suggested that wintertime release of inorganic N from resuspended sediments may partially account for winter increases in this nutrient fraction (Messer et al. 1979, Brezonik et al. 1979; cited by Federico et al. 1981). Federico et al. reported that inorganic nitrogen did not appear to be closely related to lake stage or similar morphometric parameters. Utilization by phytoplankton is probably responsible for driving inorganic N to its summertime lows.

No strong seasonal trends in total nitrogen have been apparent during the study. However, it appears from Figure 11 that total N has been generally increasing since 1977. Organic nitrogen is reponsible for this increase since this fraction has averaged 91% of the total N concentration.

Federico et al. noted a significant decline in annual inorganic nitrogen to inorganic phosphorus ratios (IN/IP). The mean annual IN/IP ratio decreased from 22.5 in 1973 to 6.1 in 1979. In 1980, this ratio was again 6.1. The ratio varied with the season, ranging from 1.8 in August to 11.8 in January (Figure 12). This seasonal variation has also been observed in previous years. Assuming an intracellular N/P ratio of 7.2:1, algal growth would have been potentially limited by

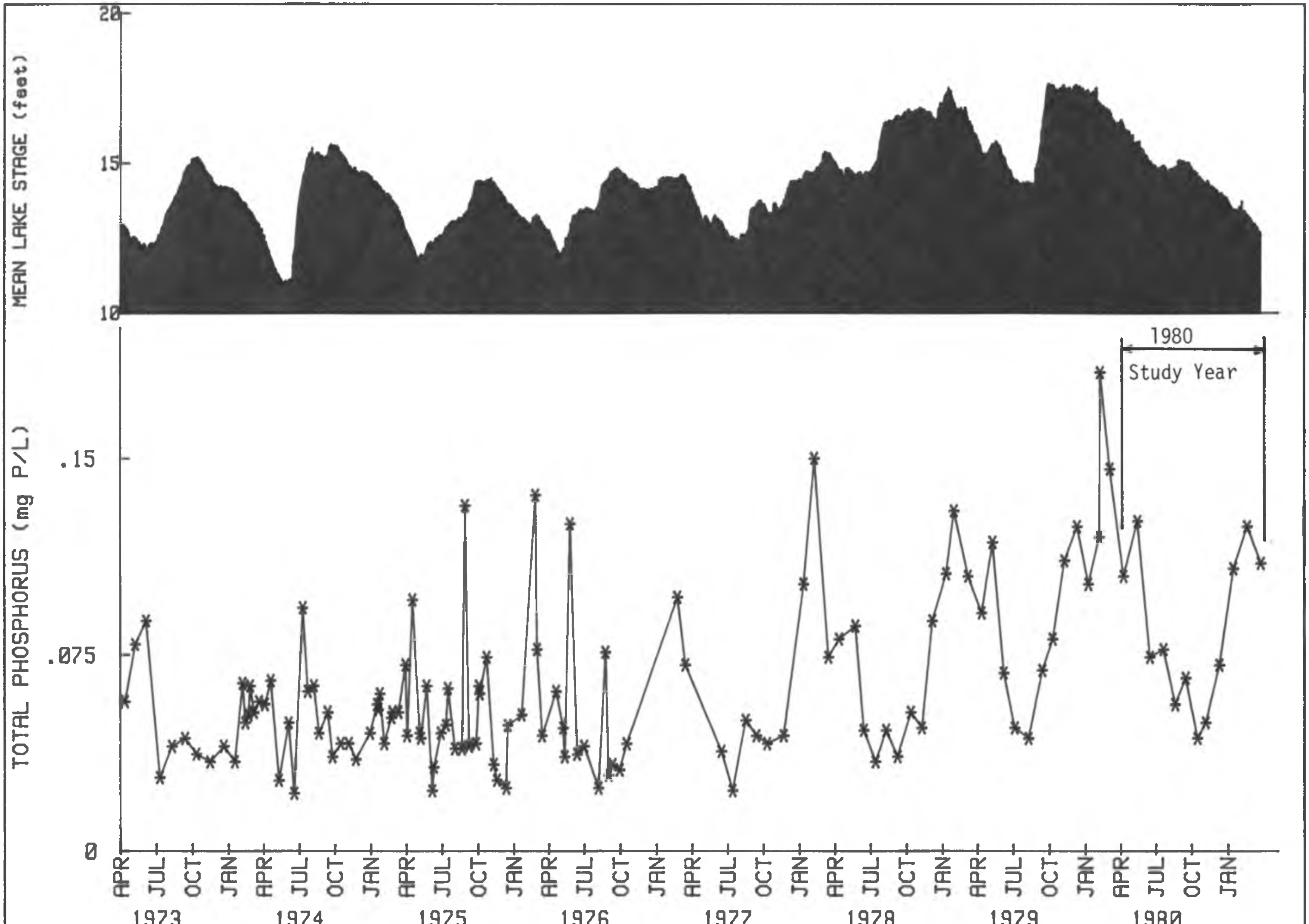

FIGURE 9. TOTAL PHOSPHORUS AND STAGE IN LAKE OKEECHOBEE - 1973 -> 1980

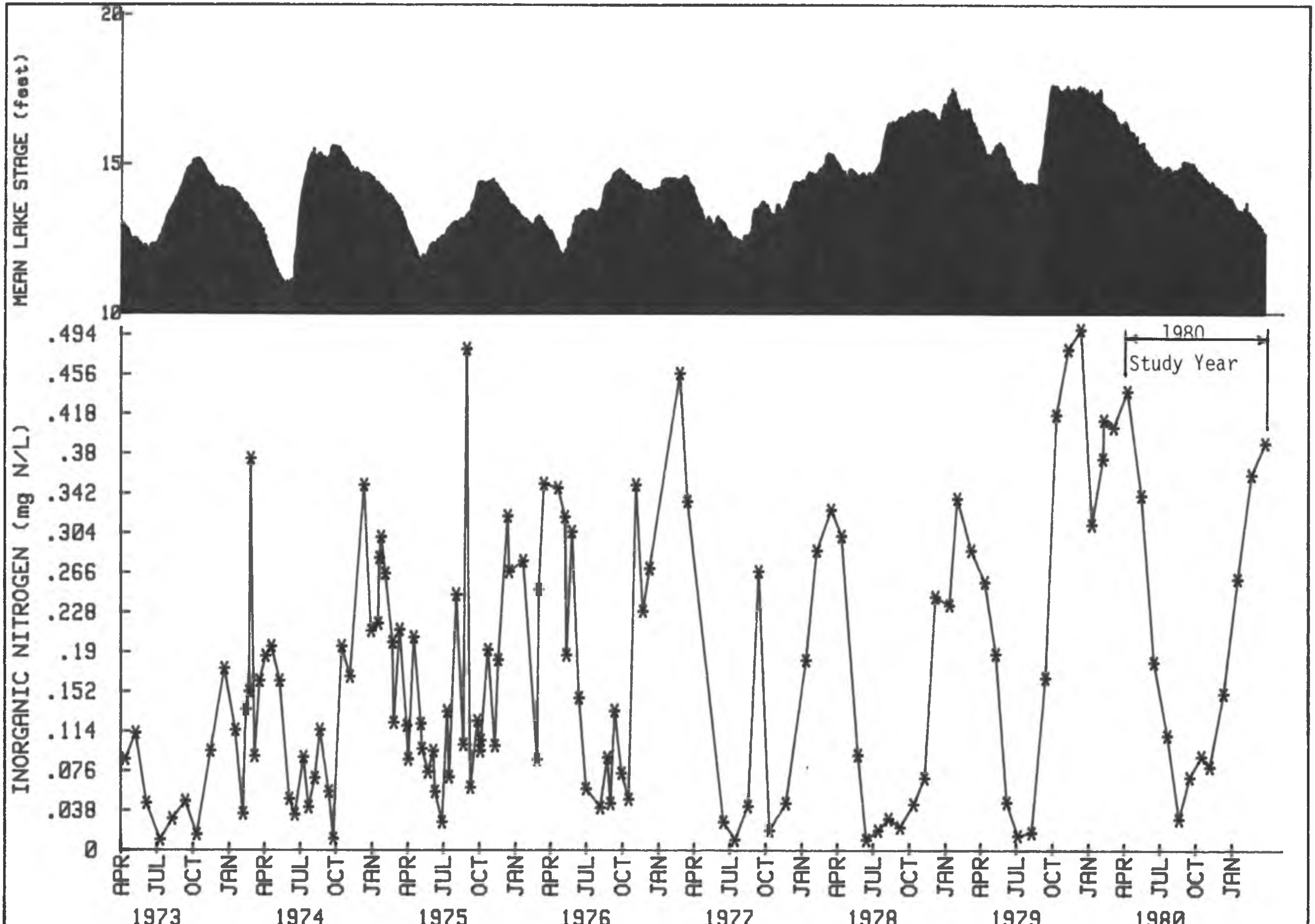

FIGURE 10. INORGANIC NITROGEN AND STAGE IN LAKE OKEECHOBEE - 1973 -> 1980

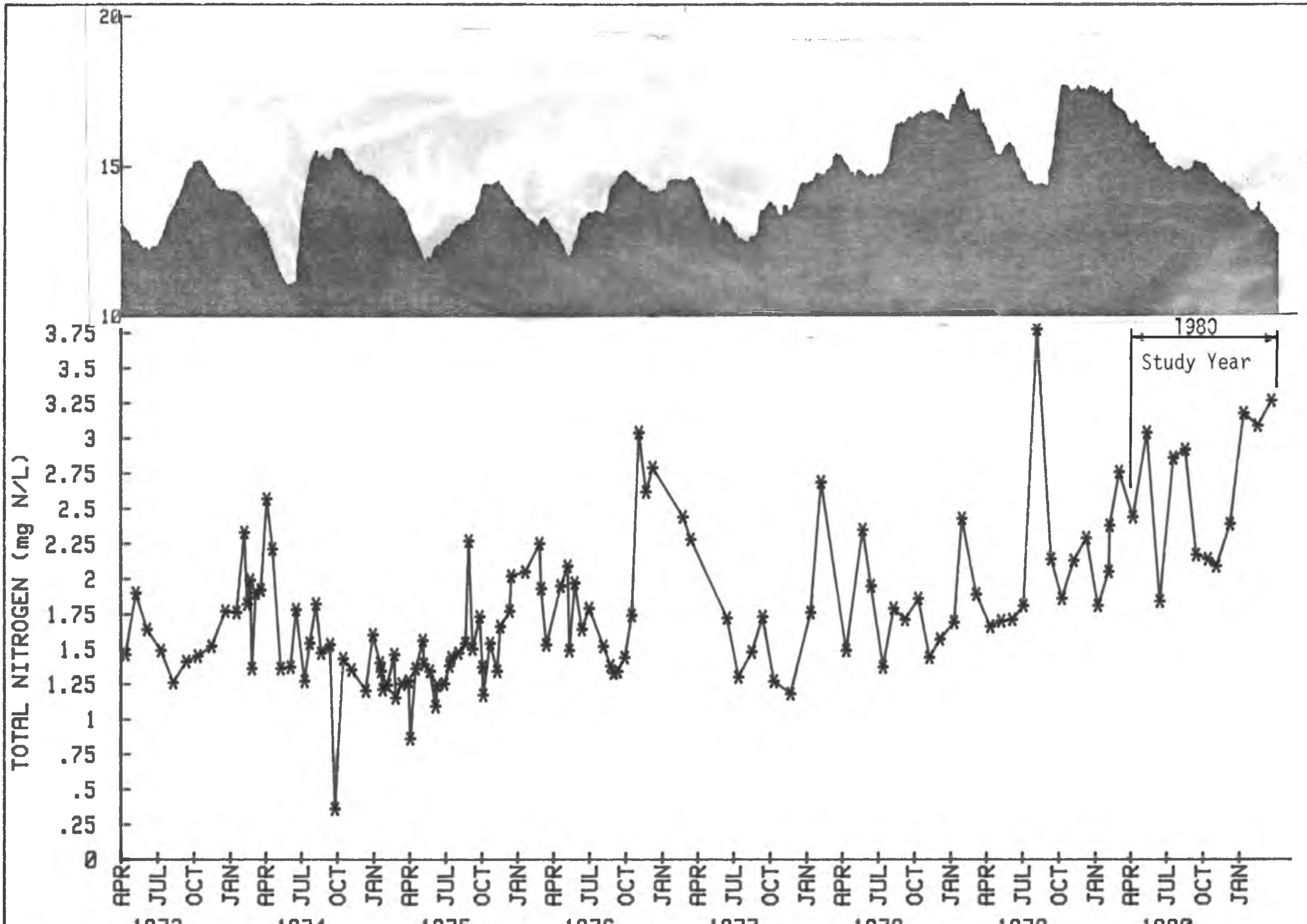

FIGURE 11. TOTAL NITROGEN AND STAGE IN LAKE OKEECHOBEE - 1973 -> 1980

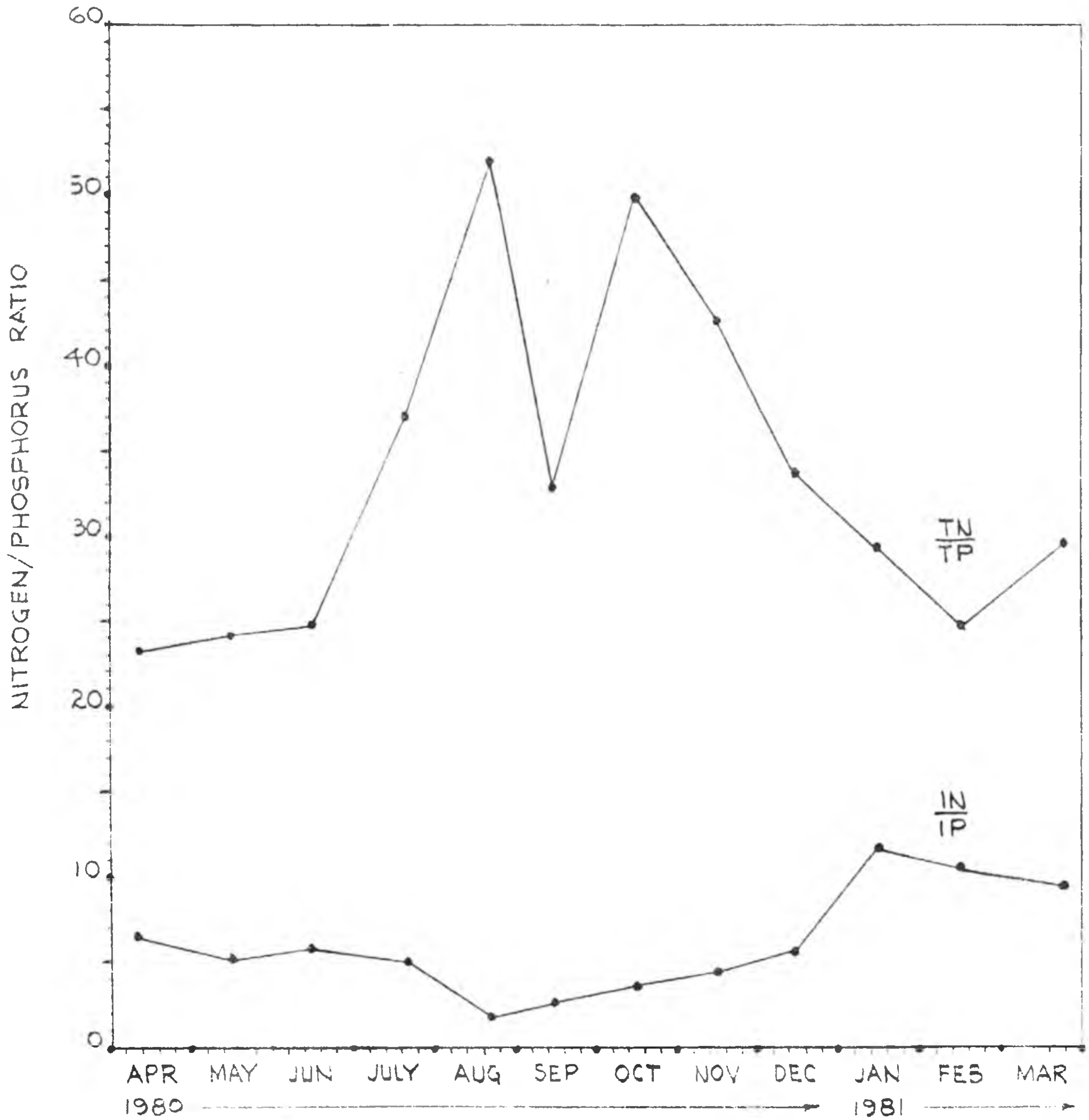

FIGURE 12. NITROGEN/PHOSPHORUS RATIOS IN THE LAKE

nitrogen in the summer. During the winter, inorganic phosphorus and nitrogen levels were high enough so that neither N nor P was a limiting factor. Some other factor (e.g. light, temperature, micronutrients) probably limits winter phytoplankton growth.

The average total nitrogen to total phosphorus ratio (TN/TP) in 1980 was 33.7. This figure is higher than the 1979 ratio of 23.6, reflecting an increase in organic nitrogen and a decrease in total phosphorus. The TN/TP ratio varied seasonally as in the past, with the highest values occurring in summer and fall months. This seasonal pattern was opposite to the seasonal pattern of IN/IP ratios.

Table 11 shows mean values of water quality parameters at each lake station. No attempt has been made to test for statistically significant differences between stations, but some relative differences can be noted. For instance, turbidity was highest at stations 3, 4, 6 and 8. Federico et al. (1981) found that turbidity levels were significantly greater at these stations than at other stations and attributed this to stations 3, 4, 6, and 8 being over mud bottoms while stations 1, 5, and 7 are over sand bottoms. In 1980, inorganic nitrogen and phosphorus concentrations were lowest at station 5 and highest at station 4. Total nitrogen concentrations tended to be slightly greater at the north end of the lake (stations 1, 2 3). Stations 3 and 4 had the highest average concentrations of total P while station 5 had the lowest. However, station 5 ranked highest in average chlorophyll a concentration. No apparent differences in IN/IP and TN/TP ratios seemed to exist between the north and south ends of the lake.

TABLE 11. MEAN ANNUAL LIMNETIC WATER QUALITY BY ST

Parameter	1	2	3
Sp. Conductance (μmhos/cm)	591 (60)	608 (46)	600 (48)
Chloride (mg/L)	79.3 (6.7)	81.5 (5.4)	79.8 (5.5)
Alkalinity (meq/L)	2.06 (0.20)	2.12 (0.16)	2.11 (0.19)
pH	8.15 (0.22)	8.25 (0.19)	8.10 (0.15)
Turbidity (NTU)	13.9 (13.5)	16.4 (11.3)	18.6 (16.1)
Secchi Depth (m)	0.51 (0.26)	0.46 (0.22)	0.51 (0.31)
Color (Pt units)	38 (16)	36 (17)	39 (13)
Dissolved O_2 (mg/L)	8.2 (1.4)	8.4 (1.5)	8.2 (1.2)
TOC (mg/L)	16.1 (1.7)	15.5 (2.0)	15.5 (2.0)
Chlorophyll _a_ (mg/m^3)	23.1 (15.6)	21.3 (11.5)	14.5 (7.7)

ATION[1]

Station 4	5	6	7	8
598 (51)	603 (49)	605 (52)	607 (50)	607 (47)
80.4 (6.3)	80.9 (5.4)	81.4 (5.5)	82.2 (6.1)	81.9 (5.6)
2.13 (0.22)	2.13 (0.20)	2.12 (0.18)	2.12 (0.17)	2.14 (0.17)
8.08 (0.15)	8.56 (0.40)	8.11 (0.21)	8.17 (0.24)	8.29 (0.29)
23.4 (16.5)	13.3 (17.0)	18.8 (17.1)	10.7 (8.8)	22.2 (18.7)
0.40 (0.29)	0.60 (0.27)	0.65 (0.53)	0.88 (0.76)	0.44 (0.28)
36 (12)	34 (13)	34 (12)	32 (12)	34 (13)
8.2 (1.2)	9.0 (1.2)	8.2 (1.3)	8.3 (1.4)	8.6 (0.9)
15.5 (2.6)	16.3 (1.8)	15.1 (1.9)	15.4 (2.7)	15.8 (2.4)
11.4 (3.3)	31.3 (23.5)	12.6 (8.6)	15.1 (12.1)	23.4 (14.7)

TABLE 11. MEAN ANNUAL LIMNETIC WATER QUALITY BY STATION (Continued)

Parameter	Station 1	2	3	4	5	6	7	8
Inorganic N (mg/L)	0.23 (0.20)	0.19 (0.16)	0.25 (0.15)	0.27 (0.15)	0.13 (0.18)	0.22 (0.15)	0.21 (0.16)	0.19 (0.17)
Organic N (mg/L)	2.63 (0.75)	2.57 (0.75)	2.54 (0.82)	2.28 (0.40)	2.40 (0.51)	2.28 (0.72)	2.31 (0.62)	2.28 (0.68)
Total N (mg/L)	2.86 (0.82)	2.76 (0.74)	2.78 (0.83)	2.55 (0.49)	2.53 (0.61)	2.50 (0.73)	2.49 (0.63)	2.47 (0.80)
Ortho P (mg/L)	0.031 (0.021)	0.029 (0.023)	0.044 (0.016)	0.048 (0.010)	0.015 (0.022)	0.036 (0.023)	0.032 (0.025)	0.029 (0.027)
Total P (mg/L)	0.082 (0.041)	0.079 (0.028)	0.101 (0.039)	0.106 (0.035)	0.058 (0.032)	0.085 (0.037)	0.072 (0.028)	0.089 (0.050)
IN/IP	7.1	6.6	5.7	5.6	8.7	6.1	6.3	6.2
IN/TP	34.8	34.9	27.5	24.1	43.6	29.4	34.4	27.8

1/ Values in parentheses are standard deviations

Table 12 shows mean annual orthophosphorus concentrations at each station over eight years. Note the large increase in mean orthophosphorus levels at all stations in 1979 and the subsequent decline in 1980 (except at stations 3 and 4). The greatest change occurred at station 5 which is closest to the western littoral zone and may have been more heavily influenced by internal nutrient loading from this area in 1979. Mean orthophosphorus at this station jumped from 0.004 mg/L in 1978 to 0.041 mg/L in 1979 and then declined to 0.015 mg/L in 1980.

TABLE 12. MEAN ANNUAL ORTHOPHOSPHORUS CONCENTRATIONS AT THE BASIC EIGHT STATIONS

	Mean Annual Ortho Phosphorus Conc. (mg/L)							
Station	1973	1974	1975	1976	1977	1978	1979	1980
L001	0.005	0.014	0.008	0.009	0.013	0.016	0.038	0.031
L002	0.004	0.009	0.009	0.013	0.014	0.018	0.044	0.029
L003	0.004	0.009	0.011	0.019	0.011	0.025	0.041	0.044
L004	0.004	0.009	0.015	0.019	0.022	0.028	0.042	0.048
L005	0.002	0.023	0.004	0.009	0.005	0.004	0.041	0.015
L006	0.011	0.017	0.016	0.021	0.020	0.029	0.058	0.036
L007	0.004	0.019	0.018	0.017	0.018	0.018	0.050	0.032
L008	0.007	0.013	0.011	0.015	0.013	0.011	0.044	0.029

Eutrophication Modeling

As outlined by Federico et al. (1981), several mass balance models have been tried in an attempt to accurately predict nutrient concentrations in Lake Okeechobee using nutrient loadings and morphometric and hydrologic data. The predicted nutrient concentrations can then be used to assess the expected trophic state of the lake given a certain nutrient load. Of the equations examined, Federico et al. found that a modified Vollenweider (1976) model was the best predictor of the observed in-lake concentrations of nitrogen and phosphorus. The modified Vollenweider equations for total P and N are expressed as:

$$TP = 0.682\ (L_p/(q_s(1 + \sqrt{\tau_\omega}\ )\ )\ )^{0.934} \quad (3)$$

$$TN = 1.29\ (L_N/(q_s(1 + \sqrt{\tau_\omega})\ )\ )^{0.858} \quad (4)$$

where,

TP and TN are the predicted in-lake concentrations of total phosphorus and total nitrogen (mg/L)

L_p and L_N are the annual loading rates of total P and total N per unit of lake surface area (g/m^2-yr)

q_s is the hydraulic loading rate (m/yr)

τ_ω is the water residence time (years)

Substituting the 1980 values for L_p, L_N, q_s and τ_ω into these equations, the predicted concentrations of total P and total N were 0.094 mg/L and 2.04 mg/L, respectively. These predicted values compare with the 1980 measured concentrations of 0.084 mg P/L and 2.62 mg N/L. The percent difference between the predicted and measured concentrations was calculated by:

$$\% \text{ difference} = \frac{\text{predicted conc.} - \text{measured conc.}}{\text{measured conc.}} \times 100 \qquad (5)$$

The difference in phosphorus concentrations was +12 percent. This indicates that the modified Vollenweider (1976) model slightly over-predicted total P concentrations in the lake for 1980. Over eight years, this model has given an even split between over-predictions and under-predictions. For the previous seven years, the model estimated P concentrations well with an average percent difference of only 2% between predicted and measured concentrations (range = -24 to +53%). The good prediction for 1980 provides further evidence that this model is well calibrated for phosphorus.

The percent difference between predicted and measured nitrogen concentrations was -22 percent which compares closely with the previous seven year average of -26% (range = -50 to -4%). The nitrogen model has consistently under-predicted nitrogen concentrations for each year of the study. Federico et al. suggested that this under-prediction resulted from an underestimation of the nitrogen loading rate, since nitrogen fixation and dry deposition of NO_2 were not considered in the nitrogen budget.

It is interesting to note that even though the 1980 hydraulic and nutrient loading rates were very low, the modified Vollenweider equations still provided a good estimate of phosphorus and an estimate of nitrogen that is consistent with estimates of other years. As a result, it can be stated that the model performs well for years when there is low inflow to the lake.

DISCUSSION

Trends in Lake Nutrient Levels

The most important finding to be drawn from the 1980 data relates to the effect of lake hydrology on nutrient levels. The 1980 study year contrasts with 1978 and 1979 with regard to both water input and lake stage. During the 1978-79 period, the lake experienced large water inputs and lake stages above 17 feet, which culminated in abnormally high limnetic nutrient concentrations at the end of 1979. In 1980, low inflow resulted in the lowest annual input of nutrients measured for any year of study and the lake stage did not exhibit its usual increase in the fall, but instead, continued to decline. Consequently, 1980 nutrient concentrations did not approach the peak levels of 1979, except for total nitrogen. It appears then, that annual changes in lake stage and/or water input can influence nutrient concentrations in the lake from year to year.

Although peak concentrations of phosphorus and inorganic nitrogen declined to their pre-1979 levels, two disturbing trends became more evident with the inclusion of the latest year of data. First, the 1979 and 1980 orthophosphorus seasonal minima have increased from previous years (Figure 8). Prior to 1979, summer ortho P levels were near the limit of detection. The higher levels in 1979 and 1980 indicate excess ortho P not taken up by phytoplankton because of limitation by some other factor, possibly nitrogen. This provides evidence, in addition to the lower IN/IP ratios observed in recent years, that summer/fall primary productivity has become limited by nitrogen rather than phosphorus. Since nitrogen can be fixed from the atmosphere by blue-green algae, productivity could be limited by the rate of nitrogen fixation. If indeed nitrogen is the limiting factor, the combination of nitrogen fixation and excess orthophosphorus could lead to greater algal blooms. Second, total nitrogen has been increasing since 1977 (Figure 11). The reason for this increase, particularly the dramatic rise in 1980 caused by an increase in the organic nitrogen component, is unclear since 1980 nitrogen inputs were low. The increase could possibly be explained by an increase in nitrogen fixation, but no evidence is presently available to support this hypothesis. Both of these trends in ortho P and total N should be watched in the future.

Recommendations for Future Studies

Although analysis by Federico et al. (1981) appears to show that the high nutrient concentrations of 1979 were caused by flooding of littoral areas as well as large external inputs, it was difficult to compare the effects of these two factors because they occurred together. Given a situation similar to 1979, an intensive study should be conducted to collect nutrient samples in and near the western littoral zone, agricultural islands and major inflows. Samples collected at this time could be compared to samples obtained during a period when surface inflows and lake stage were low. This type of study would be useful in determining the relative impacts of internal and external nutrient loading.

Other investigations could add further to an understanding of eutrophication processes in the lake. In the months since the end of the study period of this report, Lake Okeechobee dropped to a record low level due to continued drought. In the late summer and fall of 1981, precipitation fell over the Everglades Agricultural Area and this water was discharged into the lake in an attempt to increase available storage. This period, which provides an opportunity to study the effects of drought followed by large inflows of nutrient-rich water, will be discussed in the next annual report. Other possible studies involve closer looks at the effects of sediment resuspension and the relationships between primary productivity and chlorophyll a and such factors as nutrients, light penetration and season.

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APPENDIX 1

SUMMARY OF WATER QUALITY IN SURFACE DISCHARGES TO AND FROM LAKE OKEECHOBEE - APRIL 1980 THROUGH MARCH 1981

APPENDIX 1. SUMMARY OF WATER QUALITY IN SURFACE DISCHARGES TO AND FROM LAKE OKEECHOBEE - APRIL 1980 THROUGH MARCH 1981

		Dissolved O_2 (mg/l)			% D.O. Saturation			pH		Sp. Conductance (µmhos/cm)		
Station	N	Mean	Min.	Max.	Mean	Min.	Max.	Min.	Max.	Mean	Min.	Max.
Fish. Cr.	25	6.0	2.6	10.5	68	33	96	6.17	7.55	268	140	459
S-131	25	6.7	4.5	9.5	78	57	95	7.47	8.58	772	592	860
S-71	25	5.4	1.5	10.9	61	19	111	6.10	8.12	316	150	555
S-129	25	6.1	1.5	9.7	70	19	107	6.93	8.20	690	480	860
S-72	25	5.6	1.6	9.8	65	20	99	6.09	7.95	371	180	615
S-127	25	7.4	2.4	10.3	87	30	133	7.21	8.70	983	680	1430
S-84	25	7.1	4.5	9.8	83	56	99	6.34	7.44	208	100	363
S-65E	24	6.7	2.2	9.9	78	28	113	6.34	8.65	181	130	294
S-154	25	5.2	0.9	9.6	59	12	95	6.31	7.68	688	330	1350
S-133	25	8.6	3.1	12.6	101	38	165	7.07	8.73	707	620	780
S-191	25	4.6	1.8	10.6	53	23	106	6.55	7.93	686	460	1046
S-135	25	8.0	3.0	13.2	94	37	166	7.54	8.75	920	673	1080
Culv. 11	2	1.7	1.3	2.0	19	15	22	6.59	7.11	1659	978	2340
HGS-5	25	6.3	2.4	10.6	73	30	116	7.36	8.79	815	223	1830
Culv. 10	25	4.9	1.2	10.6	55	14	96	6.99	8.12	1144	620	2530
Culv. 12A	17	2.7	0.8	6.2	31	10	76	7.02	7.76	2651	1520	4290
Culv. 12	25	6.3	0.7	12.8	71	9	159	6.88	8.44	871	602	1670
S-2	25	5.8	1.7	10.1	65	21	101	7.25	8.47	1052	600	1990
Culv. 4A	25	5.9	1.2	10.1	66	14	96	7.10	8.56	873	600	1880
S-3	25	7.0	3.7	11.4	79	46	100	7.46	8.62	694	580	930
S-236	25	5.0	2.8	9.3	57	35	86	7.09	8.17	1419	1010	2350
S-4	25	5.7	1.4	9.7	66	17	102	6.94	8.69	830	600	1263
S-77	25	5.5	2.4	10.0	63	30	96	7.25	8.26	697	519	1040
Rainwater	28	-	-	-	-	-	-	-	-	33	10	100

	Alkalinity (meq/L)				Cl^- (mg/L)			
Station	N	Mean	Min.	Max.	N	Mean	Min.	Max.
Fish. Cr.	25	0.76	0.26	1.21	25	51.1	28.5	87.5
S-131	25	3.06	2.42	3.60	25	113.0	97.8	176.8
S-71	25	0.98	0.48	1.78	25	28.1	14.8	54.3
S-129	25	2.86	1.80	3.72	25	87.7	62.8	111.3
S-72	25	1.47	0.56	2.53	25	30.0	17.0	45.1
S-127	25	3.39	2.80	4.13	25	147.3	100.2	266.1
S-84	25	0.50	0.15	0.89	25	20.9	12.6	33.9
S-65E	24	0.70	0.43	0.91	24	20.9	13.9	38.4
S-154	25	1.17	0.84	1.44	25	128.2	60.4	279.0
S-133	25	2.55	2.21	3.64	25	102.7	81.0	123.2
S-191	25	1.62	1.04	2.48	25	124.5	85.7	174.1
S-135	25	3.84	2.31	5.24	25	139.2	99.8	183.3
Culv. 11	2	4.39	3.38	5.40	2	329.5	156.9	502.1
HGS-5	24	2.94	0.28	6.86	25	122.2	9.4	409.7
Culv. 10	25	4.20	2.34	8.96	25	159.6	83.8	383.8
Culv. 12A	17	7.37	4.97	10.24	17	483.4	202.3	787.6
Culv. 12	25	3.67	2.07	7.78	25	99.4	80.5	137.9
S-2	25	4.08	2.06	8.74	25	147.9	81.6	330.0
Culv. 4A	25	3.54	2.01	8.42	25	111.9	81.0	205.5
S-3	25	2.60	1.93	3.87	25	97.9	81.0	131.9
S-236	25	5.33	1.71	7.50	25	187.3	93.1	396.5
S-4	25	3.95	2.20	8.39	25	108.7	79.9	155.7
S-77	25	3.14	1.87	8.67	25	91.7	78.3	124.2
Rainwater	32	0.26	0.10	0.63	33	6.0	4.0	24.3

$SO_4^{=}$ (mg/L)				Total Fe (mg/L)			
N	Mean	Min.	Max.	N	Mean	Min.	Max.
20	16.8	5.0	38.0	24	0.43	0.15	1.58
20	41.5	19.7	140.1	23	0.16	0.02	1.38
20	50.7	24.0	84.2	24	0.56	0.05	1.92
20	49.8	27.2	76.1	24	0.13	0.02	0.66
20	55.3	24.0	89.8	22	0.81	0.41	2.18
20	69.2	41.4	115.5	24	0.14	0.02	1.05
20	33.1	14.1	62.3	24	0.30	0.12	0.56
20	21.6	10.0	47.1	23	0.25	0.07	0.37
20	51.2	19.1	114.5	24	0.57	0.16	1.31
20	46.2	14.1	75.4	24	0.16	0.02	0.75
20	42.1	21.8	76.9	24	0.38	0.07	0.63
20	47.0	29.9	75.4	24	0.14	0.02	0.76
2	89.6	62.2	116.9	2	0.33	0.06	0.59
20	56.8	35.3	109.1	23	0.48	0.02	1.47
20	91.1	40.9	271.6	22	0.21	0.02	1.08
13	272.3	125.3	558.5	16	0.17	0.05	0.81
20	93.8	40.3	277.0	23	0.15	0.02	0.69
20	87.3	39.2	215.6	24	0.11	0.02	0.44
20	73.8	42.2	217.1	24	0.10	0.02	0.50
20	56.0	36.9	120.4	24	0.11	0.02	0.52
20	103.4	51.4	231.1	24	0.13	0.02	0.65
20	59.3	31.8	99.1	24	0.10	0.02	0.40
20	45.0	31.5	60.2	24	0.12	0.02	0.41
13	10.6	5.0	53.1	14	0.07	0.02	0.24

Station	Color (Pt Units)				Turbidity		
	N	Mean	Min.	Max.	N	Mean	Min.
Fish. Cr.	24	195	70	440	25	1.8	0.4
S-131	25	75	45	125	25	1.2	0.4
S-71	25	144	82	225	25	1.7	0.5
S-129	25	97	57	160	25	1.3	0.6
S-72	25	175	100	325	25	2.0	0.7
S-127	25	103	50	165	25	1.9	0.7
S-84	24	76	40	115	25	1.4	0.7
S-65E	24	116	40	200	24	1.2	0.6
S-154	25	205	90	395	25	1.0	0.5
S-133	25	59	20	100	25	3.4	0.9
S-191	25	167	80	300	25	1.5	0.6
S-135	25	52	22	110	25	2.1	0.5
Culv. 11	3	70	20	100	3	1.4	0.7
HGS-5	24	52	23	110	24	15.6	1.5
Culv. 10	25	76	20	260	25	3.5	1.0
Culv. 12A	17	128	78	245	16	2.0	0.5
Culv. 12	25	94	20	300	25	3.6	0.6
S-2	25	74	10	200	25	2.9	0.6
Culv. 4A	25	56	15	140	25	2.9	0.9
S-3	25	44	10	85	25	3.4	1.7
S-236	25	98	68	180	25	1.7	0.6
S-4	25	93	40	220	25	1.7	0.6
S-77	25	59	30	120	25	2.3	0.7
Rainwater	20	14	4	30	14	2.4	0.3

(NTU)	Total Sus. Solids (mg/L)				Total Org. Carbon (mg/L)			
Max.	N	Mean	Min.	Max.	N	Mean	Min.	Max.
8.2	25	3.9	1.0	13.0	25	24.0	18.8	38.0
2.8	25	4.2	1.0	12.0	25	20.4	16.4	23.3
5.2	25	5.6	1.0	37.0	24	20.0	13.3	25.5
3.0	25	4.5	1.0	9.0	25	22.4	19.4	40.1
6.5	25	7.6	1.0	25.0	25	23.8	14.1	41.5
4.7	25	7.0	1.0	18.0	25	25.6	16.8	40.4
3.3	25	3.2	1.0	8.0	25	13.3	10.7	19.6
2.3	24	4.1	1.0	10.0	24	17.8	11.8	43.4
2.8	25	4.6	1.0	17.0	25	24.8	18.5	41.8
12.0	25	9.6	1.0	20.0	24	20.2	15.4	32.1
3.2	25	5.2	1.0	21.0	25	23.6	18.2	48.4
4.5	25	6.6	1.0	17.0	25	22.1	17.6	28.3
2.6	2	3.0	1.0	5.0	2	25.9	23.1	28.7
65.0	24	34.1	8.0	160.0	25	19.6	14.4	39.5
8.7	24	13.2	1.0	99.0	23	25.9	15.5	56.2
5.8	16	9.8	1.0	24.0	16	39.4	21.3	71.8
10.0	25	8.8	1.0	18.0	22	24.8	12.7	66.3
7.3	25	11.2	1.0	43.0	22	24.2	13.8	50.2
5.5	25	9.3	1.0	28.0	23	21.0	13.9	31.5
8.7	25	10.5	1.0	37.0	24	18.5	14.3	23.0
3.1	25	5.6	1.0	17.0	24	29.2	15.7	47.1
3.0	25	6.0	1.0	12.0	24	24.1	14.0	36.8
15.0	25	7.5	1.0	24.0	25	20.5	15.1	31.7
10.0	5	9.7	1.0	19.0	3	6.6	0.9	12.3

	$NO_3 + NO_2$ (mg N/L)				NH_4 (mg N/L)		
Station	N	Mean	Min.	Max.	N	Mean	Min.
Fish. Cr.	25	0.050	0.007	0.161	25	0.13	0.01
S-131	25	0.044	0.004	0.486	25	0.03	0.01
S-71	25	0.452	0.004	1.552	25	0.07	0.01
S-129	25	0.020	0.004	0.080	25	0.04	0.01
S-72	25	0.119	0.004	1.266	25	0.06	0.01
S-127	25	0.027	0.004	0.156	25	0.09	0.01
S-84	25	0.045	0.004	0.116	25	0.04	0.01
S-65E	24	0.216	0.004	0.496	24	0.07	0.01
S-154	25	0.025	0.004	0.111	25	0.07	0.01
S-133	24	0.035	0.004	0.210	25	0.06	0.01
S-191	25	0.662	0.031	1.538	24	0.44	0.01
S-135	25	0.044	0.004	0.144	24	0.03	0.01
Culv. 11	2	0.036	0.004	0.068	3	0.50	0.01
HGS-5	25	0.299	0.005	1.624	25	0.22	0.01
Culv. 10	25	0.504	0.004	10.202	25	0.87	0.07
Culv. 12A	17	0.456	0.004	6.168	16	1.74	0.01
Culv. 12	25	1.624	0.004	12.674	25	0.22	0.01
S-2	25	0.444	0.004	4.650	25	0.38	0.01
Culv. 4A	25	0.101	0.004	0.522	25	0.48	0.01
S-3	25	0.080	0.004	0.332	25	0.11	0.01
S-236	25	0.683	0.209	3.011	24	0.63	0.14
S-4	25	0.207	0.004	0.692	24	0.30	0.01
S-77	25	0.093	0.016	0.248	25	0.17	0.01
Rainwater	28	0.358	0.108	0.952	29	0.27	0.01

	Organic N (mg/L)				Total N (mg/L)			
Max.	N	Mean	Min.	Max.	N	Mean	Min.	Max.
1.26	25	2.43	1.56	6.05	25	2.60	1.63	6.28
0.17	25	2.29	1.26	3.75	25	2.36	1.28	3.77
0.38	25	2.12	1.02	3.77	25	2.64	1.04	4.39
0.27	25	2.40	1.28	2.96	25	2.46	1.33	3.06
0.26	25	2.63	1.30	5.17	25	2.82	1.35	5.49
0.55	24	2.86	1.57	4.41	24	2.98	1.75	4.43
0.20	25	1.54	0.53	4.13	25	1.62	0.54	4.15
0.34	24	1.81	0.82	3.16	24	2.09	1.03	3.17
0.41	25	2.42	1.30	4.03	25	2.52	1.34	4.13
0.74	25	2.55	1.32	5.44	24	2.63	1.33	5.46
1.64	24	2.36	1.32	3.62	25	3.50	1.74	4.80
0.16	24	2.60	1.27	4.19	25	2.67	1.33	4.20
1.41	2	1.93	1.65	2.21	2	2.71	1.74	3.69
0.94	25	2.92	0.70	9.27	25	3.43	1.10	10.05
3.93	24	3.06	1.03	7.86	24	3.96	1.26	8.77
3.52	16	4.08	0.22	8.24	16	6.30	1.06	16.91
1.59	25	4.19	1.28	19.36	25	6.04	1.39	24.20
1.56	25	3.22	0.89	6.41	25	4.04	1.57	9.53
2.42	25	2.62	1.20	4.18	25	3.20	1.30	6.25
0.62	25	2.46	1.28	3.21	25	2.65	1.33	3.58
2.02	24	3.15	0.97	5.83	25	4.45	2.35	10.55
1.55	24	2.84	1.12	5.84	25	3.39	1.56	7.31
0.87	25	2.40	0.83	3.06	25	2.67	1.07	3.98
0.83	28	0.92	0.10	1.89	24	1.52	0.56	2.79

Station	N	Ortho P (mg/L) Mean	Min.
Fish. Cr.	25	0.130	0.022
S-131	25	0.032	0.006
S-71	25	0.114	0.039
S-129	25	0.050	0.002
S-72	25	0.102	0.029
S-127	25	0.240	0.089
S-84	25	0.011	0.003
S-65E	23	0.098	0.007
S-154	24	0.224	0.003
S-133	24	0.112	0.002
S-191	22	0.881	0.264
S-135	24	0.027	0.002
Culv. 11	3	0.083	0.002
HGS-5	25	0.058	0.010
Culv. 10	25	0.075	0.002
Culv. 12A	17	0.092	0.002
Culv. 12	25	0.033	0.002
S-2	25	0.058	0.002
Culv. 4A	25	0.015	0.002
S-3	25	0.010	0.002
S-236	25	0.028	0.002
S-4	24	0.128	0.002
S-77	25	0.049	0.002
Rainwater	30	0.034	0.002

Max.	Total P (mg/L) N	Mean	Min.	Max.
0.583	25	0.175	0.059	0.607
0.087	25	0.068	0.032	0.185
0.255	25	0.157	0.075	0.316
0.166	25	0.089	0.038	0.236
0.198	25	0.170	0.071	0.347
0.385	25	0.328	0.134	0.736
0.044	25	0.032	0.009	0.061
0.297	23	0.134	0.024	0.326
0.752	24	0.336	0.061	0.834
0.378	23	0.197	0.032	0.427
1.074	23	0.974	0.155	1.297
0.112	25	0.069	0.036	0.182
0.184	2	0.140	0.085	0.195
0.135	24	0.131	0.060	0.285
0.406	25	0.161	0.019	0.561
0.257	17	0.191	0.056	0.522
0.143	25	0.086	0.022	0.360
0.384	25	0.111	0.015	0.533
0.083	25	0.055	0.002	0.123
0.076	25	0.049	0.003	0.108
0.089	25	0.060	0.002	0.139
0.758	25	0.171	0.036	0.892
0.227	25	0.091	0.019	0.276
0.015	30	0.062	0.012	0.206

Station	Na (mg/L)		K (
Fish. Cr.	29.30	(6.44) 1/	4.72
S-131	76.26	(9.08)	6.97
S-71	17.24	(6.85)	4.34
S-129	55.77	(4.97)	5.07
S-72	20.55	(3.56)	3.38
S-127	76.16	(3.54)	6.91
S-84	12.45	(5.40)	2.70
S-65E	13.58	(5.79)	2.20
S-154	71.91	(42.45)	9.26
S-133	56.62	(13.56)	6.01
S-191	61.56	(20.80)	9.26
S-135	86.04	(14.85)	5.64
Culv. 11	-	-	-
HGS-5	114.38	(47.81)	7.99
Culv. 10	81.61	(16.89)	6.01
Culv. 12A	383.20	(160.97)	13.08
Culv. 12	71.79	(18.04)	5.81
S-2	109.06	(36.77)	7.96
Culv. 4A	75.42	(23.61)	5.65
S-3	60.75	(5.88)	5.72
S-236	118.91	(31.48)	6.28
S-4	62.72	(19.04)	9.66
S-77	63.04	(10.02)	7.42

1/ Mean of 3 observations. Figures i

mg/L)	Ca (mg/L)		Mg (mg/L)		Hardness (mg CaCO/L)	
2.52)	23.56	(1.35)	6.50	(0.94)	85.6	(7.1)
0.16)	52.47	(8.69)	13.22	(0.69)	185.4	(24.5)
0.67)	38.44	(19.86)	7.81	(3.08)	128.1	(62.2)
0.40)	66.85	(5.83)	12.36	(1.70)	217.8	(20.8)
0.37)	41.85	(12.18)	8.60	(2.70)	139.9	(41.5)
0.55)	85.68	(13.37)	15.90	(1.09)	279.4	(32.1)
0.38)	14.49	(7.73)	6.13	(1.91)	61.4	(27.1)
0.06)	16.40	(6.80)	4.52	(1.58)	59.5	(23.3)
1.76)	36.88	(8.92)	15.79	(8.55)	157.1	(57.4)
1.08)	53.51	(5.72)	14.24	(3.32)	192.2	(5.3)
1.85)	37.40	(13.61)	12.33	(4.33)	144.1	(51.8)
0.82)	74.17	(7.92)	16.34	(0.42)	252.4	(20.0)
-	-	-	-	-	-	-
2.55)	57.26	(16.94)	25.79	(7.54)	249.2	(73.1)
0.37)	60.18	(7.74)	23.35	(3.60)	246.3	(33.6)
2.61)	115.33	(24.02)	53.33	(14.11)	507.5	(118.0)
0.27)	76.35	(29.23)	29.01	(13.06)	310.0	(126.5)
1.40)	70.01	(13.70)	28.66	(5.21)	292.8	(55.0)
0.33)	62.28	(7.79)	22.76	(5.45)	249.2	(40.4)
0.50)	52.61	(2.59)	18.35	(2.12)	206.9	(13.0)
0.42)	104.42	(6.44)	29.80	(4.25)	383.4	(30.6)
5.12)	73.86	(17.95)	17.77	(4.03)	257.6	(48.8)
1.84)	77.30	(11.34)	18.14	(3.32)	267.6	(36.7)

n parentheses are standard deviations

APPENDIX 2

LAKE OKEECHOBEE WATER CHEMISTRY DATA -

APRIL 1980 THROUGH MARCH 1981

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L001 CODE

SAMPLE NUMBER		DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y	-4099	4/ 9/80	1055.	24.2	7.8	494.	8.00
Y	-4109	5/15/80	1140.	26.2	7.6	514.	7.90
Y	-4119	6/16/80	950.	27.0	8.8	547.	8.74
Y	-4135	7/21/80	830.	27.6	6.4	578.	8.09
Y	-4149	8/20/80	845.	30.1	7.9	590.	7.85
Y	-4165	9/16/80	945.	28.1	6.2	570.	8.16
Y	-4181	10/16/80	1025.	24.6	7.8	590.	8.18
Y	-4191	11/ 6/80	840.	21.7	6.4	579.	8.23
Y	-4201	12/11/80	815.	19.6	8.5	610.	8.13
Y	-4212	1/15/81	1026.	11.0	11.5	640.	8.24
Y	-4222	2/19/81	1128.	21.5	8.3	688.	8.12
Y	-4232	3/26/81	950.	17.9	9.4	689.	8.15

SAMPLE NUMBER		SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y	-4099	.30	23.0	40.		.58	
Y	-4109	.50	7.2	50.			
Y	-4119		.7	45.			
Y	-4135	.60	5.8	80.			
Y	-4149	.90	3.0	30.			
Y	-4165	.90	4.5	25.			
Y	-4181	.80	5.2	20.			
Y	-4191	.50	11.0	30.			
Y	-4201	.50	12.0	35.			
Y	-4212	.25	15.5	35.			
Y	-4222	.20	36.0	26.		1.36	.02
Y	-4232	.20	43.0	35.	58.0	1.06	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L001 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4099	.311	.307	< .004	.02	2.13	2.11
Y -4109	.218	.214	< .004	.11	2.44	2.33
Y -4119	.017	.013	< .004	< .01	1.81	1.80
Y -4135	.028	.023	.005	.02	3.12	3.10
Y -4149	.004	< .004	.004	.01	3.74	3.73
Y -4165	.010	.005	.005	.06	2.31	2.25
Y -4181	.133	.129	< .004	< .01	2.02	2.01
Y -4191	< .004	< .004	< .004	< .01	2.01	2.00
Y -4201	.312	.308	< .004	.01	3.81	3.80
Y -4212	.389	.385	< .004	< .01	2.07	2.06
Y -4222	.512	.508	< .004	< .01	3.70	3.69
Y -4232	.498	.494	< .004	< .01	2.69	2.68

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4099	.33	2.44	.068	.085	9.3	2.2
Y -4109	.33	2.66	.050	.073	12.4	3.0
Y -4119	.03	1.83	.013	.052	59.2	5.5
Y -4135	.05	3.15	.013	.071	32.8	4.5
Y -4149	.01	3.74	< .002	.060		
Y -4165	.07	2.32	.022	.081		
Y -4181	.14	2.15	.026	.037	28.4	3.3
Y -4191	< .01	2.01	.003	.035	32.1	4.3
Y -4201	.32	4.12	.051	.098	9.8	2.8
Y -4212	.40	2.46	.035	.129	17.6	8.2
Y -4222	.52	4.21	.050	.183	19.8	4.2
Y -4232	.51	3.19	.046	.078	9.9	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L001 CODE

SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y -4099						1.63
Y -4109						1.90
Y -4119						1.89
Y -4135						2.09
Y -4149						2.21
Y -4165						2.28
Y -4181						2.04
Y -4191						2.04
Y -4201						1.92
Y -4212						2.15
Y -4222	52.48	4.63	40.05	17.49	172.0	2.24
Y -4232						2.34

SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y -4099	67.8		14.4
Y -4109	73.2		14.6
Y -4119	76.4		15.4
Y -4135	81.5		16.3
Y -4149	75.2		17.6
Y -4165	81.0		15.7
Y -4181	76.5		13.0
Y -4191	81.2		18.1
Y -4201	80.9		15.2
Y -4212	75.0		16.6
Y -4222	87.8		18.6
Y -4232	93.1	55.7	17.7

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L002 CODE

SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y -4100	4/ 9/80	1110.	24.7	7.9	561.	8.17
Y -4110	5/15/80	1320.	27.6	8.3	557.	7.98
Y -4120	6/16/80	1035.	27.0	7.9	571.	8.35
Y -4136	7/21/80	920.	27.8	7.5	571.	8.49
Y -4150	8/20/80	930.	29.8	7.1	624.	8.00
Y -4166	9/16/80	955.	28.3	6.7	570.	8.54
Y -4182	10/16/80	1045.	25.1	6.0	610.	8.34
Y -4192	11/ 6/80	900.	21.9	8.5	587.	8.20
Y -4202	12/11/80	1337.	19.9	8.6	600.	8.15
Y -4213	1/15/81	1012.	10.4	12.5	643.	8.49
Y -4223	2/19/81	1115.	22.1	8.6	683.	8.11
Y -4233	3/26/81	1313.	19.4	9.7	699.	8.22

SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y -4100	.24	30.0	30.		.50	
Y -4110	.30	8.6	50.			
Y -4120		10.0	40.			
Y -4136	.50	13.0	80.			
Y -4150	.60	5.8	25.			
Y -4166	1.00	3.8	25.			
Y -4182	.50	9.5	15.			
Y -4192	.50	16.0	30.			
Y -4202	.40	15.5	39.			
Y -4213	.50	12.0	36.			
Y -4223	.20	38.0	25.		.98	< .02
Y -4233	.30	34.0	30.	52.0	.84	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y   DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L002   CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4100	.399	.395	< .004	.01	2.01	2.00
Y -4110	.336	.332	< .004	.04	2.67	2.63
Y -4120	.217	.213	< .004	.02	1.69	1.67
Y -4136	.004	< .004	< .004	.05	4.18	4.13
Y -4150	.004	< .004	< .004	< .01	3.33	3.32
Y -4166	.010	.005	.005	.01	2.31	2.30
Y -4182	.072	.068	< .004	< .01	2.08	2.07
Y -4192	< .004	< .004	< .004	< .01	1.95	1.94
Y -4202	.222	.218	< .004	< .01	1.76	1.75
Y -4213	.118	.114	< .004	< .01	3.16	3.15
Y -4223	.450	.446	< .004	.02	3.11	3.09
Y -4233	.203	.199	< .004	< .01	2.85	2.84

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4100	.41	2.41	.071	.121	9.8	1.1
Y -4110	.36	3.01	.064	.096	14.5	.4
Y -4120	.24	1.91	.036	.079	16.0	.7
Y -4136	.05	4.18	.006	.077	46.4	2.5
Y -4150	.01	3.33	.003	.055		
Y -4166	.02	2.32	.016	.056		
Y -4182	.08	2.15	.008	.038	33.2	5.4
Y -4192	< .01	1.95	.011	.039	25.7	3.1
Y -4202	.23	1.98	.049	.100	11.0	2.3
Y -4213	.13	3.28	.016	.081	24.4	3.2
Y -4223	.47	3.56	.038	.089	13.0	2.4
Y -4233	.21	3.05	.025	.120	19.0	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L002 CODE

SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y -4100						1.87
Y -4110						1.96
Y -4120						1.98
Y -4136						2.09
Y -4150						2.19
Y -4166						2.22
Y -4182						2.10
Y -4192						2.07
Y -4202						2.00
Y -4213						2.26
Y -4223	55.80	5.04	42.42	18.39	181.6	2.32
Y -4233						2.40

SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y -4100	80.3		14.4
Y -4110	77.6		15.7
Y -4120	80.6		14.3
Y -4136	80.5		14.3
Y -4150	76.3		16.7
Y -4166	81.0		15.3
Y -4182	78.8		13.3
Y -4192	81.2		19.7
Y -4202	79.9		12.6
Y -4213	77.2		16.3
Y -4223	88.9		16.0
Y -4233	95.3	55.7	17.7

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L003 CODE

SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y -4101	4/ 9/80	1125.	25.4	7.8	529.	8.07
Y -4111	5/15/80	1340.	27.2	8.3	556.	7.91
Y -4121	6/16/80	1100.	27.3	7.7	575.	8.21
Y -4137	7/21/80	945.	27.9	7.2	573.	8.36
Y -4153	8/20/80	1000.	29.6	7.2	610.	7.78
Y -4167	9/16/80	1010.	28.2	6.5	570.	8.20
Y -4183	10/16/80	1103.	25.4	7.6	590.	8.16
Y -4193	11/ 6/80	928.	22.3	8.3	586.	8.05
Y -4203	12/11/80	1303.	20.1	8.5	600.	8.15
Y -4214	1/15/81	956.	16.7	11.2	638.	8.23
Y -4224	2/19/81	1055.	20.3	8.5	670.	8.04
Y -4234	3/26/81	1330.	18.5	9.2	699.	8.09

SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y -4101	.23	30.0	40.		.76	
Y -4111	.60	6.3	50.			
Y -4121		8.1	40.			
Y -4137	.45	12.0	70.			
Y -4153	1.10	3.0	40.			
Y -4167	.90	4.1	25.			
Y -4183	.80	6.8	20.			
Y -4193	.40	27.0	30.			
Y -4203	.50	11.0	47.			
Y -4214	.20	20.5	40.			
Y -4224	.20	49.0	30.		1.17	.05
Y -4234	.20	46.0	35.	62.0	1.10	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF PR

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L003 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L		NO2 MG N/L		NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4101	.443	.439	<	.004		.01	2.24	2.23
Y -4111	.262	.258	<	.004		.02	3.25	3.23
Y -4121	.368	.354		.014	<	.01	1.69	1.68
Y -4137	.066	.062	<	.004		.03	4.29	4.26
Y -4153	.020	.016	<	.004		.02	3.13	3.11
Y -4167	.042	.038		.004	<	.01	1.76	1.75
Y -4183	.163	.159	<	.004	<	.01	1.69	1.68
Y -4193	.118	.114	<	.004	<	.01	2.01	2.00
Y -4203	.222	.218	<	.004	<	.01	1.81	1.80
Y -4214	.314	.310	<	.004		.02	2.80	2.78
Y -4224	.410	.406	<	.004		.03	3.27	3.24
Y -4234	.353	.349	<	.004	<	.01	2.69	2.68

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4101	.45	2.68	.065	.094	11.1	2.7
Y -4111	.28	3.51	.064	.199	14.4	.6
Y -4121	.38	2.06	.062	.102	5.7	2.7
Y -4137	.10	4.36	.011	.061	33.5	3.3
Y -4153	.04	3.15	.025	.064		
Y -4167	.05	1.80	.040	.080		
Y -4183	.17	1.85	.047	.064	10.9	1.6
Y -4193	.13	2.13	.037	.086	19.5	8.6
Y -4203	.23	2.03	.055	.101	14.7	1.1
Y -4214	.33	3.11	.038	.158	12.0	3.4
Y -4224	.44	3.68	.037	.098	15.1	3.6
Y -4234	.36	3.04	.041	.089	8.5	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF PR

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L003 CODE

	SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y	-4101						1.69
Y	-4111						1.96
Y	-4121						1.98
Y	-4137						2.09
Y	-4153						2.30
Y	-4167						2.28
Y	-4183						2.10
Y	-4193						2.04
Y	-4203						2.03
Y	-4214						2.32
Y	-4224	53.75	4.87	40.64	17.87	175.5	2.24
Y	-4234						2.34

	SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y	-4101	72.4		13.8
Y	-4111	77.6		15.9
Y	-4121	80.6		14.8
Y	-4137	80.5		15.3
Y	-4153	73.0		16.1
Y	-4167	81.0		13.8
Y	-4183	76.5		13.7
Y	-4193	81.2		19.7
Y	-4203	79.9		13.1
Y	-4214	77.2		14.2
Y	-4224	84.6		16.6
Y	-4234	93.1	55.7	18.5

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF PR

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L004 CODE

	SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y	-4102	4/ 9/80	1145.	25.2	7.7	501.	8.04
Y	-4112	5/15/80	1355.	27.7	8.3	558.	7.93
Y	-4122	6/16/80	1115.	27.7	7.6	578.	8.27
Y	-4138	7/21/80	1005.	28.0	7.2	590.	8.11
Y	-4154	8/20/80	1015.	29.7	7.1	590.	7.75
Y	-4168	9/16/80	1033.	28.4	6.5	570.	8.19
Y	-4186	10/16/80	1135.	25.9	8.0	600.	8.30
Y	-4194	11/ 6/80	952.	22.3	8.2	587.	8.00
Y	-4204	12/11/80	1245.	20.2	8.5	600.	8.12
Y	-4215	1/15/81	941.	10.8	11.2	637.	8.15
Y	-4225	2/19/81	1037.	20.3	8.7	670.	8.03
Y	-4235	3/26/81	1350.	18.5	9.2	697.	8.07

	SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y	-4102	.18	34.0	40.		.80	
Y	-4112	.40	7.0	50.			
Y	-4122		14.0	40.			
Y	-4138	.35	24.0	45.			
Y	-4154	.60	7.2	45.			
Y	-4168	1.10	3.8	30.			
Y	-4186	.70	6.7	10.			
Y	-4194	.30	29.0	30.			
Y	-4204	.30	19.0	50.			
Y	-4215	.12	42.0	33.			
Y	-4225	.20	52.5	25.		1.43	.02
Y	-4235	.20	42.0	32.	60.0	1.27	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L004 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4102	.443	.439	< .004	.06	2.36	2.30
Y -4112	.299	.295	< .004	.03	2.26	2.23
Y -4122	.298	.294	< .004	< .01	1.92	1.91
Y -4138	.197	.193	< .004	.02	2.34	2.32
Y -4154	.100	.075	.025	.01	2.24	2.23
Y -4168	.031	.027	.004	< .01	2.20	2.19
Y -4186	.092	.088	< .004	< .01	1.86	1.85
Y -4194	.186	.182	< .004	.04	2.19	2.15
Y -4204	.222	.218	< .004	< .01	1.76	1.75
Y -4215	.264	.260	< .004	< .01	2.86	2.85
Y -4225	.419	.415	< .004	< .01	2.47	2.46
Y -4235	.452	.448	< .004	< .01	3.18	3.17

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4102	.50	2.80	.064	.155	15.8	
Y -4112	.33	2.56	.070	.161	15.9	
Y -4122	.31	2.22	.049	.089	8.4	
Y -4138	.22	2.54	.046	.108	11.9	4.7
Y -4154	.11	2.34	.043	.086		
Y -4168	.04	2.23	.036	.072		
Y -4186	.10	1.95	.039	.054	7.9	2.5
Y -4194	.23	2.38	.049	.085	12.2	5.2
Y -4204	.23	1.98	.046	.099	10.7	2.6
Y -4215	.27	3.12	.041	.100	11.1	4.0
Y -4225	.43	2.89	.043	.158	13.8	5.0
Y -4235	.46	3.63	.051	.109	6.1	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L004 CODE

SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y -4102						1.58
Y -4112						1.96
Y -4122						1.98
Y -4138						2.25
Y -4154						2.19
Y -4168						2.28
Y -4186						2.38
Y -4194						2.02
Y -4204						2.06
Y -4215						2.26
Y -4225	54.70	4.95	41.79	18.35	179.9	2.27
Y -4235						2.34

SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y -4102	67.8		12.9
Y -4112	77.6		15.9
Y -4122	81.8		14.8
Y -4138	83.6		15.3
Y -4154	75.2		15.8
Y -4168	83.3		14.7
Y -4186	78.8		12.6
Y -4194	79.0		15.7
Y -4204	80.9		14.2
Y -4215	77.2		21.3
Y -4225	86.7		13.5
Y -4235	93.1	55.7	19.7

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L005 CODE

SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y -4103	4/ 9/80	955.	23.9	8.1	578.	8.21
Y -4113	5/15/80	1030.	26.9	8.1	562.	8.08
Y -4123	6/16/80	1520.	31.3	11.1	565.	9.16
Y -4139	7/21/80	1205.	28.6	7.9	571.	8.69
Y -4155	8/20/80	1415.	32.6	7.8	660.	8.35
Y -4171	9/16/80	1430.	29.2	8.0	560.	8.85
Y -4189	10/16/80	1322.	26.3	8.6	590.	9.14
Y -4199	11/ 6/80	1142.	22.3	9.4	578.	8.86
Y -4207	12/11/80	950.	20.5	9.0	570.	8.79
Y -4220	1/15/81	1102.	10.7	11.5	641.	8.24
Y -4230	2/19/81	1204.	22.9	8.7	667.	8.29
Y -4236	3/26/81	1538.	19.0	9.3	697.	8.09

SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y -4103	.34	17.0	30.		.56	
Y -4113	.70	7.3	50.			
Y -4123		4.9	40.			
Y -4139	.70	5.2	40.			
Y -4155	.90	2.7	50.			
Y -4171	.90	3.5	30.			
Y -4189	.80	3.8	10.			
Y -4199	.50	6.3	25.			
Y -4207	.90	3.9	48.			
Y -4220	.20	37.0	26.			
Y -4230	.50	9.5	20.		.26	< .02
Y -4236	.20	58.0	33.	88.0	1.34	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L005 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4103	.399	.395	< .004	< .01	1.65	1.64
Y -4113	.164	.160	< .004	.02	2.56	2.54
Y -4123	.008	< .004	< .004	.02	2.21	2.19
Y -4139	.043	.038	.005	.01	2.06	2.05
Y -4155	.007	< .004	.005	.01	2.65	2.64
Y -4171	.010	.005	.005	.02	2.47	2.45
Y -4189	.004	< .004	< .004	< .01	2.36	2.35
Y -4199	.006	< .004	< .004	< .01	2.13	2.12
Y -4207	< .004	< .004	< .004	< .01	2.51	2.50
Y -4220	.264	.260	< .004	< .01	3.10	3.09
Y -4230	.006	< .004	< .004	< .01	1.80	1.79
Y -4236	.539	.535	< .004	< .01	3.45	3.44

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4103	.41	2.05	.063	.085	11.1	2.1
Y -4113	.18	2.72	.040	.106	19.9	3.7
Y -4123	.03	2.22	.004	.049	84.0	
Y -4139	.05	2.10	.005	.055	33.8	1.8
Y -4155	.02	2.66	.003	.032		
Y -4171	.03	2.48	.002	.045		
Y -4189	.01	2.36	< .002	.018	32.3	
Y -4199	.02	2.14	< .002	.023	60.0	3.6
Y -4207	< .01	2.51	< .002	.041	27.2	.1
Y -4220	.27	3.36	.010	.068	17.9	5.7
Y -4230	.02	1.31	< .002	.049	12.2	3.5
Y -4236	.55	3.99	.045	.120	14.5	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L005 CODE

SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y -4103						1.84
Y -4113						1.96
Y -4123						1.89
Y -4139						2.09
Y -4155						2.07
Y -4171						2.28
Y -4189						2.15
Y -4199						2.15
Y -4207						1.95
Y -4220						2.32
Y -4230	55.65	5.09	44.16	18.05	184.6	2.46
Y -4236						2.37

SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y -4103	80.3		12.6
Y -4113	77.6		16.2
Y -4123	80.6		17.1
Y -4139	80.5		18.2
Y -4155	73.0		17.9
Y -4171	81.0		17.9
Y -4189	76.5		14.4
Y -4199	82.3		17.8
Y -4207	78.8		15.8
Y -4220	78.3		15.1
Y -4230	88.9		14.9
Y -4236	93.1	53.0	17.4

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L006 CODE

	SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y	-4104	4/ 9/80	900.	23.5	6.0	559.	8.08
Y	-4114	5/15/80	830.	25.5	8.3	543.	7.85
Y	-4124	6/16/80	1200.	28.6	8.0	561.	8.52
Y	-4140	7/21/80	1045.	28.1	6.8	573.	8.02
Y	-4156	8/20/80	1100.	30.1	7.0	580.	7.75
Y	-4172	9/16/80	1120.	28.4	6.3	570.	8.10
Y	-4187	10/16/80	1210.	25.6	7.6	610.	8.33
Y	-4197	11/ 6/80	1037.	22.4	8.3	608.	8.04
Y	-4205	12/11/80	1153.	20.5	8.4	600.	8.25
Y	-4216	1/15/81	911.	10.0	11.5	672.	8.27
Y	-4226	2/19/81	948.	19.5	8.6	680.	8.00
Y	-4237	3/26/81	1432.	18.6	9.3	701.	8.10

	SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L		TDISS FE MG/L
Y	-4104	.23	36.0	30.		.69		
Y	-4114	.60	9.1	50.				
Y	-4124		6.7	40.				
Y	-4140	.75	4.6	35.				
Y	-4156	1.90	2.2	50.				
Y	-4172	1.30	4.0	30.				
Y	-4187	.80	6.2	10.				
Y	-4197	.30	34.0	30.				
Y	-4205	.50	6.2	50.				
Y	-4216	.30	26.0	26.				
Y	-4226	.20	42.0	25.		1.10	<	.02
Y	-4237	.25	48.0	24.	66.0	.93		

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L006 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4104	.466	.462	< .004	.01	1.41	1.40
Y -4114	.323	.319	< .004	.05	2.56	2.51
Y -4124	.182	.178	< .004	.01	1.34	1.33
Y -4140	.162	.158	< .004	.03	1.94	1.91
Y -4156	.011	.007	.004	.03	3.67	3.64
Y -4172	.067	.052	.015	.04	1.59	1.55
Y -4187	.054	.050	< .004	< .01	1.97	1.96
Y -4197	.118	.114	< .004	< .01	2.13	2.12
Y -4205	.083	.079	< .004	.01	2.24	2.23
Y -4216	.223	.219	< .004	< .01	3.10	3.09
Y -4226	.197	.193	< .004	.03	2.68	2.65
Y -4237	.461	.457	< .004	< .01	3.02	3.01

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4104	.48	1.88	.069	.098	5.5	4.2
Y -4114	.37	2.88	.063	.133	4.2	2.4
Y -4124	.19	1.52	.034	.077	12.4	
Y -4140	.19	2.10	.037	.069	5.6	1.6
Y -4156	.04	3.68	.030	.062		
Y -4172	.11	1.66	.044	.079		
Y -4187	.06	2.02	.033	.051	5.7	.1
Y -4197	.13	2.25	.024	.047	15.9	7.7
Y -4205	.09	2.32	< .002	.028	15.5	1.5
Y -4216	.23	3.32	.007	.094	32.6	3.2
Y -4226	.23	2.88	.031	.136	17.5	3.7
Y -4237	.47	3.48	.039	.142	11.4	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y   DATE OF

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L006   CODE

	SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACC	ALK MEQ/L
Y	-4104						1.81
Y	-4114						1.90
Y	-4124						1.98
Y	-4140						2.14
Y	-4156						2.13
Y	-4172						2.34
Y	-4187						2.15
Y	-4197						2.04
Y	-4205						2.00
Y	-4216						2.32
Y	-4226	54.54	4.95	41.79	17.96	178.3	2.27
Y	-4237						2.40

	SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y	-4104	76.9		11.1
Y	-4114	75.4		15.6
Y	-4124	79.5		16.2
Y	-4140	82.6		15.9
Y	-4156	74.1		15.2
Y	-4172	81.0		14.6
Y	-4187	81.1		12.0
Y	-4197	86.7		17.3
Y	-4205	80.9		15.5
Y	-4216	78.3		17.5
Y	-4226	85.7		14.4
Y	-4237	94.2	54.3	16.2

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y　　　　　　　　　　　　DATE OF I

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80	3/31/81	MO/DA/YR
DEPTH	0.0	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L007　　　　CODE

SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y -4107	4/ 9/80	920.	23.8	8.1	558.	8.11
Y -4115	5/15/80	900.	25.8	8.0	560.	7.91
Y -4125	6/16/80	1215.	28.4	7.9	556.	8.58
Y -4141	7/21/80	1100.	28.1	7.1	575.	8.09
Y -4157	8/20/80	1115.	30.6	7.3	600.	7.85
Y -4173	9/18/80	1132.	28.4	6.3	580.	8.00
Y -4188	10/16/80	1220.	25.8	7.7	600.	8.29
Y -4198	11/ 6/80	1050.	22.2	8.4	608.	8.12
Y -4206	12/11/80	1135.	20.5	9.4	600.	8.63
Y -4219	1/15/81	856.	10.2	11.5	666.	8.30
Y -4227	2/19/81	1002.	20.0	8.7	688.	8.04
Y -4238	3/26/81	1448.	18.7	9.5	696.	8.16

SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y -4107	.24	24.0	40.		.52	
Y -4115	.60	7.7	50.			
Y -4125		4.1	40.			
Y -4141	1.50	3.3	30.			
Y -4157	2.70	1.5	50.			
Y -4173	1.60	1.7	30.			
Y -4188	.80	6.8	10.			
Y -4198	.50	13.0	25.			
Y -4206	.80	7.5	31.			
Y -4219	.25	13.0	32.			
Y -4227	.25	17.0	25.		.55	.03
Y -4238	.45	29.0	19.	40.0	.51	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L007 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4107	.466	.462	< .004	.03	2.24	2.21
Y -4115	.372	.368	< .004	.02	2.67	2.65
Y -4125	.135	.131	< .004	< .01	1.34	1.33
Y -4141	.135	.129	.006		2.00	
Y -4157	.007	< .004	.005	.01	3.20	3.19
Y -4173	.128	.124	.004	.01	1.92	1.91
Y -4188	.133	.129	.004	< .01	2.41	2.40
Y -4198	.051	.047	< .004	< .01	1.71	1.70
Y -4206	.013	.009	< .004	< .01	2.30	2.29
Y -4219	.268	.264	< .004	< .01	3.46	3.45
Y -4227	.341	.337	< .004	.01	1.96	1.95
Y -4238	.271	.267	< .004	< .01	2.31	2.30

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4107	.50	2.71	.065	.116	4.5	.6
Y -4115	.39	3.04	.064	.093	4.1	1.6
Y -4125	.14	1.48	.027	.058	13.8	.7
Y -4141		2.14		.062	8.9	.6
Y -4157	.02	3.21	.027	.049		
Y -4173	.14	2.05	.049	.078		
Y -4188	.14	2.54	.043	.054	6.7	1.0
Y -4198	.06	1.76	.007	.023	16.3	4.5
Y -4206	.02	2.31	< .002	.044	46.1	1.8
Y -4219	.28	3.73	.014	.099	16.0	3.6
Y -4227	.35	2.30	.021	.088	14.9	4.4
Y -4238	.28	2.58	.016	.097	19.4	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF P

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L007 CODE

SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y -4107						1.87
Y -4115						1.96
Y -4125						1.95
Y -4141						2.11
Y -4157						2.19
Y -4173						2.17
Y -4188						2.15
Y -4198						1.96
Y -4206						2.03
Y -4219						2.32
Y -4227	55.65	5.10	42.42	18.47	181.9	2.35
Y -4238						2.37

SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y -4107	78.1		12.6
Y -4115	77.6		16.2
Y -4125	78.4		15.7
Y -4141	82.6		14.8
Y -4157	73.0		
Y -4173	81.0		15.9
Y -4188	81.1		11.7
Y -4198	87.8		16.2
Y -4206	86.4		16.8
Y -4219	77.2		15.1
Y -4227	88.9		13.0
Y -4238	94.2	55.7	21.8

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF PR

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L008 CODE

SAMPLE NUMBER	DATE MO/DA/YR	TIME HOUR,MIN	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
Y -4108	4/ 9/80	1010.	24.0	7.9	573.	8.16
Y -4118	5/15/80	1100.	26.2	6.0	552.	7.92
Y -4126	6/16/80	1540.	29.7	6.7	565.	8.67
Y -4142	7/21/80	1223.	29.1	7.7	589.	8.37
Y -4158	8/20/80	1430.	32.7	7.8	650.	8.15
Y -4174	9/16/80	1445.	29.8	6.1	570.	8.83
Y -4190	10/16/80	1343.	27.2	8.7	590.	8.70
Y -4200	11/ 6/80	1203.	22.5	8.4	602.	8.08
Y -4210	12/11/80	1019.	20.0	8.6	580.	8.37
Y -4221	1/15/81	1116.	11.6	11.2	645.	8.10
Y -4231	2/19/81	1220.	22.0	8.6	672.	8.12
Y -4239	3/26/81	1559.	18.3	9.0	696.	8.05

SAMPLE NUMBER	SECCHI M	TURB JTU	COLOR UNITS	T.SUS.SD MG/L	TOTAL FE MG/L	TDISS FE MG/L
Y -4108	.28	30.0	30.		.50	
Y -4118	.30	13.0	50.			
Y -4126		6.4	40.			
Y -4142	.60	15.0	15.			
Y -4158	1.00	3.7	50.			
Y -4174	.70	4.4	30.			
Y -4190	.60	9.2	10.			
Y -4200	.30	29.0	30.			
Y -4210	.60	8.7	50.			
Y -4221	.15	54.0	41.			
Y -4231	.10	38.0	36.		1.40	.03
Y -4239	.20	55.0	27.	72.0	1.34	

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF PR

PARAMETER	RANGE OF VALUES		UNITS
DATE	4/ 1/80 -	3/31/81	MO/DA/YR
DEPTH	0.0 -	0.0	METERS
SAMPLE	0.	0.	TYPE

STATION = L008 CODE

SAMPLE NUMBER	NOX MG N/L	NO3 MG N/L	NO2 MG N/L	NH4 MG N/L	TKN MG N/L	TKN-NH4 MG N/L
Y -4108	.455	.451	< .004	< .01	2.13	2.12
Y -4118	.413	.409	< .004	.04	3.49	3.45
Y -4126	.160	.156	< .004	.01	1.34	1.33
Y -4142	.039	.031	.008	.03	2.34	2.31
Y -4158	.004	< .004	< .004	< .01	1.21	1.20
Y -4174	.098	.094	.004	.01	2.36	2.35
Y -4190	.004	< .004	< .004	< .01	2.08	2.07
Y -4200	.083	.079	< .004	< .01	2.01	2.00
Y -4210	< .004	< .004	< .004	.01	1.81	1.80
Y -4221	.146	.142	< .004	< .01	2.86	2.85
Y -4231	.391	.387	< .004	.01	3.02	3.01
Y -4239	.266	.262	< .004	< .01	2.91	2.90

SAMPLE NUMBER	NOX+NH4 MG N/L	TOTAL N MG N/L	OPO4 MG P/L	TPO4 MG P/L	CHLOR A MG/M3	PHAEO MG/M3
Y -4108	.47	2.59	.073	.089	9.0	3.3
Y -4118	.45	3.90	.067	.147	11.5	3.4
Y -4126	.17	1.50	.022	.085	57.4	
Y -4142	.07	2.38	.039	.090	27.7	3.3
Y -4158	.01	1.21	.003	.038		
Y -4174	.11	2.46	< .002	.037		
Y -4190	.01	2.08	< .002	.030	31.1	2.5
Y -4200	.09	2.09	.010	.050	24.8	1.2
Y -4210	.01	1.81	.005	.056	16.1	3.4
Y -4221	.16	3.01	.016	.131	15.3	7.5
Y -4231	.40	3.41	.046	.188	17.7	2.9
Y -4239	.28	3.18	.059	.123		

LAKE OKEECHOBEE WATER CHEMISTRY DATA

PROJECT Y DATE OF PR

PARAMETER	RANGE OF VALUES			UNITS
DATE	4/ 1/80	-	3/31/81	MO/DA/YR
DEPTH	0.0	-	0.0	METERS
SAMPLE	0.		0.	TYPE

STATION = L006 CODE

SAMPLE NUMBER	NA MG/L	K MG/L	CA MG/L	MG MG/L	HARDNESS MG/LCACO	ALK MEQ/L
Y -4108						1.95
Y -4118						1.90
Y -4126						1.98
Y -4142						2.19
Y -4158						2.13
Y -4174						2.17
Y -4190						2.15
Y -4200						2.21
Y -4210						1.92
Y -4221						2.32
Y -4231	54.38	5.07	42.42	18.05	180.2	2.35
Y -4239						2.40

SAMPLE NUMBER	CL MG/L	SO4 MG/L	TOTORG C MG/L
Y -4108	80.3		12.9
Y -4118	77.6		14.5
Y -4126	79.5		12.6
Y -4142	84.7		18.4
Y -4158	75.2		17.6
Y -4174	82.2		17.7
Y -4190	78.8		13.8
Y -4200	83.4		20.3
Y -4210	78.8		16.2
Y -4221	78.3		16.0
Y -4231	88.9		13.8
Y -4239	95.3	55.7	15.6