JACKSON LAKE: RESPONSE TO NUTRIENT REDUCTION

David M. Kamps

AUTHORS: Georgia Environmental Protection Division, Water Quality Management Program, 7 MLK Jr., Drive, Suite 643, Atlanta, GA 30334.
REFERENCE: Proceedings of the 1989 Georgia Water Resources Conference, held May 16 and 17, 1989, at The University of Georgia. Kathryn J. Hatcher, Editor, Institute of Natural Resources, The University of Georgia, Athens, Georgia, 1989.

INTRODUCTION

Jackson Lake is a 4750 acre Georgia Power Co. impoundment of the Ocmulgee River located 40 miles southeast of Atlanta. The lake was formed in 1911 by the closure of Lloyd Shoals Dam and has served as an important recreational resource since that time.

In the 1960's, Jackson Lake exhibited signs of rapidly accelerating eutrophication. Symptoms included fish kills, algal blooms, hypolimnetic anoxia and floating debris. Subsequent studies revealed the primary cause to be excessive input of nutrients, mainly from the South River and to a lesser extent from the Yellow River. The principal nutrient inducing algal growth was found to be phosphorus.

By the mid 1970's construction projects were initiated to improve wastewater treatment in the South and Yellow River Basins. Major upgrades to facilities in both basins included phosphorus reduction. The City of Atlanta also initiated the Three Rivers Project which diverted treated wastewater from two facilities on the South River to the Chattahoochee River, and another major discharge was diverted to a land application system. In 1983, DeKalb County instituted advanced treatment with phosphorus reduction at the Snapfinger Water Pollution Control Plant, and in December 1984, the City of Atlanta began operation of the Three Rivers pipeline. Also, in early 1986, facilities to handle the "first flush" from three combined sewer overflows in the upper South River Basin were put into service.

STUDY METHODS AND RESULTS

The purpose of this paper is to report the changes in phosphorus loading to Jackson Lake and water quality changes within the lake.

Jackson Lake samples were collected from the one meter depth at three to six locations during the study period. These locations are shown in Figure 1. Sample analyses were conducted by Environmental Protection Division (EPD) laboratories. In 1987, a nutrient budget study was conducted. Major tributaries were sampled three or more times each month.

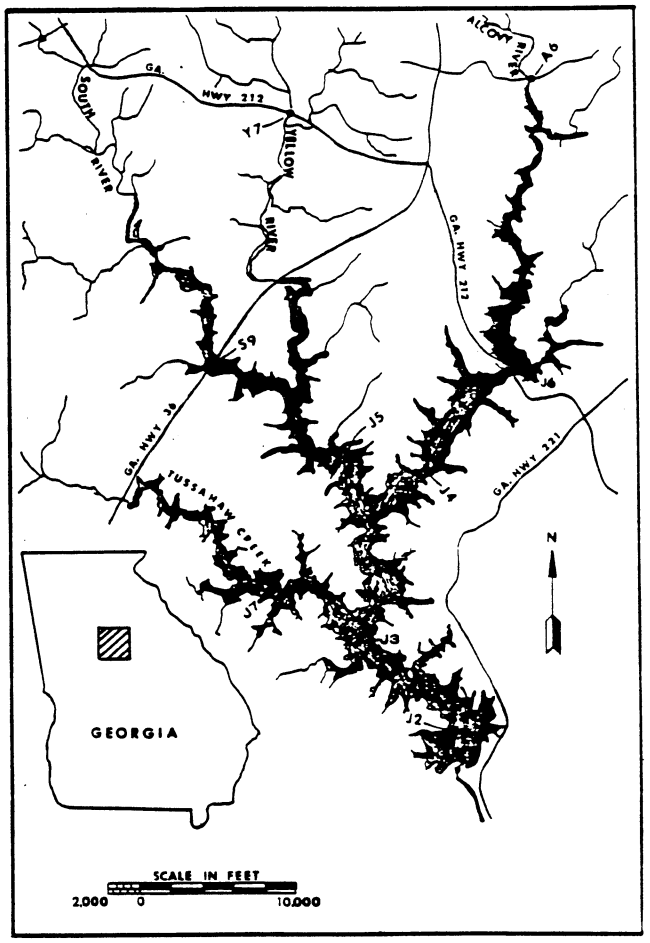

Figure 1. Jackson Lake Area Map.

Data from intensive surveys and the EPD trend monitoring network have revealed a substantial reduction in total phosphorus (TP) concentration with the changes in wastewater treatment (Table 1). The South River TP concentrations dropped from an average 0.80 mg/l for the ten year period prior to nutrient reduction at the Snapfinger WPCP to 0.34 mg/l in 1984. A further reduction in 1985 can be attributed to diversion of treated

wastewaters through the Three Rivers pipeline. Reduced TP concentration have also been observed in the Yellow River. Phosphorus concentrations in the Alcovy River have remained relatively stable and low since 1974.

Table 1. Jackson Lake Mean Tributary Phosphorus Concentration (mg/l).

Years	South River	Yellow River	Alcovy River
1974-1983	0.80	0.14	0.06
1984	0.34	0.10	0.04
1985	0.26	0.10	0.05
1986-1988	0.24	0.08	0.05

A nutrient budget was conducted in 1987 to ascertain current phosphorus and nitrogen loadings. Total phosphorus loading was found to have been reduced by 70% since a 1973-1974 nutrient budget calculated by the National Eutrophication Survey (1975) and by over 54% from a 1979-1980 phosphorus budget conducted by EPD (EPD, 1984) (Table 2).

Table 2. Jackson Lake Phosphorus Budget.

Date	Total Phosphorus (kg/year)
1973-1974	640,000
1979-1980	413,000
1987	187,000

The result of this substantial nutrient reduction has been a reduction in algal growth within Jackson Lake. Chlorophyll *a* concentrations in the dam pool area (J2) were reduced from a mean of 35.7 µg/l during the 1979-1980 study period to 13.5 µg/l in 1988 (Table 3). In 1984 and 1985, large chlorophyll *a* reductions were noted in response to the wastewater treatment changes and diversion from the South River Basin. In 1986, the increases noted for most lake sites were related to drought conditions which reduced tributary flow. The overall effect was increased inlake phosphorus concentration which stimulated algal growth.

Station J5 at the upper end of the lake near the point where the South and Yellow Rivers enter has shown little response to phosphorus reduction. This can be attributed to the phosphorus concentrations, which although reduced, remain high enough to generate sizable algal populations in the upper lake area.

The reduction in algal density has resulted in increased water clarity. Table 4 provides information on the changes in Secchi Disk transparency which have occurred since nutrient reduction. As observed for the chlorophyll *a* data, improvement has been most dramatic in the dam pool area (Station J2) while no change was observed in the upper lake area. Again, the 1986 data were affected by the drought conditions which increased algal density throughout the lake.

Table 3. Jackson Lake Mean Chlorophyll *a* Data (µg/l).

Year	Station J2	J3	J4	J5	J6	J7
1979-80	35.7		37.2	39.7		
1984	30.4	33.9	32.8	43.3		
1985	21.5	23.6	23.0	36.0	18.6	
1986	26.1	29.7	30.4	51.5	25.4	18.4
1987	15.2	18.7	20.1	37.3	19.5	18.3
1988	13.5	20.1	21.7	36.8	17.7	17.6

Table 4. Jackson Lake Mean Secchi Transparency In Meters.

Year	Station J2	J3	J4	J5	J6	J7
1979-80	1.04		0.97	0.83		
1984	1.13	1.08	1.14	0.86		
1985	1.18	1.14	1.08	0.76	1.31	
1986	1.21	1.09	1.07	0.63	1.12	1.25
1987	1.56	1.32	1.28	0.77	1.30	1.35
1988	1.67	1.28	1.20	0.83	1.26	1.34

CONCLUSIONS

The data presented here demonstrate that Jackson Lake has had a remarkable recovery from the highly eutrophic conditions observed in the 1960's and 1970's. This recovery has been directly related to the reduction in phosphorus loading to the lake. The continued high productivity in the upper lake area, however, serves notice that phosphorus loading must remain at current or reduced levels to insure the maintenance of this recovery.

LITERATURE CITED

EPD. 1974. A Water Quality Investigation of Jackson Lake and Tributaries, June 1979-May 1980. Georgia Environmental Protection Division. 61p.

National Eutrophication Survey. 1975. Report on Jackson Lake, Butts, Jasper, and Newton Counties, Georgia. EPD Region IV. Working Paper No. 290.