Assessment of Nutrient Trends and Loads for the Mobile River Basin

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U.S. Geological Survey (USGS) surface-water sampling sites in the Mobile River Basin were reviewed for available nutrient data for the period 1970-97. Sites having sufficient nutrient data were evaluated for long-term trends in nutrient concentrations and nutrient transport was calculated for selected basins. The effort was undertaken as part of the National Water-Quality Assessment (NAWQA) Program (Gilliom et al. 1995).

USGS sampling sites having periods of continuous streamflow and nutrient data from the period 1970-97 were examined for long-term trends with the Seasonal Kendall trend test. Trends and loads were estimated for total nitrogen at 14 sites and for total phosphorus at 15 sites (Figure 1 and Table 1). The Seasonal Kendall trend test adjusts for seasonal variability using nutrient concentrations adjusted for the effects of streamflow with residuals from LOWESS (Locally Weighted Sum of Squares) smoothed curves. Trends were also determined for sites without continuous data using multivariate regression analysis.

Figure 1. Location of the Mobile River Basin and stream water quality sites used for nutrient assessment.

Table 1. Mean total nitrogen and total phosphorus loads, and yields for selected stations within the Mobile River Basin

[mi^2, square miles; tons/yr, tons per year; tons/mi^2/yr, tons per square mile per year; -, not available]

Map number	Station name	Station number	Drainage area (mi^2)	Period of record analyzed	Mean total nitrogen load (tons/yr)	Mean total nitrogen yield (tons/mi^2/yr)	Mean Total Phosphorus Load (tons/yr)	Mean Total Phosphorus Yield (tons/mi^2/yr)
1	Etowah River at Canton, Ga.	02392000	613	1988-96	457	0.75	115	0.188
2	Etowah River at Allatoona Dam	02394000	1,120	1988-96	-	-	115	0.102
3	Etowah River at Rome, Ga.	02396000	1,820	1988-96	-	-	296	0.163
4	Coosa River near Rome, Ga.	02397000	4,040	1988-96	-	-	972	0.241
5	Alabama River near Montgomery, Ala.	02420000	15,087	1988-90	17,900	1.19	1,270	0.084
6	Cahaba River near Mountain	02423380	140	1988-96	281	1.98	21.3	0.152
7	Little Cahaba River near Jefferson Park, Ala.	02423400	24.4	1988-96	45.1	1.85	-	-
8	Cahaba River at Centreville, Ala.	02424000	1,027	1989-96	1,260	1.23	-	-
9	Alabama River at Claiborne, Ala.	02429500	21,967	1988-96	21,800	0.99	2,380	0.108
10	Tombigbee River near Fulton, Miss.	02431000	612	1988-96	751	1.23	101	0.164
11	Tibbee Creek near Tibbee, Miss.	02441000	926	1988-96	2,410	2.61	206	0.222
12	Luxapallila Creek near Columbus, Miss.	02443500	715	1988-95	1,550	2.17	45.1	0.063
13	Noxubee River near Geiger, Ala.	02448500	1,097	1988-96	1,550	1.42	291	0.265
14	Tombigbee River at Gainesville, Ala.	02449000	8,632	1988-96	-	-	-	-
15	Sipsey Fork near Grayson, Ala.	02450250	92.1	1988-96	181	1.97	2.98	0.032
16	North River near Samantha, Ala.	02464000	223	1988-96	203	0.91	16.9	0.076
17	Black Warrior River below Selden Lock and Dam near Eutaw, Ala.	02466031	5,810	1988-96	9,350	1.61	588	0.101
18	Tombigbee River below Coffeeville Lock and Dam near Coffeeville Ala.	02469762	18,417	1988-96	24,200	1.31	3,220	0.175

The Alabama River at Claiborne, Alabama, and Tombigbee River below Coffeeville Lock and Dam near Coffeeville, Alabama, stations (sites 9 and 18, respectively) were used to represent the most downstream locations in their respective basins. The trends identified included decreasing concentrations of total nitrogen which suggest that there has been an overall reduction in the nitrogen contributions to Mobile Bay from the Mobile River from the mid-1970s to the present. Total nitrogen concentrations have also decreased (1980-95) in the Black Warrior River, one of the major tributaries to the Tombigbee River. Total phosphorus concentrations increased from 1970 to 1996 at three stations on the Etowah River in Georgia (Figure 2).

Total nitrogen and total phosphorous loads were calculated using multivariate linear regression with bias correction by a minimum variance unbiased estimation method (Cohn et al. 1989). Total nitrogen loads were estimated for the Tombigbee River below Coffeeville Lock and Dam (site 18; 24,200 tons/yr average for 1988-96) and Alabama River at Claiborne, Alabama (site 9; 21,800 tons/yr). The total nitrogen yield for the Tombigbee River site (site 18; 1.31 tons/mi^2/yr), which drains a greater percentage of agricultural (row crop) land use, was greater than that of the Alabama River site (site 9; 0.99 ton/mi^2/yr) (Table 1).

Two headwater tributaries to the Tombigbee River had the highest estimated total nitrogen yields of the 15 sites evaluated: Tibbee Creek (site 11; 2.61 tons/mi^2/yr) and Luxapallila Creek (site 12; 2.17 tons/mi^2/yr). Other sites having nitrogen yields higher than 1.75 tons/mi^2/yr included the Cahaba River near Mountain Brook (site 6; 1.98 tons/mi^2/yr), and the Little Cahaba River (site 7; 1.85 tons/mi^2/yr), both located in the Alabama River Basin (Figure 3).

Total phosphorous loads in the Tombigbee River (site 18) were estimated at 3,220 tons/yr (mean 1988-96) and 2,380 tons/yr for the Alabama River (site 9). The yield for the Tombigbee River (site 18; 0.175 ton/mi^2/yr) was greater than that of the Alabama River (site 9; 0.108 ton/mi^2/yr). The phosphorus yield for the Tombigbee River near Fulton, Mississippi, (site 10; 0.164 ton/mi^2/yr) in the headwaters of the basin was similar to that estimated at the most downstream station (site 18), indicating little range in nutrient concentration form the subbasin. The highest

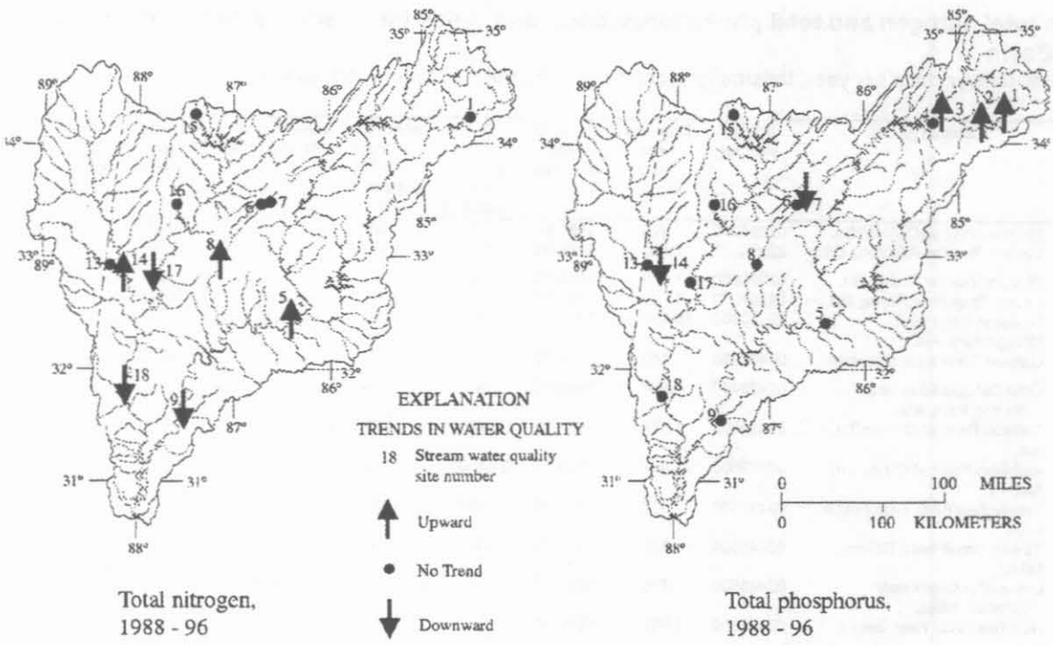

Figure 2. Results of trend analyses for total nitrogen and total phosphorus concentrations.

phosphorus yield was estimated for the Noxubee River (site 13: 0.265 tib/mi^2/yr) located in an agricultural area of the Tombigbee Basin. Tibbee Creek (site 11), another headwater tributary in an agricultural area of the Tombigbee Basin. Tibbee Creek (site 11), another headwater tributary in an agricultural area of the Tombigbee River, had a total phosphorus yield of 0.222 ton/mi^2/yr. Other yields higher than 0.16 ton/mi^2/yr were estimated for the Etowah River at Canton, Georgia, (site 1; 0.188 ton/mi^2/yr), the Etowah River at Rome, Georgia, (site 3; 0.163 ton/mi^2/yr), and the Coosa River near Rome, Georgia, (site 4; 0.241 ton/mi^2/yr) (Figure 3). These two rivers drain developed areas in the vicinity of Rome, Georgia, and flow into Weiss Lake in Alabama, an impoundment of the Coosa River. Weiss Lake has been classified as eutrophic by the Alabama Department of Environmental Management (Alabama Department of Environmental Management 1996).

LITERATURE CITED

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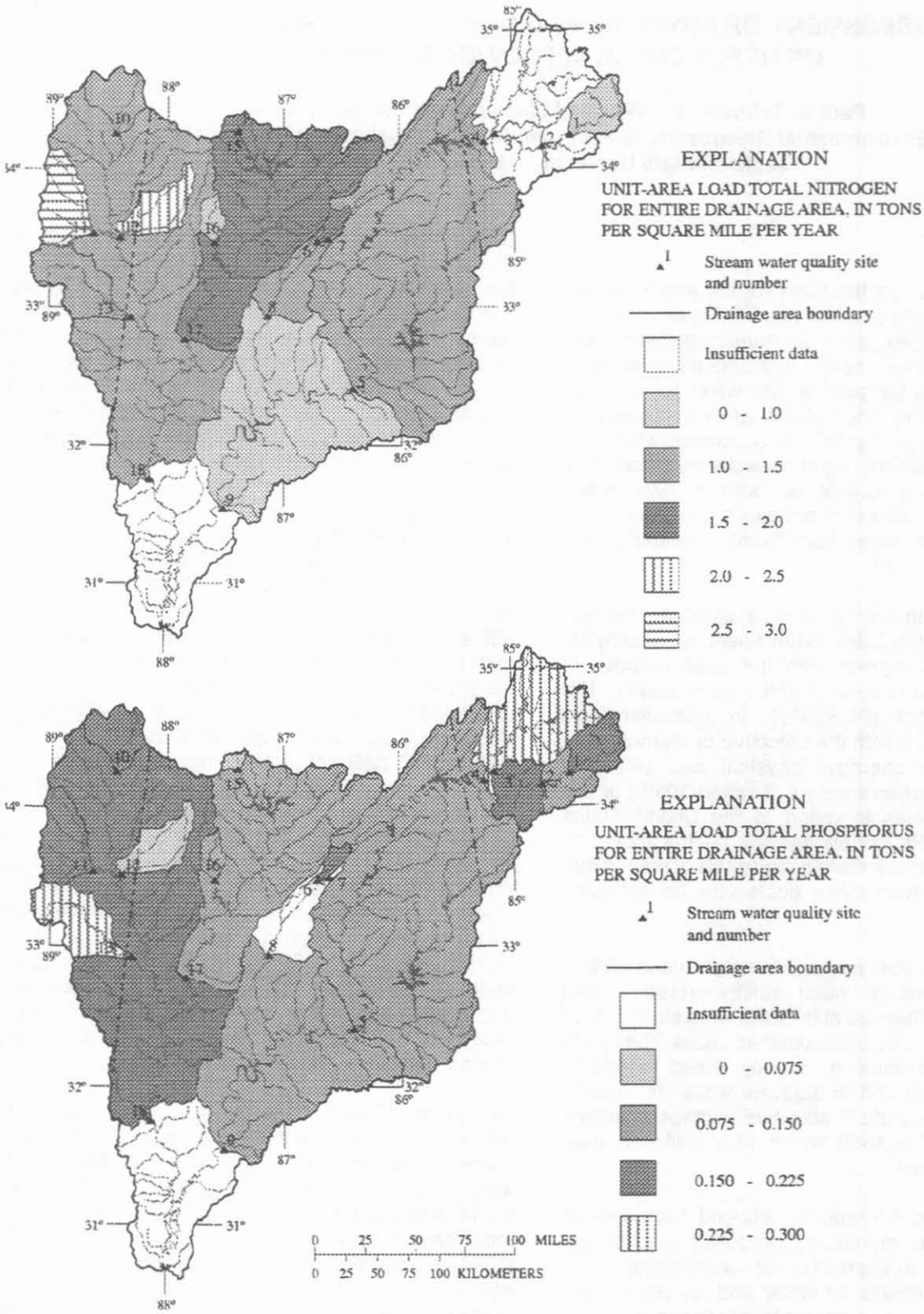

Figure 3. Mean annual total nitrogen and total phosphorus yields.