Table 4. Regression summary for the seven-parameter, log-linear regression model used to estimate nutrient concentrations at sites in the Mobile River Basin

[s, standard deviation of the residuals from ordinary least-squares fit, in log units; R^2, coefficient of determination; B_0, constant; B_1, coefficient of natural logarithm of streamflow; B_2, coefficient of natural logarithm of streamflow, squared; B_3, coefficient of time; B_4, coefficient of time, squared; B_5, coefficient of sine (time); B_6, coefficient of cosine (time); bold indicates coefficients with an absolute T value greater than 2, which indicates statistical significance; —, no regression results because of insufficient data]

Constituent	s	R^2	β_0	β_1	β_2	β_3	β_4	β_5	β_6	Annual nutrient loads, in tons per year			Mean annual load, in tons per year	Yield, in tons per year per square mile
										1999	2000	2001		
Alabama River at Claiborne, Alabama														
Total nitrogen	0.12	0.52	**-0.5214**	**0.0682**	-0.0087	0.0027	-0.0136	0.0603	0.0365	12,400	8,190	18,900	13,200	0.60
Dissolved nitrite-plus-nitrate nitrogen	.36	.67	**-1.8380**	**.2411**	**-.1937**	-.0690	.0689	**.3490**	**.3279**	4,110	2,080	4,830	3,670	.17
Total phosphorus	.20	.56	**-2.607**	**.1786**	**.1071**	-.0492	-.0397	-.0213	.0242	1,780	1,130	2,860	1,920	.09
Dissolved orthophosphate	.45	.24	-4.213	-.1488	.0546	-.1821	-.0475	-.0395	.1081	389	244	380	338	.02
Suspended sediment	.46	.81	**3.225**	**.7934**	-.0393	.1038	.1584	.116	-.1806	889,000	458,000	2,150,000	1,160,000	53
Black Warrior River below Bankhead Lock and Dam near Bessemer, Alabama														
Total nitrogen	0.20	0.79	-0.5028	0.0126	0.0042	0.0197	0.1387	**0.3157**	**0.2329**	6,720	6,280	—	6,500	1.6
Dissolved nitrite-plus-nitrate nitrogen	.49	.74	-.7663	-.0002	-.0011	-.1274	.0741	**.7576**	**.5863**	5,470	3,940	—	4,700	1.2
Total phosphorus	.40	.59	**-4.9088**	.0366	**.0245**	.0834	-.0444	**-.0999**	**.3333**	346	454	—	400	.10
Dissolved orthophosphate	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Suspended sediment	.69	.36	**1.1439**	.0502	.0454	-.4065	.4314	.2130	.1341	56,800	57,200	—	57,000	14

Table 4. Regression summary for the seven-parameter, log-linear regression model used to estimate nutrient concentrations at sites in the Mobile River Basin—Continued

[s, standard deviation of the residuals from ordinary least-squares fit, in log units; R^2, coefficient of determination; B_0, constant; B_1, coefficient of natural logarithm of streamflow; B_2, coefficient of natural logarithm of streamflow, squared; B_3, coefficient of time; B_4, coefficient of time, squared; B_5, coefficient of sine (time); B_6, coefficient of cosine (time); bold indicates coefficients with an absolute T value greater than 2, which indicates statistical significance; —, no regression results because of insufficient data]

Constituent	s	R^2	β_0	β_1	β_2	β_3	β_4	β_5	β_6	Annual nutrient loads, in tons per year			Mean annual load, in tons per year	Yield, in tons per year per square mile
										1999	2000	2001		
Bogue Chitto Creek near Memphis, Alabama														
Total nitrogen	0.62	0.35	**0.9518**	**0.1169**	0.0050	-0.0190	-0.0723	**-0.4359**	**-0.2017**	277	139	507	308	5.8
Dissolved nitrite-plus-nitrate nitrogen	2.10	.31	**-1.9861**	**.3641**	.0077	-.3386	.0620	-.1863	.3295	939	299	824	688	13
Total phosphorus	.54	.72	**-2.2521**	**.1931**	**.0287**	-.0987	-.1806	-.0637	.0037	68	44	95	69	1.3
Dissolved orthophosphate	.98	.58	**-4.4214**	**.2873**	.0142	**-.4216**	.1330	-.4553	.3913	23	5.2	19	16	.3
Suspended sediment	.96	.71	**3.1245**	**.3349**	**.0426**	.0194	-.4499	.0155	.0137	54,800	70,900	103,000	76,200	1,450
Cahaba River at Centreville, Alabama														
Total nitrogen	0.29	0.51	-0.2163	**0.2305**	-0.0378	0.2711	0.0455	-0.0794	0.0029	893	855	1,900	1,220	1.2
Dissolved nitrite-plus-nitrate nitrogen	.67	.46	**-0.7924**	.1496	**-.2078**	.1463	.1332	-.0379	.3675	560	373	683	539	.52
Total phosphorus	.55	.56	**-2.5746**	.5435	-.0315	.3090	.3709	-.3649	.0515	131	119	444	231	.22
Dissolved orthophosphate	.59	.49	**-3.6079**	.0697	**-.2296**	.1505	.3674	-.1204	.2821	33	20	60	38	.04
Suspended sediment	.62	.79	**3.5701**	**1.0095**	-.0194	.3520	-.1383	**-.3049**	**-.3592**	80,100	152,000	134,000	122,000	118

Table 4. Regression summary for the seven-parameter, log-linear regression model used to estimate nutrient concentrations at sites in the Mobile River Basin—Continued

[s, standard deviation of the residuals from ordinary least-squares fit, in log units; R^2, coefficient of determination; B_0, constant; B_1, coefficient of natural logarithm of streamflow; B_2, coefficient of natural logarithm of streamflow, squared; B_3, coefficient of time; B_4, coefficient of time, squared; B_5, coefficient of sine (time); B_6, coefficient of cosine (time); bold indicates coefficients with an absolute T value greater than 2, which indicates statistical significance; —, no regression results because of insufficient data]

| Constituent | s | R^2 | B_0 | B_1 | B_2 | B_3 | B_4 | B_5 | B_6 | Annual nutrient loads, in tons per year | | | Mean annual load, in tons per year | Yield, in tons per year per square mile |
										1999	2000	2001		
Cahaba Valley Creek at Cross Creek Road at Pelham, Alabama														
Total nitrogen	0.36	0.49	**0.3502**	**-0.2265**	0.0329	0.0631	-0.1170	-0.0218	-0.0440	39	39	58	45	1.8
Dissolved nitrite-plus-nitrate nitrogen	.34	.77	-.1567	**-.501**	.0193	.1063	-.0675	.0453	-.0123	25	25	37	29	1.1
Total phosphorus	.44	.55	**-1.7401**	-.0706	.0481	**-.2159**	**-.471**	**-.2316**	**-.0445**	4.4	4.8	4	4.4	.17
Dissolved orthophosphate	.50	.75	**-2.5645**	**-.5323**	.0276	**-.28**	**-.4989**	-.0819	.0852	2.4	2.4	1.6	2.1	.08
Suspended sediment	.68	.64	**3.3777**	**.9537**	-.0455	-.0746	-.1086	**-.6077**	**-.3410**	1,420	2,390	3,980	2,600	101
Chattooga River above Gaylesville, Alabama														
Total nitrogen	0.21	0.36	-0.1388	0.1005	**-0.0919**	0.1675	0.0308	-0.0679	-0.1112	332	270	—	301	0.82
Dissolved nitrite-plus-nitrate nitrogen	.42	.47	**-1.0541**	-.0591	-.1227	.1718	.3699	.3036	-.2369	182	138	—	160	.44
Total phosphorus	.75	.50	**-1.9321**	.0982	-.0276	-.2094	-.1434	**-1.0236**	**.1281**	110	62	—	86	.23
Dissolved orthophosphate	.32	.90	**-1.9897**	**-.5542**	-.0374	-.0933	-.3588	**-.3617**	**.0335**	54	43	—	49	.13
Suspended sediment	.59	.68	**3.9187**	.9545	**-.3282**	.3565	-.8726	**-.7031**	**-.3333**	10,200	9,990	—	10,100	28

Table 4. Regression summary for the seven-parameter, log-linear regression model used to estimate nutrient concentrations at sites in the Mobile River Basin—Continued

[s, standard deviation of the residuals from ordinary least-squares fit, in log units; R^2, coefficient of determination; B_0, constant; B_1, coefficient of natural logarithm of streamflow; B_2, coefficient of natural logarithm of streamflow, squared; B_3, coefficient of time; B_4, coefficient of time, squared; B_5, coefficient of sine (time); B_6, coefficient of cosine (time); bold indicates coefficients with an absolute T value greater than 2, which indicates statistical significance; —, no regression results because of insufficient data]

Constituent	s	R^2	β_0	β_1	β_2	β_3	β_4	β_5	β_6	Annual nutrient loads, in tons per year			Mean annual load, in tons per year	Yield, in tons per year per square mile
										1999	2000	2001		
Pintlalla Creek at Liberty Church Road near Pintlalla, Alabama														
Total nitrogen	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dissolved nitrite-plus-nitrate nitrogen	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total phosphorus	0.44	0.55	**-2.0187**	**0.1970**	0.0045	0.1458	-0.2824	**-0.5120**	**-0.1353**	6.8	2.4	—	4.6	0.08
Dissolved orthophosphate	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Suspended sediment	.51	.72	**2.8225**	**0.2557**	0.0107	-0.3743	-0.5202	0.2045	-0.1057	1,740	1,360	—	1,550	26
Threemile Branch at North Boulevard at Montgomery, Alabama														
Total nitrogen	0.31	0.52	0.3021	**0.1201**	-0.0745	-0.0309	-0.0024	**0.0874**	**0.2709**	13	10	—	12	1.4
Dissolved nitrite-plus-nitrate nitrogen	.44	.54	**-0.6907**	**-0.2387**	-0.0927	**-0.2293**	0.1952	**0.0905**	**0.2927**	6	3.6	—	4.8	.55
Total phosphorus	.75	.57	**-1.9639**	**0.6709**	-0.125	0.2183	-0.1788	-0.2334	-0.1308	1.6	1.6	—	1.6	.18
Dissolved orthophosphate	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Suspended sediment	1.10	.63	**3.2539**	**1.0873**	-0.0711	0.4911	-0.1328	-0.1882	0.2899	684	894	—	789	90

Table 4. Regression summary for the seven-parameter, log-linear regression model used to estimate nutrient concentrations at sites in the Mobile River Basin—Continued

[s, standard deviation of the residuals from ordinary least-squares fit, in log units; R^2, coefficient of determination; B_0, constant; B_1, coefficient of natural logarithm of streamflow; B_2, coefficient of natural logarithm of streamflow, squared; B_3, coefficient of time; B_4, coefficient of time, squared; B_5, coefficient of sine (time); B_6, coefficient of cosine (time); bold indicates coefficients with an absolute T value greater than 2, which indicates statistical significance; —, no regression results because of insufficient data]

| Constituent | s | R^2 | β_0 | β_1 | β_2 | β_3 | β_4 | β_5 | β_6 | Annual nutrient loads, in tons per year | | | Mean annual load, in tons per year | Yield, in tons per year per square mile |
										1999	2000	2001		
Tombigbee River below Coffeeville Lock and Dam near Coffeeville, Alabama														
Total nitrogen	0.34	0.51	-0.3761	0.0370	-0.0317	-0.0709	0.1501	0.2689	0.0435	25,400	12,400	29,200	22,300	1.2
Dissolved nitrite-plus-nitrate nitrogen	.48	.63	**-1.2628**	.0975	**-.1489**	-.0628	.0445	.3604	.2236	8,370	4,740	9,930	7,680	.42
Total phosphorus	.32	.65	-2.5005	**.2363**	**.0802**	-.0227	-.0638	-.0043	.1057	3,200	2,080	4,960	3,420	.19
Dissolved orthophosphate	.53	.20	-3.9985	-.0718	-.0471	-.0840	-.1250	-.0998	.2356	346	252	472	356	.02
Suspended sediment	.61	.77	**3.6137**	**.7695**	.1087	.0955	-.1880	-.2630	-.0374	2,450,000	2,220,000	5,290,000	3,320,000	180

nitrogen), Bogue Chitto Creek (total nitrogen, nitrate, total phosphorus, orthophosphate), Pintlalla Creek (total phosphorus), and Threemile Branch (total nitrogen, total phosphorus).

Nutrient yields are useful for comparing nutrient loads from sites with different drainage basin sizes. Normalizing the nutrient load to basin size eliminates the effect of basin size. For example, the Tombigbee River had a mean annual nitrogen load of 22,300 tons per year (tons/yr), and Bogue Chitto Creek had a mean annual total nitrogen load of 308 tons/yr (table 4); however, the yield for the Tombigbee River and Bogue Chitto Creek was 1.2 tons per year per square mile ([tons/yr]/mi^2) and 5.8 (tons/yr)/mi^2, respectively, indicating higher total nitrogen inputs per square mile in the Bogue Chitto Creek Basin. Total nitrogen yields at Bogue Chitto Creek were almost five times higher than at the Tombigbee River, and Bogue Chitto Creek had the highest yields for all constituents for all sites.

Nutrient yields were nearly twice as high in the Tombigbee River compared to the Alabama River for total nitrogen, nitrate, and total phosphorus, reflecting more agricultural and urban influences in the Tombigbee River Basin (table 4). Nutrient yields in Bogue Chitto Creek were higher than the other indicator sites. Nutrient yields were highest in Bogue Chitto Creek, Cahaba Valley Creek, and Threemile Branch due to the agricultural and urban land-use influences in those watersheds.

Flow-weighted mean concentrations also are helpful in comparing nutrient loads from sites with differing streamflow regimes by eliminating the influence of streamflow. Flow-weighted mean concentrations were computed by dividing the estimated annual load by the mean annual streamflow for the load computation period. Clark and others (2000) calculated flow-weighted mean concentrations for selected nutrients in undeveloped basins around the United States to estimate background nutrient levels. Flow-weighted mean concentrations for the nine Mobile River Basin sites equaled or exceeded median flow-weighted means representing background concentrations of 0.02 mg/L of ammonia, 0.087 mg/L of nitrate, 0.26 mg/L of total nitrogen, 0.01 mg/L of orthophosphate, and 0.022 mg/L of total phosphorus (table 5).

Flow-weighted mean concentrations also were computed for ammonia, nitrate, total nitrogen, orthophosphate, and total phosphorus for all NAWQA Study Units, including the Mobile River Basin Study Unit, from the period 1999 to 2001, and sites from this study unit were ranked against these values according to land-use category (table 5). Flow-weighted mean concentrations for the Mobile River Basin sites generally were in the lower to middle percentile ranges compared to data from other NAWQA studies across the Nation. However, Bogue Chitto Creek's flow-weighted mean concentrations of ammonia, total

Table 5. Flow-weighted mean nutrient concentrations at sites in the Mobile River Basin

[ft^3/s, cubic feet per second; mg/L, milligrams per liter; —, not estimated]

Site name	Land-use category	Years	Mean annual streamflow (ft^3/s)	Ammonia Flow-weighted mean concentration (mg/L)	Ammonia Percentile	Nitrate Flow-weighted mean concentration (mg/L)	Nitrate Percentile	Total nitrogen Flow-weighted mean concentration (mg/L)	Total nitrogen Percentile	Ortho-phosphate Flow-weighted mean concentration (mg/L)	Ortho-phosphate Percentile	Total phosphorus Flow-weighted mean concentration (mg/L)	Total phosphorus Percentile
Alabama River	Mixed	2	21,549	—	—	0.16	22	0.62	25	0.02	33	0.09	40
Black Warrior River	Mixed	2	5,933	—	—	.74	53	1.41	52	—	—	.80	94
Bogue Chitto Creek	Agriculture	2	45	0.21	90	.14	19	4.19	83	.14	82	1.07	95
Cahaba River	Mixed	2	1,160	—	—	.45	42	1.11	43	.03	49	.21	65
Cahaba Valley Creek	Urban	2	33	.03	40	.83	56	1.42	52	.03	49	.14	53
Chattooga River	Mixed	2	380	—	—	.61	48	.88	36	.08	70	.14	52
Pintlalla Creek	Agriculture	2	53	—	—	—	—	—	—	—	—	.15	53
Threemile Branch	Urban	2	9	—	—	.41	38	1.31	51	—	—	.22	65
Tombigbee River	Mixed	2	21,133	.03	39	.31	34	.85	34	.02	33	.14	52