Table 4.3. Correlations between relative abundances of fish species and the summer nutrient multimetric index in streams of watersheds with low urban activity. The numbers in bold are significant correlations ($p<0.05$) without correcting for multiple tests.

Fish Species	SUMNUTEMMI
BANDED_DARTER	-0.073
BANDED_SCULPIN	0.100
BLUEGILL_SUNFISH	0.178
BLUNTNOSE_MINNOW	-0.029
CARDINAL_SHINER	-0.225
CENTRAL_STONEROLLER	-0.105
CREEK_CHUB	0.221
FANTAIL_DARTER	-0.143
GOLDEN_REDHORSE	0.081
GREEN_SUNFISH	-0.118
GREENSIDE_DARTER	-0.223
LARGEMOUTH_BASS	-0.042
LOGPERCH	**-0.393**
LONGEAR_SUNFISH	-0.224
MOSQUITOFISH	0.229
NORTHERN_HOGSUCKER	-0.062
ORANGETHROAT_DARTER	**0.276**
REDSPOT_CHUB	-0.134
ROCK_BASS	0.040
SLENDER_MADTOM	**0.268**
SMALLMOUTH_BASS	-0.244
SOUTHERN_REDBELLY_DACE	0.069
SPOTTED_BASS	-0.134
STIPPLED_DARTER	**0.306**
YELLOW_BULLHEAD	-0.031

EXHIBIT R

Table 5.1 Predicted changes in TP concentration in spring and summer under different management scenarios at 3 locations in the IRW. Changes are predicted with regression models used to smooth the variability in processed-based watershed models constructed by Dr. Bernard Engel in his Expert Witness Report. The intercept, slope, and statistical significance of the regression models are recorded, as well as the predicted TP concentration in 2008 and in 2058. The average change in TP at the 3 locations over 50 years is calculated for each scenario and season.

Season	Mgmt Scenario	River	Intercept ($x10^{-5}$)	Slope ($x10^{-5}$)	Stat. Sig. (p)	Current TP (mg/L)	50 yr TP (mg/L)	% 50 yr chg	Ave chg by season & scenario
Spring	Control	Illinois at Tahlequah	0.115	0.173	0.867	0.1497	0.1506	0.57	-12.64
Spring	Control	Baron Fork	0.101	-0.341	0.559	0.0325	0.0308	-5.53	
Spring	Control	Caney Creek	0.293	-1.326	0.018	0.0267	0.0201	-32.97	
Spring	No Litter	Illinois at Tahlequah	1.267	-5.818	0.000	0.0987	0.0697	-41.76	-35.83
Spring	No Litter	Baron Fork	0.238	-1.054	0.013	0.0264	0.0211	-24.99	
Spring	No Litter	Caney Creek	0.321	-1.472	0.004	0.0254	0.0181	-40.75	
Spring	No Litter & Buffer	Illinois at Tahlequah	1.067	-4.872	0.000	0.0887	0.0643	-37.86	-29.93
Spring	No Litter & Buffer	Baron Fork	0.159	-0.688	0.055	0.0208	0.0174	-19.76	
Spring	No Litter & Buffer	Caney Creek	0.222	-1.003	0.019	0.0206	0.0156	-32.18	
Spring	Continued Growth	Illinois at Tahlequah	-7.903	40.343	0.000	0.1979	0.3996	50.48	24.07
Spring	Continued Growth	Baron Fork	-0.579	3.057	0.134	0.0348	0.0501	30.49	
Spring	Continued Growth	Caney Creek	0.112	-0.426	0.802	0.0265	0.0243	-8.75	
Summer	Control	Illinois at Tahlequah	0.082	0.241	0.744	0.1304	0.1316	0.92	-11.28
Summer	Control	Baron Fork	0.052	-0.188	0.712	0.0142	0.0133	-7.06	
Summer	Control	Caney Creek	0.137	-0.612	0.109	0.0141	0.0111	-27.69	
Summer	No Litter	Illinois at Tahlequah	1.074	-4.925	0.000	0.0851	0.0604	-40.75	-33.21
Summer	No Litter	Baron Fork	0.104	-0.463	0.200	0.0110	0.0087	-26.56	
Summer	No Litter	Caney Creek	0.154	-0.696	0.043	0.0142	0.0108	-32.33	
Summer	No Litter & Buffer	Illinois at Tahlequah	0.901	-4.102	0.000	0.0773	0.0568	-36.10	-26.99
Summer	No Litter & Buffer	Baron Fork	0.072	-0.311	0.303	0.0096	0.0080	-19.45	
Summer	No Litter & Buffer	Caney Creek	0.108	-0.479	0.093	0.0118	0.0094	-25.42	
Summer	Continued Growth	Illinois at Tahlequah	-7.670	39.070	0.000	0.1753	0.3706	52.71	24.32
Summer	Continued Growth	Baron Fork	-0.183	0.987	0.568	0.0152	0.0201	24.52	
Summer	Continued Growth	Caney Creek	0.041	-0.127	0.927	0.0155	0.0149	-4.27	

EXHIBIT R

Table 5.2. The expected average spring TP concentrations in the 96 representative watersheds in 2058 under different management scenarios. The percent change for each scenario is listed as well as the spring injury benchmark (0.027 mg TP/L). The numbers marked in bold are the highest lowest ranking site with nutrients that exceeded the spring injury benchmark.

Rank	100-Percentile	Summer 2006 TP (mg/L)	Spring (0.027 mg TP/L benchmark)			
			Control	No Litter	No Litter & Buffer	Continued Growth
			-12.64 %	-35.83 %	-29.93 %	24.07 %
1	100.00	0.006	0.005	0.004	0.004	0.007
1	98.96	0.009	0.008	0.006	0.006	0.011
1	97.92	0.009	0.008	0.006	0.006	0.011
1	96.87	0.010	0.009	0.006	0.007	0.012
1	95.83	0.017	0.015	0.011	0.012	0.021
1	94.79	0.018	0.015	0.011	0.012	0.022
1	93.75	0.018	0.016	0.012	0.013	0.022
1	92.71	0.018	0.016	0.012	0.013	0.023
1	91.67	0.021	0.018	0.013	0.015	0.026
1	90.62	0.021	0.018	0.013	0.015	0.026
1	89.58	0.021	0.018	0.013	0.015	0.026
1	88.54	0.022	0.019	0.014	0.015	0.027
1	87.50	0.023	0.020	0.015	0.016	**0.028**
1	86.46	0.025	0.022	0.016	0.017	0.031
1	85.42	0.025	0.022	0.016	0.017	0.031
1	84.37	0.025	0.022	0.016	0.017	0.031
1	83.33	**0.029**	0.025	0.018	0.020	0.035
1	82.29	0.029	0.025	0.019	0.020	0.036
1	81.25	0.030	0.026	0.019	0.021	0.037
1	80.21	0.030	0.026	0.019	0.021	0.038
1	79.17	0.033	**0.029**	0.021	0.023	0.041
1	78.12	0.035	0.031	0.022	0.025	0.043
1	77.08	0.036	0.031	0.023	0.025	0.044
1	76.04	0.037	0.032	0.024	0.026	0.046
1	75.00	0.037	0.032	0.024	0.026	0.046
1	73.96	0.038	0.033	0.024	0.026	0.047
1	72.92	0.038	0.033	0.025	0.027	0.047
1	71.87	0.039	0.034	0.025	0.027	0.048
1	70.83	0.039	0.034	0.025	0.027	0.048
1	69.79	0.040	0.035	0.026	**0.028**	0.050
1	68.75	0.040	0.035	0.026	0.028	0.050
1	67.71	0.040	0.035	0.026	0.028	0.050

EXHIBIT R

Rank	100-Percentile	Summer 2006 TP (mg/L)	Spring (0.027 mg TP/L benchmark)			
			Control	No Litter	No Litter & Buffer	Continued Growth
			-12.64 %	-35.83 %	-29.93 %	24.07 %
1	66.67	0.042	0.037	0.027	0.029	0.052
1	65.62	0.043	0.038	**0.028**	0.030	0.053
1	64.58	0.044	0.039	0.028	0.031	0.055
1	63.54	0.045	0.039	0.029	0.032	0.056
1	62.50	0.045	0.039	0.029	0.032	0.056
1	61.46	0.046	0.040	0.029	0.032	0.057
1	60.42	0.046	0.040	0.030	0.032	0.057
1	59.37	0.048	0.042	0.031	0.034	0.059
1	58.33	0.048	0.042	0.031	0.034	0.060
1	57.29	0.049	0.043	0.032	0.035	0.061
1	56.25	0.051	0.044	0.033	0.036	0.063
1	55.21	0.051	0.045	0.033	0.036	0.063
1	54.17	0.051	0.045	0.033	0.036	0.063
1	53.12	0.052	0.045	0.033	0.036	0.065
1	52.08	0.053	0.046	0.034	0.037	0.066
1	51.04	0.054	0.047	0.035	0.038	0.067
1	50.00	0.055	0.048	0.035	0.039	0.068
1	48.96	0.055	0.048	0.035	0.039	0.068
1	47.92	0.057	0.049	0.036	0.040	0.070
1	46.87	0.061	0.054	0.039	0.043	0.076
1	45.83	0.063	0.055	0.040	0.044	0.078
1	44.79	0.064	0.055	0.041	≤0.045	0.079
1	43.75	0.064	0.056	0.041	0.045	0.079
1	42.71	0.065	0.057	0.042	0.046	0.081
1	41.67	0.068	0.060	0.044	0.048	0.085
1	40.62	0.072	0.063	0.046	0.050	0.089
1	39.58	0.072	0.063	0.046	0.050	0.089
1	38.54	0.072	0.063	0.046	0.051	0.090
1	37.50	0.073	0.064	0.047	0.051	0.091
1	36.46	0.081	0.071	0.052	0.057	0.101
1	35.42	0.082	0.072	0.053	0.058	0.102
1	34.37	0.083	0.072	0.053	0.058	0.103
1	33.33	0.086	0.075	0.055	0.060	0.107
1	32.29	0.091	0.080	0.059	0.064	0.113
1	31.25	0.093	0.082	0.060	0.065	0.116

EXHIBIT R

Rank	100-Percentile	Summer 2006 TP (mg/L)	Spring (0.027 mg TP/L benchmark)			
			Control	No Litter	No Litter & Buffer	Continued Growth
			-12.64 %	-35.83 %	-29.93 %	24.07 %
1	30.21	0.102	0.089	0.065	0.071	0.126
1	29.17	0.103	0.090	0.066	0.072	0.128
1	28.12	0.116	0.101	0.074	0.081	0.144
1	27.08	0.117	0.102	0.075	0.082	0.145
1	26.04	0.128	0.112	0.082	0.090	0.159
1	25.00	0.141	0.123	0.090	0.098	0.174
1	23.96	0.142	0.124	0.091	0.100	0.177
1	22.92	0.154	0.135	0.099	0.108	0.192
1	21.87	0.157	0.137	0.100	0.110	0.194
1	20.83	0.170	0.148	0.109	0.119	0.211
1	19.79	0.187	0.163	0.120	0.131	0.232
1	18.75	0.187	0.163	0.120	0.131	0.232
1	17.71	0.189	0.165	0.121	0.132	0.234
1	16.67	0.190	0.166	0.122	0.133	0.236
1	15.62	0.191	0.167	0.122	0.134	0.237
1	14.58	0.236	0.206	0.152	0.166	0.293
1	13.54	0.255	0.222	0.163	0.178	0.316
1	12.50	0.260	0.227	0.167	0.182	0.322
1	11.46	0.283	0.247	0.181	0.198	0.351
1	10.41	0.350	0.306	0.225	0.245	0.434
1	9.37	0.383	0.334	0.245	0.268	0.475
1	8.33	0.437	0.382	0.281	0.306	0.543
1	7.29	0.446	0.389	0.286	0.312	0.553
1	6.25	0.475	0.415	0.305	0.333	0.589
1	5.21	0.557	0.487	0.357	0.390	0.691
1	4.16	0.592	0.517	0.380	0.415	0.735
1	3.12	0.597	0.522	0.383	0.419	0.741
1	2.08	1.428	1.248	0.917	1.001	1.772
1	1.04	4.111	3.591	2.638	2.880	5.100

EXHIBIT R

Table 5.3. The expected summer average TP concentrations in the 96 representative watersheds in 2058 under different management scenarios. The percent change from summer 2006 for each scenario is listed as well as the summer injury benchmark (0.060 mg TP/L). The numbers marked in bold are the highest lowest ranking site with nutrients that exceeded the summer injury benchmark.

100-Percentile	Summer 2006 TP (mg/L)	Summer (0.060 mg TP/L)			
		Control	No Litter	No Litter & Buffer	Continued Growth
		-11.28 %	-33.21 %	-26.99 %	24.32 %
100.00	0.006	0.005	0.004	0.004	0.007
98.96	0.009	0.008	0.006	0.006	0.011
97.92	0.009	0.008	0.006	0.006	0.011
96.87	0.010	0.009	0.007	0.007	0.012
95.83	0.017	0.015	0.011	0.012	0.021
94.79	0.018	0.016	0.012	0.013	0.022
93.75	0.018	0.016	0.012	0.013	0.022
92.71	0.018	0.016	0.012	0.013	0.023
91.67	0.021	0.019	0.014	0.015	0.026
90.62	0.021	0.019	0.014	0.015	0.026
89.58	0.021	0.019	0.014	0.015	0.026
88.54	0.022	0.020	0.015	0.016	0.027
87.50	0.023	0.020	0.015	0.017	0.028
86.46	0.025	0.022	0.016	0.018	0.031
85.42	0.025	0.022	0.016	0.018	0.031
84.37	0.025	0.022	0.017	0.018	0.031
83.33	0.029	0.025	0.019	0.021	0.036
82.29	0.029	0.026	0.019	0.021	0.036
81.25	0.030	0.027	0.020	0.022	0.038
80.21	0.030	0.027	0.020	0.022	0.038
79.17	0.033	0.029	0.022	0.024	0.041
78.12	0.035	0.031	0.023	0.026	0.044
77.08	0.036	0.032	0.024	0.026	0.044
76.04	0.037	0.033	0.025	0.027	0.046
75.00	0.037	0.033	0.025	0.027	0.046
73.96	0.038	0.033	0.025	0.028	0.047
72.92	0.038	0.034	0.026	0.028	0.048
71.87	0.039	0.034	0.026	0.028	0.048
70.83	0.039	0.035	0.026	0.028	0.048
69.79	0.040	0.035	0.027	0.029	0.050
68.75	0.040	0.036	0.027	0.029	0.050
67.71	0.040	0.036	0.027	0.029	0.050

EXHIBIT R

100-Percentile	Summer 2006 TP (mg/L)	Summer (0.060 mg TP/L)			
		Control	No Litter	No Litter & Buffer	Continued Growth
		-11.28 %	-33.21 %	-26.99 %	24.32 %
66.67	0.042	0.037	0.028	0.031	0.052
65.62	0.043	0.038	0.029	0.031	0.053
64.58	0.044	0.039	0.030	0.032	0.055
63.54	0.045	0.040	0.030	0.033	0.056
62.50	0.045	0.040	0.030	0.033	0.056
61.46	0.046	0.041	0.031	0.033	0.057
60.42	0.046	0.041	0.031	0.034	0.057
59.37	0.048	0.042	0.032	0.035	0.059
58.33	0.048	0.043	0.032	0.035	**0.060**
57.29	0.049	0.044	0.033	0.036	0.061
56.25	0.051	0.045	0.034	0.037	0.063
55.21	0.051	0.045	0.034	0.037	0.063
54.17	0.051	0.045	0.034	0.037	0.063
53.12	0.052	0.046	0.035	0.038	0.065
52.08	0.053	0.047	0.035	0.039	0.066
51.04	0.054	0.048	0.036	0.039	0.067
50.00	0.055	0.049	0.037	0.040	0.068
48.96	0.055	0.049	0.037	0.040	0.068
47.92	0.057	0.050	0.038	0.041	0.070
46.87	**0.061**	0.054	0.041	0.045	0.076
45.83	0.063	0.056	0.042	0.046	0.078
44.79	0.064	0.056	0.042	0.046	0.079
43.75	0.064	0.057	0.043	0.047	0.080
42.71	0.065	0.058	0.044	0.048	0.081
41.67	0.068	**0.060**	0.045	0.050	0.085
40.62	0.072	0.064	0.048	0.052	0.089
39.58	0.072	0.064	0.048	0.053	0.090
38.54	0.072	0.064	0.048	0.053	0.090
37.50	0.073	0.065	0.049	0.053	0.091
36.46	0.081	0.072	0.054	0.059	0.101
35.42	0.082	0.073	0.055	0.060	0.102
34.37	0.083	0.074	0.055	**0.061**	0.103
33.33	0.086	0.076	0.057	0.063	0.107
32.29	0.091	0.081	**0.061**	0.067	0.113
31.25	0.093	0.083	0.062	0.068	0.116

EXHIBIT R

100-Percentile	Summer 2006 TP (mg/L)	Summer (0.060 mg TP/L)			
		Control	No Litter	No Litter & Buffer	Continued Growth
		-11.28 %	-33.21 %	-26.99 %	24.32 %
30.21	0.102	0.090	0.068	0.074	0.126
29.17	0.103	0.091	0.069	0.075	0.128
28.12	0.116	0.103	0.077	0.085	0.144
27.08	0.117	0.104	0.078	0.085	0.145
26.04	0.128	0.114	0.085	0.093	0.159
25.00	0.141	0.125	0.094	0.103	0.175
23.96	0.142	0.126	0.095	0.104	0.177
22.92	0.154	0.137	0.103	0.113	0.192
21.87	0.157	0.139	0.105	0.114	0.195
20.83	0.170	0.151	0.113	0.124	0.211
19.79	0.187	0.166	0.125	0.136	0.232
18.75	0.187	0.166	0.125	0.137	0.233
17.71	0.189	0.168	0.126	0.138	0.235
16.67	0.190	0.169	0.127	0.139	0.236
15.62	0.191	0.169	0.127	0.139	0.237
14.58	0.236	0.210	0.158	0.173	0.294
13.54	0.255	0.226	0.170	0.186	0.317
12.50	0.260	0.230	0.173	0.190	0.323
11.46	0.283	0.251	0.189	0.206	0.352
10.41	0.350	0.311	0.234	0.256	0.435
9.37	0.383	0.339	0.255	0.279	0.476
8.33	0.437	0.388	0.292	0.319	0.544
7.29	0.446	0.396	0.298	0.326	0.554
6.25	0.475	0.421	0.317	0.347	0.591
5.21	0.557	0.494	0.372	0.407	0.692
4.16	0.592	0.525	0.395	0.432	0.736
3.12	0.597	0.530	0.399	0.436	0.743
2.08	1.428	1.267	0.954	1.043	1.776
1.04	4.111	3.647	2.745	3.001	5.110

EXHIBIT R

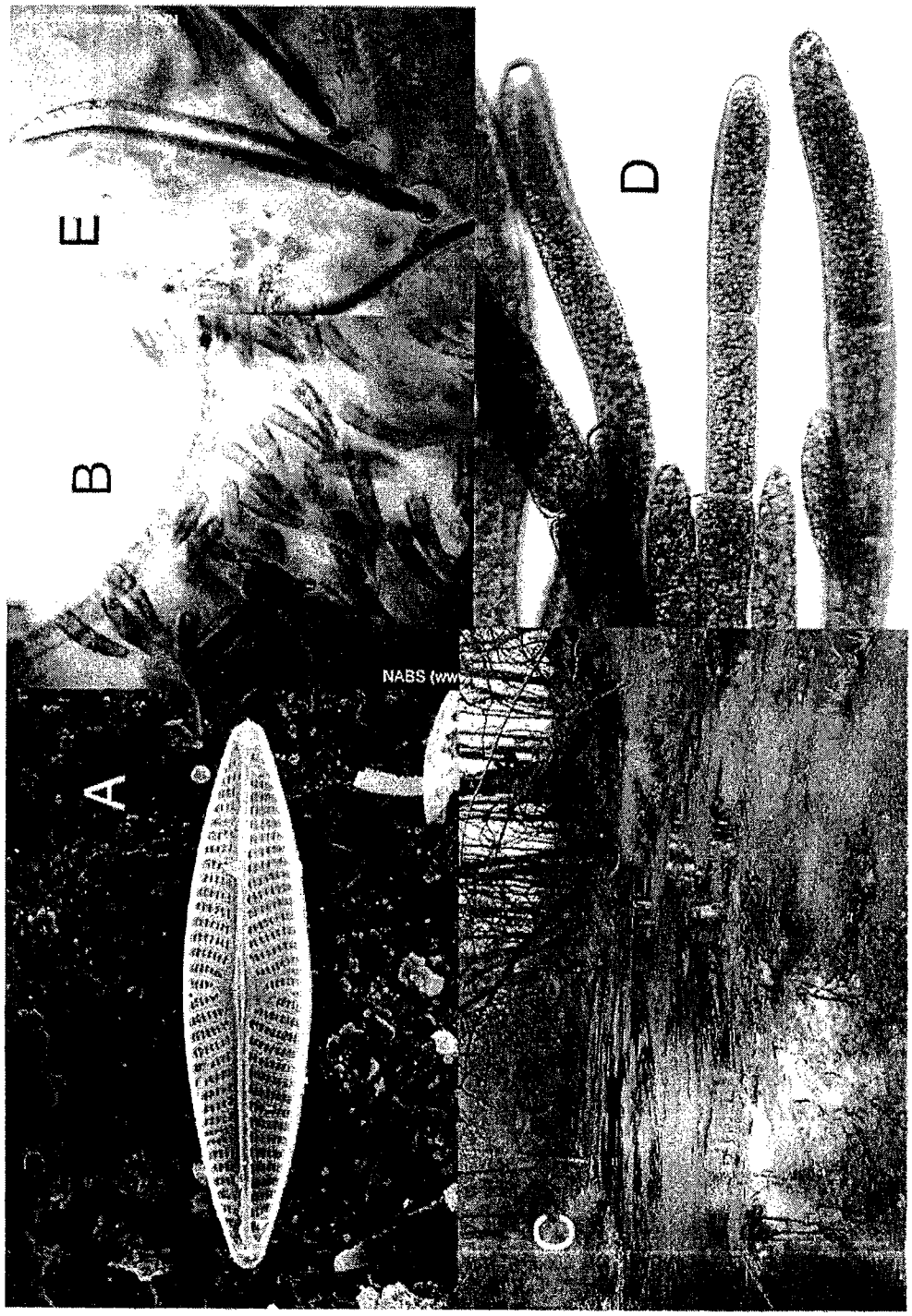


Figure 1.1 Common types of algae in streams. A) an electron micrograph of a cell that is 0.02 mm long; B) a photograph from a light microscope of diatoms with brown pigments in chloroplasts; C) a photograph of filamentous green algae in Ballard Creek, Arkansas; D) a picture of *Cladophora* under the microscope; E) a picture of a filamentous cyanobacterium.

EXHIBIT R

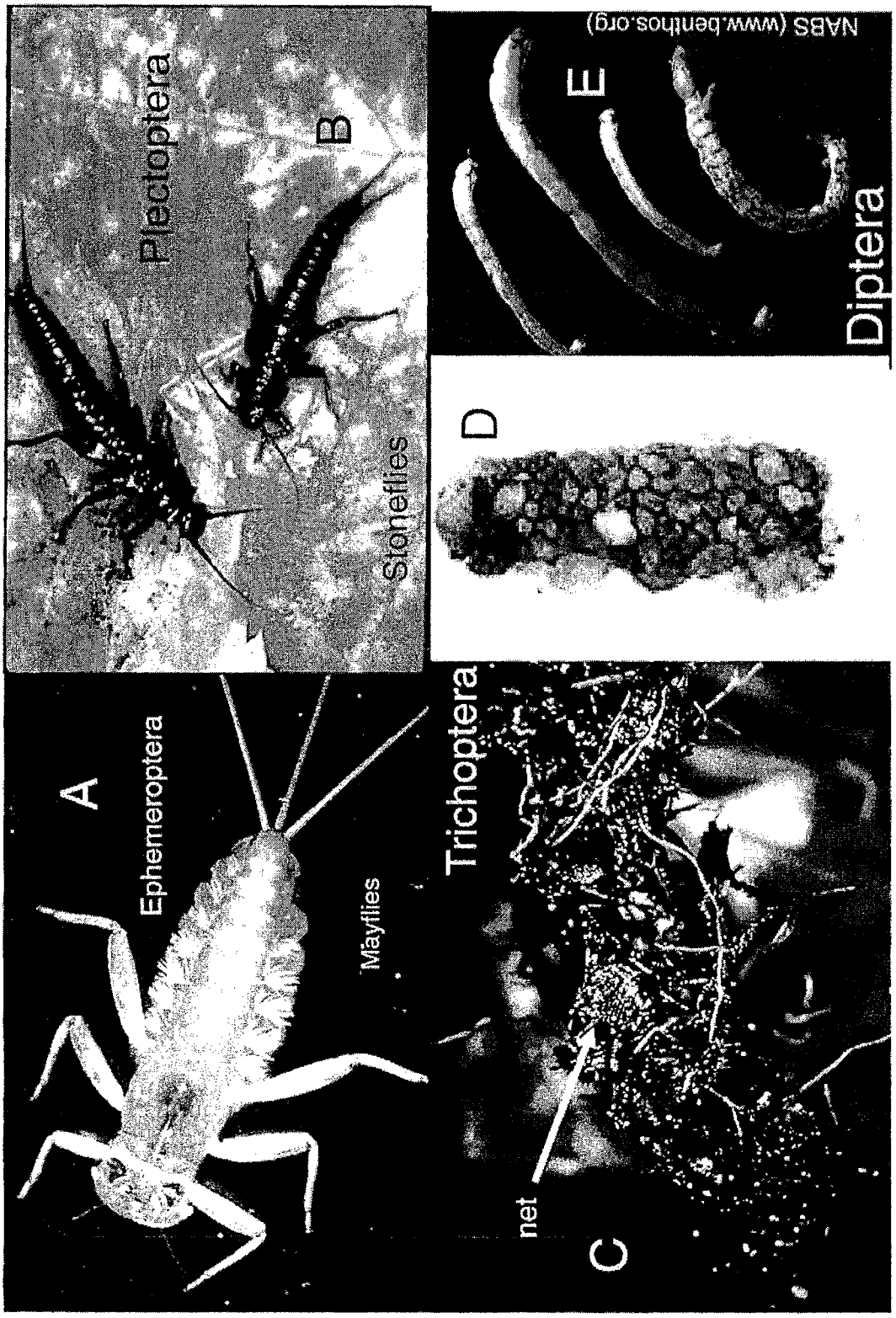


Figure 1.2 Common aquatic insect larvae in streams. A) a mayfly (Ephemeroptera); B) a stonefly (Plecoptera); C) the nets of caddislies on a stick from a stream (arrow); D) a caddisfly in a stone case; E) a dipteran larvae. A slides are from the image file of the North American Benthological Society.

EXHIBIT R

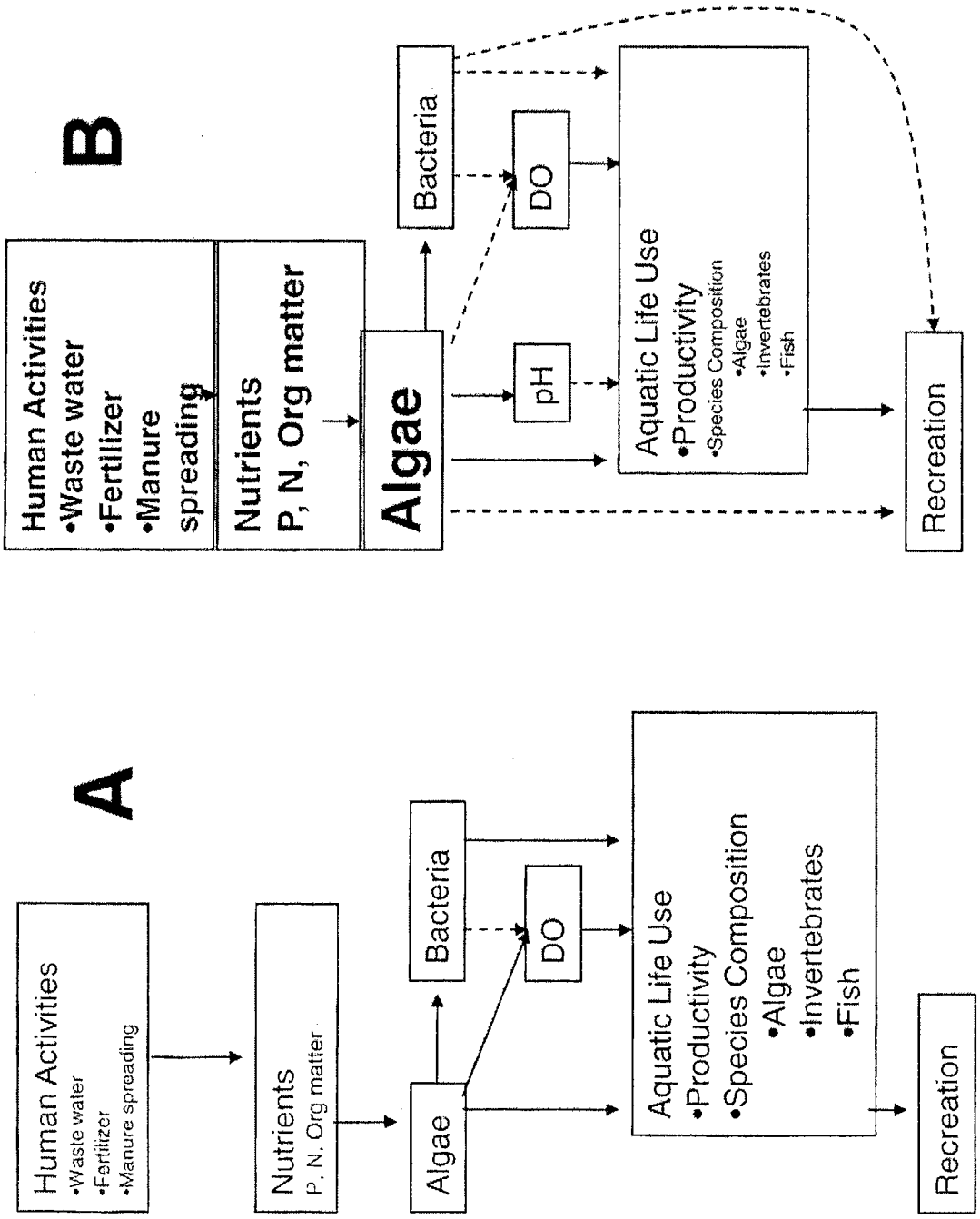
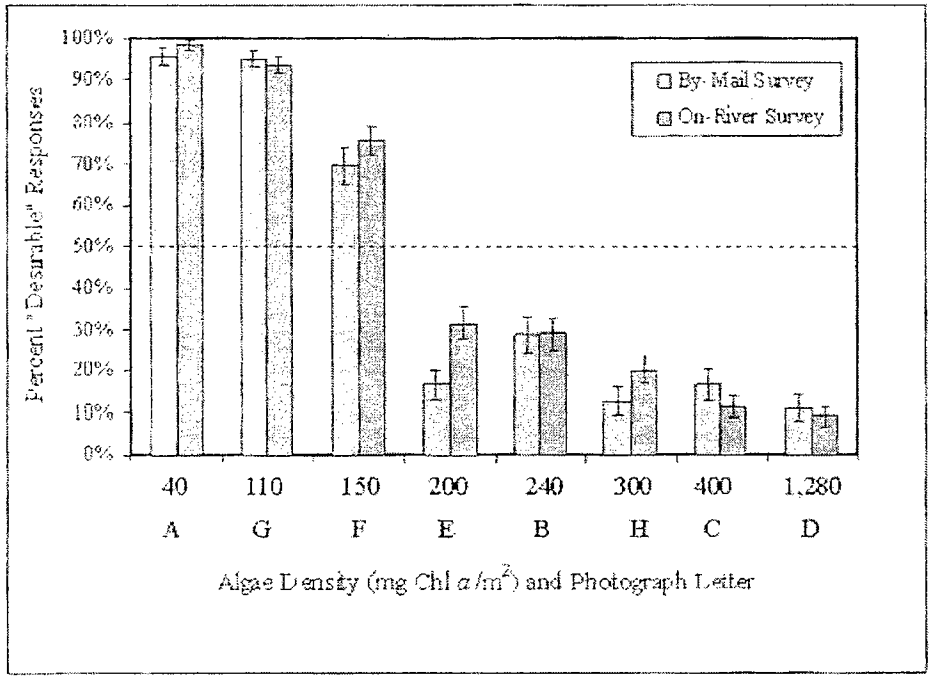


Figure 1.3. Causal pathway for effects of human actitivies on nutrients and valued ecological attributes (aquatic life use and recreation). In this model, two scenarios are presented, one with low nutrient pollution from humans (A) and another with high nutrient pollution from humans (B). Solid lines represent a positive effect and dashed lines indicate a negative effect of one factor on another.

EXHIBIT R



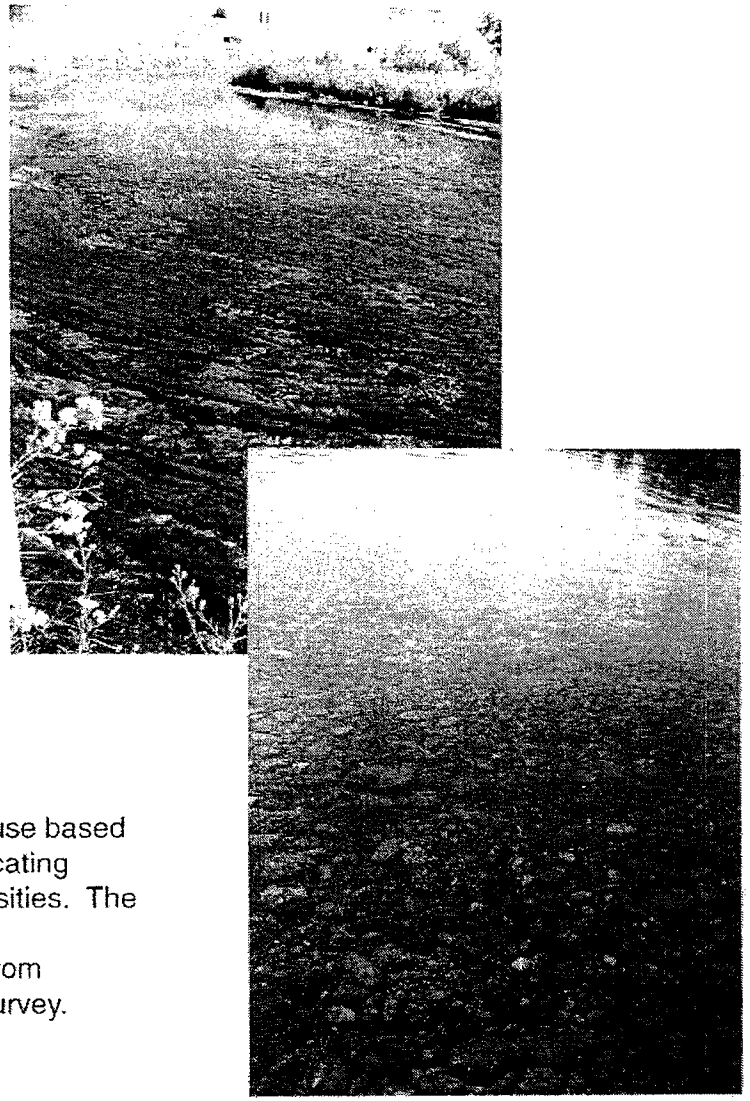


Figure 1.4. Public perception of desirability of streams for recreational use based on amount of algae in stream. The graph shows percent of people indicating condition is desirable in photographs of streams with different algal densities. The pictures are representative pictures from a website posting the graph ([illegible]). Work cited from Suplee, M. draft. Statistical Survey Analysis Report: Algal Perception Survey. Report to Montana Department of Environmental Protection.

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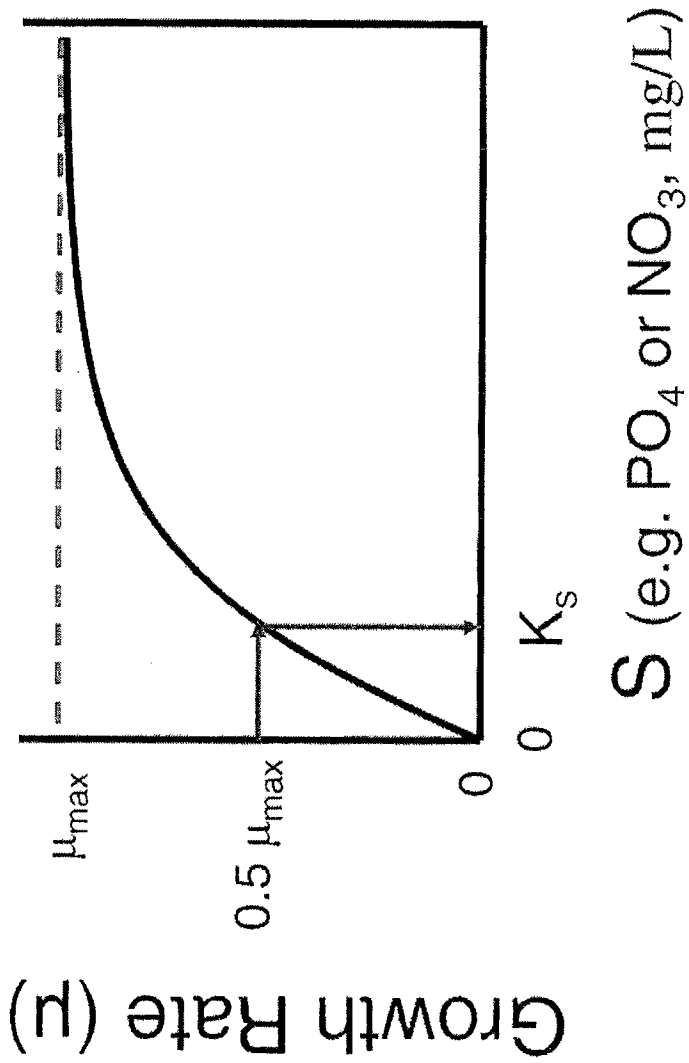

Figure 1.5. The Monod (1950) Model. Here growth rate (μ) increases asymptotically with increasing nutrient concentration (S) such that half of the maximum growth rate (μmax) occurs at the half-saturation constant (Ks). Here, μ=μmax(S/(Ks+S)).

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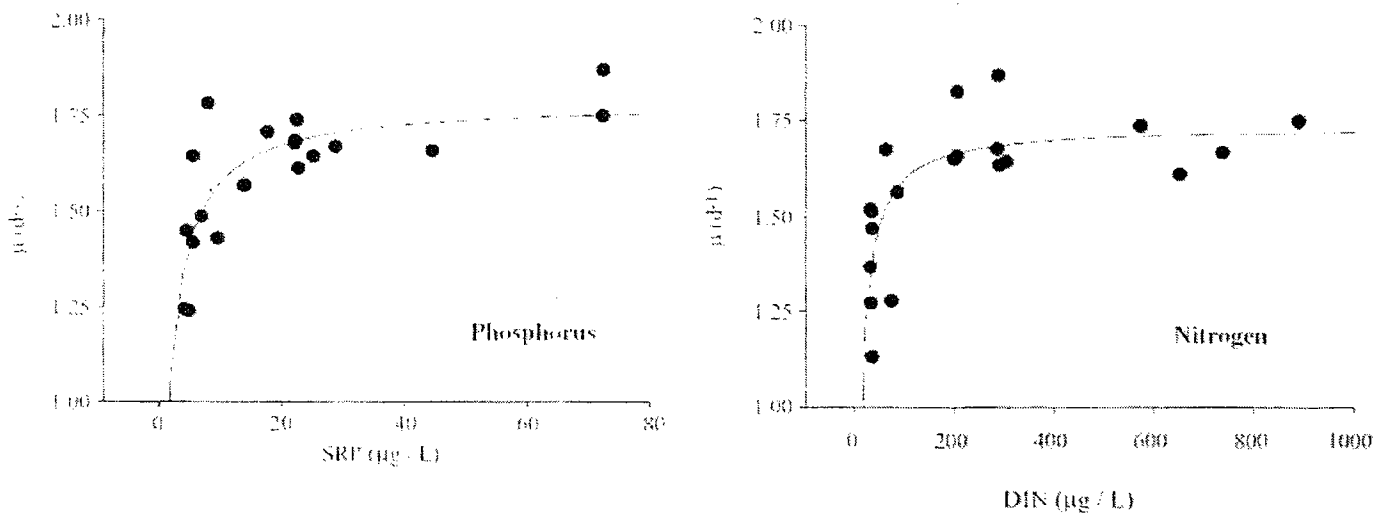

Figure 1.6. Algal growth rates (µ) based on chlorophyll a as a function of dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) from Rier and Stevenson (2006). The curve represents the best fit of data to the Monod (1950) model.

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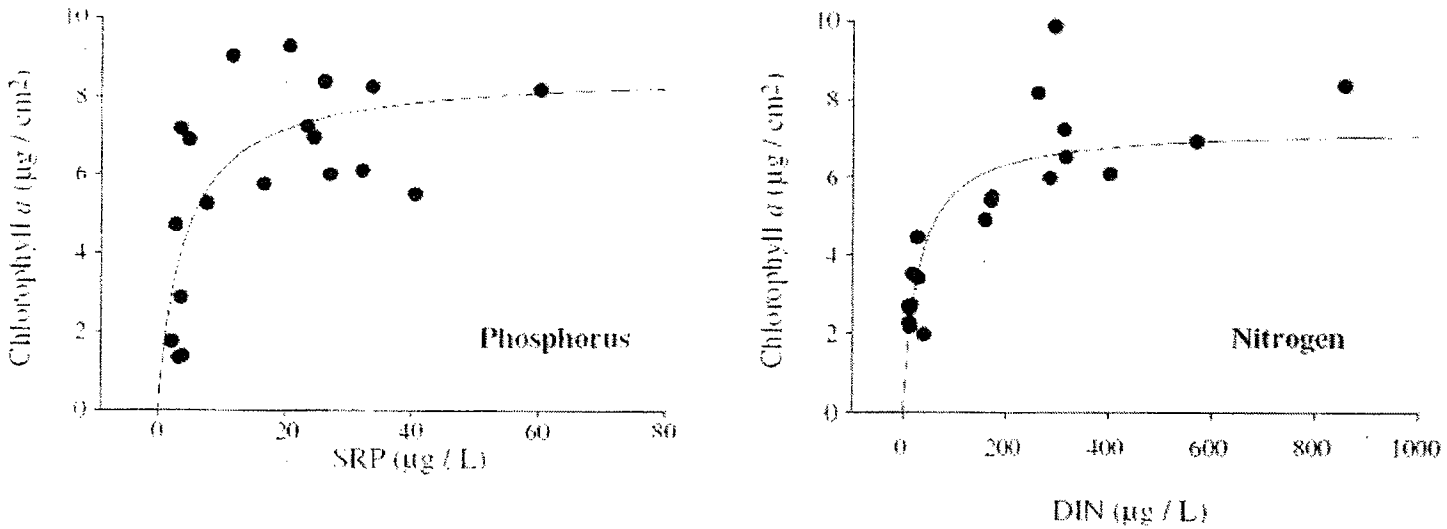

Figure 1.7. Peak biomass (chlorophyll a) as function of dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) from Rier and Stevenson (2006). The curve represents the best fit of data to the Monod (1950) model

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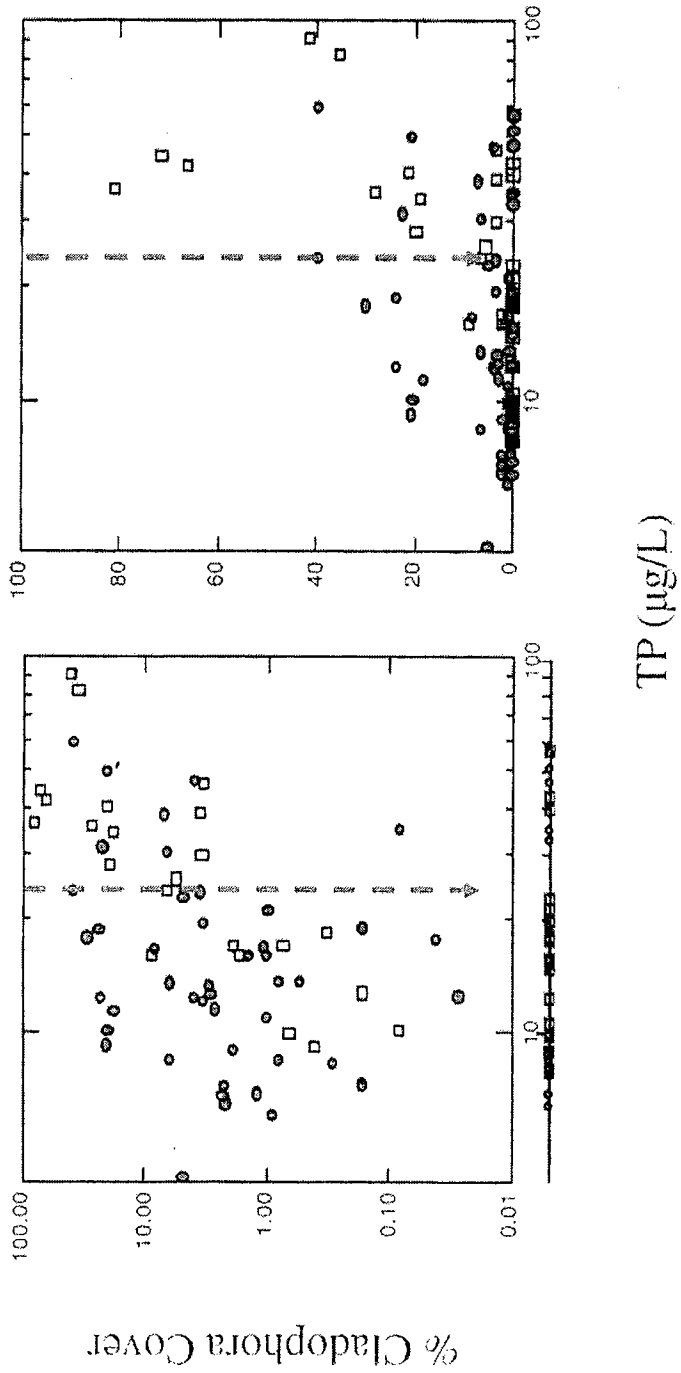

Figure 1.8. Comparison of percent *Cladophora* cover and measured TP in streams in Michigan and Kentucky. This review of the data in Stevenson et al. (2006) indicate a threshold in *Cladophora* cover near 0.024 mg TP/L

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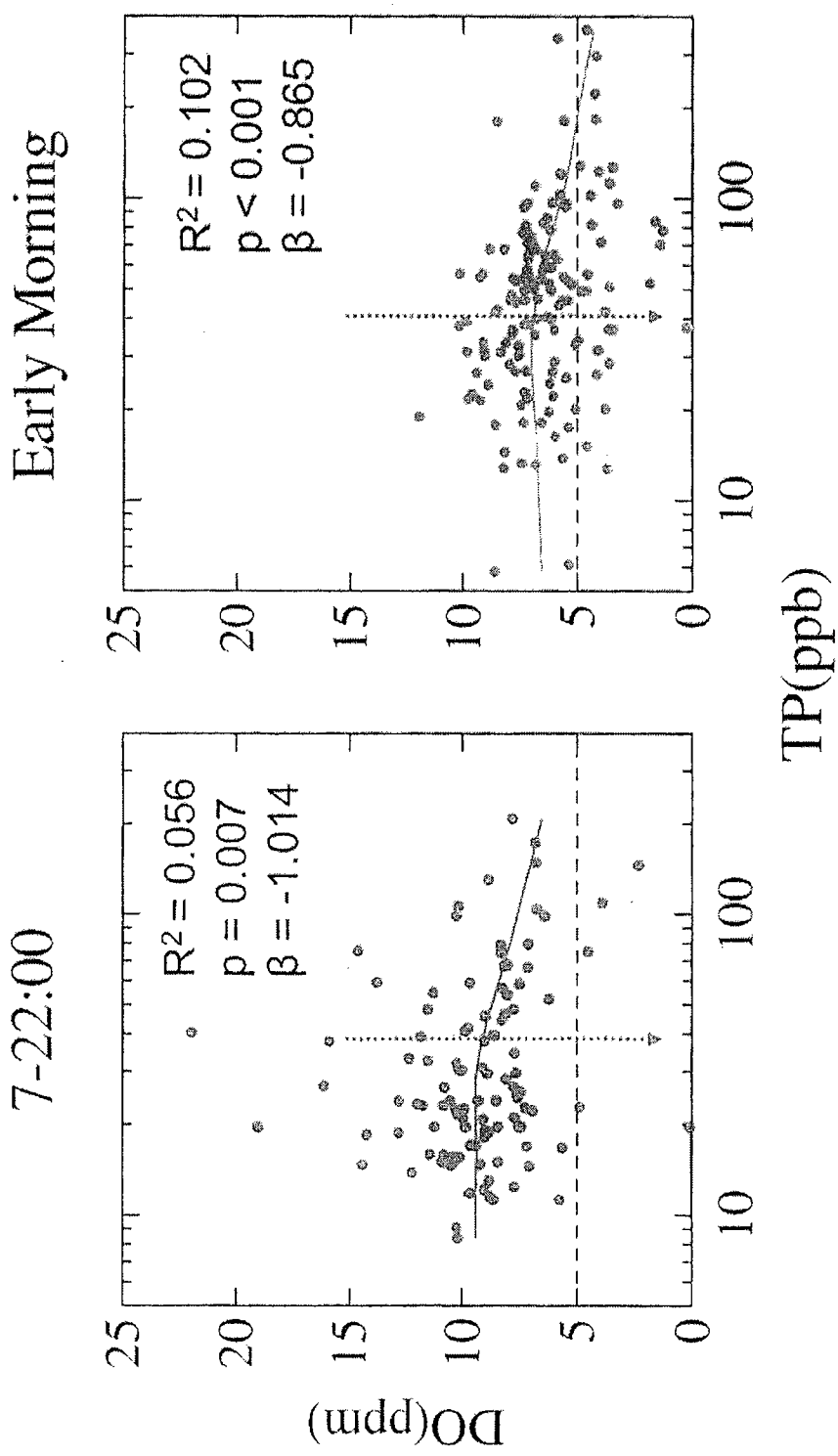

Figure 1.9 Relationships between dissolved oxygen and TP concentrations in Michigan streams when measured throughout the day (on left) and when measured only in the early morning (right).

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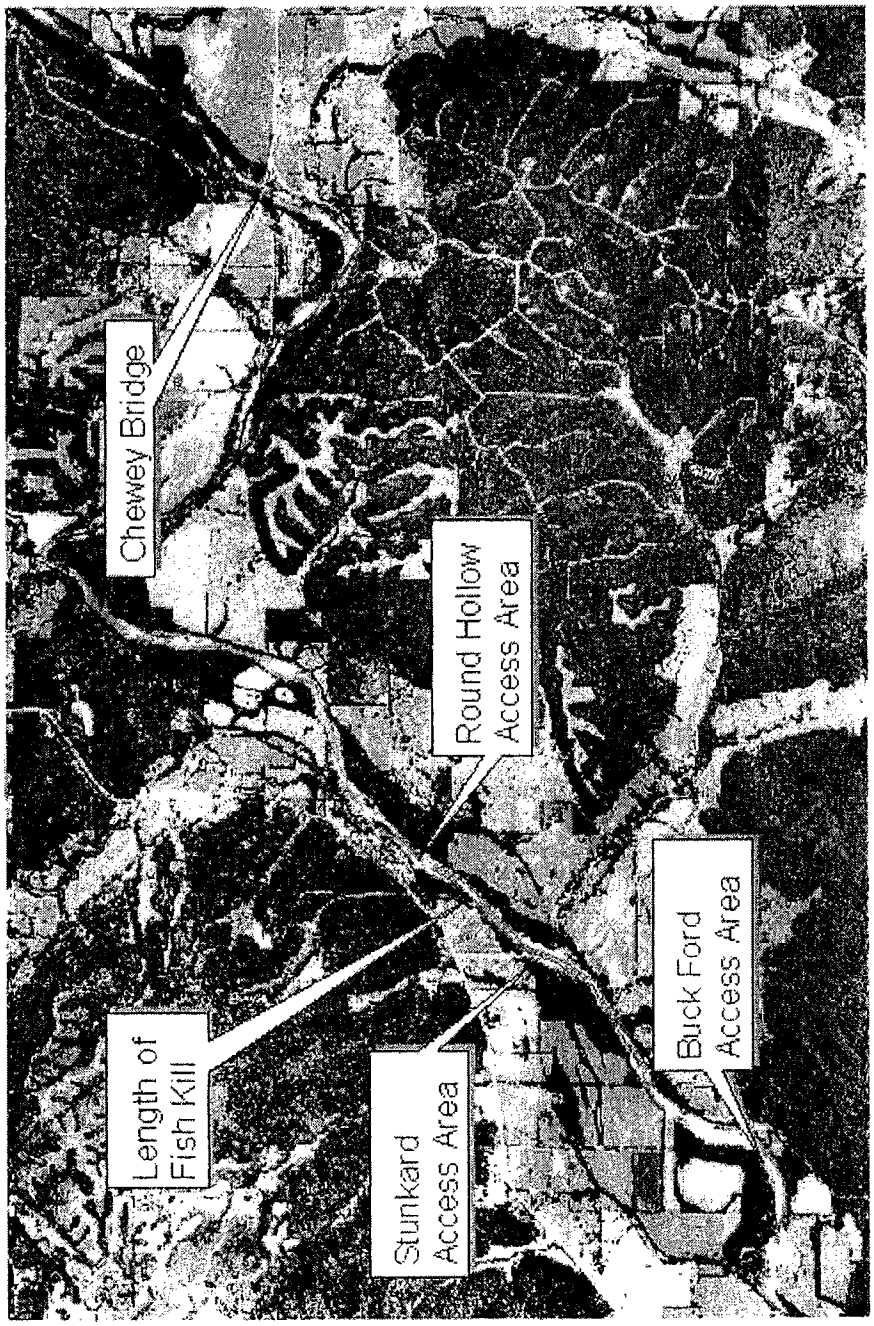

Figure 1.10 Section of Illinois River affected by fish on April 19, 2006. Map from ODWC.

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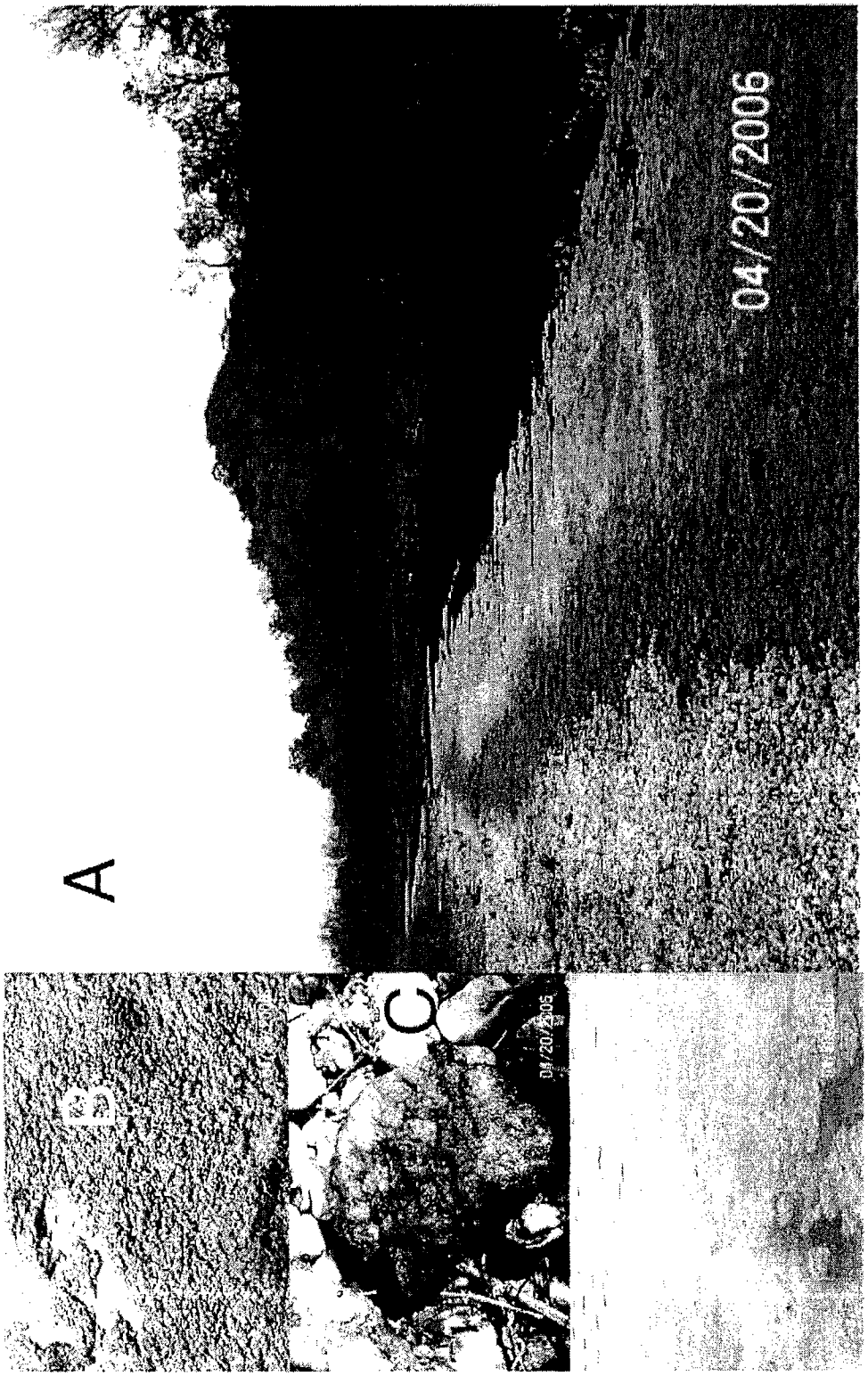

Figure 1.11 Illinois River during fish kill on April 20, 2006. A) river; B) filamentous green algae in very shallow water of river margin; C) filamentous green algae on rock; and D) filamentous green algae floating in shallow water with dead fish.

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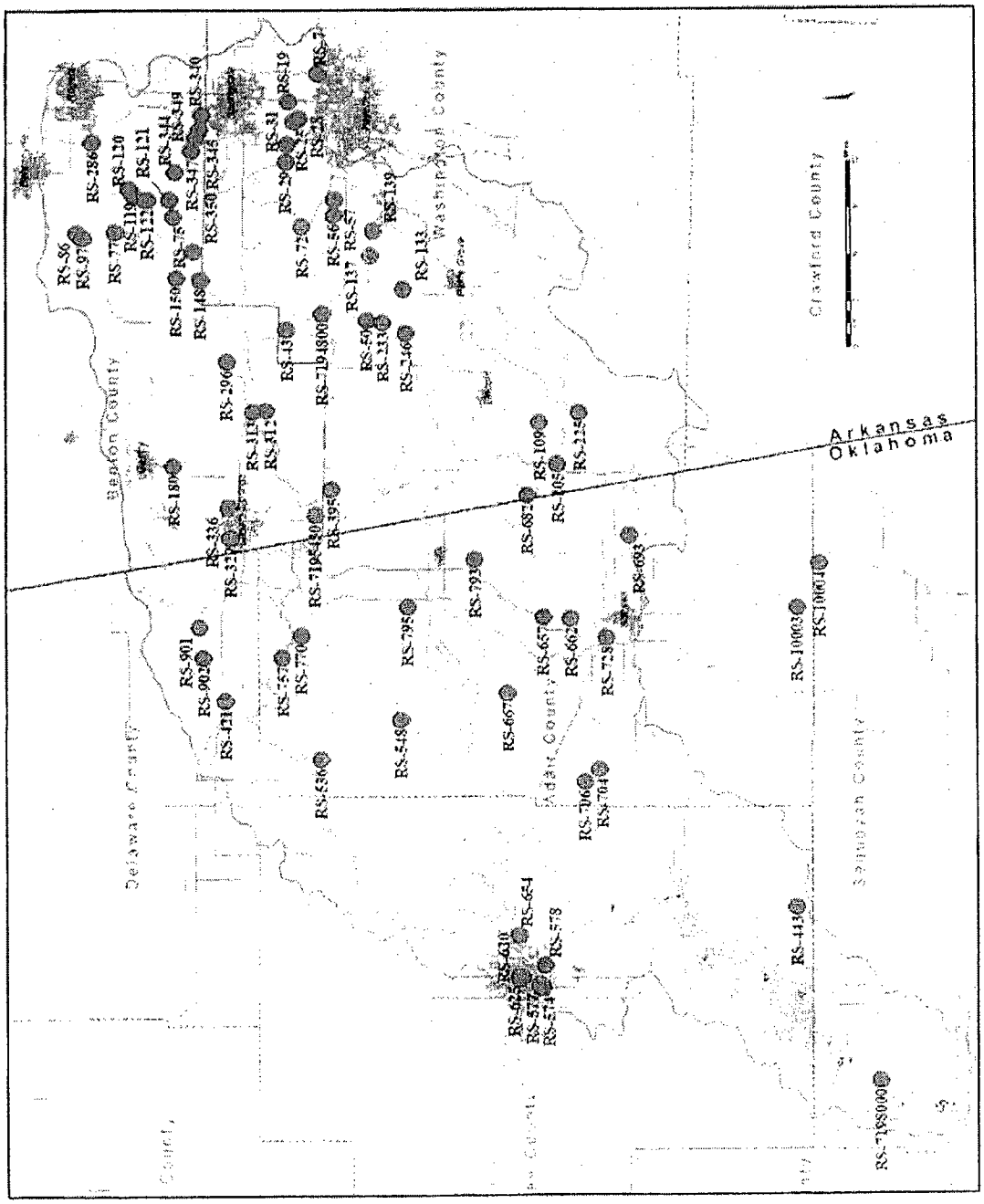

Figure 2.1 Sampling locations during the summer 2006 field sampling program.

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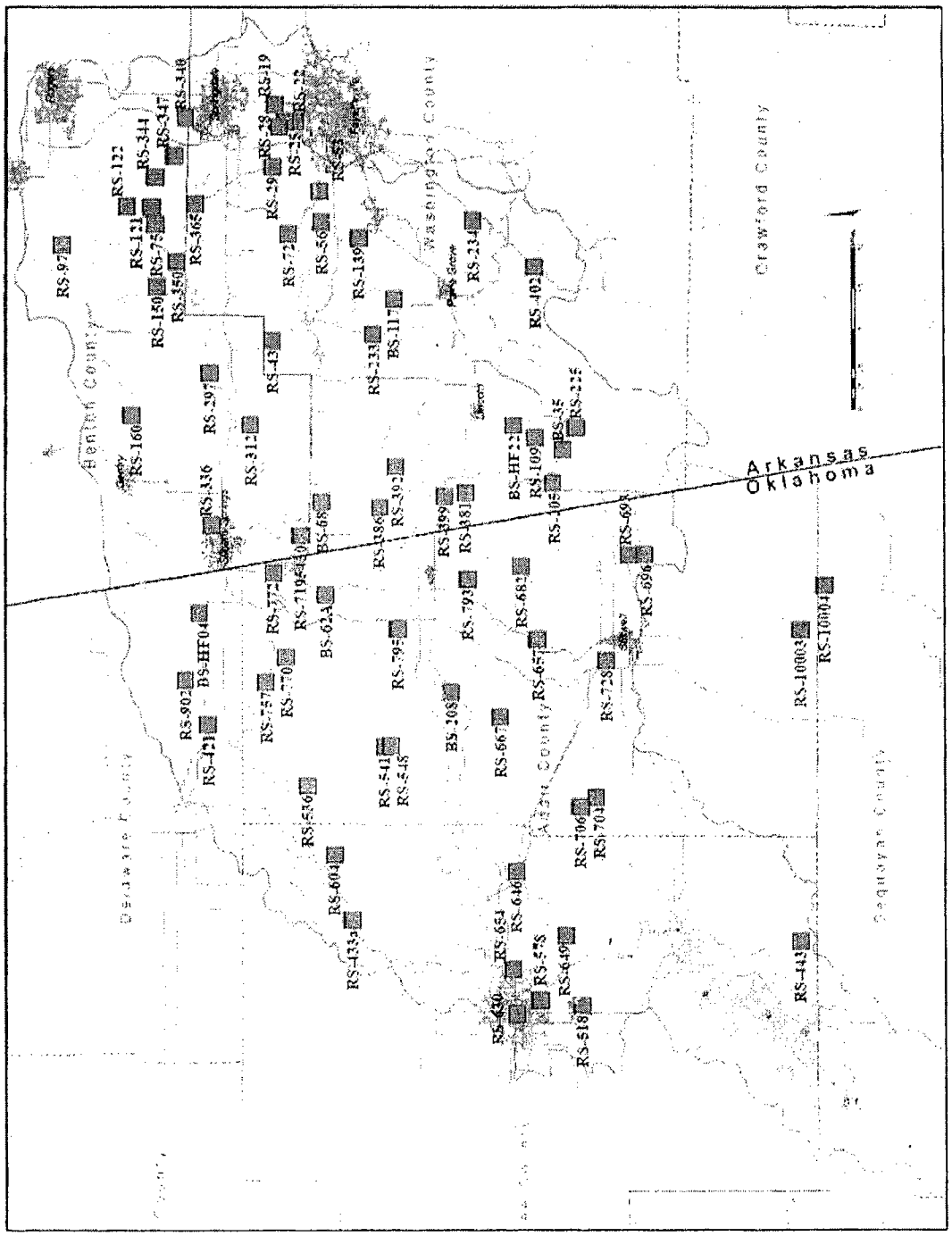

Figure 2.2 Sampling locations during the spring 2007 field sampling program.

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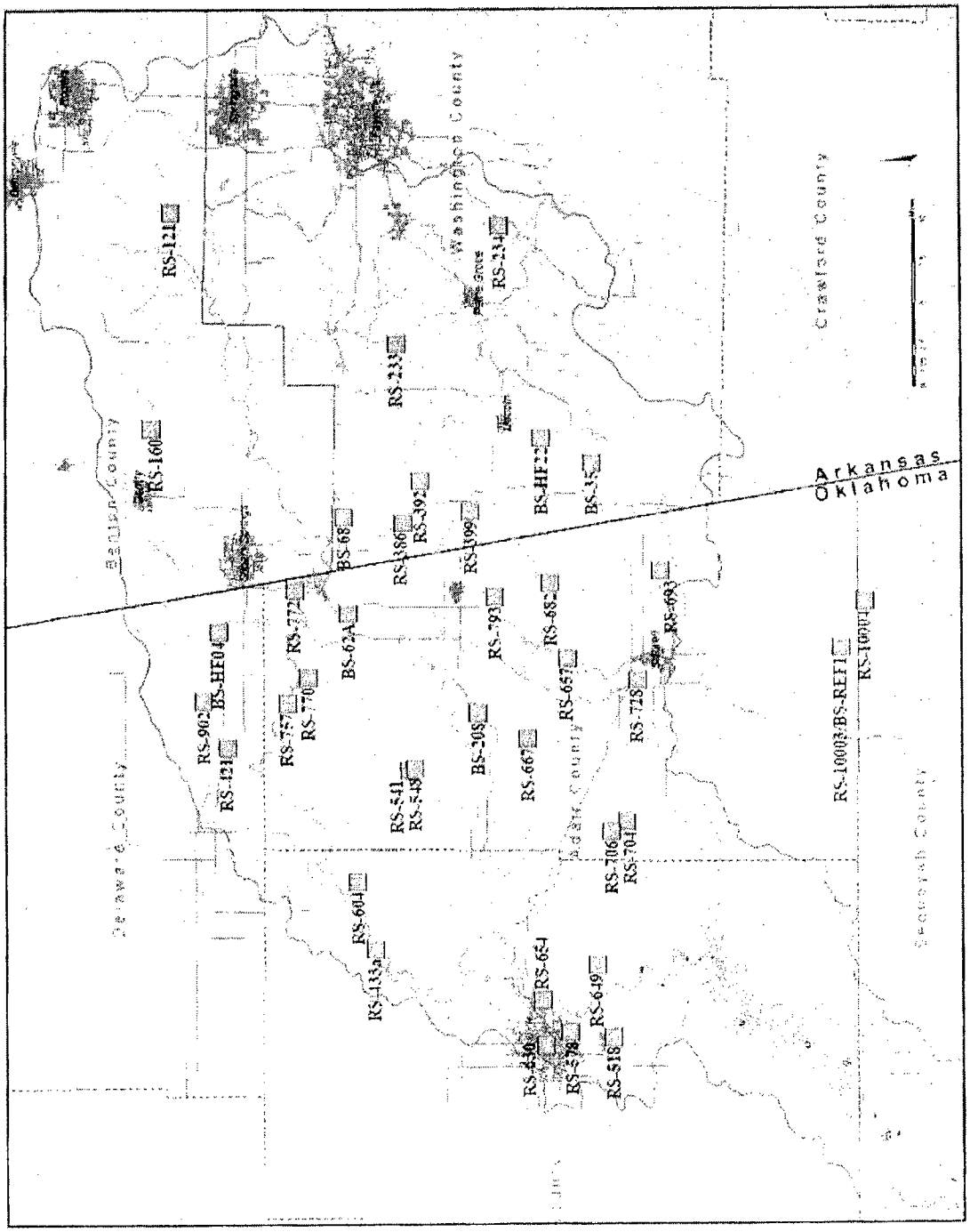

Figure 2.3 Sampling locations during the summer 2007 field sampling program.

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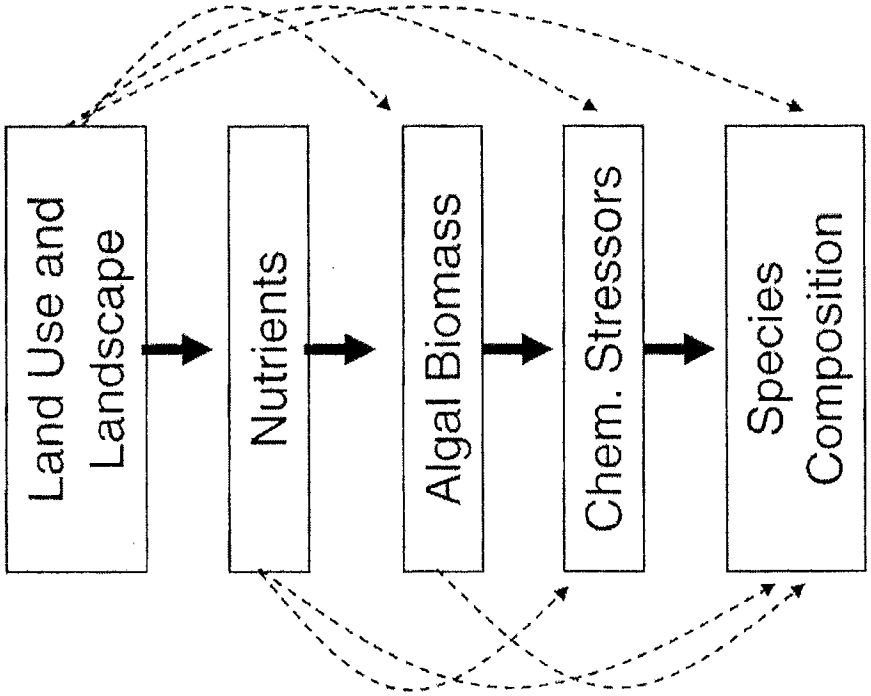

Figure 2.4 Variables grouped into five categories according to their causes and their effects in the conceptual model. Solid arrows indicate direct effects. Dashed arrows indicate indirect effects.

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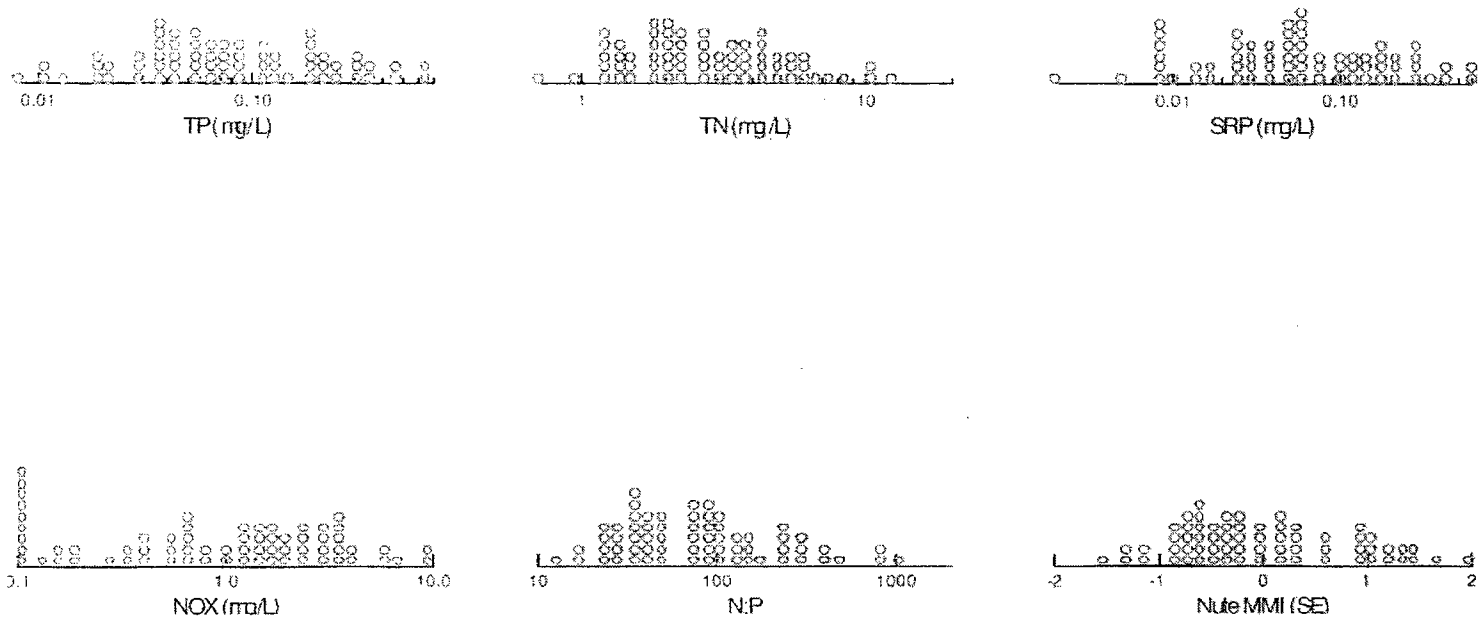

Figure 2.5 Nutrient concentrations at sites sampled during the Summer 2006 sampling campaign.

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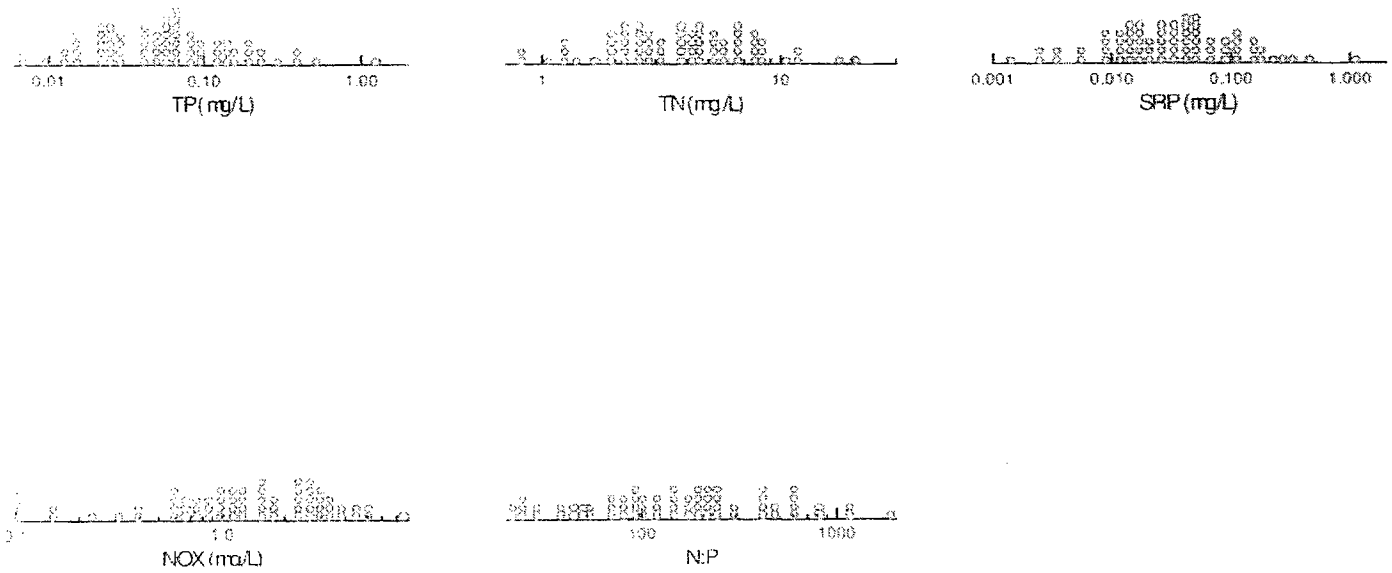

Figure 2.6 Nutrient concentrations at sites sampled during the Spring 2007 sampling program.

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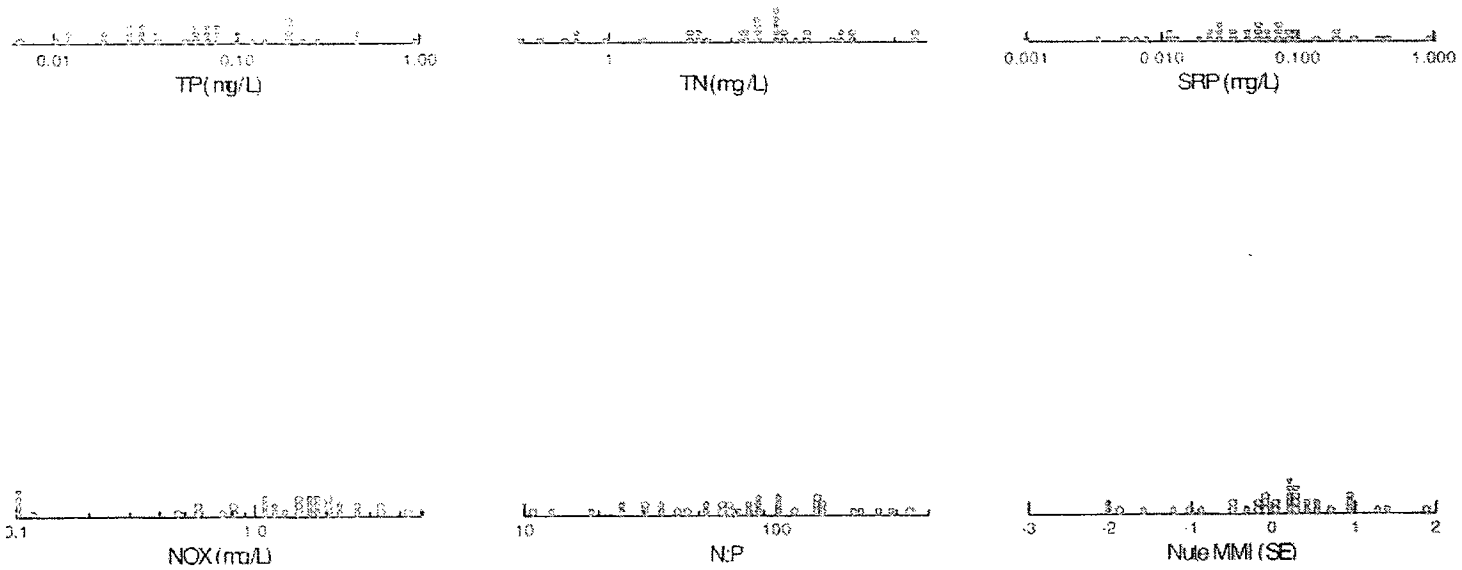

Figure 2.7 Nutrient concentrations at sites sampled during the Summer 2007 sampling program.

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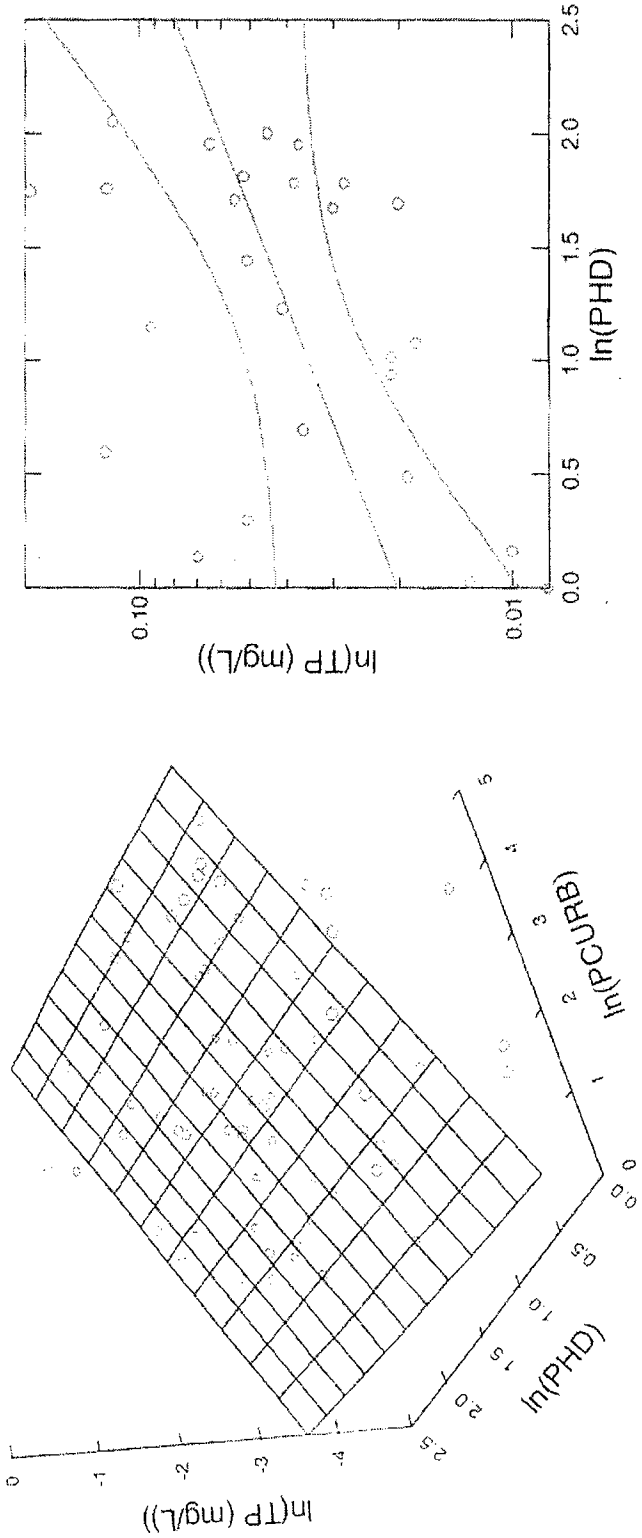

Figure 2.8 Regression analysis of total phosphorus (TP) concentrations during summer 2006 and relationships to poultry house density (PHD) and percent urban land use (PCURB).

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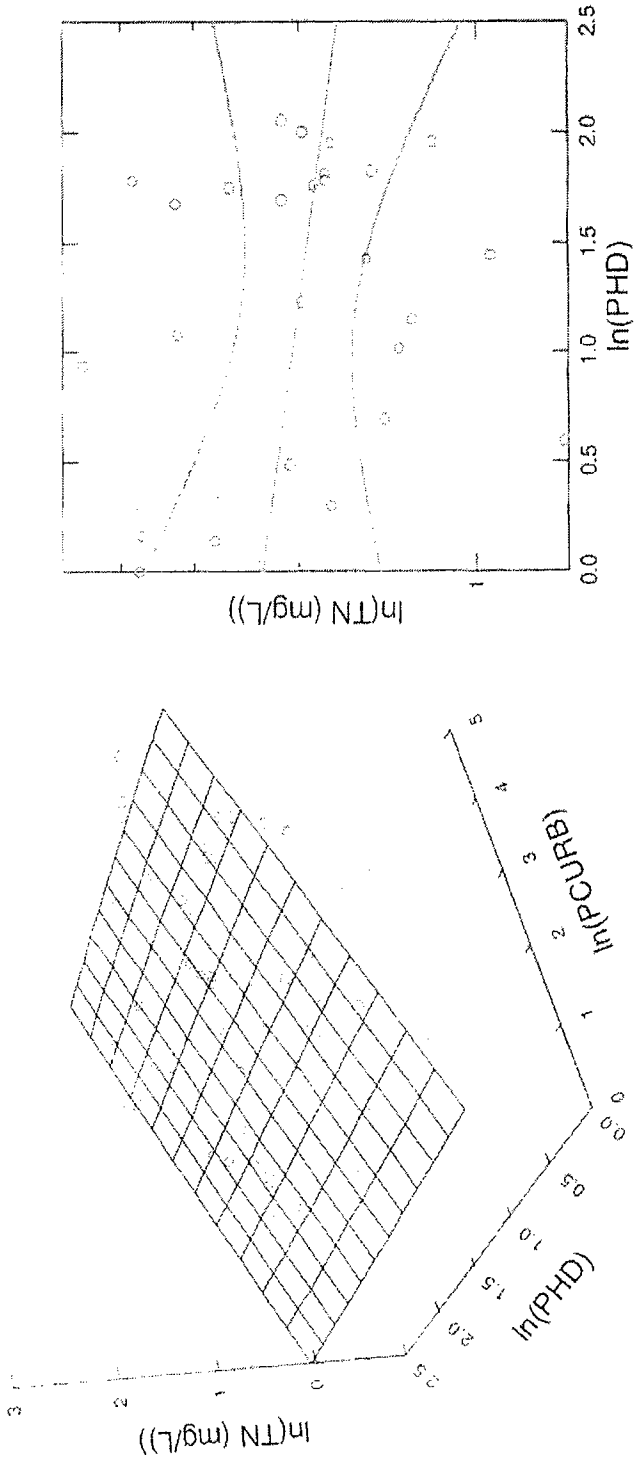

Figure 2.9 Regression analysis of total nitrogen (TN) concentrations during summer 2006 and relationships to poultry house density (PHD) and percent urban land use (PCURB).

EXHIBIT R

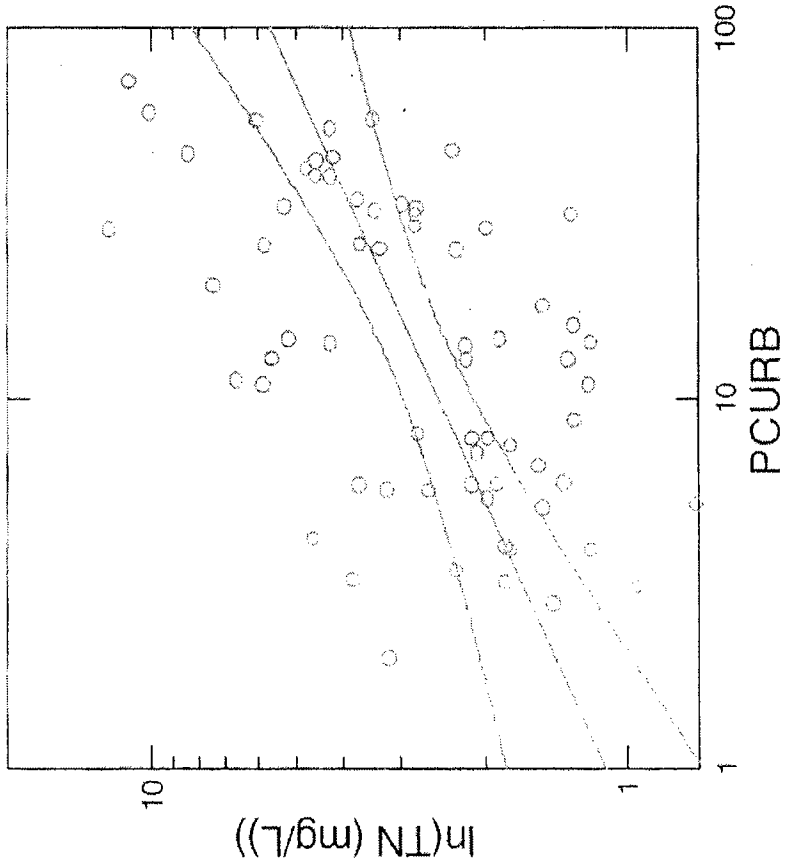

Figure 2.10 Model showing TN concentrations in summer 2006 in relation to percent urban land use (PCURB) with an r^2 indicating 0.29 (29%) of the variation in ln(TN) could be explained by ln(PCURB).

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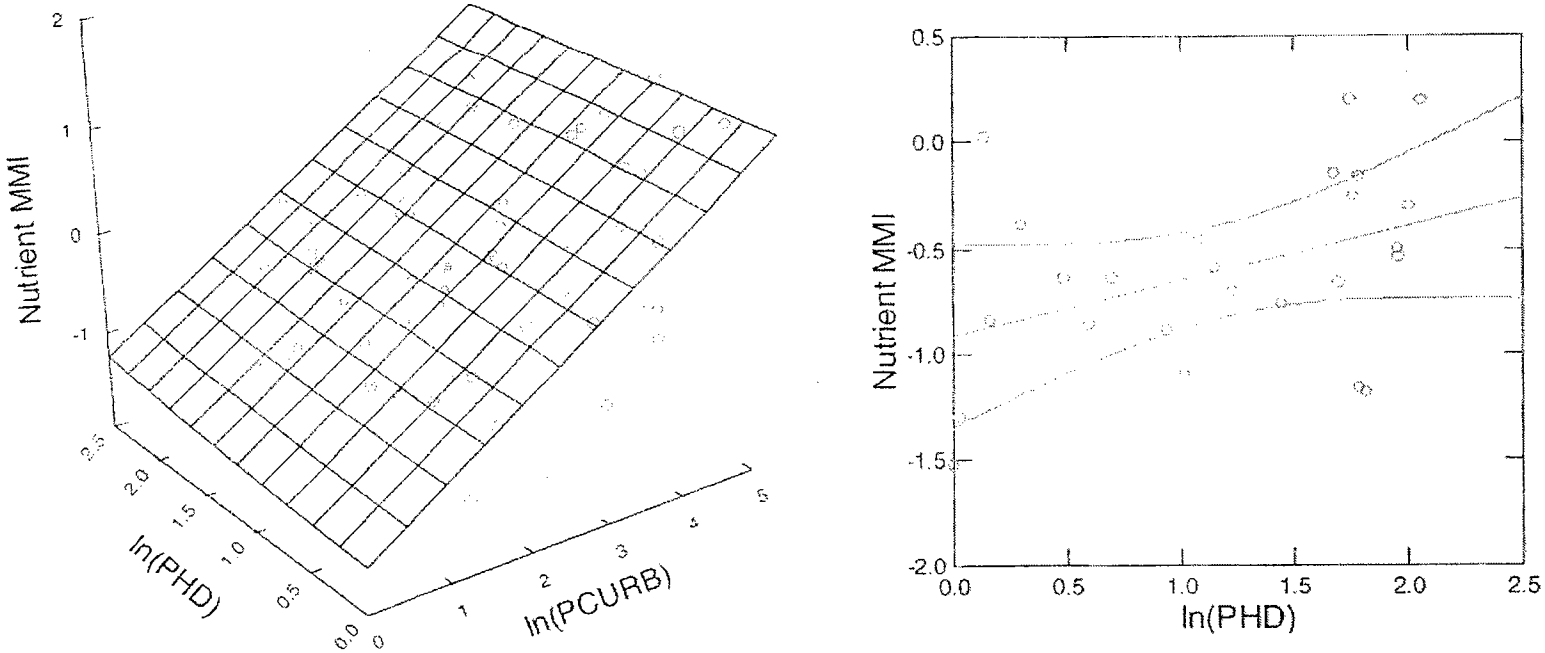

Figure 2.11 Multimetric indicator of nutrient conditions (NuteMMI) in streams for summer 2006 related to poultry house density (PHD) and related to ln(PCURB) ($p<0.001$) in a multiple regression model.

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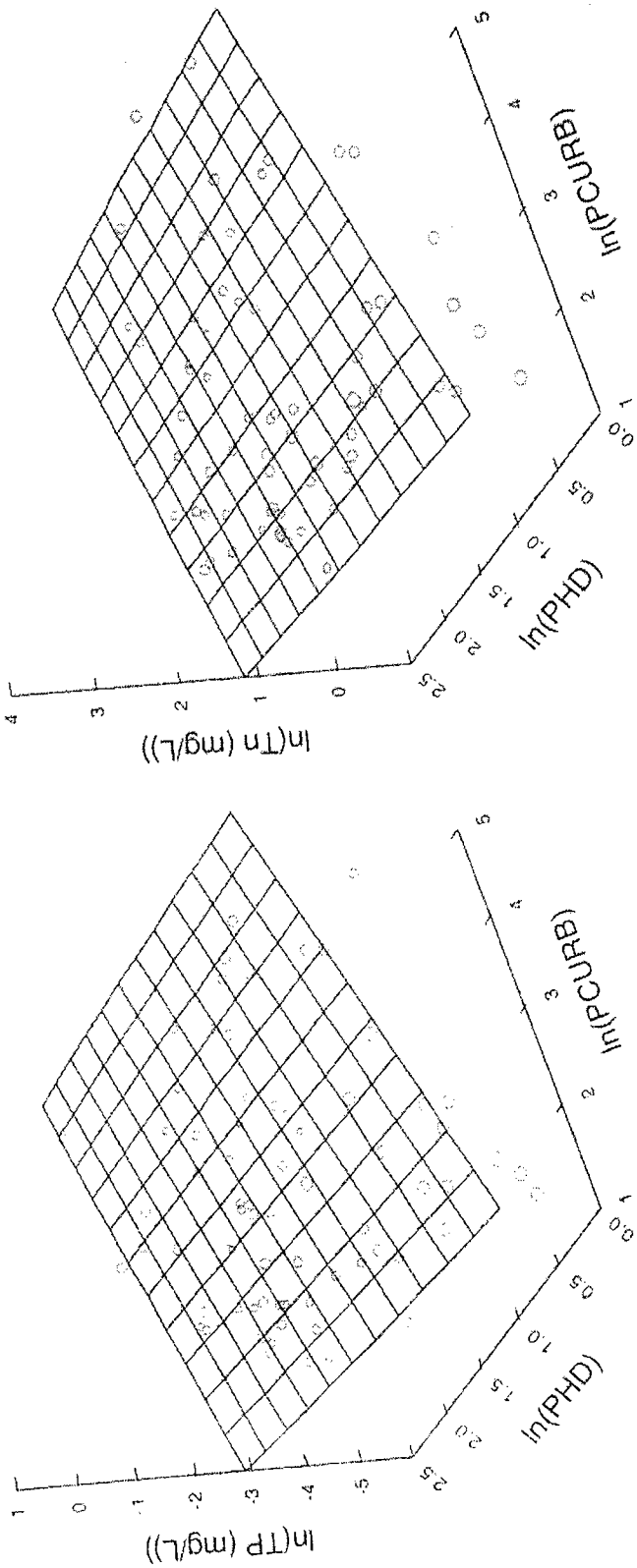

Figure 2.12 Regression analyses showing TP (on left) and TN (on right) concentrations in IRW streams during spring 2007 as related to poultry house density and the percent urbanized land use in watersheds.

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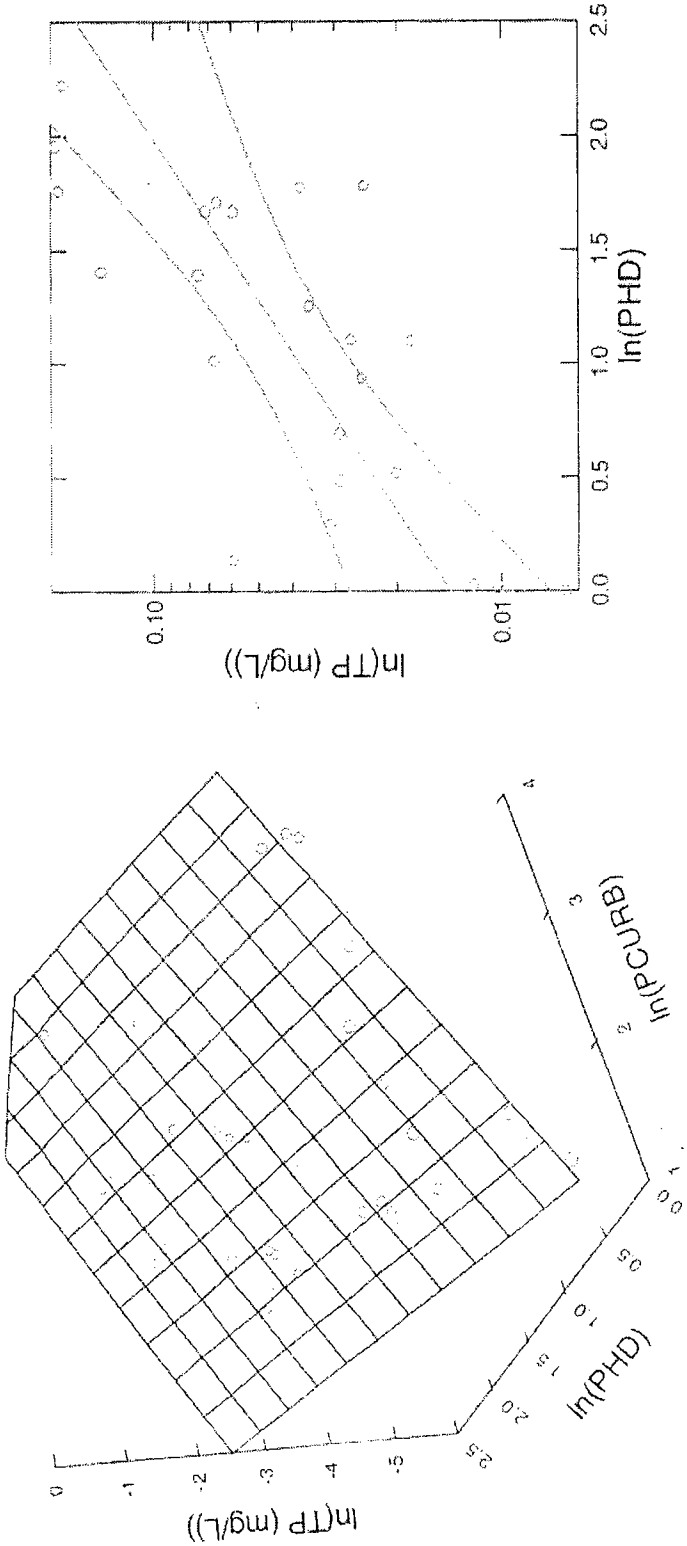

Figure 2.13 Regression analysis of total phosphorus (TP) concentrations during summer 2007 and relationships to poultry house density (PHD) and percent urban land use (PCURB).

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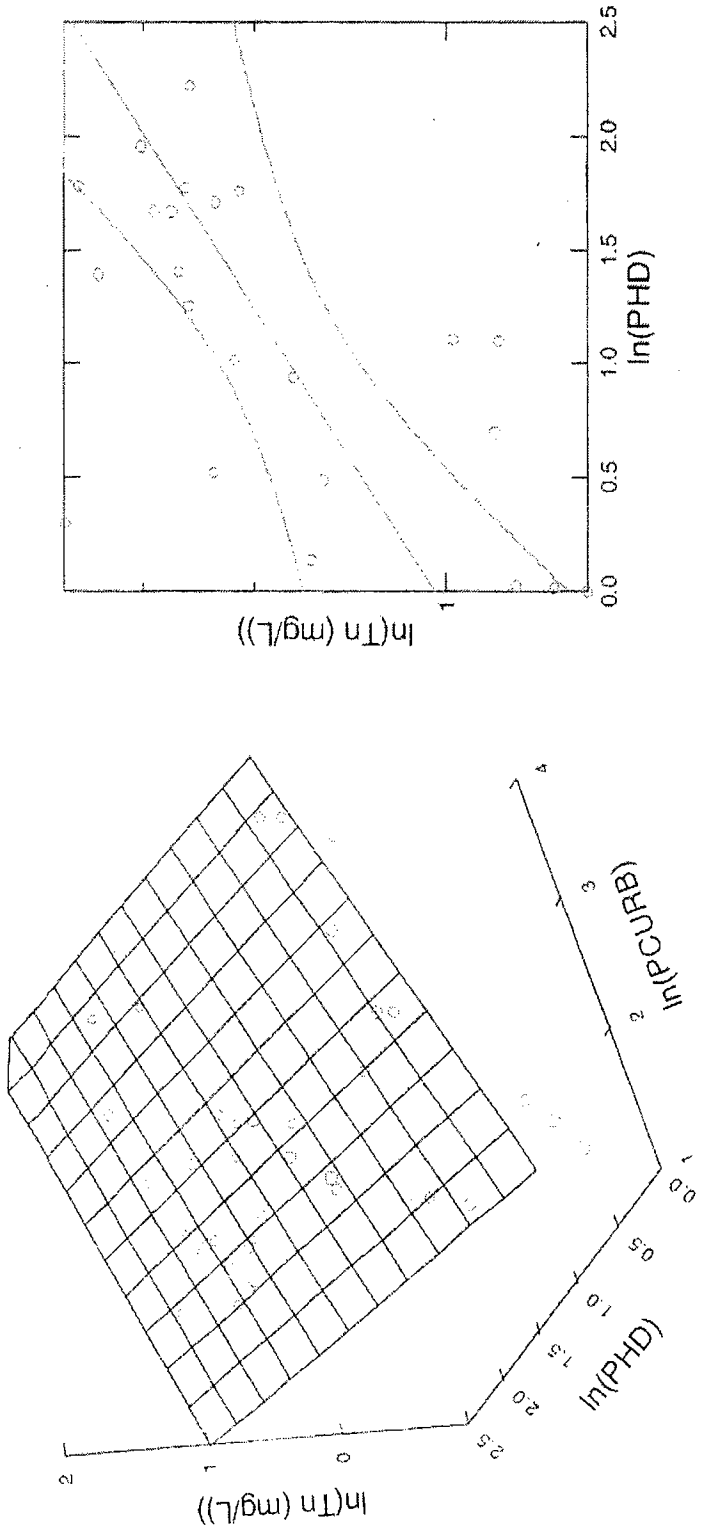

Figure 2.14 Regression analysis of total nitrogen (TN) concentrations during summer 2007 and relationships to poultry house density (PHD) and percent urban land use (PCURB).

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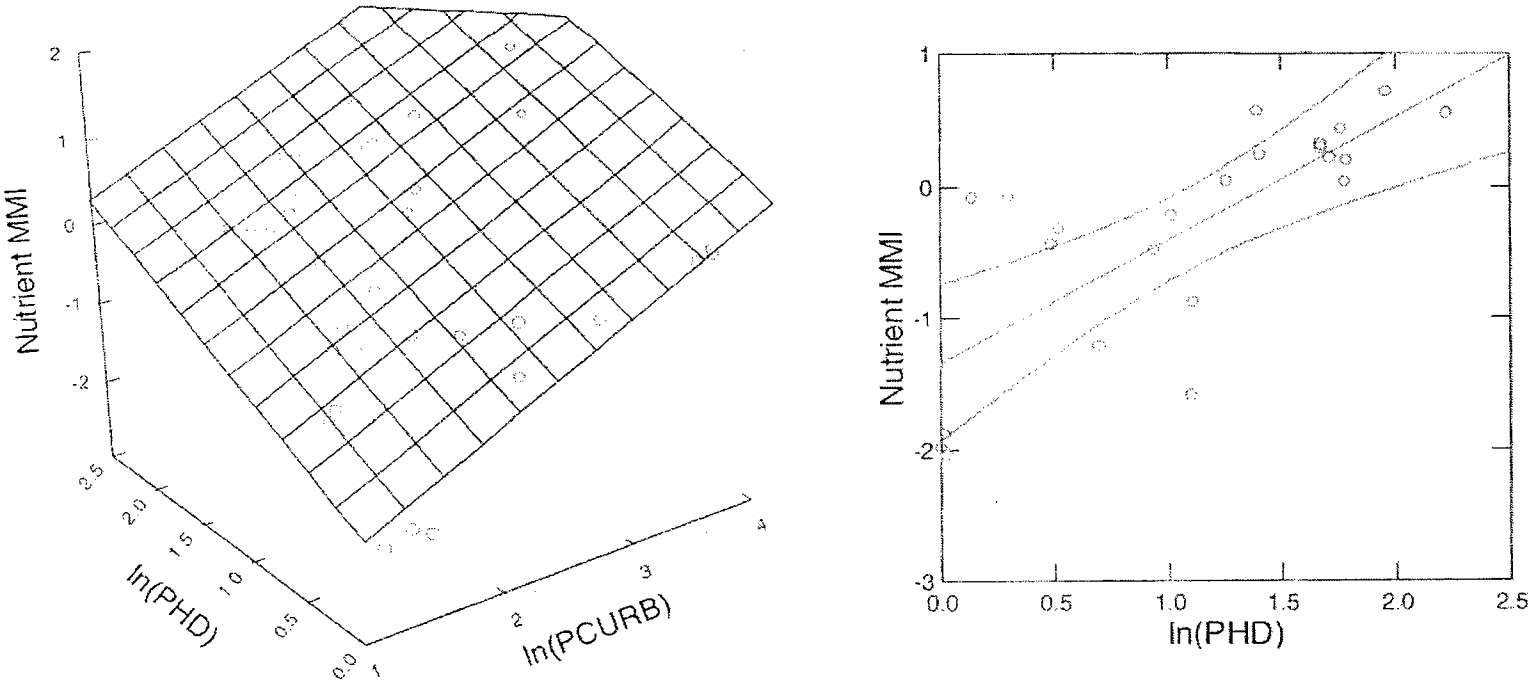

Figure 2.15 Multiple regression model showing the multimetric indicator of nutrient conditions (NuteMMI) in streams for summer 2007 related to poultry house density (PHD) and related to ln(PCURB) ($p<0.001$).

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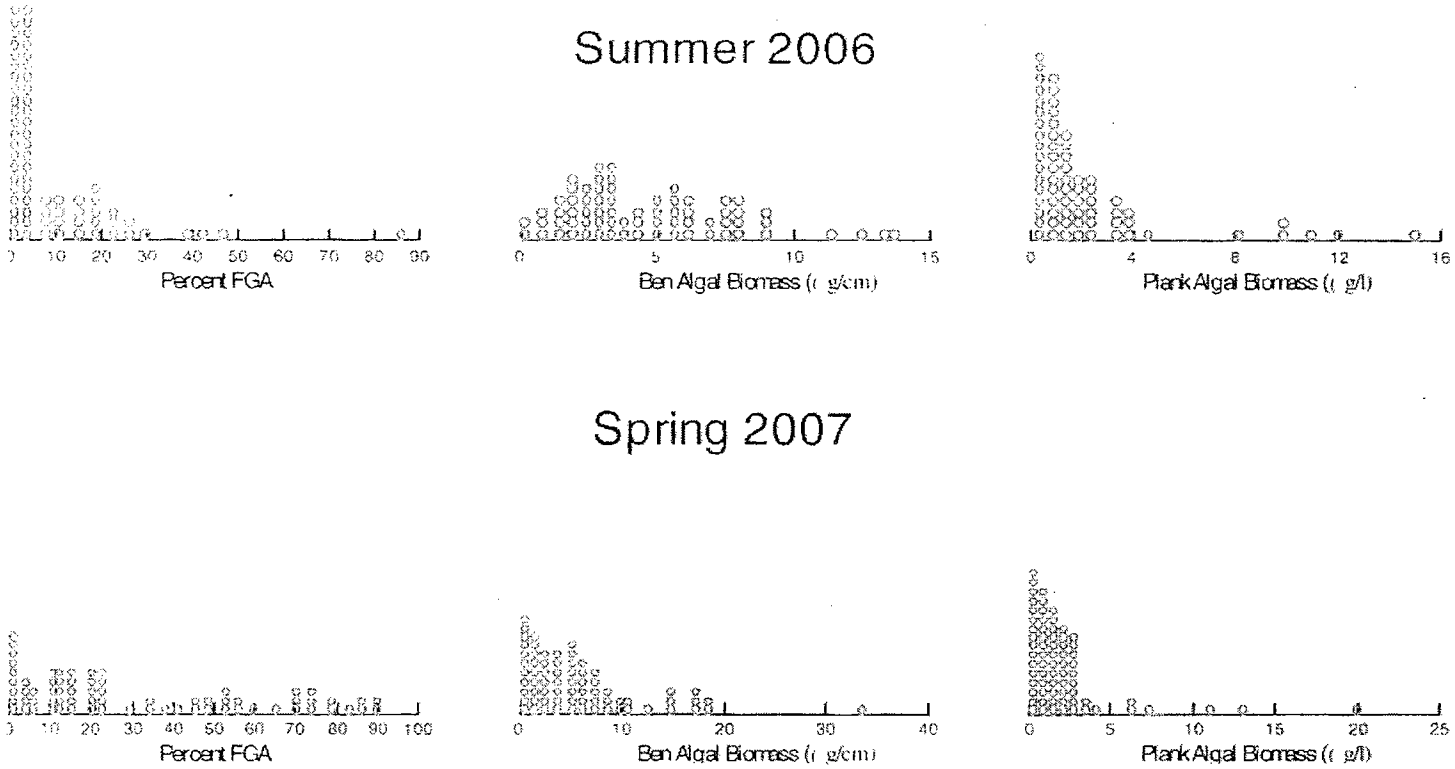

Figure 2.16 Ranges in algal biomass as percent filamentous green algae (FGA), benthic algal biomass, and planktonic algal biomass from data collected in summer 2006 and spring 2007.

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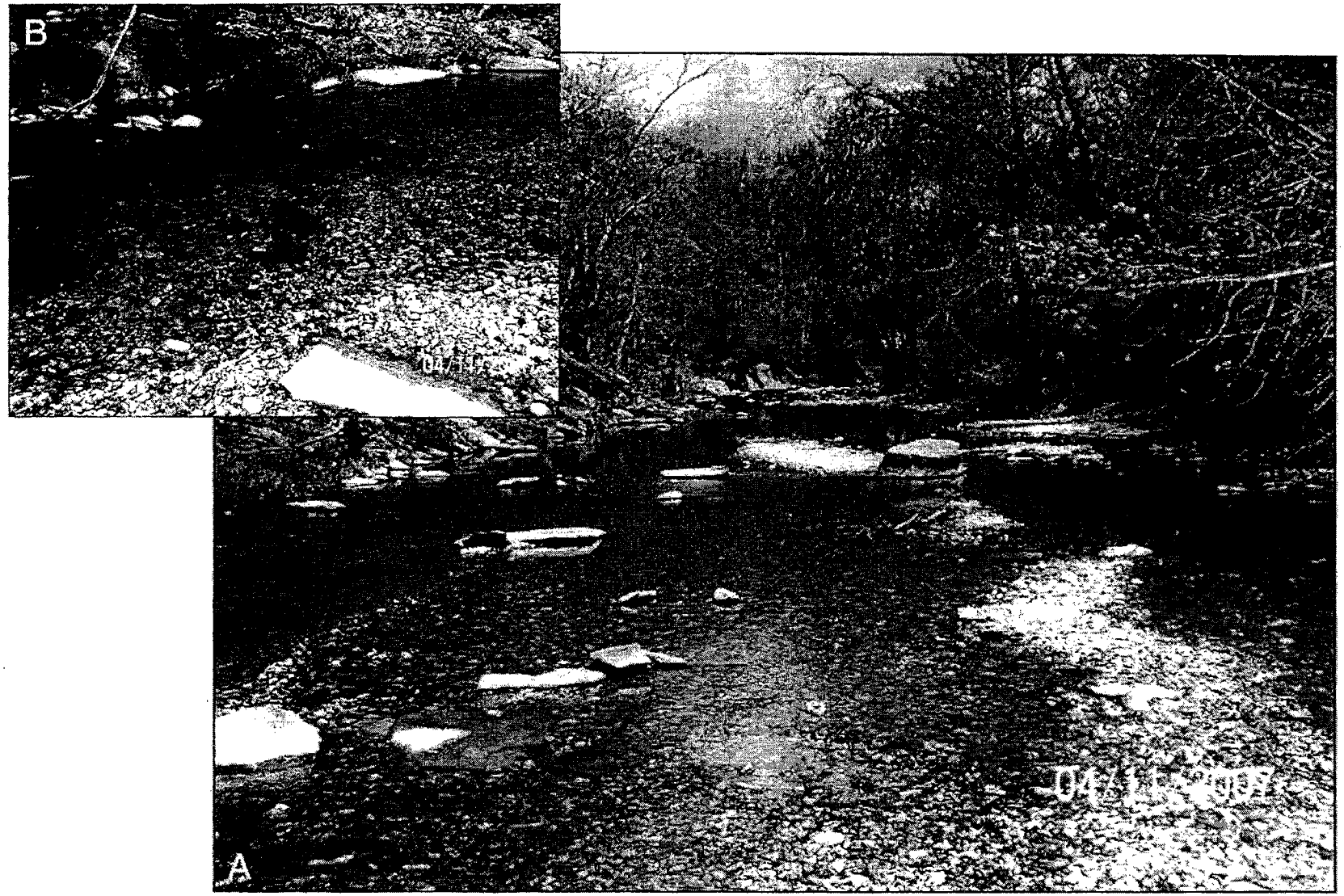

Figure 2.17 Photographs of site RS-10003/BS-Ref1 taken during the spring of 2007 sampling events. This site is representative of a natural reference location with an average filamentous green algae cover of <10% during the 8-week sample period. A site wide view of the sample reach is shown (A) along with a close-up view of the stream substrate at the site (B).

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Figure 2.18 Photographs of site RS-336 taken during the spring of 2007 sampling events. This site is representative of a location with an average filamentous green algae cover of approximately 20% during the 8-week sample period. A site wide view of the sample reach is shown (A) along with a close-up view of the stream substrate at the site (B).

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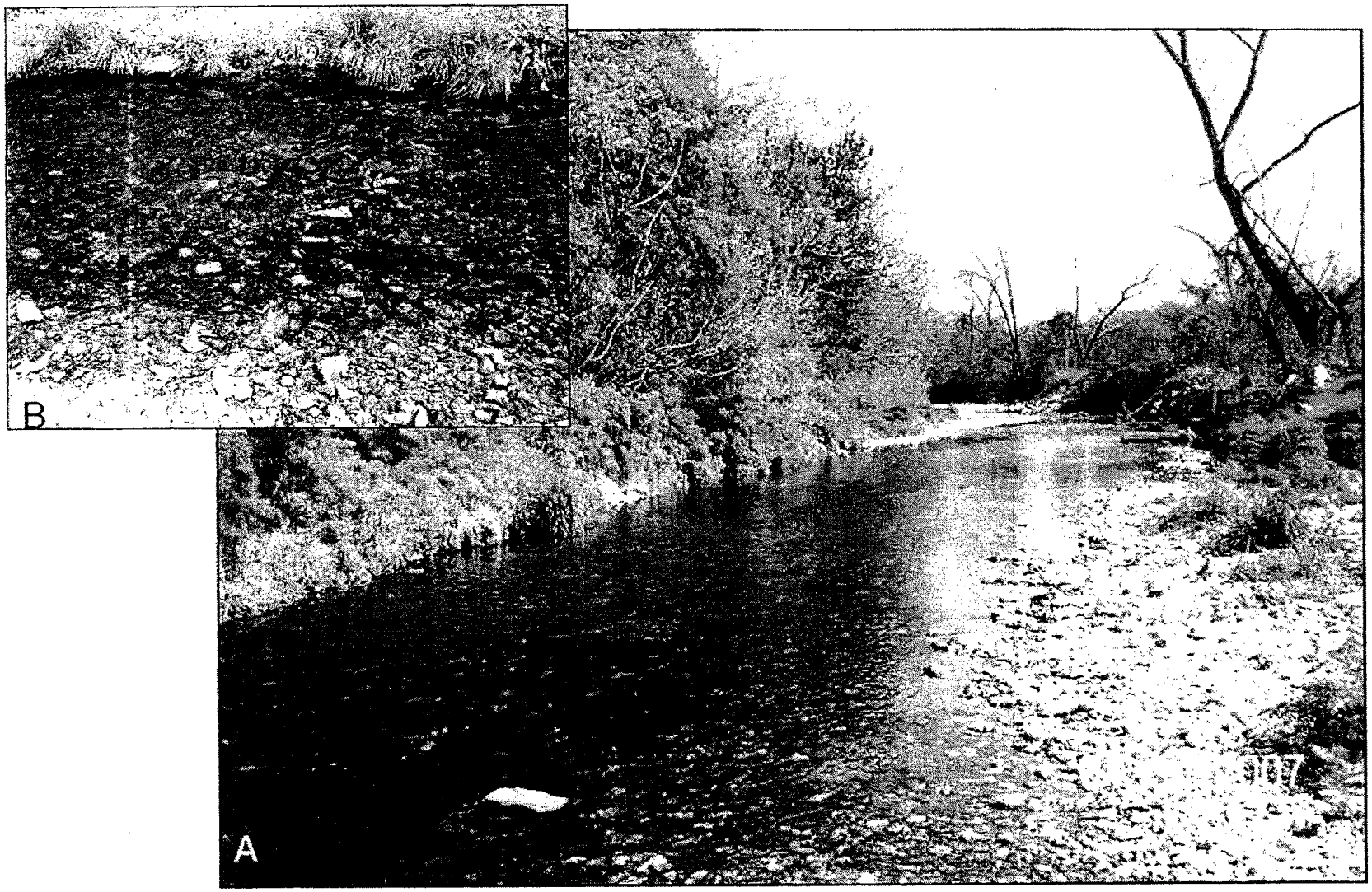

Figure 2.19 Photographs of site BS-HFS-04 taken during the spring of 2007 sampling events. This site is representative of a location with an average filamentous green algae cover of approximately 50% during the 8-week sample period. A site wide view of the sample reach is shown (A) along with a close-up view of the stream substrate at the site (B).

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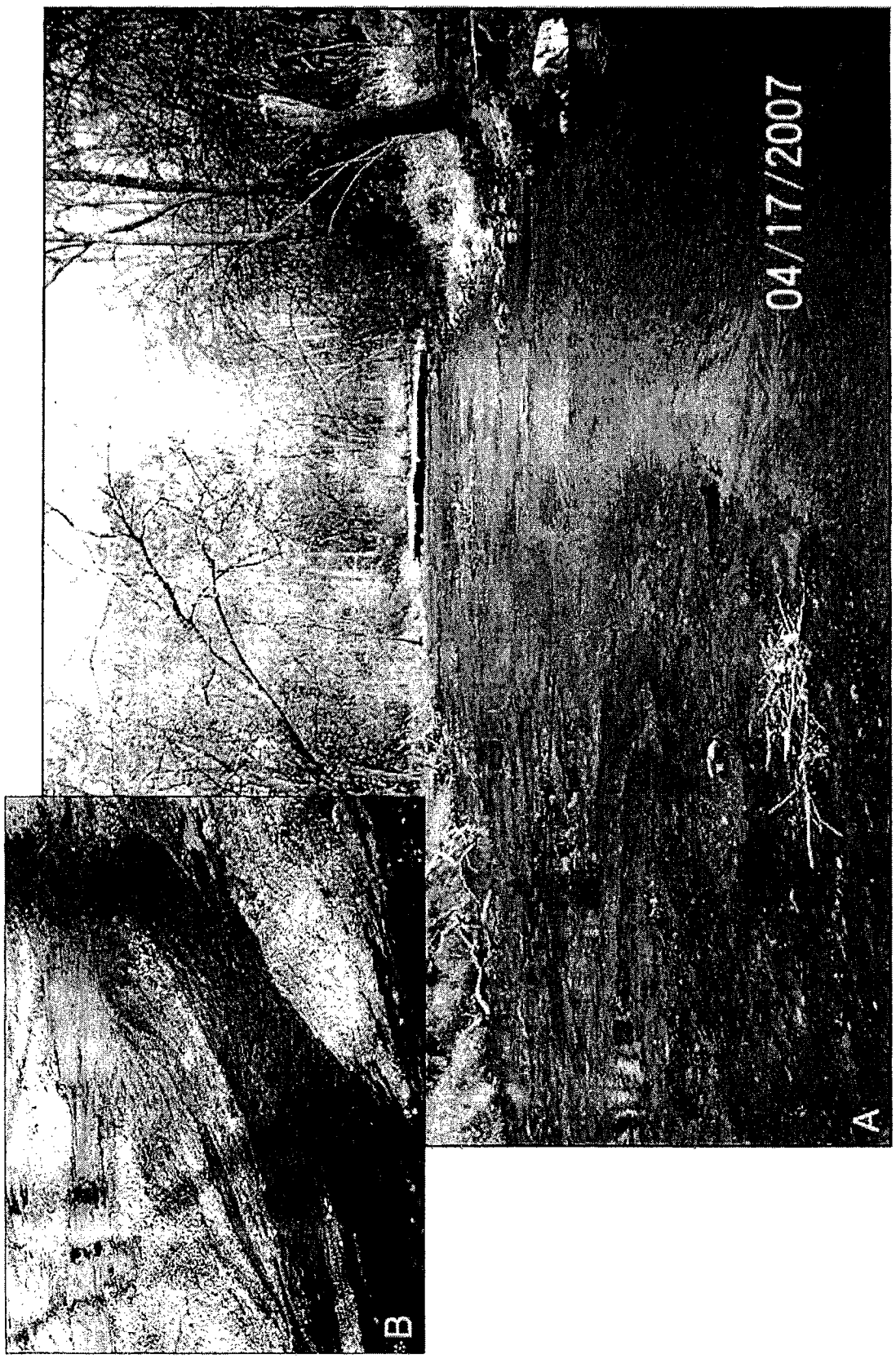

Figure 2.20 Photographs of site RS-109 taken during the spring of 2007 sampling events. This site is representative of a location with an average filamentous green algae cover of approximately 90% during the 8-week sample period. A site wide view of the sample reach is shown (A) along with a close-up view of the stream substrate at the site (B).

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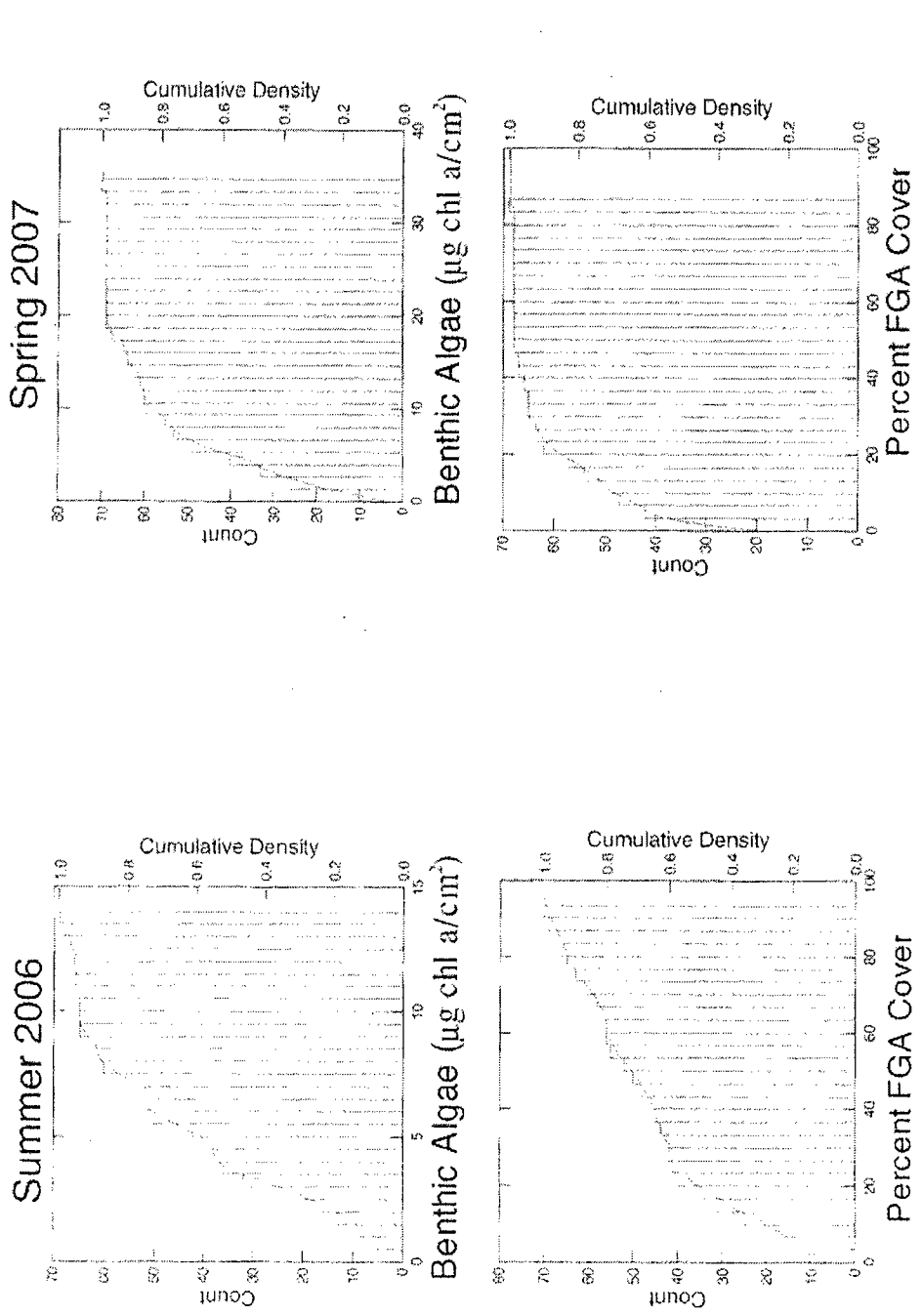

Figure 2.21 Cumulative frequency distribution of biomass of FGA cover and benthic algae algal biomass at stations sampled in Summer 2006 and Spring 2007.

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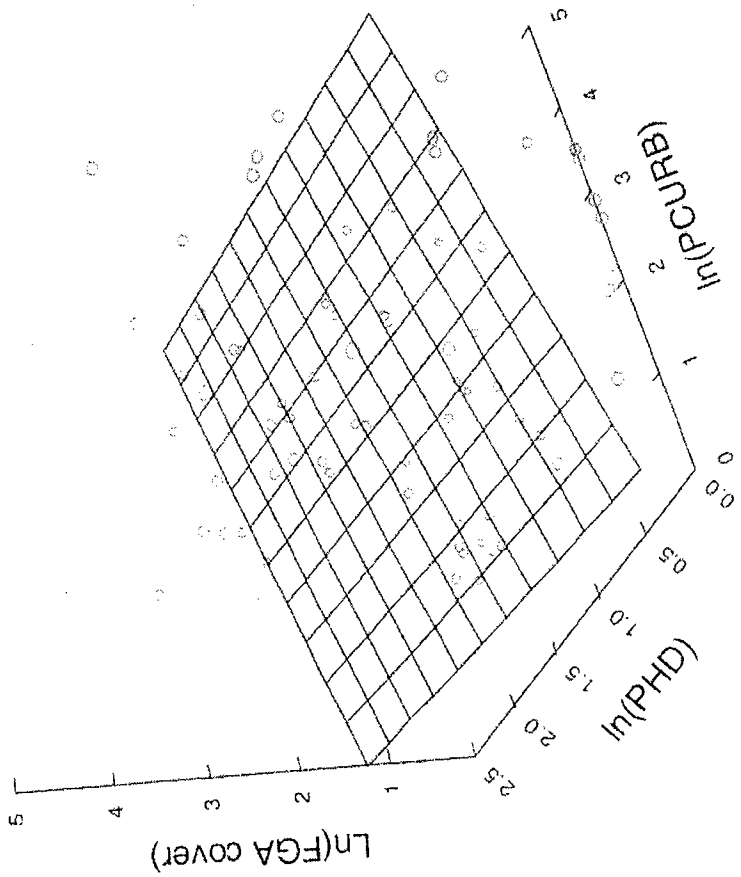

Figure 2.22 Cover of the stream bottom by filamentous green algae (FGA) as related to poultry house density (PHD) and urban land use (PCURB) during summer 2006.

EXHIBIT R

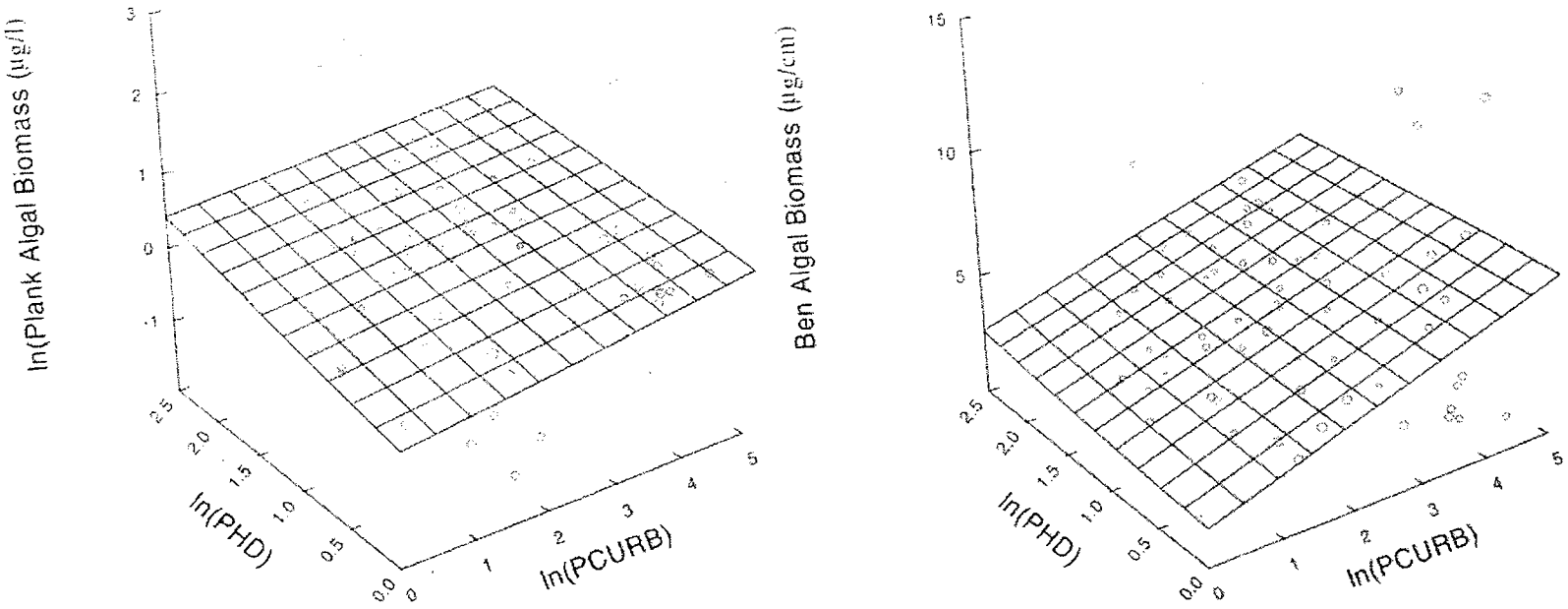

Figure 2.23 Relationship of planktonic algal biomass (on left) and benthic algal biomass (on right) to poultry house density (PHD) and percent urban land use (PCURB) for data collected in summer 2006.

EXHIBIT R

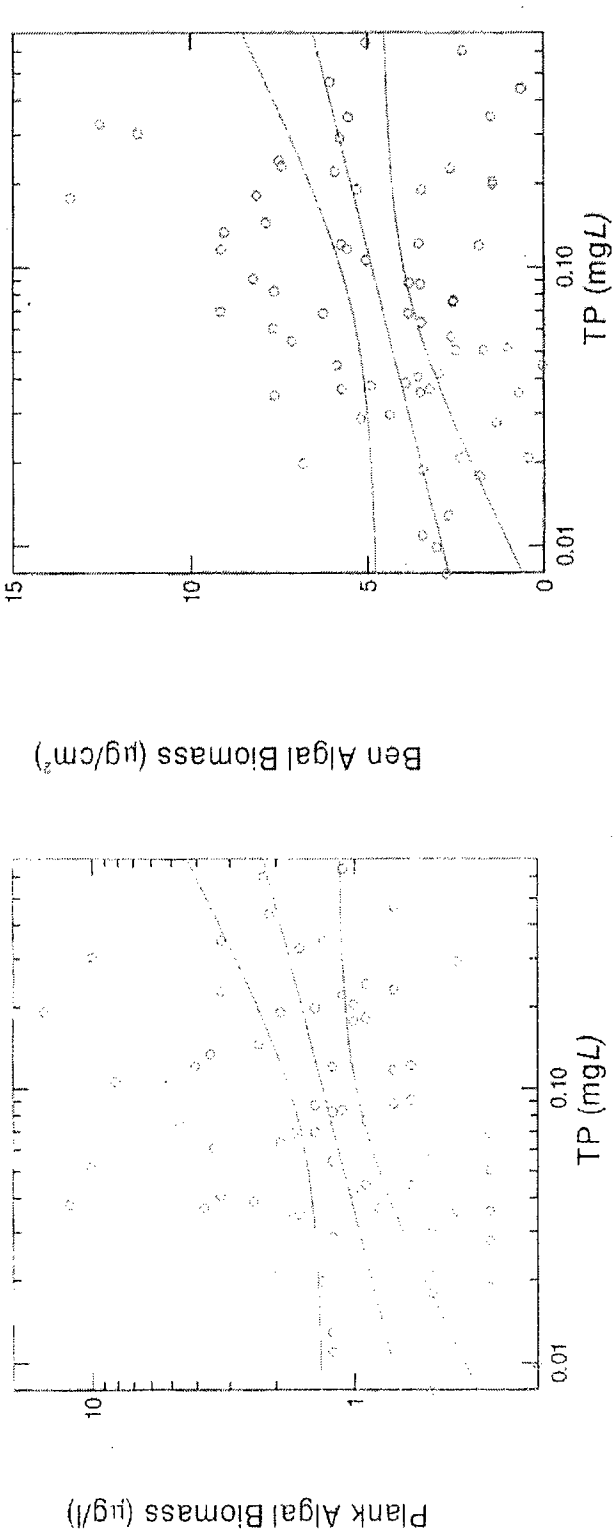

Figure 2.24 Relationship of planktonic algal biomass (on left) and benthic algal biomass (on right) to total phosphorus (TP) concentrations in summer 2006. The three lines represent the linear regression model and the 95 % confidence intervals around the predicted model.

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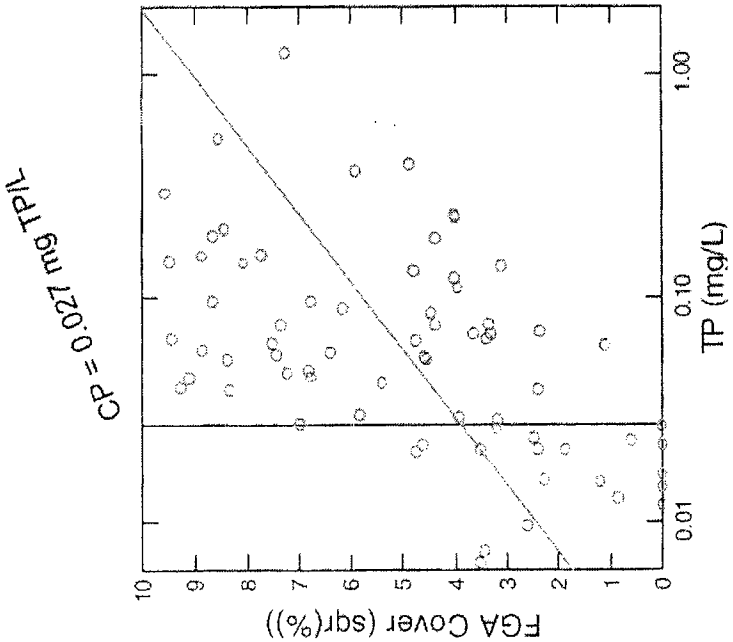

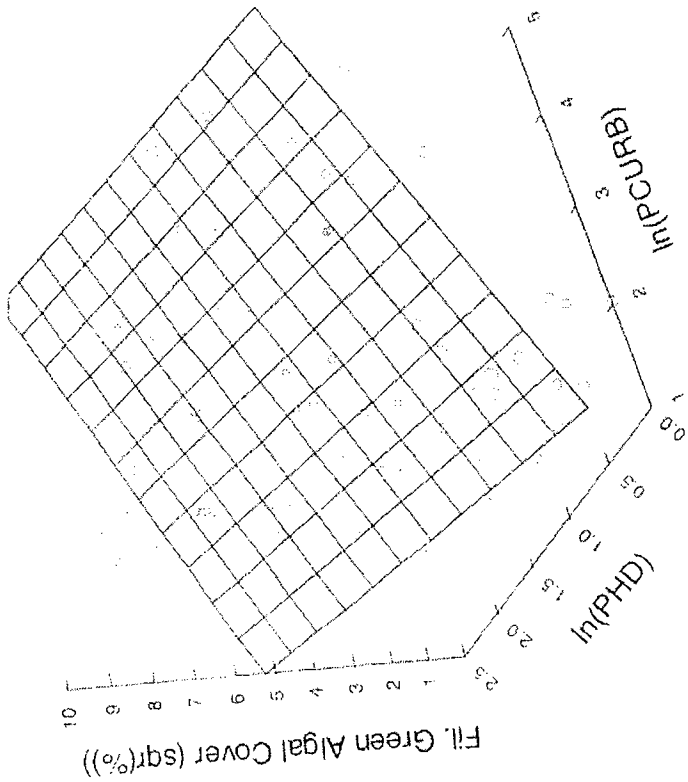

Figure 2.25 Relationships of Percent green algal cover to poultry house density (PHD), percent urban land use (PCURB), and total phosphorus (on right) during spring 2007.

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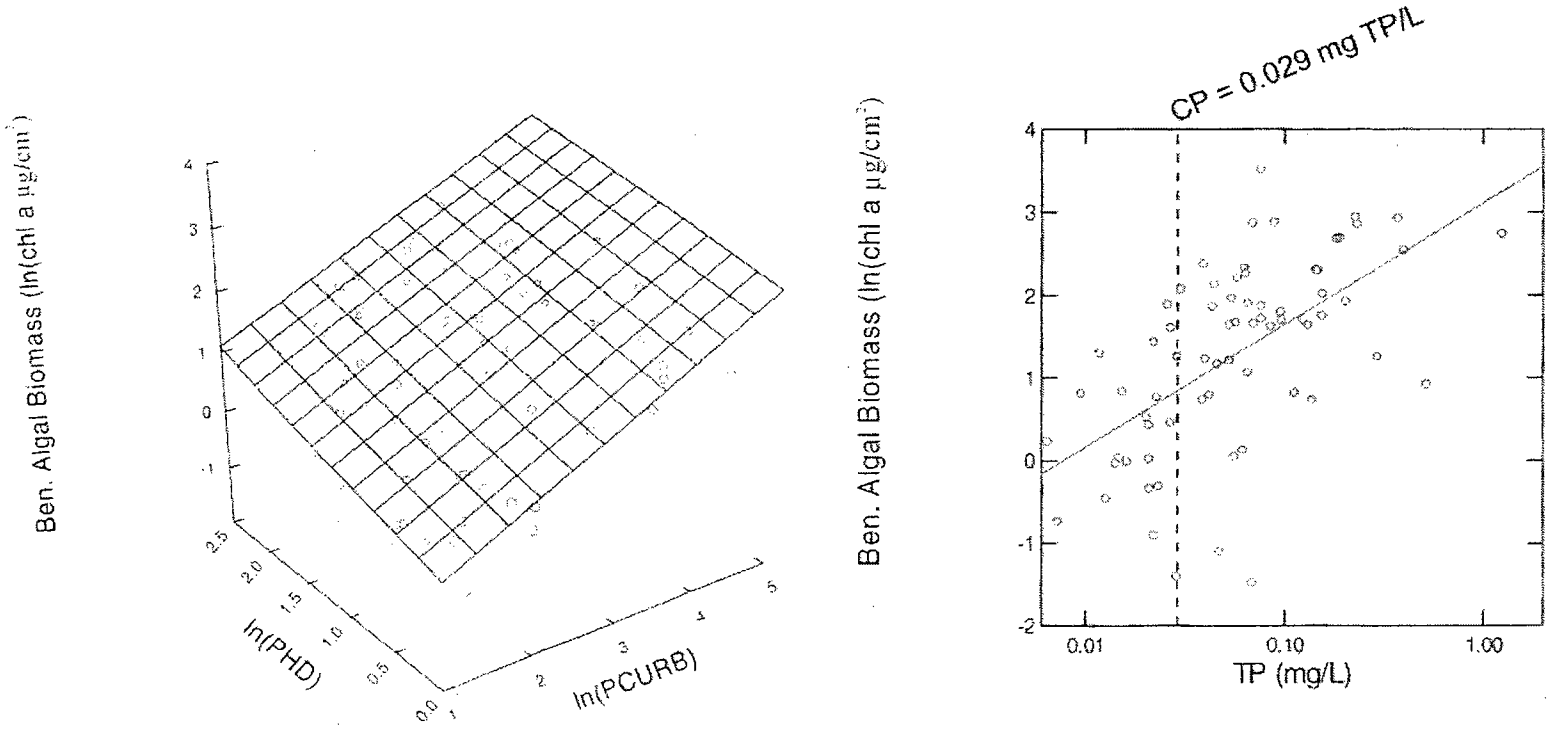

Figure 2.26 Relationships of benthic algal biomass to poultry house density (PHD), percent urban land use (PCURB), and total phosphorus (on right) during spring 2007.

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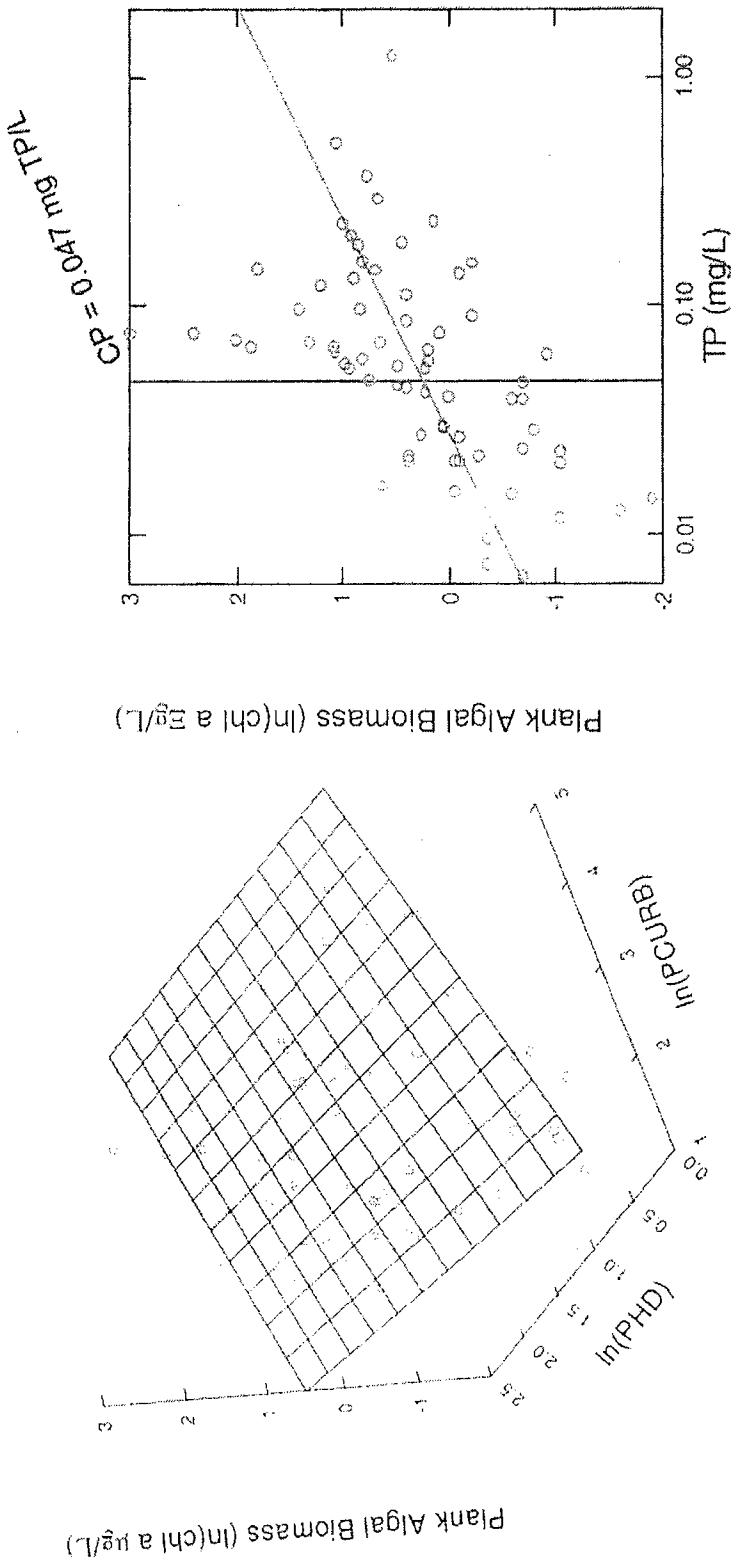

Figure 2.27 Relationships of planktonic algal biomass to poultry house density (PHD), percent urban land use (PCURB), and total phosphorus (on right) during spring 2007.

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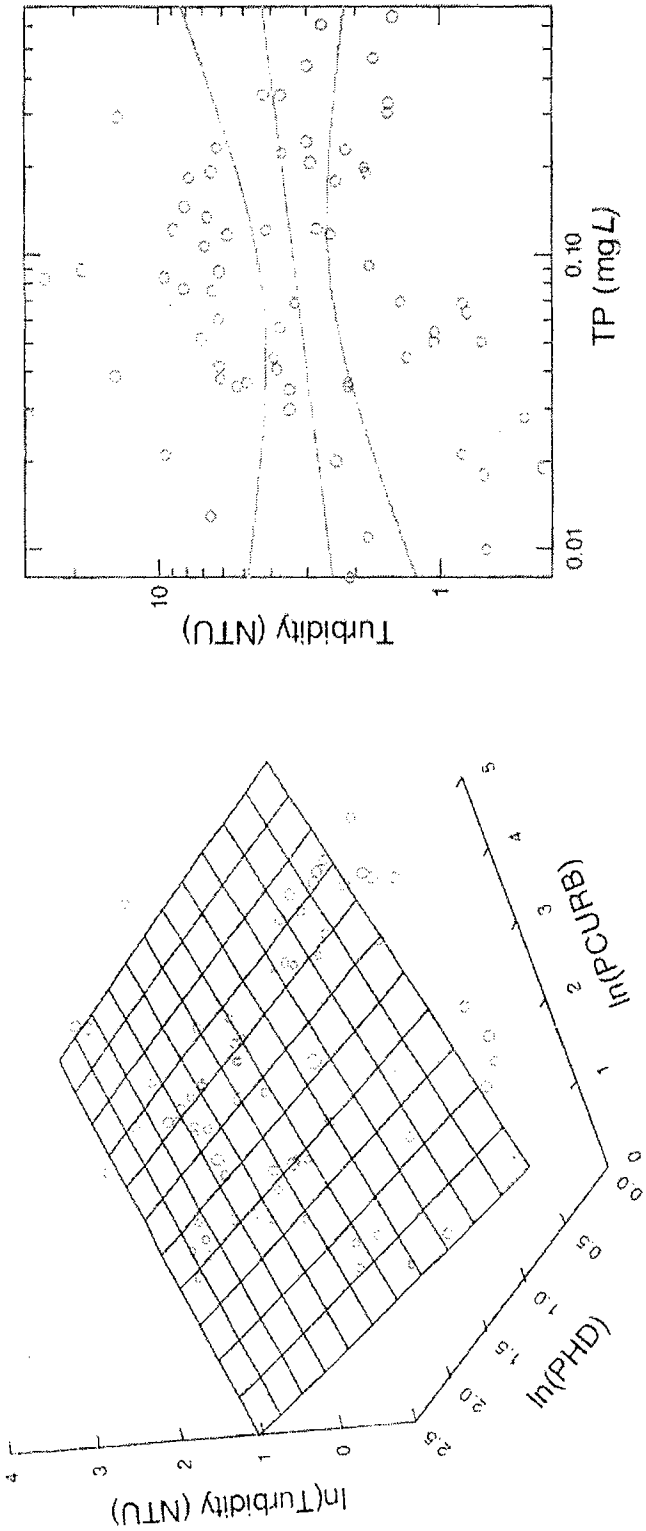

Figure 2.28 Relationships of Turbidity (measured in nephalometric turbidity units) to poultry house density (PHD), percent urban land use (PCURB), and total phosphorus (on right) during summer 2006.

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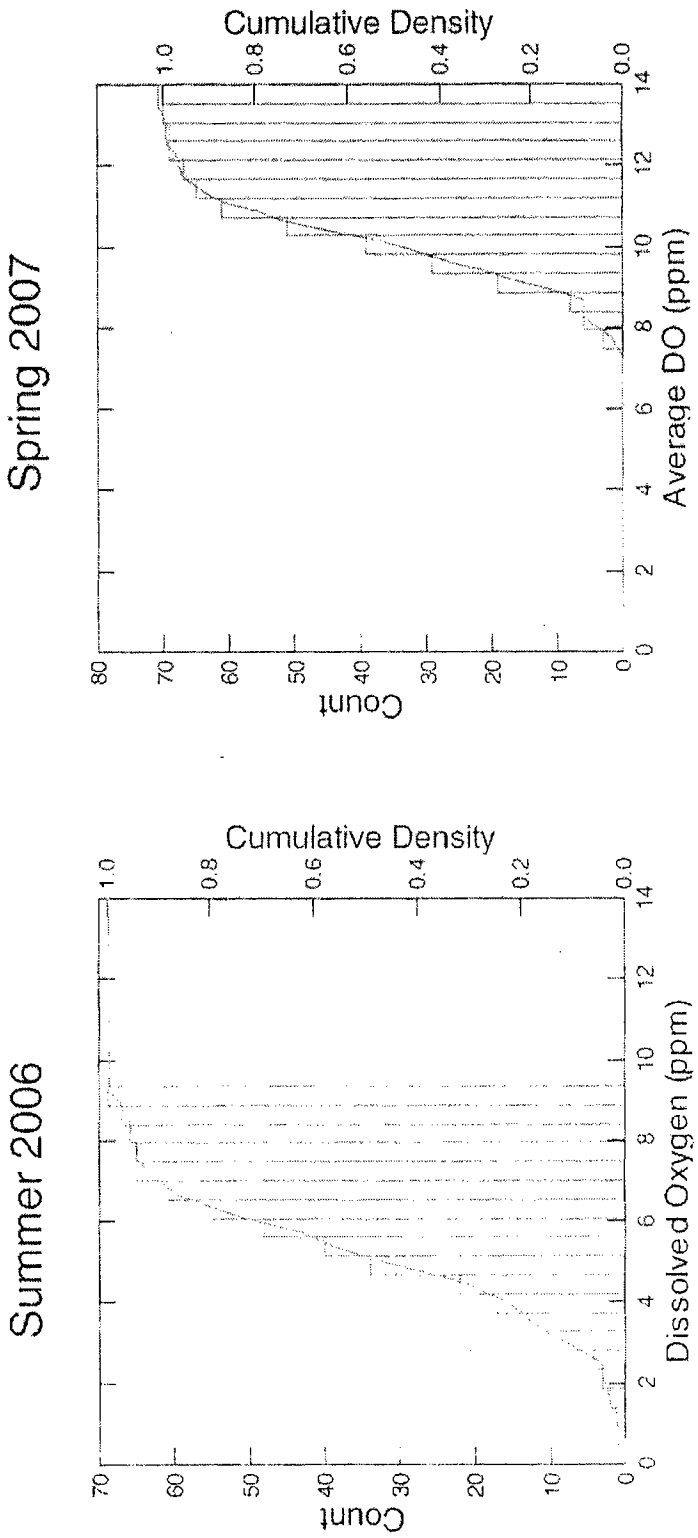

Figure 2.29 Cumulative frequency distribution of dissolved oxygen concentrations measured in Summer 2006 and Spring 2007.

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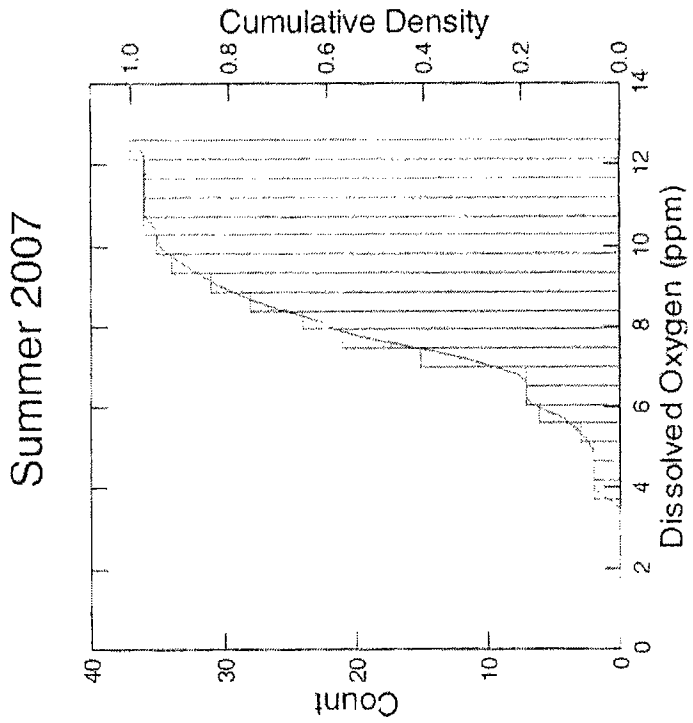

Figure 2.30 Cumulative frequency distribution of dissolved oxygen concentrations measured in Summer 2007.

EXHIBIT R

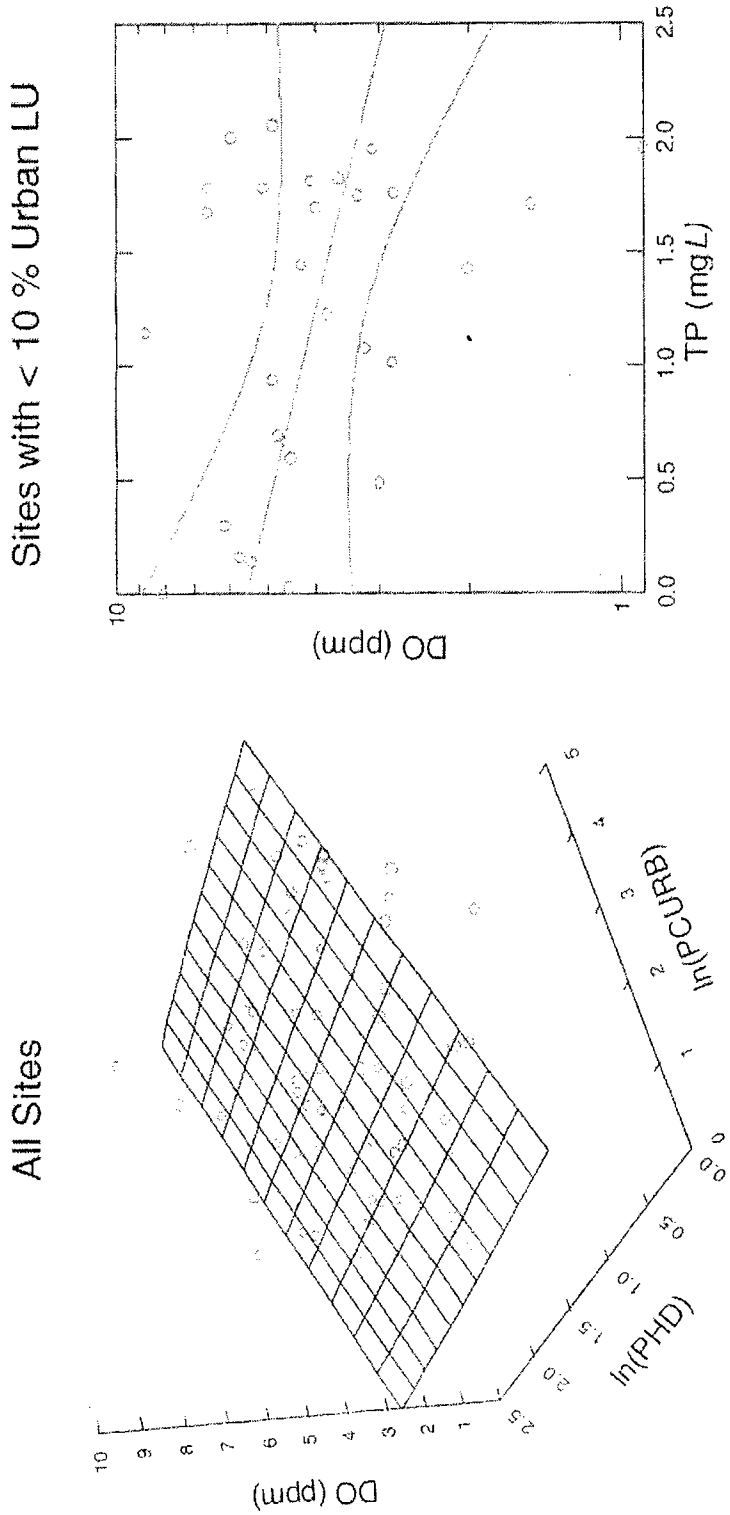

Figure 2.31 Relationships of dissolved oxygen concentrations to poultry house density and urban land use during summer 2006. All site are included in the analysis on the left and only sites with low urban land use on the right.

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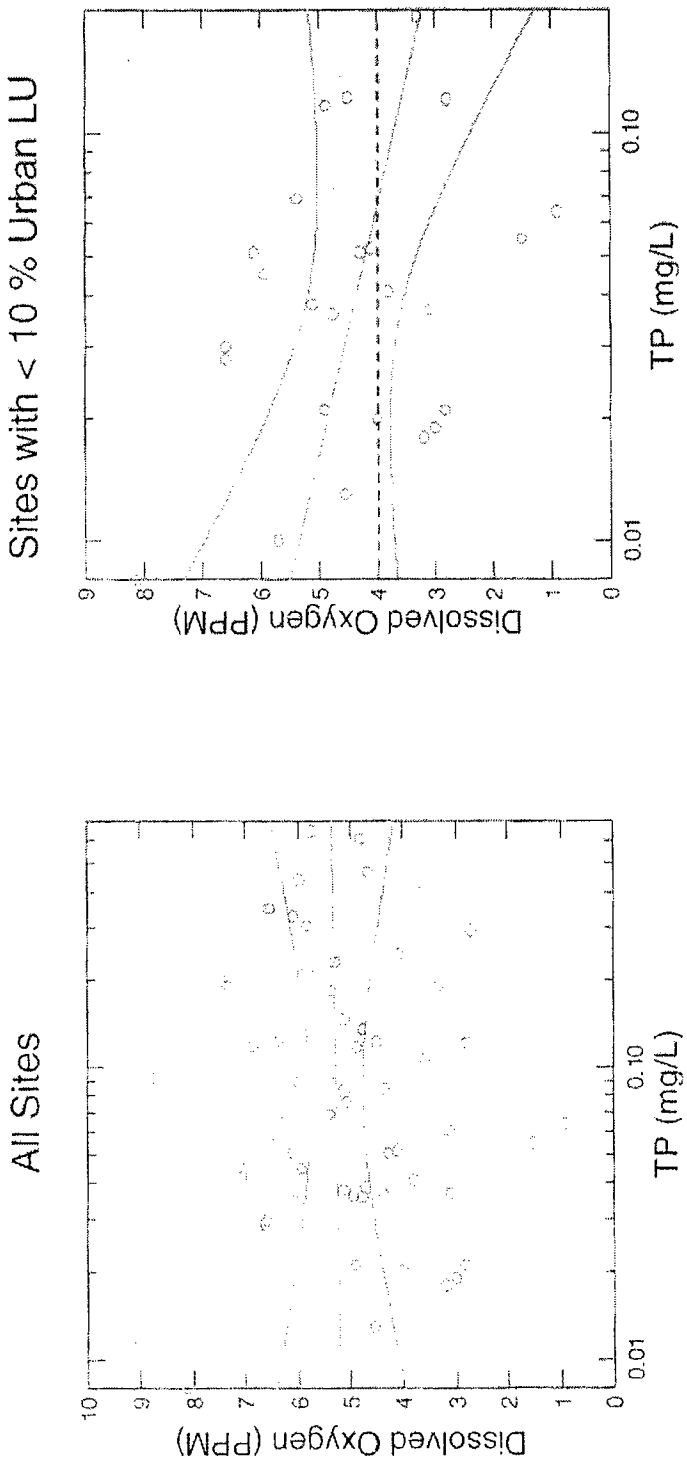

Figure 2.32 Relationship of dissolved oxygen concentrations to total phosphorus (TP) at all sites in summer 2006 (on left) and at sites with less then 10% urban land use only in summer 2006 (on right).

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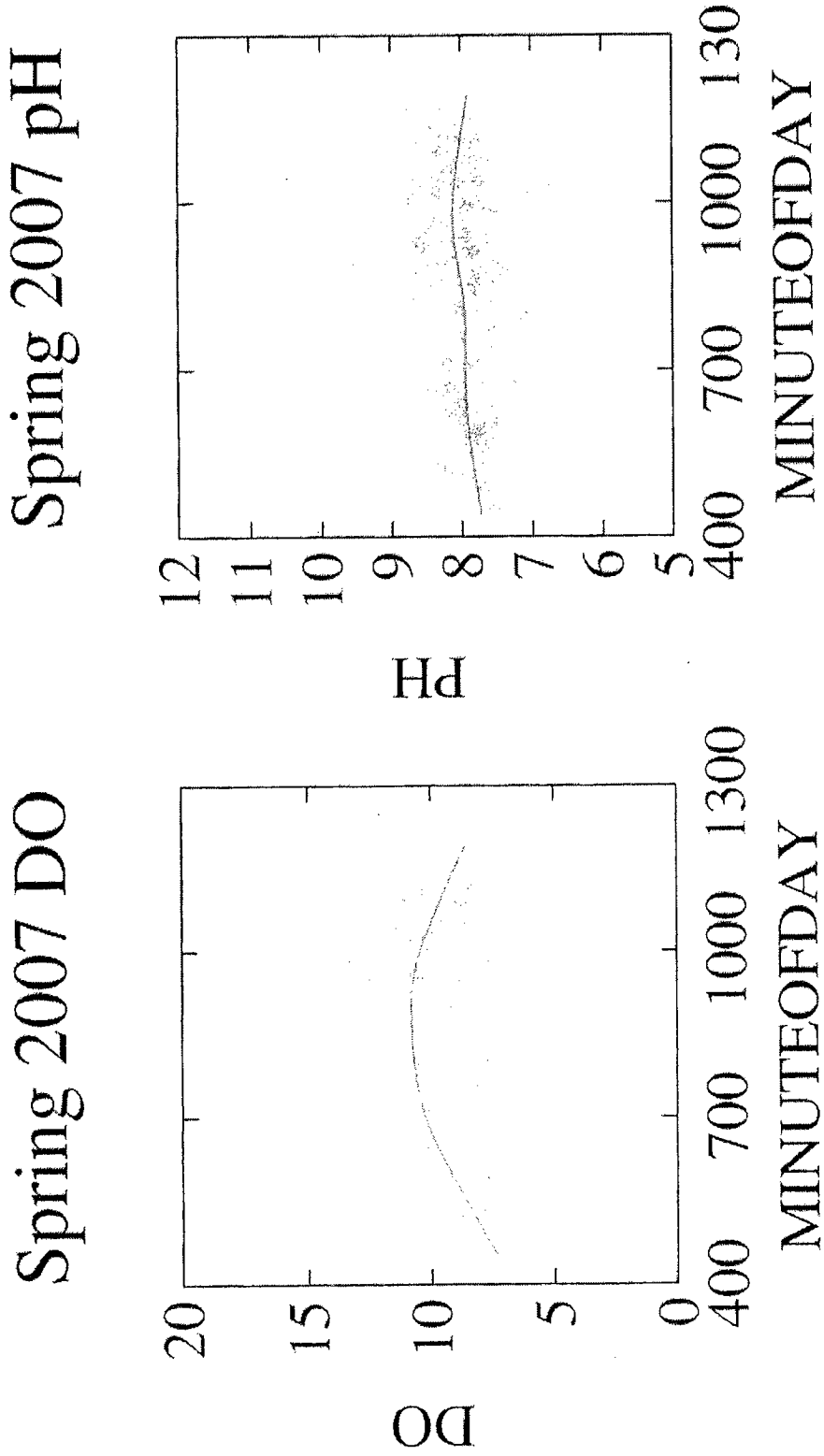


Figure 2.33 Variation in DO and pH concentrations with time of day at all stations over an eight week time period.

EXHIBIT R

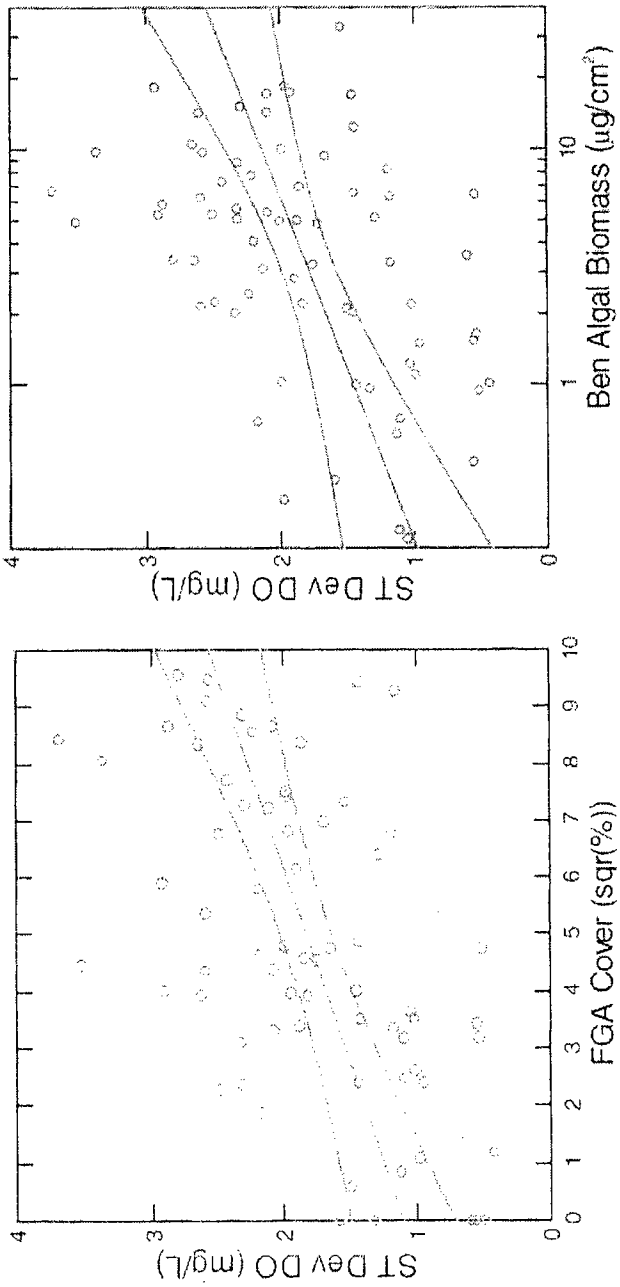
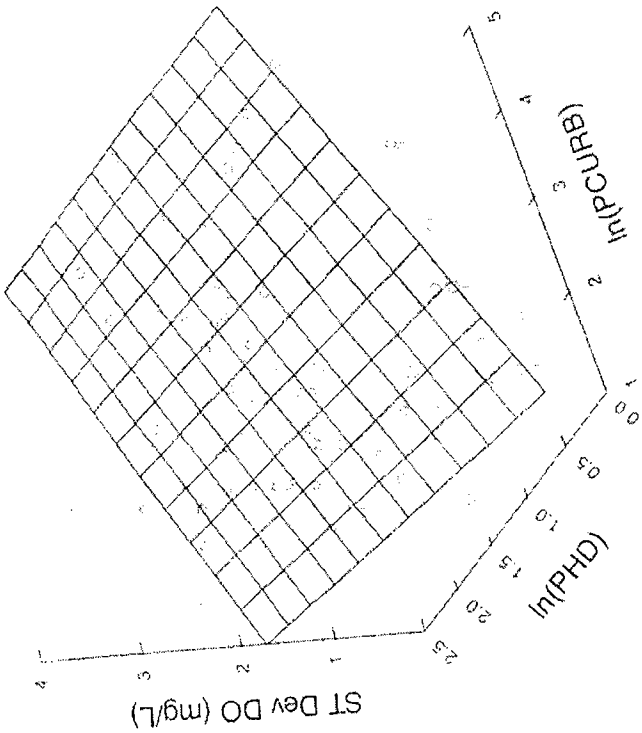


Figure 2.34 The standard deviation in dissolved oxygen (ST Dev DO) of streams related by multiple linear regression to the amount of algae in streams during the eight weeks of sampling in spring of 2007. Independent variables are sqr(percent FGA cover), and average benthic algal biomass (µg chl a/cm2).

EXHIBIT R



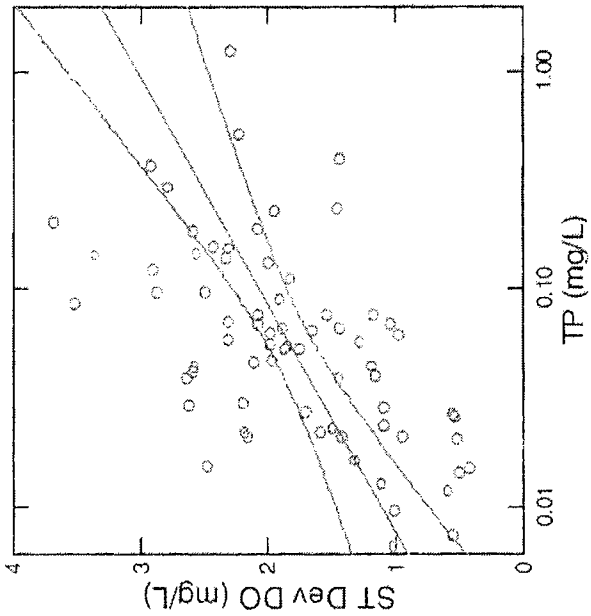


Figure 2.35 The standard deviation in dissolved oxygen (ST Dev DO) of streams related to the poultry house density and percent urban land use (on left) and total phosphorus (on right) during the eight weeks of sampling in spring of 2007. The independent variables ln(percent urban land use) (LPCURB), ln(poultry house density (houses/mi2) (LCHDPMI2), and ln(TP) (LTP).

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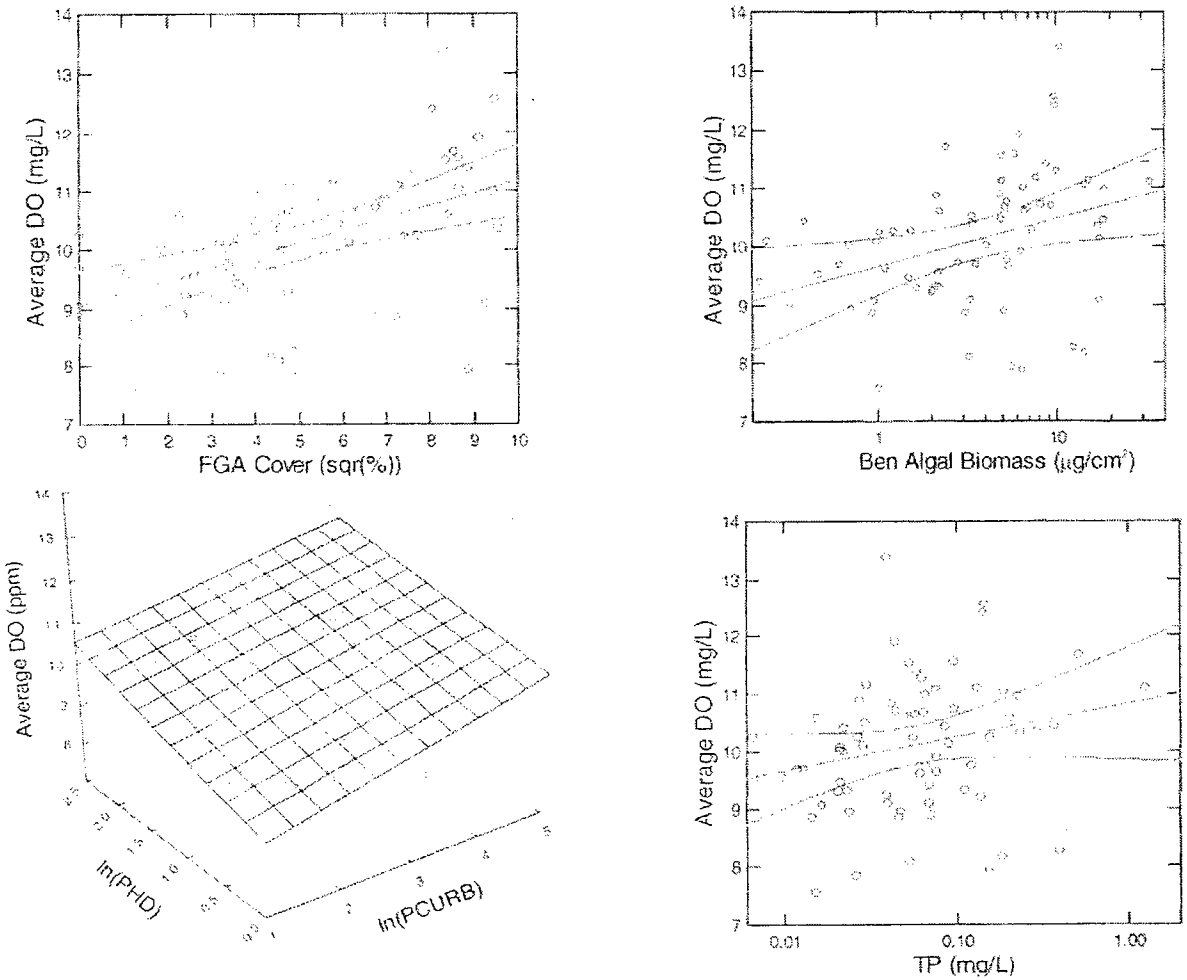

Figure 2.36 Average dissolved oxygen measured in a stream as related to benthic algal biomass, filamentous green algal cover, TP concentration, and poultry house density and percent urban land use in watersheds during spring 2007.

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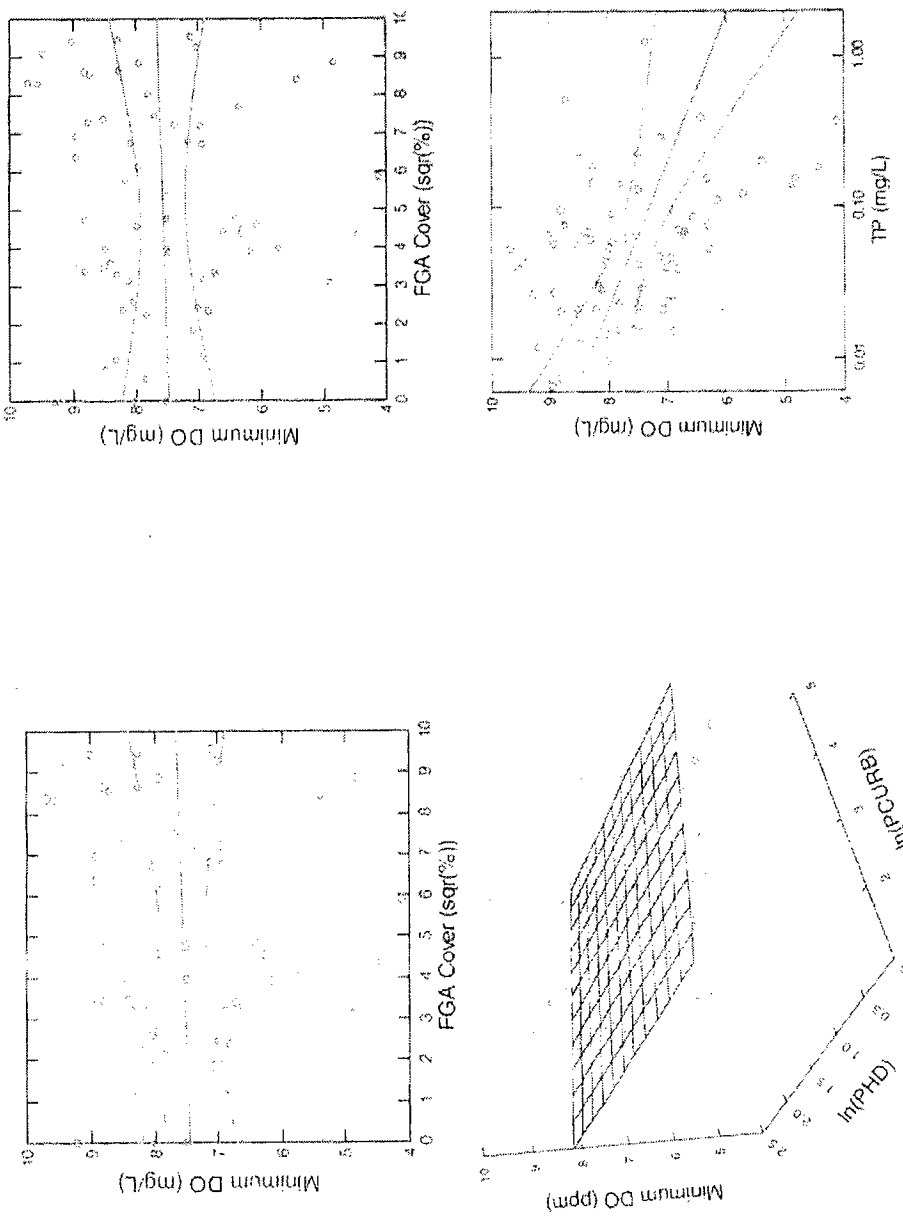

Figure 2.37 Minimum dissolved oxygen concentrations as related to algal biomass, poultry house density, percent urban land use, and total phosphorus concentrations in streams in Spring 2007.

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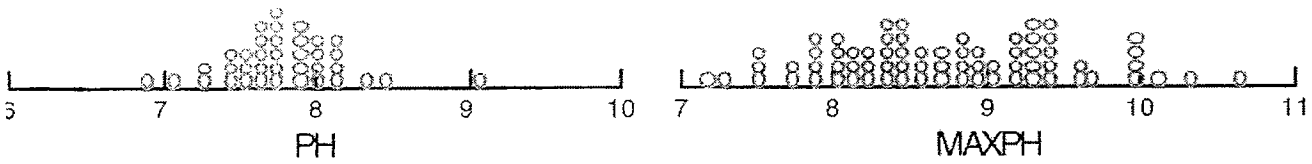

Figure 2.38 Distribution of average pH and maximum pH concentrations at stations sampled during an eight week period in spring 2007.

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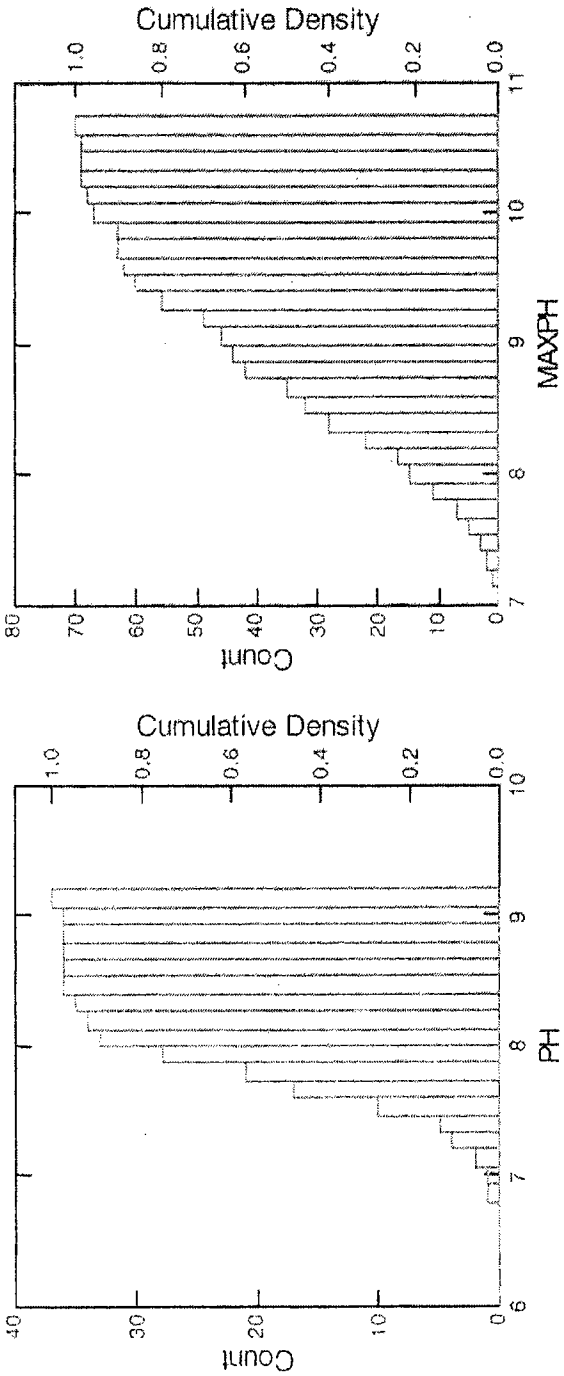

Figure 2.39 Cumulative frequency distribution of average pH and maximum pH concentrations at stations sampled during an eight week period in spring 2007.

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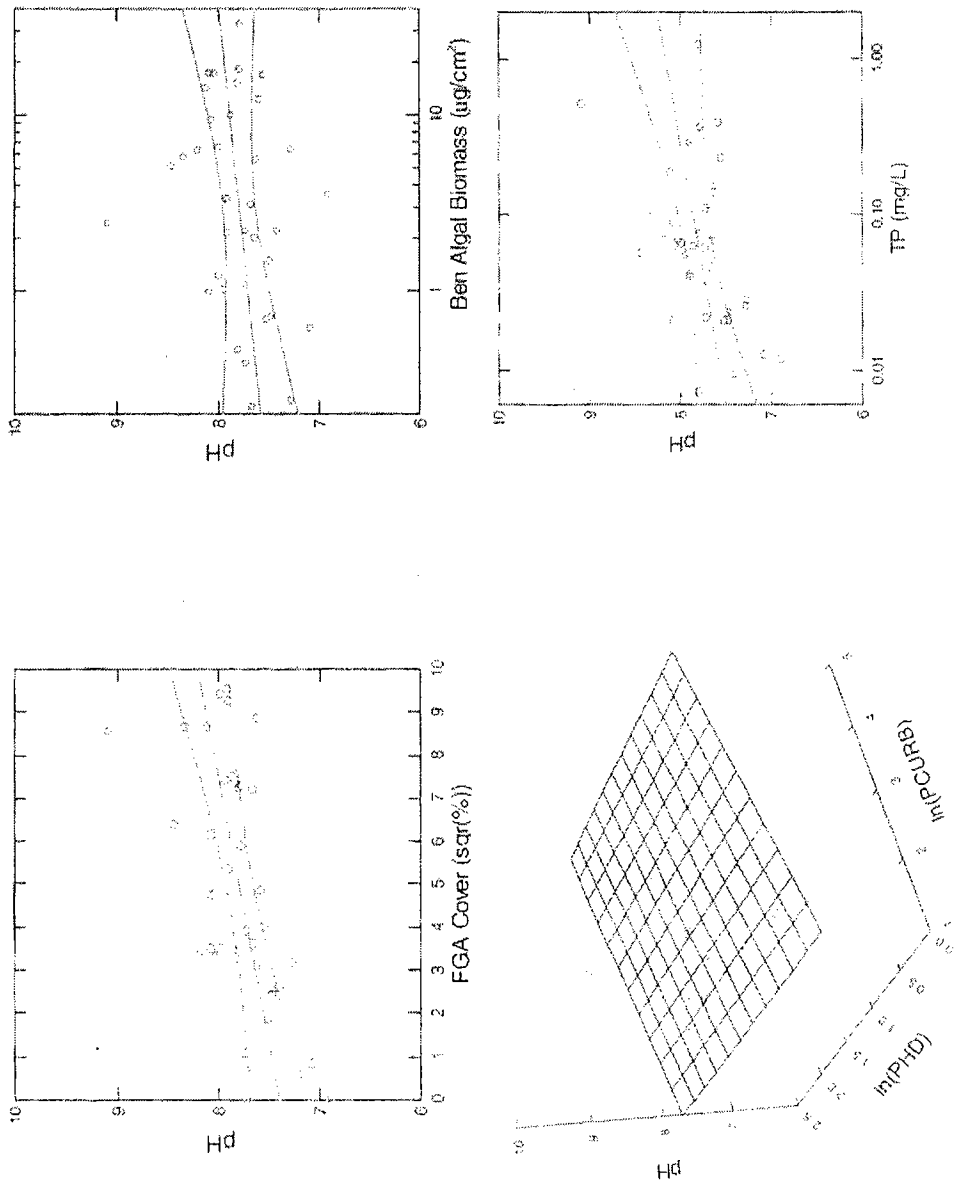

Figure 2.40 Average pH at sites related to benthic algal biomass, filamentous green algal cover, total phosphorus concentration, urban land use, and poultry house density during the spring of 2007.

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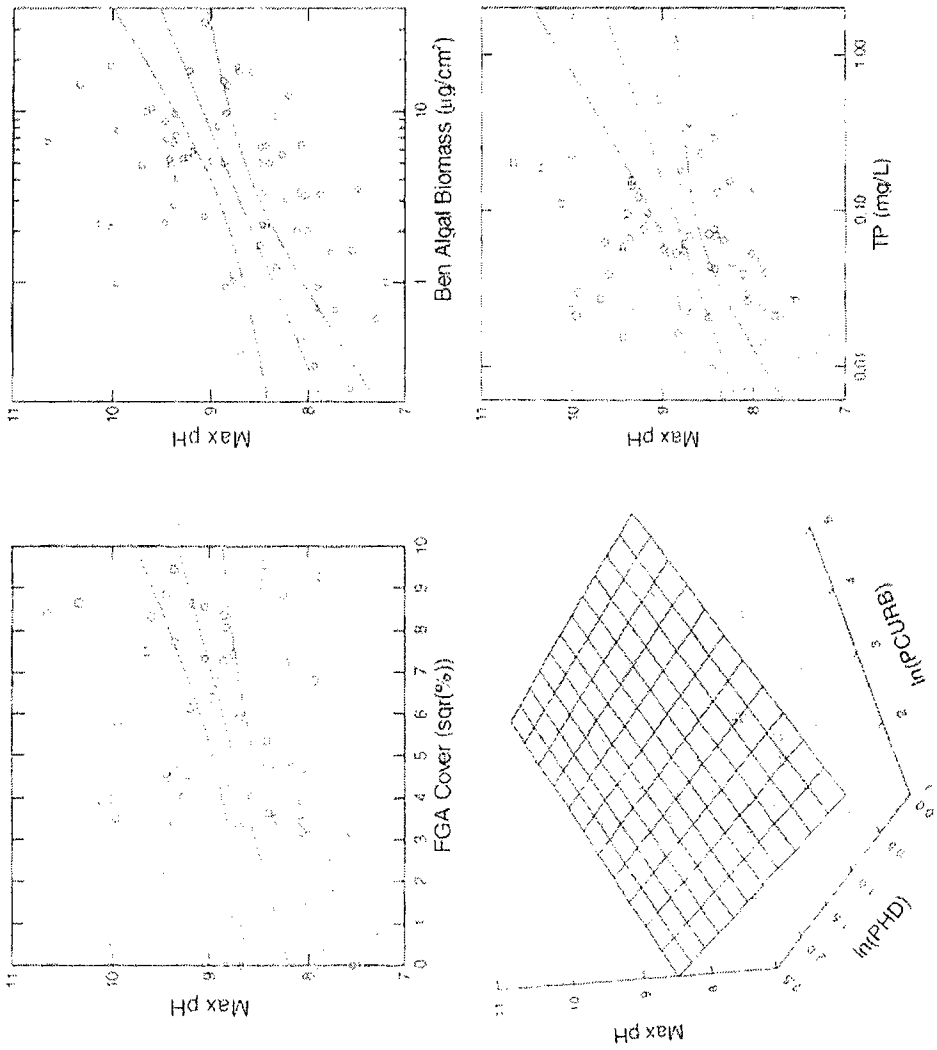

Figure 2.41 Maximum pH at sites related to filamentous green algal cover, benthic algal biomass, total phosphorus concentration, urban land use, and poultry house density during the spring of 2007.

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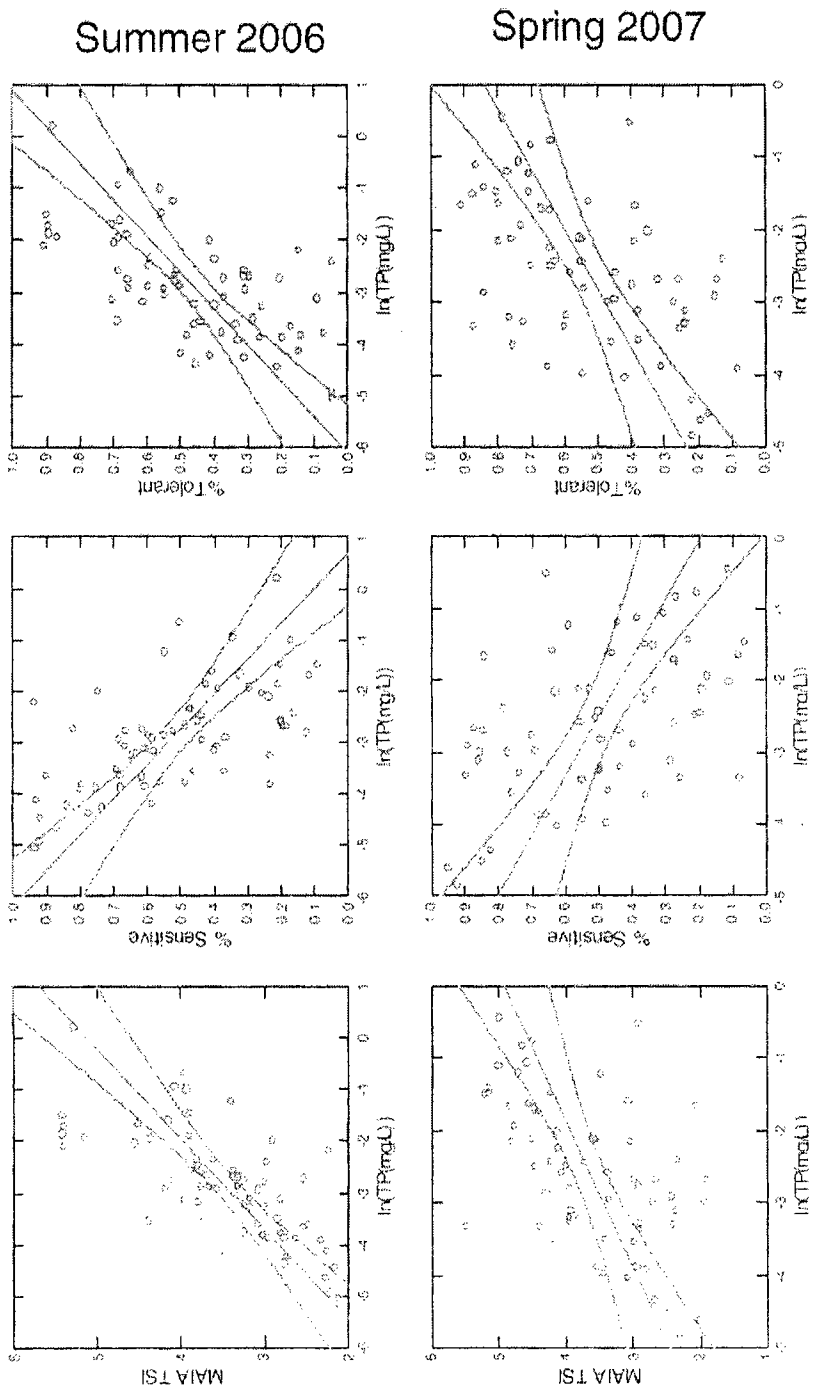

Figure 3.1 Metrics for species composition of diatom assemblages as related to total phosphorus (TP) concentrations in summer 2006 and spring 2007. See table in text for indicator acronyms.

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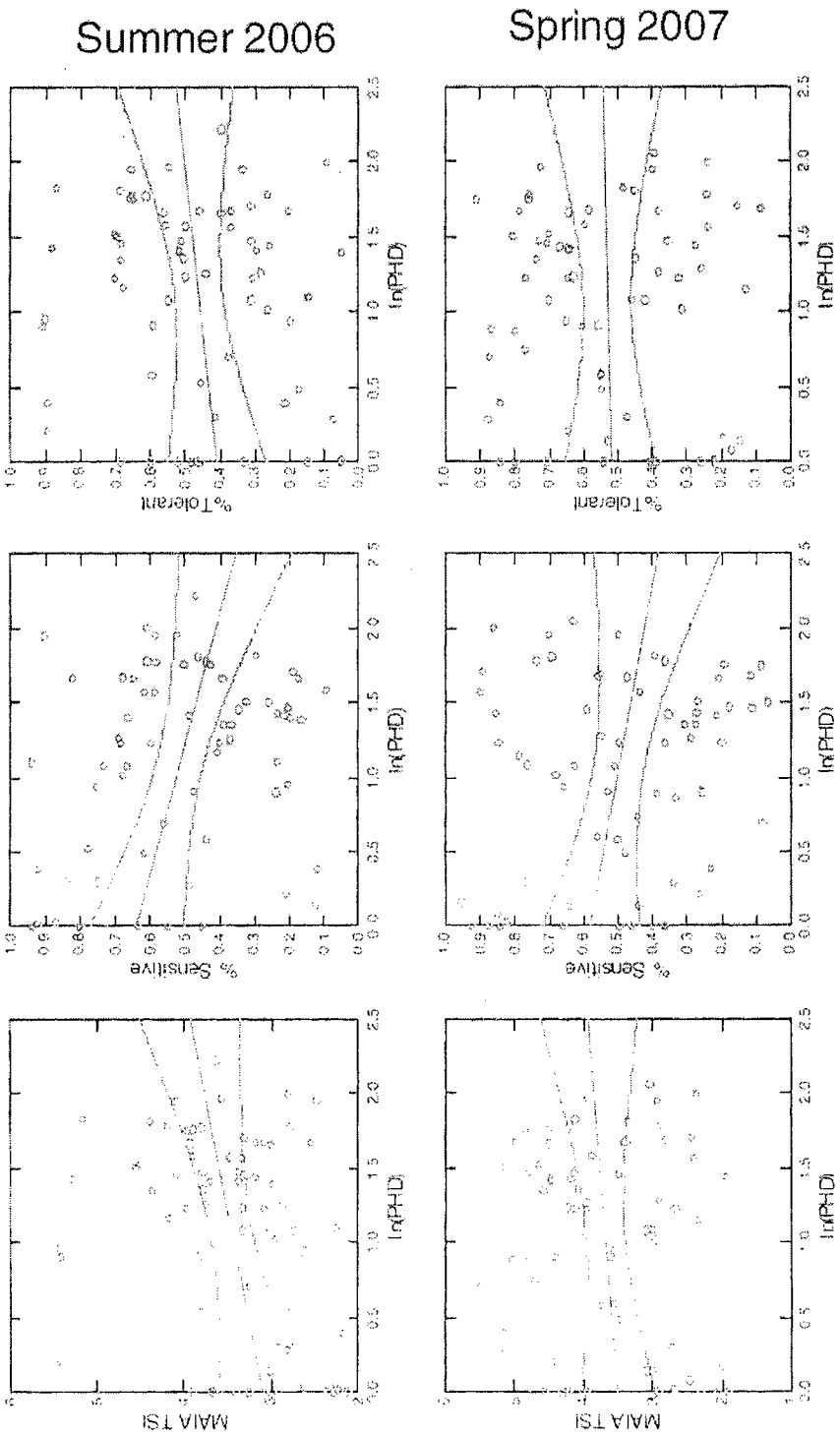

Figure 3.2 Metrics for species composition of diatom assemblages as related to poultry house density in summer 2006 and spring 2007. See table in text to translate indicator codes.

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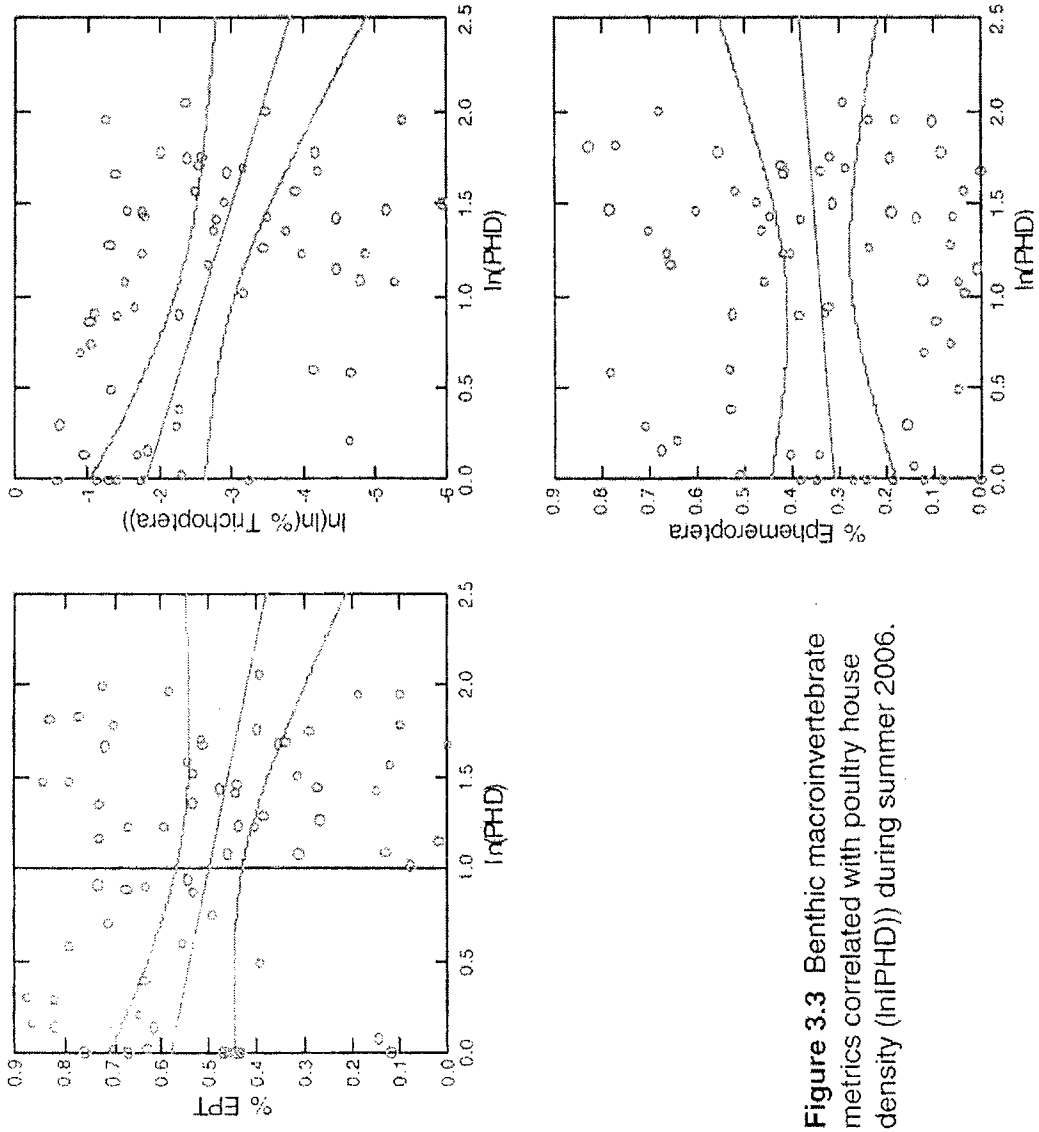

Figure 3.3 Benthic macroinvertebrate metrics correlated with poultry house density (lnlPHD)) during summer 2006.

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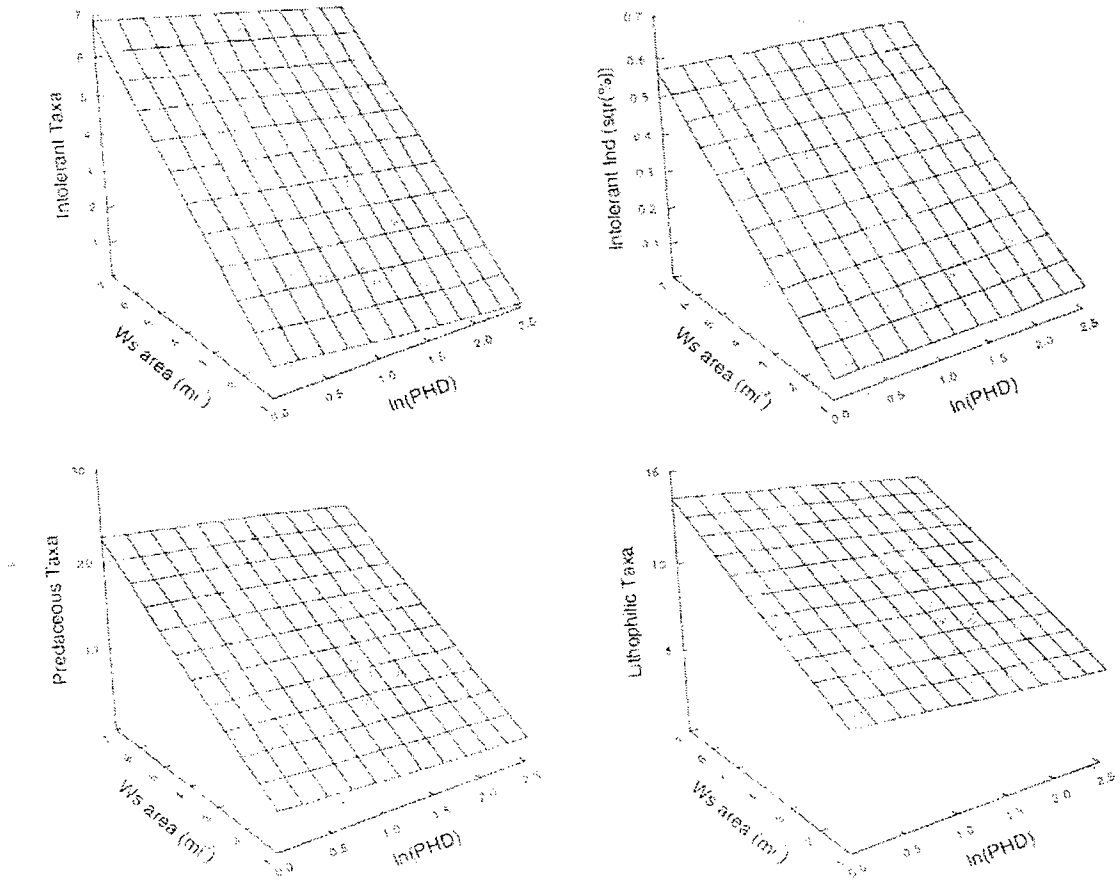

Figure 4.1 Fish community indicators as related to watershed size and poultry house density from summer 2007 fish sampling data. Indicators: the number of EPA Intolerant Taxa, the square root of the percent of EPA intolerant individuals, the number of predaceous taxa, and the number of lithophilic taxa.

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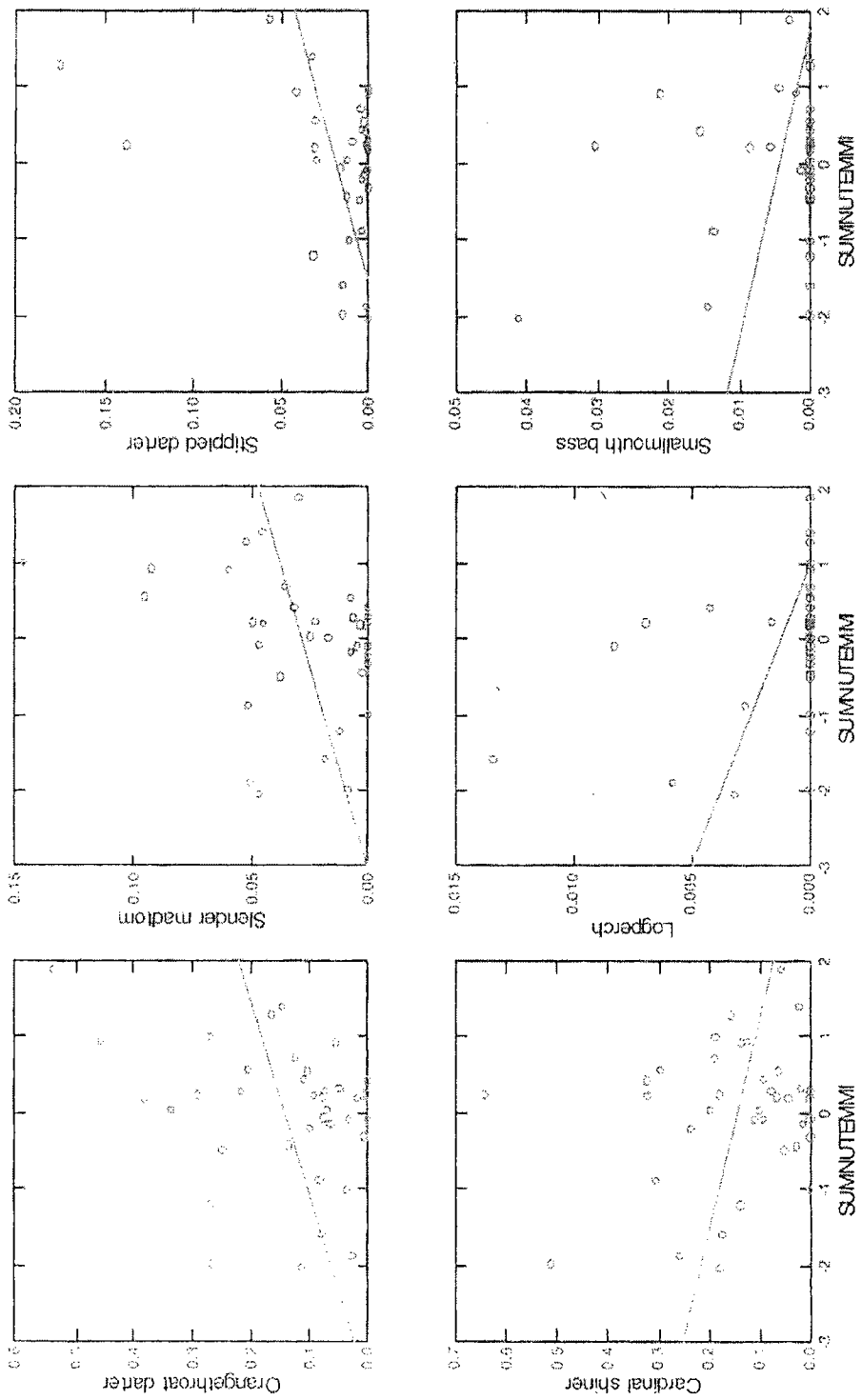

Figure 4.2 Relationships between relative abundances of fish species and the summer nutrient multimetric index. See Table 4.3 for statistical significance of the relationships.

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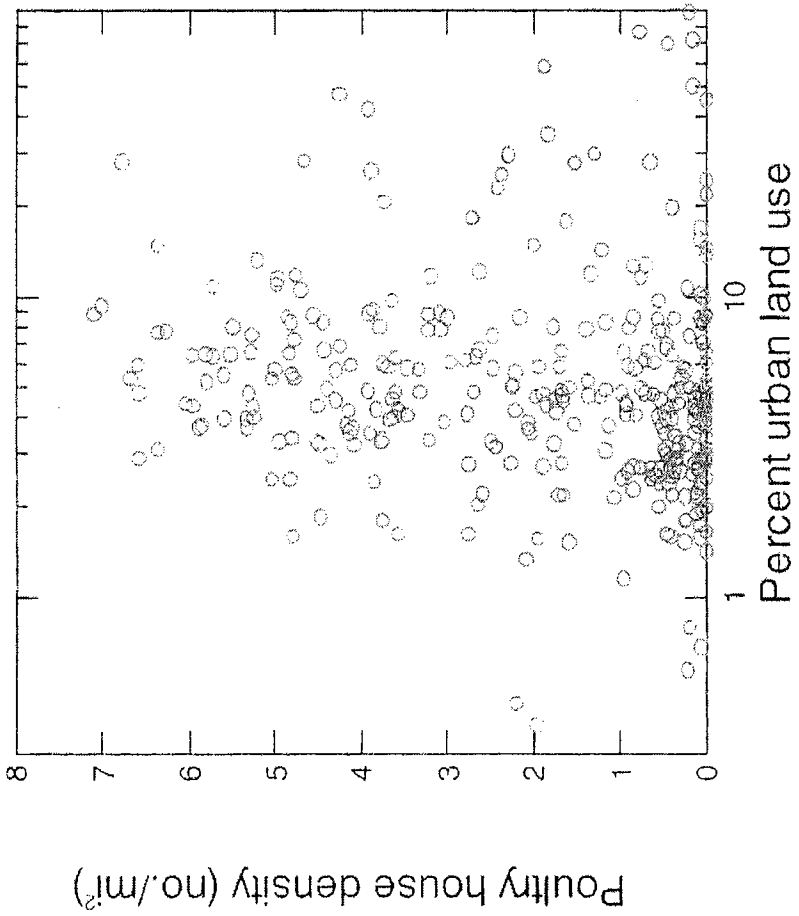

Figure 5.1 Poultry house density vs. percent urban land use for the Illinois River Watershed for 336 sites in the IRW.

EXHIBIT R