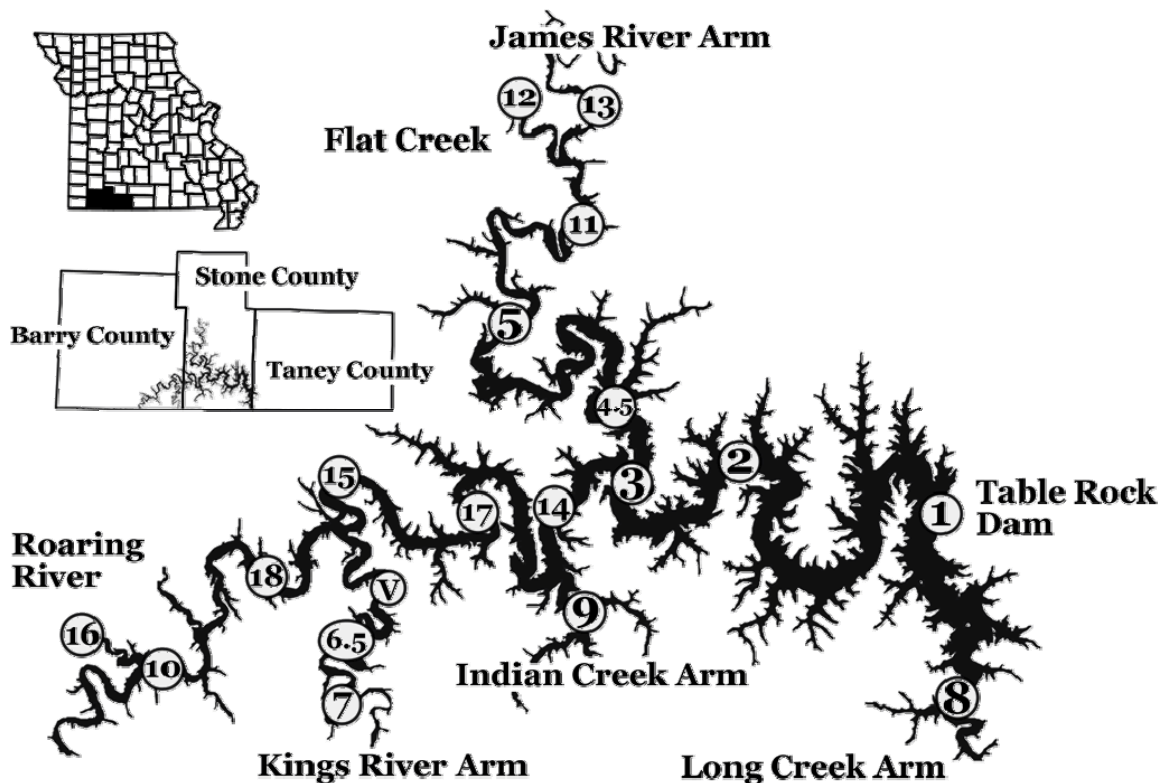


Table Rock Lake

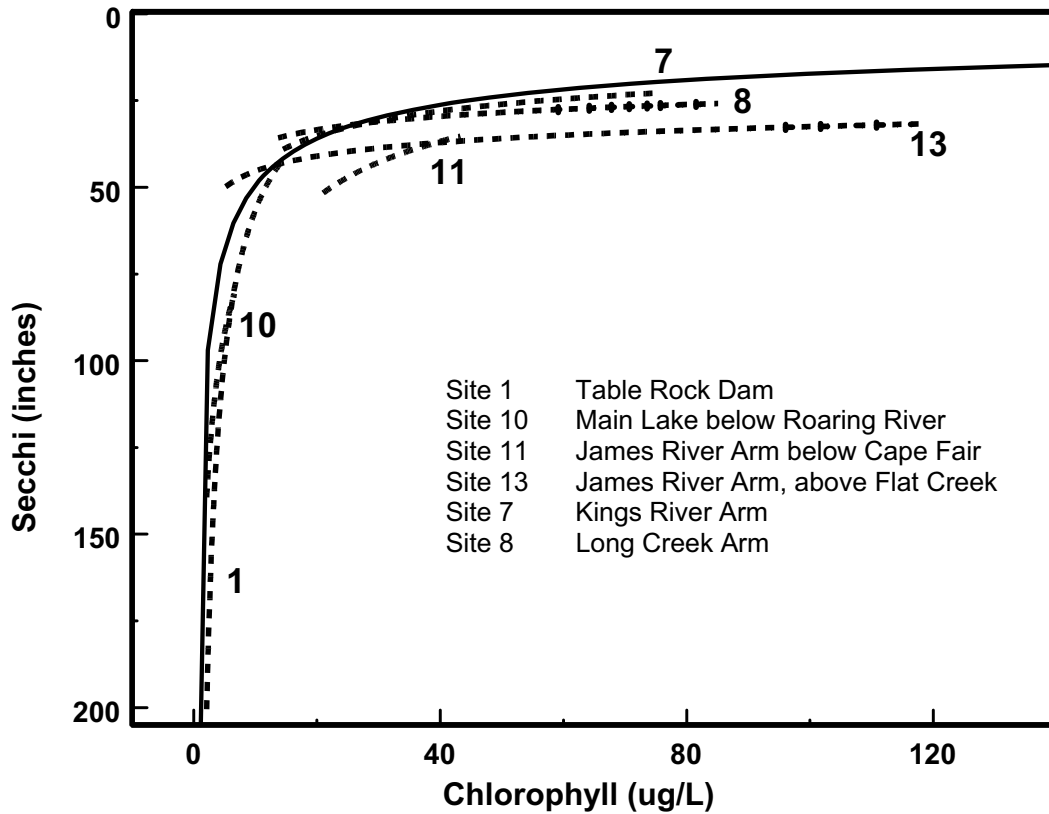


Location of Table Rock Lake and its sample sites

Table Rock Lake is a 43,100-acre Army Corps of Engineers reservoir located in southwest Missouri. This lake is in the White River System and is preceded upstream by Beaver Lake in northwest Arkansas. The lake consists of a long, winding main branch and three major arms. Kings River and Long Creek flow north out of Arkansas to enter Table Rock Lake while the James River flows south from the central Ozark Highlands Region. The majority of the lake’s watershed is forested, but development around the lake and urban areas on the lake’s tributaries threaten water quality.

Table Rock Lake

The Chlorophyll—Secchi relationship of selected Table Rock Lake sites.



Solid line represents all 2005 LMVP data; dotted lines and numbers represent Table Rock Lake Sites.

For sites with low chlorophyll concentrations, a small increase in the amount of algae can dramatically reduce Secchi transparency. By contrast, sites with high chlorophyll concentrations can experience large shifts in algal biomass without a noticeable impact on Secchi transparency.

For example, Site 1 (Table Rock Dam) chlorophyll concentrations only vary by 9.6 ug/L, while Secchi transparency values vary by 141 inches. In contrast, Site 13 (James River arm—near Cape Fair) chlorophyll concentrations vary by 112 ug/L, but Secchi values only vary by 17 inches.

Table Rock Lake: Main Channel

Descriptive statistics from the main channel of Table Rock Lake - 2005

		Site	Site	Site	Site	Site	Site	Site	Site
Parameters		10	18	15	17	14	3	2	1
Secchi Transparency (inches)	Mean	110	142	159	140	149	144	108	102
	Minimum	61	98	117	94	106	95	63	27
	Maximum	143	212	210	193	187	200	154	168
Phosphorus (ug/L)	Mean	6	7	6	6	6	7	7	5
	Minimum	5	5	5	5	4	5	5	3
	Maximum	9	10	8	9	9	14	9	10
Nitrogen (ug/L)	Mean	301	240	279	285	401	439	405	415
	Minimum	200	200	220	280	240	240	320	290
	Maximum	420	390	450	470	660	1000	730	740
Chlorophyll (ug/L)	Mean	3.4	1.8	2.4	2.5	2.8	4.6	3.5	4.9
	Minimum	2.1	0.8	1.2	1.2	1.6	1.9	1.8	2.1
	Maximum	6.6	3.5	5.5	6.2	6.1	10.9	8.1	14.5

Table Rock Lake, Main Channel Sites

Typically the dam has the lowest concentrations of nutrients and chlorophyll. However, in 2005 the dam site and the two main lake sites nearest the dam (Sites 1, 2 and 3) had unusually high concentrations of chlorophyll early in the sampling season, which elevated the overall mean value. As a result, Secchi values at these sites were lower than expected, relative to the other sites in the main channel. Mean phosphorus concentrations were virtually identical across the main channel, though the highest value was observed at Site 3 rather than an up-lake site. Nitrogen concentrations were also a bit higher than expected at the down-lake sites, due to high values early in the season.

Table Rock Lake: Main Channel Relative Ranks

See Page 9 for help interpreting these graphs

Table Rock, Site 1

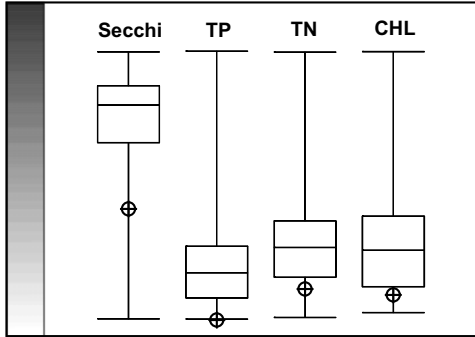


Table Rock, Site 2

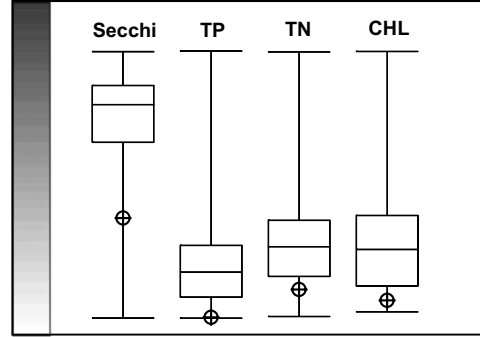


Table Rock, Site 3

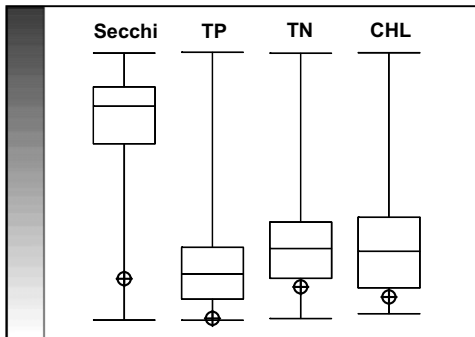


Table Rock, Site 17

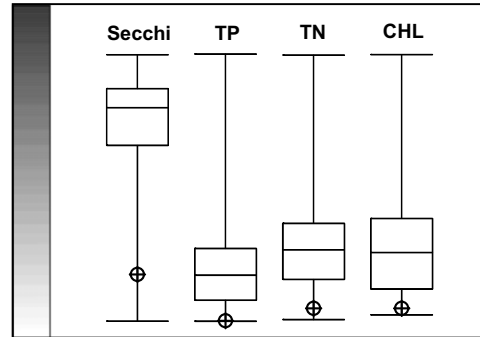
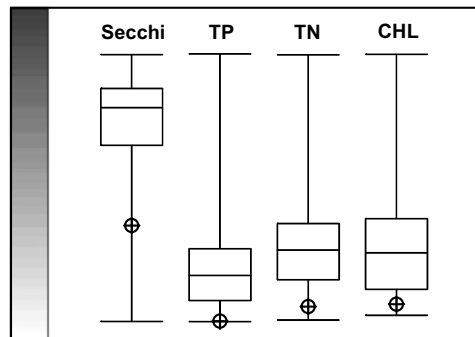
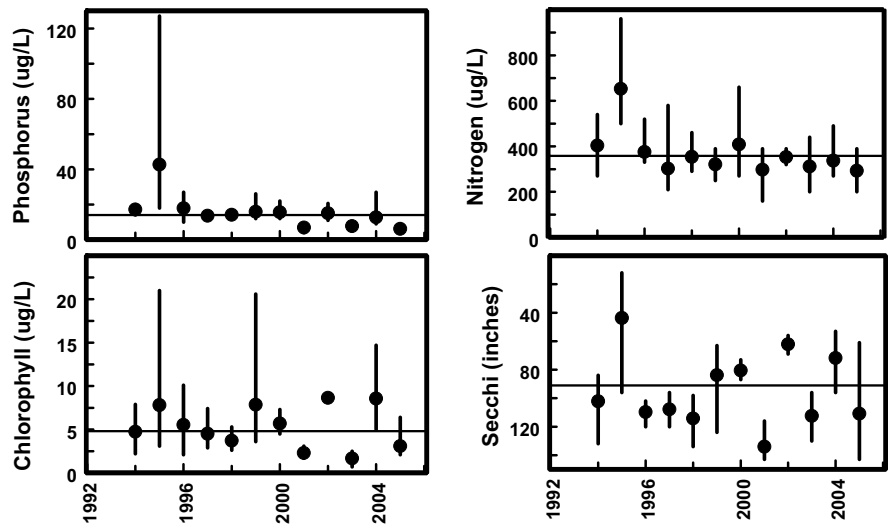


Table Rock, Site 10



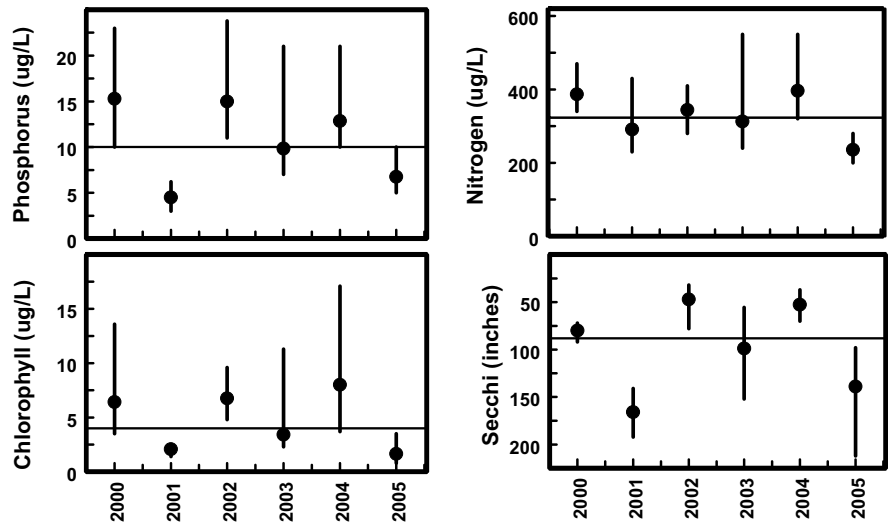
Water quality in the main lake at Table Rock Lake in 2005 was exceptional. Concentrations of nutrients and chlorophyll were lower than found in more than 75% of Missouri lakes. Phosphorus concentrations were among the lowest of any lake in Missouri. For this reason, Table Rock Lake's water quality should be protected.

Table Rock Lake: Main Channel



Multi year trends at Table Rock Lake, Site 10

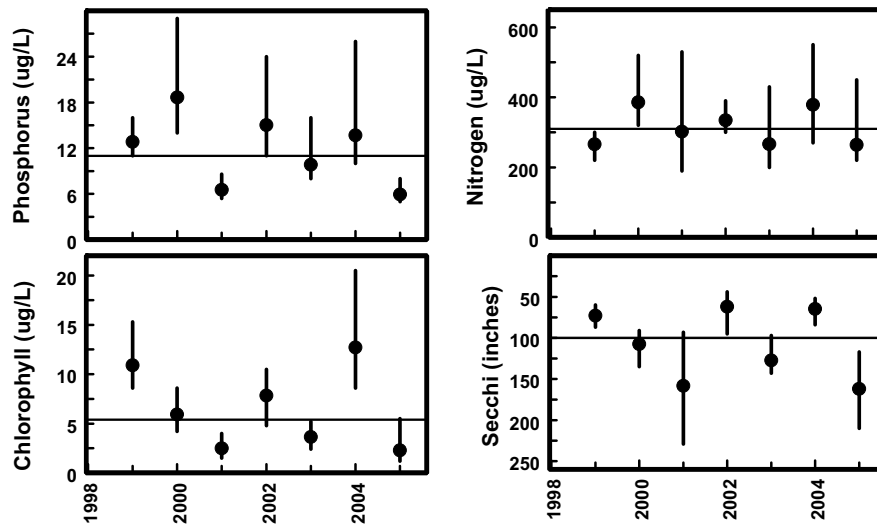
Though nitrogen concentrations have been very consistent at Site 10 (except for 1995), phosphorus, chlorophyll and Secchi values vary among years. 2001, 2003 and 2005 had particularly low concentrations of phosphorus and chlorophyll compared to 2002 and 2004. Site 10 had an 80 inch range of Secchi values in 2005. These variable conditions are attributable to the low chlorophyll concentrations observed in 2005 (see Chlorophyll-Secchi graph on page 103).



Multi year trends at Table Rock Lake, Site 18

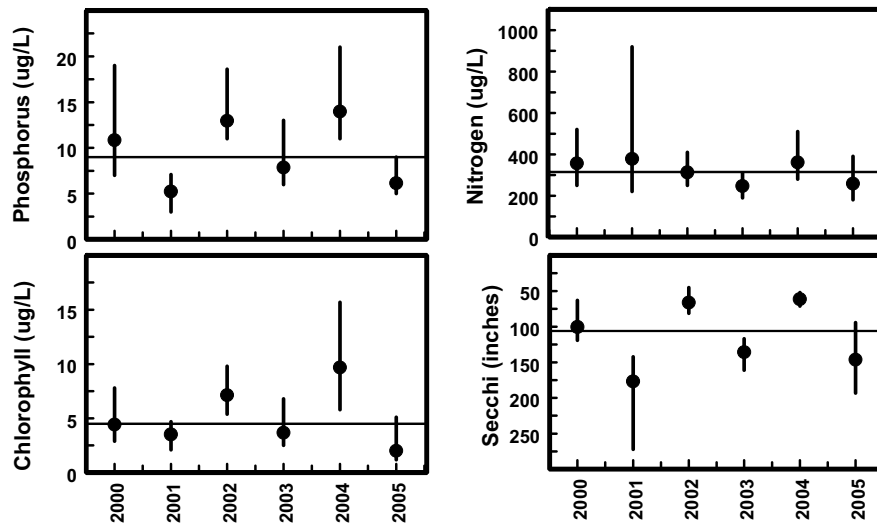
Site 18 shows the same pattern as site 10. Nitrogen concentrations remain consistent among years, while phosphorus and chlorophyll show variation among years. Again, 2001, 2003 and 2005 had lower concentrations of phosphorus and chlorophyll than observed in 2002 and 2004.

Table Rock Lake: Main Channel



Multi year trends at Table Rock Lake, Site 15

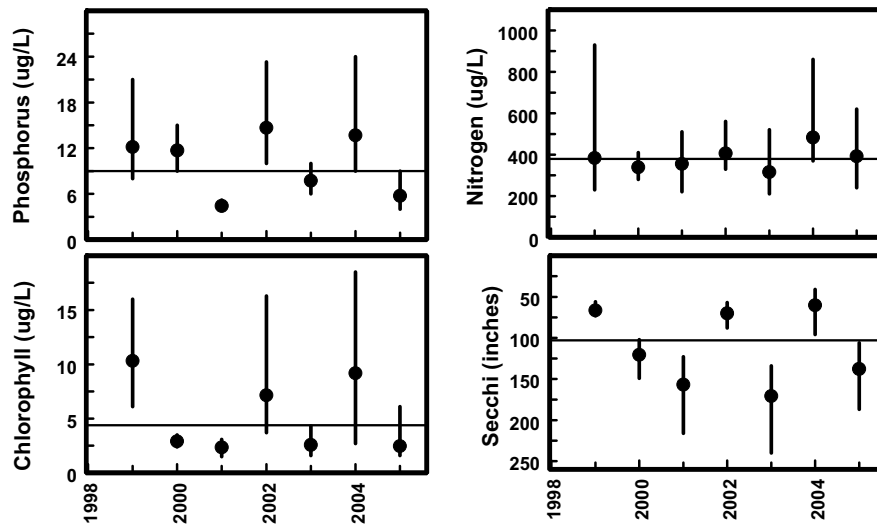
The data are too variable to allow any declaration of a trend at this time. However 2005 was a particularly good year for water quality. Phosphorus and chlorophyll concentrations in 2005 were among the lowest observed at Site 15, and water clarity was among the best.



Multi year trends at Table Rock Lake, Site 17

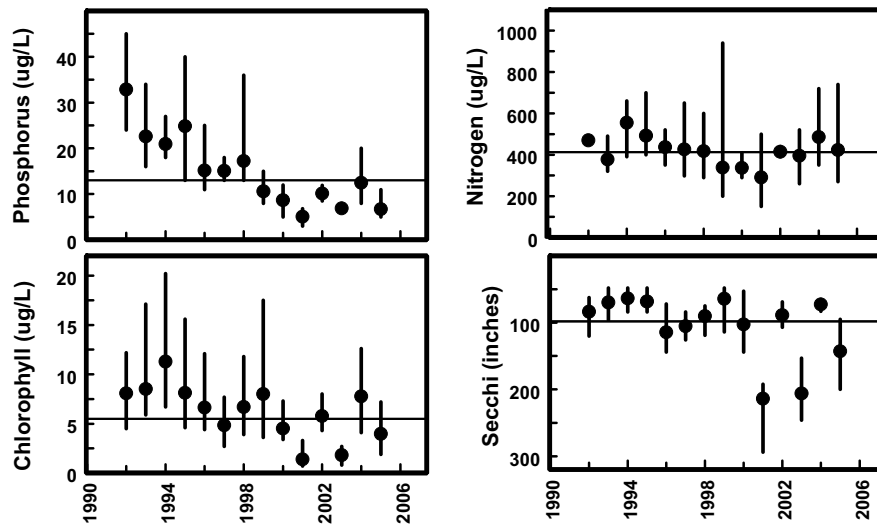
Conditions at Site 17 are nearly identical to the conditions observed at Site 15.

Table Rock Lake: Main Channel



Multi year trends at Table Rock Lake, Site 14

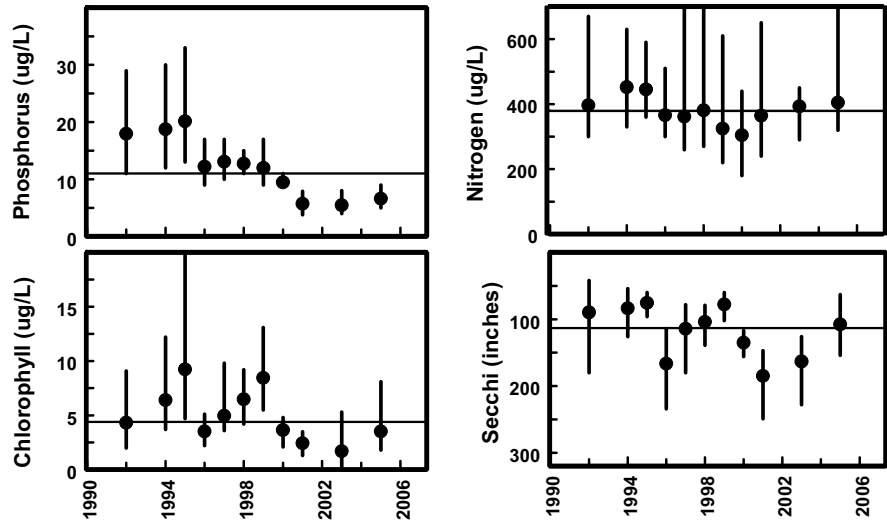
There are no apparent trends observed at Site 14. This site experienced a low concentration of chlorophyll in 2000, despite higher than average phosphorus concentrations. 2005 had better than average clarity, and lower than average concentrations of phosphorus and chlorophyll.



Multi year trends at Table Rock Lake, Site 3

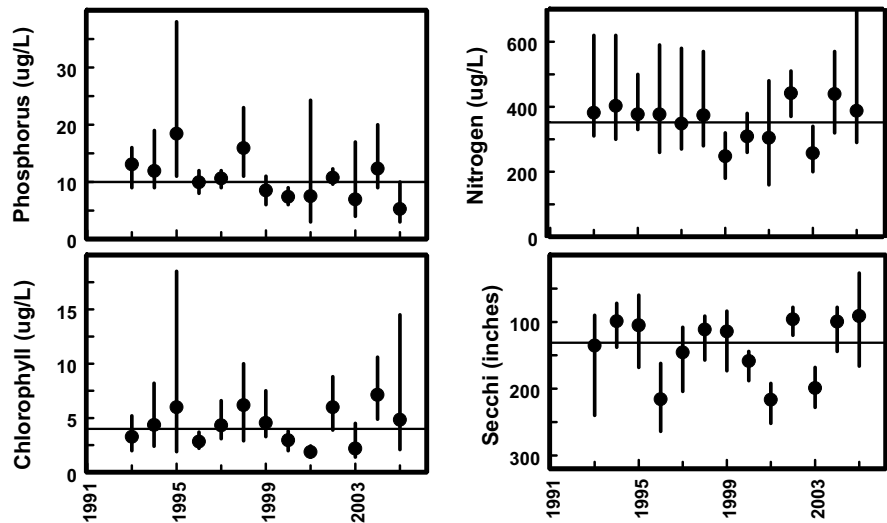
Phosphorus concentrations have decreased steadily since 1992 at this site. Chlorophyll concentrations are lower in recent years, with the exception of 2002 and 2004. An examination of Secchi values shows that 2002 and 2004 are comparable to previous years, but that 2001, 2003 and 2005 had extremely clear water compared to ALL other years. Nitrogen concentrations remain unchanged since 1992.

Table Rock Lake: Main Channel



Multi year trends at Table Rock Lake, Site 2

With the years 2002 and 2004 missing from the Site 2 graphs, the impression is given that phosphorus and chlorophyll concentrations have reduced dramatically. We know that 2002 and 2004 exhibit high concentrations of phosphorus and chlorophyll at other sites, so it is assumed that Site 2 would mimic that pattern.



Multi year trends at Table Rock Lake, Site 1

While phosphorus concentrations were lower in 2005 than in previous years, chlorophyll concentrations higher than the overall mean. More algae led to reduced water clarity (as measured by Secchi transparency). Though there is a trend of reduced phosphorus concentrations at Site 1, it is much more apparent at Site 3.

Table Rock Lake: James River Arm

Descriptive statistics from the James River Arm of Table Rock Lake - 2005

Parameters		Site 13	Site 11	Site 5	Site 4.5
Secchi Transparency (inches)	Mean	37	45	69	96
	Minimum	32	37	52	73
	Maximum	49	61	87	110
Phosphorus (ug/L)	Mean	76	31	14	10
	Minimum	42	21	8	6
	Maximum	114	52	16	32
Nitrogen (ug/L)	Mean	1430	865	701	482
	Minimum	1040	510	450	270
	Maximum	2160	1320	1510	1010
Chlorophyll (ug/L)	Mean	42.2	27.1	11.0	4.6
	Minimum	5.2	21	5.8	3.2
	Maximum	117.6	43.3	22.2	9.0

Concentrations of phosphorus, nitrogen and chlorophyll decrease as the sites move from the upper end of the James River arm toward the main lake. At the same time Secchi transparency values increase. This so-called “longitudinal” gradient is typical of reservoirs.

Water quality at Site 4.5 was comparable to the main lake.

Table Rock Lake: James River Arm Relative Rank

Table Rock, Site 4.5

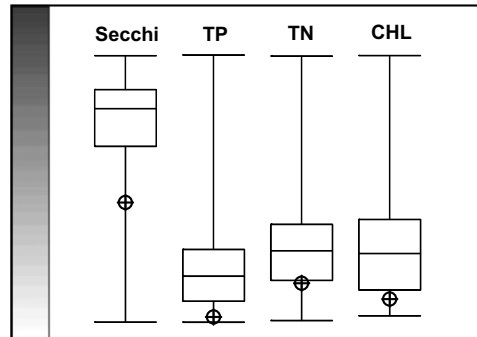


Table Rock, Site 5

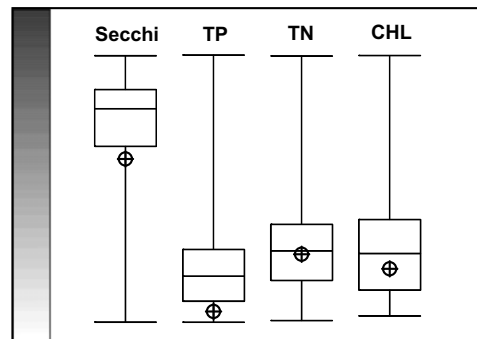


Table Rock, Site 11

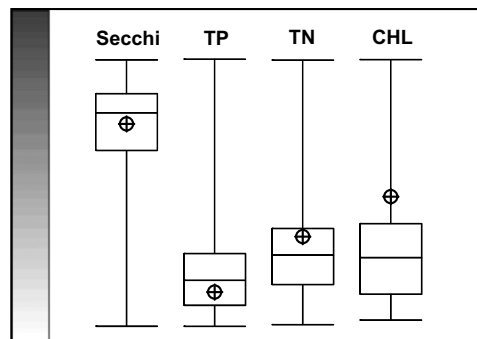
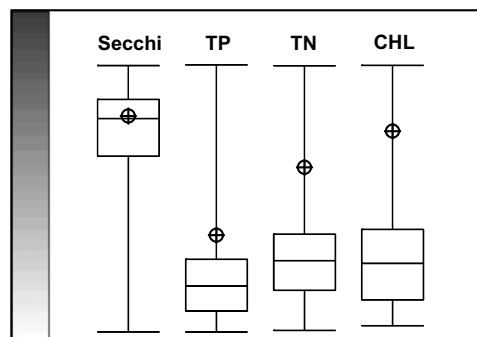
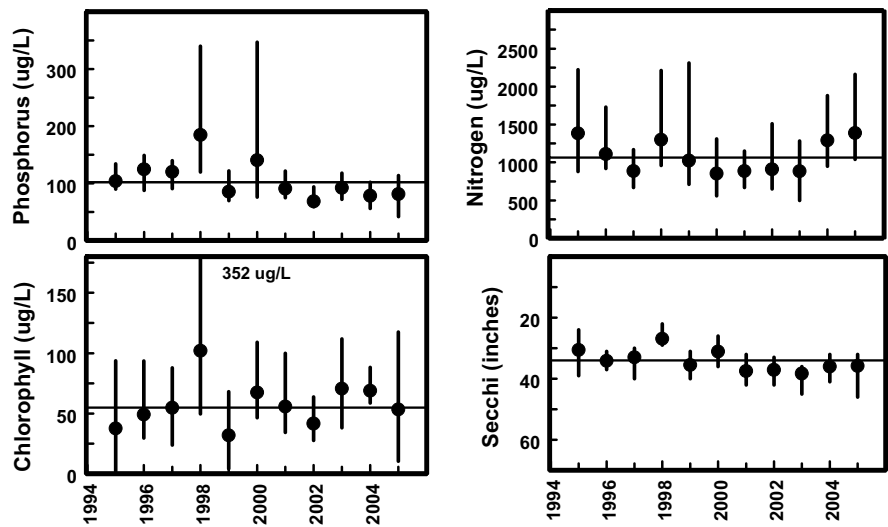


Table Rock, Site 13



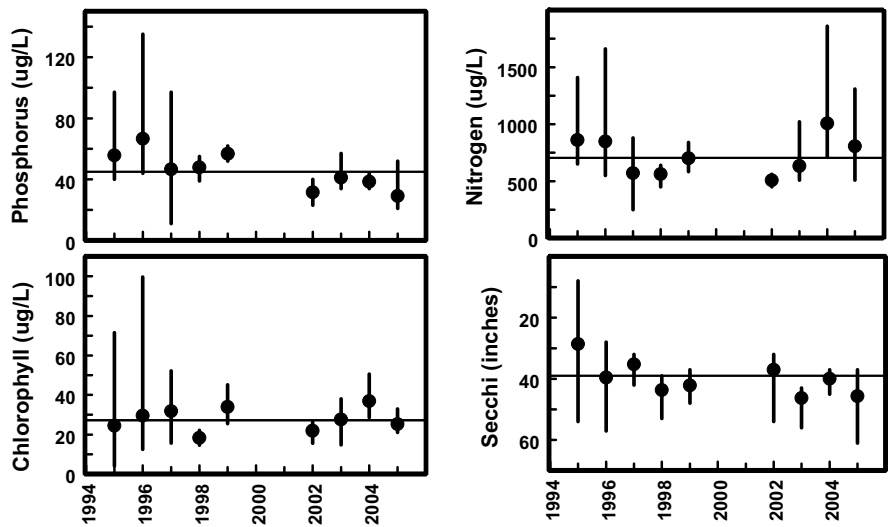
Conditions in the James River Arm of Table Rock Lake represent an extreme range. At site 4.5, the site closest to the White River Channel, nutrients, chlorophyll and Secchi rank among the best 25% of Missouri's lakes. However, at the upper end of the arm (Site 13) nutrients and chlorophyll concentrations are higher than over 75% of Missouri's lakes.

Table Rock Lake: James River Arm



Multi year trends at Table Rock Lake, Site 13

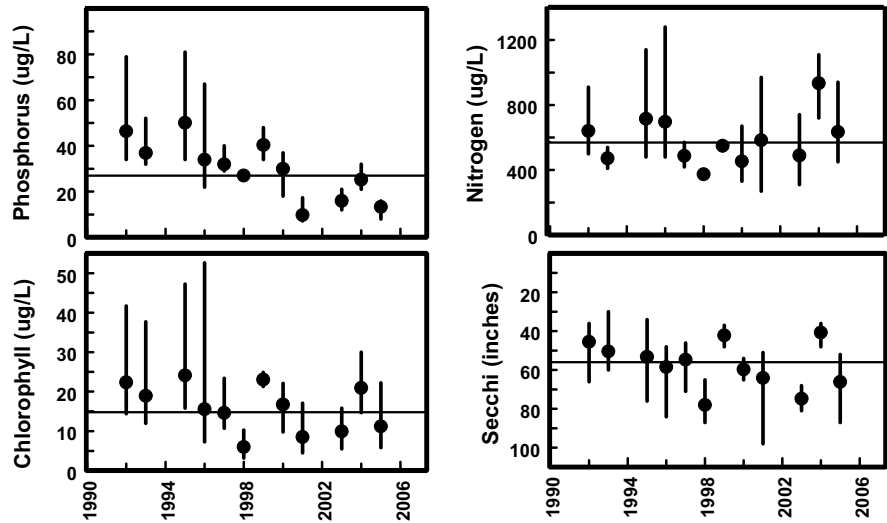
While nitrogen concentrations have been higher than average for the past two years, phosphorus concentrations have been lower than average for the past five years. Chlorophyll concentrations showed considerable variation in 2005, with the highest observation since 1998, and the lowest since 1999. Nevertheless, the average 2005 chlorophyll concentration matched the overall, long-term average for Site 13.



Multi year trends at Table Rock Lake, Site 11

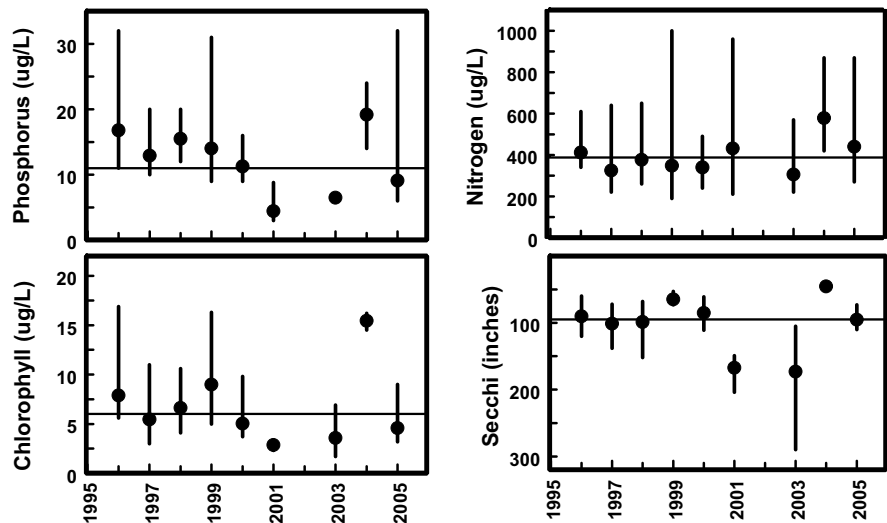
There are no obvious trends at Site 11, though phosphorus has been low for the past 4 years, relative to the overall average. Nitrogen concentrations in 2004 and 2005 were among the highest observed at Site 11.

Table Rock Lake: James River Arm



Multi year trends at Table Rock Lake, Site 5

Phosphorus concentrations have decreased at Site 5, with the greatest overall reduction appearing in 2001. The City of Springfield completed an upgrade to the Southwest Treatment Plant in 2001. This upgrade included phosphorus reduction, and explains the lower phosphorus concentrations observed in the James River Arm of Table Rock Lake.



Multi year trends at Table Rock Lake, Site 4.5

A single high phosphorus value in early June is responsible for the extreme phosphorus range observed in 2005. Aside from that value, phosphorus concentrations at Site 4.5 were considerably lower than the overall mean.

Table Rock Lake: King's River Arm

Descriptive statistics from the King's River Arm of Table Rock Lake - 2005

Parameters		King's River		
		7	6.5	Viola
Secchi Transparency (inches)	Mean	30	63	91
	Minimum	22	54	86
	Maximum	50	79	96
Phosphorus (ug/L)	Mean	48	19	
	Minimum	29	14	
	Maximum	82	26	
Nitrogen (ug/L)	Mean	479	318	
	Minimum	170	250	
	Maximum	870	460	
Chlorophyll (ug/L)	Mean	31.2	10.8	
	Minimum	14.5	6.1	
	Maximum	74.5	21.2	

Secchi transparency is measured at three sites in the King's River Arm of Table Rock Lake. The other parameters are measured at two sites (6.5 and 7).

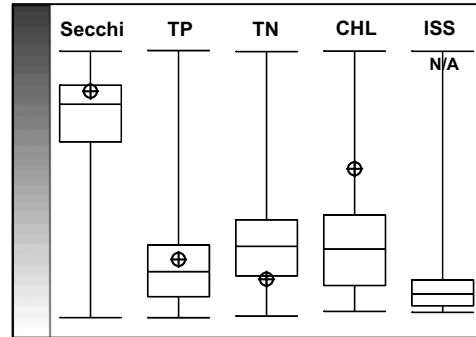
The mean Secchi transparency at Site 7 is only half that of Site 6.5 and only one third of the observed value at the Viola Access. This "longitudinal" gradient is typical of reservoirs.

Nutrient and chlorophyll concentrations show a similar gradient from Site 7 to Site 6.5, with concentrations being higher up-lake than down.

Table Rock Lake: King's River Arm Relative Rank

Table Rock Lake Sites 6.5 and 7 are only 4 miles apart, however, water quality conditions differ considerably between the sites. The up-lake Site 7 has more algae than 75% of Missouri's lakes. Phosphorus concentrations are high also, well above the median observed in Missouri. Likewise, Secchi transparency is low. Nitrogen concentrations are low for a Missouri lake, however.

Table Rock, Site 7



Site 6.5, 4 miles down-lake from Site 7, has only slightly less nitrogen than Site 7, but has less than half of the phosphorus. Nutrient concentrations are lower and Secchi greater than 75% of Missouri's lakes. Chlorophyll concentrations at Site 6.5 are typical of a Missouri lake.

Table Rock, Site 6.5

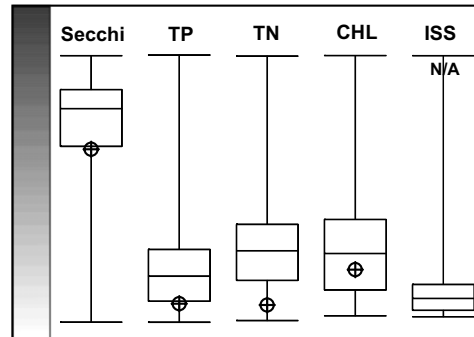
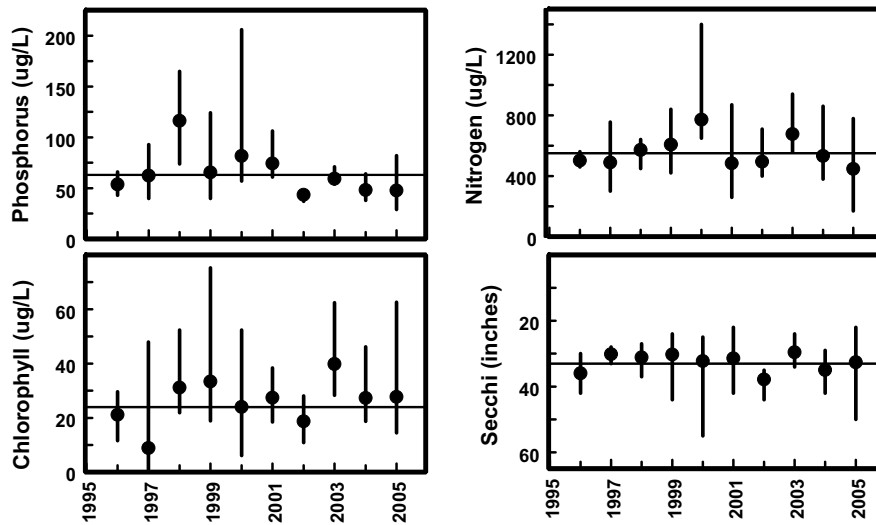
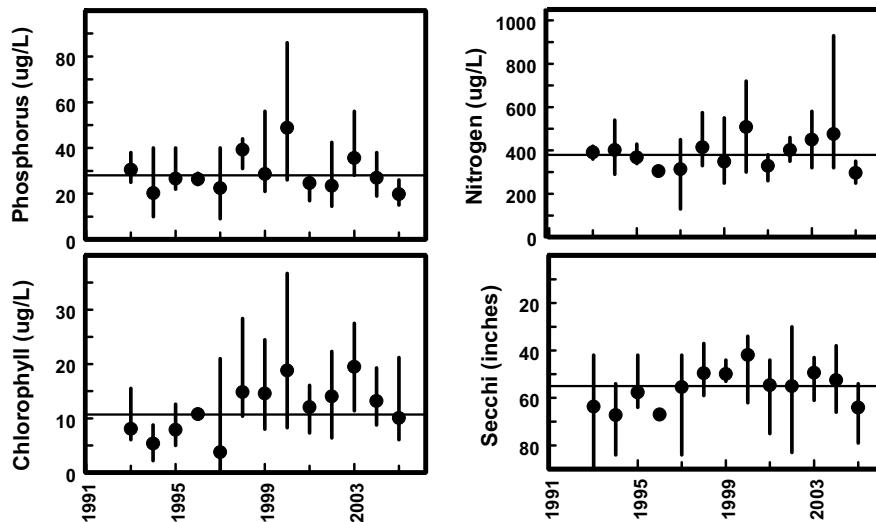


Table Rock Lake: Kings River Arm



Multi year trends at Table Rock Lake, Site 7

Phosphorus concentrations at Site 7 have been below the overall site average since 2002. However, chlorophyll concentrations have been above the mean for the last 3 years. In 2005, Secchi displayed higher within-year variability than any year since 2000.



Multi year trends at Table Rock Lake, Site 6.5

Though the 2005 phosphorus and nitrogen concentrations were among the lowest observed at Site 6.5, the chlorophyll concentrations displayed a considerable amount of variability. Nevertheless, the Secchi transparencies observed at Site 6.5 in 2005 were higher than the long-term average for this site.

Table Rock Lake: Tributary Sites

Descriptive statistics from other tributary sites on Table Rock Lake - 2005

Parameters		Indian	Long	Flat	Roaring
		Creek	Creek	Creek	River
		9	8	12	16
Secchi Transparency (inches)	Mean	116	31	50	40
	Minimum	86	21	33	38
	Maximum	166	40	94	44
Phosphorus (ug/L)	Mean	7	25	32	34
	Minimum	5	4	13	18
	Maximum	9	42	77	51
Nitrogen (ug/L)	Mean	466	672	963	701
	Minimum	240	340	570	159
	Maximum	630	1390	1470	1300
Chlorophyll (ug/L)	Mean	3.7	29.9	9.3	11.6
	Minimum	1.8	13.7	0.8	1.4
	Maximum	9.7	85.1	64.1	24.8

The Indian Creek, Long Creek, Flat Creek and Roaring River arms were all sampled during 2005.

Of the tributary sites sampled, Indian Creek had the highest mean Secchi transparency, comparable to the main lake. 2005 mean phosphorus and chlorophyll concentrations were also comparable to the main lake.

The Long Creek arm had low clarity and very high chlorophyll concentrations.

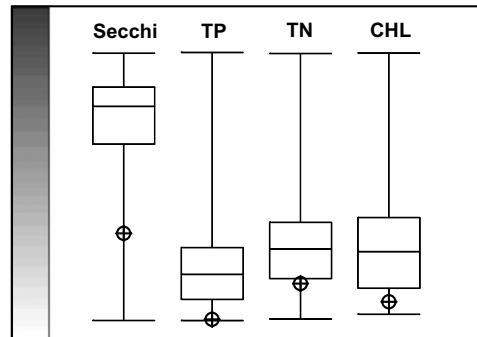
The Flat Creek arm had higher clarity and lower mean concentrations of chlorophyll than the nearby sites on the James River arm (Sites 11 and 13), but exhibited high variability.

The Roaring River site had mean nutrient, chlorophyll and Secchi values similar to Flat Creek, though the variability was considerably less.

Table Rock Lake: Tributary Sites Relative Rank

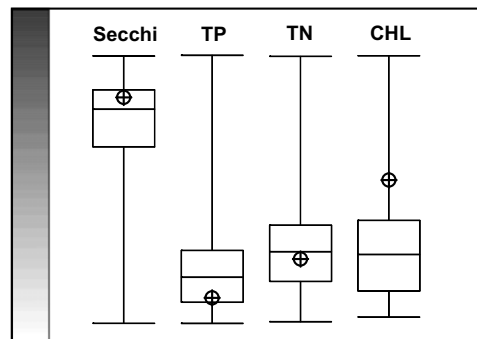
The Indian Creek site (9) had nutrient and chlorophyll concentrations lower (and Secchi transparency values higher) than observed in 75% of Missouri's lakes.

Table Rock, Site 9



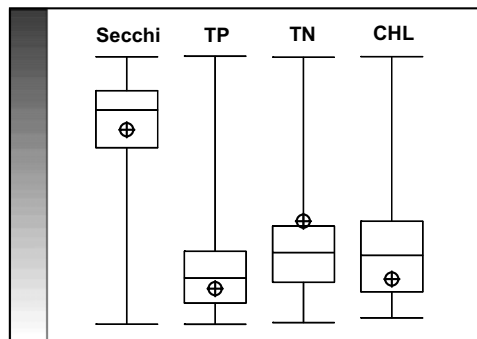
The Long Creek site (8) had water clarity (Secchi) values lower than most Missouri lakes, likely due to the high chlorophyll concentrations.

Table Rock, Site 8



The Flat Creek site (12) had phosphorus and chlorophyll concentrations lower than (and Secchi transparency values higher than) most Missouri lakes. Surprisingly, nitrogen concentrations were higher than observed in 75% of Missouri lakes.

Table Rock, Site 12



Average conditions at the Roaring River site (16) were slightly lower than statewide medians for all parameters.

Table Rock, Site 16

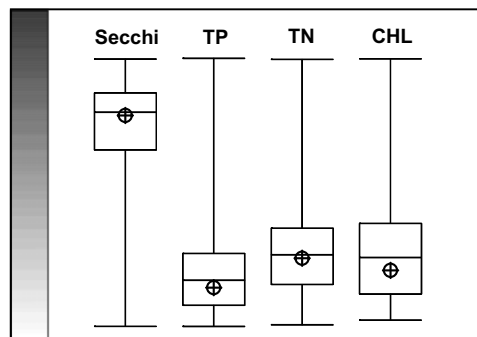
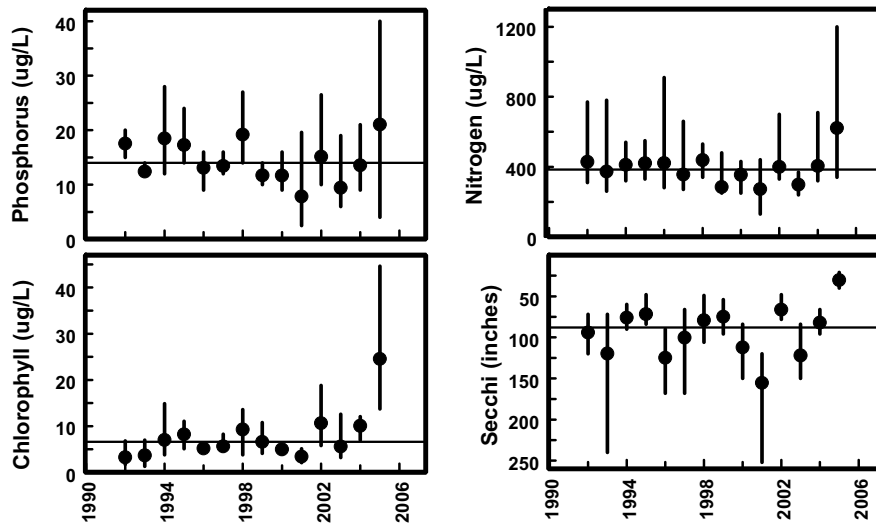
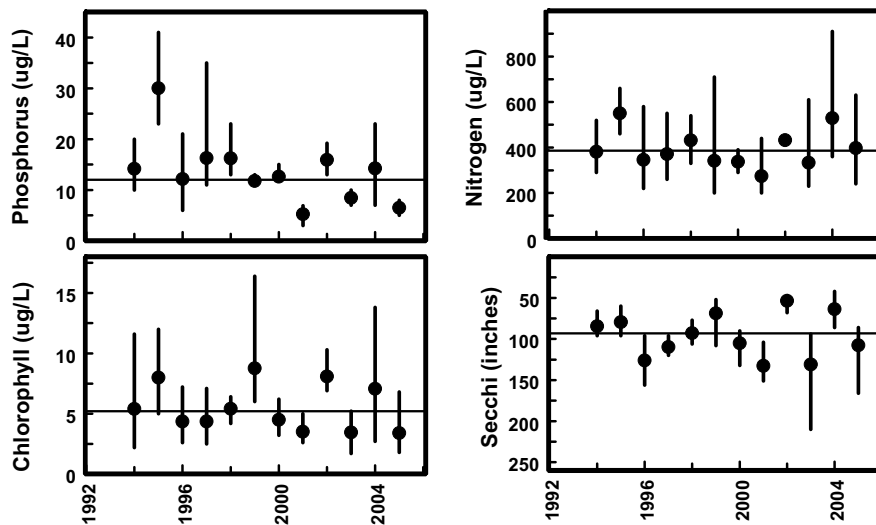


Table Rock Lake: Tributary Sites



Multi year trends at Table Rock Lake, Site 8

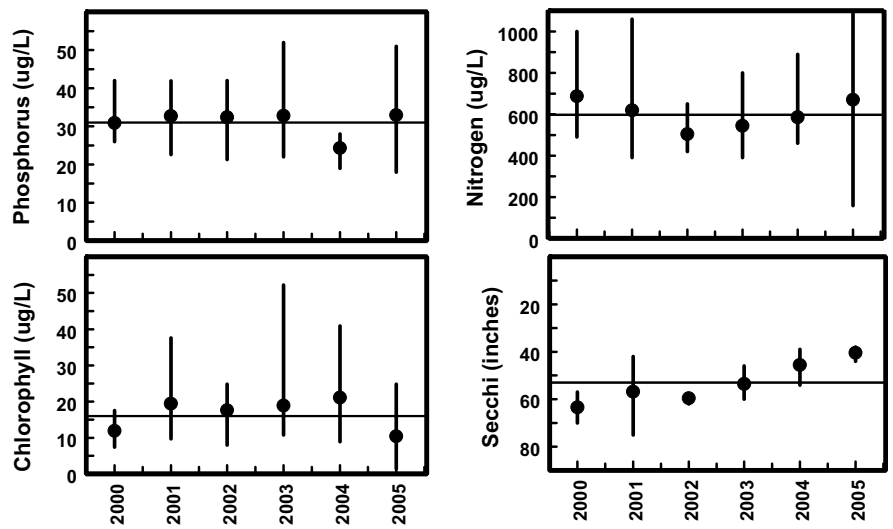
New volunteers began sampling Site 8 (Long Creek) in 2005. It is possible the site was moved, and this will be double checked. If the site has not moved, water quality appears to have degraded considerably. Nutrient and chlorophyll concentrations were much higher in 2005 than previously observed, and Secchi transparency was much lower.



Multi year trends at Table Rock Lake, Site 9

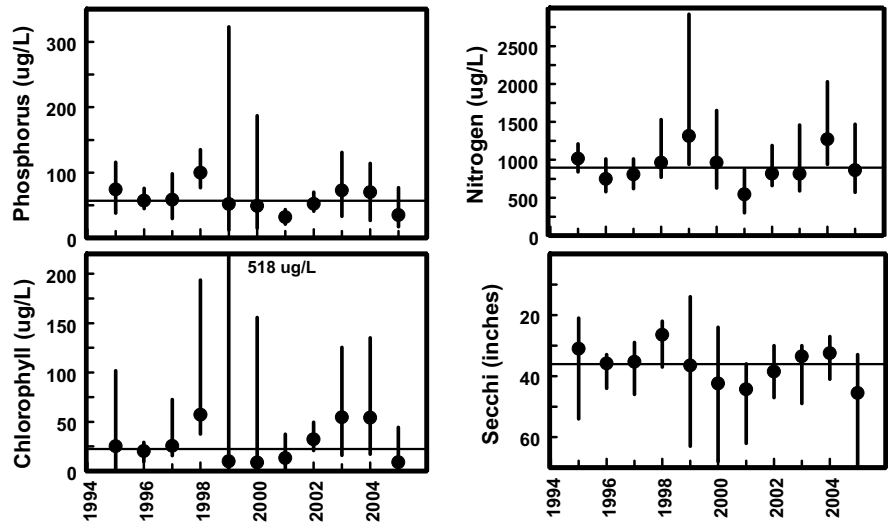
Phosphorus and chlorophyll concentrations at Indian Creek in 2005 were among the lowest observed to date. Nitrogen concentrations were typical, and Secchi was just above average.

Table Rock Lake: Tributary Sites



Multi year trends at Table Rock Lake, Site 16

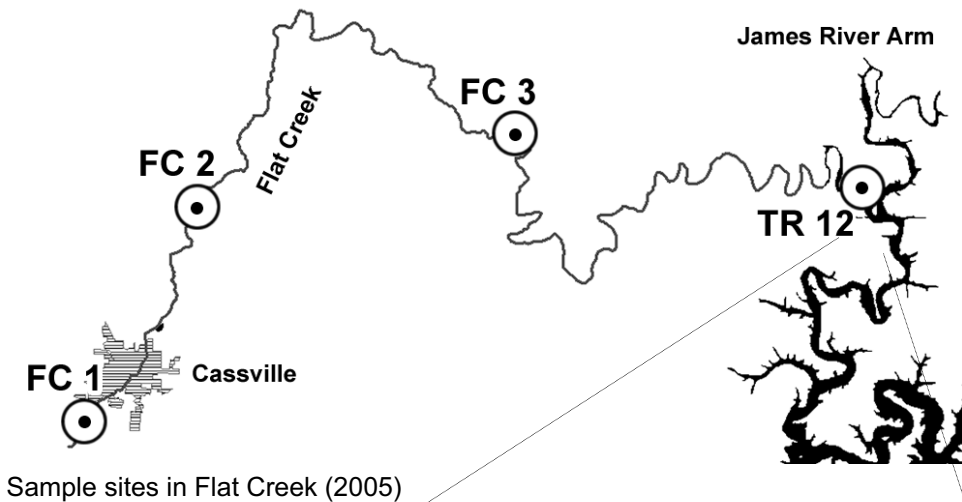
For the third consecutive year, Secchi has decreased at the Roaring River site. Phosphorus and chlorophyll concentrations haven't shown an increase, so algae is probably not to blame. It's possible that the sediment inflow has been higher in recent years.



Multi year trends at Table Rock Lake, Site 12

The site at Flat Creek has shown incredible variability in its chlorophyll concentrations. These are usually due to one or two high values within each season. 2005 had no outrageous peaks in chlorophyll concentration. On the contrary, 2005 appears to have been a rather good year for water quality in Flat Creek with record high Secchi measurements and below average concentrations of chlorophyll and phosphorus.

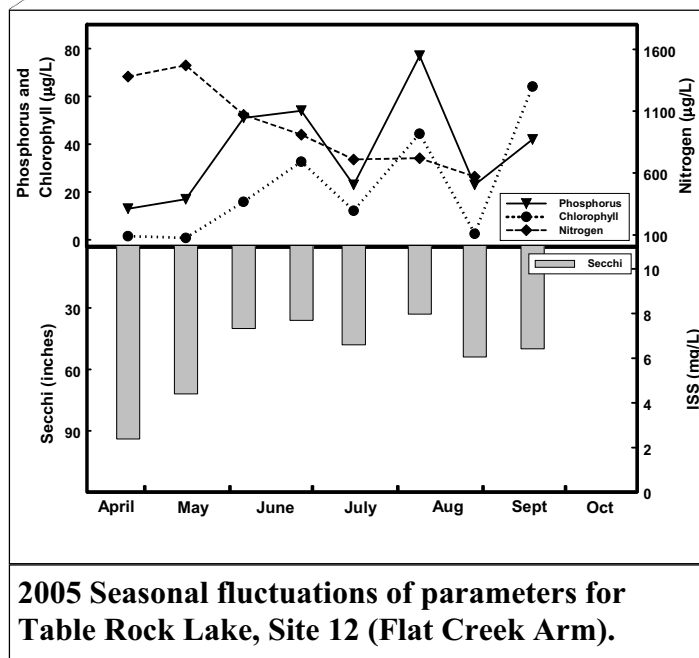
Table Rock Lake: Flat Creek



2005 was the second year of gathering samples from within Flat Creek to determine the source of extreme chlorophyll variability observed at Table Rock Lake Site 12.

Due to the different types of algae found in streams versus lakes, chlorophyll was not measured at these sites. Only nutrients and suspended sediments were monitored.

Groundwater often has high nitrogen concentrations. The sample from Flat Creek Site 1 (FC1), which is near a spring, has the highest nitrogen concentrations of any Flat Creek site. The concentrations decrease with distance away from the site.

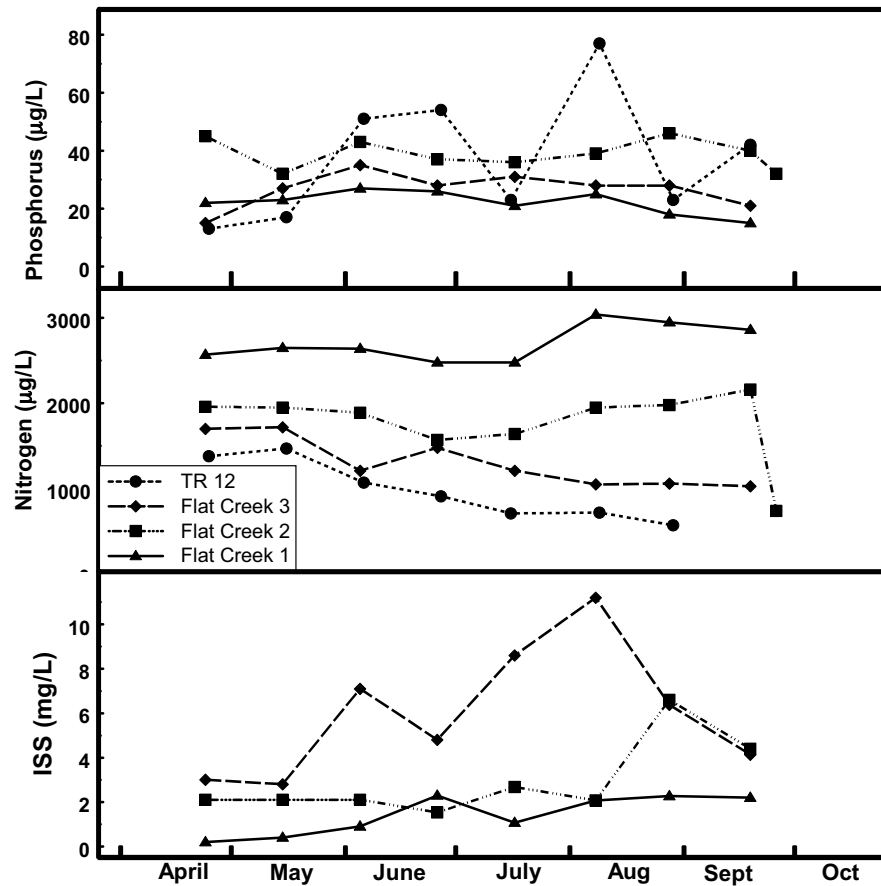


Phosphorus concentrations are higher at FC2, which is downstream from the city of Cassville, and at TR12 than at either FC1 or FC3. This was true last year as well, implying that phosphorus is entering Flat Creek between FC1 and FC2 and between FC3 and TR12.

This is last year that LMVP volunteers will be gathering samples throughout Flat Creek.

Table Rock Lake: Flat Creek

Seasonal variation at sites in Flat Creek and the Flat Creek Arm of Table Rock Lake



Descriptive Statistics for sites in Flat Creek and the Flat Creek Arm of Table Rock Lake

Parameters		FC1	FC2	FC3	TR12
Phosphorus (ug/L)	Mean	22	39	26	32
	Minimum	15	32	15	13
	Maximum	27	46	35	77
Nitrogen (ug/L)	Mean	2701	1694	1281	963
	Minimum	2480	740	1030	570
	Maximum	3040	2160	1720	1470
ISS (mg/L)	Mean	1.1	2.6	5.4	
	Minimum	0.2	1.5	2.8	
	Maximum	2.3	6.6	11.2	