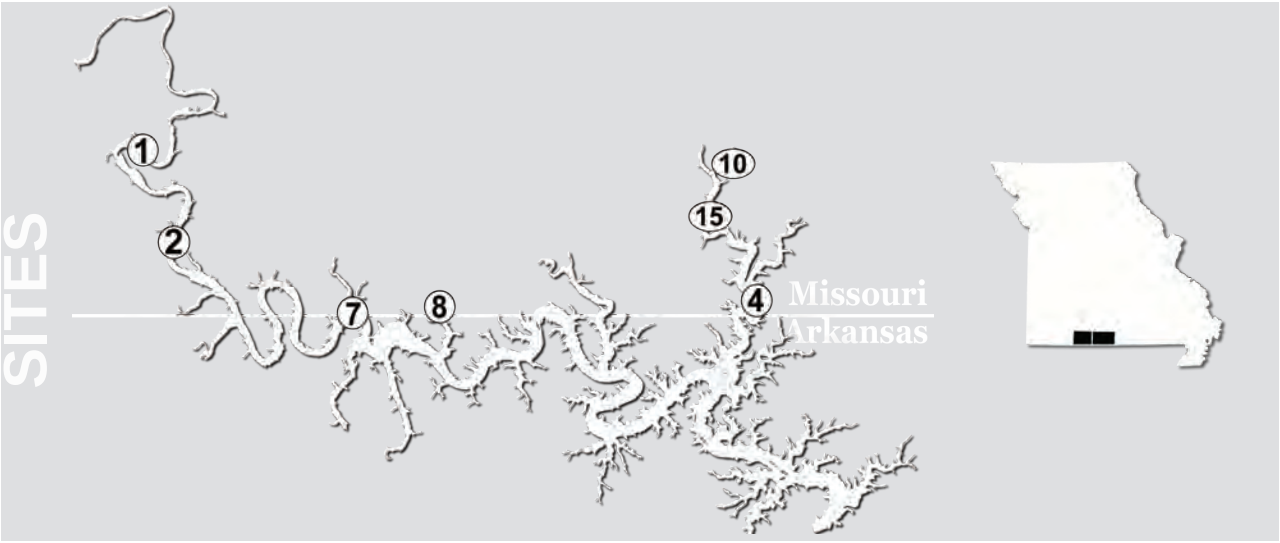
Bull Shoals Lake

Taney County and Ozark County



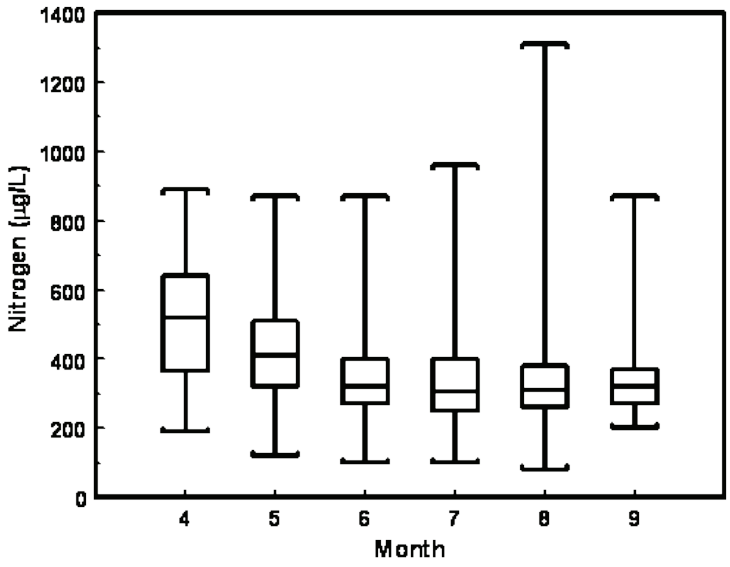
Seasonal Analysis

Nutrient concentrations in the main lake sites (1, 2, & 7) and Site 8 (located in a tributary of the main lake) all displayed similar patterns during the 2010 season. Nitrogen levels were highest during the early part of the season, then decreased by around 50% and remained stable during the second half of the sample season. Nitrogen concentrations were similar at all four sites. In comparison, phosphorus values were fairly stable across the whole sample season at the four sites. There was slightly more phosphorus at Site 1 than the other three sites, though the difference was minimal. Chlorophyll values showed a little more variability than phosphorus, but generally tracked phosphorus concentrations. While chlorophyll values at the four sites did not differ greatly, there were substantial differences in maximum water clarity readings. Minimum Secchi readings were similar for the sites, but sites 1 and 2 only ranged about 33 inches of clarity. Site 8 ranged by 99 inches while Site 7 had almost twice that range at 179 inches.

		Main Channel			Shoal Creek	North Fork Arm		
	SITE	**1**	**2**	**7**	**8**	**10**	**15**	**4**
	Number of Samples	5	5	8	8	8	8	7
Secchi (inches)	Mean	80	96	141	111	63	100	141
	Minimum	62	74	85	81	42	69	96
	Maximum	96	106	264	180	160	200	210
TP (µg/L)	Mean	14	11	9	10	24	13	7
	Minimum	12	9	7	7	14	8	5
	Maximum	17	13	11	13	40	23	13
TN (µg/L)	Mean	377	350	381	354	598	397	407
	Minimum	290	260	260	260	370	290	250
	Maximum	610	680	660	620	870	570	660
CHL (µg/L)	Mean	5.9	5.0	3.5	4.2	9.8	5.9	2.9
	Minimum	4.1	3.0	1.8	2.0	6.6	3.1	1.5
	Maximum	11.3	6.4	7.4	8.2	16.4	11.3	5.0

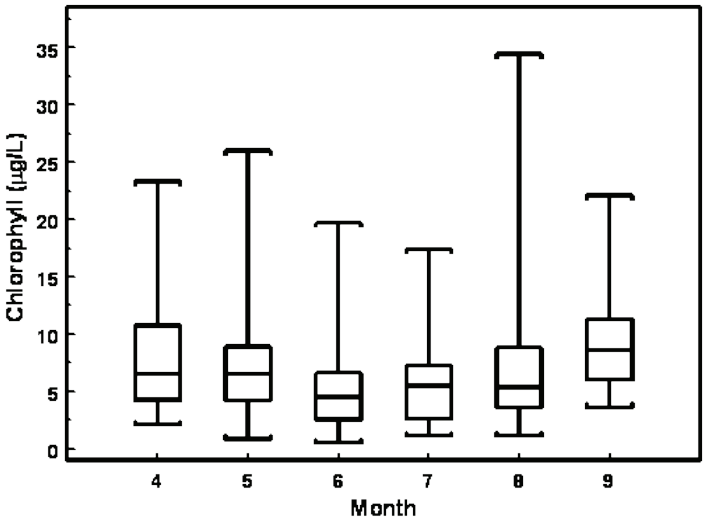
Seasonal Analysis (continued)

The three sites (10, 15 and 4) located within the Little North Fork River Arm of Bull Shoals Lake display the expected longitudinal gradient. Phosphorus and algal chlorophyll concentrations decrease as the site location moves down the tributary arm towards the main lake. In response to the lower chlorophyll levels, we find substantially clearer water at Site 4. While nitrogen levels were highest at the up-lake site, concentrations at the two lower sites were for the most part equal.



When nitrogen values from all years and all sites are grouped by month of sample collection and graphed using box plots we find a seasonal trend. The tendency is for higher nitrogen values in April, a decrease through May, and fairly stable conditions through the remainder of the sample season. [Compare the boxes, which represent the middle 50% of data and the bars within the boxes which are the median values.] The median nitrogen value for samples collected in April was 520µg/L, 410µg/L in May, and between 305 and 320µg/L in the other months. In contrast, phosphorus values did not show any seasonal trend, with monthly median values differing by only 3µg/L.

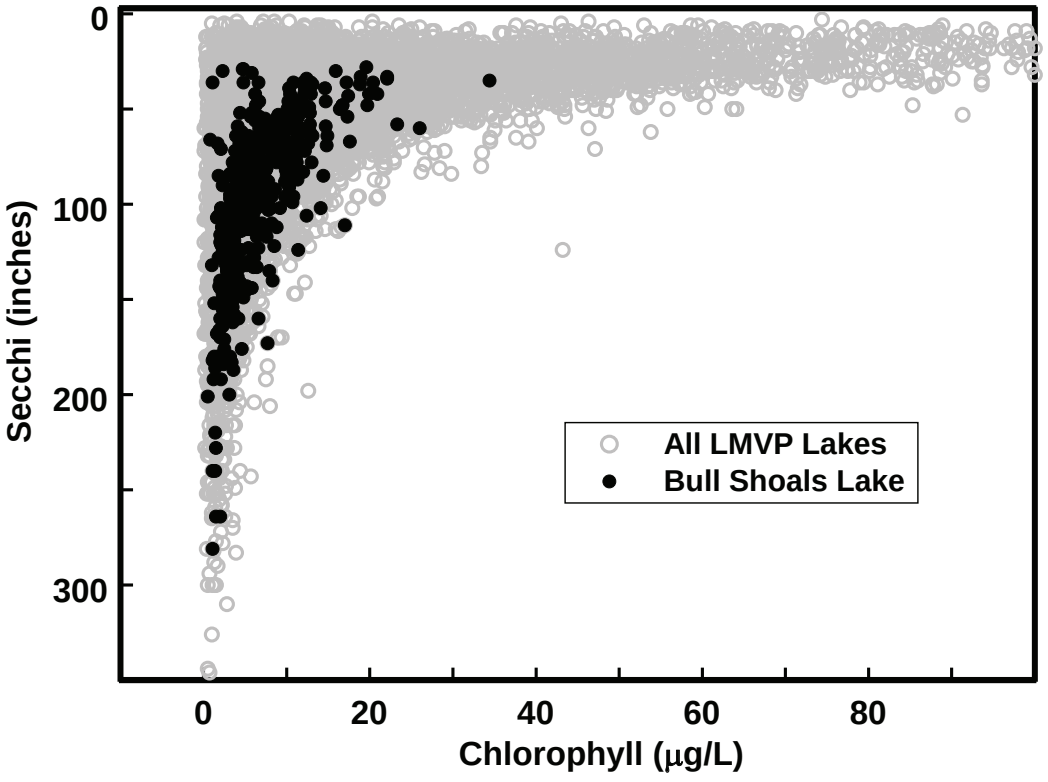
Chlorophyll concentrations were generally lowest in June (median of 4.5µg/L) and highest in September (median of 8.6µg/L), though the overlap in the boxes indicate differences were nominal. The other months of the sampling season tended to have intermediate chlorophyll levels. Because the fluctuations in algal chlorophyll across the season do not reflect changes in nutrients, another factor such as grazing by zooplankton may explain the slight suppression of algal chlorophyll in June.



Seasonal Analysis (continued)

When individual chlorophyll values are plotted against their corresponding Secchi readings from all LMVP lakes we find a non-linear relationship. Water clarity decreases dramatically as chlorophyll concentrations increase from near zero to about 7µg/L. After this point there is still a decrease in clarity as chlorophyll increases, but at a much slower rate. As chlorophyll levels approach 15µg/L the relationship flattens out with little change in Secchi transparency across a wide range of chlorophyll concentrations.

The majority of data from Bull Shoals Lake is located on the vertical portion of the relationship, where chlorophyll concentrations are low and water clarity high. Most of the data points that do fall into the flattened portion of the relationship are from sites 10 and 1. These two sites tend to have higher phosphorus concentrations than the other Bull Shoals sites, which translates to more algal growth and lower water clarity (note the samples from Site 1 that fall into the flattened portion of the Secchi-Chlorophyll relation were collected in the 1990s, before phosphorus reductions occurred).

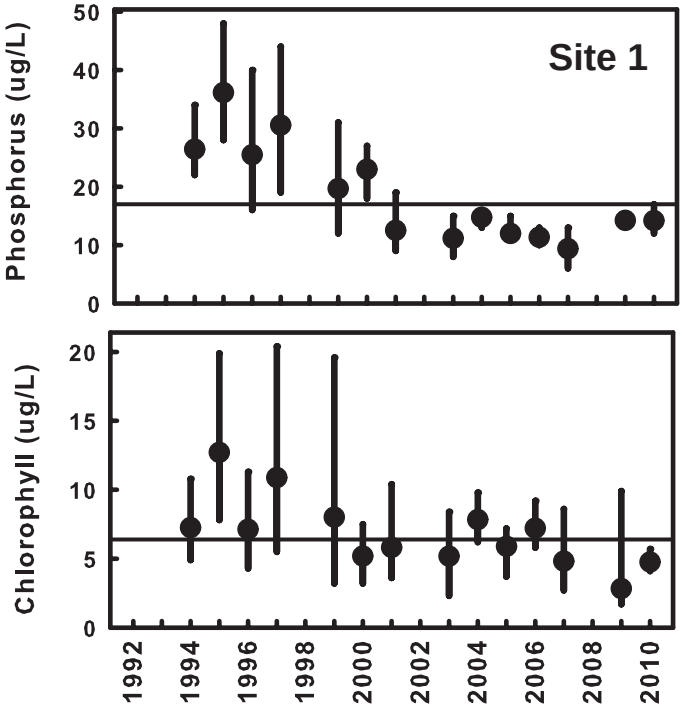


Bull Shoals Lake

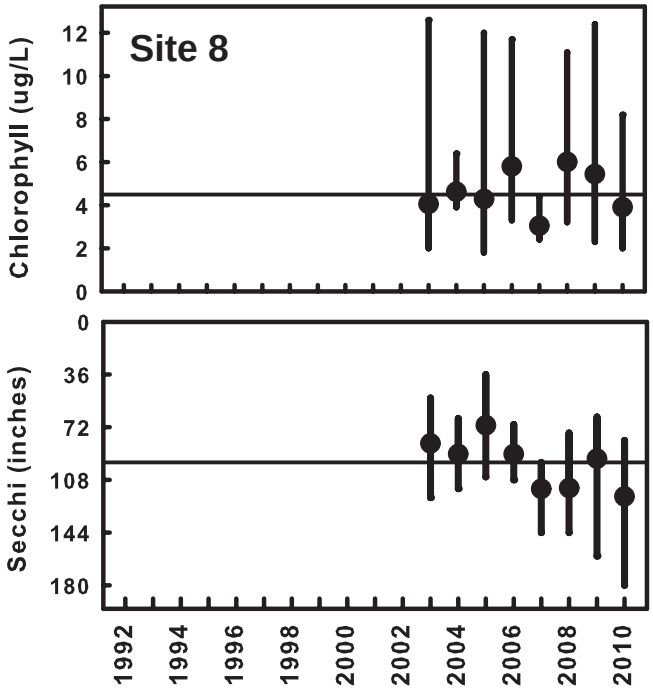
Main Lake Trend Data

Bull Shoals Trends

The long-term trend for phosphorus at Site 1 has been a decline through the 1990s, with low and stable values over the last decade. These lower phosphorus values reflect reductions in phosphorus inputs into Lake Taneycomo and Table Rock Lake, both located upstream. The algal chlorophyll concentrations have mimicked the phosphorus in terms of trends.



At Site 8 we have seen deeper Secchi transparency readings during the last four years. Three of the summertime mean values have been below the long-term average, and maximum Secchi readings have been deeper than previously measured. Algal chlorophyll values have not been consistently lower during these past four years, suggesting that improvements in water clarity may relate to a decline in suspended sediment at this site.



Bull Shoals Lake

Bull Shoals Trends

The same pattern (but over the last three years) of improved water clarity without a decrease in algal chlorophyll has been measured at the two upper most sites (10 and 15) in the Little North Fork River Arm. Again, these improvements in clarity do not seem to reflect shifts in algal chlorophyll concentrations. Improved clarity is the result of lower levels of suspended sediment or a shift in the algal community at these sites. If the algal community has shifted to species with larger bodies it is possible that the chlorophyll concentrations would remain the same, while clarity would improve (many smaller algae would reduce clarity more than fewer large algae).