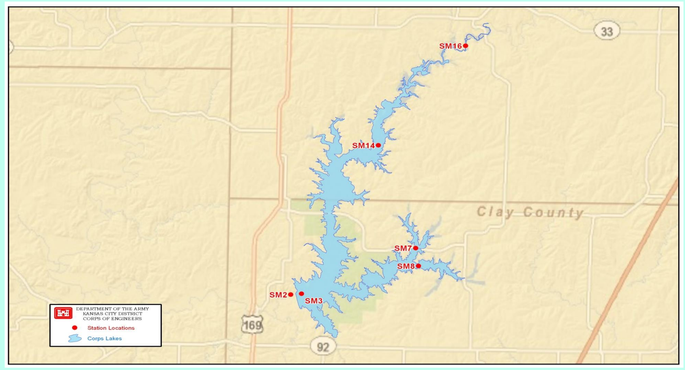
Smithville Lake Water Quality Summary

2005-2014

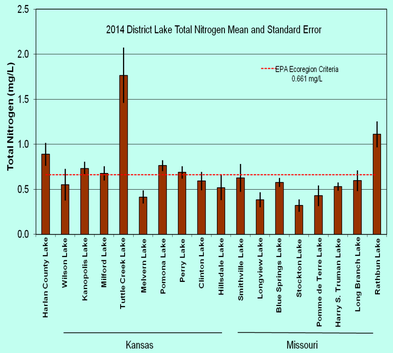


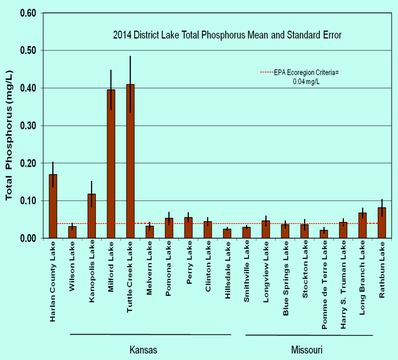
Smithville Lake

- Built on Little Platte River reaching full pool in 1982.
- **Watershed** = 213 square miles/ 136,320 Surface Acres (SA)
- **Capacity:** Flood Control: 101,777 Acre-feet (AF) / 9,990 SA
  - Multipurpose: 141,666 AF / 7,115 SA / 175 miles of shoreline
  - Avg. annual inflow (2005-2014)=110,126 AF; 2014 inflow= 96,012 AF
- **Operating project purposes**: flood control, water quality, recreation, fish and wildlife, and water supply.
- **Water Quality** at Smithville Lake in 2014 was beneficial to operating purposes listed with documented exception of dissolved oxygen levels measured below MO State WQ Standards for "Protection of Aquatic Life-AQL" at Sm-3 in August and September. This exception is attributed to biological processes not resulting from introduced contaminants as regulated in state code (**10 CSR 20-7.031).**

Nutrient Enrichment

Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor driving fish and aquatic plant growth rates and productivity. Excess nutrients from urban, agricultural or natural sources increases the natural aging process in lakes. This rapid aging process, called eutrophication, is responsible for changes in plant and aquatic life in lakes and water bodies including algal blooms, low dissolved oxygen that affect fish survival, and taste and odor issues in drinking water. In 2014, Smithville Lake was below the USACE Kansas City District lake averages for total phosphorus (0.094 mg/L) and averages for total nitrogen (0.68 mg/L). Smithville Lake average TP concentration was below the EPA Ecoregion recommended criteria and most of the lake can be classified at the low end of eutrophic range (i.e. 0.24-0.96 mg/L) as described by Carlson's trophic class system. The level of biological productivity and associated aquatic plant and algae production at Smithville has not resulted in any negative impacts associated with excessive nutrients. Standard error bars in the figures below illustrate the variation in sample results from each site in 2014.



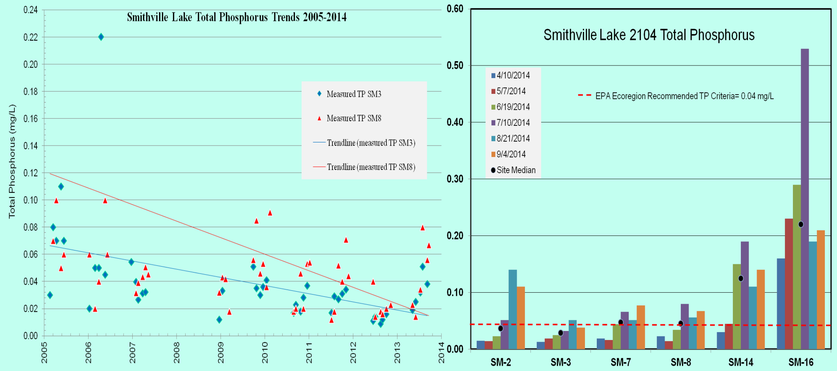


The US Army Corps of Engineers (USACE) Water Quality Program collects monthly water samples at Smithville Lake* from April through September. These figures present data collected between 2005-2014 from the inflow (#16), four lake sites (#3,7,8,14), and the outflow (#2) below the dam. Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. USACE uses this data to describe conditions and changes from the inflow streams, within the main lake, and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

*Note: The term "lake" is substituted for technically correct "reservoir" throughout this document for consistency.

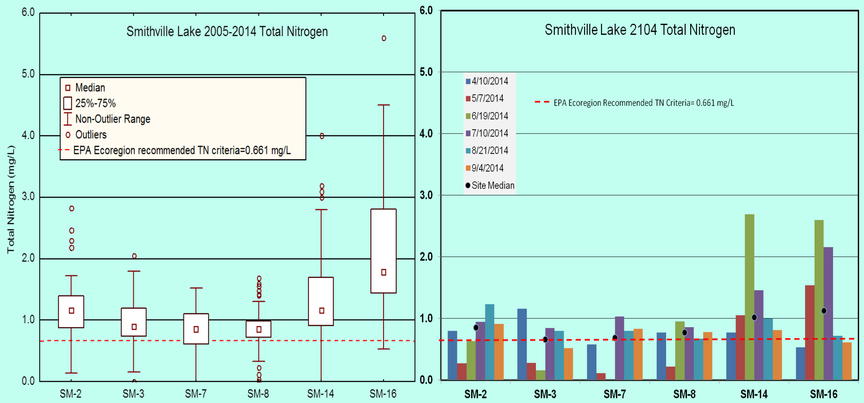
Total Phosphorus

Total phosphorus (TP) median concentrations from 2014 Smithville Lake samples were near EPA Ecoregion recommended criteria (0.04 mg/L) at lake sites SM-2, SM-3, SM-7, and SM-8. Higher TP concentrations and a wider range of data is usually found in the upper lake sites (SM-14) and inflows (SM-16) due to mobilized nutrients bound to silt particles in moving water and biological uptake or consumption of nutrients as the water flows through the lake. This process is apparent at Smithville Lake, but trend lines for smaller lake arms (SM-8) and lower lake sites (SM-3) show declines in total phosphorus from 2005-2014. Drought, reduced inflows, reduced internal loading, and watershed influences likely influence TP reductions. The Little Platte R. is the main contributor of phosphorus compared to Camp Branch and other creeks.



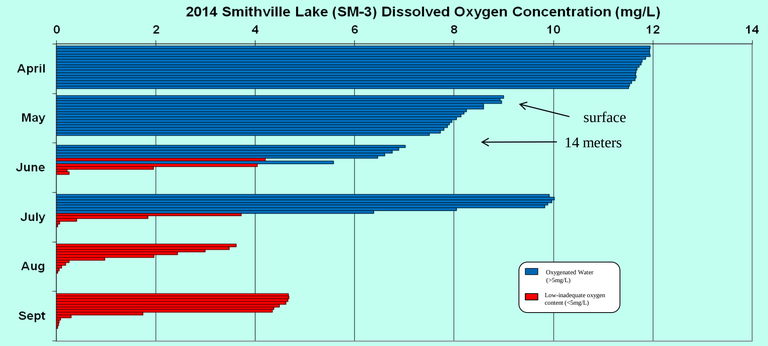
Total Nitrogen

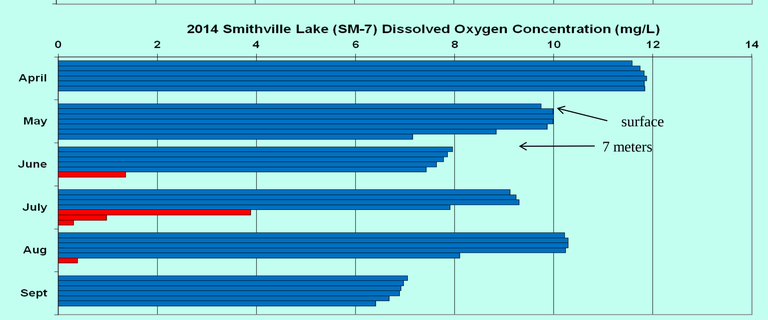
In 2014, median total nitrogen concentrations were very similar to 10-year trends at lake sites and the outflow. Total Nitrogen median values for 2014 at all sites were very near the EPA Ecoregion recommended criteria (0.661 mg/L) for lakes and slightly lower than 10-year median values. Total nitrogen concentrations are highly variable between sites and years and most related to inflows, conversion of nitrates and watershed factors (i.e. soils and farming practices).

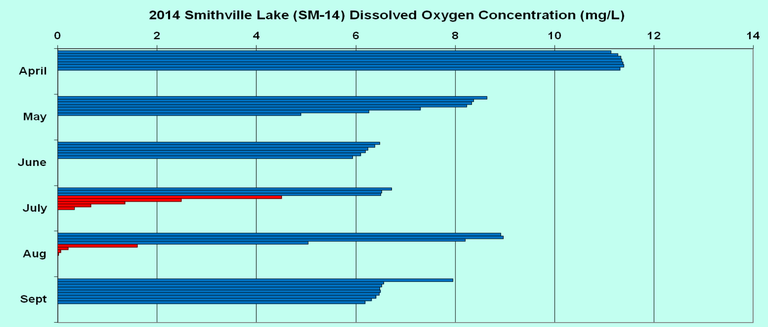


Dissolved Oxygen

Dissolved oxygen (D.O.) is an important factor in aquatic species location, growth, and ultimately survival in lakes. Smithville undergoes a process called stratification and developing layers based on temperature, oxygen and chemistry. The figure below shows dissolved oxygen measured in the water column in one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September. Smithville Lake typically stratifies during summer months and low dissolved oxygen (i.e. 5 mg/L or less as shown in red) can stress aquatic life including fish. During the stratified period of 2014, August and September had periods of low dissolved oxygen at the dam which is not typical for Smithville for more than one sample. The other 3 lakes sites had sufficient dissolved oxygen from the surface layer to 3-meters during all samples. Biological oxygen demand from high algae populations is the likely cause of the low D.O. No fish kills were reported during low dissolved oxygen conditions during any months.







Water Quality Concerns:

- Eutrophication-Low Dissolved Oxygen
- Nutrients
- Sediment inputs

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Kansas City, MO