A comparative assessment of the water quality of Claremore Lake, Oklahoma: Population growth and its effect on water quality

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I. SUMMARY

This study was conducted to determine the current water quality of Claremore Lake, the water reservoir for the city of Claremore, OK., and to compare past water quality data to the present to determine if any spatial or temporal changes have occurred. Claremore Lake serves as the main source of drinking water for the growing population of Claremore, OK. Use of the lake as a water supply will increase with the population, which has increased 30% from 1993, and is projected to increase another 30% by 2030.

We collected water samples from 13 sites over the lake for the months of April and May, 2014 for physical and chemical measurements, and the results were compared with past water quality data from April and May of 1993 and 1994 (U.S. EPA, 2010). We found that the pH recorded in 1993-94 was both slightly lower and more stable than that of the 2014 samples. The concentrations of Na^+ and Cl^- have more than doubled in the last 20 years while the concentrations of NO_3^- and PO_4^{3-} were below the detection limits. There was a 30% increase in total dissolved solids (TDS) concentrations over the years.

When compared with the US EPA standards for drinking water this reservoir still remains within the acceptable limits. However, we observed some changes in the water chemistry that are similar to the changes one would see as a result of increasing population and change in land use. This is significant because with the current growth rate of the city of Claremore, pollutants will most likely continue to make their way into the lake until the water becomes impaired.

II. SETTING

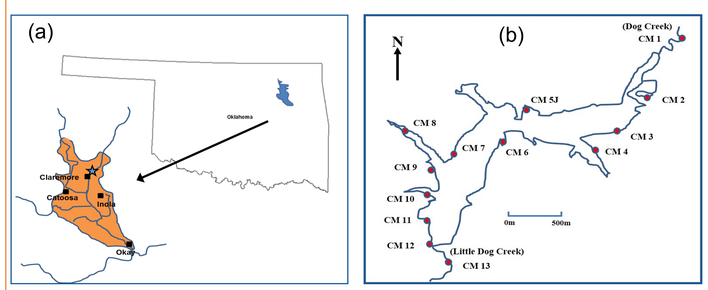

Figure 1: (a) Map of Oklahoma showing the Lower Verdigris Watershed, and the Lower Verdigris River Watershed with the location of Claremore Lake starred. (b) Map of the 13 sites we sampled.

III. METHODS

We conducted standard field measurements (pH, temperature, alkalinity, conductivity, TDS, and dissolved oxygen) and performed a laboratory analysis of anions (by ion chromatography) and cations (by Inductively Coupled Plasma-Optical Emission Spectrometry.

Figure 2. (a) Taking measurements with the Yellow Stone Instrument Multi-Parameter probe and (b) collecting samples and making measurements.

IV. RESULTS

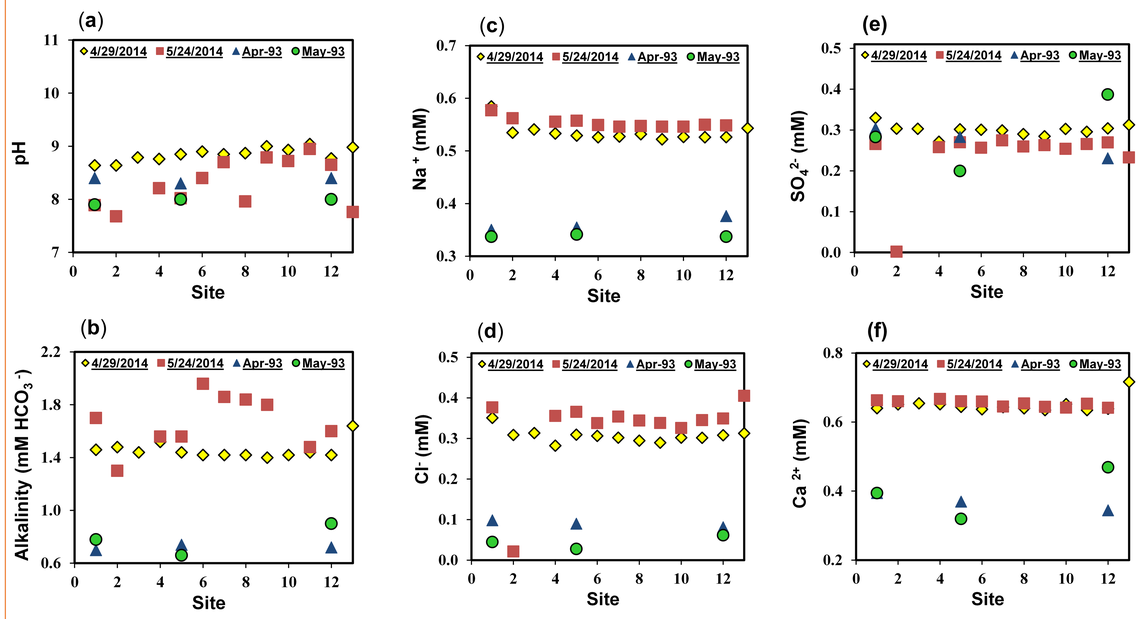

Figure 3: (a) The pH recorded in 1993-94 was both slightly lower and more stable than that of the 2014. (b) The alkalinity of samples taken in 2014 was significantly higher. The concentration of Na^+ (c) and Cl^- (d) has more than doubled in the last 20 years. (e) The concentration of SO_4^{2-} has slightly risen since 1993-94. (f) The concentration of Ca^{2+} has doubled.

V. DISCUSSION / CONCLUSION

- Relatively higher pH in 2014, compared to 1993-94, is due to a higher amount of photosynthetic activity.
- The alkalinity concentration mimics the pH due to the high amount of CO_2 in the lake, as a result of photosynthesis.
- The 30% increase in TDS concentrations could be due to the anthropogenic impacts of the population growth.
- The increases observed in the Cl^- and Na^+ concentrations could indicate an increasing use of road salt during the snowy months.
- The increase in alkalinity and TDS could be indicators of increases in the amount of untreated sewage inflow into the lake. If the population of Claremore, OK continues to grow, it is likely that the water quality could be compromised.

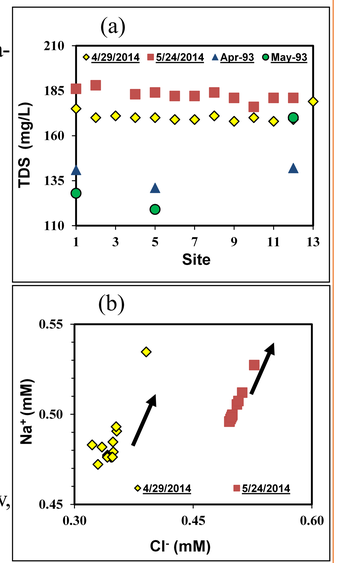

Figure 4: (a) Plot showing the overall increase in TDS across the lake. (b) Cross plot of Na^+ and Cl^- with increasing trends highlighted by the arrows.

REFERENCES

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