



Water Quality Studies On The Big Sunflower River And The Yazoo River In Mississippi.

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Abstract

The Mississippi Department of Environmental Quality has set regulations to protect water quality. Water quality standards were adopted by the State in 1995 for intrastate, interstate, and coastal waters. The policy was adopted to protect and upgrade lotic water quality within the state. This study was therefore conducted to find out if the Big Sunflower River and the Lower Yazoo River met the standard of fresh water bodies in Mississippi. Adverse water quality is usually indicated by such conditions as increased concentrations of metals and nutrients, decreased dissolved oxygen, and diverse changes in physical characteristics. During the period, September to December 1999, water samples were collected at different locations in three replicates from the Big Sunflower River in the area near the Delta National Forest in Sharkey County and the Lower Yazoo River in Redwood area, and the area near the Yazoo City Pumping Station MS. The samples collected were taken to the laboratory at Alcorn State University, and tested according to the methods of LaMotte water pollution and detection kits, and analyzed. For the Big Sunflower River, the parameters tested and the average readings recorded were: hardness (189 ppm), alkalinity (61.3ppm), pH (6.9), dissolved oxygen (6.8ppm), chromate (0.6 ppm), chloride (48.0ppm), and fluoride (0.3ppm). The average surface water temperature was 24.3° C. For the Yazoo River, the parameters tested and the average readings recorded were: alkalinity (110.6 ppm), pH (7.8), dissolved oxygen (9.1ppm), chromate (0 ppm), chloride (23.4ppm), fluoride (0.1ppm), and sulfate (0 ppm). The average surface water temperature was 15.90° C. Based on the water quality parameters tested, both the Big Sunflower River and the Lower Yazoo River met the Mississippi water quality standards with the exception of hardness and alkalinity for the first and alkalinity for the latter.

Keywords: Water, Quality, Alkalinity, Concentrations, Sunflower and Yazoo.

1.0 Introduction

The Big Sunflower River is a tributary of the Yazoo River and the Yazoo River empties into the Mississippi River (See Figures 1 and 2). The Mississippi Department of Environmental Quality has set regulations to protect the water. Water quality standards were adopted by the State in 1995 for intrastate, interstate, and coastal waters. The policy was adopted to protect and upgrade lotic (running) water quality within the state (MDEQ, 1995). Adverse water quality is usually indicated by such conditions as increased concentrations of metals and nutrients, decreased dissolved oxygen, high biochemical oxygen demand (BOD), and diverse changes in physical characteristics. Life on land, and in the lakes, rivers, and other freshwater habitats on earth is vitally dependant on renewable fresh water (Jackson *et al.*, 2001) – good quality fresh water!

Few bodies of water remain free of human contamination or pollution. Pollutants have drastically altered the ecology of many streams. Biological indicators, (e.g. Fecal coliform bacteria, “blooms” of blue green algae, sludge worms, (Tubificidae) diversity indices (the more polluted a body of water is the lower the diversity index), and bioassays, do not reveal the exact identity of pollutants. Therefore chemical and physical analyses of water need to be made in order to know them. (Brower *et al.*, 1998).

Acholonu *et al.* (1999) reported on benthic invertebrates of Lake Yazoo and Yazoo River. Benthic invertebrates form resident communities of individuals that move very little within a particular reach of a stream or lake throughout their lifetime in the water (Wells and Demas, 1979). It is said that the composition of these benthic organisms can be indicative of the hydrologic and *water - quality*

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conditions where they live (Mackenthum and Ingram, 1966). This revelation gave us the impetus to subsequently investigate the water quality of the Yazoo River after reporting on the benthic invertebrates and along with the Big Sunflower River. So, the purpose of this study was to determine the chemical contaminants in the Big Sunflower River and Lower Yazoo River and to find out if the two rivers met the water quality criteria for freshwater bodies in the State of Mississippi.

2.0 Materials and Methods

During the period, September to December 1999, water samples were collected at different locations about 50 meters apart and at depths of 1-4 meters

in three replicates from the Big Sunflower River in the area near the Delta National Forest in Sharkey County, MS (see Figures 3 - 6) about 82.1 km north of Vicksburg, MS. This was similarly carried out in the Lower Yazoo River in Redwood area, about 29 km north of Vicksburg and area near Yazoo City Pumping Station (see Figures 7-10). The samples were taken to the Alcorn State University laboratory, tested according to the procedures indicated in the LaMotte pollution test kits supplied by Carolina Biological Supply CO, NC, and analyzed.

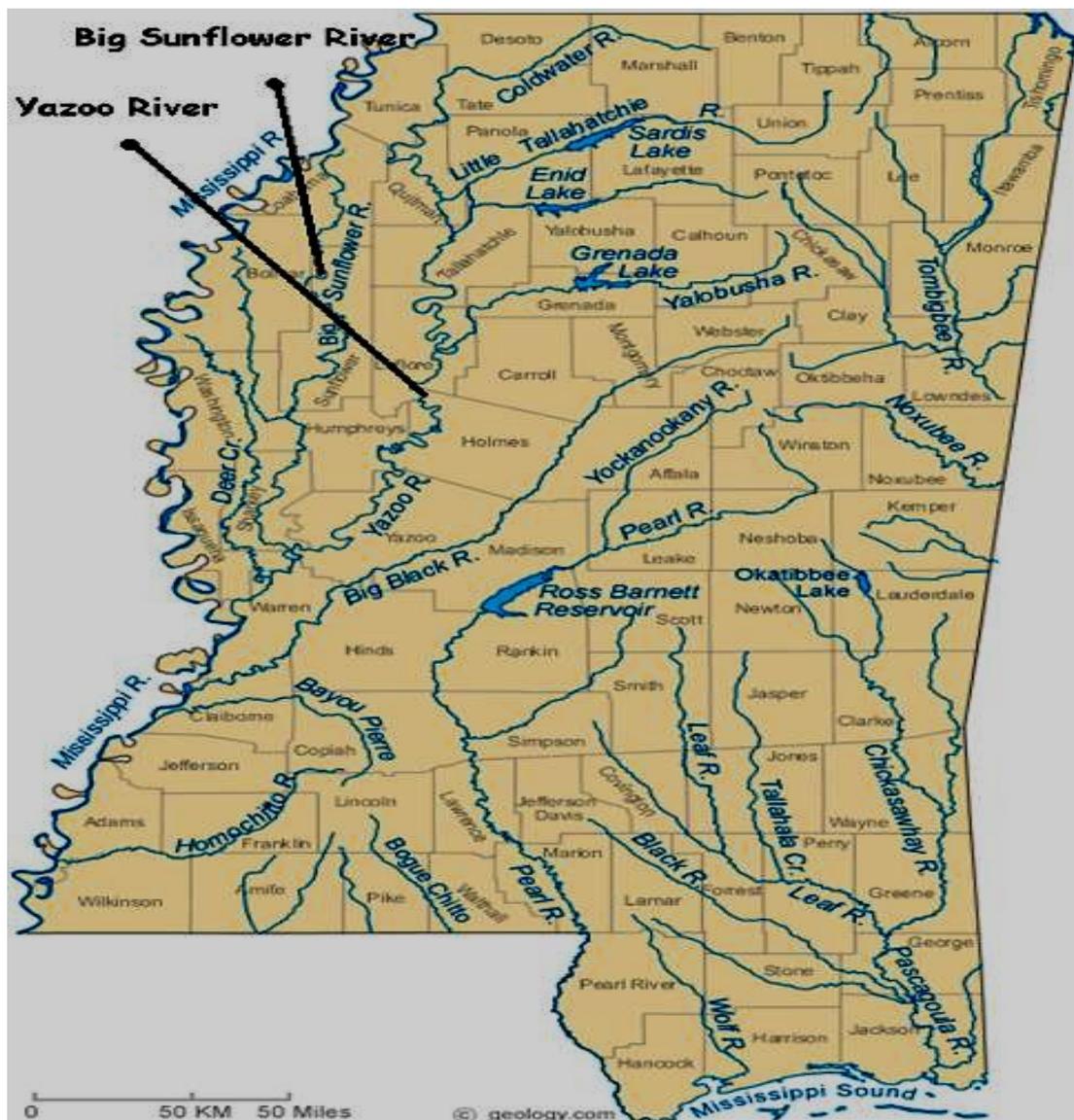


Figure 1: Map of Mississippi showing location of Big Sunflower River and Yazoo River (from geology.com)

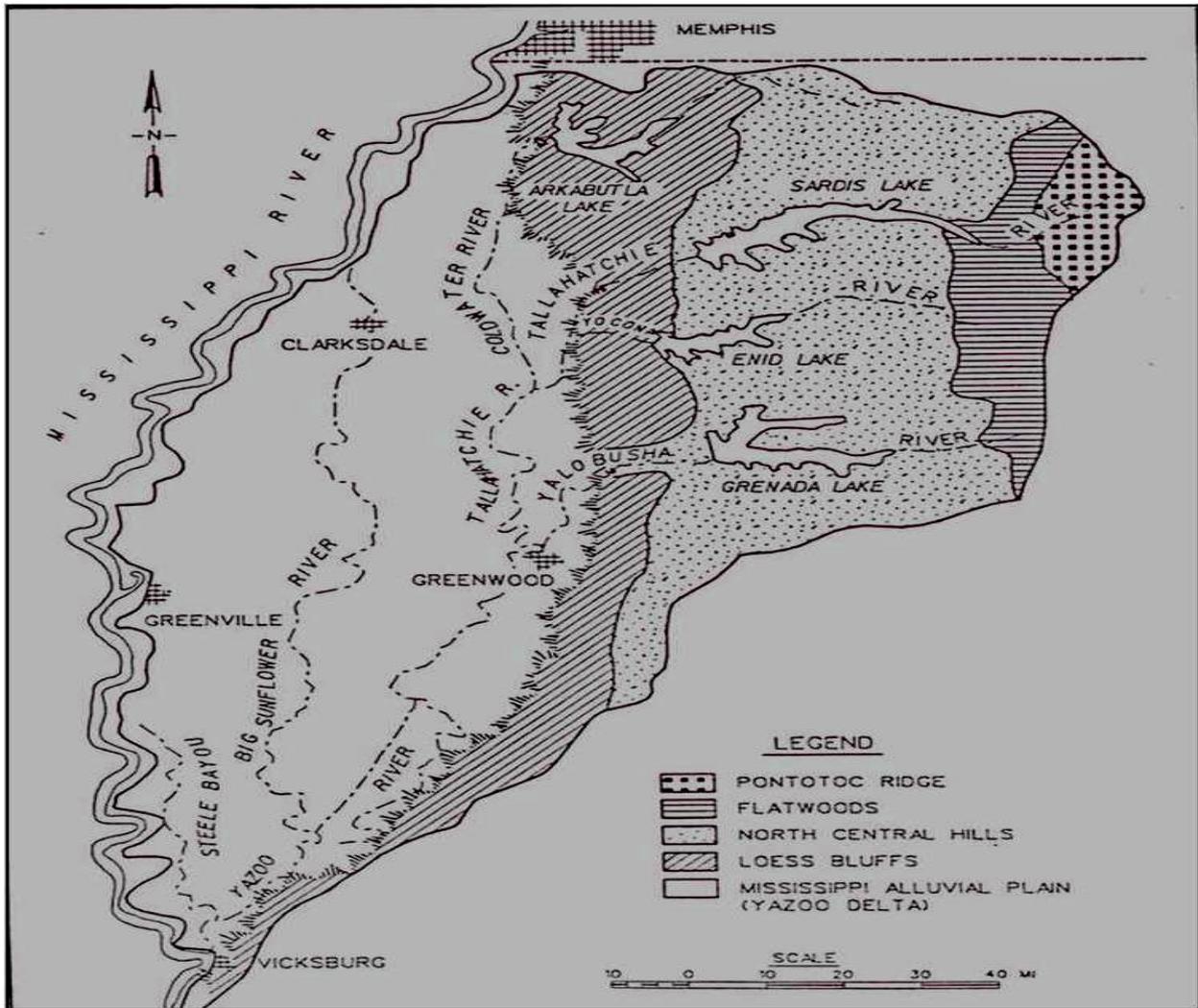


Figure 2: Yazoo River Basin showing the Big Sunflower River, Yazoo River, Mississippi River and location of Vicksburg, Mississippi.



Figure 3: Shows location of water collection in Big Sunflower River



Figure 4: A View of Big Sunflower River



Figure 5: A view of Big Sunflower River



Figure 6: Student participants in the study in a Big Sunflower River site



Figure 7: View showing location of collection of water samples in Yazoo River



Figure 8: Dr. Alex Acholonu showing students how to collect water samples at deeper depths.



Figure 9: Student collecting water sample (Yazoo River)



Figure 10: A view of Yazoo River in the area near Yazoo City Pumping Station

3.0 Results

Table 1 and Figure 11 show the parameters tested, average readings recorded for the Big Sunflower River and Lower Yazoo River in parts per million (ppm) and the Mississippi Water Quality Criteria (MSWQC) and/or Environmental Protection Agency (EPA) standards. They indicate that alkalinity was significantly higher in the Lower Yazoo River than the Big Sunflower River (110.6/61.3),

($p < 0.05$) and that dissolved oxygen (DO) and pH were slightly higher in the Yazoo River (9.1/6.8 ppm and 7.8/6.9 respectively) ($p > 0.05$). Conversely, chloride concentration and surface water temperature were significantly higher in the Big Sunflower River than in the Yazoo River (48.0/23.4 ppm and 24.3/15.9 °Celsius respectively; $p > 0.05$). Water hardness was significantly higher than the MSWQC/EPA Standards (189/50 ppm ($p < 0.05$)).

Table 1: Parameters Tested, Average Readings For Big Sunflower River And Yazoo River In ppm And MSWQC/EPAS Standards

Parameters	Average Readings for Big Sunflower	Average Readings For Yazoo River	MSWQC/EPA Standards
Alkalinity	61.3*	110.6*	3.08
Chloride	48.0	23.4	230
Chromate	0.6	0.0	0.5
Dissolved Oxygen	6.8	9.1	4-5
Hardness	189*	NA	50
Fluoride	0.3	0.1	1.2
pH	6.9	7.8	6.5
Sulfate	NA	0.0	250
Surface Water Temperature	24.3C	15.9C	Not to exceed 32.2C

MSWQC= Mississippi Water Quality Criteria
NA= Not available; not done

EPA = Environmental Protection Agency

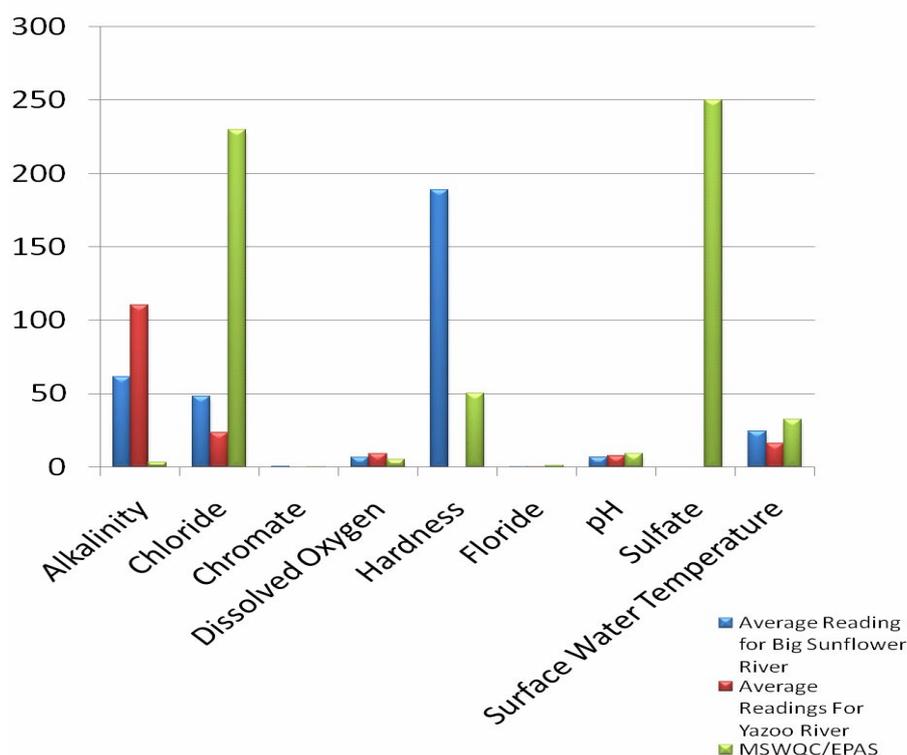


Figure 11: Parameters Tested, average readings for Big Sunflower river and Yazoo river in ppm and MSWQC / EPAS

4.0 Discussion

Based on the water quality parameters tested, both the Big Sunflower River and the Lower Yazoo River met, in general, the Mississippi water quality standards for freshwater bodies with the exception of alkalinity and hardness for the Big Sunflower River and alkalinity for the Yazoo River. This was also the case with the Yazoo River with respect to alkalinity. It is surmised that this would have been the same with water hardness concentration if the test was carried out.* This is based on the fact that the study done by Acholonu and Harris (2011, in press) on the water quality of the Lower Mississippi River into which the Yazoo River empties, indicated a hardness concentration that far exceeded the MSWQC/EPA standard (194.6/50) ($p < 0.05$).

A comparison between the chemical profiles of the Big Sunflower River and the Lower Yazoo River showed notable differences but almost all of these did not significantly exceed the MSWQC/EPA standards ($p > 0.05$) with the exception of alkalinity for both and hardness for only the Big Sunflower River.

Acholonu *et al.* (1999) reported that some of the

*The test kit was not available at the time that the study was conducted

benthic organisms found in their study such as oligochaetes may serve as biotubators and enhance contaminant release. The midges fly larvae burrow and grow as they emerge as adult flies and thus could in the process stir the sediment vertically and cause contamination. Our assessment of the results of this present study does not show that benthic organisms had appreciable impact on the water quality of the two rivers.

It is recommended that a continual or periodic assessment of the quality of these two freshwater bodies be made as a monitoring effort.

Acknowledgement

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References

Acholonu, A.D.W., T.J. Stewart, L.J Thibodeaux and K.T. Valsaraj, 1999, "An annotated checklist of benthic invertebrates of Lake Yazoo and Yazoo

- River, Mississippi”, *J. MS Acad. Sci.* **44** (4), 230-234.
- Acholonu, A.D.W. and M. Harris, 2011, “Water Quality Studies on the Lower Mississippi River in the Port Gibson Area”, *MS. J. MS Acad. Sci.* (in press).
- Brower, J.E., J.H. Zar and C.N. von Ende, 1998, “Field and Laboratory Methods for General Ecology 4th ed. McGraw-Hill, New York, NY. pp 273
- Jackson, R.B., S.R. Carpenter, C.N. Dahm, D.M. McKnight, R. J. Naiman, S.L. Postel and S.W. Running, 2001, “Waters in A Changing World”, *Issues in Ecology* No 9, 1-16.
- Mackenthum, K.M., and W.M. Ingram, 1966, “Pollution and the life in water”, in K.W. Cummins, C.A. Tryon, Jr., and R.T. Hartman, eds. *Organism-Substrate relationships in streams*. University of Pittsburgh, Pennsylvania, Pymatuning Laboratory of Ecology Special Publication, **4**, 136-145.
- Mississippi Department of Environmental Quality 1995, “State of Mississippi Water Quality Criteria for intrastate, interstate, and coastal waters, Appendix 1-18
- Wells, F.C., and C.R. Demas, 1979, “Benthic Invertebrates of the Lower Mississippi River”, *Water Resources Bull.* **15**, 1565 – 1577.