



Water quality survey of Mississippi's Upper Pearl River

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ABSTRACT

Surface water samples were collected from May 2002 through May 2003 at seven locations within the Upper Pearl River Basin (UPRB) in east-central Mississippi to assess levels of pesticide impairment in the watershed. Depth-integrated samples were collected at three sites from September 2001 through January 2003 for total dissolved solid (TDS) analysis. Samples were extracted via Solid Phase Extraction (SPE) and analyzed for fifteen pesticides: triclopyr, 2,4-D, tebuthiuron, simazine, atrazine, metribuzin, alachlor, metolachlor, cyanazine, norflurazon, hexazinone, pendimethalin, diuron, fluometuron, and the dichlorodiphenyltrichloroethane (DDT) degradation product p,p'-DDE. Of the analyzed compounds, hexazinone was detected in 94% of the samples, followed by metolachlor (76%), tebuthiuron (48%), and atrazine (47%). Metribuzin was detected in 6% of the samples and was the least detected compound of those analyzed. Sediment concentrations ranged from 20.64 mg/L at Burnside to 42.20 mg/L at Carthage, which also had the highest cumulative total sediment concentration at 4009 mg/L.

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1. Introduction

Over the past decade, the Environmental Protection Agency (EPA) has begun enforcing §303(d) of the Clean Water Act (CWA), including Total Maximum Daily Loads (TMDLs), drawing attention to nonpoint-source (NPS) pollution, especially contamination related to pesticides, pathogens, organic enrichment, and sediment runoff. Many studies have shown pesticide detections in surface waters (Ensminger et al., 2013; Lerch et al., 2011; Rebich et al., 2004; Shaw et al., 2006; Bottoni et al., 2013). As new pesticides have been developed and increasingly used by farmers since the 1960's, detections of pesticides in surface waters have been consistently linked to agricultural production (Smith et al., 1993; Coupe et al., 1998; Wauchope, 1978; Zimmerman et al., 2000; Silburn et al., 2013). Quite often, however, levels of pesticides detected in surface waters are low (ppb), as in Senseman et al. (1997a, 1997b). Nevertheless, agricultural pesticides have been detected in the Mississippi River and its tributaries, in surface waters of the Midwestern United States and California, as well as in surface waters near agricultural areas of other countries (Tanabe et al., 2001; Domagalski, 1996; Pereira and Hostettler, 1993; Battaglin et al., 2003; Dabrowski et al., 2002; Masiá et al., 2013). There have been many studies conducted in different areas of the highly agricultural Mississippi Delta (in the western part of the state), monitoring both persistent organic pollutants and current-use pesticides (Ford and Hill, 1991; Moore et al., 2007; Cooper et al., 1987; Zimmerman et al., 2000; Shaw et al., 2006). However,

there is no peer-reviewed pesticide or sediment data available for the Upper Pearl River Basin (UPRB), Hydrologic Unit Code (HUC) 03180001, located in east-central Mississippi (Fig. 1).

Nationwide, litigation has forced the EPA and state primacy agencies to address the CWA's TMDL provisions. The Mississippi Department of Environmental Quality (MDEQ) is Mississippi's state primacy agency for administering CWA programs. The TMDL process requires the MDEQ to submit a biannual CWA §303(d) list of impaired waterbodies to EPA, while later preparing and submitting a TMDL for each impaired waterbody. The TMDL must address both point and NPS contaminants. Mississippi's 2004 §303(d) list showed 19 impaired waters (13 monitored and 6 evaluated) in the UPRB (HUC 03180001), with the following impairments: 12 biological and 4 each for nutrients, pathogens, organic enrichment, pesticides, and sediment (Mississippi Department of Environmental Quality, 2004). Evaluated stream segments are those for which there was no monitoring data available, and these listings were based mostly on land-based anecdotal information and initially placed on the state's 1996 CWA §303(d) list. In Mississippi, pesticides have been frequently listed as an "evaluated" NPS of contamination based on past land use patterns and concerns over the presence of legacy compounds, with no regular monitoring data to support the listing. While TMDLs have been developed for all UPRB stream segments listed as impaired due to pesticides, these TMDLs were based on the legacy pesticides DDT and toxaphene. The UPRB was selected as a study area to monitor selected pesticide and suspended sediment levels because of its unique water quality and public health issues and the lack of water quality data for sediment and pesticides, both legacy and currently used compounds. The Pearl River feeds into the Ross Barnett Reservoir, which is located in an EPA-designated priority watershed

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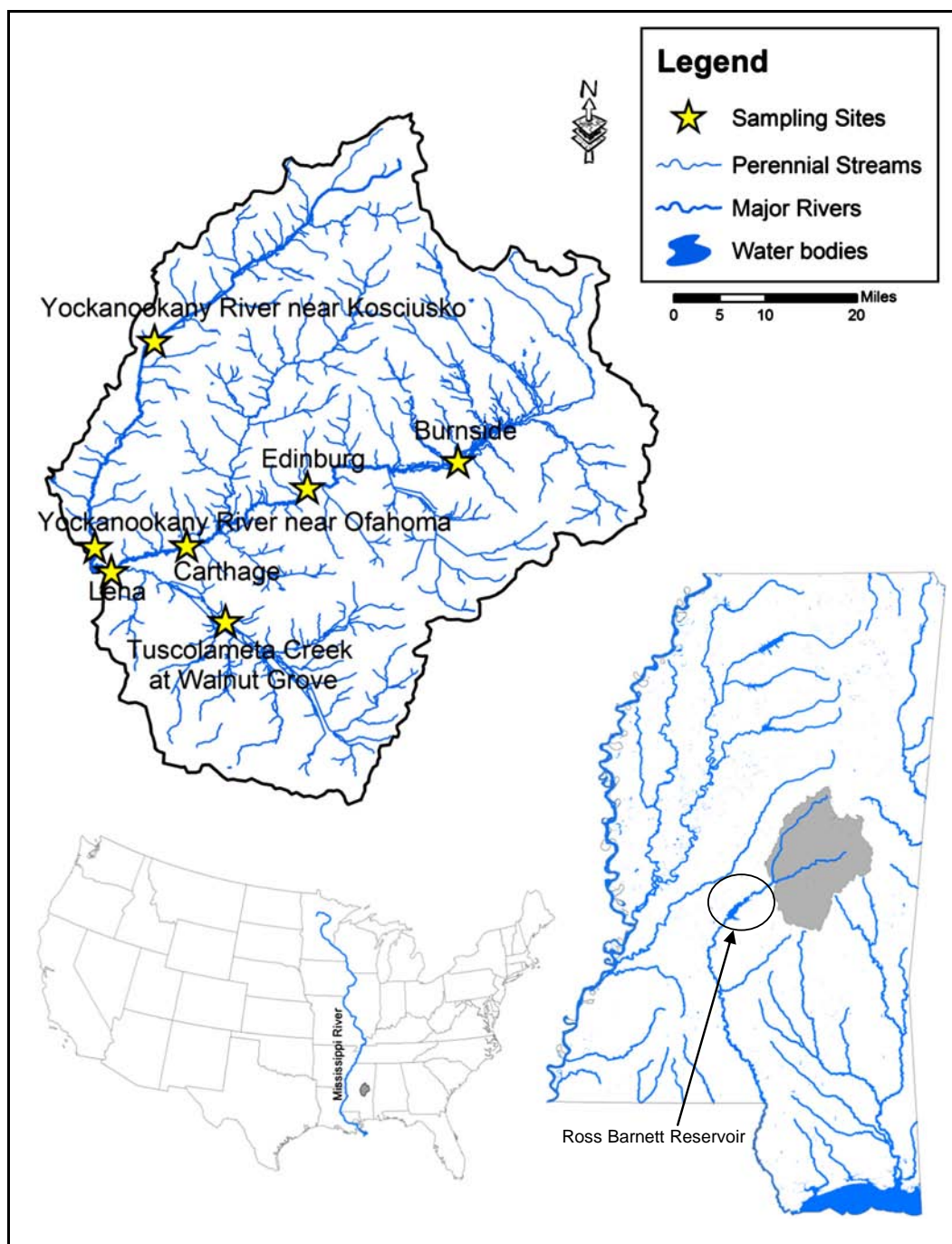


Fig. 1. Location of the Upper Pearl River Basin study area and water sampling locations in east-central Mississippi.

(Middle Pearl Strong, HUC 03180002) and serves as the primary drinking water supply for Jackson, Mississippi, the state's capital city. The Pearl River flows south through the state of Mississippi, forming the most eastern boundary between Louisiana and Mississippi, and exits to the Gulf of Mexico. The first objective of this study was to determine the presence and concentration of selected pesticides in particular segments of the Upper Pearl River and segments of the Yockanookany River and Tuscolameta Creek, both tributaries of the Pearl River. The second objective was to determine the concentration of suspended sediment at three selected sites – Burnside, Edinburg, and Carthage – along the Upper Pearl River. Samples were analyzed for suspended sediment because siltation was the leading cause of impairment in the UPRB on the MDEQ's 1998 §303(d) list (Mississippi Department of Environmental Quality, 1999).

2. Materials and methods

2.1. Pesticide selection criteria

Compounds were selected for analysis based on several factors. Samples were analyzed for *p,p'*-DDE (a metabolite of DDT) due to regulatory concern over the presence of persistent, organic pollutants in Mississippi's surface waters. Samples were analyzed for hexazinone and triclopyr because of the silviculture acreage in the study area, since these compounds are commonly used in site preparation and release of young pine trees. The remaining compounds were studied because a literature review showed that they have been previously detected in surface and/or ground water samples (Buttle, 1990; David et al., 2003; Field et al., 2003; Kalkhoff et al., 2003; Köck-Schulmeyer

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