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Water Quality Trends Following Anomalous Phosphorus Inputs to Grand Bay, Mississippi, USA

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ABSTRACT

Grand Bay National Estuarine Research Reserve (GBNERR) is a 7500 ha protected area in Jackson County, MS. In 2005, a levee breach at a fertilizer manufacturing facility released highly acidic and phosphate—rich wastewater into the reserve. A second spill occurred in September 2012 following Hurricane Isaac. We used orthophosphate (PO_4^{3-}) concentrations to categorize the 2 events, post—events, and non—impact periods between the 2 spills. We examined spatial and temporal patterns in nutrients, chlorophyll, pH, and other parameters within and between monitoring stations. After the first event, pH at the Bangs Lake water quality station decreased to 3.7 and PO_4^{3-} increased to over 4 mg P/l. Orthophosphate returned to background concentrations near the detection limit after approximately one year. Sampling 3 weeks after Hurricane Isaac showed PO_4^{3-} concentrations over 1 mg P/l in Bangs Lake. Elevated PO_4^{3-} levels were detected at other monitoring locations for 3—5 months, depending on distance from the fertilizer facility. Multiple comparison tests of trends within stations showed that both events had statistically similar PO_4^{3-} concentrations, although the magnitudes and the time to return to baseline concentrations differed between stations. Temporal patterns of other nutrients had apparent long—term trends, particularly chlorophyll a, which showed an increase from 18—56% depending on station. This study provides a rare description of decadal water quality trends in a shallow, temperate estuary in response to discrete spill events. The results provide new information on the effects of phosphorus inputs to nitrogen—limited systems, having management implications for Gulf Coast estuaries.

Full Text

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