RESULTS

Fourteen years of monthly transect data, including data from this collaborative project with 

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ABSTRACT

Changing hydrologic regimes and nutrient loadings in coastal waters may impact ecosystem restoration and public health. Large rivers like the Mississippi can have a significant impact on coastal processes in the coastal zone and shifts in nutrients within estuaries may promote growth of potentially toxic algal species. Our research focus is on planktonic community structure and function, measuring particulate organic matter (POM) composition and microbial metabolites, and algal growth rates, and harmful algal blooms (HABs) and increased waterborne pathogens such as Vibrio vulnificus. Our research in the Barataria Bay and Breton Sound Estuaries: using Mississippi River water diversions greatly increases nutrient loading into these estuaries and, therefore, increases the possibilities of increased eutrophication and incidence of hypoxia.

Eutrophication can also stimulate HABs and HAB toxin production. Large rivers like the Mississippi can have a significant impact on biological processes in estuaries and nearshore zone, and shifts in nutrients may promote growth of potentially toxic algal species. Besides HABs, Vibrio bacteria can also pose health risks in coastal systems. Infection by Vibrio parahaemolyticus is one of the leading causes of seafood-related illnesses in the United States.

RESULTS

Fourteen years of monthly transect data, including data from this collaborative project with Sibel, are being summarized and the trends identified. A significant drop in Chl a in the Barataria Basin has been quantified. A major increase in phytoplankton biomass occurred when the Bonnet Carre diversion was opened, which was successfully predicted using the anticipated nitrogen load (Figure 1). (Turner Lab).

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Objectives:

The overall hypothesis of the proposed work is changing hydrologic regimes and nutrient loadings will impact ecosystem restoration and public health in coastal waters.

The specific objectives and related approaches of this project are:

1. To quantify temporal and spatial dynamics of community biomass in the two Louisiana estuaries;
2. To determine plankton community metrics, using fingerprint of microbial metabolites, nutrient bioassays (e.g., bacterial densities, and to examine profiles of water quality preserved in sediment records);
3. To routinely sample estuarine waters to quantify occurrence and abundance of harmful algal species, and also begin to quantify HAB toxicity using ELISA and HPLC;
4. To develop qPCR protocols to detect and quantify potentially pathogenic Vibrio species of interest in coastal waters and study the temporal and spatial dynamics of Vibrio vulnificus and Vibrio parahaemolyticus using both culturing and molecular methods;
5. To determine the impacts of physicochemical parameters (temperature, salinity, and nutrients in particular) on the development of microbial populations.

DISCUSSION

Our group has a particular emphasis on water quality changes resulting from increased nutrient and sewage loading. Eutrophication is a prominent stressor in coastal systems, and is the net result of nutrient-enhanced aquatic primary productivity, and indicated by the presence of noxious phytoplankton blooms, bottom water hypoxia, pathogen accumulation, and wetland plant stress, and has been reported from a variety of estuarine and coastal environments (e.g., Rose and Haines 2003). Concerns for the Barataria and Breton Sound Estuaries targeted for "restoration" by increased inputs of Mississippi River water thus include possible eutrophication and hypoxia in localized areas, as well as possible increased occurrence of HABs and pathogenic Vibrio spp.

One of the explanations for relatively constant biomass patterns between seasons and years could be that light controls the phytoplankton production. This seems the most logical inference given the constant year-to-year estimates and the very moderate seasonal variations. Turbid estuaries often have high light attenuation due to nutrients, and phytoplankton blooms, bottom water hypoxia, pathogen accumulation, and wetland plant stress, and has been reported from a variety of estuarine and coastal environments (e.g., Rose and Haines 2003). Concerns for the Barataria and Breton Sound Estuaries targeted for "restoration" by increased inputs of Mississippi River water thus include possible eutrophication and hypoxia in localized areas, as well as possible increased occurrence of HABs and pathogenic Vibrio spp.

Overall, the results of this research have the potential to greatly enhance our understanding of the ecological function of coastal systems, particularly as they translate to environmental health issues and, given the importance of these issues to Louisiana.