

Louisiana HAB Efforts and Capabilities

Overview

Conventional wisdom has maintained that coastal Louisiana is protected from red tides by its low-salinity waters. This notion was obviated in 1996 when a *Karenia brevis* bloom developed east of the Mississippi River, resulting in the closure of oyster beds. No similar events have occurred.

A greater emerging threat in Louisiana waters may come from *Pseudo-nitzschia* spp., which are occasionally abundant in offshore and estuarine waters including those over oyster reefs. It is curious that, despite periodic high abundance of *Pseudo-nitzschia* in oyster-growing areas, no cases of amnesic shellfish poisoning have ever been observed in Louisiana.

A large freshwater input into the Louisiana coastal zone results in a wealth of nutrient-rich, oligohaline habitat. These low-salinity waters are disproportionately impacted by cyanobacterial blooms, in particular species of *Anabena*, *Microcystis* and *Cylindrospermopsis*. Lake Pontchartrain and the upper Barataria Basin, which periodically receive large pulses of nutrients from the Mississippi River, are especially susceptible to massive blooms of cyanobacteria.

Louisiana Department of Health and Hospitals

The LDHH is the lead agency responsible for monitoring HABs and assuring the microbiological quality of shellfish-growing waters in Louisiana. Bruce Champion directs the program with monitors *Karenia brevis* according to Interstate Shellfish Sanitation Conference (ISSC) guidelines. The monitoring program includes sampling in all major estuaries, with special emphasis on areas east of the Mississippi River. LDHH has an in-house laboratory for the identification and enumeration of *K. brevis* only. They cooperate with the Louisiana Department of Wildlife and Fisheries, which manages the oyster fishery and alerts them to HAB events, and the Louisiana Universities Marine Consortium, which also monitors HABs and provides taxonomic expertise.

Louisiana Universities Marine Consortium

Phytoplankton community composition studies over a range of habitats have been ongoing in coastal waters since 1989 by LUMCON researchers. Dr. Quay Dortch established the HAB research and monitoring program at LUMCON; upon her departure Dr. Nancy Rabalais took over her programs and research group, and they are continuing to collect data in the same areas.

The distribution of samples extends from the Mississippi River delta to the middle Texas coast, from near shore to as far as 100 km offshore. Monthly phytoplankton samples from transects off Terrebonne and Atchafalaya Bays, and annual shelf-wide mid-summer transects are collected. In addition to these marine samples, the LUMCON Phytoplankton Group has been participating in a monthly transect of 37 stations along the axis of the Barataria Basin (a highly eutrophic system with a wide range of salinities and residence times) since January 1994. The transect spans from a freshwater stream entering Lac des Allemands on the north through an estuarine tidal pass near Grand Isle, Louisiana on the south. Five stations per month are counted for HABs. The result of this extensive sampling has been the collection of a variety of phytoplankton species from

many diverse groups. An in-house species list of those taxa encountered over the years was created and is still being maintained; many of the species on that list have been photographed and archived with collection data in the course of developing the taxonomic expertise of the LUMCON Phytoplankton Group. In addition to routine phytoplankton monitoring efforts, the Phytoplankton Group also provides assistance with taxonomic identification and enumeration on samples of suspected harmful algal blooms collected by state and federal water quality officials, or from the general public.

In 2005 the Phytoplankton Group received funding from the EPA Gulf of Mexico Program to produce a web- and cd-based taxonomic "Guide to Phytoplankton from Louisiana Estuarine and Coastal Waters," including taxa that have been shown in the literature to be harmful or noxious. This funding will help make available the accumulated taxonomic knowledge of the LUMCON Phytoplankton Group and should directly facilitate the transfer of biological information to other researchers, the educational community, and resource managers charged with protecting water quality. The Guide will be a searchable, annotated pictorial atlas of phytoplankton species found in the Barataria, Terrebonne, and Pontchartrain estuaries and coastal Louisiana offshore waters, and will include for each species, photographs taken with different light and stain techniques, distinguishing identification characteristics, taxonomic classification, size ranges, distribution, references to useful literature, and comments as to toxicity or harmful effects. The Guide will be published on a website maintained at LUMCON, and CD ROMs to be distributed upon request.

In 2006, the Phytoplankton Group received funding, also from the EPA Gulf of Mexico Program, for a project to study HAB species and the presence/absence of associated toxins in three large fresh to brackish water lakes (Lac des Allemands, Lake Cataouatche and Lake Salvador) in the upper portion of the Barataria Basin. This environment supports a variety of HAB species due to high nutrient inputs, and cyanobacterial blooms occur on a regular basis, including species that have been toxic in Lake Pontchartrain (*Anabaena cf. circinalis*) or elsewhere (*Microcystis*, *Cylindrospermopsis raciborskii*, *Raphidiopsis curvata*). Of the few analyses done before this project began, microcystins were documented in water from Lac des Allemand, the most eutrophic of the three lakes. The Davis Pond Diversion is a controlled diversion of Mississippi River water into the upper end of Lake Cataouatche that began in late 2003. Although the diversion is not yet fully operational as originally designed, the limited outflows have affected the salinity regimes in Lakes Cataouatche and Salvador, and salinity is a major environmental factor controlling blooms of cyanobacterial HABs. Increased nutrient loads also stimulate phytoplankton biomass and increase cyanobacteria, including potential toxin-producers. The project goal is to document what HAB species are present in field water samples that also test positive for certain toxins, to isolate and grow in the lab monocultures of the ambient HABs and analyze those samples for toxins, all in an effort to link species and toxins. Toxin analyses will also be conducted on consumers of cyanobacteria (such as fish, crustaceans and shellfish) to identify food resources that could cause a potential human health problem because of the ingestion or accumulation of the toxins by the seafood.

LUMCON maintains six fixed hydrographic stations that may be useful in the monitoring of HABs. They are located in Lake Pontchartrain, the Mississippi River at New Orleans, Southwest Pass, Cocodrie, Terrebonne Bay, and Bay Tambour. The

Mississippi River, Southwest Pass, and Bay Tambour sites include sensors for the measurement of chlorophyll (fluorescence).

Louisiana State University

Dr. Sibel Bargu has expertise in phytoplankton ecology, HABs and food web interactions. She recently received an award from the Board of Regents to monitor the distribution, abundance and toxicity of *Pseudo-nitzschia* in the Louisiana Coastal Waters for the next 3 years. She also has NOAA funding for two years to monitor HAB species in general in Louisiana coastal waters, and additional support for event responses. Dr. Bargu is leading several laboratory projects to study nutrient variation and its impact on *Pseudo-nitzschia* and cyanobacteria toxicity.

The LSU Coastal Studies Institute maintains five monitoring stations in bays and nearshore environments of southeast and south-central Louisiana which may be useful to HAB monitoring.

Nicholls State University

Drs. Thomas Soniat and Sammy Ray (Texas A&M University at Galveston) maintain Oyster Sentinel (www.oystersentinel.org), a gulf-wide collaboration which uses oysters as bio-indicators of estuarine health. The web site is offered as one of many that will disseminate information concerning HABs in the Gulf of Mexico. Oyster Sentinel assisted in the establishment of the Bay Tambour monitoring station which is operated and maintained by LUMCON. The station is adjacent to an oyster reef that has been regularly sampled for more than a decade. Cooperatively with the Dortch lab a long-term data set of chlorophyll *a* and phytoplankton-species composition from water samples collected above oyster reefs was generated, and studies were conducted on the ability of oysters to ingest *Pseudo-nitzschia*.