

The Florida Area Coastal Environment Program supports science-based water quality management

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The Florida Area Coastal Environment (FACE) Program is an ongoing research effort led by the National Oceanic and Atmospheric Administration (NOAA) Atlantic Oceanographic and Meteorological Laboratory since 2004. The FACE Program highlights the need to comprehensively assess the coastal zone to help understand the impacts of land-based sources of pollution on southeast Florida coral reef habitats and to formulate science-based management. The broad objectives of the program include the following:

- Quantifying the sources of nutrients and microbial contaminants;
- Quantifying the relative contributions of those sources to the nutrient budget and microbiological loads of the region; and
- Determining the likely exposure of coral reef resources to nutrient and microbiologic sources.



Study sites of the FACE Program include inlets and ocean outfalls from sewage treatment plants from Miami (Miami-Dade County) to Boynton Inlet (Palm Beach County).

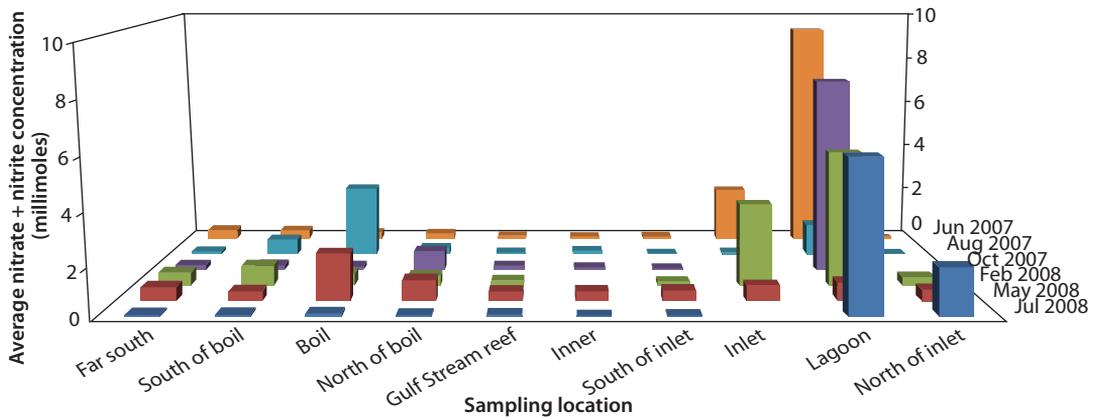
This extensive field program has performed surveys of sewage outfalls at all six existing wastewater plants in the study area (Miami Central, Miami South, Hollywood, Broward, Boca Raton, and South Central) and at several inlets and their respective receiving waters. Ultimately, FACE will undertake detailed physical, chemical, and biological studies at each inlet and outfall, including recording ocean currents, nutrient concentrations and source tracking, microbiology, and stable isotope analyses. Examples of information from some completed studies are given here.

Tracer studies

A study was conducted at the Hollywood Wastewater Treatment Plant outfall in June 2004 using sulfur hexafluoride to trace the direction of the outfall plume (i.e., boil). Sulfur hexafluoride is a humanmade compound. The plume was traced flowing north, near the coast, for 66 kilometers (41 miles). A second tracer study was performed near the outfall of the South Central Regional Wastewater Treatment Plant and in nearby Boynton Inlet in 2007. Results suggested a rapid dilution of the outfall effluent by the surroundings waters. Waters exiting Boynton Inlet were traced over 34 km (21 mi) north of the inlet.

Currents

Measurements of currents help to elucidate sources of water that can affect important coral communities. Ocean current data have been measured at several locations off Palm Beach County for extended periods of time. For example, instrumentation at the north end of Gulf Stream Reef from April 2006 – September 2007 recorded a northerly current flow 86% of the time.



Averaged concentrations of nitrate and nitrite from six bimonthly cruises from south of the South Central ocean outfall (i.e., boil) to north of Boynton Inlet. Horizontal axis names refer to sampling regions. Seasonal variation and variation by site are shown in this three-dimensional graph.

Nutrients

Nutrients (e.g., nitrite, nitrate, orthophosphate, silicate, ammonia) were measured during intensive studies at the Boynton Inlet and at all six wastewater treatment plant ocean outfalls. These results help to evaluate the relative concentration as well as the dilution of these nutrients in the receiving waters. Elevated nutrients were found near the outfall boils and at Boynton Inlet.

Inlet studies

Detailed flow, chemical, and microbiological sampling measurements were made at the Boynton Inlet during two 48-hour-long studies. These studies

noted considerable, but highly variable nutrient flux. Additional inlet studies are planned.

Microbiology

A variety of microbial contaminants were measured at sewage outfalls and at several inlets and adjoining waters. High bacterial counts (*Methanobrevibacter smithii*), viral counts (*Norovirus*), and intestinal parasitic protozoans (*Cryptosporidium* and *Giardia*) were detected at sewage outfalls and during outgoing tides from inlets. A comparison of results from the six outfalls shows the highest concentrations of microbial contaminants at the Miami-North boil.

Location	<i>M. smithii</i> (GE*/100mL)	<i>Norovirus</i> (GE*/100mL)	<i>Cryptosporidium</i> oocysts	<i>Giardia</i> cysts/100L
South Central boil	700	no detection	no detection	no detection
Hollywood boil	3.0×10^5	235	55	67
Boca Raton boil	2.7×10^4	2.3	<1	<1
Broward boil	3.7×10^5	6.3	8	2
Miami-North boil	1.3×10^5	347	236	246
Miami-Central boil	3.4×10^5	11	8	120
Deep-water control	no detection	no detection		

*GE = Genome Equivalent is a measure of the abundance of microbes.

Abundances of microbes, including intestinal bacteria (*Methanobrevibacter smithii*), human viral pathogens (*Norovirus*), and intestinal parasitic protozoans (*Cryptosporidium* and *Giardia*) from surface water at wastewater ocean outfalls (i.e., boils) and a deep-water control site, February 2008.