

Field Programs: The FACE Environmental Monitoring Program

A long-term monthly water quality-sampling program for the southeast Florida coast will begin in 2009. The program will build a multi-year database of ocean currents (direction and velocity) and seawater temperature along depth profiles at specific sites in Florida's east coast (see below).

Specific analytes include temperature, salinity, depth, ammonia (NH_3^+), nitrite (NO_2^-), nitrate (NO_3^-), orthophosphate (PO_4^{3-}), silica (SiO_2^{2-}), and chlorophyll-a, total suspended solids (TSS), turbidity and pH. Measurements will be made at various depths to obtain vertical profiles. The data will be available to the public in accord with NOAA policy.

Results of the program will be used in the elucidation of environmental questions such as the quantitation of the contribution of the various sources of nutrients into Florida's coastal ocean.

The Florida Area Coastal Environment (FACE) Program

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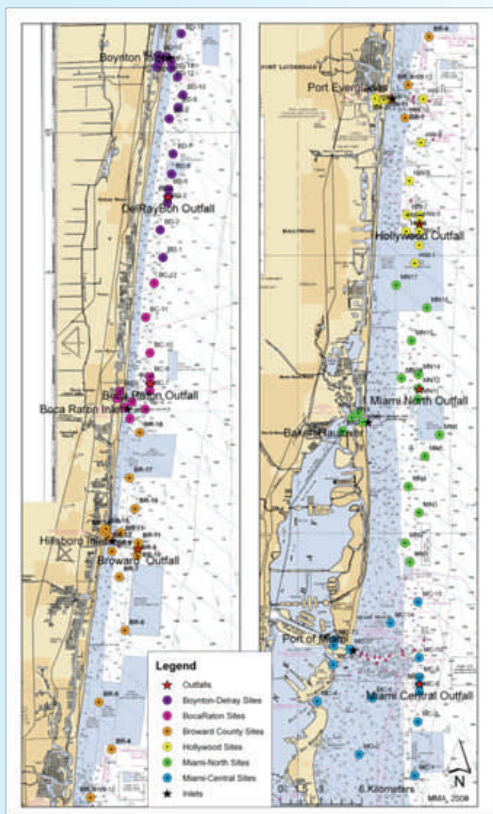
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themes/CoastalRegional/projects/FACE/faceweb.htm

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Sampling sites for the FACE monitoring program.

FACE The Florida Area Coastal Environment Program



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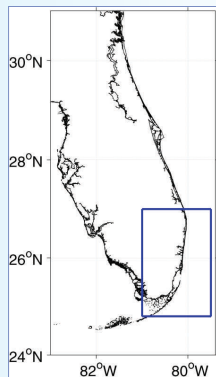
Vision

The Florida Area Coastal Environment (FACE) program was created in 2004 to obtain the scientific knowledge and long-term data needed to address key scientific issues of concern for environmentally compatible infrastructure operation, regulation, and coastal management. This program supports the key NOAA mission goal to protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management.

The FACE project is primarily concerned with anthropogenic discharges in the Florida's coastal ocean. FACE field operations includes collecting a wide range of physical, biological, and chemical oceanographic measurements such as ocean currents, nutrients, stable isotopes, acoustic remote sensing of plumes, microbiological monitoring, and coral reef health monitoring. These measurements will evolve into multi-year data sets to be employed to develop an overall understanding of the near-shore environment. This understanding will then be applied to answer environmental issues from a viewpoint that includes regulatory realities as well as environmental concerns.

Geographic Area

Currently, the FACE program is focused on the coastal waters of Florida from Miami-Dade to Brevard County. This region includes a variety of economically significant recreational activities (fishing, diving, boating) and several coral reef tracks. These seven counties are home to over 6.4 million people (2005). Their coastal waters support Florida's \$33.4B tourist industry, where sport fishing alone generated \$3.5B and employed 58,000 people in 1996.¹



FACE area of focus

History

The FACE program is an outgrowth of scientific efforts that have been ongoing for more than two decades at AOML. The *South-east Florida Outfall Experiment* (SEFLOE)² was a pioneering study using acoustically guided chemical and biological sampling to investigate the behavior of a Wastewater Treatment Plant (WTP) effluent plume discharged into the Florida Current during various oceanographic conditions. This study was instrumental in the development of legislation by the state government of Florida.

¹Martin, D. M. et al., *Estuaries on the Edge: the Vital Link Between Land and Sea*, The American Oceans Campaign, Washington, D.C., 1996.

²SEFLOE I, 1986 and SEFLOE II, 1991.

Nutrients in the Coastal Ocean

Dissolved nutrients (nitrate, nitrite, ammonia, phosphate, silicate) are necessary for life in the coastal ocean. However, excess nutrients may be harmful. They have been implicated in changes in primary production, episodes of harmful algal blooms, marked changes in plant communities and diversity, changes in seawater transparency and color, and other undesirable effects.³ There are several probable sources of nutrients to the coastal ocean regions of Florida, including the following:

Coastal inlets. Southeast Florida is characterized by lagoons with widely separated inlets. The inlets are the primary means of drainage for a large portion of southeastern Florida (including major canals). This area includes significant agriculture and industry, and a rapidly increasing population.

Ground Water Seepage is known to be an important contributor of nutrients (especially nitrate) to the coastal ocean in some regions of Florida.⁴ Ground water seepage may be contaminated with various chemicals from septic tanks, polluted aquifers, landfills, injected treated wastewater, or agricultural chemicals, and can transport these materials to the coastal ocean. The contribution of ground water seepage has not been adequately evaluated in the FACE region.

Oceanic upwelling of deep, cooler water near shore has been observed off Florida's east coast.⁵ These waters are known to be enriched in nutrients. However, the quantity, duration, and seasonality of the upwelled nutrient contribution to the coastal nutrient budget has not been determined.

Atmospheric deposition has been shown to be the principal source of nitrogen in some river systems in Florida.⁶ It has been implicated in causing toxic algal blooms (e.g., *Karenia brevis*).⁷ Its importance for Florida's coastal waters is not known.

Outfalls. There are six WTP release pipes (outfalls) in southeast Florida. Outfall effluent may contain nutrients (nitrate and phosphate), metals, pathogens, and pharmaceuticals.⁸ The WTPs are monitored and comply with current Florida standards. Their impact on the nutrient balance in the ocean is currently under study.

³R. Howarth, R. Marino, and D. Scavia, *Nutrient pollution in coastal waters: Priority topics for an integrated national research program for the United States*, NOAA, 2003.

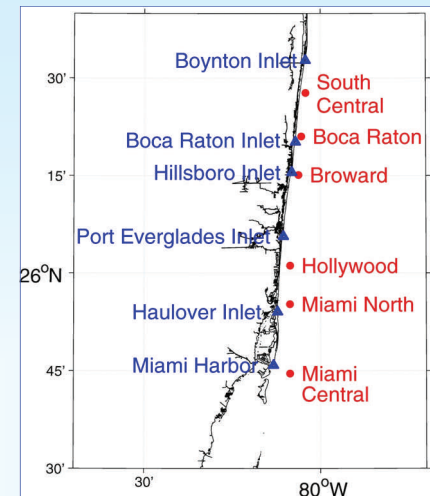
⁴e.g., D. Capone and M. Baustista, *A groundwater source of nitrate in near-shore marine sediments*, *Nature* 313, 214, 1985.

⁵N. Smith, *Temporal and special characteristics of summer upwelling along Florida's Atlantic shelf*, *J. Phys. Oceanogr.* 13, 1715, 1983.

⁶Winchester et al., *Atmospheric deposition and hydrogeologic flow of nitrogen in northern Florida watersheds*, *Geochim. Cosmochim. Acta* 59, 2215, 1995.

⁷D. Griffin et al., *The global transport of dust*, *Amer. Sci.* 90, 228, 2002.

⁸B. Koopman et al., *Ocean Outfall Study*, FDEP, 2006.



Southeast Florida Inlets and Outfalls

FACE Publications

JR Proni, H Huang, WP Dammann. *Initial Dilution of Southeast Florida Ocean Outfalls*. *J. Hydraul. Eng.* 120: 1409-1425, 1994.

TP Carsey, R Ferry, KD Goodwin, PB Ortnier, JR Proni, PK Swart, J-Z Zhang. *Brevard County Nearshore Ocean Nutrifcation Analysis*. NOAA Technical Report OAR-AOML-37, July 2005.

R Wanninkhof, KF Sullivan, WP Dammann, JR Proni, F Bloetscher, AV Soloviev, and TP Carsey. *Farfield tracing of a point source discharge plume in the coastal ocean using sulfur hexafluoride*. *Environ. Sci. Technol.* 39: 8883-8890, 2005.

M Adler, N Amornthammarong, J Bishop, F Bloetscher, TP Carsey, J Craynock, S Cummings, WP Dammann, C Drayer, C Featherstone, KD Goodwin, D Meerhoff, JR Proni, E Peltola, D Pierrot, C Sinigalliano, PK Swart, J Stamates, KF Sullivan, R Wanninkhof, J-Z Zhang. *Final Report: An investigation of the South Central Regional Wastewater Treatment Ocean Outfall and Coastal Environment*, NOAA, January 2009.

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TP Carsey, KD Goodwin, J Hendee, JR Proni, C Sinigalliano, J Stewart, J-Z Zhang, N Amornthammarong, J Craynock, S Cummings, WP Dammann, C Featherstone, J Stamates, KF Sullivan. *A glimpse of the Florida Area Coastal Environment (FACE) program*. Presented at the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008. Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008, in press.