The background of the slide is a photograph of the ocean surface, showing gentle ripples and a mix of blue and greenish-blue tones. A light blue rectangular box is positioned in the upper half of the image, containing the title text.

Ocean Chemistry Division Overview

John R. Proni

Talk Overview

- Mission Statement
- Who we are
- Vision
- Research Topics
- Challenges

Mission Statement

Improve understanding of the biogeochemical processes regulating the composition of ocean and coastal waters and the health and sustainability of their ecosystems.

MISSION ACCOMPLISHED BY

- State-of-the-art interdisciplinary research
- Development of methods and technologies
- Gathering and dissemination of the synthesized data

NOAA STRATEGIC PLAN

OCD research aligns with the NOAA strategic plan, addresses societal needs, and addresses the Ecosystem, Climate, and Commerce & Transportation mission goal areas.

Who we are

The Ocean Chemistry Division has

- 21 Federal Employees
- 12 CIMAS employees
- 12 employees with PhD degrees

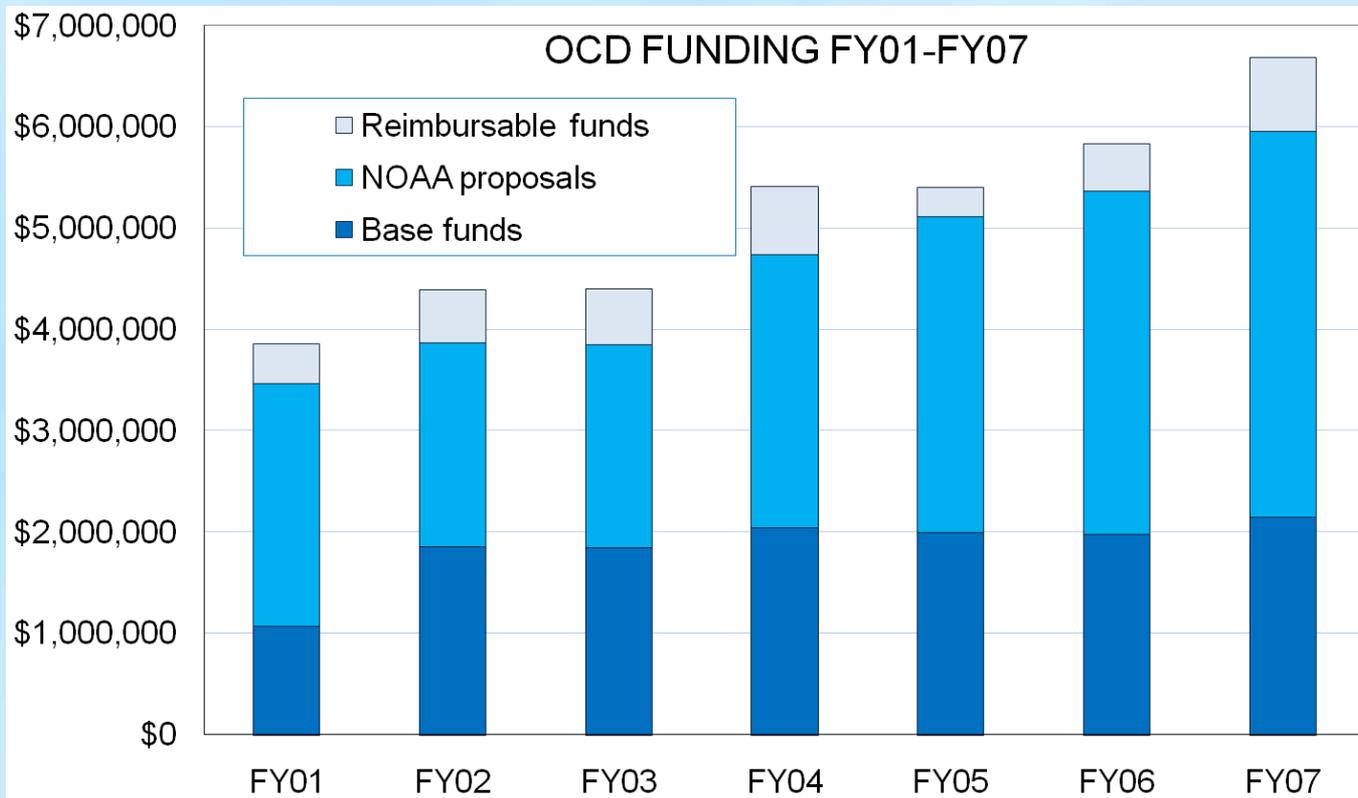


Partners

Applied Physics Lab, U. Washington
Audubon Society
Australian Institute of Marine Science
Bermuda Institute of Ocean Sciences
Brookhaven National Lab.
BSC Laboratories, Inc.
CarboOcean
Centers for Disease Control and Prevention
Central Caribbean Marine Institute (Cayman I.)
Discovery Bay Marine Laboratory (Jamaica)
Eco-Hydrology, Inc.
Florida Atlantic U.
Florida Department of Environmental Protection
Florida Department of Health
Florida Gulf Coast U.
Florida Institute of Oceanography
Florida International U.
Florida Keys National Marine Sanctuary
Florida State U.
Great Barrier Reef Marine Park Auth.
International Ocean Carbon Coordination Project
Lachat instrument, USA
Lamont-Doherty Earth Observatory, Columbia U.
Louisiana State U.
Meteorological Research Institute, Japan
National Aeronautics and Space Adm.
National Autonomous U. of Mexico
National Center for Atmospheric Research
National Oceanographic Center, Taiwan
National park service
Nature Conservancy
NOAA Florida Keys National Marine Sanctuary
NOAA: NESDIS, NMFS, SWFSC, Sea Grant
NOAA: PMEL, NOS, GFDL, ESRL, HML
Northern Gulf of Mexico Cooperative Institute
Nova Southeastern U.
Oak Ridge National Laboratory
OHHC at U. of Hawaii
OHHC at U. of Miami

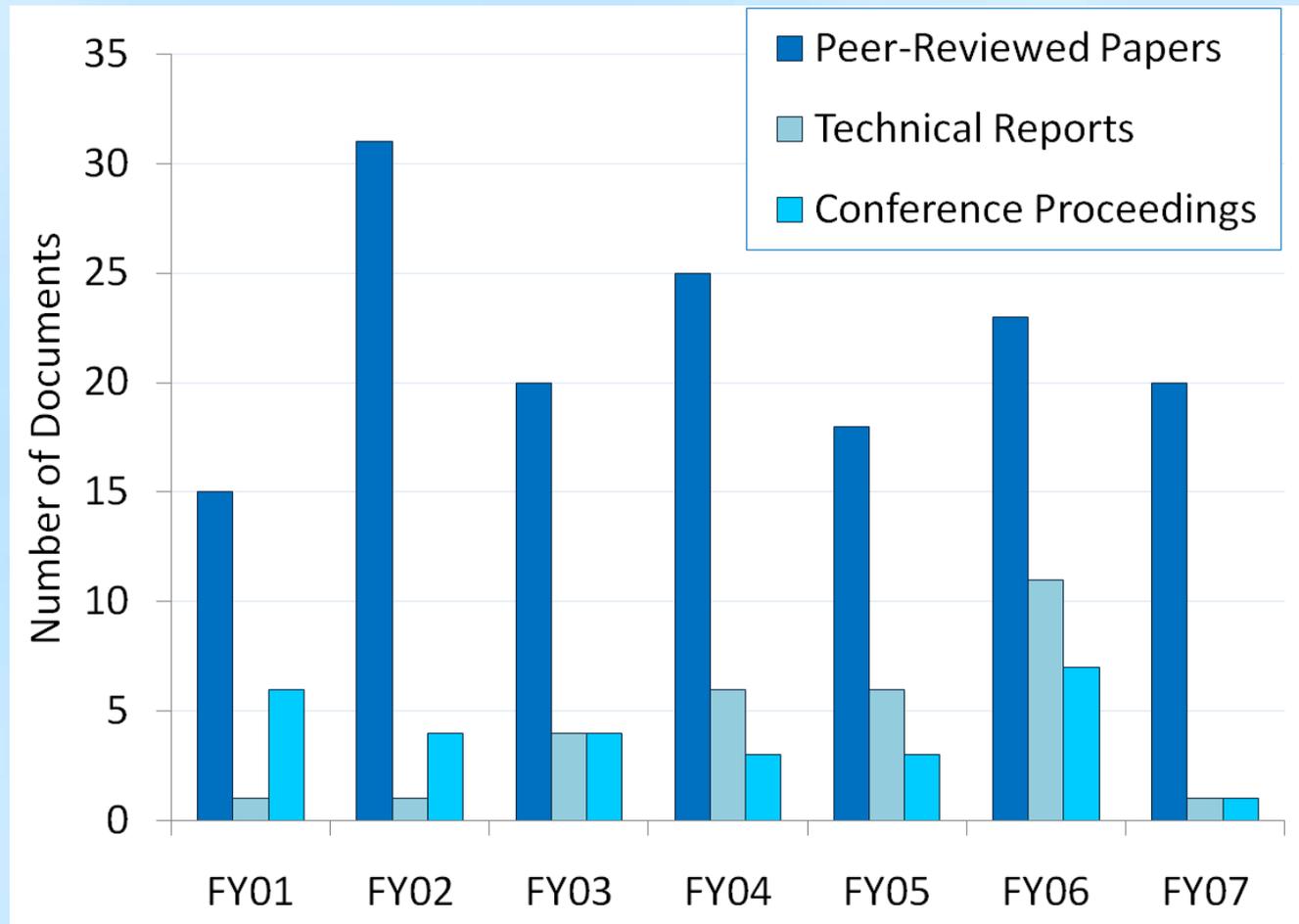
OHHC at Woods Hole and MBL
Oregon State U.
Perry Institute for Marine Science
Princeton U.
Scripps Institute of Oceanography
SE Environmental Research Center (FIU)
Surface Ocean Lower Atmosphere Study (SOLAS)
Texas A&M U.
U. Bremerhaven (Germany)
U. Die Eidgenössische Technische Hochschule, Zurich
U. Georgia
U. Hawaii
U. Maryland, Baltimore Campus
U. Massachusetts
U. New Hampshire
U. of Bergen (Norway)
U. of East Anglia (UK)
U. of Florida
U. of Galway (Ireland)
U. of Heidelberg
U. of Kiel (Germany)
U. of Las Palmas de Gran Canaria
U. of Miami School of Medicine
U. of Miami, RSMAS
U. of Millorca
U. of North Carolina at Chapel Hill
U. of Paris (France)
U. of Plymouth (UK)
U. of Puerto Rico
U. of South Florida
U. of Southern Mississippi
U. of the Virgin Islands
U. of Victoria (BC)
U. of Vigo (Spain)
U. Xiamen (China)
U., Pohang (S. Korea)
US Geological Survey
Woods Hole Oceanographic Institute
World Precision instrument, USA

Funding



OCD funding has increased each year. Since FY03, while base funding has remained nearly flat, proposal funds have increased nearly \$500K per year.

Publications



OCD has maintained an average output of about 21 peer-reviewed publications per year.

Vision

To serve NOAA and the Nation as a center of scientific excellence in measurement, analysis, and understanding of the inter-linked biological, chemical and physical processes basic to ocean and coastal water composition and ecosystem sustainability.

Research Topics

Presented Topics

- Ocean carbon program
- Coral ecosystem forecasting
- Ecosystem restoration program
- Nutrient dynamics in the ocean
- Regional ecosystem connections*
- Microbial water quality of ecosystems

Other Projects

- Ocean acidification
- Iron fertilization
- Ocean energy
- Science support for seaports
- Tracers in the ocean
- Atmospheric chemistry
- Hurricane impacts
- Petroleum in sediments
- Florida area coastal environment
- Biosensor development

*video presentation

Principal Investigator

Rik Wanninkhof
Jim Hendee
Chris Kelble
Jia-Zhong Zhang
Elizabeth Johns
Chris Sinigalliano

(to be hired)
J. Zhang, R. Wanninkhof
J. Proni
J. Proni
R. Wanninkhof
T. Carsey
R. Black, J. Proni
J. Proni
J. Proni, T. Carsey
K. Goodwin

SCIENCE PRESENTATIONS

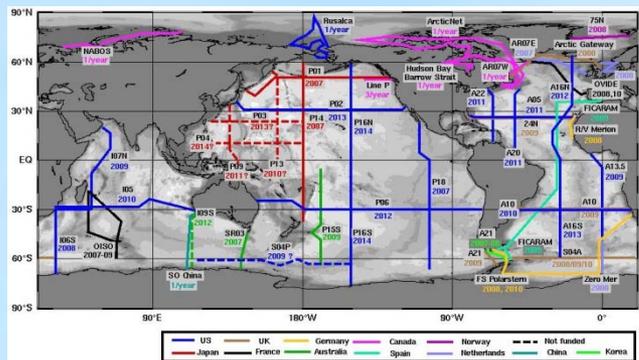
Ocean Chemistry Division

Global Ocean Carbon Program

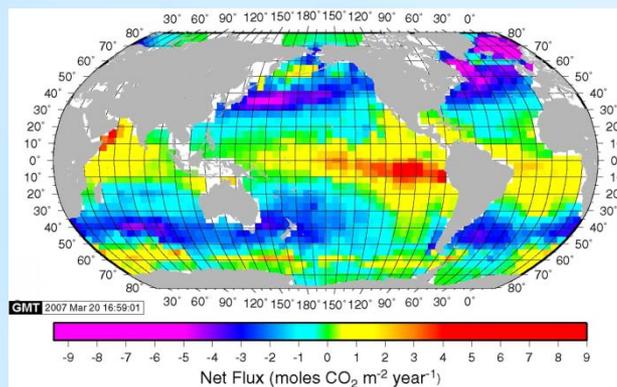
R. Wanninkhof, T.-H. Peng, D. Pierrot

Sustained observations of surface/column CO₂

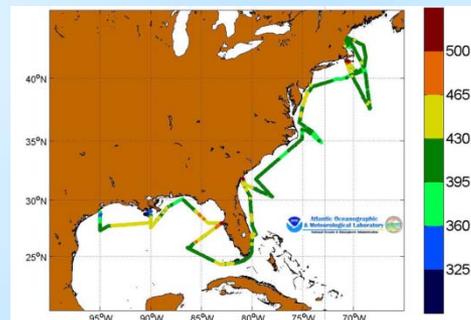
- Decadal variability in CO₂ and Nutrients in the Atlantic Ocean
- Global air-sea of CO₂ flux field
- Technology transfer of surface water CO₂ Instrument
- Estimation of air-sea CO₂ fluxes
- Supports NOAA's Climate Mission Goal: seasonal to decadal sequestration of CO₂ by the ocean



Map of Repeat Hydrography Surveys
http://www.ioc.unesco.org/ioccp/Hydrography/Hydro_Map.htm



Mean annual air-sea flux of CO₂ for 2000
Reference: Takahashi *et al.* 2008, Deep Sea Res. II (accepted).



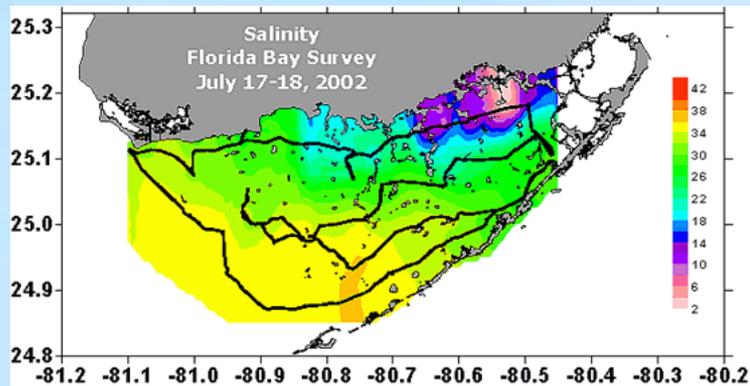
CO₂ flux map for the GOMECC cruise (Gulf of Mexico and East Coast Carbon Cruise). The black line along the coast shows the cruise track. The lines further out are data from the Explorer of the Seas used to create this map for July 2007

South Florida Ecosystem Restoration

Chris Kelble

Examining the Ecosystem of Florida Bay and vicinity, and how it is affected by changes brought about by The Comprehensive Everglades Restoration Plan (CERP).

- Proposed a management action to mitigate hypersalinity.
- Examined the impact of hurricanes on the coastal ecosystem.
- Helped complete an integrated ecosystem assessment of the greater Everglades ecosystem including the nearshore area
- Evolution of field program from research to operations
- Project supports Ecosystem Mission Goal to Protect, Restore and Manage Use of Coastal and Ocean Resources.



Salinity contour map for Fl. Bay, July, 2002



Florida Keys and FKNMS



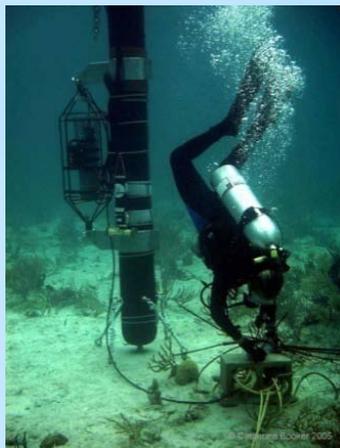
Zooplankton tow in Florida Bay

Coral Reef Ecosystem Forecasting

Jim Hendee

Produces ecosystem forecasts from ~120 sites around the world for Coral Reef habitats. Maintains growing number of coral reef monitoring stations in the Caribbean.

- Gathers many long-term data sets at major US coral reef areas
- Design, build and install custom in situ monitoring stations
- Ecosystem Forecasts, involving Integration of data from many sources for near-realtime forecasting
- New instruments modified and deployed (e.g., for coral physiology and partial pressure of CO₂)
- Supports NOAA's Ecosystem Goal of ecosystem-based management through ecological forecasts for environmental managers, researchers and the public. Supports NOAA's goals of understanding climate variability and change, and in serving society's needs for water and weather information.



Installing the SAMI pCO₂ Sensor



Existing CREWS stations...
ICON stations at the Bahamas (L),
St. Croix, Puerto Rico, and Jamaica (R).



3-day moving average of sea temperature at reef bottom, Discovery Bay, Jamaica.

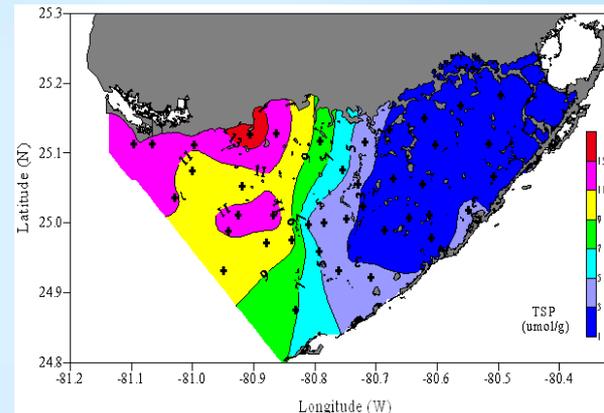
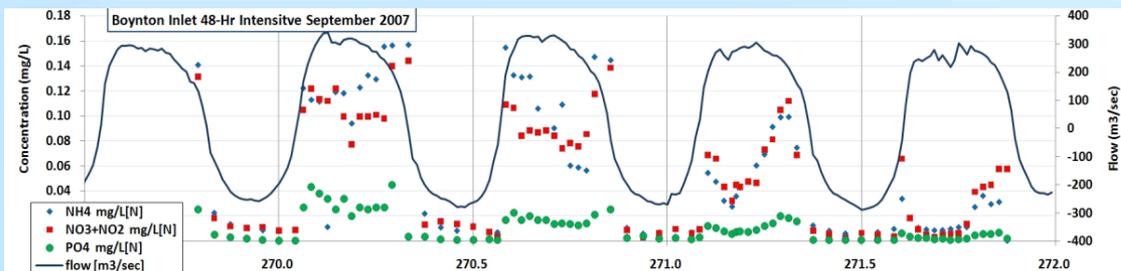
Nutrient Dynamics in the Ocean

Jia-Zhong Zhang, Xiaolan Huang, N. Amornthammarong

Methods development, sample analysis, data interpretation for coastal and deep ocean water nutrients (nitrate, nitrite, ammonium, phosphate, and silicate)

- Development of *liquid waveguide* nutrient measurement systems
- Observation of the nano-molar nitrate diel variation in the open ocean.
- Mapping nano-molar phosphate spatial gradient in Florida Bay water.
- Establish the equations describing water-sediment phosphate equilibria.

Program supports NOAA's *Ecosystem Mission* Goal to Protect, Restore and Manage Use of Coastal and Ocean Resources, and the *Technology and the Mission Support* goal of Research Tools for Improving Products, Services and Information.



Spatial distribution of total sedimentary phosphorus in the surface sediments of Florida Bay, documenting availability of this limiting nutrient in the bay.

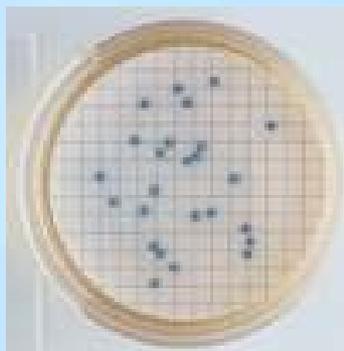
Nutrient results (colored symbols) along with current flow ($\text{m}^3 \text{sec}^{-1}$) through the Boynton Inlet, Sep. 2007. Outbound flow is positive.

Microbiology in the Coastal Ocean

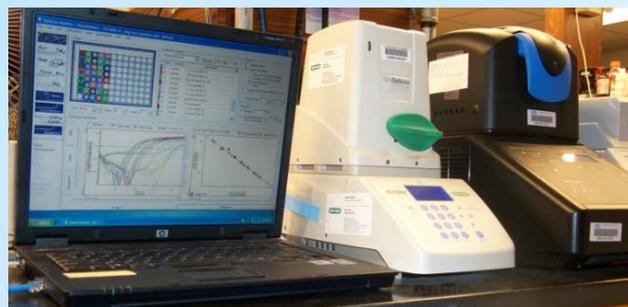
Chris Sinigalliano, Kelly Goodwin

Molecular detection methods development for microbial contaminants in coastal environments and transfer to field operations to benefit coastal resource management, living marine resources, and public health

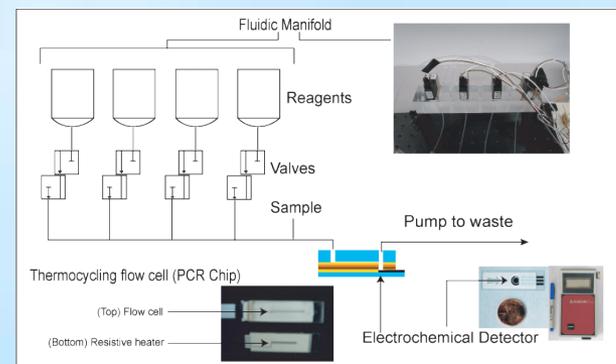
- Molecular assay development for indicators, pathogens, and source-tracking markers; deployed in large field programs and to evaluate hurricane impacts.
- Adaptation of molecular assays and sensors for rapid, high-throughput, and portable applications.
- Program supports the 5-year Ecosystem Mission Goal: Protect, Restore, and Manage Use of Coastal and Ocean Resources. Program also supports Research Tools for Improving Products, Services and Information (Technology and the Mission Support Goals).



Fecal enterococci on mEI agar



Real-time qPCR of microbial contaminants
(quantitative Polymerase Chain Reaction)



Schematic for prototype
handheld biosensor

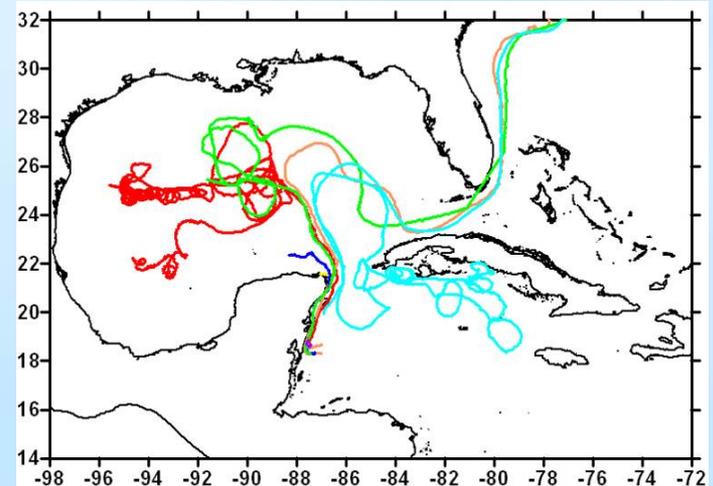
ECOSYSTEM CONNECTIVITY

Elizabeth Johns

Scientists from AOML are working collaboratively with scientists from SEFSC to determine the degree of physical and biological connectivity of the coral reefs of NOAA's Florida Keys National Marine Sanctuary (FKNMS) with upstream coral reef ecosystems

- The FKNMS is strongly linked by ocean currents to waters of the Yucatan Peninsula
- Eddies and gyres are important in establishing the time and length scales of the physical connectivity
- This physical connectivity between geographically separated spawning grounds may have an important influence on the degree of biological connectivity between larval reef species populations
- The project supports NOAA's 5-year Ecosystem Mission Goal to Protect, Restore and Manage Use of Coastal and Ocean Resources.

Drifter Trajectories from the
Gordon Gunter Cruise, March 2006



Science Challenges

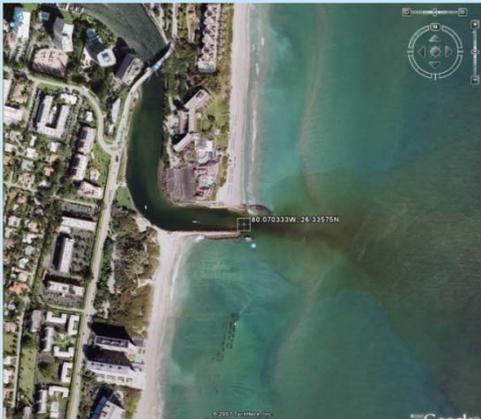
- Need to fill significant data gaps in long-term observations of CO₂ and related parameters in the US coastal ocean. (RW)
- Integration of data from disparate sources: timing issues (interpolation of discrete measurements), maintenance and calibration of multiple instruments (especially for remote stations); modification of procedures and requirements for each location. (JH)
- The use of molecular assays for microbial water quality lacks standardization among the molecular assay community regarding the methods, controls, and alternative indicator targets. (CS, KG)
- Development of in situ sensors for time-series measurements of low nutrients in oligotrophic ecosystems. (JZ)
- Quantitatively delineating the effect of management actions from natural ecosystem variation. (CK)
- Understanding the alkalinity variations in surface and deep oceans. (TP)

Administrative Challenges

- Staff and PI recruitment
- Rise and demise of the coastal ocean carbon program. (RW)
- Improving inclusion of ongoing programs into the PPBES process and appropriations.
- Improving coordination and interaction in shiptime scheduling/prioritization between OMAO and program offices.
- Need for increased NOAA support for on-going programs (ICON, Oceans & Human Health -- microbiology)
- Continuing Resolutions & Cash Flow (late receipt coupled with year end close-out)

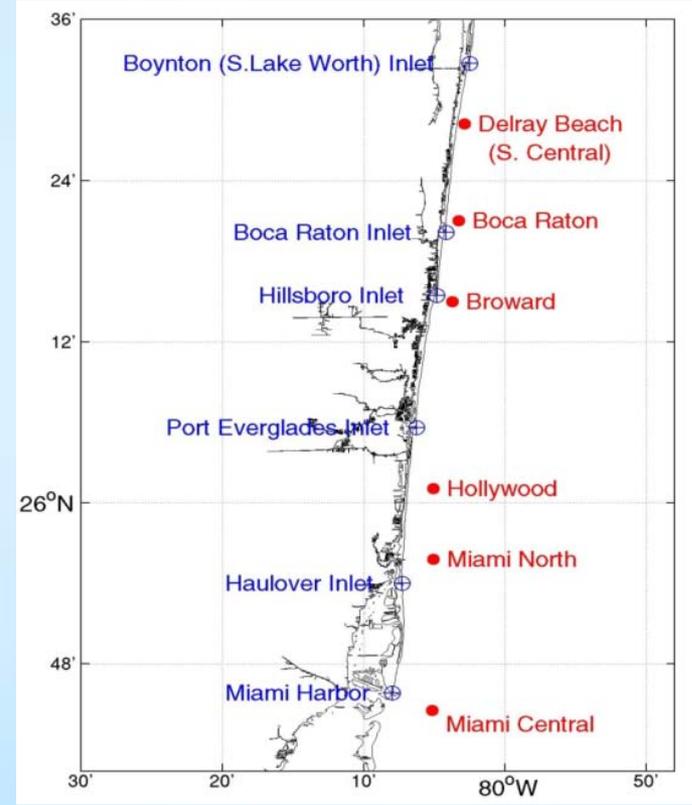
Questions?

The Florida Area Coastal Environment (FACE) Program



Boca Raton Inlet
(GoogleEarth)

Boca Raton WWTP outfall boil
October, 2006



Inlets and TWWP Outfalls in SE Florida

FACE

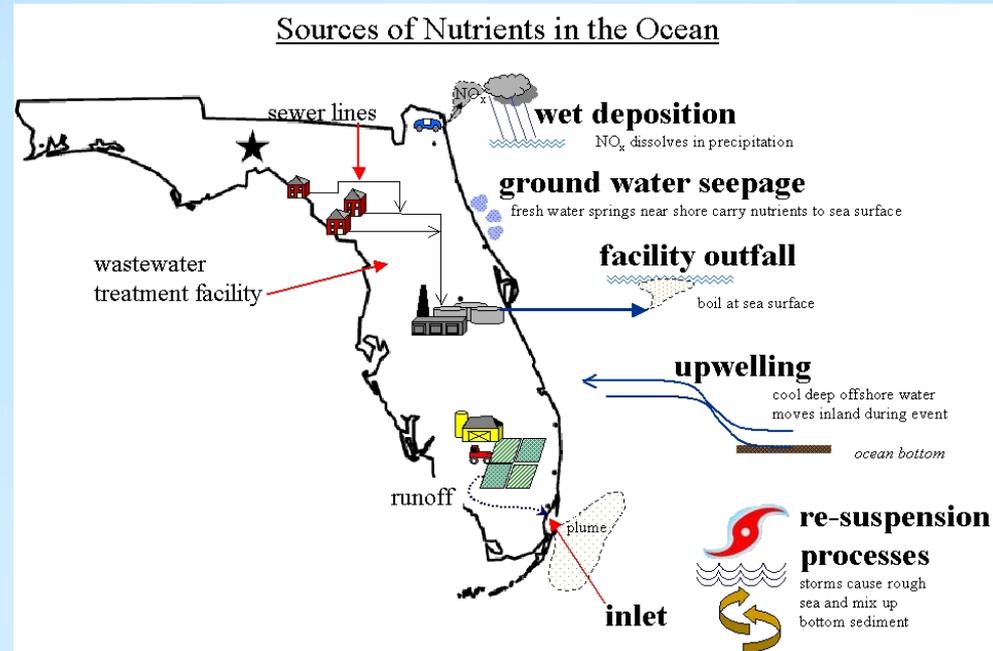
FACE Mission

FACE is a multi-agency program including federal, state, local governments, and water and sewer authorities.

- Provide scientific information for management decision-making
- Develop a multi-decadal database on coastal environmental parameters
- Communicate results to the general public.

FACE Approach

- Quantify nutrient and microbiological sources
- Determine natural (background) concentrations
- Determine potential effects of the anthropogenic substances



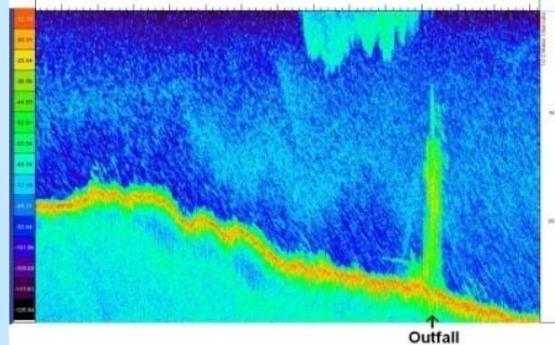
NOAA R/V Nancy Foster



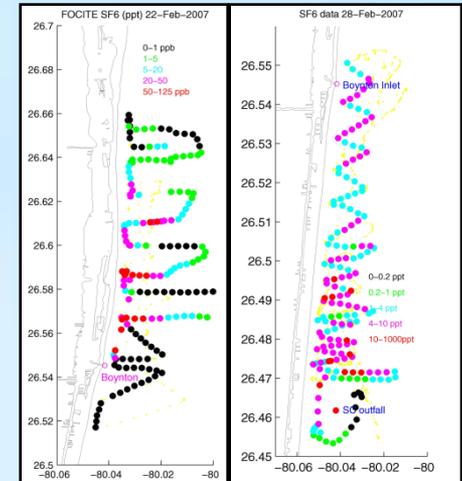
NOAA R/V Cable

Field Program

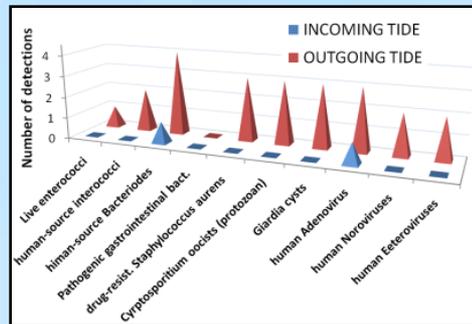
- Tracer Experiments at Inlets and Outfalls
- Water quality monitoring programs
- Inlet Characterization
- Ocean Current measurements
- Microbiology investigations
- Acoustic backscatter profiles
- Stable isotope studies (^{15}N , ^{13}C)



Acoustic backscatter image of SC plume

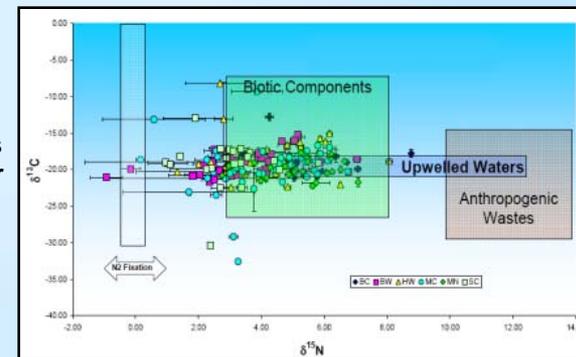


SF₆ concentrations at Boynton Inlet (L) and S.C. outfall plume (R), Feb. 2007



Microbiology of Boynton Inlet

Stable Isotope analysis of TWWP plume water



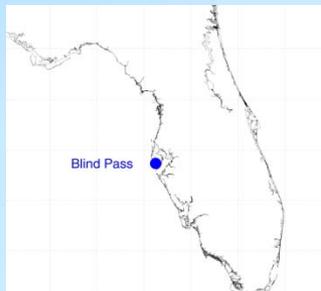
Publications

- P. Swart and C. Drayer, FACE 1st Year Report, Sampling of Nitrogen Compounds for Determination of Isotopic Values in Benthic Macroalgae, Sediment Organics, and Seawater, 2008.
- J. Proni et al., Brevard County Near Shore Ocean Nutrifcation Analysis, NOAA Technical Report OAR-AOML-37, July, 2005.
- R. Wanninkhof et al., Farfield Tracing of a Point Source Discharge Plume in the Coastal Ocean Using Sulfur Hexafluoride, Environ. Sci. Technol. 39, 8883-8890, 2005.
- J. Proni and R. Williams, Acoustic Measurement of Currents and Effluent Plume Dilutions in the Western Edge of the Florida Current, in Acoustic Remote Sensing Applications, p. 537-550, 1997.
- SEFLOE Final Report, Hazen and Sawyer, 1994.

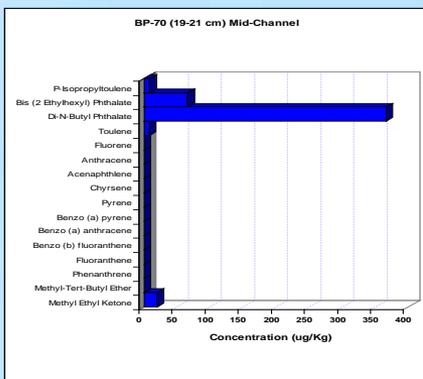
Petroleum in Sediments: Blind Pass

Field Program

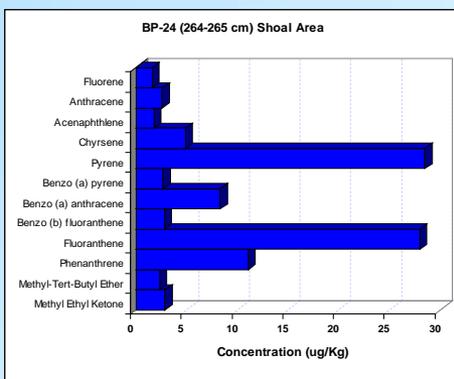
- ~100 cores will be extracted (P. Wang, U.S.F)
- Core extracts analyzed for hydrocarbons by GC-MS (P. Blackwelder, UM-RSMAS)
- Evaluation of the Vertek Penetrometer for analysis of hydrocarbons in marine sediments



Core locations map.
Green: cores obtained to date



MS-GC analysis of BP-70, shallow sediments, probable storm water run-off or small boat contamination.



GS-MS results for BP24, deep sediments, similar to results from a sample from a 1993 oil spill.



Cone Penetrometer

Hurricanes Impact at the Coast

J. Proni (AOML), S. Kimble (USA) B. Black (AOML)

Outline

- Measure the development of waves during a hurricane or strong storm.
- Measure sub-surface water currents.
- Recover the instruments and make available quality controlled data to test hurricane and storm surge models.
- Disseminate results to science and public through peer-reviewed publications.



Waves And Currents (AWAC) Gear Deployed in the Northern Gulf of Mexico, August 7-8, 2007

Collaborators and Co-workers

- Sytske Kimble, Kieth Blackwell, Ryan Wade, Donald Wright and Todd Murphy from U. of South Alabama, Mobile, AL.
- Eric Siegle and Don Conlee of Nortek USA
- Mike Dardeau, Rodney Collier, Tom Guoba and Clark Lollar of Dauphin Island Sea Lab, Dauphine Isand, AL
- James Cappellini and Doug Dooner, Mooring Systems Inc. Cautamet, Ma.
- Jon Wood, Ocean Data Technologies, Inc. Marstons Mills MA.

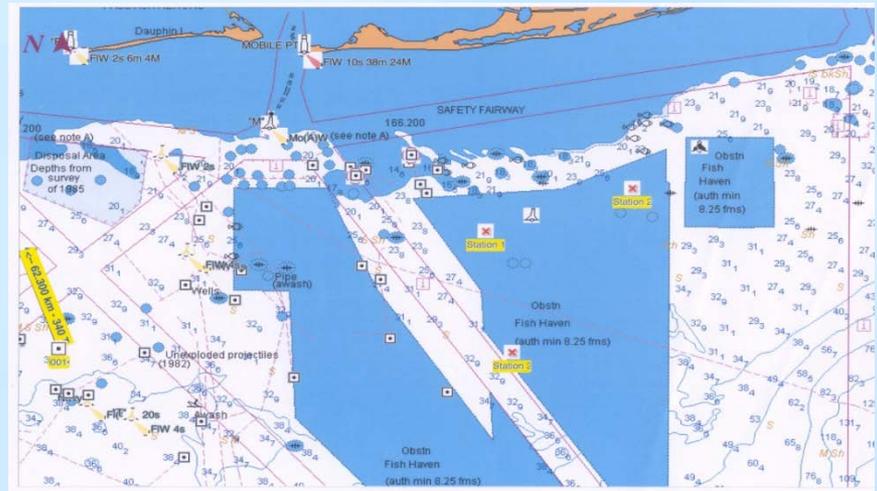


Chart showing location of three upward-looking ADCP units

Thank you