NOAA Ocean Acidification Program Brief for the Southern Association of Marine Laboratories 2014 Annual Meeting

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Duck Key , Florida
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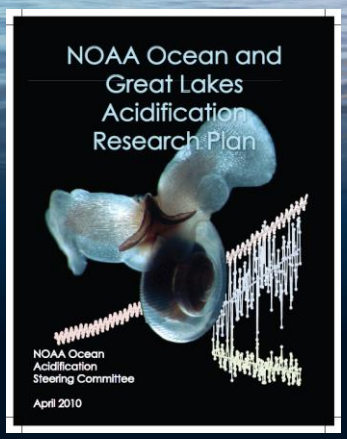
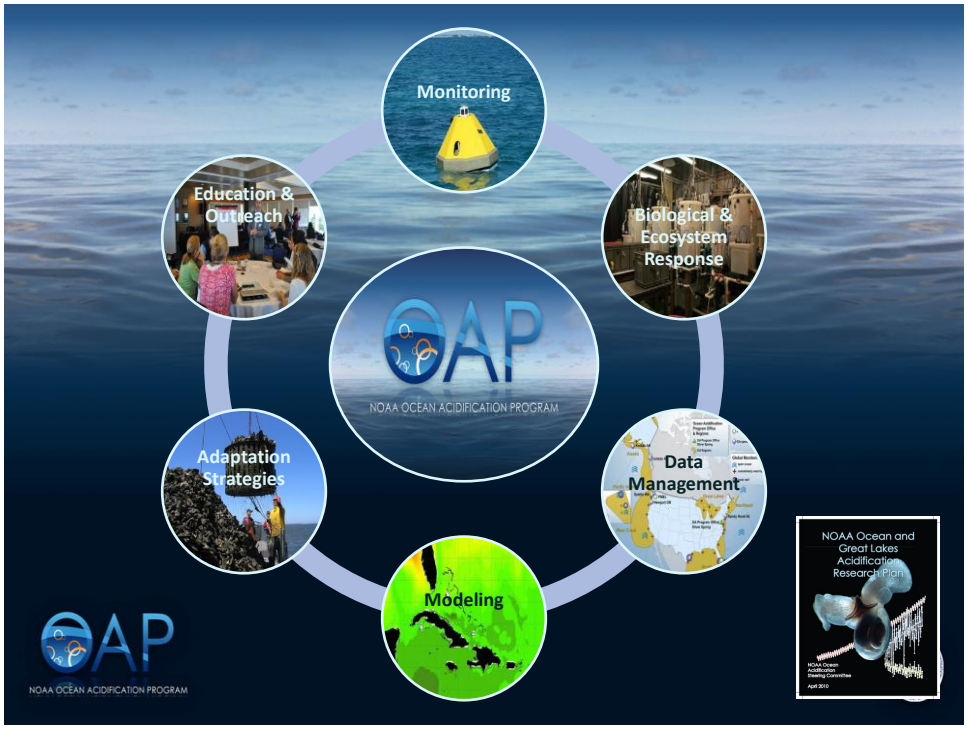
NOAA Ocean and Great Lakes Acidification Research Plan

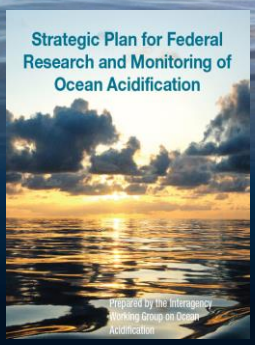
"The purpose…is to present a consensus research strategy for NOAA to advance the understanding of the impacts of ocean acidification and to address related challenges to local and national ecosystems and communities."





Interagency Working Group on Ocean Acidification

1. Research to Understand Responses to OA
2. Monitoring of Ocean Chemistry and Biological Impacts
3. Modeling to Predict Changes in the Ocean Carbon Cycle and Impacts on Marine Ecosystems and Organisms
4. Technology Development and Standardization of Measurements
5. Assessment of Socioeconomic Impacts and Development of Strategies to Conserve Marine Organisms and Ecosystems
6. Education, Outreach, and Engagement Strategy on OA
7. Data Management and Integration



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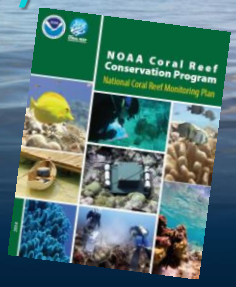
NOAA's National Coral Reef Monitoring Program (NCRMP)

- What is the status of coral reef ecosystems?
- What are the trends in conditions of coral reef ecosystems?







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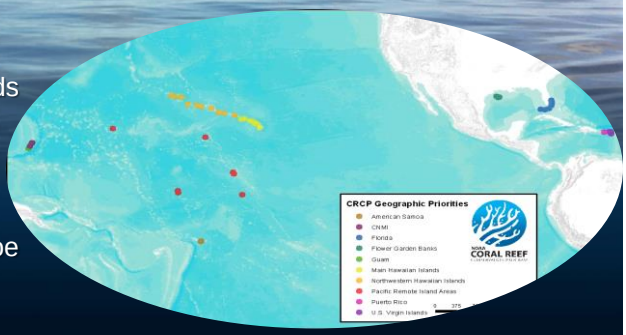
NOAA coral reef CONSERVATION PROGRAM

Priority Geographic Areas

- American Samoa,
- Commonwealth of the Northern Mariana Islands
- Guam
- Hawaii
- Pacific Remote Island Areas
- Florida (Martin to Monroe Counties)
- Flower Garden Banks
- Puerto Rico and U.S. Virgin Islands



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The Strategic Objectives

Direct Chemistry Changes	• What is Rate of change (e.g., $\Delta\Omega/\Delta t$) in seawater carbonate chemistry (CO2sys) within reef environments relative to comparative rates of changes in neighboring open ocean surface waters?
Biodiversity Impacts	• What are the changes in biodiversity as apparent from changes in benthic composition, community structure, and ecological function?
Community	• What are the long-term trends in annual integrated net community metabolic performance?
Dissolution/Bioerosion	• What are long-term trends in rates of mechanical breakdown and dissolution of $CaCO_3$ owing to biological and chemical (and physical) processes?
Organism Response	• What are the long-term regional changes in growth rates of target taxa in response?

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NOAA's National Coral Reef Monitoring Program (NCRMP)

• Several NCRMP metrics could be adapted to CROAMP.

• Requires adoption of several Tier 2 and Tier 3 measures

	Tier 1 - Critical	Tier 2 - Important	Tier 3 - Informative
Coral/ Benthos	• percent cover of benthic organisms / substrate • coral condition (*e.g.*, bleaching, disease) • abundance and size structure • rugosity • benthic diversity • key species	• rates of growth & bioerosion	• reproduction • recruitment • mortality • metabolic performance (*e.g.*, pCO_2) • microbial communities • non-indigenous species • protected species
Fish	• abundance and size structure • diversity • key species		• reproduction • population fecundity • recruitment • distribution • trophic structure • non-indigenous species • protected species
Climate	• temperature / thermal stress • vertical thermal structure • carbonate chemistry	• insolation • wave energy / hydrodynamics	• nutrients / productivity • meteorology • other impacts of global change

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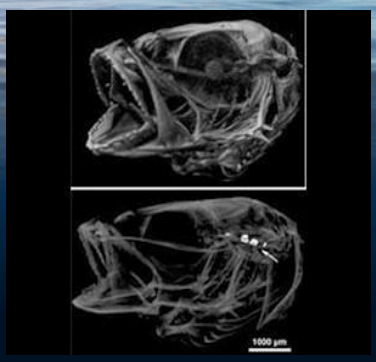
Revisiting Concerns for Marine Organisms and Ecosystems



Bignami et al. 2013

- Reduced calcification rates
- Significant shifts in key nutrient and trace element speciation
- Shifts in phytoplankton diversity
- Changes to key biogeochemical cycles
- Reduced growth, production and life span of larvae, juveniles and adults
- Reduced recruitment and settlement
- Changes to fitness and survival
- Changes to species biogeography
- Reduced tolerance to other environmental fluctuations
- Changes in food webs
- Changes to ecosystems and their services

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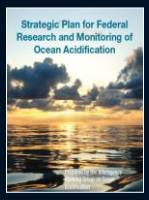
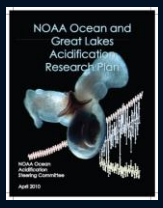
State of the OAP Program –FY15-17 Request for Sustained Investment (SI) Workplans

- Sustain current research/monitoring activities, i.e., long term observing, experimental facilities, modeling, species response studies and data management
- Geographic areas with existing OA research infrastructure/operations currently supporting OAP priorities and led by NOAA PIs or their pre-arranged designees
- Observing Networks, Experimental Facilities/Systems, Data QA/QC and Management, Modeling, OA Response Studies (NMFS)





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SI Workplan Vision Statements

- Forward-looking; rationale of broader OA research endeavor
- Collective vision serving to catalyze OA research efforts within region
- Platform on which additional OAP funds requested through BI LOIs
- Describes intended long-term outcomes on which OAP can develop programmatic performance measures
- Endorsed by PIs

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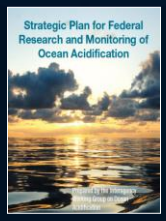
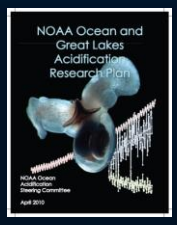
OAP FY15-17 Letters of Intent for Build-out Investments (BIs)

- BI funds will focus on more robust implementation of the OAP Sustained Investments (SIs) supporting ocean acidification observational and experimental capabilities to better achieve the strategic requirements of the program.





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Synoptic geochemical strategies to fully characterize the dynamics of coastal margins

- What are the rates of change
- What controls the dynamics?
- What is the ecological response?

Inventory long-term biological surveys from marine labs - Trawls, benthic surveys, corals, plankton surveys…

FY16 – Secure cruise from Miami to Scotian Shelf

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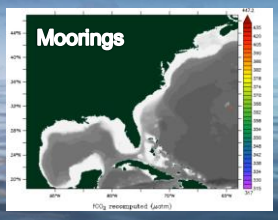
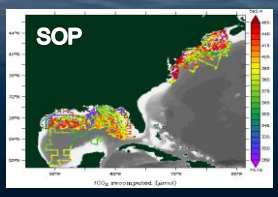
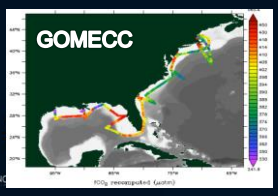
Hydrographic Cruises, Volunteer Ships of Opportunity, and Buoys/Autonomous Systems







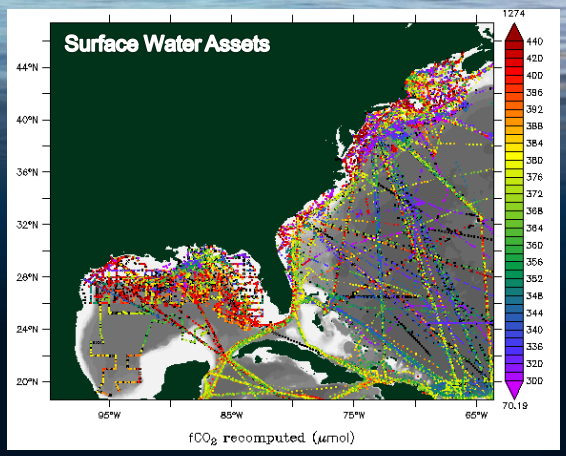
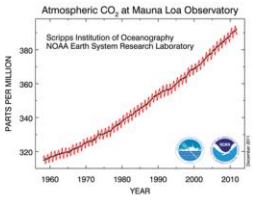
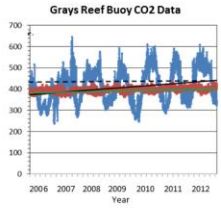


Figure Courtesy R. Wanninkhof, AOML

Gray's Reef Buoy Data





Atmospheric CO_2
15 ppm in 5 years
=0.783%/year

Worldwide Seawater CO_2
1.2 to 2.1 ppm/year
= ~0.5%/year

Atmospheric CO_2
21 ppm in 7 years
Average=391.7 ppm*
=0.77%/year

Seawater CO_2
78 ppm in 7 years
Average=411.6 ppm*
=2.7%/year

Note: Averages based on Gray's Reef data set

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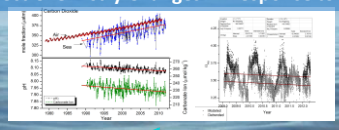
Interconnected Ecosystem

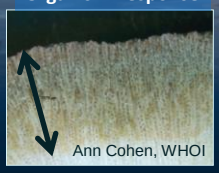
The Direct Chemistry Changes in Response to OA



Community-scale Impacts

Kim Yates, USGS

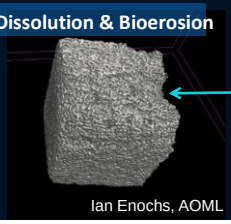
Organism Response



Ann Cohen, WHOI

Biodiversity Impacts

Dissolution & Bioerosion



Ian Enochs, AOML

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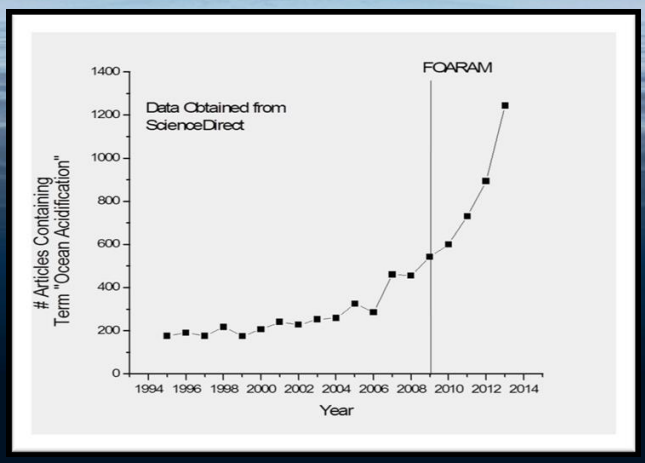
Publications Containing "OA"



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What Do We Know? What Don't We Know?
What Do We Need to be Thinking About?

- What is the state of the science?
- Who are the stakeholders?
- What are the unique considerations of the region?
  - Estuaries, Gulf Stream, Eddies, Species (coralline algae, seagrasses, corals, crustaceans, bivalves, finfish)
- Others TBD?

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SECOORA
Southeast Coastal Ocean Observing Regional Association

Resources/Contacts

Website: oceanacidification.noaa.gov

http://oceanacidification.noaa.gov/IWGOA.aspx

Email: paula.keener-chavis@noaa.gov