Second U.S. Ocean Acidification Principal Investigators' Meeting
Gallaudet University's Kellogg Conference Center, Washington, DC
September 17-20 2013
Breakout Details

Ten concurrent breakout sessions, each with no more than 20 discussants, are tasked with considering overarching issues affecting OA investigators in multiple disciplines and in numerous study sites/contexts. Discussions are intended to synthesize the state of knowledge and assess where the current science is headed.

In August, meeting participants were asked to indicate which breakout sessions they would most like to attend. Meeting organizers tried to accommodate participants' choices, but in some cases they may have assigned discussants to specific breakout sessions to achieve disciplinary balance or to elicit a specific perspective.

Breakout sessions

1. Characterizing the natural system Leads: Simone Alin (NOAA), Rusty Brainard (NOAA)
Main Auditorium (1st floor)

Given the advances made in the past two years in setting up a global ocean acidification observing network (GOA-ON) through the 2012 and 2013 workshops, discussants will extend the global conversation to consider: 1) the chemical and physical long-term monitoring framework needed to more robustly attribute ecological and ecosystem changes to ocean acidification; 2) sufficient spatial and temporal sampling approaches for biological processes to effectively inform society about the socio-ecological impacts of ocean acidification from community to ecosystem scales; and 3) necessary chemical and ecological components for two or three example long-term monitoring programs in different ecosystem types. Discussion will explore what knowledge is attainable in the short term (1-5 years) from existing programs, resources and methods, enhanced by new collaborations, and what knowledge is needed from the long-term observations to best inform policy decisions to optimize societal benefits.

2. Linking measurements to processes Leads: Andreas Andersson (SIO), David Kline (SIO)
Room 1BC (1st floor)

Discussants in this session will focus on the numerous challenges associated with using experimental outcomes to describe processes in situ. The conversation will focus primarily on: 1) linking experimental results and measurements to the natural environment, especially given biogeochemical feedbacks; 2) understanding the responses of organisms to ocean acidification in the context of natural variability; and 3) assessing ocean acidification's effects on ecosystems and foodwebs. Insight will be sought from studies of other environmental variables, and consideration of physiological tolerance to changing mean or extreme conditions.

3. Technical developments Leads: Kendra Daly (USF), Todd Martz (SIO)
Room 2 (2nd floor)

Discussants will begin by reviewing the results of a brief community survey focusing on usage trends and challenges associated with sensors and carbonate chemistry equipment. Then, the discussion will explore 1) needs associated with development of new techniques, sensors, and equipment; 2) possibilities of developing or enhancing sensor networks, particularly with an eye toward coordination and intercomparison; and 3) additional tools needed, such as analytical facilities, shared instrument repositories, or computing tools. In each case, identified needs will be matched with estimates of the type and magnitude of obstacles (e.g., time, cost, manpower, etc.) facing them.

4. Methodological and experimental developments Leads: Dwight Gledhill (NOAA) & Gretchen Hofmann (UCSB)
Room 3 (2nd floor)

As ocean acidification science has advanced, so too has the complexity of our understanding. Heterogeneity in both the dynamics of ocean acidification and organism responses has revealed a more nuanced and intricate narrative than previously imagined. Discussants in this session will focus on new and developing methods of ocean acidification experimental science that can 1) better emulate natural variability in carbonate dynamics; 2) incorporate multi-stressor impacts; 3) elicit improved insight into potential adaptive capacities; and 4) better utilize data from biogoechemical observing assets in experimental design.

5. Uncertainty Leads: Sergio Signorini (NASA) & Shallin Busch (NOAA)
Room 4AB (2nd floor)

Ocean acidification science includes many widely acknowledged uncertainties, yet incorporating uncertainty fully into the science is still at the early stages. Discussants in this session will focus on 1) how we can make measurements to allow us to estimate uncertainty adequately; 2) how we can best incorporate uncertainty into models of all types (e.g. numerical to mental); and 3) how we can best talk about uncertainty when we convey our results. This wide-ranging interdisciplinary session will touch on topics ranging from statistics and model-building to communication.

6. OA as one of many issues Leads: Joe Salisbury (UNH) & Denise Breitburg (SERC)
Room 4C (2nd floor)

Discussions about ocean acidification often point out that it is just one of many natural and anthropogenic processes affecting marine life, especially in the coastal zone. For instance, temperature increase, hypoxia, land use changes, ocean circulation, and disease also add pressure to marine ecosystems. These processes may combine synergistically or antagonistically, yet their full effects are not yet known. This discussion will explore the 1) multiple causes of acidification; 2) the effects of multiple stressors when one is ocean acidification; and 3) temporal and spatial scale issues and variations among systems related to multiple stressor effects.

7. Designing large multidisciplinary research efforts Leads: Kim Yates (USGS), Carol Turley (PML)
Room 5AB (2nd floor)

Understanding ocean acidification increasingly requires interdisciplinary work among chemists, biologists, physicists, and geologists. Calls for multidisciplinary studies are growing, urging consideration of marine changes in the context of global processes, human development, and more. To design and implement large multidisciplinary efforts, a high degree of coordination must be achieved. This session will consider 1) what the key elements of successful multidisciplinary research efforts are, especially those that could serve as analogs to future efforts to study ocean acidification; 2) how to implement such programs together organizationally; and 3) how to shape multidisciplinary projects once underway. Discussants will consider other successes and failures, and they will especially focus on temporal and spatial scale coordination.

8. Other theories to inform OA studies Lead: Cathy Pfister (U. Chicago)
Room 6AB (2nd floor)

Ocean acidification is not the first large-scale environmental challenge that has been studied intensively, but as oceanography is a relatively young field, most prior challenges have been in terrestrial and atmospheric environments. Discussants in this session will consider outcomes of other environmental impacts studies, especially those in other environments which may be unfamiliar to the ocean science community, to consider 1) how they can inform ocean acidification studies; 2) whether there are generalizable theories (e.g. spatial ecological principles, etc.) that can be borrowed from other disciplines and applied to ocean acidification, and 3) whether analytical or theoretical frameworks exist to consider this information.

9. Organizational needs & decisionmaking Leads: Sarah Cooley (WHOI), Libby Jewett (NOAA)
Executive Boardroom (2nd floor)

Discussants in this session will consider the intersection between the ocean acidification research community and decisionmakers/science programs. The conversation will consider 1) what the research community is expected to do and by whom; 2) what information different groups want from researchers; and 3) what activities can be undertaken to help science respond to these needs, including new science focuses, capacity building, and stronger coordination. Discussants will ideally include representatives from the research community as well as the decisionmaker and science-agency communities, and will include a mix of early and later career individuals.

10. Gamechangers & black swans Leads: Jeremy Mathis (NOAA), Dick Feely (NOAA)
Tiered Classroom (2nd floor)

Discussants in this session will be encouraged to think broadly about possible developments that could suddenly accelerate or end ocean acidification research. The discussion will consider: 1) scientific issues such as

tipping points, geosolutions, other major stressors (e.g., hypoxia, overfishing); 2) "mainstreaming" of ocean acidification research into overall marine science, as the community becomes larger and targeted research support declines; and 3) communication about the research in the face of increasing politicization of ocean acidification.

Overarching breakout session goals

- Consider the state of ocean acidification knowledge in an interdisciplinary context: What do we /don't we know?
- Start synthesizing trends and themes in ocean acidification science across environments (e.g., reef, coastal, polar, etc.) and processes (e.g., physical, chemical, or biological)
- Explore how enhanced interdisciplinary activity (e.g., collaboration, knowledge exchange) can address knowledge gaps
- Identify logical short-term steps and longer-term goals for the research community

Each breakout session's discussion will lay the groundwork for a synthesis paper in a special issue of Oceanography Magazine planned for December 2015.