

# Workshop Summary

## Effective Practices for Communicating Ocean Acidification Workshop September 2012



**Convened by NOAA West Coast National Marine Sanctuaries  
September 27-28, 2012  
Monterey, CA**

**Prepared by Kearns & West  
December 2012**

## Executive Summary

Ocean Acidification (OA) is an emerging issue that could have far reaching impacts on the health of our ocean and long-term sustainability of ecosystems that support human populations. On September 27-28, eighty-five individuals participated in the *Effective Practices for Communicating Ocean Acidification Workshop* in Monterey, California. The workshop was designed to create a forum for educators to have access to the latest science information on this topic and to be able to effectively communicate the science of ocean acidification, potential impacts, and positive actions to reach diverse audiences. The workshop included a mix of expert panel discussions and breakout session activities. Participants included scientists, educators, and communications experts from federal agencies, academia and research, aquariums and museums, environmental non-governmental organizations (NGOs), and other organizations interested in marine resource protection and OA in particular. The workshop was strategically planned to take place immediately following the *International Symposium on the Ocean in a High CO<sub>2</sub> World* (September 23 - 27 in Monterey) to build on the momentum of that event and to be able to include the expert scientists in the workshop.

The workshop's **primary objectives** were to:

1. Discuss and identify effective strategies and tools for communicating OA, including: target audiences, case studies, key research and literature, key messages, and desired changes in behavior
2. Identify associated gaps and needs, and strategies for addressing them.
3. Develop relationships and establish an action plan for ongoing coordination among OA communicators and educators

**Target audiences:** Workshop participants recognized that discussions of effective communication of OA need to be focused on specific audiences. Workshop discussions focused primarily on: teachers, students (K-12), families, policy makers, resource managers, and commercial and recreational users (including fishermen, seafood industry, and seafood consumers). Other key audiences addressed included conservation groups and the media.

**Case studies:** Workshop participants discussed a range of case studies that could be used to communicate OA to different audiences. Interested participants will continue to work with scientists over the coming months to further identify and refine the most effective examples. Case studies that received attention during the workshop included: Pacific Northwest oysters, impacts on clown fish olfactory cues, harmful algal blooms, corrosive impacts associated with upwelling on the California Current Large Marine Ecosystem, impacts on different life stages of urchins, species adaptations to CO<sub>2</sub> vents, corals serving as a barrier from extreme weather, food web effects (i.e., pteropods and salmon, krill and whales), seagrass beds, and blue carbon.

**Communication strategies:** Participants shared advice on how to message effectively on OA. Key guidance included:

- Clearly distinguish OA from climate change.
- Establish the role, importance and function of the ocean and use analogies (such as the other lung of the planet) to demonstrate that a living ocean matters to all life on earth.
- Let the audience know that they have a role to play both at the individual and community level.
- Link OA impacts to species or locations that people care about.

- Avoid using the term “acid” ocean, as the ocean is not actually becoming an acid, it is becoming more acidic and the term “acid ocean” can be confusing.
- Use simple messages to demonstrate that OA is real and happening now. Tell stories about how it is impacting people and about people taking positive action.
- Focus on outcomes and solutions for which audiences can be hopeful.
- Avoid messages that cause audiences to tune out. For example, when:
  - Issues are messaged as crises. “Gloom and doom” does not work.
  - They are made to feel guilty, solely responsible, or alone in their concern.
  - They don’t feel they can actually have an impact on the problem.
  - They believe that the solutions they are being asked to adopt are not to the scale with the problem (e.g., change light bulbs to combat OA).
  - They worry that they cannot afford to make big changes.
  - They don’t feel that an issue that is far away in time or space affects them.
  - Messages come from a messenger they don’t identify with.

**Key messages:** Workshop participants discussed a number of key messages over the course of the workshop. The following three messages resonated especially well with participants:

- The current rate of change of OA is faster than any time on record (10 times faster than the last major OA event 55 million years ago).
- Marine organisms with calcium carbonate shells or skeletons (coral, oysters, clams, mussels, etc) can be affected by small changes in acidity.
- OA has the potential to fundamentally change the ocean, its habitats, food webs and marine life.

**Research and literature:** Workshop participants identified five main categories of OA research and literature and the audiences to which each category applies:

- Foundational science, such as biology, chemistry, etc. (targets teachers, students, and teens)
- Socioeconomics (targets commercial users, policy makers, and media)
- Education research and communication (targets OA educators and communicators and scientists)
- Current research (targets adults, conservation interests, media)
- Predictions (targets commercial users, policy makers, and conservation interests)

**Desired changes in behavior:** Participants identified a broad range of desired behaviors on the part of specific target audiences. These ranged from numerous ways to reduce carbon footprints (including making homes more energy efficient, transportation choices, buying locally grown food, supporting green energy, etc.) and incorporating OA into long-term business planning to encouraging collaboration within and between audiences and increasing funding for monitoring and research. A working group will follow up to develop more specific “asks” for target audiences.

**Challenges:** As the workshop participants explored ways to effectively communicate OA, they also identified some core challenges to be addressed. Key challenges discussed included:

- OA is still not well understood by most audiences and is not on the radar for many policy makers; this is complicated by OA being a complex issue that is difficult to communicate quickly and succinctly.
- Insufficient funding exists to support key gaps around OA communication, such as development of effective educational materials and curricula, and stakeholder outreach and engagement.

- There are risks in having OA linked to the politically-charged debate over climate change.
- Success stories and best practices around OA need to be developed.
- Citizens located away from the ocean may tend to view OA as a coastal problem that is not relevant to them.

### **Action plan and recommendations**

As a key next step following the workshop, NOAA will develop an education implementation and action plan to build upon the momentum created. The action plan will include findings from the pre-workshop needs assessment survey and lessons learned from the workshop, and it will focus on key steps for building an OA communicators' network. Workshop participants signed up to participate in topic-specific working groups to continue their discussions around effective OA communication.

The workshop, including a share-a-thon event, provided a welcome opportunity for participants representing science, education, communication, resource management, policy and ocean dependent industries to network, exchange ideas and project experiences, and build relationships. Participants recommended keeping communication channels open between these groups to continue the work of developing a consistent and coordinated approach to communicating ocean acidification to the public.

## A. Introduction

On September 27<sup>th</sup> and 28<sup>th</sup>, eighty-five individuals participated in the *Effective Practices for Communicating Ocean Acidification Workshop* in Monterey, California. Ocean Acidification (OA) is an emerging issue that is predicted to have far reaching impacts on the health of our ocean and long-term sustainability of ecosystems that support human populations. The workshop was designed to create a forum for educators to have access to the latest science information on this topic and to be able to effectively communicate the science of ocean acidification, potential impacts, and positive actions to reach diverse audiences. This workshop was identified as a priority education strategy in the West Coast National Marine Sanctuaries Ocean Acidification Action Plan ([http://sanctuaries.noaa.gov/about/pdfs/wc\\_onms\\_plan.pdf](http://sanctuaries.noaa.gov/about/pdfs/wc_onms_plan.pdf))

The workshop participants included scientists, educators, and communications experts from federal agencies, academia and research, aquariums and museums, environmental non-governmental organizations (NGOs), ocean dependent industries, and other organizations interested in marine resource protection and ocean acidification (OA) in particular. A complete list of participants is included in Appendix A.

The workshop was coordinated by National Marine Sanctuaries of the West Coast (Channel Islands, Monterey Bay, Gulf of the Farallones, Cordell Bank, and Olympic Coast) in collaboration with the Monterey Bay Aquarium Research Institute with funding provided by the NOAA Ocean Acidification Program, NOAA Coral Reef Conservation Program, West Coast Region of the NOAA Office of National Marine Sanctuaries, Monterey Bay Sanctuary Foundation and the National Marine Sanctuary Foundation. Input on workshop objectives and design was provided by a steering committee, including representatives from California Academy of Sciences, Center for Ocean Solutions, Monterey Bay Aquarium, NOAA Coral Reef Conservation Program, NOAA Fisheries, NOAA Ocean Acidification Program Office, The Ocean Conservancy and NOAA Office of National Marine Sanctuaries.

The workshop was strategically planned to take place immediately following the *International Symposium on the Ocean in a High CO<sub>2</sub> World* (September 23 - 27 in Monterey) to build on the momentum of that event and to be able to include the expert OA scientists in the workshop. Many of the workshop participants also attended the Symposium and brought their new knowledge and insights to the workshop discussions.

Over the course of the workshop, participants became immersed in the challenges and opportunities that currently exist and lie ahead for communicating to and educating their audiences about ocean acidification. Sessions were focused around expert panel discussions and participation in small group activities.

This workshop summary captures key outcomes and discussions from the workshop. It is not intended to be a transcript of every point made. The summary is organized into the following sections:

- A. Introduction
- B. Workshop objectives
- C. Welcoming remarks and reflections
- D. Panel discussions
- E. Share-a-thon
- F. Development of OA communications and education approaches and tools
- G. Discussion of action plan for ongoing work

- H. Next steps
- I. Pre-post survey results

## B. Workshop Objectives

The workshop's primary objectives were to:

1. Discuss and identify effective strategies and tools for communicating ocean acidification, including:
  - Target audiences
  - Case studies
  - Key research and literature
  - Key messages
  - Desired changes in behavior
2. Identify associated gaps and needs, and strategies for addressing them
3. Develop relationships and establish network for ongoing coordination among ocean acidification scientists, communicators and educators

The dynamic two-day workshop proceeded in three main parts. The first part focused on the state of OA Science after the Symposium, status of public knowledge about OA and ways to communicate OA, and was comprised of a suite of expert panel presentations and group discussion. The second part was an education share-a-thon of teaching and outreach activities on OA. The third part focused on developing an OA communication and education approach, which consisted of a suite of diverse breakout group discussions and reports back to the plenary. The workshop ended with participants discussing the outline of an action plan for moving forward and making commitments to continue the dialogue. The workshop agenda is included in Appendix B. The workshop was facilitated by Kearns & West.

## C. Welcoming Remarks and Reflections

Laura Francis, education coordinator for NOAA Channel Islands National Marine Sanctuary, opened the workshop and Bill Douros, Acting Deputy Director of the NOAA Office of National Marine Sanctuaries, provided welcoming remarks. Both speakers expressed their hope that by bringing a large and diverse group together to focus on OA communications, a more consistent and coordinated approach can be developed to reach target audiences about this topic. Bill emphasized the value of being place-based organizations (sanctuaries, parks, aquariums, museums) and the unique opportunity that provides us to connect to our audiences.

Participants were also offered the opportunity to share some initial lessons learned from the *International Symposium on the Ocean in a High CO<sub>2</sub> World* that might have implications for the workshop. Key comments shared included:

- Some species may have more resilience to changing ocean chemistry and may be able to acclimate or adapt. We know that the ocean will change but there is some uncertainty as to how. (This may help instill hope.)
- The fact that some species and habitats have resilience to OA may also make our job of communicating this topic even more challenging.

- We need to be careful with the terms “winners” and “losers”. Each “winner/loser” has a different ecological role in the complex food web and these terms don’t take into account how preferred food could switch among species. These terms may also confuse audiences, potentially fuel skeptics, and may not be an effective way to get the message across.
- A major challenge that remains for communicating OA is that many people care about the ocean, but they do not know what they can do in their daily lives to address the problem.
- Multiple stressors such as lower oxygen and increasing temperature can exacerbate the problem of OA.
- It was mentioned that Joanie Kleypas, who provided the wrap-up session to the science symposium, used an effective analogy of a smoker. Smoking causes multiple health issues in people. Until the smoker can kick the habit, her doctor may treat the symptoms rather than the cause and may advise the patient to lower stress, stop drinking, develop a healthy lifestyle, good diet, etc. Similar to smoking, carbon emissions cause health issues for the ocean. Until we can kick the habit of the cause of ocean acidification (CO<sub>2</sub> emissions from burning fossil fuels), we need to reduce the other stressors on the ocean, such as pollution, habitat loss, overfishing, etc.

## D. Panel Discussions

**Panel Discussion One (Day 1):** International Ocean in a High CO<sub>2</sub> World Symposium Science Overview

*Moderator: Eric Poncelet, Kearns & West*





*Panelists:*

- *Libby Jewett, Director, NOAA OA Program Office*
- *Sarah Cooley, Ocean Acidification Scientist, Woods Hole Oceanographic Institution*
- *Jenny Stock, Education Coordinator, NOAA Cordell Bank National Marine Sanctuary*
- *Geraldine Fauville, Education Project Coordinator, University of Gothenburg*

The purpose of this panel was to summarize the take away messages from the International Science Symposium and identify case studies that participants can utilize moving forward. Case studies serve as key stories to which many audiences can relate.

The panelists discussed the following case studies and highlighted these key messages:

- Pacific Northwest Oysters: Oyster larvae mortality has significantly increased under more acidic ocean conditions. Five-year failure in recruitment of oyster larvae has occurred on the west coast, and one business now rears larvae in Hawaii, while others have to constantly monitor their local water quality to prevent mass die-off. OA is a serious threat to businesses, and this example shows adaptation of the shellfish industry in relation to this issue. ([NOAA Pacific Marine Environmental Lab 2012](#))
- Ocean acidification makes it difficult for shellfish and corals to form calcium-based structures and shells. ([NOAA Pacific Marine Environmental Lab 2012](#))
- Prey and megafauna: Larval development of Antarctic krill is affected by high CO<sub>2</sub> conditions. ([Kawaguchi 2008](#)). Krill is an important food source for whales. We need a better understanding of this potential impact, and if krill along the West Coast are similarly affected to make a link to OA in this possible case study. Pteropods (sea butterflies) are a type of mollusk that are an important prey item for salmon. Pteropods may be impacted by ocean acidification ([Mathis 2009](#)).
- Clownfish behavior changes: When raised in high CO<sub>2</sub> environments, clownfish olfactory cues are impaired, causing them to have a higher likelihood of swimming into the path of predators. This case study example could potentially have broad appeal to a general public audience. The clownfish could be a possible “poster fish” for the issue of OA. ([Munday, 2008](#))
- Harmful Algal Blooms (HABs): Certain types of phytoplankton that contain toxins (domoic acid) can rapidly accumulate in high CO<sub>2</sub> environments. These phytoplankton are consumed by shellfish, anchovies, and sardines, which are then eaten by sea lions and other marine mammals. This results in potential impacts to fisheries and aquaculture, and is occurring now in the Baltic Sea. The frequency and intensity of HABs seems to be increasing under more acidic ocean conditions. ([Sunda 2012](#))
- Seagrass beds sequester CO<sub>2</sub> and may provide benefits to coral reefs downstream by taking in CO<sub>2</sub> as carbon sinks. Protecting or restoring sea grass beds may serve as a positive adaptation to changing ocean chemistry. ([Manzello et al. 2012](#))
- The rate of change of OA is faster than any time on record - 10 x faster than the last major OA event 55 million years ago, ([Honisch et al. 2012](#)).
- California Current: Upwelled water on the North American Continental Shelf is more corrosive than it was in the past and we are seeing these changes in chemistry faster than was anticipated. Upwelled water was not corrosive during the pre-industrial era, so there is a direct connection of human actions to increased acidity. ([Feely et al. 2008](#))
- Urchins have a variable response to high CO<sub>2</sub> and low pH, and their sensitivity depends on the stage of their life cycle. Larval urchins seem to be more sensitive. Urchins have a critical ecological role in maintaining the balance between algae and reef ecosystems.



Scientists are working to understand the complex ecosystem consequences of more acidic conditions. ([Hoffman Lab](#))

- Champagne sites are natural CO<sub>2</sub> vents that have been studied in Papua New Guinea and the Mediterranean. These sites provide clues to what a high CO<sub>2</sub> ocean will look like. More algae and seagrass are present, but there is less overall biodiversity ([Brahic et al 2008](#)).
- Hermit crabs studied by MBARI scientists are impacted by OA ([Kim et al 2012](#)).
- Mesocosms: This is an experimental tool that brings a small part of the natural environment under controlled conditions such as Free Ocean Carbon Enrichment ([FOCE](#)) system.

There was additional discussion about community engagement and examples of C40 cities and schools converting to solar, the potential to use Endangered Species Act and the Clean Water Act to regulate emissions.

Regarding challenges, the panelists agreed that cooperation is a large issue. Scientists across the world may be studying the same species or habitats, but adequate sharing of this information may be lacking. Cooperation is currently more on a local scale, and it is important for it to expand regionally, nationally and internationally. Building international trust in terms of science and the global policies that are put into place will be important with regard to this issue.

### Discussion

During the question and answer period, workshop participants shared similar experiences about challenges with communication. Participants encouraged scientists to contact journalists when working on a story of potential public interest, and suggested that it is okay to be the center of the story because it can help move science forward. It was also suggested that journalism needs to capture the human side of science stories, by highlighting the scientists that are conducting the research. Participants noted that it is important for scientists and educators to think about how to better connect with each other, and noted that in this current economy where funding is limited, collaboration is essential. Participants also suggested that early career scientists should focus on getting communications training, so as they move throughout their careers they will understand how to message their work to reach a broader audience. There were also suggestions regarding scientists working with the seafood industry, such as the California Coastal Acidification Network (C-CAN), on providing monitoring tools for OA.

Another discussion point was that terminology can be effective or misleading. For example, adaptation is very different in biology than in social science. We need to make sure terms are used appropriately and be aware of potentially misleading terms.

**Panel Discussion Two (Day 1):** What does the public understand about ocean acidification, and what compels them to act?

*Moderator: Julia Roberson, Ocean Conservancy*

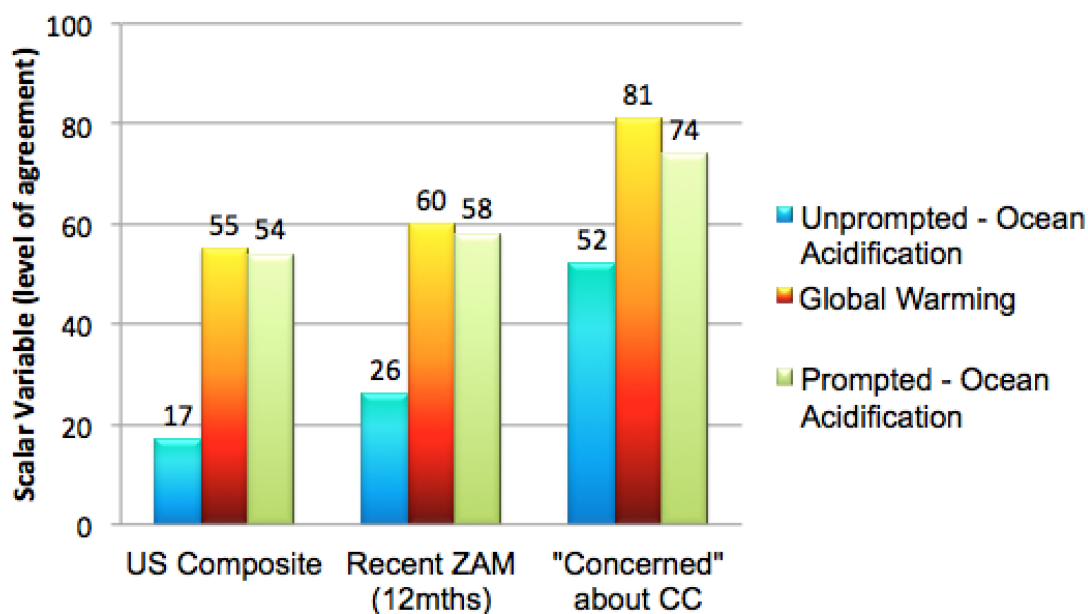
*Panelists:*

- *Wei Ying Wong, The Ocean Project*
- *Rachel Weidinger, Upwell*
- *Lisa Dropkin, Edge Research*

The Ocean Project (TOP) shared survey data on effective OA communication. A survey of more than 1,800 adults in the United States showed low numbers for those who have heard of, are

familiar with, or are informed about OA. As an issue, global warming currently has more traction with the public but it is also highly politicized.

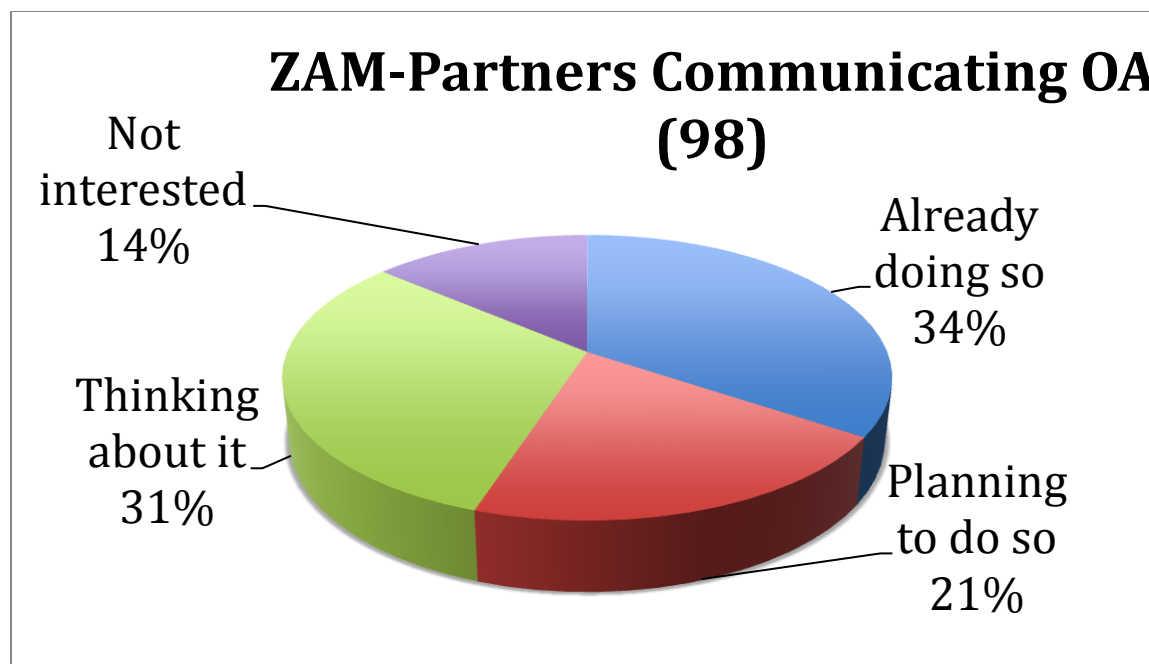
## I am worried about...



ZAM = Zoo, Aquarium, Museum visitors  
CC = Climate Change

Even just seeing the words “ocean acidification” was enough for some to express concern. On the scale where a value of 100 means complete agreement with the statement the score for “I am worried about...” ocean acidification was 17. When prompted with a brief explanation of what ocean acidification is, that score increased to 54. For all recent Zoo, Aquarium and Museum (ZAM) visitors, the agreement score went from 26 (without prompting) to 60 (with prompting). For those already concerned about climate change, it went from 58 (without prompting) to 78 (with prompting).

This presents an opportunity for aquariums and other informal science education centers. The research suggests that now is the time to help place this issue on the public radar and that ZAMs provide a remarkable opportunity to frame this issue accurately, raise awareness, and inspire action on ocean acidification.



Prior TOP research has shown that the public expects ZAMs to provide them with information about the problems and ways to be part of the solution. The research also indicated that these efforts are most likely to be successful when the problems are put in the context of specific species, and the solutions in the form of personal actions. TOP research suggests that visitors are very likely to welcome information about the problems and solutions associated with ocean acidification, especially when framed in the context of conserving shellfish or corals, for example, however visitors are highly unlikely to want to increase their knowledge on the specifics of the issue itself, such as the chemical processes at play or the logarithmic nature of the pH scale. To help people take action, ZAMs do not necessarily need to make them scientifically literate on the issue, but do need to provide some ways to help make information accessible.

Upwell has been tracking the online conversation about OA and shared their data from June 15 – Sept 13, 2012. Upwell currently tracks the online conversation across eight ocean topic areas: acidification, cetaceans, Gulf of Mexico, MPAs, tuna, sharks and Shark Week, overfishing and sustainable seafood and ocean.

The Upwell team works with government, media, NGOs, and scientists, and tracks social mentions with key word searches. The level OA conversation is relatively small compared to other topics such as sharks and whales. Upwell can unpack these mentions and see the source of media who sent it out and when. There are many voices in social media. Upwell's goal is to get more, longer, higher spikes for ocean issues.

Upwell noted a spike to 3,100 mentions of ocean acidification for Dr. Jane Lubchenco's (NOAA Administrator) talk at the International Coral Reef Symposium in July 2012 and then hovered about 500 mentions/day. There were a lot of mentions about pacific oysters/shellfish and "acidifying faster than expected." The tagline of "osteoporosis of the sea" was used to describe ocean acidification.

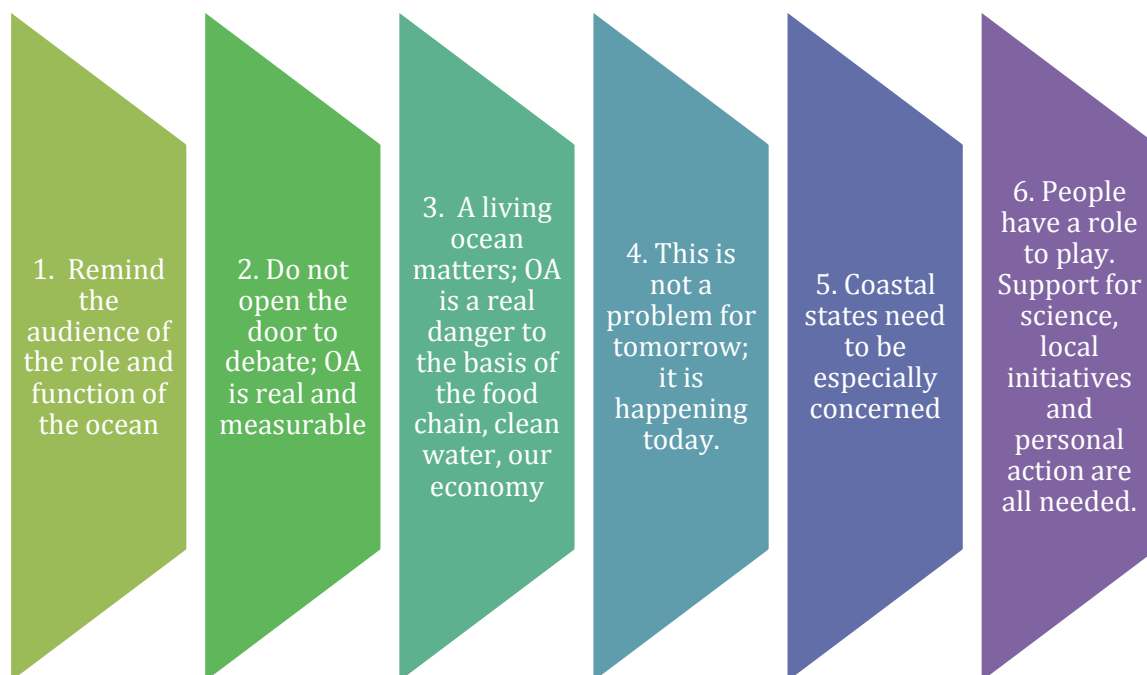
Upwell has done some micro/test campaigns to get a better understanding of the online conversation related to OA. One was: This is your ocean. This is your ocean on fossil fuels.

The following hash tags: #endfossilfuelsubsidies and #oceanacidification have been used as twitter tags to help track the conversation. Upwell finds that people latch onto a phrase that characterizes the issue.

Edge Research has conducted national public opinion polling that tells us that the issue of OA is not on the radar...yet. When asked what the most serious threats to the ocean are in a 2011 survey, respondents indicated that dumping of sewage, chemicals, and other pollutants was the greatest threat followed by plastic trash and debris, and offshore oil and gas drilling and related spills. Ocean acidification was way down this list at number 10. However, Edge Research did find that just the term “ocean acidification” without a description of impacts, intuitively concerns. Our challenge as communicators is making it relevant. When asked if OA has consequences for today only 19% of respondents nationally and 17% in California agreed with that statement. Studies in the Puget Sound area of Washington State found that people feel the issue has higher relevance to the area and the community than to them personally.

Edge Research suggested making a strong statement on carbon, but refraining from national/international solutions that are tied to the climate change debate. Edge survey data also shows that being associated with climate change can be a barrier to effectively communicating about OA.

The message platform below was developed by Edge and The Ocean Conservancy. Individual messages can be developed using this platform as a framework.



In terms of messaging, the term “ocean acidification” tested better with audiences than “acid ocean.” The term “acid” fuels skeptic’s arguments that the ocean is not actually turning into an acid and was viewed as having more negative connotations. “Ocean acidification” was viewed as being a more effective description of the issue.

Panelists discussed that, overall, although the knowledge of OA is increasing, it is important for communicators to critically think about how to message OA. For example, communicators may be more effective by linking OA impacts to species or locations that people care about. The public needs to understand that OA is something that is happening today rather than happening in the future. Communicators need to increase the urgency without overwhelming audiences. The panelists also suggested appropriate framing to make the topic relevant to different audiences and to find ways to repeat the same facts in a few different ways to reach a wider variety of people.

### Discussion

During the question and answer portion, some participants wondered how long they should remain calm about this topic. With recent evidence showing the rate of change to be taking place much faster than previously understood, and with OA still receiving very little attention in the media, when is it time to increase the urgency? The panelists thought that having an emotional connection to OA can help reach certain audiences, although it is important to consider how to frame the issue appropriately given your target audience. The panelists shared that workshop participants have a lot of influence and credibility and should use it for communicating OA. It will take many voices to carry this issue forward.

### **Panel Discussion Three (Day 1):** Communicating OA amongst aquariums: Lessons learned *Moderator: Wei Ying Wong, The Ocean Project*

#### *Panelists:*

- Aaron Pope, California Academy of Sciences
- John Anderson, New England Aquarium
- Jim Covel, Monterey Bay Aquarium

The panelists suggested a multi-pronged approach is best to engage ZAM audiences and provided some advice on what works and what doesn't in connecting with visitors. The panelists shared the term "green glazing," which defines the look guests have when their eyes glaze over and they disengage after hearing too much about "green environmental issues." To avoid green glazing with regard to OA, which is a scientifically complex topic, they suggested that communicators and educators start small. It is important to instill in these audiences some level of ownership, bringing them in to feel a part of the solution. Using animal ambassadors can also assist in engaging ZAM audiences. Charismatic penguins, for example, could help connect to visitors. Typically, visitors focus on what is directly in front of them. By interacting with the penguins and hearing the challenges they face, visitors will want to help them and will stay engaged to hear how.

Panelists noted that sometimes conversations OA communicators have with members of the public can get contentious. One way to mitigate this is to share stories. Stories invite solutions that can assist the individual and the community in addressing the challenges posed by OA. Sharing personal stories of when and how someone learned about OA and changed their course of action helps provide the listener with hope rather than despair.

The panelists noted that people often tune out when:

1. Issues are messaged as crises. "Gloom and doom" does not work.
2. They are made to feel guilty, solely responsible, or alone in their concern.
3. They don't feel they can actually have an impact on the problem.
4. They believe that the solutions they are being asked to adopt are not to scale with the problem (e.g., change light bulbs to combat OA).

5. They have difficulty comprehending how changing their lives can be positive.
6. They worry that they cannot afford to make big changes.
7. They don't feel that an issue that is far away in time or space affects them.
8. Messages come from a messenger they don't identify with.

### Discussion

Participants asked the panelists if they had thought of bringing visitors through the emotional cycle, including denial and grief. The panelists responded that although some exhibits have executed this message in the past, focusing on a positive future will get audiences engaged and encouraged to act faster. Panelists re-emphasized that “gloom and doom” does not work and that a multi-pronged approach is key—one size does not fit all. When asked about how ZAMs are utilizing social media, the panelists responded that the Sea Nettle exhibit at the Monterey Bay Aquarium has been the most photographed exhibit in the world. As such, ZAMs have potential to reach broad audiences with social media and are exploring ways to become more impactful through social media platforms.

### **Panel Discussion Four (Day 2): Understanding Impacts to Stakeholder Communities**

*Moderator: Eric Poncelet, Kearns & West*

#### *Panelists:*

- *Terry Sawyer, Hog Island Oyster Company*
- *Cindy Walter, Owner of Passionfish Restaurant*
- *Oren Frey, MBNMS - Monterey Bay Local Catch Program Coordinator*
- *Brian Nelson, Dive Boat Captain*

Panelists introduced the session by noting that OA stakeholders represent a wide variety of perspectives and interests. They can include coastal communities, local and regional businesses, tourists, regional cultures, businesses, and indeed anyone who is supported by, relies on, or is in some way invested in the health of the ocean.

The panelists shared ideas on how to effectively engage stakeholders, particularly fishermen and the shellfish industry who may feel the impacts of OA in the near future. Panelists noted that fishermen do not have a history of engaging with the government because they have not always felt heard in the past. When engaging with fishermen, it is important to have in-person interaction and provide a message that allows them to feel a part of the solution such as working towards better fuel efficiency and promoting locally caught fish.

The panelists suggested that when communicating with a variety of stakeholders, keeping the message simple is essential. Simple messages allow people to understand the issue and understand the ways they can make a difference. Passionfish has served local sustainable fish in Pacific Grove for the past 16 years and has found that providing short and simple messages about ocean health to consumers that connect to what they are eating can be very effective in the choices that they make. It is important to offer ideas and possible solutions. Creating measurable regional community and business goals to reduce CO<sub>2</sub> emissions can be an effective strategy. People need to know that their daily choices can make a difference and that they can impact policy decisions.

The panelists also shared specific tools and programs already in place that they found to be effective. For example, community supported agriculture (CSA) and/or local catch programs allow consumers to receive a fresh box of produce, fish, or meat from a local organization. These programs are expanding and becoming part of the local food movement and connect

consumers directly to their food and where it comes from. OA communicators can also engage fishermen through channels they are already familiar with including peers and fishing forums.

### Discussion

During the question and answer portion of the panel, participants further discussed how fishermen are currently approaching OA. The panelists stressed the importance of establishing trust and being clear with what actions people can take regarding OA. In some cases, scientists are working with fishers to provide pH sensors that they can use to monitor ocean chemistry. An example was provided of potentially using this as a predictive tool to determine where certain shellfish such as crabs may be in relation to lower pH water. The panelists also shared that establishing trust begins with having open conversations about a difficult topic. Finally, participants noted that it is also helpful to connect stakeholders from the farm to the plate; showing consumers where their food comes from can be a sensory and enjoyable experience. This comment came in response to the panelists' past experiences working directly with stakeholders.

### **E. Share-a-thon**



The *Effective Practices for Communicating Ocean Acidification* workshop held an informal evening “share-a-thon” event that allowed participating educators to share simple exhibits, hands-on activities, and short demonstrations with other workshop participants. The aim of this event was to provide a venue where workshop participants could showcase effective, activity-oriented projects that advance the understanding of OA as part of either formal or informal educational settings.

This share-a-thon event included 14 participating organizations (see Appendix E), each displaying their content, materials, and activities in the exhibit area, with share-a-thon attendees interacting one-on-one or as part of small groups with the demonstrators to learn more about



the educational project. The event also featured a subset from this group that demonstrated their activities to the entire audience, using a projector, a large screen, and speakers. Eighty workshop participants were part of this two-hour long evening event, either as attendees or presenters.

One of the benefits of this share-a-thon event was to provide workshop participants with semi-structured time to share the many worthwhile projects currently underway or in development that help advance OA education.

## F. Development of OA Communications and Education Approaches and Tools

The third part of the workshop was focused on engaging workshop participants in the development of effective OA communications and education approaches and tools. This took place through two breakout session activities. The first was focused on identifying key case studies, messages, and research and literature to support effective communication of OA. The second was focused on key audiences and identifying for each of these: desired outcomes in terms of communicating with these audiences, key tools to achieve these outcomes, potential gaps and challenges, and desired actions to help achieve these outcomes.



A summary of the breakout group discussions is captured below. A list of breakout group participants is available in Appendix C. The flip chart notes from the breakout sessions are in Appendix D.

### Breakout Group Activity #1

In the first breakout session, the groups were charged with the following tasks:

- Group 1: Identify **key case studies**, and associated audiences to target, tools for conveying, and gaps and needs
- Group 2: Identify **key messages**, and associated audiences to target, tools for conveying, and gaps and needs

- Group 3: Identify **key research and literature** to inform OA outreach, and associated audiences to target, tools for conveying, and gaps and needs
- Group 4: Identify steps to create an OA **communication network** and potential **collaboration opportunities**

Key outcomes from the breakout session discussions are summarized below.

#### Group 1 – Case Studies

Group 1 identified three case studies that members thought were particularly effective for communicating OA, and then identified the audience they relate to, as well as the needs and tools for each story.

The first case study concerned OA impacts on Pacific Northwest Oysters. Breakout group members described this case study as effective because this is a current problem affecting aquaculture today. This story can reach a variety of audiences including the restaurant industry, non-profits (NGO's), policy makers, teachers, as well as seafood producers and consumers. Since this case study is focused on the Pacific Northwest, it may not resonate quite so much in the Midwest or other parts of the country where the consumer base is not as great compared to coastal communities. With the oyster case study, one of the needs is to identify messaging that avoids feelings of “gloom and doom” among the audience members.

The second case study focused on clownfish olfactory cues (i.e., “Nemo”). Recent experimental research has shown that clownfish experience sensory and behavioral defects when reared in high CO<sub>2</sub> environments that lead to elevated mortality rates. This case study addresses not only the species but habitat (coral reefs that may be impacted by OA) as well. Breakout group members thought that this story could potentially resonate with families, kids, teachers, media and entertainment, as well as divers. The group also thought that one of the biggest challenges for this case study is being able to tell the story without inciting feelings of gloom and doom; this is especially a concern for kids and families. The data on this case study demonstrate that fish exposed to high CO<sub>2</sub> a mortality rate nine times greater than fish that are not exposed to high CO<sub>2</sub>. We need to confirm the details of this study with the researcher who is the primary investigator of these experiments ([Munday et al, 2008](#)) and identify what the appropriate information is to share with the public.

The last case study addressed by the group concerned natural CO<sub>2</sub> vents or “champagne sites.” The breakout group viewed this as a potentially a more challenging case study to convey as audiences would need to have a better understanding of the function of the ocean in order for this to resonate with them. Communicators will need to determine how best to share basic information about the CO<sub>2</sub> vents. Another challenge with this case study is that these are naturally-occurring phenomena, which may lead some audiences to doubt that high CO<sub>2</sub> in the ocean is a problem. A key benefit of this case study is that this can be used to show possible future high CO<sub>2</sub> scenarios and help to show which species may or may not be able to adapt to this type of environment.

The breakout group listed the following possible tools to support communication and education around these case studies:

- Videos
- Life cycle visuals
- Placemats in restaurants
- Pocket or wallet cards

- “Nemo likes it!” labels similar to the Energy Star labels
- Games or multi-media activities

The breakout group acknowledged that these case studies have three different time frames. The oyster story is happening now, the clownfish case study is focused more on the near future, and CO<sub>2</sub> seeps represent a possible future ocean that is much farther in the future. This range can assist communicators depending on their audience and situation.

### Group 2 – Messages

Group 2 came to the early recognition that any discussion of key messages needed to be focused on specific audiences, as different messages will resonate with different audiences. The group produced recommendations for addressing the following audiences: resource managers, policy makers, aquarium visitors, students, young adults, and teachers.

**Resource Managers/Policy Makers:** When working with decision makers, it is important to consider what issues they are already addressing and how OA can be incorporated into this work. A key message that OA communicators can share with this audience is that by addressing OA, decision makers are also working on other environment stressors, such as pollution. The group recognized that OA is not yet on the radar for many resource managers or policy makers, or if it is on their radar, they may not aware of the resources they have available to address it. The group recommended that OA communicators and educators be specific about what can be done from a policy or management perspective when working with this audience.

**Aquarium Visitors, (including Students and Young Adults):** One way of communicating effectively with aquarium visitors is to understand causal chains. This approach involves identifying who the audience is and their motivations for visiting the aquarium and then determining what type of message will resonate with them. This is important, because communicators have about thirty seconds to interact with the typical aquarium guest. The group recommended utilizing analogies like, “the ocean is the other lung of the planet,” or, “the ocean starts in your backyard.” Health-based analogies and analogies related to places that visitors value as important can be helpful

**Teachers:** For educators, the group recommended considering how OA can best be integrated into existing curricula, and recommended finding ways to help teachers collaborate around the issue. The group suggested that online discussion forums may allow for good conversations and effective engagement but also recommended that teachers clearly distinguish OA from climate change.

### Group 3 – Research and Literature

Group 3 focused on existing research and literature on OA. They discussed the National Academy of Science’s 2011 Report – [Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean](#), Dr. Phillip Munday’s clownfish research (2008), Ken Caldera’s work on anthropogenic carbon and ocean pH (2003), and West Coast upwelling of post-industrial era corrosive water ([Feely et al 2008](#)) as a few strong research documents. The group identified five key literature and science categories:

- Foundational science (e.g., biology, chemistry, geology)
- Socio-economics
- Education research and communication
- Current research

- Predictions

The group suggested that more research done on these categories will assist future messaging around OA. There are a few challenges that exist regarding research and literature. More examples are needed to demonstrate the impact that human behavioral changes can have on carbon emissions. Clear data to showing to what level in emissions are reduced by purchasing local produce, a hybrid or electric car, or insulating a home would be helpful to consumers. The group also mentioned that it is important to quantify carbon emissions in different parts of the country. For example, buying a Hybrid or electric car on the West Coast may provide different results than buying an electric car on the East Coast because of where the energy comes from to power the electric car (solar vs. coal).

As noted above, more research needs to be completed on the socioeconomics around OA. Having a better understanding of community demographics will assist communicators in knowing how to properly message OA information and what “asks” to make of the community.

The group then identified multiple audiences who may be responsive to important research and literature. They also indicated what type of research, based on the five categories above, would be most effective for which audience.

Foundational Science Audiences:

- Teachers
- Students and teens

Socioeconomics Audiences:

- Industry/policy makers
- Media

Education Research and Communications Audiences:

- OA educators and communicators
- Scientists
- Evaluators

Current Research Audiences:

- Adults
- Conservation interests and environmentalists
- Media

Predictions Audiences:

- Industry/policy makers
- Conservation interests and environmentalists

The group proposed an approach to identifying key research needs that begins with identifying the intended outcome first, and then identifying audiences, tools, and needed resources. Overall, the group recommended that OA communicators should focus on where the biggest difference can be made in terms of reducing CO<sub>2</sub> emissions. For example, insulating a house may be more efficient than buying a hybrid vehicle depending on where people live. This type of information should be gathered and shared with audiences to target actions that have more impact.

Group 4: OA Communications Network and Collaboration Opportunities

Group 4 focused on how to create an effective network of OA communicators. The group approached this activity by each describing their “gots” and “needs”—i.e., what each of them can share, and what each needs help with. For example, a participant may have many personal connections with fishermen but needs help with establishing a social media presence. After sharing their resources, the group was able to identify where opportunities exist to collaborate.

Overall, this activity solidified the importance of bringing all of the participants together. The group thought that establishing a Google Group email list and a Wiki Website would assist with sharing resources and consistently communicating. This wiki could include a directory of participants’ contact information, as well as their “gots” and their “needs”. The group also believed that many opportunities exist by which OA communicators can connect. The group recommended that an OA-focused Facebook group be established, and that a survey be conducted to help establish what people need and the best ways to communicate with one another. This survey would also help establish long-term goals for this group.

Participants pointed to the [National Lab Network](#) as an effective way to build local communities of support that will foster ongoing collaborations among volunteers, students and educators. Interested participants can also subscribe to the [Upwell Tide Report](#) to receive updates on social media and ocean content.

### **Breakout Group Activity #2**

Breakout groups in the second session focused on key audiences in relation to OA.

- Group 1: Teachers
- Group 2: Families
- Group 3: Students (K-12)
- Group 4: Policy makers
- Group 5: Commercial and recreational users

Each group was asked to identify the following for their focal audience:

- Desired outcomes regarding OA communication and education
- Key tools to help achieve these outcomes
- Potential gaps and challenges that exist for this audience
- Desired actions to help achieve these outcomes

#### Group 1 - Teachers

As they began their discussions, Group 1 members recognized that it can be difficult to separate students from teachers when communicating OA. Many of the same tools or key messages apply to both. Group 1 identified the following desired outcomes for teachers communicating OA.

- Teachers need to be aware and achieve their own evidence-based understanding of OA.
- Teachers need to understand and be able to teach a different level of complexity of OA depending on their grade level. This means that OA communicators need to develop multiple approaches when working with teachers.
- Teachers can be effective in inspiring action and stewardship.

Group 1 discussed a range of tools for communicating with teachers. These included: using online data sources and multimedia tools, developing a network of scientists and experts as well as networks of teachers, including OA in science education standards and curriculum, developing hands-on activities and place-based field activities, and creating opportunities for site visits and for students to interact with the ocean environment.

The group identified multiple needs and gaps with the teacher audience. These gaps include the lack of support, particularly in funding and time. There is also a lack of good OA solutions, materials, and hands-on experience across grade-levels. Looking at the education system holistically, there is a lack of inclusion for ocean science in the standards and curriculum as well as a general lack of science in schools. The group recognized that the challenges facing communicating with teachers about OA are similar to the challenges facing education as a whole: with student-to-teacher ratios continuing to increase, there are fewer resources for teachers and less time to educate them on OA and assist them in incorporating new activities into the classroom. A needs assessment would be helpful in understanding what teachers have and need regarding resources.

Regarding conservation actions teachers can achieve, the group developed the following list:

1. Gaining awareness of OA locally and regionally
2. Reducing carbon footprints
3. Taking other actions related to resilience to multiple stressors (i.e. adopt a beach, sustainable seafood, recycle)
4. Developing relationships with scientists, conservation organizations, community service and social organizations.
5. Building community amongst teachers
6. Empowering teachers to develop creative solutions

#### Group 2 - Families

Group 2 identified three desired outcomes for communication and education of OA directed to families.

1. Knowledge: People need to recognize the problem and know it's real and measurable. Families need to understand that OA is real, measureable and happening now and that they can make impactful changes.
2. Behavior: Families are part of the problem and the solution. OA communicators should engage in discussions with families and empower them to change their behavior and consider OA in daily activities.
3. Tools and communications (outcome directed to OA communicators): Families are already a community. Parents, teens, and kids engage at different levels, but they all engage. This means that there is not a standard way of communicating with this audience. Messaging must be adapted when working with parents or teens or kids. OA communicators can tap into people's sense of place and scale. The desired outcome here is to increase the tools and communications assistance when working with families.

Important tools to utilize while communicating with families about OA include: messages properly framed, videos and visuals, a strong social media presence, leveraging professional networks, mediation/facilitation, animals, and photo opportunities. The group specifically recommended communicators use the "Research 2 Practice" website (found [here](#)) because it accumulates tools already in existence that OA communicators can utilize together.

Group 2 acknowledged a variety of challenges facing improved communication of OA with families. Communications need to be fun, but it can be difficult to make exhibits or activities that engage people at all age levels. Working with families is also time intensive, and as a community, OA communicators still need to establish an efficient way to find and share



examples of success. OA communicators would benefit by having more examples of success stories and successful tools they can use when engaging with families.

Group 2 identified a list of conservation actions that OA communicators can share with families. Key actions included: turning off lights, preparing locally-sourced family meals, driving less, taking alternative transportation, and voting. Possible community-level actions included school recycling programs and zero waste lunches.

The group also listed why OA is important to families. A healthier ocean means a healthier community and home; OA communicators can share with families that the ocean starts in the backyard. Their actions have an impact on the ocean and the ocean has an impact on their family.

### Group 3 – Students (K-12)

Group 3 reiterated many of the themes discussed by group 1 due to similarities between students and teachers as audiences. In terms of desired outcomes, group 3 noted that it is important for students to understand how humans and oceans are connected and to better comprehend their individual carbon footprint. Other desired outcomes included increasing individual, family and community conservation actions, increasing students' understanding of global impacts, and having students share their knowledge with peers and others utilizing critical thinking skills.

Group 3 identified several tools for reaching out to this audience. Key tools included: hands-on activities, field trips, exhibits, real time access to data, case studies, and volunteer activities. The largest challenge is that teachers are limited in resources to incorporate OA into curriculum. There is also a lack of access to local scientists and a nation-wide lack of priority on ocean awareness.

As students get older, they will be able to incorporate more actions into their daily lives. Consequently, the group identified the following set of actions for ascending grade levels:

Kindergarten - 5<sup>th</sup> grade:

- Turn off lights, water tap, etc.
- Reuse and recycle
- Eat your dinner: use what you take

6<sup>th</sup> - 8<sup>th</sup> grade:

- Decrease waste
- Put on a sweater before the heater
- Refill water bottles
- Unplug electronics

9<sup>th</sup> – 12<sup>th</sup> grade:

- Decrease consumption
- Transportation options
- Food choices
- Outreach/action
- Community/organization participation

### Group 4 – Policy Makers

Group 4 discussed what it viewed as one of the more challenging audiences to reach out to: policy makers. Group 4 thought that it may be most effective for OA communicators to begin at



the local level of elected officials and move up to state and then federal officials. When working with policy makers, there are not just elected officials but also non-elected officials who also have a lot of influence on policy. Desired outcomes the group hopes to see include increased funding for monitoring, researching and outreach; maintaining and building relationships with the OA community; policy makers acknowledging OA as a problem; and implementation of emissions regulations.

Group 4 identified several tools for working with policy makers, including:

- Draft a Congressional Resolution
- Create media opportunities
- Hold an alternative future dinner (i.e., demonstrating what a meal could look like in the future due to OA outcomes)
- Connect OA to food issues
- Utilize constituents to communicate with their representatives
- Organize congressional visits
- Work with both Democrats and Republicans

Group 4 identified challenges when working with policy makers. Many elected officials have scientists on staff to inform them on certain issues, but these scientists may not be effective advocates around the issue of OA due to the expectation that they inform elected officials but not take positions. Another challenge is how to work with states in the center of the country. OA and other ocean issues may not be seen as being relevant for these states.. To address this, OA communicators should strive to connect OA to many other issues, including food and energy issues that directly affect communities throughout the country.

Another recommendation discussed is that OA communicators should consider expanding the range of people who communicate OA. Group 4 identified actors and religious leaders as possible effective messengers to not only policy makers but all audiences. Regardless of the messenger, group 4 emphasized that it is crucial to keep messages clear and simple—i.e., show that OA is real, happening now, and impacting people.

To inspire policy makers to achieve the desired actions described above, group 4 noted that there is power in numbers. OA communicators need to collaborate as a community to stimulate policy makers and their constituents to take action. The more people involved and engaged, the better. When communicating with this audience, it is important to not only share the same problem but also the same solutions, keeping the message consistent.

#### Group 5 – Commercial and recreational users

Group 5 addressed commercial and recreational users, focusing on fishermen in particular, and discussed ways to increase their participation in OA conservation actions. The group approached their task by identifying three separate desired outcomes and then the tools, gaps, and actions for each outcome.

The first desired outcome is to increase awareness regarding the need for adaptation to OA. The tools to use to achieve this outcome include providing findings from collaborative fisheries research, and identifying key individuals within user communities to target first. Anticipated actions to ask of fishermen include incorporating OA information into their business' long term planning and developing creative solutions from within their user community.

Group 5 suggested that it is important to frame messages carefully with fishermen and noted that one of the biggest challenges is that best practices for fishermen still need to be established. For instance, OA communicators should consider how fishermen can incorporate conservation practices into their business plan. OA communicators also need to increase the dialogue and trust they have with recreational and commercial users, find more opportunities for funding, and not put the load entirely on the users. OA communicators need to share ideas and maintain communication, and they need to listen well to this audience.

The second desired outcome is to reduce fuel use. When introducing this potential outcome to fishermen and the shipping industry, it is important for OA communicators to explain this in terms of what is beneficial to them and how they could benefit from investing in more efficient engines to reduce fuel consumption and carbon emissions. OA communicators can also share current best practices and success stories to inspire users to initiate their own change. A challenge to achieving this outcome is that best practices for fishermen have not been universally identified and adopted.

The third desired outcome is to increase trust between commercial and recreational users and scientists and communicators. OA communicators need to establish a strategy prior to meeting with recreational and commercial users; they need to identify key users to engage with and seek to understand the needs of the community. The challenges for this outcome include a lack of funding to support engagement, and identifying success stories. OA communicators should also strive to increase the dialogue between fishermen and other community interests regarding OA; from this, a greater impact will result.

## **G. Discussion of Action Plan for Ongoing Work**

Laura Francis described how an action plan will be developed following the workshop to build upon the momentum created. The action plan will likely include a compilation of findings from the pre-workshop needs assessment survey on key tools and perceived gaps, the lessons learned from the workshop including key messaging and audiences, and will focus on future outcomes and next steps for the OA communicators' network. Workshop participants were also invited to identify which topics they were most interested to continue working on following the workshop. Identified future working groups included:

- Target audiences
- Key messages
- Key case studies
- Key literature
- Effective actions
- Networking

Many of the workshop participants signed up for different working groups with the expectation that these working groups will self organize and continue their discussions around effective OA communication (see Appendix F).

Participants also brainstormed additional topics for future working groups to address. These included:

- Examine “asks”: what can the OA community ask of various audiences including visitors, the general public, funders, and journalists?

- Focus on how to better communicate about uncertainty in science.
- Investigate smart phone applications and opportunities that exist within social media to spread the word about OA.
- Create more materials, activities, and lesson plans for teachers. For example, expand teaching about the pH scale to focus on how small changes in pH can potentially have large impacts on living organisms in ocean.
- Create a working group primarily focused on looking for funding and collaborating with professional organizations.

## **H. Next Steps**

Laura Francis thanked the participants for their engagement in the workshop, and the workshop facilitator described the following next steps:

- Participants were all invited to complete a workshop evaluation.
- The OA Steering Committee will meet to debrief the workshop.
- The facilitation team will prepare a workshop summary document by the end of 2012.
- The NOAA OA Program will prepare and disseminate an education implementation plan by February 2013.
- Participants signed up to be part of ongoing working groups focused on further refining messages, case studies, key literature for target audiences
- Upwell will develop a group email list Facebook group and Wiki site to continue the conversation and share materials.

## **I. Pre-Post Survey Results**

A needs assessment was conducted prior to the workshop to gain a better understanding of participants' roles in communicating OA, as well as important OA messages, target audiences, case studies and tools used by each participating organization. Participants also filled out a post-workshop evaluation asking some of the same questions immediately following the workshop. After the workshop 85% of participants indicated that they plan to use the information gained from the workshop in their OA communication efforts at their organization.

Participants also ranked effective messages pre and post workshop, and there were some notable changes in these rankings. The chart below shows the percentage of participants who indicated the message was effective or very effective.

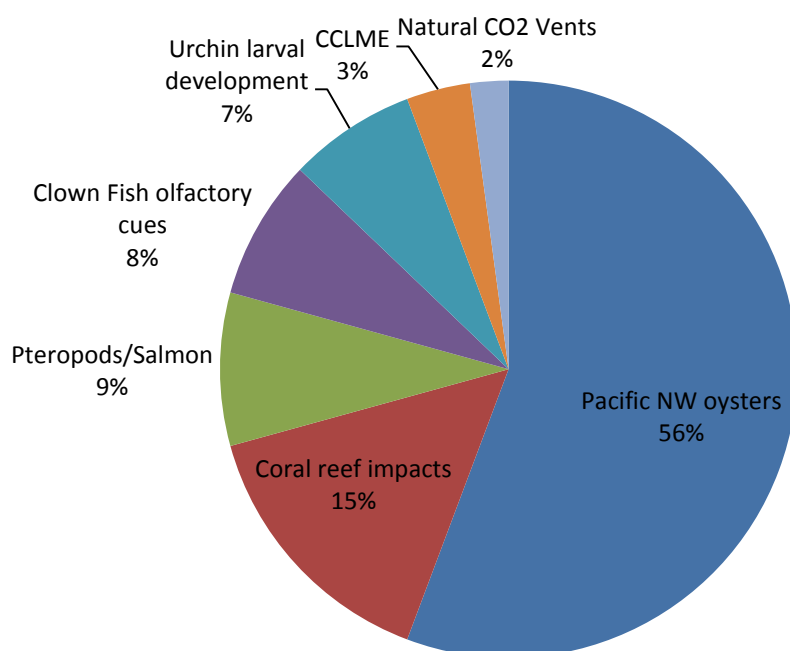
Message	Pre-Workshop	Post Workshop
As CO <sub>2</sub> increases in the atmosphere, it dissolves in the ocean and it is changing the pH of the sea making it more acidic. Ocean acidification is the other CO <sub>2</sub> problem	68	70
The more CO <sub>2</sub> we emit, the more acidic the ocean water becomes: a phenomenon known as ocean acidification.	28	37.5
Biodiversity of the global ocean is changing due to Ocean Acidification	67	60
Marine organisms with calcium carbonate shells (e.g. oysters, clams and mussels) can be affected by small changes in acidity	51	65
This rate of change is unprecedented in the last 55 million years. The rate of ocean acidification will continue to accelerate in the coming decades	69	86
Ocean acidification has the potential to fundamentally change the ocean, its habitats, food webs and marine life	35	80
	66	91

## Ocean Acidification Case Studies: Analysis Pre and Post the Effective Practices Workshop

### Pre-Workshop Analysis:

Respondents were asked to list their top 3 favorite OA case studies. Thirty nine of 59 respondents provided case study information. Case studies were ranked based on respondent preference: 1st choice case study was given 3 points, 2nd choice was given 2 points, and 3rd choice (plus any others listed) was given 1 point. Points were tallied for each case study and the percentage of points that each case study was given is presented below in the pie chart. Pacific NW oysters (56% of total points) and coral reef impacts (15% of total points) were cited as the 2 most useful case studies, followed by clown fish olfactory cues (8%), urchin larval development (8%), the California Current Large Marine Ecosystem (4%), and natural CO<sub>2</sub> vents (2%).

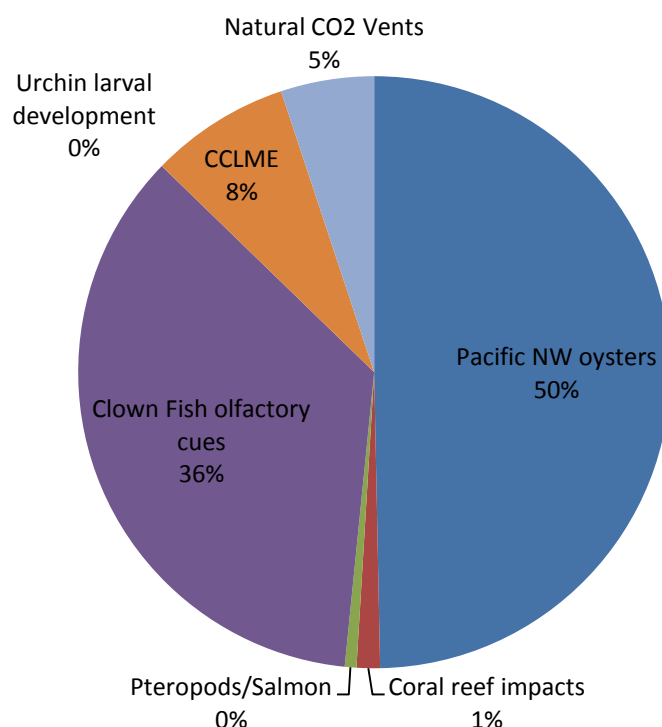
### Pre-Workshop Case Study Preference



### Post-Workshop Analysis:

Respondents were asked to identify the most effective case study (or studies). Forty of 62 respondents provided case study information. Though this question was worded slightly differently (by asking for the most effective, rather than the top 3), the case studies were ranked again based on respondent preference, in the same manner as the pre-workshop analysis. Points were tallied for each case study, and the percentage of points that each case study was given is presented below in the pie chart. The most notable differences when comparing pre and post-workshop analysis is that the preference for Clown Fish olfactory cues increased dramatically, from 8% to 36%. Preference for Pacific NW oysters decreased slightly from 56% to 50%, coral reef impacts decreased from 15% to 1%, and Pteropods/Salmon and Urchin larval development all but disappeared from respondents' radar.

### **Post-Workshop Case Study Preference**



## Appendix A: Workshop Participants

	Participant	Title	Organization
1	Aaron Pope	Manager of Sustainability Programs	Cal Academy of Sciences
2	Adina Abeles	Director of Education and Training	Center for Ocean Solutions
3	Adina Payton	Research Scientist	University of California Santa Cruz
4	Alicia Archer	Education Coordinator	Aquarium of the Pacific, Long Beach
5	Annie Frankel	Public Education Program Coordinator	California Coastal Commission
6	Bill Douros	Director	ONMS West Coast Region
7	Bill Hanshumaker	Chief Scientist	Hatfield Marine Science Center
8	Brian Nelson	Dive Boat Captain	Dive Boat Captain Monterey SAC
9	Bruce Steele	Commercial Fisherman	CINMS Advisory Council
10	Carol Blanchette	Research Scientist	University of California Santa Barbara
11	Carol Preston	Education and Outreach Coordinator	Gulf of the Farallones National Marine Sanctuary
12	Carolyn Skinder	Education Specialist	Monterey Bay National Marine Sanctuary
13	Carrie Chen	Director of Education and Conservation	Aquarium of the Bay
14	Cathy Sakas	Education and Outreach Coordinator	Grays Reef National Marine Sanctuary
15	Chris Parsons	Director	Word Craft
16	Cindy Walter	Owner	Passionfish
17	Claire Fackler	National Education Liaison	Office of National Marine Sanctuaries
18	Claudia Ludwig	Education Program Manager	Institute for Systems Biology
19	Cortland Jordan	Educator	Elkhorn Slough National Estuarine Research Reserve
20	Corina Marks	Graduate Student	California State University Monterey Bay



21	Dan Howard	Superintendent	Cordell Bank National Marine Sanctuary
22	David Kline	Assistant Project Scientist	Scripps Institution of Oceanography
23	Dennis Long	Executive Director	Monterey Sanctuary Foundation
24	Elizabeth Selna	Public Programs Manager	California Academy of Sciences
25	Ellen Parry Tyler	Sea Grant Fellow	Rep Sam Farr
26	Erin Sams	Sea Grant Fellow	NOAA Education
27	Fran Spector Atkins	Owner	SpectorDance
28	George Leonard	Director of Aquaculture	Ocean Conservancy
29	George Matsumoto	Senior Education and Research Specialist	Monterey Bay Aquarium Research Institute
30	Geraldine Fauville	Education Project Coordinator	University of Gothenburg
31	Greg Rau	Senior Research Scientist	University of California Santa Cruz
32	Gwen Shaughnessy	Educator	NOAA Coastal Services Center
33	Helen Findlay	Biological Oceanographer	Plymoth Marine Lab
34	Jacqueline Laverdure	Education Specialist	Olympic Coast National Marine Sanctuary
35	Janine Scianna	Program Manager	CeNCOOS
36	Jason Hodin	Virtual Urchin Media and Content Manager	Hopkins Marine Station
37	Jason Patlis	Executive Director	National Marine Sanctuary Foundation
38	Jenn Bennett	Sea Grant Fellow	NOAA OA Program Office
39	Jenny Stock	Education and Outreach Coordinator	Cordell Bank National Marine Sanctuary
40	Jennifer Westerbeck	Engineer Academy Coordinator	Alisal High School
41	Jim Covell	Manager of Visitor Services	Monterey Bay Aquarium
42	John Anderson	Education Director	New England Aquarium
43	Julia Roberson	Director, Ocean Acidification Program	Ocean Conservancy

44	Julie Bursek	Education Outreach Team Lead and West Coast Regional Education Representative	Channel Islands National Marine Sanctuary
45	Karen Matsumoto	Marine Science Education Coordinator	Seattle Aquarium
46	Kristen Matsumoto	Teacher	Stevenson School
47	Kathryn Danielson	Graduate Student	San Francisco State University
48	Kelly Higgason	Resource Protection	Gulf of the Farallones National Marine Sanctuary
49	Kristi Birney	Marine Conservation Analyst	Environmental Defense Center
50	Laura Francis	Education and Outreach Coordinator	Channel Islands National Marine Sanctuary
51	Libby Jewett	Director	NOAA OA Program Office
52	Linda Chilton	Education Program Coordinator	COSEE West/USC Sea Grant
53	Lisa Adams	College Professor	Kennesaw
54	Lisa Dropkin	Principal	Edge Research
55	Lisa Jenson	Educator	Cal State University Monterey Bay
56	Lisa Uttal	Interim Director	Sanctuary Exploration Center
57	Mareva Kuchinke	Research Scientist	CSIRO-CMAR - Australia
58	Mary Miller	Project Director, Public Understanding of Science	Exploratorium
59	Matthew Huelsenbeck	Marine Scientist	Oceana
60	Mia Hanak		Millenium Art
61	Nancy Muehllehner	Graduate Student	Rosenstiel School
62	Oren Frey	Monterey Bay Local Catch	Program Coordinator
63	Pam Miler	Educator	Hopkins Marine Station
64	Paul McElhany	Ecologist	NOAA Fisheries
64	Paulo Marin	Education Coordinator	NOAA Coral Reef Conservation Program

65	Rachel Heuer	Graduate Student	University of Miami
66	Rachel Weidinger	Director	Upwell
67	Richard Feely	Senior Scientist	NOAA Pacific Marine Environmental Laboratory
68	Sally Ingleton	Executive Producer	360 Degree Films, Australia
69	Sara Hutto	Sea Grant Fellow	California Sea Grant/Channel Islands National Marine Sanctuary
70	Sarah Allen	Ocean Stewardship Program Coordinator	National Parks Western Region
71	Sarah Cooley	Research Scientist	Woods Hole Oceanographic Institution
72	Sarah Mae Nelson	Climate Change Interpretive Specialist	Monterey Bay Aquarium
73	Scott MacKenzie	Online Program Director	Monterey Bay Aquarium/Climate Interpreter
74	Seaberry Nachbar	Program Manager	ONMS/BWET
75	Sean Bingami	Graduate Student	University of Miami
76	Simona Bartl	Adjunct Professor	Moss Landing Marine Lab
77	Sonja Gomez	Education and Volunteer Manager	Aquarium of the Bay
78	Stuart Goldberg	Science Policy Fellow	Consortium for Ocean Leadership
79	Suzanne Hebert	Youth Programs Manager	Long Marine Lab
80	Terry Sawyer	Owner	Hog Island Oyster Company
81	Tom Gaskill	Education Coordinator	South Slough National Estuarine Research Reserve
82	Wei Ying Wong	Communication Project Coordinator	The Ocean Project
82	Zeta Strickland	Science Interpretation Manager	Pacific Science Center Seattle
	<b>Facilitators</b>		
83	Eric Poncelet	Senior Director/Senior Mediator	Kearns and West
84	Kelsey Rugani	Project Coordinator	Kearns and West

## Appendix B: Workshop Agenda

### Effective Practices for Communicating Ocean Acidification Workshop

September 27, 2012 (2:00-5:30 PM)\*

September 28, 2012 (8:00 AM - 5:00 PM)

**Ferrantes Bayview Room, 10th Floor, Monterey Marriott Hotel**

\*Reception hosted by Monterey Bay Sanctuary Foundation to follow at the Monterey Plaza Hotel

#### Workshop Objectives

1. Discuss and identify effective strategies and tools for communicating Ocean Acidification, including:
  - Target audiences
  - Case studies
  - Key research and literature
  - Key messages
  - Desired changes in behavior
2. Identify associated gaps and needs, and strategies for addressing them
3. Develop relationships and establish an action plan for ongoing coordination among Ocean Acidification communicators and educators

#### Day 1: Thursday, Sept. 27, 2012

##### Status of OA Communication and Education

Time	Item
<b>1:45 PM</b>	<i>Arrivals</i>
<b>2:00 PM</b>	<b>Welcome, Introductions and Overview of Effective Practices Workshop, Objectives, and Intended Outcomes</b> <i>Bill Douros, West Coast Regional Director, NOAA Office of National Marine Sanctuaries</i>
<b>2:20 PM</b>	<b>Meet and Greet:</b> Discuss one new OA fact learned from the International Symposium and/or common misconceptions about Ocean Acidification with a neighbor and report out to group
<b>2:35 PM</b>	<b>Panel Discussion:</b> International Ocean in a High CO <sub>2</sub> World Symposium Science Overview <i>Moderator: Eric Poncelet, Kearns &amp; West</i>  <i>Panelists:</i> <ul style="list-style-type: none"><li>• Libby Jewett, Director, NOAA OA Program Office</li><li>• Sarah Cooley, Ocean Acidification Scientist, Woods Hole Oceanographic Institution</li><li>• Jenny Stock, Education Coordinator, Cordell Bank NMS</li><li>• Geraldine Fauville, Education Project Coordinator, University of</li></ul>

	<i>Gothenburg</i>
<b>3:25 PM</b>	<i>Break</i>
<b>3:40 PM</b>	<p><b>Panel Discussion:</b> What does the public understand about ocean acidification and what compels them to act?  <i>Moderator: Julia Roberson, Ocean Conservancy</i></p> <p><i>Panelists:</i></p> <ul style="list-style-type: none"> <li>• <i>Lisa Dropkin, Edge Research</i></li> <li>• <i>Julia Roberson, Ocean Conservancy</i></li> <li>• <i>Wei Ying Wong, The Ocean Project</i></li> <li>• <i>Rachel Weidinger, Upwell</i></li> </ul>
<b>4:40 PM</b>	<p><b>Panel Discussion:</b> Communicating OA amongst aquariums: Lessons Learned  <i>Moderator: Wei Ying Wong, The Ocean Project</i></p> <p><i>Panelists:</i></p> <ul style="list-style-type: none"> <li>• <i>Aaron Pope, California Academy of Sciences</i></li> <li>• <i>John Anderson, New England Aquarium</i></li> <li>• <i>Jim Covell, Monterey Bay Aquarium</i></li> </ul>
<b>5:30 PM</b>	<i>Recess</i>
<b>6:00-8:00 PM</b>	<i>Evening Reception Networking Event at the Monterey Plaza Hotel (including Share-a-Thon)</i>

## Day 2: Friday, September 28, 2012

### Development of OA Communication and Education Approach and Tools

Time	Item
<b>7:45 AM</b>	<i>Arrive</i>
<b>8:00 AM</b>	<b>Questions and Reflections on Day 1</b>
<b>8:10 AM</b>	<p><b>Panel Discussion:</b> Understanding Impacts to Stakeholder Communities  <i>Moderator: Eric Poncelet, Kearns &amp; West</i></p> <p><i>Panelists:</i></p> <ul style="list-style-type: none"> <li>• <i>Terry Sawyer, Hog Island Oyster Company</i></li> <li>• <i>Cindy Walter, Owner Passionfish Restaurant</i></li> <li>• <i>Oren Frey, MBNMS - Monterey Bay Local Catch Program Coordinator</i></li> <li>• <i>Brian Nelson, Dive Boat Captain</i></li> </ul>

<b>9:00 AM</b>	<b>Breakout Group Activity #1</b> Breakout groups: Group 1: Identify <b>key case studies</b> , and associated audiences to target, tools for conveying, and gaps and needs Group 2: Identify <b>key messages</b> , and associated audiences to target, tools for conveying, and gaps and needs Group 3: Identify <b>key research and literature</b> to inform OA outreach, and associated audiences to target, tools for conveying, and gaps and needs Group 4: Identify steps to create an OA <b>communication network</b> and potential <b>collaboration opportunities</b>
<b>10:30 AM</b>	<i>Break</i>
<b>10:50 AM</b>	<b>Reports Back to Plenary from Breakout #1</b>
<b>11:50 AM</b>	<i>Lunch on own</i>
<b>1:05 PM</b>	<b>Breakout Group Activity #2</b> Discuss effective communicating tools, appropriate conservation actions, and gaps and needs for communicating with key audiences Breakout groups (key target audiences) Group 1: Teachers Group 2: Families Group 3: Students (K-12) Group 4: Policy makers Group 5: Commercial and recreational users
<b>2:35 PM</b>	<i>Break</i>
<b>2:55 PM</b>	<b>Reports back to plenary from Breakout #2</b>
<b>3:55 PM</b>	<b>Develop and Agree on Action Plan for Ongoing Work</b>
<b>4:45 PM</b>	<b>Wrap up and Next Steps</b>
<b>5:00 PM</b>	<i>Adjourn</i>

## Appendix C: Break-Out Groups

### Break-Out #1 Groups

	<b>1: Case Studies</b>	<b>2: Key Messages</b>	<b>3: Key Research</b>	<b>4: OA Network</b>
<b>Facilitator:</b>	Eric Poncelet	Julia Roberson	Sara Hutto	Carol Blanchette
<b>Participants:</b>	Aaron Pope	Adina Abeles	Brian Nelson	Adina Payton
	Carol Preston	Alicia Archer	Carolyn Skinder	Annie Frankle
	Claudia Ludwig	Carrie Chen	Chris Parsons	Cathy Sakas
	Corina Marks	Cindy Walter	Claire Fackler	Ellen Parry Tyler
	George Leonard	Cortland Jordan	Dan Howard	Fran Spector Atkins
	Geraldine Fauville	Elizabeth Selna	George Matsumoto	John Anderson
	Jenny Stock	Erin Sams	Janine Scianna	Karen Matsumoto
	Jim Covell	Gwen Shaughnessy	Jenn Bennett	Laura Francis
	Julie Bursek	Jacqueline Laverdure	Katherine Danielson	Mareva Kuchinke
	Libby Jewett	Jason Hodin	Lisa Adams	Mary Miller
	Lisa Dropkin	Kelly Higgason	Lisa Jensen	Matthew Huelsenbeck
	Mark Gleason	Kristi Birney	Melissa Pitkin	Nancy Muehllehner
	Maya Hanak	Linda Chilton	Pam Miller	Oren Frey
	Paulo Marin	Lisa Uttal	Sarah Allen	Rachel Weidinger
	Rachel Heuer	Paul McElhany	Simona Bartl	Richard Feeley
	Suzanne Hebert	Sarah Mae Nelson	Wei Ying Wong	Scott MacKenzie
	Terry Sawyer	Sonja Gomez	Zeta Strickland	Shakoora Azimi-Gaylon
		Tom Gaskill		

### Break-Out #2 Groups

	<b>1: Teachers</b>	<b>2: Families</b>	<b>3: Students</b>	<b>4: Policy Makers</b>	<b>5: Com/Rec Users</b>
<b>Facilitator:</b>	Jacqueline Laverdure	Jim Covell	Jenny Stock	Adina Abeles	Eric Poncelet



<b>Participants:</b>	Carol Blanchette	Alicia Archer	Aaron Pope	Claire Fackler	Brian Nelson
	Claire Fackler	Annie Frankel	Adina Payton	Corina Marks	Cathy Sakas
	Fran Spector Atkins	Carol Preston	Carolyn Skinder	Dan Howard	Jenn Bennett
	George Matsumoto	Carrie Chen	Claudia Ludwig	Ellen Parry Tyler	John Anderson
	Karen Matsumoto	Chris Parsons	Cortland Jordan	George Leonard	Julie Bursek
	Laura Francis	Cindy Walter	Erin Sams	Gwen Shaughnessy	Kristi Birney
	Linda Chilton	Elizabeth Seina	Geraldine Fauville	Janine Scianna	Lisa Dropkin
	Nancy Muehllehner	Julia Roberson	Jason Hodin	Kelly Higgason	Mareva Kuchinke
	Pam Miller	Lisa Uttal	Katherine Danielson	Lisa Jensen	Maya Hanak
	Paulo Marin	Mary Miller	Libby Jewet	Matthew Huelsenbeck	Melissa Pitkin
	Rachel Heuer	Oren Frey	Lisa Adams	Paul McElhany	Rachel Weidinger
	Simona Bartl	Sarah Mae Nelson	Mark Gleason	Sarah Allen	Richard Feeley
	Tom Gaskill	Sonja Gomez	Suzanne Hebert	Scott MacKenzie	Shakoora Azimi-Gaylon
		Zeta Strickland		Wei Ying Wong	Terry Sawyer

## Appendix D: Breakout Group Flip Chart Notes

### Breakout Activity 1

#### Case Studies (Group 1)

Identify 3 stories

3 timescales

Audiences, gaps, goals, and tools for each story

Candidates:

- Oysters
- Algal blooms/human health
- Megafauna/prey
- Seagrass
- Rate of change/Paleo PETM
- CA current/upwelling
- Urchins
- SF Bay Artificial reefs
- Corals
- CO<sub>2</sub> seeps/champagne sites
- Nemo's sniffer
- Hermit crabs
- Trophic/food web
- Multi-stressors
- Under saturated/crab fishery
- Modeling with socioeconomics

Oysters:

- Struggling industry/farmers
- Production gaps/\$ increase
- Current problem

Audience:

- Seafood producers and consumers
- Restaurant industry
- Community/culture
- NGO's/advocacy
- Policymakers
- Educators/students

Gaps

- Non-local, non-seafood people
  - Address local business/CSA story/Action
- Doom and gloom
- Lack of awareness
- So what? What to do? Cost?

Goals and desired action:

- Individual = decrease CO<sub>2</sub> by eating locally
- Community = bike to work

Tools:

- Videos with stakeholders
- Address the people/community/indirect effects
- Lifecycle visuals
- Pocket-cards/Media to restaurants
- Pilot study of action tools/locations

Nemo:

- Touching story
- Fish or reefs/habitat

Audiences:

- Families/kids
- Teachers
- Media/entertainment
- Drivers and aquarists

Tools

- Visuals
- Good “Hook”, intro to other stories
- Good analogies for humans
- “Nemo likes it!” branding
- Gaming/apps

Gaps

- Story is based on future projections (raise reef resilience?)
- Legal issues, licensing, copyright
- Not a complete story (also advantage)

Goal/ask: learn more about OA

CO<sub>2</sub> Seeps:

Bubbling in H<sub>2</sub>O: bubbling the atmosphere

Window into the future (biodiversity loss)

Audience:

- Educators and students
- Ocean-literate people
- Policy makers
- Business/fishermen
- Recreation

Tools

- Present-day preview
- Some bright spots/winners
- Visuals (video, photo)
- Comparison of biodiversity/system interactions

- Misconception that it is a complete habitat

#### Gaps:

- “It’s natural” argument – still not all species adapt
- Need a base knowledge of “normal” underwater environment
- Doom and gloom – compare healthy reef, tell positive story of what action can do

#### Goals (Asks):

- Treat symptoms/stresses to increase resiliency
- Decrease local pollution
- “Ocean starts in your backyard”
- Bigger goal: policy

#### Key Messages (Group 2)

1. Resource managers and policy makers
2. Aquarium visitors/staff/volunteers (adults, K-12)
3. Teachers – tribal/educators/students
4. Fishermen/growers/NGO’s
5. General public
6. Media

#### Share your “a-ha” moments

- “Ocean friendly”
- Using values
- Analogies
- Links to community solutions
- Physical experiences
- Everyday language → check on international translation
- Online discussion forum allows for natural conversation and engagement
- Values
- Inter-connectedness
- Distinct from climate change
- Impacts today
- Education and damage control with media
- Consistency
- Educators → tie to current curriculum

#### Research and Literature (Group 3)

- \*National Academy of Science (NAS) (2011) OA Publication and synthesis is excellent!
- TOP public opinion and research
- Clownfish – Munday (Caution: science is preliminary but there are good charts)
- Ken Caldera’s models and projections (2003)
- Joe Salisbury – West Coast upwelling – Feely

- Post-industrial era corrosive H<sub>2</sub>O
- Human dimension societal research (people's ideas)
- Conservation psychology
- C40 cities (large city majors)
- Science learning and education
- Gerladine Faulville → science education on OA
- Gap → quantify data on carbon emissions (e.g. buy local, Prius, etc.)
- Choose activity → reduction
- Climate works – identifies game changers (individual vs. community)
- Also check 350.org
- Gap → identify what works everywhere (ex. Electric car on W. Coast vs. E.C.)
- More relevant to National and State Standards
- Incremental asks
- NOAA's PMEL (basic chemistry online and in FAQ'S)
- Andy Jacobson (NOAA) – 2 min animated TIFF/research behind CO<sub>2</sub> data
- Beth Fulton – impacts of OA on food webs and fisheries
- Oceanography (2009, Dec) – global modeling, economics
- Gap → Socioeconomics and governance (values of ecosystem services)

## 5 Key Literature and Science Categories

1. Foundational science (geological history, OA, CO<sub>2</sub>, in the atmosphere)
2. Socioeconomics/(human dimensions)
3. Education research (formal and informal) and communication
4. Current research (regional examples)
5. Predictions (modeling, etc.)

## Audiences

- Industry/policy makers (predictions)
  - Socio-economic (basics for all audiences)
- Teachers/students = foundational science
- Educators/communicators = education research
- Adults/managers = current research
- Teens = foundational science tools and hands-on activities/activators = current research and predictions
- Conservationists/environmentalists = current research and predictions
- Scientists = education and communication research
- Media = current research and socio-economics
- ZAM informal educators = 180 million visitors a year
- Local businesses and communities
- Gap → connecting scientists and education/communication to classrooms
- Gap → in research, solutions effectiveness

## Tools

- Jacobson's animated tool (foundational science)
- Utilizing backwards planning: identify outcome first, then audiences, then tools.

### Steps to creating an OA Communication Network (Group 4)

Carol Blanchette, UC Santa Barbara

Got: a network of scientists, wants to do a better job of communicating to the public and adult populations, people who vote

Need: Opportunity for Broader Impact for NSF.

Fran of SpectorDance

Got: making information accessible, 35 minute dance, 10 minute piece

Need: ask to audience, connections to Native American community

Opportunity: e-workshop, frameworks, institute.org

Mary Miller of the Exploratorium

Got: NOAA partnership, new building, SF Bay observatory, big audience

Need: Scientists to work and facility, connect with larger non-local audiences too

Oren, Kayak Guide, MBNMS, CSF

Got: Audience with CSF, localcatch.org

Need: short videos

Opportunity: allow for collective (yet individual), action/participation

Laura, Channel Islands NMS

Got: we have a special place that people can connect to - sanctuary, 140 whale watching volunteers, after discussion considering changing [acidocean.org](http://acidocean.org) to [yourchangingocean.org](http://yourchangingocean.org)

Need: would like for this group to continue to work together after the workshop

Opportunity: invitation to work with peers on OA communication efforts

Rachel, Upwell

Got: Tide report, network of about 350

Need: OA network

John, New England Aquarium

Got: hope, lots of hope and many networks, convene groups 20-25 over 3 months

Need: examples of good stuff happening to normalize

Matt, Upwell

Got: ex: 350.org, deep network, "Do the math", models for local actions, alliance for climate education, animations

Need: Most sharable, most socially liquid, video under 3 minutes, images that tell a story, [tips@upwell.us](mailto:tips@upwell.us)

Opportunities: ocean frontier, carbon nation

Matthew, Oceana

Got: national press, ocean based food security in a high CO2 world

Need: needs impact stories, letters, groundswell

Scott, MPAQ, [climateinterpreter.org](http://climateinterpreter.org)

Got: sharing platform (climate interpreter), peer reviewed training materials

Need: liquid social content, people to share, move boldly

Nancy, Graduate Student, U-Miami Rosenthal

Got: classroom experience and ideas

Need: money and supportive funders, NSF grant?

Annie, CA Coastal Commission

Got: 70k list, 1/3 personal emails, federated

Geraldine, MA MIT, PhD soon

Got: EU OA contacts, know all 10 EU OA educators

Need: new tech for better environmental awareness, cross US/EU money

Karen, Seattle Aquarium

Got: connections to tribal communities, citizen science, 800k visitors a year

Need: Native American community is stakeholders, EJ community, and subsistence fishing in US

Opportunity: link education and health/subsistence to fishing to ocean health

Mareva, Australian Gov

Got: Pacific Island communications partnership, pacific island scientist network, includes 15 countries

Need: link to fishermen, aquaculture, training in Australia, KITS, local materials citizen science

Opportunity: link to tourism, diving black pearls

Cathy, Grays Reef NMS

Got: translates research, works with GAAQ, SCAQ and regional, ed. Listserv of 3,000, "Gray's reef bites", distance learning

Need: networking

Ellen Parry -Tyler Sam Farr's Office,

Got: Understanding of national policy level discussions, authorizing and appropriating legislation.

Needs: Understanding range of solutions at local level, regional level. Examples of places that are tackling issue on local level. How do you make it relevant to local communities? How do we connect with policy holders outside district? How do you make people feel empowered now and that Individual actions are important.

Need an organization that focuses on reducing energy consumption. Making cities more energy efficient. Can reduce own carbon footprint and cities. C40 initiative.

Ways to connect to non-coastal cities.

A network is born:

1. Scott will be surveying and working on LT solutions
2. Laura and Rachel make Google doc directory of participant contact, needs, gots

3. Facebook Group – Laura, Geraldine, and Rachel
4. If you want socially “slippery” OA content, subscribe to Upwell Tide Report, [www.upwell.us](http://www.upwell.us)

## **Breakout Activity 2**

### Group 1 – Teachers

#### Desired Outcomes

1. Comfortable presenting
2. Hands-on activities
3. Standards/Curriculum Connections
  - a. Integrated at State Level
  - b. How to Integrate in Curriculum
4. Emotional – physical/values connection
5. Network of marine scientists for support
6. Opportunities to visit and interact
7. Teachers capable of independent thought
  - a. Evidence-based understanding
  - b. Connections to community, geography, culture and local economy
  - c. Teachers will use awareness and understanding to achieve evidence-based understanding
  - d. “Visceral” multi-disciplinary connections
  - e. Emotional/value connections
  - f. Action/stewardship
    - i. “If teachers are \_\_\_\_\_, then students will \_\_\_\_\_.”
8. Action
9. Reduce CO<sub>2</sub> emissions
10. Build network of teachers

#### Outcomes

- Teachers will be aware and achieve their own evidence-based understanding of OA
- Teachers will incorporate “this knowledge” (OA) into their “teaching practice” (curriculum)
- Teachers will inspire actions and stewardship

#### Tools:

1. Online data sources
  - a. Ocean Observing Systems (OOS) and real world data (experiences)
2. Professional development for ZAM’s
3. Network of scientists and experts: National Lab Network
4. Opportunities to visit and interact
5. Standards and curriculum
6. Network of teachers
7. Hands on activities
8. Place-based field activities
9. Multi-media – listing of existing resources
10. Teacher internships/Recent ex-teachers, or retired, (RET)/Teacher at sea



11. Lesson plans and other resources
12. Using arts, nature, and culture

#### Conservation Actions

1. Gaining awareness of OA locally and regionally
2. Reduce carbon footprints
3. Take other actions related to resilience to multiple stressors (MPAs, adopt a beach, sustainable seafood, recycle)
4. Develop relationship with conservation organizations, community service and social understanding
5. Building community
6. Creative expression
7. Empowering creative solutions

#### Needs and gaps

1. Needs assessment
2. Lack of support (time, money)
3. Lack of inclusion of ocean science in standards
  - a. Lack of connection to existing standards
4. OA literacy standards
5. General lack of science in schools
6. Lack of values and citizenship
7. Lack of arts support
8. Lack of good solutions
9. Not enough opportunities to bring scientists and teacher together building a community
10. Lack of hands-on experience across grade-levels
11. Lack of materials that can be adapted and no resources

#### Strategies

1. Connect teachers with ZAM's
2. Find money for transportation
3. Ways to support each other
4. Bring successful approaches to others
5. Distance learning tools
6. Make global connections locally relevant
7. Leverage partnerships and resources
8. Redistributing resources

#### Group 2 – Families

##### Outcome 1: Knowledge

- Recognizing problem
- Real and measurable (verifiable, tangible) knowledge
- Established knowledge
- Scientific consensus (case studies)
- No debate – there will be impacts

##### Outcome 2: Behavior: your choices have impact

- Part of the problem

- Part of the solution
- “Ocean-friendly”/sustainable behavior
- Engaging in discussion
- Avoid ecophobia
- Empowerment

#### Outcome 3: Tools and Communication

- Family is already a community
- Parents engage at X-level
- Teens engage at Y-level
- Kids engage at Z-level
- Sense of place – places of personal care
- Sense of scale – where people are at
- Additive impacts

#### Tools:

- Framing
- Conversation
- Modeling
- Video/visuals
- Social media
- Programs
- Mediation/interpretation/facilitation
  - Staff making the experience better
- Animals
- Multi-sensory interactives
- Activities/multi-modal play
- Experiences in nature
- Photo-ops
- Community
- Quality of life (Nemo approved!)
- Leveraging professional networks (NAAEE)
  - NAI, ASTC, AZA, NMEA, AAM
- Research to practice: [www.research2practice.info/](http://www.research2practice.info/)
- Youth networks

#### Actions:

- Validation
- Conversation
- Go to the place
- Pay it forward
- Infect with passion
- Advocacy
- Think first
- Culture/cultural behaviors

#### Conservation Actions:

- Turn off lights
- Locally sourced family meals

- Driving less
  - Kids buy parents
  - Alternative transportation
- Make a good choice
- Voting
  - Talk to kids about why you make choices the way you do
- Explicit community action
  - School recycling
  - Youth advocates (Jamba Juice example)
  - Zero waste lunch

#### Gaps/Needs

- Wide-ranging exhibits/programs to engage 1 to 100
- “Let your hair down”
- Time – engage littles while working with bigs
- Professional development
- Time – profession sharing
- Get marketing on board
- Examples of success
- Evaluated results
- Evaluation tool kits
- How do we make it fun

#### So What/Why

- Health safe homes/communities
- The ocean starts in your backyard
- Modeling allows people to touch/participate in our culture
- Reinforce/establish values because that’s what good parents do
- It’s fun!
- There is so much to discover/there is so much we don’t know.

#### Group 3 – Students

##### Outcomes to achieve:

1. Ocean literacy principle #6 (humans and ocean are interconnected)
  - a. To identify/use: tools that incorporate
2. Critical thinking skills to increase understanding of OA.

##### OA is the case study

##### Other outcomes:

- Knowledge of carbon footprint
- Personal/family/community action
- Global impact/understand it
- Share knowledge with peers and others

#### Gaps/Needs

- Clearinghouse of information for educators?
- Student-driven information/empowerment
- Access to scientists/science
- Identify relevant, appropriate knowledge of regional networks i.e. teens for oceans

- Options for action
- Grade-level appropriate messages
- Quantifiable measurements of action
- Lack of priority to ocean awareness

#### Tools

- Hands-on
- Exhibits
- Field trips
- Videos/multi-media interactive
- Volunteer opportunities
- Informed, engaged teachers
- Real-time data
- Links
- Case studies

#### Appropriate Actions

##### K-5:

- Turn off lights, tap, etc.
- Reuse and recycle
- Eat your dinner: use what you take

##### 6-8:

- Decrease waste
- Put on a sweater before heat
- Refill water bottles
- Unplug electronics

##### 9-12

- Decrease consumption/consumerism
- Transportation options
- Food choices – eat less meat?
- Outreach/action
- Community/organization/participation/connection

### Group 4 - Policy Makers

#### Audiences

- Local/state non-elected
- Federal elected
- Federal non-elected
- Local/state elected

#### Federal Outcomes

1. Research Funding
  - a. For funding for monitoring
2. Maintaining and building relationships
3. Acknowledge of problem
4. Emission Regulations

#### Tactics

##### Politically potent and locally relevant

1. Support other federal funding mechanisms
2. FOAR AM reauthorization

### 3. NASA/NOAA/NSF CC education Funding

Avoid OA deniers/opposition (win the messaging war)

-Focus on unequivocal data

Step 1: Take advantage of and make stronger relationship building to elected that are sympathetic to cause

Step 2: Maintaining and acknowledge care/aware of problem

- Congressional visits from experts
- Show of support of overwhelming
- Media and science connection
- Use the credible messenger
  - Religious leaders
  - Industry/fishers
  - Celebrities
  - Community leaders
  - Rec advocates
  - Scientists/universities
- C40
- Bring experts and conferences to DC area
- ID case studies – more than shellfish (gap)

#### Tools

- Congressional Resolution
- Create media opportunities
- Alternative future dinner (less and less at progressive dinner)
- Parties to highlight issue on hill (connect food to issue)
- Use constituents
- Organize congressional visits
- Get a Republican

#### Gap:

- Internal states
- Use energy framing
- Campaign to connect inland states to OA

#### Address middle of country:

- Dependent on importing seafood
- Grocer's associations

#### Message:

- Start with connection to constituents
- 30% more acidic
- Rate of change not seen in Earth's history
- It's real, it's here and it's impacting people that vote for you
- Acid rain – connections

Need: visual for economic impact at national level (beyond DC)

Challenge: projected costs not realized

Challenge: Conn < -> OA & CC

Challenge: CO2 reduction is not actionable

Answer: engage local issues on addressing impact

Discussion and disagreement  
Problem: when is the night time?  
What is the actionable solution?  
Use constituents for CO2 emission  
Lobbying  
Scientists/science to raise awareness/understanding  
Suite of local hook  
Gap: understand local contribution for pH  
Tool for agencies: CWA, CAA

Audience: Policy makers

1. Elected – federal
2. Local
3. Federal agency

Outcomes:

Immediate: funding maintained for monitoring, research, education and outreach

- FOARAM Reauth (maybe next Congress)
- Integrate into NASA/NDAA/NSF funding and other federal funded mechanisms
- Understand how much local drivers affect pH

Immediate: build and maintain awareness of issue and get them to care

- Use credible messengers (not NGO's)
- Experts make long visits
- Use media
- Congressional resolution
- Alternatives future progressive dinner
- Get a Republican spokesperson

Messages

It's real, it's here and people (i.e. constituents) are affected

What can we do?

- Action with CO2 at local level
- Action with CO2 at federal level – disagreement

Challenge: discussion OA, CC, CO2

Gaps: other case studies, internal/non-coastal states (connection with seafood)

Work with politics we have, not the political we want

### Group 5 - Recreational/Commercial Users

Desired outcomes

Action?

Awareness?

Ultimate goal

- Reduced fuel use?
- Adaptation/adaptability?
- Increased awareness of business
- Increased participation

Action

- Switch to bio-fuel
- Good maintenance of boats
- Participate in research data collection

Outcome 1

- Increased awareness around future possible need for adaptation
  - Targeted to businesses

#### Tools/Strategies

- First – listen!
- Need to help their business
- Collaborate fisheries research (paid)
- Identify key individuals within user communities

#### Actions

- Incorporated of OA information into long term planning
- Development of ideas from within user community

#### Gaps

- Refined measurements of OA impacts on specific species but only introduce after community requests

### Outcome 2: Reduce fuel use

#### Tools/Strategies

- Need to frame carefully
  - In terms of benefits to them (but not top down)
  - Users initiating their own change
- Sharing best practices but need to understand the different user sectors better
- Sharing success stories
- Talk to NOAA Economist (Rob Ehler, Bob Leeworthy) – get info (for ex) – Where are most efficient whale watching operations

#### Actions

- Implementing best practices

#### Gaps

- Identifying best practices and clarify financial incentives
  - Whale watching
  - Cruise ships
  - Fishing vessels

### Outcome 3: Increase trust between comm./recreational users, scientists, communicators

#### Tools/Strategies

- Need to develop a strategy/game plan
  - Start with key relationships (e.g. intermediaries)
  - Need to understand the communities better
  - Participate in their meeting; collect info
- Start by listening, asking about their needs
- Wait for them to ask about relevant OA info
  - Local info
  - Provide the info they need
- Share the load

#### Actions

- More citizen science/CFR
- Increase dialogue

#### Gaps

- Need funding; lots of effort is needed
- Finding the intermediaries; be introduced to the communities
- Finding success stories

## Appendix E: Share-a-thon Participants

Organization	Activity
<b>UCSC/C-MORE Center for Microbial Oceanography: Research and Education</b>  Presenters: Christina Comfort ( <a href="mailto:ccomfort@hawaii.edu">ccomfort@hawaii.edu</a> ) , Julie Robidart, ( <a href="mailto:jrobidar@ucsc.edu">jrobidar@ucsc.edu</a> )	<b>C-MORE Kits</b> <i>(Audience: grades 6-12)</i> This two-lesson kit familiarizes students with the causes and consequences of ocean acidification. Lesson 1 includes a simple hands-on experiment, a short PowerPoint, and optional readings with worksheets. In Lesson 2, students conduct a more in-depth experiment with electronic probes to simulate the process of ocean acidification. <a href="http://cmore.soest.hawaii.edu/education/teachers/science_kits/ocean_acid_kit.htm">http://cmore.soest.hawaii.edu/education/teachers/science_kits/ocean_acid_kit.htm</a>
<b>Institute for Systems Biology</b>  Presenter: Claudai Ludwig <a href="mailto:Claudia.Ludwig@systemsbiology.org">Claudia.Ludwig@systemsbiology.org</a>	<b>OA Curriculum Kit/Ocean Acidification: A systems approach to a Global Problem</b> <i>(Audience :High School)</i> In this curriculum module, students in high school life and marine science courses act as interdisciplinary scientists and delegates to investigate how the changing carbon cycle will affect the oceans along with their integral populations. Students closely model what is occurring in laboratories worldwide, and at ISB through Monica Orellana's research to analyze the effect CO <sub>2</sub> has on ocean chemistry, ecosystems and human societies. Students experiment, analyze public data, and prepare for a mock summit to address concerns. <a href="http://baliga.systemsbiology.net/drupal/education/?q=content/ocean-acidification-systems-approach-global-problem">http://baliga.systemsbiology.net/drupal/education/?q=content/ocean-acidification-systems-approach-global-problem</a>
<b>Environmental Defense Center</b>  Presenter: Kristi Birney <a href="mailto:kbirney@environmentaldefensecenter.org">kbirney@environmentaldefensecenter.org</a>	<b>Ocean Acidification PSA</b> <i>(Audience: all)</i> A 30-sec animated public service announcement on OA. <a href="http://www.cisanctuary.org/acidocean/pledge.php">http://www.cisanctuary.org/acidocean/pledge.php</a>
<b>NOAA Cordell Bank Nat'l Marine Sanctuary</b>  Presenter: Jennifer Stock <a href="mailto:jennifer.stock@noaa.gov">jennifer.stock@noaa.gov</a>	<b>Ocean Acidification Kit including Whale Jenga</b> <i>(Audience: 5-8 grades)</i> These two lessons correlated with National Science Education Standards. Students use the scientific method to conduct an experiment to understand the effects of increased acidity on certain marine species. Using the popular wood block game Jenga, explore the relationship between predators and prey in an ocean food web and how it's affected by ocean acidification. This game makes the interconnection of the food web very concrete. As the bottom of the food web is impacted, the whole web becomes more fragile and eventually collapses. <a href="http://www.cisanctuary.org/acidocean/">http://www.cisanctuary.org/acidocean/</a>
<b>NOAA Coral Reef Conservation Program</b>  Presenter: Paulo Maurin	<b>OA Data in the Classroom and OA Ed Website</b> <i>(Audience: High School)</i> This set of scalable lesson plans features five activities at different levels to help you learn about ocean acidification



<a href="mailto:Paulo.Maurin@noaa.gov">Paulo.Maurin@noaa.gov</a>	using real data. Our new OA Ed page contains close-captioned presentations, curricula, multimedia, and background materials. <a href="http://coralreef.noaa.gov/education/oa/">http://coralreef.noaa.gov/education/oa/</a>
<b>Pacific Science Center</b>  Presenter: Zeta Strickland <a href="mailto:ZStrickland@pacsci.org">ZStrickland@pacsci.org</a>	OA Discovery Cart (Audience: all) Mobile activity stations that can be set up in any area of the museum floor, and are designed to engage small groups of visitors of a variety of ages and complement other exhibits. A cart contains several individual activities around the themes of OA; these activities can be done in any order, and together build a knowledge set for the guest who may stay at the station for anywhere from 3-20 minutes. The OA centered activity consist of 4 activities 1) Pools, cycles, and Flux! Oh My! 2) Do it yourself Carbonic Acid 3) Lego Shell-Building and 4) Food Web Mechanics
<b>Digital Explorer</b>  Presenter: Jamie Buchanan-Dunlop <a href="mailto:jamie@digitalexplorer.co.uk">jamie@digitalexplorer.co.uk</a>	<b>Digital Explorer Oceans</b> (Audience: all) Four curriculum booklets for Geography and Science education in the UK, and an International version, comprising 50 lesson plans as well as 60 activity and fact sheets; multimedia software containing 35+ short films and 200+ photos <a href="http://oceans.digitalexplorer.com/">http://oceans.digitalexplorer.com/</a>
<b>Aquarium of the Bay</b>  Presenter: Carrie Chen <a href="mailto:carrie@bay.org">carrie@bay.org</a>	Ocean's Recipe for Success (Audience: all) This visitor program is a hands-on, interactive presentation to help our guests understand and value the importance of how human activities influence the health of the ocean ecosystem and Importance of how changes in the ocean ecosystem affect marine life and human life. This 20 min activity is designed for all ages and works best with groups of 5-15 people. <a href="http://www.aquariumofthebay.org">www.aquariumofthebay.org</a>
<b>Spector Dance/ MBA</b>  Presenter: Fran Spector Atkins via Sara Hutto <a href="mailto:spectordance@earthlink.net">spectordance@earthlink.net</a>	<b>Ocean: performance piece and educational program</b> (Audience: middle school, general public) <b>OCEAN</b> is their new dance media project about the ocean and its impact on climate change. Along with a live performance for general audiences, the program offers optional educational sessions and/or pre- performance lectures by ocean science experts. SpectorDance and the Monterey Bay Aquarium Research Institute are building a two-part program that brings together art and science to explore our oceans. It targets public school audiences in the hope of educating people about the state of our world ocean. <a href="http://www.spectordance.org/">http://www.spectordance.org/</a>
<b>Monterey Bay Aquarium</b>  Presenter: Sarah Mae Nelson <a href="mailto:SNelson@mbayaq.org">SNelson@mbayaq.org</a>	<b>iGlobe ocean data sets, Plankton Video Microscope, weigh your impact activity</b> (Audience: all) These exhibit provided a range of activities, from the techy

	<p>modeling visualization to the simple wooden blocks in the scale game. engaging way to render 2D climate data visualizations into stunning 3D-like models, along with simple life-choices in the balance</p>
<p><b>Inquiry to Insight ,The Sven Lovén Centre for Marine Sciences and Stanford</b></p> <p>Presenters: Geraldine Fauville, Jason Hodin, Pam Miller  <a href="mailto:geraldine.fauville@loven.gu.se">geraldine.fauville@loven.gu.se</a></p>	<p><b>Acid Ocean: a virtual lab</b>  <i>(Audience: High School)</i>  The Inquiry-to-Insight (I2I) project promotes international collaboration among high school / secondary school students as they learn about, discuss, and envision solutions to shared environmental challenges. In particular, it offer the following free, interactive digital learning tools relating to climate change and ocean acidification  A set of engaging multimedia and interactive, web-based activities that walk students through the process of investigating OA, the science behind it, and its effect on the marine food web.  <a href="http://i2i.stanford.edu/AcidOcean/AcidOcean.htm">http://i2i.stanford.edu/AcidOcean/AcidOcean.htm</a></p>
<p><b>National Marine Sanctuary Foundation</b></p> <p>Presenter: Jason Patlis  <a href="mailto:Jason@nmsf.org">Jason@nmsf.org</a></p>	<p><b>Federal Policy and Funding Related to Ocean Acidification</b>  <i>(Audience: agencies and NGOs )</i>  NMSF staff presented the new report highlighting OA efforts across the US federal government.  <a href="http://www.nmsfocean.org/files/OA_Report.pdf">http://www.nmsfocean.org/files/OA_Report.pdf</a></p>
<p><b>Oceana</b></p> <p>Presenter: Matthew Huelsenbeck  <a href="mailto:mhuelsenbeck@oceana.org">mhuelsenbeck@oceana.org</a></p>	<p><b>Ocean-Based Food Security Threatened in a High CO2 World</b>  <i>(Audience: n/a)</i>  Oceana is working to reduce the cause and effects of ocean acidification by promoting government policies to cap CO<sub>2</sub>emissions, eliminate offshore drilling, and by advocating for energy efficiency and alternative energy sources such as wind power and more.  <a href="http://oceana.org/en/our-work/climate-energy/ocean-acidification/overview">http://oceana.org/en/our-work/climate-energy/ocean-acidification/overview</a></p>
<p><b>New England Aquarium</b></p> <p>Presenter: John Anderson  <a href="mailto:janderson@neaq.org">janderson@neaq.org</a></p>	<p><b>Climate Interpreter Activities</b>  <i>(Audience: all)</i>  A set of hands-on activities to effectively convey key OA messages, including a carbon footprint calculator, the carbon cycle, and a close up look at specific ways in which climate change might affect a most charismatic marine fauna, the penguins.  (main page: <a href="http://climateinterpreter.org/">http://climateinterpreter.org/</a>)  <a href="http://climateinterpreter.org/resource/climate-training-activities-penguin-balance">http://climateinterpreter.org/resource/climate-training-activities-penguin-balance</a></p>

## Appendix F: Ongoing Working Groups

<b>Networking (Facebook Page, project Wiki site, collaboration opportunities)</b>			
Sarah Allen			
Laura Francis			
Mary Miller			
Scott MacKenzie			
Jenn Bennett			
Carol Blanchette			
Erin Sams			
Zeta Strickland			
Claudia Ludwig			
Geraldine Fauville			
<b>Research and Literature (examples include socioeconomic, current research and regional examples, models and predictions, education, communication strategies)</b>			
Dan Howard		Research	
Kathryn Danielson		Research/Education	
Libby Jewett		Research	
Simona Bartl		Research	
Wei Ying		Strategic Communications/Social Marketing	
Geraldine Fauville		Education	
<b>Messaging (include audience perspective)</b>			
Jim Covel			
Cathy Sakas			
Jennifer Stock			
Linda Chilton			
Julia Roberson			
Sean Bingami			
Kristi Birney			
Janine Scianna			
Julie Bursek			
Ellen Tyler			
Claire Facker			
Jason Hodin			
Elizabeth Selna			
NPS Rep (Ask Sarah Allen)			
<b>Case Studies</b>			
John Anderson		Matrix of Success Stories	
Karen Matsumoto		WA tribes and OA research/cultural connections	
Fran Atkins			
Linda Chilton			
Julie Bursek			
Paulo Maurin			
Jason Hodin			

<b>Asks (What are we asking our audience to do?)</b>		Create a framework, menu	
Jim Covell			
Aaron Pope			
Carolyn Skinder			
Jacqueline Laverdure			
<b>Audiences</b>			
<b>Teachers</b>			
Jennifer Westerbeck			
Nancy Muehlelehner			
Sean Bingami			
Simona Bartl			
<b>Students and Youth Media</b>			
Jennifer Stock			
Jason Hodin			
Erin Sams			
Claire Fackler			
Pam Miller			
Carolyn Skinder			
<b>Families</b>			
Alicia Archer			
Sarah Mae Nelson			
<b>Policy Makers</b>			
Nancy Muehlelehner			
<b>Stakeholders</b>			
Jenn Bennett			
<b>Social Networking</b>			
Rachel Weidinger			
Sean Bingami			
Geraldine Fauville			
<b>Funding</b>			
Wei Ying Wong			
Simona Bartl			
Jason Hodin			
<b>Leverage Professional Orgs</b>			
Jim Covell		National Association of Interpreters	
<b>Music Video</b>			
Sarah Mae Nelson			
<b>Communicate uncertainty in science, avoid pitfalls of climate change</b>		skepticalscience.com	
Aaron Pope			
Carol Blancheltte			
Zeta Strictland			