Communicating Ocean and Coastal Climate Change Impacts & Solutions

This factsheet was prepared in 2015 for the California Ocean Protection Council by Susanne C. Moser, Ph.D. It characterizes the communication challenge, summarizes what is known about public perceptions of ocean and coastal climate change issues, provides guidance to communicators with the goal of enabling audiences to better understand the link between our climate, oceans, and coastal areas, and to actively engage them in finding and enacting solutions. It also offers further readings & resources.

Introduction

Human-caused climate change has a significant impact on the coastal and marine environment, particularly as a result of ocean warming, acidification and sea-level rise. In the oceans, these changes to the physical environment affect marine water quality; the distributions, behaviors, population sizes, and survival of individual species; and the viability and geographic positions of marine habitats. Along the coast, sea-level rise increases flooding, storm surge, coastal erosion, loss of beaches and coastal habitats, and saltwater intrusion.

While many Americans increasingly recognize the causes of climate change, and widely-reported disasters, such as Hurricane Katrina and Superstorm Sandy, have raised awareness of emerging climate change threats to coastal areas in the U.S., Americans are still largely unfamiliar with all of the impacts of global warming on the ocean.

The Communication Challenge

Communicators face significant communication challenges:

- **Shortening the psychological distance between people and oceanic climate change**: Effective communication regarding oceanic and coastal climate change must overcome the psychological distance that people place between themselves and these issues, as well as the physical distance between people and climate change impacts on the coasts and ocean. Individuals differ in their levels of access to witness oceanic climate change for themselves. A lack of firsthand experience with these impacts can lead to a disconnect, such that people generally perceive themselves as being unaffected by them. There is also a temporal dimension to the challenge, since people tend to find it difficult to stay motivated to take actions to mitigate and prepare for climate change impacts when the benefits of those actions are not fully realized instantaneously. With psychological distancing, climate threats and particularly the oceans remain abstract and intangible, thus leading to the lack of a sense of urgency to address climate change.

- **Filling ocean-climate knowledge gaps**: Over the past two decades, the public's understanding of oceans, marine ecosystems, the link between oceans and the economy, the link between oceans and climate, and the most important threats to the marine environment has remained low, despite growing efforts in ocean education. With large numbers of people living near the coast, understanding of coastal changes is better, but still quite superficial. Climate literacy is also lacking. Studies suggest that most Americans are concerned about coastal and ocean health, despite having little to no factual or policy-relevant knowledge about it. Knowledge is lacking particularly about the essential role of the ocean in the climate system; key climate change impacts such as sea-level rise and ocean acidification, the causal link between CO_2 emissions and ocean acidification, hypoxia (low oxygen), temperature and ocean circulation changes, and about possible solutions.

- **Overcoming pre-existing, misleading mental models**: Mental models are the basic simplifying constructs that people use to quickly make sense of the world and how things work. Most people view the ocean as vast, natural, resilient, separate from the human realm, and thus mostly beyond human control. To some extent, this is also true for the climate, even though climate communicators have tried to change that mental model for years. This mental model pre-disposes people to think of the oceans as being beautiful, self-healing, and serving as a backdrop for fun, recreation, and spiritual renewal, rather than as an integral part of the interconnected Earth system that is profoundly changed by CO_2 emissions and other activities.

- **Breaking through polarization, overwhelm, and helplessness**: The public discourse on climate change in the U.S. essentially dictates the way in which ocean communicators can discuss ocean-climate issues. The most engaged Americans are divided almost equally into those who are most alarmed by and those who are entirely dismissive of climate change, while the remaining majority holds weak, poorly formed, and largely uninformed opinions about the matter. The polarization is a turn-off for many, making it difficult to share new information. In addition, climate change is seen as a global problem, which leads people to believe that only global policy and technical solutions can solve this large-scale issue, while taking personal actions makes no difference. A general sense of overwhelm, personal helplessness, and the assumption that climate change is a problem for someone else to solve, lead many to tune out and turn to other pressing concerns of daily life. Problems with the oceans are similarly viewed as big, overwhelming, and seemingly beyond the effective influence of individuals.

U.S. Public Understanding of Ocean-Climate Issues

Few detailed studies of distinct segments of the U.S. population exist that reveal people's understanding of ocean-climate issues. Detailed audience-specific messaging recommendations are thus premature and should be tested prior to widespread use.

From the limited knowledge available, key findings offer important insights, particularly on ocean acidification:

- Connections between oceans and climate change are typically not top-of-mind. But when people are asked about marine problems, the first things that usually come to mind are either specific incidents (like big oil spills) or visible pollution problems (like garbage on beach). Positive associations include the food that comes from the ocean and the ocean as a place of recreation and spiritual renewal. Charismatic megafauna (including whales, dolphins, and sharks) are fascinating and motivate action, but are not understood to be part of the marine ecosystems that are being altered by climate change.

- At most, only up to a quarter of the U.S. population has heard of "ocean acidification" or knows that climate change may have a negative impact on coral reefs. Other impacts on oceans are even less familiar.

- The word "acidification" is reminiscent of "acid rain," which leads many to believe that ocean acidification is the result of acid rain falling on land and running off into the ocean. Importantly, once given the proper scientific explanation, people can quickly grasp the problem.

- Because CO_2 is generally thought of as a naturally-occurring compound and people have only a superficial understanding of how human activities can cause climate change, they are hard-pressed to explain how the greenhouse effect works, how emissions affect the ocean, and how changes in the ocean could affect the many marine ecosystem goods and services that link it to other earth systems, species, humans, and the economy.

- Americans lack a systems-based causal model of how the ocean is related to the climate and thus do not understand that the ocean has a crucial regulatory function or that it affects interannual, seasonal, and short-term climate and weather patterns. Furthermore, they do not know that the ocean absorbs heat or that it takes up much of the atmospheric CO_2 and becomes increasingly acidic, as a result.

- Consequently, most Americans can only think of common responses to waste and water quality problems, such as recycling and stopping the dumping of pollutants, when considering what they can do about oceanic climate change.

Communicating Ocean-Climate Impacts & Solutions

Because evidence for how different audiences think about ocean-climate issues is still limited, the first recommendation to ocean communicators is to follow communication best practices:

- **Identify and get to know your audience(s)** (i.e., common concerns and interests; core values; pre-existing knowledge and beliefs; misconceptions; and lack of knowledge).
- **Specify a desired communications outcome** (i.e., increased ocean-climate literacy; engagement or interest; behavior change; or support for policy).
- **Strategically select and use the right opportunity and method for communication** to engage the audience(s) (i.e., the where, when, how, how often, by what channel(s), and through which messenger(s) people can best learn about and interact with ocean-climate issues).
- **Form a bond around what you share**, e.g. stewardship, love of nature, connection to place, and excitement.
- **Use observed changes and or current news items** as hooks to engage audiences and to tap into existing curiosities. This opens opportunities to talk about the things they most care about or about a wider range of ocean-climate impacts.
- **Explain processes briefly and in simple terms, rather than just listing facts**, impacts, problems, or solutions, because people understand and retain knowledge best when it is causally linked.
- **Always give people a sense of hope that "together, we can solve the problem** (i.e., the problem is serious and urgent, but can be addressed through concerted policy actions at all levels, and every person can help through specified actions and civic/political engagement).
- **Repeat simple messages often** (e.g., climate change and its impacts on oceans are real, happening now, and human-caused; the vast majority of scientists agree on this)

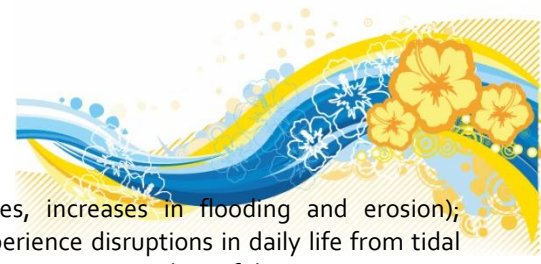**Specific Recommendations from the FrameWorks Institute:**
More specifically, ocean communicators can overcome the aforementioned challenges of communicating ocean-climate impacts and solutions using the following approach:

Lead with values: The strongest support for action ensues from values like "protection," "responsible management," and "stewardship," followed by "scientific authority."

Use explanatory metaphors to explain (1) the causes of climate change and (2) to connect ocean and climate: (1) Driving cars and burning coal and gas to power our homes emit "gases that trap heat in the atmosphere" and warm our climate. (2) The ocean regulates the climate system "like your heart" regulates the flow of blood throughout your body.

Distinguish regular levels of CO_2 from excessive or rampant levels of CO_2: Regular amounts of CO_2 that

feed plants are a good thing, but too much of it is harmful. Burning fossil fuels results in an excess of CO_2, and it is getting out of control.

Use an explanatory metaphor for the effects of ocean acidification: The ocean takes up CO_2 from the air, making the water increasingly acidic, thus causing "osteoporosis of the sea." As a result, animals such as shellfish have trouble building and maintaining their shells, surviving, and reproducing. This disrupts the food chain.

Focus on marine ecosystem goods and benefits people receive and link them to fundamental ocean processes.

Be ready to answer questions about what people can do to help improve ocean health and protect the climate (focus on age-appropriate behaviors and actions). If everyone took these actions, the collective impact would be enormous.

Everyday actions people can take to help improve the health of the ocean and to protect the climate

- Reduce energy consumption in your home.
- Make safe, sustainable seafood choices.
- Use fewer (or no) plastic products.
- Help take care of the beach.
- Don't purchase items that exploit marine life.
- Be an ocean-friendly pet owner.
- Support organizations working to protect the ocean.
- Ask your political representatives about their support for ocean and climate policies.
- Practice responsible boating, kayaking, and surfing.
- Educate yourself about oceans and marine life.

(More information at:
http://ocean.nationalgeographic.com;
http://sanctuaries.noaa.gov/protect/oceanetiquette.html)

U.S. Public Understanding of Coastal Climate Issues

In addition to the more difficult-to-imagine and distant ocean impacts of climate change, how do Americans think and feel about coastal impacts? Most of the available work has focused on sea-level rise and coastal hazards:

- Sea-level rise is discussed in the media, but individuals don't think much, and show little concern, about it.
- However, distance matters: the closer people live to the shore, the greater their awareness of, and concern about, sea-level rise and related coastal hazards.
- Partly as a result of past communication, many feel detached from sea-level rise and see it as something that "happens in a 100 years from now," and to people on small islands or in countries far from them.
- Those who live closest to the shore frequently have observed changes over time (e.g., shifting shorelines,

ecological changes, increases in flooding and erosion); some already experience disruptions in daily life from tidal flooding, higher storm surges, or loss of their own property.

- Where people have such direct experience of sea-level rise and related impacts, they generally view sea-level rise as negative and frequently express fear and hopelessness.
- Most feel they can't do much to address the causes or have any responsibility to address the impacts of sea-level rise.
- Because of the low climate literacy, and people not fully understanding how climate warming relates to sea-level rise, many hold false mental models about what actions could limit sea-level rise (e.g., recycling).

Communicating Coastal Climate Impacts & Solutions

The eight general best practices described above apply equally to ocean as to coastal climate impacts and solutions. Where impacts in coastal areas are already evident, these observed changes can serve as a starting point for engagement around solutions. At the same time, under such circumstances emotional responses to the apparent and growing risks may be stronger, which can make communication and engagement more challenging. The following recommendations help with effectively communicating coastal climate change:

- **Use observed changes, experiences, or visualizations of future impacts to make coastal impacts and response options "real" in particular places**. This helps overcome the misperception that sea-level rise happens in the distant future, in faraway places, and to other people. The King Tides Initiative is an example of encouraging people to share experiences during regularly occurring extreme tides.
- **Depending on the audience and available science stay agnostic or attribute observed changes to human-caused climate change**. Answer questions people have about causes, but stay engaged with those who refuse to believe sea-level change can be linked to climate change.
- **Listen and make space for people to share their experiences and feelings.** This will reveal how the audience understands and thinks about causes, effects and solutions; where members of the audience share common concerns, feelings, and values; and which misconceptions may need to be addressed through education.
- **Help people understand that uncertainty is not a good reason for inaction**, as things can turn out more or less severe. Work with scenarios to explore impacts.
- **Be as specific as possible.** If adaptation is an unfamiliar or negatively loaded term, describe concrete actions communities and households can take and frame it as extensions of responsible planning and management.
- **Tap into values that resonate broadly** (i.e., preparedness, stewardship, responsibility, precaution, leadership).

Further Reading and Resources

Note, all readings and resources freely available or accessible online are provided with links, current as of July 2015. Others are copyright protected and can be purchased from the relevant journal websites.

Communicating about Climate Change and the Ocean

Bunten, A., Simon, A., Volmert, A., & Kendall-Taylor, N. (2014). *The Value of Explanation: Using Values and Causal Explanations to Reframe Climate Change.* Washington, DC: FrameWorks Institute. Access here.

Chilvers, J., I. Lorenzoni, G. Terry, P. Buckley, J. K. Pinnegar & S. Gelcich (2014). Public engagement with marine climate change issues: (Re)framings, understandings and responses. *Global Environmental Change,* 29, 165-179.

FrameWorks Institute (2009). *How to Talk About Climate Change and Oceans.* A FrameWorks Message Brief. Washington, DC: FrameWorks Institute. Access here.

Frisch, L. C., J. T. Mathis, N. P. Kettle & S. F. Trainor (2015). Gauging perceptions of ocean acidification in Alaska. *Marine Policy,* 53, 101-110. Access here.

Gelcich, S., P. Buckley, J. K. Pinnegar, J. Chilvers, I. Lorenzoni, G. Terry, M. Guerrero, J. C. Castilla, A. Valdebenito & C. M. Duarte (2014). Public awareness, concerns, and priorities about anthropogenic impacts on *marine environments. PNAS*, 111, 15042-15047. Access here.

Kelly, L.-A. D., J. F. Luebke, S. Clayton, C. D. Saunders, J. Matiasek & A. Grajal (2014). Climate change attitudes of zoo and aquarium visitors: Implications for climate literacy education. *Journal of Geoscience Education*, 62, 502-510. Access here.

Kelly, R. P., S. R. Cooley & T. Klinger (2014). Narratives can motivate environmental action: The Whiskey Creek ocean acidification story. *Ambio,* 43, 592-599. Access here.

Leiserowitz, A., Smith, N. & Marlon, J.R. (2011). *American Teens' Knowledge of Climate Change. Yale University.* New Haven, CT: Yale Project on Climate Change Communication. Access here.

Leiserowitz, A., Smith, N. & Marlon, J.R. (2010). *Americans' Knowledge of Climate Change. Yale University.* New Haven, CT: Yale Project on Climate Change Communication. Access here.

Meyer, D., A. Isakower, and B. Mott (2015). *An Ocean of Opportunities.* The Ocean Project.

Meyer, D., A. Isakower, and B. Mott (2012). The Ocean Project.

NOAA Office of National Marine Sanctuaries (2015). Sanctuaries and climate change (website and resources).

Portman, M. E. (2014). Visualization for planning and management of oceans and coasts. *Ocean & Coastal Management,* 98, 176-185. Access here.

Volmert, A. (2014). *Getting to the Heart of the Matter: Using Metaphorical and Causal Explanation to Increase Public Understanding of Climate and Ocean Change.* Washington, DC: FrameWorks Institute. Access here.

Volmert, A., Baran, M., Kendall-Taylor, N., Lindland, E., Haydon, A., Arvizu, S., & Bunten, A. (2013). "*Just the Earth Doing its Own Thing": Mapping the Gap Between Expert and Public Understandings of Oceans and Climate Change.* Washington, DC: FrameWorks Institute. Access here.

Communicating about Climate Change and the Coast

Burch, S.L.M., Sheppard, S.R.J., Pond, E., Schroth, O. (2013). Climate change visioning: Effective processes for advancing the policy and practice of local adaptation. In: Moser, S.C., Boykoff, M.T. (eds.), *Successful Adaptation to Climate Change: Linking Science and Policy in a Rapidly Changing World*. London; New York: Routledge, 270–286.

Friesinger, S., Bernatchez, P. (2010). Perceptions of Gulf of St. Lawrence coastal communities confronting environmental change: Hazards and adaptation, Québec, Canada. *Ocean Coast Management*, 53: 669–678. Access here.

Furth I, Gantwerk H. (2013). *Citizen Dialogues on Sea Level Rise: Start with Impacts/End with Action*. Viewpoint Learning: San Diego, CA. Access here.

Harvatt, J., Petts, J., Chilvers, J. (2011). Understanding householder responses to natural hazards: Flooding and sea-level rise comparisons. *Journal Risk Res*, 14:63–83. Access here

Moser, S.C. (2013). Navigating the political and emotional terrain of adaptation: Community engagement when climate change comes home. In: Moser, S.C., Boykoff, M.T. (eds.), *Successful Adaptation to Climate Change: Linking Science and Policy in a Rapidly Changing World*. London: Routledge, 289–305. Access from here.

Mustelin, J., Klein, R., Assaid, B., Sitari, T., Khamis, M., et al. (2010). Understanding current and future vulnerability in coastal settings: community perceptions and preferences for adaptation in Zanzibar, Tanzania. *Popul Environ*, 31: 371–398. Access here.

Responsive Management (2010). Delaware Residents' Opinions on Climate Change and Sea Level Rise. Access here.

Thomas, M., N. Pidgeon, L. Whitmarsh & R. Ballinger (2015). Mental models of sea-level change: A mixed methods analysis on the Severn Estuary, UK. *Global Env Change*, 33, 71-82. Access here.

Whitmarsh L. (2008). Are flood victims more concerned about climate change than other people? The role of direct experience in risk perception and behavioural response. *J Risk Res*, 11:351–374. Access here.

Communicating about Climate Change Impacts and Responses Generally

Climate Access: Community of practice and communication resources. Access here.

Climate Access: Talking about impacts, even with Republicans. Access here.

Corner, A. (2014). *Climate Silence (and How to Break It)*. Briefing Paper 1, Climate Outreach and Information Network (COIN). Access here.

Corner, A., Lewandowsky, S., Phillips, M. & Roberts, O. (2015). *The Uncertainty Handbook: A Practical Guide for Climate Change Communicators*. Bristol: University of Bristol. Access here.

ecoAmerica & Center for Research on Environmental Decisions (CRED) (2014). *Connecting on Climate: A Guide to Effective Climate Change Communication*. Access here.

ecoAmerica & CRED (2013). *Communicating on Climate: 13 Steps*. Washington, DC and San Francisco, CA: momentUS/ecoAmerica. Access here.

ecoAmerica & Lake Research Partners (2012). *Climate Impacts: Take Care and Prepare. Focusing Americans on Climate Action*. Washington, DC: ecoAmerica. Access here.

Howe, P. D., M. Mildenberger, J. R. Marlon & A. Leiserowitz (2015). Geographic variation in opinions on climate change at state and local scales in the USA. *Nature Climate Change,* 5, 596-603.

Ledley, T. S., A. U. Gold, F. Niepold & M. McCaffrey (2014). Moving toward collective impact in climate change literacy: The Climate Literacy and Energy Awareness Network (CLEAN). *Journal of Geoscience Education,* 62, 307-318.

Moser, Susanne C. and Carol Berzonsky (in review). Hope: A bridge without railing. *Journal of Sustainability Education*, in review. Access draft from here.

Moser, Susanne C. and Carol Berzonsky (2015). There must be more: Communication to close the cultural divide. In: O'Brien, K. and E. Selboe (eds.), *The Adaptive Challenge of Climate Change,* in press. Access from here.

Moser, Susanne C. (2014). Communicating climate change adaptation: The art and science of public engagement when climate change comes home. *Wiley Interdisciplinary Reviews–Climate Change* 5: 337-358. Access from here.

Pike, C., S. Eaves, M. Herr and A. Huva (2015). *The Preparation Frame: A Guide to Building Understanding of Climate Impacts and Engagement in Solutions*. Access here.

Other Relevant Ocean & Coastal Communication Resources:

Barr, B.W. & A.D. Kliskey (2014). "I know it when I see it": Identifying ocean wilderness using a photo-based survey approach. Global Ecology and Conservation 2: 72–80. Access here.

Barr, B. W. & A. D. Kliskey (2014). Perceptions of wilderness and their application to ocean and coastal waters. *Ocean & Coastal Management,* 96, 1-11. Request here.

Perry, E. E., M. D. Needham, L. A. Cramer & R. S. Rosenberger (2014). Coastal resident knowledge of new marine reserves in Oregon: The impact of proximity and attachment. *Ocean & Coastal Management,* 95, 107-116. Access here.

Ruckelshaus, M., S. C. Doney, H. M. Galindo, J. P. Barry, F. Chan, J. E. Duffy, C. A. English, S. D. Gaines, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman & L. D. Talley (2013). Securing ocean benefits for society in the face of climate change. *Marine Policy,* 40, 154-159. Access here.

Schneller, A. J. & A. Irizarry (2014). Imaging conservation: Sea turtle murals and their effect on community pro-environmental attitudes in Baja California Sur, Mexico. *Ocean & Coastal Management,* 89, 100-111. Access from here.

Steel, B. S., C. Smith, L. Opsommer, S. Curiel & R. Warner-Steel (2005). Public ocean literacy in the United States. *Ocean & Coastal Management,* 48, 97-114. Access here.

White, M., A. Smith, K. Humphryes, S. Pahl, D. Snelling & M. Depledge (2010). Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology,* 30, 482-493.

Key Ocean-Climate Collaboratives and their Communication Tools:

The Oceans Project's communication resources.

The FrameWorks Institute's research and resources, in general and specifically on climate change and oceans here

National Network for Ocean and Climate Change Interpretation (NNOCCI)'s Study Circles program.

Climate Interpreter's Building Ocean Awareness Together (BOAT) project and other communication resources.

Selected Coastal & Marine Ecosystem Services

Coastal and marine ecosystems offer us a wide variety of goods and benefits (ecosystem services) on which we depend for food, economic activities, recreation, inspiration, and enjoyment. This graphic (produced for the Third US national Climate Assessment (2014) shows many of these services in a hypothetical island setting, but many of them can also be found along mainland coastlines.

Source: Figure 25.8 in: Moser, S. C., M. A. Davidson, P. Kirshen, P. Mulvaney, J. F. Murley, J. E. Neumann, L. Petes, and D. Reed (2014). *Coastal Zone Development and Ecosystems.* Ch.25 in: *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, T.C. Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, Washington, DC, 579-618.