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## Safeguarding our Oceans in a Warming World: Addressing Global Warming and Ocean Acidification

From rising sea levels and higher temperatures to more extreme weather events and ocean acidification, global warming pollution presents a serious threat to our already-stressed ocean systems. Treasured oceans and beaches, food staples, recreation, and employment are all at risk in the coming decades. To avoid the worst impacts, federal and state governments must protect our oceans by reducing global warming emissions and enacting policies that will boost the ability of natural systems to weather the ongoing and expected changes brought on by global warming and ocean acidification. Climate and energy legislation expected to be passed by Congress this year presents an opportunity to take a major step toward that goal.

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### Global Warming Threatens Ocean and Coastal Ecosystems

Global warming is contributing to higher ocean temperatures, more extreme weather events, rising sea levels, and changing circulation patterns. In addition, higher concentrations of CO<sub>2</sub> in the atmosphere are pushing the oceans beyond their ability to safely absorb the gas, directly altering the chemistry of the ocean and causing the water to become more acidic. We are already starting to see the effects. Left unchecked, all of these changes will have a profound impact on coastal and marine ecosystems including:

Rising sea levels will increase erosion of beaches, cause saltwater intrusion into water

supplies, inundate coastal marshes and other important habitats, cause inward migration of estuaries, and make coastal property more vulnerable to storm surges. For example, the relative sea-level in the mid-Atlantic region rose about 1 foot during the 20th century. Tidal wetlands like the Mississippi River Delta and Blackwater River marshes of Maryland are already being submerged by sea-level rise.

More extreme weather events, including intense rainfall, floods, droughts, and tropical storms, will alter freshwater flows into estuaries and lagoons, exacerbate polluted runoff and water supply problems, and damage coastal habitats and property. An increase in wave height



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over the past 50 years has already been measured in the Northeast and the Pacific Northwest.<sup>1</sup> **Higher ocean temperatures** will cause extensive coral bleaching, enhance marine diseases, alter species' ranges and populations, and stress many valuable fish and shellfish populations. For example, unusually warm winters have resulted in lobster disease outbreaks in Long Island Sound as well as the northward spread of an oyster parasite from southern the United States to areas north of Delaware Bay.<sup>2</sup>

**Changes in local and regional water circulation patterns** may occur, causing changes in ocean productivity. For example, recent changes in the timing and duration of upwelling along the Pacific coast—which are believed to be related to changes in wind patterns from continental warming—have triggered sea bird colony die-offs and dead zones along the West Coast of the United States over the past few years.<sup>3</sup>

### Ocean Acidification Endangers Marine Life

**Ocean acidification** will profoundly affect many forms of marine life, particularly those with carbonate shells or external skeletons such as corals and crustaceans. When carbon dioxide reacts with water to produce carbonic acid, the increased ocean acidity reduces the availability of carbonate, making it more difficult for organisms to build their shells. The net result is slower growth rates, fragile shells, and reduced survivability. Many of the organisms affected are either at the base of the food chain or provide critical habitat for other forms of marine life. Recent research shows corrosive waters are now being upwelled onto the continental shelf off the West Coast of the United States due to ocean acidification.<sup>4</sup> There is significant concern of what impacts this could have on coastal resources and ecosystems.

### Recommendations for Addressing Global Warming and Building Healthy and Resilient Oceans

Coordinated planning is needed at the state and federal levels to reduce global warming pollution and to adapt to those global warming and ocean acidification impacts already occurring. Congress should pass climate adaptation legislation that

provides the clear direction and sufficient funding needed to make these efforts successful. These policies should be a part of a presidential-level national strategy that includes input from all federal agencies, scientists, and the public and addresses the following:

1. To prepare for sea-level rise, coastal states and the federal government must implement ecologically and economically sound adaptive policies and strategies that discourage development in vulnerable areas and encourage development farther inland of eroding shorelines. Such policies will reduce risks to human safety and ensure the preservation of beaches, dunes, and other natural coastal habitats that are so important to coastal economies and quality of life.
2. To deal with extreme weather events, such as heavy downpours and droughts, coastal states and federal agencies must encourage the protection and restoration of shoreline and streamside riparian vegetation and wetlands, upgrade stormwater management to take account of more frequent and heavier rainfall events, and increase water use efficiency and opportunities for beneficial reuse.
3. To protect our fisheries we must restore depleted fisheries as soon as possible, stop overfishing, and protect habitat to enhance fisheries' ability to withstand the additional stresses accompanying global warming.
4. To address ocean acidification, coastal states and the federal government must be leaders in efforts to significantly reduce CO<sub>2</sub> emissions and to restore the health and resilience of marine ecosystems, particularly coral reefs. Because ocean acidification is an emerging issue, directed research and monitoring funds should be made available as soon as possible. Knowledge gained about the effects of ocean acidification at varying carbon dioxide concentrations should be used to inform any carbon cap set by Congress.

If these provisions are included in a package that also establishes a cap and trade system, a portion of the revenues from the auction of carbon allowances should be directed specifically to federal and state adaptation activities. This funding should supplement rather than replace existing agency funding streams and should be isolated from revenue pots that may go to other adaptation activities, including protecting infrastructure.

1 Woolf D.K., Challenor P.G., Cotton P.D. 2002. "Variability and predictability of the North Atlantic wave climate." *Journal of Geophysical Research-Oceans* 107. Allan JC, Komar P.D. 2006. "Climate controls on US West Coast erosion processes." *Journal of Coastal Research* 22: 511-529.

2 J. Pearse, N. Balcom. 2005. "The 1999 Long Island Sound lobster mortality event: Findings of the comprehensive research initiative." 691-697 *Journal of Shellfish Research* 24. Ford SE, Smolowitz R. 2007. "Infection dynamics of an oyster parasite in this newly expanded range." *Marine Biology* 151: 119-133.

3 Chan F, et al. 2008. "Emergence of anoxia in the California current large marine ecosystem." *Science* 319: 920-920.

4 Feely, R.A. et al. 2008. *Science Express*.1155676.

