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Harnessing the Potential of the Clean Water Act to Address Ocean Acidification

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In the halls of Congress and at the climate conference in Copenhagen, the question of how we can agree to reduce greenhouse gas pollution looms large. Under the sea's surface, the question is whether the carbon dioxide (CO_2) reductions will come soon enough. Each day the oceans absorb another 22 million tons of CO_2 from the atmosphere, altering seawater chemistry and making it more acidic. Ocean acidification is rapidly advancing, with harmful consequences for marine life and ocean ecosystems on the horizon. Yet, ocean acidification has received far too little attention in the public and policy debate around climate change. We need a fresh approach to the problem of ocean acidification, and there is no need to wait for a new climate law or treaty. Instead, the Clean Water Act offers a framework with the potential to begin to address this dire problem.

Impacts of High CO_2 Oceans

As a result of CO_2 pollution, primarily from burning fossil fuels, the oceans have already become about 30 percent more acidic on average since preindustrial values.[1] Ocean acidification impairs the ability of marine animals to build the protective shells they need to survive. This phenomenon affects marine life from plankton to corals with perilous biological consequences.

While the worst consequences are predicted for the future, the impacts of ocean acidification are already underway in some regions. Coral growth rates have declined in the Great Barrier Reef,[2] and scientists predict that the world's coral reefs will be destroyed by mid-century.[3] A survey of the California coast, with its unique currents, has shown that waters affected by acidification are upwelling onto the continental shelf, exposing marine life along the entire coast to corrosive waters during certain seasons.[4] Along the Oregon and Washington coasts, oyster farm production has collapsed in recent years with reproductive failures up to 80 percent, which are likely due to impacts from ocean acidification.[5] One new report forecasts that by 2016, parts of the Arctic Ocean will become corrosive, which means that mussels and other calcifying animals may begin to dissolve more quickly than they can grow.[6] Tiny plankton, which form the basis of the marine food web, are growing thinner and weaker shells in some areas of the ocean,[7] which is particularly troubling given the potential effects of decreased plankton populations on entire ecosystems. Ocean acidification also stresses fish, shellfish, and other marine animals, leaving them more susceptible to other threats such as ocean warming, disease, and pollution.

These effects warn of more troubling impacts to come if we fail to reduce CO_2 pollution. According to preeminent coral biologist Charlie Veron, most of the world's coral reefs are committed to an irreversible decline at the current levels of 387 parts per million (ppm) of CO_2 in the atmosphere.[8] Scientists now tell us that to avoid mass extinctions on land and sea, atmospheric CO_2 will need to be stabilized below 350 ppm.[9] However, society is on the opposite trajectory. By the end of this century, CO_2 levels are predicted to reach 788 ppm, which could amount to a 100–150 percent change in ocean acidity.[10] A pH change of this magnitude has not occurred for more than 20 million years.[11] Unfortunately, the CO_2 reductions proposed in the climate bill now making its way through Congress are unlikely to result in an atmospheric concentration below 450 ppm, much less 350 ppm.

Not only does ocean acidification threaten severe problems for marine biodiversity and the healthy functioning of ocean ecosystems, it also comes at a cost to society and our economy. Assuming business as usual projections for carbon emissions and a corresponding decline in ocean pH and mollusk harvests, ocean acidification's broader economic losses for the United States would range from $1.5–6.4 billion through 2060.[12] Coral reefs are estimated to be worth $172 billion a year worldwide for the variety of food, tourism, and other services they provide.[13] Additionally, many other industries and communities rely on ocean and coastal resources, which are increasingly threatened by acidification.

Only in recent years has it become widely accepted that we need to take action on climate change, but it is this lesser known but dire acidification problem that also needs our urgent attention.

Water Quality Problem? Clean Water Act Solution

While it may not be obvious to use the Clean Water Act to address carbon dioxide pollution, the law has sufficient breadth to address ocean acidification. Congress enacted the Clean Water Act to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[14] This makes the Clean Water Act the nation's strongest law protecting water quality and a good match for addressing ocean acidification, because it is poised to become the foremost threat to seawater quality. Increasingly, environmental law is shifting towards an understanding that ecosystem-based management is necessary, and treating air pollution as if it has no effect on the water is a fallacy for which the day is past. Using the Clean Water Act to address carbon effects in our oceans advances us towards President Obama's call for ecosystem-based management of our oceans.[15]

The Clean Water Act broadly regulates all sorts of water pollution. Among its various provisions, section 303 provides a framework with the potential for tackling ocean acidification. First, the law establishes standards against which to measure water quality, including a standard for seawater acidity. Next, an unacceptable change in ocean acidity can trigger regulatory provisions aimed at reducing pollution causing the water quality problem. A discussion of how each of these steps applies to ocean acidification follows.

Water Quality Standards for Ocean Acidification

Toward the Clean Water Act's goals of eliminating water pollution and protecting water quality for marine life and recreation, the Clean Water Act requires states to establish water quality standards.[16] These standards must "provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation."[17]

Standards for ocean water acidity are *already* in place. While precise standards vary from state to state, the Environmental Protection Agency (EPA) criteria establish that seawater acidity shall not deviate more than 0.2 pH units from natural variation.[18] This translates to about a 60 percent change in acidity because a decrease of 1 unit on the pH scale marks a tenfold increase in acidity. States must adopt EPA's criterion or provide a science-based alternative for implementing their water quality standards.

Recent EPA actions underscore the ability to address ocean acidification through the Clean Water Act's water quality standards. Right now, EPA is reviewing its recommended seawater pH criteria to determine if revisions are needed to better protect marine life from the threat of ocean acidification. On April 15, 2009, EPA issued a notice in the Federal Register soliciting information and data on how to account for ocean acidification in its seawater pH water quality criterion.[19] In the notice, EPA acknowledged the threat that ocean acidification poses to marine ecosystems:

Preliminary projections indicate that oceans will become more acidic over time and overall, the net effect is likely to disrupt the normal functioning of many marine and coastal ecosystems.[20]

In the coming year, EPA will make a determination about how to address ocean acidification through the Clean Water Act water quality criteria. This EPA undertaking responded to a citizen-petition that sought to strengthen seawater pH criteria to help protect American waters from ocean acidification.[21] According to the petition, one impediment to coastal states properly reviewing whether their ocean waters are impaired by acidification is that EPA's governing pH criterion, adopted in 1976, is outdated because little was known about acidification when this standard was created.

EPA's water quality criteria are vital to preventing ocean acidification because they are the measure against which states gauge the need to regulate pollution. States must update their own water quality standards to conform to the EPA's criteria or provide a scientifically defensible alternative.[22] It is against these standards that all pollution controls under the Clean Water Act are based, including impaired waters listings and total maximum daily loads, which brings us to step two.

Impaired Waters Trigger Regulation

Under the Clean Water Act, each state must identify waters within its boundaries that violate any water quality standard.[23] Specifically, every two years states must establish a list of impaired water bodies for which existing pollution controls "are not stringent enough to implement any water quality standard applicable to such waters."[24] EPA reviews and approves each state's list of impaired waters, and must assist states in remedying inadequate lists.[25]

With respect to ocean acidification, the Clean Water Act requires a state to deem as impaired any coastal waters affected by acidification in excess of the seawater pH standard. Even though the EPA's seawater pH criterion is likely underprotective, ocean acidification is occurring so rapidly that acidification levels once predicted for century's end are already being measured and the criterion is being exceeded in certain regions. According to one scientific study, seawater pH off the coast of the State of Washington has declined by more than 0.2 pH units over the past decade.[26] A lawsuit is currently pending in U.S. District Court that seeks to compel EPA to designate these Washington waters as impaired.[27] Additionally, ocean acidification may also warrant listing of waters as impaired for violating other water quality standards, which include all numeric criteria, narrative criteria, water body uses, and antidegradation requirements.[28] For example, most coastal waters are designated for the protection and propagation of fish, shellfish, and wildlife.[29] Since ocean acidification may threaten these water body uses, this requirement can serve as another basis for impaired waters listing.

There are a variety of benefits to listing ocean waters as impaired due to ocean acidification. First, there is an educational benefit that local and state governments and the public will recognize the importance of addressing ocean acidification. Second, it puts ocean acidification as a priority issue in water quality management. Third, it can help garner funding and guidance for states to address ocean acidification.

Most importantly, once a water body is listed as impaired pursuant to Clean Water Act § 303(d), the state has the authority and duty to control pollutants from all sources that are causing the impairment. Specifically, the state or EPA must establish total maximum daily loads of pollutants that a water body can receive and still attain water quality standards.[30] States then implement the maximum loads by incorporating them into the state's water quality management plan and controlling pollution from point sources and nonpoint sources.[31] The goal of section 303(d) is to ensure that our nation's waters attain water quality standards regardless of the source of pollution.

The Clean Water Act can provide for concrete pollution reductions that could be used to address ocean acidification and reduce CO_2 emissions. The implementation of total maximum daily loads is flexible and can take a number of forms. Point sources are required to reduce pollution through permit requirements, and nonpoint sources can be controlled through a variety of state, regional, or national programs, which can be regulatory, voluntary, or incentive based. Moreover, grants and other assistance are available to reduce pollution contributing to impaired waters. The Clean Water Act has successfully helped reduce other atmospheric forms of pollution such as mercury, polychlorinated biphenyls (PCBs), and compounds causing acid rain.

The Clean Water Act tools discussed above are designed to operate specifically where other pollution controls have proven insufficient to protect water quality. This characteristic of the Clean Water Act ensures that it will remain an important supplement to any climate laws or other CO_2 regulations that are ultimately implemented. EPA and the states should move forward quickly with pollution reduction measures under the law. For the West Coast shellfish farmers whose oyster harvests are collapsing, that time has clearly come. The Clean Water Act has been successfully applied to traditional and emerging pollution problems for over three decades. Although we have only recently come to recognize CO_2 as a form of water pollution, the Clean Water Act, properly applied, is an essential tool in reducing this most dangerous of pollutants.

[jump to end/comments]

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[1] Richard A. Feely et al., *Evidence for Upwelling of Corrosive "Acidified" Water onto the Continental Shelf*, 320 SCIENCE 1490, 1490 (2008); James C. Orr et al., *Anthropogenic Ocean Acidification over the Twenty-first Century and Its Impact on Calcifying Organisms*, 437 NATURE 681, 681 (2005).

[2] Glenn De'ath, Janice M. Lough & Katharina E. Fabricius, *Declining Coral Calcification on the Great Barrier Reef*, 323 SCIENCE 116, 116 (2009).

[3] Ove Hoegh-Guldberg et al., *Coral Reefs Under Rapid Climate Change and Ocean Acidification*, 318 SCIENCE 1737, 1740–41 (2007).

[4] Feely et al., *supra* note 1, at 1490, 1492.

[5] A. Whitman Miller et al., *Shellfish Face Uncertain Future in High CO_2 World: Influence of Acidification on Oyster Larvae Calcification and Growth in Estuaries*, 4(5) PLoS ONE e5661, e5661 (2009) (last visited Nov. 18, 2009).

[6] Marco Steinacher et al., *Imminent Ocean Acidification in the Arctic Projected with the NCAR Global Coupled Carbon Cycle-Climate Model*, 6 BIOGEOSCIENCES 515, 525 (2009).

[7]Andrew D. Moy et al., *Reduced Calcification in Modern Southern Ocean Planktonic Foraminifera*, 2 NATURE GEOSCIENCE 276, 276 (2009).

[8] Charlie Veron et al., *The Coral Reef Crisis: The Critical Importance of <350 ppm CO_2*, 58 MARINE POLLUTION BULL. 1428, 1428 (2009).

[9] *Id.*; *see also* James Hansen et al., *Target Atmospheric CO_2: Where Should Humanity Aim?*, 2 OPEN ATMOSPHERIC SCI. J. 217, 217 (2008); Long Cao & Ken Caldeira, *Atmospheric CO_2 Stabilization and Ocean Acidification*, 35 GEOPHYSICAL RES. LETTERS L19609 (2008) (noting that to prevent harmful consequences of ocean acidification we need stabilize CO_2 below 450 ppm).

[10] Orr et al., *supra* note 1, at 681–82 (figures are based on atmospheric CO_2 levels reaching 788 ppm by 2100, as predicted by the Intergovernmental Panel on Climate Change's IS92a "business-as-usual" scenario).

[11] Richard A. Feely et al., *Impact of Anthropogenic CO_2 on the $CaCO_3$ System in the Oceans*, 305 SCIENCE 362, 362 (2004).

[12] Sarah R. Cooley & Scott C. Doney, *Anticipating Ocean Acidification's Economic Consequences For Commercial Fisheries*, 4 ENVTL. RES. LETTERS 024007 (2009) (last visited Nov. 18, 2009).

[13] John Platt, *How Much Are Coral Ecosystems Worth? Try $172 Billion—A Year*, SCIENTIFIC AMERICAN OBSERVATIONS (Oct. 22, 2009).

[14] 33 U.S.C. § 1251(a) (2006).

[15] Barack Obama, Memorandum on National Policy for the Oceans, Our Coasts, and the Great Lakes (June 12, 2009).

[16] 33 U.S.C. § 1313.

[17] Water Quality Standards, 40 C.F.R. § 130.3 (2008).

[18] U.S. ENVTL. PROT. AGENCY, QUALITY CRITERIA FOR WATER 342–43 (1976).

[19] Ocean Acidification and Marine pH Water Quality Criteria, 74 Fed. Reg. 17,484 (Apr. 15, 2009).

[20] *Id.* at 17,485.

[21] Center for Biological Diversity, Petition for Revised pH Water Quality Criteria under Section 304 of the Clean Water Act, 33 U.S.C. § 1314, to Address Ocean Acidification 1 (Dec. 18, 2007).

[22] 40 C.F.R. § 131.11(b) (2008).

[23] 33 U.S.C. § 1313(d) (2006).

[24] *Id*.

[25] 33 U.S.C. § 1313(d)(2).

[26] Timothy J. Wootton, Catherine A. Pfister & James D. Forester, *Dynamic Patterns and Ecological Impacts of Declining Ocean pH in a High-Resolution Multi-Year Dataset*, 105 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 18,848, 18,849 (2008) (pH declined in an annual trend of -0.045 pH on average).

[27] Ctr. for Biological Diversity v. EPA, No. 2:09-cv-670 (W.D. Wash. filed May 15, 2009).

[28] Section 303(d) of the Clean Water Act requires states to establish a list of impaired water bodies within their boundaries for which existing pollution controls "are not stringent enough to implement any water quality standard applicable to such waters." 33 U.S.C. § 1313(d). In turn, water quality standards include all numeric criteria, narrative criteria, waterbody uses, and antidegradation requirements. 40 C.F.R. § 130.7(b)(3) (2008).

[29]States have to establish water quality standards that take into account the water's "use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes." 33 U.S.C § 1313(c)(2)(A); *accord* 40 C.F.R § 131.2. California's Ocean Plan defines the designated uses of ocean waters: "The beneficial uses of the ocean waters of the State that shall be protected include industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture; preservation an enhancement of designated Areas of Special Biological Significance (ASBS); rare and endangered species; marine habitat; fish migration; fish spawning and shellfish harvesting." STATE WATER RES. CONTROL BD., CAL. ENVTL. PROT. AGENCY, STATE OF CALIFORNIA, WATER QUALITY CONTROL PLAN: OCEAN WATERS OF CALIFORNIA: CALIFORNIA OCEAN PLAN 3 (2005) (under amendment in 2009).

[30] 33 U.S.C. § 1313(d).

[31] 33 U.S.C. § 1313(e); 40 C.F.R. §§ 130.6, 130.7(d)(2).