Sent via fax and electronic mail

March 20, 2008

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Re: Comments on Washington's Draft 2008 Water Quality Assessment

Dear Ken Koch,

In response to Washington's request for comments on the Draft 2008 Water Quality Assessment, the Center for Biological Diversity requests that Washington's ocean segments be added to the state's 303(d) List due to impairment resulting from ocean acidification.

The Center for Biological Diversity is a nonprofit organization that works to conserve native species and their habitats. The Center's Oceans Program is focused on the protection of marine species and ocean ecosystems, including significant efforts to address the problem of ocean acidification. Moreover, the Center has a longstanding interest in the conservation of imperiled wildlife and habitats, including specific efforts focused on Washington and the Puget Sound.

The ocean absorbs carbon dioxide causing seawater to become more acidic. Among various adverse impacts to marine life, this process termed ocean acidification impairs the ability of calcifying organisms to build their protective structures. Already ocean pH has changed significantly due to human sources of carbon dioxide; and on the current trajectory, ocean ecosystems could become severely degraded due to ocean acidification.

On August 15, 2007, the Center for Biological Diversity submitted scientific information supporting the inclusion of ocean waters on Washington's 303(d) List. Since then, it has only become more apparent that ocean acidification poses serious threat to Washington's water quality with adverse effects on marine life. However, Washington's Draft 2008 Water Quality Assessment failed to include any ocean segments impaired by carbon dioxide pollution.

Moreover, the draft assessment completely failed to discuss or mention ocean acidification, a serious water quality problem facing Washington's Department of Ecology.

In light of this significant oversight, the Center for Biological Diversity respectfully requests that Washington:

- **Include all ocean water segments in Washington's List of Impaired Waterbodies ("303(d) List") under section 303(d) of the Clean Water Act as impaired for pH due to absorption of anthropogenic carbon dioxide pollution.**

The previous letter and supporting documents submitted by the Center for Biological Diversity support this action and are incorporated by reference here. This comment letter provides additional support for the request that the Department of Ecology address ocean acidification. The following discussion describes Washington's authority to list ocean waters as impaired, new scientific information supporting the request, and the Department of Ecology's duty to consider information submitted by the Center on ocean acidification.

(1) Washington's Assessment should have included ocean segments as impaired for pH due to ocean acidification

Pursuant to the Clean Water Act and Washington's laws implementing the Act, the Department of Ecology has the authority and duty to list ocean waters in the 303d List. Ocean waters do not attain Washington's water quality standards because they are being degraded in violation of the antidegradation policy and in the near future, they will not attain the pH standard. Moreover, there are not sufficient controls on carbon dioxide pollution to address the serious water quality problem of ocean acidification.

Under the Clean Water Act, each state must 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). The Clean Water Act's section 303(d) requires each state to identify waters for which existing regulations are inadequate to protect water quality—resulting in a "303(d) List." 33 U.S.C. § 1313(d). "Each state shall identify those waters within its boundaries for which the effluent limitations … are not stringent enough to implement any water quality standard applicable to such waters." 33 U.S.C. § 1313(d)(1)(a). A water body failing to meet any numeric criteria, narrative criteria, waterbody uses, or antidegradation requirements shall be included as a water-quality limited segment on the 303(d) List. 40 C.F.R. § 130.7(b)(3). Relevant here, one of the conventional pollutants recognized under the Clean Water Act is pH. 33 U.S.C. § 1314(a)(4). Consequently, an unacceptable change in pH constitutes a basis for inclusion in the 303(d) List.

The Clean Water Act's 303d List was intended as a mechanism to address problems such as ocean acidification, and the 303d List is an effective mechanism to address atmospheric

deposition. EPA's *Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions* acknowledges that atmospheric deposition must be a factor considered by states during their water quality assessments (available at http://www.epa.gov/owow/tmdl/2008_ir_memorandum.html). Moreover, 303d listing and the establishment of total maximum daily loads has been an approach applied to parallel air deposition pollutants causing water quality problems such as mercury and acid rain.

Washington's water quality standards provide further authority for listing ocean segments for ocean acidification problems. Washington requires that pH not vary more than 0.2 units due to human-caused changes. W.A.C. 173-201A-210(1)(f). Additionally, Washington's antidegradation policy provides that existing water quality must be maintained or returned to the designated standard (Tier I). W.A.C. 173-201A-310 If the waterbody exceeds the established criterion, new activities that would measurably alter water quality are not allowed, absent exceptional circumstances. W.A.C 173-201A-310. A measurable change in pH is defined as 0.1 pH units or greater. W.A.C. 173-201A-320. Here, Washington's ocean waters are on a trajectory of non-attainment of the pH standard within decades, and the degradation of water quality already violates the antidegradation policy. Absent a specific finding exempting certain waters, ocean waters violate the antidegradation standard.

Ocean acidification is perhaps the most serious water quality problem facing our oceans. Ocean acidification is a persistent problem impairing Washington's ocean waters, and there are currently no existing pollution controls on carbon dioxide, the pollutant causing the impairment. Credible scientific reports, experiments, and models unequivocally demonstrate that carbon dioxide pollution is causing ocean acidification with significant adverse impacts on the marine life.

Washington's ocean waters are approaching non-attainment of the pH water quality criterion allowing no more than 0.2 unit change. Under current trajectories, ocean acidification will cause seawater to exceed Washington's pH water quality criterion within decades, as summarized in a recent article by 25 of the leading scientists studying ocean acidification (Caldiera 2007). They note that ample scientific research demonstrates that pH changes of the magnitude currently allowed by EPA's water quality criteria, upon which Washington's criterion is based, will pose serious risks to marine life (Caldeira 2007). One of the authors commented, "we need to start thinking about carbon dioxide as a pollutant in the ocean" (Carnegie Institution for Science 2007). The latest scientific research has shown that a decrease of that magnitude will adversely affect marine life (Caldeira et al 2007). The pH criterion permitting a change of 0.2 units is inadequate to protect water quality. Based on federal water quality criteria that were developed in the 1970s, the numeric criteria is woefully outdated and does not consider the threat of ocean acidification caused by anthropogenic carbon dioxide pollution.

As ocean acidification progresses, it is also causing degradation of coastal and open waters. The scientific consensus is that ocean pH has already changed 0.11 units on average due to anthropogenic carbon dioxide pollution. With the oceans absorbing about 22 millions of carbon dioxide each day (Feely 2006), seawater pH will continue to decrease. Assuming current

trends of greenhouse gas emissions, the global average pH of seawater will drop another 0.3-0.4 units (Orr 2005). Unabated, carbon dioxide pollution will degrade seawater quality beyond Washington's water quality standards and will cause nonattainment of designated uses. By the end of this century, absent significant reductions in carbon dioxide emissions, this will result in a pH change up to 0.5 units (Royal Society 2005). These impacts of carbon dioxide are highly predictable and there is ample scientific evidence demonstrating degradation of marine water quality from ocean acidification. This degradation violates Washington's antidegradation standard prohibiting a measurable change.

(2) New scientific research demonstrates the threats of ocean acidification

New scientific research provides further evidence that ocean acidification is a water quality problem and that it has adverse effects on marine life. The first effects of ocean acidification will be experienced in deeper waters and the polar regions, many ocean waters will become undersaturated in calcium carbonate by the end of the century (See Figure 1). (Nellemann 2008). Studies have suggested that conditions detrimental to high-latitude ecosystems could develop within decades, not centuries as previously suggested (Nellemann 2008). According to Nellemann, "[t]he impacts of ocean acidification are potentially widespread and devastating, and may change marine life as we know it."

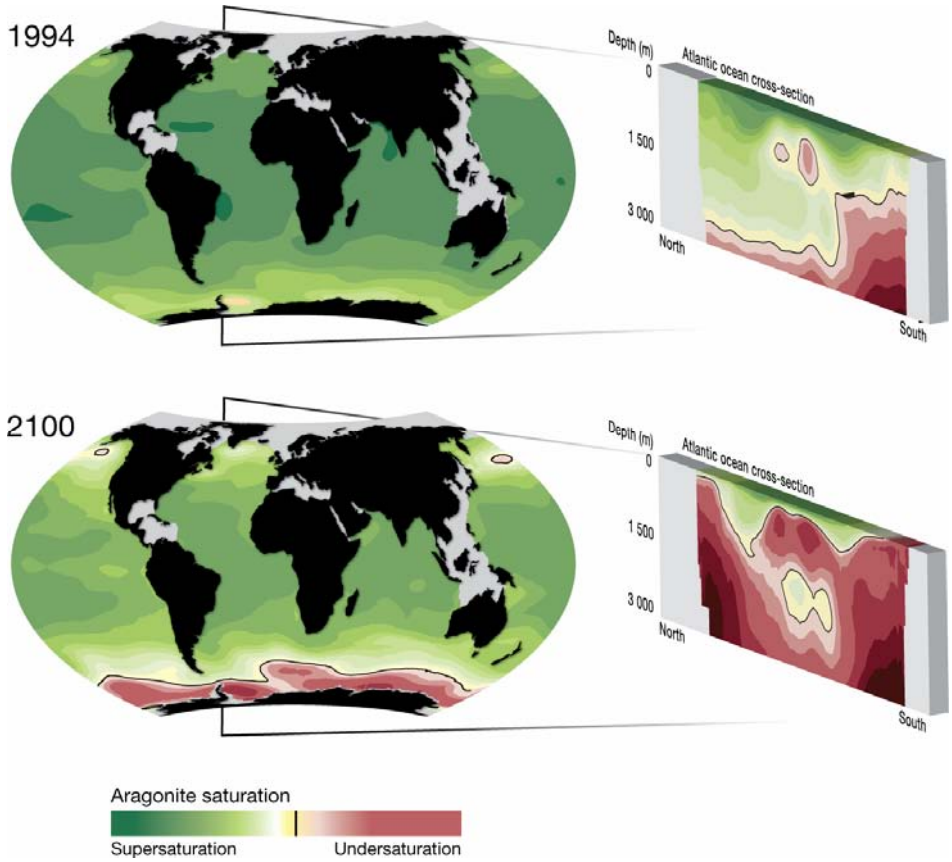

Figure 1. Calcium carbonate availability for corals and planktons, 1994 and 2100 (projection) due to antropogenic carbon dioxide emissions

Source: Nellemann 2008 (citing Donner, S.D., Skirving, W.J., Little, C.M., Hoegh-Guldberg, O., Oppenheimer, M. 2005. Global assessment of coral bleaching and required rates of adaptation under climate change. Global Change Biology vol, 11, 2251-2265. Orr, James C. 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature, vol 437, 681-686.)

Citing ocean acidification as one of the key factors, scientists have called for a new epoch in the planet's geologic history, the *Anthropocene* (Zalasiewicz 2008). Present and future predictions of ocean acidification will change the physical and biological characteristics of the ocean so significantly that according to some scientists a new epoch is warranted (Zalasiewicz 2008). A new map of the world's oceans shows that they are in serious trouble and that ocean acidification is a threat to be taken very seriously (Halpern 2008). Using parameters from various threats to the world's oceans such as overfishing and climate change, the map shows impacts on Washington's ocean waters (see Figure 2). Among the factors taken into consideration in the map was ocean acidification, which was found to affect a vast area of ocean and ranked among the top threat scores (see Figure 3).

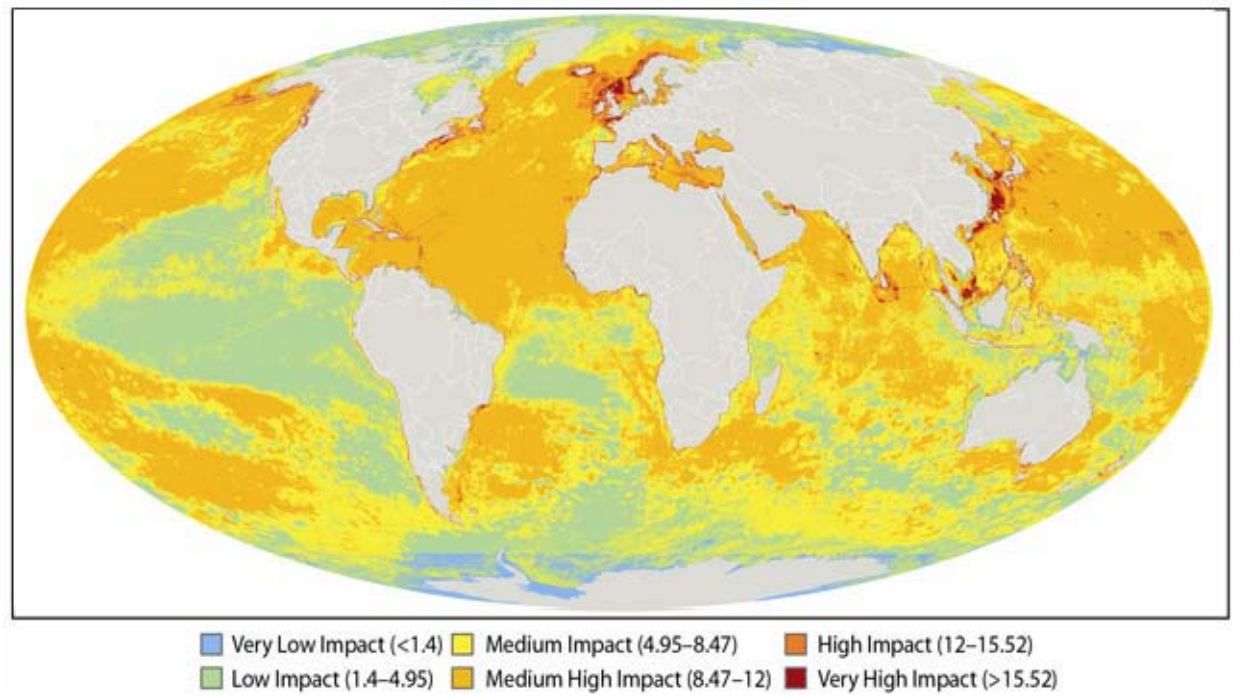

Figure 2. Global map of cumulative human impact across 20 ocean ecosystem types.
Source: Halpern 2008

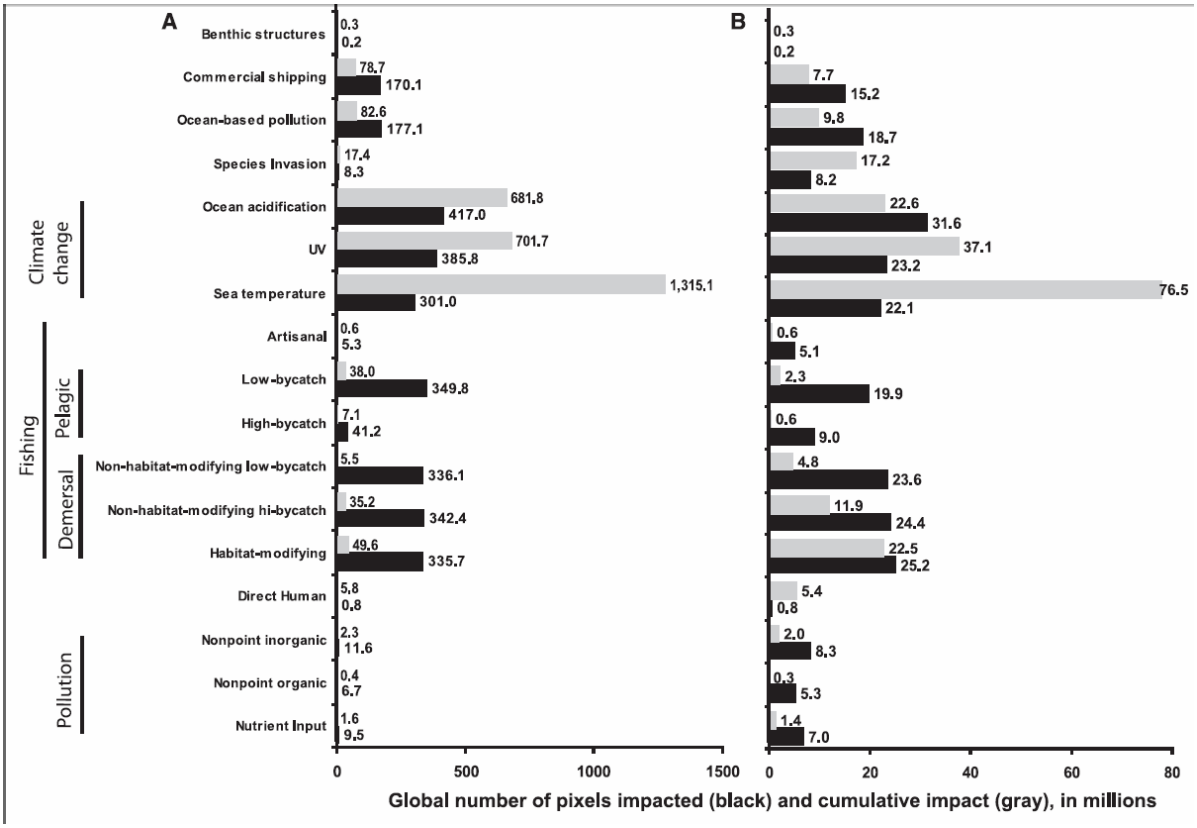

Figure 3 Total area affected (square kilometers, gray bars) and summed threat scores (rescaled units, black bars) for each anthropogenic driver (A) globally and (B) for all coastal regions <200 m in depth. Values for each bar are reported in millions.
Source: Halpern 2008

Leading scientists studying ocean acidification predict that ocean acidification coupled with global warming will kill the world's coral reefs before the end of the century (Hoegh-Guldberg et al. 2007). In the Australian Great Barrier Reef, scientists have found that calcification had slowed by 21 percent in just the past 16 years (Cooper 2008). A recent study by U.S. Geological Survey (USGS) looked at the growth of crustose coralline algae, an important plant for coral reef building. The study showed that ocean acidification will have serious negative consequences for coral reefs, at pH levels expected within the century, the algae decreased by 92 percent (Kuffner 2008). Studies of coral reefs are relevant to Washington's ocean water quality because they demonstrate the impact of ocean acidification on calcifying organisms. Washington's calcifying plankton, the basis of the marine food web, will likewise be faced with impaired calcification.

Washington's cold-water corals are particularly vulnerable to ocean acidification because the aragonite saturation horizon is predicted to experience shoaling in North Pacific waters within the century (Lumsden 2007). Several cold-water coral ecosystems will be in aragonite undersaturated water, and unable to calcify, or dissolving, by 2020, with 70 percent of

scleractinian cold-water coral ecosystems in undersaturated water by 2100 (Guinotte et al 2006; Turley 2007). The Olympic coast is one of the largest accumulations of colonial scleractinian corals at about 250 meters depth (Lumsden 2007). Estimates predict that within decades the aragonite saturation horizon will be shallower than 200 meters, with impacts likely on deep water corals (Lumsden 2007). Changes in these cold-water corals could influence the marine food web, and cause indirect effects to nutrient and toxin availability (Lumsden 2007).

In addition to direct effects on calcification, new scientific research also shows that ocean acidification has indirect effects with potential adverse biological impacts (Bibby 2007). In studies of marine gastropods, researchers found the conditions of ocean acidification disrupted the capability of organisms to express induced defenses, thus increasing their vulnerability to predation (Bibby 2007).

This new scientific information coupled with the information previously submitted by the Center for Biological Diversity demonstrates that ocean acidification is a serious water quality problem facing Washington's oceans. The science is unequivocal that ocean pH is decreasing and that adverse impacts on marine life are expected. Urgent action is needed to control carbon dioxide pollution and 303d listing is a first step. Unabated, carbon dioxide emissions will significantly harm marine ecosystems and water quality.

(2) Washington has a duty to consider information and data available related to ocean acidification

In preparing its Draft 2008 Water Quality Assessment, Washington has a duty to consider the information submitted by the Center for Biological Diversity. The regulations governing implementation of the Clean Water Act's section 303(d) *require* that Washington "evaluate all existing and readily available water quality-related data and information to develop the list." 40 C.F.R. § 130.7(b)(5); *see also Sierra Club v. Leavitt*, 488 F.3d 904 (11th Cir. 2007).

The data and information provided by the Center for Biological Diversity on ocean acidification is from credible sources and must be considered by the Department of Ecology. The information provided in this comment letter, the August 2007 letter, and supporting documentation was from reliable, high quality scientific journals and reports. Not only is the scientific understanding of ocean acidification well established, but also the magnitude of the problem and likely effects are predictable with a high degree of certainty. The Center understands that for the 2008 assessment, Washington requires quality-assured data, accordingly all of the data referenced in the Center's submission were from credible sources. To aid processing, we have also attached numeric data for the Pacific Ocean waters.

Conclusion

Thank you for the opportunity to submit comments concerning Washington's Draft 2008 Water Quality Assessment. We urge the Department of Ecology to revise its report to address the

most serious water quality threat facing our oceans—ocean acidification. Washington has the authority and the duty to list ocean waters on its 303d List due to degradation caused by carbon dioxide pollution. Ocean pH is declining with adverse effects on a myriad of marine species, and the problem is only going to worsen absent decisive action.

Sincerely,

/s/ Miyoko Sakashita
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Sources Attached (other sources included with the August letter):

Bibby, Ruth, Polly Cleall-Harding, Simon Rundle, Steve Widdicombe, and John Spicer. (2007) Ocean acidification disrupts induced defences in the intertidal gastropod Littorina littorea. *Biol. Lett.* 3: 699–701.

Caldiera, K. et al. Comment on "Modern-age buildup of CO_2 and its effects on seawater acidity and salinity" by Hugo A. Loáiciga, *Geophysical Research Letters* 34: L18608 (2007).

Cooper, Timothy F. et al (2008).Declining coral calcification in massive Porites in two nearshore regions of the northern Great Barrier Reef. *Global Change Biology* 14: 529–538.

Halpern, Benjamin et al. (2008) Global Map of Human Impact on Marine Ecosystems, *Science* 319: 948.

Hoegh-Guldberg, et al., Coral Reefs Under Rapid Climate Change and Ocean Acidification, *Science* 318:1737-1742 (2007).

Lumsden, Hourigan TF, Bruckner AW and Dorr G (eds.) The State of Deep Coral Ecosystems of the United States. NOAA Technical Memorandum CRCP-3. Silver Spring MD 365 pp.

Nellemann, C., Hain, S., and Alder, J. (Eds). (February 2008) *In Dead Water – Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds.* United Nations Environment Programme.

Turley, C. et al., Corals in deep water: will the unseen hand of ocean acidification destroy cold-water ecosystems? *Coral Reefs* 26:445-448 (2007)