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CENTER for BIOLOGICAL DIVERSITY

*Because life is good.*

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**RE: Comments on Climate Change & Water Resources**

Dear State Water Resources Control Board Members,

Thank you for the opportunity to provide comments on the State Water Resources Control Board's ("Board") consideration of a resolution to develop additional information and consider actions pertaining to climate change and water resources. These comments are submitted on behalf of the Center for Biological Diversity ("Center"). The Center is a non-profit organization with over 35,000 members, the majority of whom reside in California. The Center is dedicated to protecting imperiled species and their habitats by combining scientific research, public organizing, and administrative and legal advocacy.

The Center supports the Board's actions to address climate change and consideration of measures to address its impacts on water resources. The Center also supports the Resolution, and believes that it should be strengthened by adding language that commits the Board to implementing strategies to reduce greenhouse gas emissions within a prompt timeline. The California Global Warming Solutions Act, AB 32, places a mandate on state agencies not only to consider climate change in its actions, but also to take affirmative steps to address greenhouse gas emissions. AB 32 requires that all state agencies must "consider and implement strategies to reduce their greenhouse gas emissions."

California has taken a leading role in confronting the threats posed by global warming resulting from anthropogenic carbon dioxide emissions. Nevertheless, California still ranks as one of the world's top carbon dioxide emitters. Global warming poses serious threats to California's water resources and aquatic ecosystems. Warming waters, rising seas, water availability, changing weather patterns, melting snow, and ocean acidification are among the issues facing California's water resources. The Board now has a great opportunity and a duty to implement measures that will avoid, reduce, and mitigate greenhouse gas emissions.

The Board's Resolution to evaluate input, develop approaches, and consider climate change in its various activities is vital and needs to proceed swiftly toward implementing real

steps that reduce greenhouse gas emissions. The Board has received comments and input from a variety of sources and the Center would like to point the Board to some of its central concerns that may have received inadequate attention thus far. While the Board is considering approaches to address climate change and greenhouse gas emissions, the Center urges the Board to:

- Consider ocean acidification and implement measures to avoid, reduce, and mitigate this threat to California's ocean waters;
- Issue regulatory guidance on water conservation measures;
- Evaluate climate change impacts and water availability on riparian areas and riparian dependent ecosystems;
- Quantify and reduce the greenhouse gas emissions from energy intensive water delivery systems; and
- Reduce greenhouse gas emissions from the State and Regional Water Boards' activities and infrastructure.

Each of these issues is discussed more specifically below for the Board's consideration.

## **I. OCEAN ACIDIFICATION**

Global warming is not the only significant impact of carbon dioxide emissions. In addition to their contribution to global warming, these same carbon dioxide emissions also pose a severe threat to California and the world's oceans. The ocean waters of California are a major source of biological diversity, productivity, and social and economic activity and need protection from ocean acidification.

The world's oceans are an important part of the planet's carbon cycle, absorbing large volumes of carbon dioxide and cycling it through various chemical, biological, and hydrological processes. The oceans have thus far absorbed approximately 50% of the excess carbon dioxide emitted since the beginning of the industrial revolution (Sabine 2004). The world's oceans, in fact, store about 50 times more carbon dioxide than the atmosphere (WBGU 2006), and most carbon dioxide released into the atmosphere from the use of fossil fuels will eventually be absorbed by the ocean (Caldeira and Wickett 2003). As the ocean absorbs carbon dioxide from the atmosphere it changes the chemistry of the seawater by lowering its pH. The oceans' uptake of these excess anthropogenic carbon dioxide emissions, therefore, is causing ocean acidification (WBGU 2006).

Surface ocean pH has already dropped by about 0.1 units on the pH scale, from 8.16 in 1800 to 8.05 today — a rise in acidity of about thirty percent (Orr et al. 2005). The pH of the ocean is currently changing rapidly at a rate 100 times anything seen in hundreds of millennia, and may drop by another 0.3 or 0.4 (100 – 150% increase in the concentration of H<sup>+</sup> ions) by the end of this century (Orr et al. 2005, Meehl et al. 2007).

Scientists agree that carbon dioxide pollution is causing ocean acidification with adverse impacts on many marine organisms. Available evidence suggests that the consequences of anthropogenic carbon dioxide accumulation have already begun in surface waters (Pörtner 2005).

Ocean acidification from unabated anthropogenic carbon dioxide emissions poses a profound threat to marine ecosystems because it affects the physiology of numerous marine organisms, causing detrimental impacts that may ripple up the food chain. Changes that have been observed in laboratory experiments include impacts to the productivity of algae, photosynthesis of phytoplankton, metabolic rates of zooplankton and fish, oxygen supply of squid, reproduction of clams, nitrification by microorganisms, and the uptake of metals (WBGU 2006). Perhaps most importantly, increasing ocean acidity reduces the availability of carbonate ions needed by marine life to build shells and skeletons (Orr et al. 2005).

Nearly all marine species that build shells or skeletons from calcium carbonate that have been studied have shown deterioration when exposed to increasing carbon dioxide levels in seawater (Feely 2006). Phytoplankton, corals, coralline macroalgae, urchins, seastars, clams, oysters, crustaceans and many other organisms rely on calcium carbonate in the ocean to build skeletons (WBGU 2006). Normally, ocean waters are saturated with carbonate ions that marine organisms use to build skeletons (WBGU 2006). However, the acidification of the oceans shifts the water chemistry to favor bicarbonate, thus reducing the availability of carbonate to marine organisms (WBGU 2006). Acidic waters also dissolve existing protective carbonate skeletons and shells (Orr et al. 2005). Already the ocean surface layer has lost 10% of its carbonate compared to preindustrial levels (WBGU 2006). Continuing carbon dioxide emissions could result in a decrease in calcification rates by up to 60% by the end of this century (Ruttimann 2006). Alarming, calcifying plankton form the basis of the marine food web and adverse impacts on plankton from ocean acidification will reverberate up the food chain.

Due to the specific habitat tolerances of many species, some species may become imperiled from the impacts of high concentrations of carbon dioxide. Additionally, many threatened and endangered species depend on California's ocean ecosystem and are extremely vulnerable to changes in marine habitat. Ocean acidification jeopardizes the continued existence of some of these species. For example, ocean acidification may dissolve the shell of the endangered white abalone or inhibit shell formation and growth. Also, there are numerous threatened and endangered species such as blue, humpback, and fin whales, and sea otters that prey on calcifying species. Declining fitness of fish due to acidification could not only impact depleted fish populations, but also already imperiled fish-eating species such as the California least tern, California brown pelican, marbled murrelet, Steller sea lion, and Guadalupe fur seal. Similarly, impacts to squid, among the most sensitive of marine species to changes in pH, would likely impact squid-eating species such as sperm whales.

The Center recommends that the Board take the following actions to address ocean acidification:

- Include all segments of California's ocean waters on the Clean Water Act's section 303(d) List of impaired waterbodies because current measures are not stringent enough to prevent

ocean acidification and achieve water quality standards.<sup>1</sup> 33 U.S.C. § 1313(d). Under the Clean Water Act, section 303(d) requires states to protect water quality by establishing a list of water bodies that do not meet water quality standards. 33 U.S.C. § 1313(d). Recognized as a conventional pollutant under the Clean Water Act, an unacceptable change in pH constitutes a basis for inclusion in the 303(d) List. 33 U.S.C. § 1314(a)(3). Once a water body is listed as impaired, the state must also promulgate Total Maximal Daily Loads (TMDLs) of pollutants to protect the water quality. Here, the Board should develop TMDLs for carbon dioxide pollution causing the pH impairment of seawater.

- The Board should also amend the Ocean Plan, creating a more stringent water quality standard for acidity.<sup>2</sup> At present, the Ocean Plan's pH standard is out-dated and too lax to address the devastating impacts of ocean acidification. A new standard that does not allow any measurable deviation in pH from naturally occurring values should be considered. Additionally, the Center recommends increased monitoring of seawater pH and consideration of additional strategies to address ocean acidification.

## II. WATER CONSERVATION

During the hearings and elsewhere the Board and other stakeholders acknowledged that conservation would be the single greatest source of greenhouse gas reductions, as well as increasing available water. Nonetheless, many water districts, cities and counties do not yet have water conservation measures in place (whether mandatory or voluntary). This is unacceptable.

The Water Code provides a tool to further water conservation measures. The Code prohibits waste, unreasonable use, unreasonable method of use and unreasonable method of diversion of water. Cal. Water Code §§ 100, 275. This provision applies to all uses of all waters of the state and is a limitation on every water right and every method of diversion.

The Board should develop regulatory guidance on the definition of "waste" that would include the failure to implement basic conservation measures such as:

- Drought-tolerant landscaping and use of mulch
- Monitoring and repairing leaks
- Watering landscapes during the evening or early morning
- Use of water efficient irrigation and reclaimed water for irrigation
- Use of energy and water efficient appliances
- Use low-flow toilets and faucets

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<sup>1</sup> In a letter dated February 27, 2007, the Center submitted data and information concerning ocean acidification to each of the coastal regional water boards nominating ocean waters under their jurisdiction for the 303d List.

<sup>2</sup> In comments to the Board dated July 26, 2007, the Center proposed that the pH standard for marine waters be strengthened in the Ocean Plan.

Moreover, while some agricultural communities have embraced conservation, others have not. The Board should likewise consider regulatory guidance on "waste" that would include the use of water for agriculture in excess of that required if well-known conservation measures were employed. Such conservation measures include:

- Avoid water-intensive crops, plant crops appropriate for the climate and water availability
- Monitor soil moisture and water only as-needed for specific crop
- Monitor weather and schedule irrigation accordingly
- Avoid land use that is water-inefficient (i.e. level land or furrow dikes)
- Use mulch to prevent evaporation
- Cover cropping and crop rotation to reduce runoff
- Prevent or reclaim runoff
- Use water-efficient irrigation systems such as drip irrigation
- Use reclaimed water for irrigation to the maximum extent possible.

Additional measures and incentives can also promote water conservation. For example, incentives can be developed in urban, suburban, and rural areas to diversify landscapes to achieve more water catchment. Farmers can be given incentives to achieve conservation in the form of credits for implementing water-saving irrigation techniques and other practices.

### **III. RIPARIAN AREAS AND RIPARIAN DEPENDENT ECOSYSTEMS**

While the Board is considering the issue of water availability within the context of climate change, it is essential that the Board ensure water availability for riparian ecosystems and aquatic life. Water availability strategies should not only provide water for human uses, but also provide water in sufficient quantities for California's wildlife and habitat needs.

Global warming is not only exacerbating water availability issues for the human population but is putting increasing stress on many riparian and riparian dependent ecosystems in California. From the high sierra to the inland valleys to the deserts to the coastal ranges species are being impacted by diminished snowpack, increased water extractions from surface and ground water that is fueling sprawl development/growth, and by climate change. The Board must prioritize protecting instream flows and groundwater needed to preserve riparian and riparian dependent ecosystems as part of a comprehensive policy in response to climate change.

As the Board is well aware, the remaining wetlands and riparian habitat in the California is believed to represent far less than 10% of the historic riparian habitat. Riparian areas support a disproportionate share of the State's biodiversity and preservation of these vegetation communities is critical to the survival of rare, sensitive, threatened and endangered plants and wildlife (Atlas of the Biodiversity of California, California Department of Fish and Game, 2003). Wetlands and riparian habitats are truly among the rarest and most sensitive ecosystem types in California. These areas are critical for biodiversity, harboring high concentrations of threatened, endangered, and sensitive species. Krueper (1992) estimates that wetland and riparian habitat

occupies less than 1% of the total land area in the western U.S., yet is critical for up to 80% of terrestrial vertebrate species. Riparian habitats are relatively rare in the California deserts, but extensively degraded. As noted above, more than 90% of the State's riparian areas and wetlands have already been lost, but while there are fewer acres of riparian habitat than other plant communities, riparian areas sustain a disproportionately high number of aquatic and terrestrial wildlife species (Faber et al. 1989). Riparian communities in the arid areas of the State are typically surrounded by far drier environments, and the water and riparian vegetation that they provide are vitally important to many species (Krueper 1992).

The Board should consider limiting excessive and wasteful water use and additional appropriations from heavily impacted stream-systems, and supporting programs to promote preservation of in-stream flows. A comprehensive analysis of water resources worldwide (Pimentel 2004) looked at ways that agriculture can save water to protect California's wetlands and riparian areas. While agriculture is one sector where large water savings can be achieved through implementation of cutting edge irrigation techniques or land use practices, significant water savings can also be achieved in urban and suburban area through xeriscaping and water conservation. A significant reduction in water use by individuals, farmers, and industry, could significantly benefit wetland and riparian recovery in California.

Approaches to address water availability in the context of climate change must not forget the importance of assuring water for riparian habitat. The Board must protect in-stream flows and ensure the viability of riparian ecosystems in the face of climate change. Water conserved through such efficiency measures should be earmarked first to establish and maintain critical in-stream flows that support the ecological health of wetlands and riparian areas.

#### **IV. WATER DELIVERY SYSTEMS.**

Water use in California is extremely energy intensive. The Board should consider and quantify the greenhouse gases produced to deliver water throughout the state. The State Water Project which delivers water across the state, moving large quantities over vast distances, is the state's single largest user of electrical energy (California Energy Commission, 2004). The Project uses 5,000 GWh per year, which is 2 to 3 percent of all the electricity consumed in California. *Id.*

In California, there are eight large water projects that transport water across the state. While two-thirds of the population lives in southern California, two-thirds of the precipitation is in the north (Krebs 2007). Delivering water over the Tehachapi mountains to southern California requires 2,200 kWh per acre-foot of water pumped. (California Energy Commission 2004).

California's water related energy use consumes 19 percent of the state's electricity, 30 percent of natural gas, and 88 billion gallons of diesel fuel each year (Krebs 2007). This includes water conveyance, storage, treatment, distribution, wastewater collection, treatment, and discharge. In 2004, 60 percent of energy in California was produced by coal and natural gas

contributing significant greenhouse gas emissions to the atmosphere *Id.* The lesson here is that water use in California is a major contributor to global warming.

As one of the largest contributors to greenhouse gas emissions in the state, the Board should develop and implement strategies to reduce greenhouse gas emissions from water delivery in California. The Board should minimize water delivery to the maximum extent possible, employ solar and other alternative energy, improve energy efficiency, retrofit infrastructure for efficiency and conservation, improve metering, promote off-peak water use, and encourage water conservation.

## V. REDUCING THE AGENCY'S GREENHOUSE GAS EMISSIONS

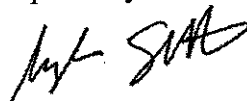
In addition to the Board leveraging its authority to reduce greenhouse gas emissions and address climate change impacts, the Board should implement measures to reduce its own greenhouse gas footprint. The state and regional boards should adopt policies and practices that aim to avoid and reduce greenhouse gas emissions. For example, the Board could implement the following strategies:

- Installation of solar power on agency facilities;
- Water and energy conservation measures used in transportation, and daily operating activities;
- Requiring energy efficiency/green building requirements for State and Regional Water Board infrastructure;
- Installation of electric vehicle charging stations;
- Use of energy efficient facilities for public meetings and conferences;
- Reduce the need for travel;
- Incentives for employees to use public transportation or bicycles for commuting;
- Incentives for the Board and the public to use public transportation or bicycles to participate in meetings;
- Conversion of vehicle fleet to alternative fuel vehicles, and requirements and incentives for fleets to run on alternative fuels.

## VI. CONCLUSION

Thank you for the opportunity to provide comments on the topic of climate change and water resources. It is vital that the Board and other California agencies take action now to prevent the worst impacts of greenhouse gas pollution. If you have any questions or would like further information on the issues mentioned in this Comment letter, please contact me.

Respectfully submitted,



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## VII. SOURCES

- Barry, J.P., et al. Utility of Deep Sea CO<sub>2</sub> Release Experiments in Understanding the Biology of a High-CO<sub>2</sub> Ocean: Effects of Hypercapnia on Deep Sea Meiofauna, *Journal of Geophysical Research* 110:(C09)S12 (2005).
- Caldeira, K. & Wickett M.E., Anthropogenic Carbon and Ocean pH, *Nature* 425, 365 (2003).
- California Department of Fish and Game, Atlas of the Biodiversity of California, (2003).
- California Energy Commission, Water Use in California (2004) available at <http://energy.ca.gov/pier/iaw/industry/water.html>.
- Faber, P. A., E. Keller, A. Sands, and B. M. Massey. 1989. The ecology of riparian habitats of the southern California coastal region: A community profile. United States Fish and Wildlife Service Biological Report 85(7.27):1-152.
- Feely, R.A., et al., Carbon Dioxide and Our Ocean Legacy (2006).
- Feely, R.A., et al., Impact of Anthropogenic CO<sub>2</sub> on the CaCO<sub>3</sub> System in the Oceans, *Science* 305:362-366 (2004).
- Gattuso, J.P., et al. Effect of Calcium Carbonate Saturation of Seawater on Coral Calcification, *Global and Planetary Change* 18:37-46 (1998).
- German Advisory Council on Global Change ("WBGU"), The Future Oceans—Warming Up, Rising High, Turning Sour (2006).
- Guionette, J.M, et al. Will Human-induced Changes in Seawater Chemistry Alter the Distribution of Deep-Sea Scleractinian Corals?, *Frontiers in Ecol. Environ.* 4: 141-146 (2006).
- Haugan, P.M, Turley, C., & Poertner H-O, Effects on the Marine Environment of Ocean Acidification Resulting from Elevated Levels of CO<sub>2</sub> in the Atmosphere, OSPAR Commission Report (2006)
- Ishimatsu, Atsushi, Effects of CO<sub>2</sub> on Marine Fish: Larvae and Adults. *Journal of Oceanography* 60(4) (2004).
- Kleypas, J.A., et al., Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers (2006).
- Kolbert, E., The Darkening Sea, *The New Yorker* (Nov. 11, 2006).
- Krebs, Martha, Water-Related Energy Use in California, PIER (Feb. 20, 2007).
- Krueper, David J., 1992, Effects of land use practices on western riparian ecosystems In: Finch, Deborah M.; Stangel, Peter W. (eds.). Status and management of neotropical migratory birds: September 21-25, 1992, Gen. Tech. Rep. RM-229. U.S. Dept. of Agriculture, Forest Service: 331-338.



- Morgan, L.E., C-F Tsao, JM Guinotte, Status of Deep Sea Coral in US Waters, with Recommendations for their Conservation and Management (2006).
- Murray, J.R., et al. Reefs of the Deep: The Biology and Geology of Cold-Water Coral Ecosystems, *Science* 312: 543-547 (2006).
- Orr, J.C., et al., Anthropogenic Ocean Acidification over the Twenty-first Century and Its Impact on Calcifying Organisms, *Nature* 437:681-686 (2005).
- Pimentel, David, et al., "Water Resources: Agricultural and Environmental Issues." *BioScience* Vol. 54 No. 10, 909-918, October 2004.
- Pörtner, H.O., Langenbuch, M. & Reipschläger, A, Biological impact of elevated ocean CO<sub>2</sub> concentrations: lessons from animal physiology and earth history, *Journal of Oceanography* 60, 705-718 (2004).
- Pörtner, Hans O., Synergistic effects of temperature extremes, hypoxia, and increases in CO on marine animals: From Earth history to global change, *Journal of Geophysical Research* 110(c9) (2005).
- Riebesell, U, et al., Reduced Calcification of Marine Plankton in Response to Increased Atmospheric CO<sub>2</sub>, *Nature* 407:364-367 (2000).
- Royal Society, Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide (2005).
- Ruttimann, J. Sick Seas, *Nature News Feature* 978-980 (2006).
- Sabine, C.L., et al. The Oceanic Sink for Anthropogenic CO<sub>2</sub>, *Science* 305:367-371 (2004).
- Shirayama, Y., Effect of increased atmospheric CO on shallow water marine benthos, *Journal of Geophysical Research* 110(c9) (2005).
- Turley, C., et al. Chapter 8: Reviewing the Impact of Increased Atmospheric CO<sub>2</sub> on Oceanic pH and the Marine Ecosystem, *Avoiding Dangerous Climate Change* (2006).