Carbon dioxide from water pollution, as well as air pollution, may adversely impact oceans

September 19 2012

Carbon dioxide (CO_2) released into the oceans as a result of water pollution by nutrients—a major source of this greenhouse gas that gets little public attention—is enhancing the unwanted changes in ocean acidity due to atmospheric increases in CO_2. The changes may already be impacting commercial fish and shellfish populations, according to new data and model predictions published today in ACS's journal, *Environmental Science & Technology*.

William G. Sunda and Wei-Jun Cai point out that atmospheric levels of CO_2, the main greenhouse gas, have increased by about 40 percent since the Industrial Revolution due to the burning of fossil fuels and land-use changes. The oceans absorb about one-third of that CO_2, which results in acidification from the formation of carbonic acid. However, pollution of ocean water with nutrient runoff from fertilizer, human and animal waste, and other sources also is adding CO_2 via the biological breakdown of organic matter formed during algal blooms, which also depletes oxygen from the water.

Sunda and Cai developed a computer model to project the likely consequences of ocean acidification from this process both currently and with future increases in atmospheric CO_2. The model predicted that this process will interact synergistically with the acidification of seawater from rising atmospheric CO_2 in seawater at intermediate to higher temperatures. Together, the two ocean processes are predicted to substantially increase the acidity of ocean waters, enough to potentially impact commercial fisheries in coastal regions receiving nutrient inputs,

such as the northern Gulf of Mexico and Baltic Sea. Clams, oysters, scallops and mussels could be the most heavily impacted, the report indicates.

More information: "Eutrophication Induced CO2 Acidification of Subsurface Coastal Waters: Interactive Effects of Temperature, Salinity, and Atmospheric PCO2" dx.doi.org/10.1021/es300626f

Abstract

Increasing atmospheric carbon dioxide (CO2) is raising seawater CO2 concentrations and thereby acidifying ocean water. But a second environmental problem, eutrophication, is also causing large CO2 inputs into coastal waters. This occurs because anthropogenic inputs of nutrients have fueled massive algal blooms, which deplete bottom waters of oxygen (O2) and release CO2 when the organic matter from these blooms is respired by bacteria. Based on a biogeochemical model, these CO2 inputs are predicted to decrease current pH values by 0.25 to 1.1 units, effects that increased with decreasing temperature and salinity. Our model predictions agreed well with pH data from hypoxic zones in the northern Gulf of Mexico and Baltic Sea, two eutrophic coastal systems with large temperature and salinity differences. The modeled and measured decreases in pH are well within the range shown to adversely impact marine fauna. Model calculations show that the acidification from respiratory CO2 inputs interacts in a complex fashion with that from increasing atmospheric CO2, and that these pH effects can be more than additive in seawater at intermediate to higher temperatures. These interactions have important biological implications in a future world with increasing atmospheric CO2, increasing anthropogenic inputs of nutrients, and rising temperatures from CO2-linked global warming.