Computer models show possible impact to world's oceans of four major stressors due to climate change

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An international team of researchers has developed a computer model that makes predictions regarding four major stressors to the world's

oceans over the next several decades. In their paper published in the journal *Nature Communications*, the team describes the factors that went into the model and how it can be tuned to make predictions based on estimates of greenhouse gas emissions over the coming years.

Most people know that if the planet heats up, so, too, will the world's oceans. Scientists have been conducting experiments designed to understand what that might mean for sea life—but as the researchers with this new effort note, to date, not much work has been done to unite current findings regarding stressors (changes to marine conditions) to predict when certain changes might come about, or if there might be some overlap.

To create their model, the researchers added information about four main stressors: pH level (more CO_2 makes the water more acidic), primary production (availability of food), and water temperature and oxygen levels in the water. Then, they ran 12 climate models to give their own model more information regarding where each of the stressor types was likely to have an impact and when.

The model predicted that within just 15 years more than half of the world's oceans will be reacting to more than one of the four stressors—by 2050, that number will jump to 86 percent. These estimates were based on the status quo, meaning emissions levels remain at current levels. If the countries that signed the Paris agreement come through with their pledges, however, the model showed that could put off the changes due to stressors by approximately 20 years. It also showed that changes in pH levels are likely to have the earliest impact—indeed virtually all of the oceans have already been impacted. They note that particular stressors and their degree of impact will almost certainly vary between geographical areas and types of marine life in that area. They also note that their model is not capable of detailing a timeline for overlap between the stressors—they point out a current

example in which both oxygen and pH levels move lower in one part of the ocean, causing corals and crustaceans to become more sensitive to changes in water temperature. The model is not able to predict which sorts of adaptions marine life might make, or which are likely to survive under different scenarios.

More information: Stephanie A. Henson et al. Rapid emergence of climate change in environmental drivers of marine ecosystems, *Nature Communications* (2017). DOI: 10.1038/ncomms14682

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