Crosscut
News of the Great Nearby

Science faces the fate of the sea

Nearly 500 researchers from around the world meet in Monterey for an epic conference on ocean acidification, and Crosscut is there.

By Eric Scigliano
October 09, 2012.

One way to measure the urgency of the scientific response to ocean acidification is by its carbon footprint. In 2004, 125 marine scientists gathered in a single room in Paris to ponder the effects that surging loads of human-generated carbon dioxide into the atmosphere might have on the sea below. They heard 24 research presentations, nearly the sum total of papers published on the subject worldwide that year.

That they were discussing "ocean acidification" at all was somewhat serendipitous: The term itself had only been coined the year before; scientists had anticipated for decades that CO2 levels would rise in the sea, which absorbs the gas from the air, but only recently considered the effects this would have on its chemistry and biota. Their meeting was originally convened to explore the then-fashionable idea of dumping more carbon into the ocean.

Four years later, 227 researchers gathered in Monaco for the second installment, with 44 presentations. Two weeks ago, 542 racked up the air miles to get to Monterey, California for the Third International Symposium on the Ocean in a High-CO2 World. They came from as far afield as Iceland, Chile, Bangladesh and New Zealand, and braved a rapid-fire marathon of 146 research presentations, culled from hundreds more.

Some of the findings could come from a horror movie: Toxic algae such as those that cause paralytic shellfish poisoning ("red tide") and amnesiac shellfish poisoning (the inspiration for Hitchcock's The Birds) become more toxic yet when CO2 saturation rises and levels of certain minerals fall. More CO2 (which means more acidity or less alkalinity) plus warmer water makes European crab shells "bleed calcium" — i.e., dissolve. Scampi's claws get so brittle they snap off. Summer flounder lose cartilage and suffer liver damage and deformed muscle. Lowering the pH level by .3 points (which doubles the acidity level, as you doubtless recall from high school chemistry) cuts their survival by half.

Since humans began spewing industrial-scale quantities of carbon into the air, oceanic surface pH has fallen by more than .1 point, to about 8.1 — faster than any past change uncovered in the geological record. If it falls by .3 points more it will reach what coral experts call a "critical threshold." Below pH 7.8, one warned in Monterey, "reef development ceases."

The effects extend beyond unlucky critters and imperiled ecosystems; they feed back to the climate itself. Through a chemical knock-on process, the ocean's uptake of CO2 reduces its production of another compound, dimethylsulfide (DMS). This marine DMS is the largest natural source of sulfur in the atmosphere, and that sulfur screens out solar radiation. Less sulfur means more planetary warming—compounding the impact of carbon emissions.

These effects are so far largely matters of extrapolation (i.e., modeling) or manipulation — experiments performed by pumping CO2 into tanks or "mesocosms" sealed off from the rest of the sea. They show what will happen if our species keeps burning, consuming, and emitting as it has been (and so far it's shown little inclination toward restraint). Mitt Rommey, a born-again climate-change denialist when it's expedient, scores campaign points by mocking the very idea.

Again and again, however, the assembled researchers noted one region where acidification is clear, present, and meticulously documented, with economic as well as ecological impacts: the Pacific Northwest. Here, upwellings of deep offshore water (where CO2 concentrates) push into shore in summer and fall, sending pH levels plummeting. This distinct regional effect is compounded by a common ill along shores where lots of people live and farm: nutrient-rich sewage outfalls and agricultural runoff, which fertilize bumper algal blooms that take carbon from the air, then die, rot, and release it into the water.

As previously reported, these dual acid factors nearly destroyed the region's oyster industry, killing the bivalves' larvae in their vulnerable first weeks. (Research presented in Monterey shows that even if they survive larval exposure to high-CO2, low-pH water, native Olympia oysters grow up stunted.) Shellfish hatcheries in Oregon and Washington have learned to dance around the problem so far by obsessively monitoring CO2 and other factors in their intake water, and only drawing it when and where it's sweetest.

Several speakers in Monterey noted the example of Dave Nisbet, a veteran grower on Willapa Bay, where oysters have failed to spawn successfully since 2005. To be sure of a seed supply, he's built a hatchery in Hawaii. One indication of how far this story has traveled: None of the speakers pronounced "Willapa" correctly, and one placed it in Oregon.

Many in the international assemblage also noted a more hopeful local development: Washington's Blue Ribbon Panel on Ocean Acidification, which Gov. Gregoire convened in response to the shellfish crisis. It will soon deliver its recommendations for action, after much gnashing over the sometimes-conflicting imperatives of thinking locally and globally. Some hope for guidance and leadership from this acidification frontline. "We're all watching to see what Washington does," a staff scientist with a leading D.C.-based environmental group told me. (Disclosure: I'm helping write a report that's going to the panel.)

More and more, as acidification science enters its second phase, researchers are also trying to identify exceptions to the rule: winners as well as losers, species and populations within species that survive, even thrive, in acidifying waters. Summer flounder suffer, but winter flounder (a different species) seem to do fine. Likewise tropical sea stars — bad news for the coral they feed on. Even corals aren't equally afflicted; massive varieties such as brain and boulder coral are tougher than more-exposed feathery species, so reefs will become more bulky and stolid before they collapse. Some colonies of purple sea urchins do better than others. Some researchers are trying to unravel the genetic factors that confer such resilience.

They speak of adaptation — of selecting and breeding not only cultivated but wild species to survive in souring seas.
But hardier urchins or heaps of jellyfish will hardly compensate for razed coral reefs and an enormous loss of biodiversity in other systems. And as in the climate debates, selective adaptation has political as well as ecological pitfalls.

Mindful of the gridlock that's overtaken international action on warming and the industry-fueled campaign to undermine climate science in this country, the scientists invited a few policy mavens to speak on the social political implications of their work. One was Miyoko Sakashita, oceans director and senior attorney at the Center for Biological Diversity, who has sued the EPA to make Washington State list its waters as "impaired" by acidification, a designation that could force action under the Clean Water Act.

That law and the Endangered Species Act provide powerful weapons for addressing acidification, Sakashita declared. But science needs to provide the ammunition. "Develop local data, which [is] what the states want." Don't be shy: "Say what you can," rather than bogging down in details. And try not to talk about "winners and losers — they're a policy dead end."