Oceans and Earth’s habitability

On 8 June, the United Nations Educational, Scientific and Cultural Organization (UNESCO) celebrates World Oceans Day, a fitting occasion to remind ourselves of the essential role of the oceans in making Earth a habitable planet. We have had an official day of celebration for the oceans only since December 2008. In contrast, Earth Day has been celebrated every year since 1970. Conceived by U.S. Senator Gaylord Nelson in the aftermath of the 1969 Santa Barbara oil spill, Earth Day became a focus for the growing environmental movement (it became an international event in 1990) and the catalyst that led to the Clean Air, Clean Water, and Endangered Species Acts in the United States. Imagine what might be accomplished if World Oceans Day could similarly inspire actions for improving the state of the oceans worldwide.

Many environmental crises play out in the ocean in slow motion and are not currently addressed by the protections that are in place. For example, oceans absorb about 90% of the heat building up from the release of excess greenhouse gases. The system of Argo profiling floats indicates that the heat content of the upper 2000 meters of the ocean has increased by about $8 \times 10^{22}$ joules over the past 10 years. The yearly increase in heat to the ocean is roughly equivalent to 100 times the average annual energy consumption of the United States (100 quadrillion BTU = $10^{20}$ joules). We have so much to learn about the microbiota in the upper ocean (see the Tara Oceans special section on p. 873), and the effect that this added heat will have on them is entirely unknown. It is likely to have deleterious impacts on fisheries already stressed from overharvesting. And yet, if it were not for the large amount of heat that the oceans absorb, the amount of global warming we would otherwise experience would be truly intolerable.

It is not just excess heat that the oceans absorb. As CO$_2$ is released to the atmosphere from the burning of fossil fuels, about a quarter is absorbed by the ocean, lowering its pH. Since the start of the Industrial Revolution, ocean acidity has increased by 30%, with negative repercussions for many organisms, including those that build their shells from calcium carbonate minerals. Such organisms are essential links in marine food webs and the foundation for very profitable fisheries. As the oceans become more saturated with CO$_2$, their ability to mitigate the buildup of CO$_2$ in the atmosphere by absorbing it will decrease, and greenhouse warming will accelerate.

The oceans help to moderate climate, keeping tropical latitudes cool and temperate latitudes warm through major circulation systems that transport large amounts of equatorial heat poleward. The ongoing warming could change ocean circulation in complex ways, a problem worth addressing at the UN Framework Convention on Climate Change (COP21) in December. World Oceans Day’s focus on the ocean’s role in the climate system will expand global awareness just ahead of this summit.

When scientists search for extraterrestrial worlds that might be habitable, they look for water and signs of an ocean. I find it ironic that in the most recent budget for the National Aeronautics and Space Administration, the U.S. Congress is willing to explore these distant worlds but slashes funding to monitor Earth, the one planet we know is suitable for life as we know it.

With every other breath you take this 8 June, take a moment to thank the ocean for supplying half of your oxygen and for all the other ways in which it makes Earth a habitable planet. It is time to start valuing the ocean and stop using it as a dump for waste heat, CO$_2$, sewage, pollutants, and other trash.

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