

MARINE CONSERVATION

A profound plan to save the seas

Rejecting piecemeal strategies, a conservationist encourages total ocean protection

By **Mary Ellen Hannibal**

A long-time marine conservation advocate, Deborah Rowan Wright has spent decades supporting piecemeal strategies to protect the oceans. Yet despite her efforts and those of many others, our ocean life-support system continues to buckle under human pressures. We have been approaching marine conservation backward, she argues at the outset of her new book, *Future Sea*. Instead of regulating individual fisheries or putting boundaries around select areas of the ocean, we need to protect the whole thing.

The ocean waters that make Earth habitable for humans are becoming increasingly polluted with plastics and chemicals; they are acidifying and warming. They are also losing species at a rate that could drive many to extinction. The profound interconnectivity of ocean organisms means that negative impacts are amplified throughout the food web. But, according to Rowan Wright, the biggest problem many ocean denizens face is a shortage of food. Humanity is eating it all. In 2018, the Food and Agriculture Organization of the United Nations reported 4.6 million fishing vessels in operation, harvesting two-thirds of commercial stocks to capacity and the final third in biologically unsustainable numbers.

Science has long shown the negative impacts of lower-trophic-level overharvests on the rest of the food web (1). In Antarctica, we harvest krill—small planktonic crustaceans near the bottom of the food chain—for use in health supplements and fish-farm feed. Krill are eaten by a wide panoply of seabirds, by invertebrates such as squid, and by fish. They are also an important part of the whale diet. Take out the krill, and many other species go hungry; eventually, the ecosystem will collapse.

Removal of top predators likewise has negative impacts on the process, function, and resilience of the ecosystem (2). Humans like to eat bluefin tuna, for example, which have been hunted nearly to extinction.

As Rowan Wright probes catch limits putatively designed to prevent collapse of the fishery, she finds that, often, these limits are set well above those recommended by ex-

perts. “It’s a familiar and tedious tale,” she writes, “authorities giving way to the short-term economic demands of the fishing industry rather than ensuring the long-term viability of wild fish populations.”

Oceans are vulnerable to what Garrett Hardin memorably called “the tragedy of the commons,” wherein individuals fail to act in accordance with the common good and collectively exploit a shared resource (3). This is particularly true of the high seas, where both the lack of sovereign jurisdiction and technological advances have allowed humanity to penetrate the ocean’s farthest reaches, leading to the decimation of harvests even in the most remote waters.

Rowan Wright’s solution to the current plight of the seas is to reinvigorate existing international laws according to economist Elinor Ostrom’s principles for good commons governance. These include a “common-purpose, cross-sector, tiered (but non-hierarchical) system...rooted in the ecosystem-based and precautionary approaches and coordinated by a central agency.”

As she sets out to aggregate the various treaties and agreements that address human impacts on the ocean, Rowan Wright is surprised to learn that “virtually all the seas and oceans in the whole world are already protected by international law.” The comprehensive United Nations effort—called, simply, the Law of the

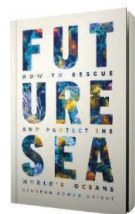
Sea—is an existing treaty signed by 180 countries (the United States is notably absent), which covers most of the bases necessary to mitigate damage to the ocean, from catch-size limits to guidelines for minimizing pollution.

The problem, argues Rowan Wright, is lax enforcement and apathy. Sovereignties are inconsistent and self-serving when it comes to upholding the rules to which they have agreed, and we have not put pressure on our governments to do better. “Most of us simply

don’t see the connection between healthy oceans and a better future (in fact, any future)” she writes.

Last month, the sun did not rise in San Francisco. Or at least that is what it felt like, as smoke from fires around the West blotched out the light. Amid the helplessness and panic, I kept thinking: if only. If only we could go back 20 years and listen to the natural resource managers, scientists, and Indigenous peoples who predicted this exact scenario and offered strategies to mitigate such

a tragedy. We know the disaster that awaits us when the ocean reaches its tipping point. Will this ecosystem meet the same fate? ■



Future Sea: How to Rescue and Protect the World's Oceans

Deborah Rowan Wright
University of Chicago
Press, 2020. 200 pp.

REFERENCES AND NOTES

1. A. D. M. Smith *et al.*, *Science* **333**, 1147 (2011).
2. J. A. Estes *et al.*, *Science* **333**, 301 (2011).
3. G. Hardin, *Science* **162**, 1243 (1968).

10.1126/science.abe0339



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Michael Brenner, Pia Sörensen, David Weitz
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Science and Cooking: Physics Meets Food, From Homemade to Haute Cuisine

Science **370** (6516), 538.
DOI: 10.1126/science.abf0517

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