

## INTRODUCTION

# Changing Oceans

THE OCEAN IS A DYNAMIC AND RAPIDLY EVOLVING ENVIRONMENT, A LONG-appreciated truth which becomes increasingly apparent as we observe it ever more carefully. Some of the transformations that we see are ones we are causing, and some are new to us only because we are looking in greater detail and with more sophisticated tools. This special issue contains a series of Reviews and News pieces that highlight some of the ways in which we see our oceans changing. Lozier (p. 1507) discusses how recent studies have challenged our view of large-scale ocean circulation as a simple conveyor belt, by revealing a more complex and nuanced system that reflects the effects of ocean eddies and surface atmospheric winds on the structure and variability of the ocean's overturning. Next, Doney (p. 1512) reviews how the chemistry of the oceans is changing, mostly due to human fossil fuel combustion, fertilizer use, and industrial activity. Nicholls and Cazenave (p. 1517) present an overview of recent sea-level rise, its impacts on coastal regions, and how adaptation may lessen those impacts. Two pieces examine how climate change is affecting marine biological systems: Schofield *et al.* (p. 1520) illustrate and discuss the role of ocean-observation techniques in documenting how marine ecosystems in the West Antarctic Peninsula region are evolving, and Hoegh-Guldberg and Bruno (p. 1523) present a more global view of the ways in which marine ecosystems are being affected by rapid anthropogenic variations.

Several News pieces provide even more information about current ocean trends. Kerr (p. 1500) discusses the certainty of ocean acidification and the uncertainty surrounding acidification's effects on marine life. Malakoff (p. 1502) takes on ocean noise, which is increasing because of ever-expanding ship traffic. Stokstad (p. 1504) covers improvements in shrimp aquaculture, and Kaiser (p. 1506) sets the record straight on the ocean's garbage patches. Information on where and how researchers are keeping tabs on the sea is supplied as a graphic (p. 1498). In News Focus, a story by Stone (p. 1476) looks at the ocean's microbial carbon pump. On *Science Careers* ([www.sciencecareers.org](http://www.sciencecareers.org)), Fields has profiled human geographer Joshua Cinner, whose work informs coral reef management.

In a related Policy Forum, Lubchenco and Sutley (p. 1485) propose an approach to safeguard U.S. ocean, coastal, and Great Lakes ecosystems from the increasingly numerous and intense stresses that human activities are causing.

Together, these pieces provide an introduction to some of the important discoveries we have made recently about our oceans, underscore how human activities are changing them, and identify some of the challenges we must face if we are to continue to enjoy their vast but finite resources.

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See also News Focus p. 1476; Policy Forum p. 1485; Science Podcast; and Science Careers at [www.sciencecareers.org](http://www.sciencecareers.org)

# Science

## Changing Oceans

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