What is upwelling and how do wind patterns relate to it?
Upwelling refers to the process by which equator-ward, alongshore wind currents over ocean regions drive nutrient-depleted water away from the shoreline, replacing it with cold, nutrient-rich water from the bottom of the ocean. This maintains ecosystem productivity and overall health.

What is the importance of eastern boundary upwelling systems?
Eastern boundary current systems (EBCSs) are areas along the eastern margins of ocean basins. These regions are prime environments for upwelling, leading to extraordinary productivity and species diversity. The California (California, Oregon, and Washington), Humboldt (Peru and Chile), Benguela (South Africa and Namibia), and Canary (northern Africa to Portugal) regions comprise the world’s EBCSs and are the focus of this study’s analysis. These essential upwelling systems are among the most heavily impacted in the world with exhausted fish populations, changing food web dynamics, and altered habitats which disrupt naturally stable cycles. The scientific framework for ecosystem-based management is still being developed, and it will be enhanced by understanding changes in upwelling since upwelling is fundamental to the health and productivity of these ecosystems.

What did Andrew Bakun propose in 1990? How is this paper related to Bakun’s hypothesis?
Andrew Bakun proposed that the human-created increase in greenhouse gases would lead to intensification of upwelling in the world’s EBCSs due to a strengthening of upwelling-favorable winds in those areas. There is significant debate within the scientific community as to whether current wind patterns corroborate his hypothesis. In order to get a more accurate view of global upwelling patterns, scientists at the Farallon Institute and their collaborators created a combined analysis of 22 previously-published studies that tested Bakun’s theory.

What were our results and what do they mean for ecosystem productivity?
With evidence of wind intensification in the California, Humboldt, and Benguela systems, the analysis found that the existing body of research generally supports Bakun’s hypothesis. We also found that the degree of wind intensification was more pronounced at greater latitudes, which is in line with warming patterns observed with the onset of climate change. While it may sound as if wind intensification could benefit ecosystems due increased upwelling, large changes in wind patterns could, in fact, harm ecosystems by changing ocean chemistry and throwing off the balance of organism interactions. The complex nature of natural systems, though, makes it extremely difficult to predict the ecological effects of wind intensification in these ecosystems.

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