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Human impact on the ocean will double by 2050, UCSB scientists warn

The seas have long sustained human life, but a new UC Santa Barbara study shows that rising climate and human pressures are pushing the oceans toward a dangerous threshold.

Vast and powerful, the oceans can seem limitless in their abundance and impervious to disturbances. For millennia, humans have supported their lives, livelihoods and lifestyles with the ocean, relying on its diverse ecosystems for food and material, but also for recreation, business, wellness and tourism.

Yet the future of our oceans is worrying, according to researchers at UCSB's [National Center for Ecological Analysis and Synthesis \(NCEAS\)](#).

“Our cumulative impact on the oceans, which is already substantial, is going to double by 2050 — in just 25 years,” said marine ecologist and NCEAS director [Ben Halpern](#), who led the effort to forecast the future state of marine environments as they bow under the combined pressures of human activities, which include ocean warming, fisheries biomass loss, sea level rise, acidification and nutrient pollution, among other impacts. “It’s sobering. And it’s unexpected, not because impacts will be increasing — that is not surprising — but because they will be increasing so much, so fast.”

The research team, which includes collaborators from Nelson Mandela University in South Africa, also finds that the tropics and the poles will experience the fastest changes in impacts, and that coastal areas will feel the brunt of the increased impacts.

Their research is published in [the journal Science](#).

A comprehensive global model of human impacts

As human activity on the ocean and along the coast has intensified, so have impacts on the marine environment. Halpern and a group of scientists first tackled the challenge of understanding how these pieces fit together to affect the ocean nearly 20 years ago, laying the groundwork for the current study.

“People tracked one issue at a time, but not everything together,” Halpern said. “More importantly, there was a pervasive sense that the ocean is so huge the human impacts couldn’t possibly be that bad.”

Their quest to build a comprehensive model of human impacts on the ocean led to a [2008 paper in the journal Science](#), a [landmark study](#) that synthesized 17 global data sets to map the intensity and extent of human activity on the world’s oceans. That initial view revealed startling results: No place was untouched, and 41% of the world’s marine environments were heavily impacted.

“The previous paper tells us where we are; the current paper tells us where we are headed,” Halpern said.

Ocean warming and biomass loss due to fisheries are expected to be the largest overall contributors to future cumulative impacts. Meanwhile, the tropics face rapidly increasing rates of impact, while the poles, which already experience a high level of impact, are expected to experience even more. According to the paper, the high level of future impacts “may exceed the capacity of ecosystems to cope with environmental change,” in turn posing challenges for human societies and institutions in a variety of ways.”

The world’s coasts are expected to bear the brunt of these increasing cumulative impacts — an unsurprising reality, the researchers say, given most human uses of the ocean are near coasts. Yet it’s also a “worrisome result nonetheless,” according

to the paper, because the coasts “are where people derive most value from the ocean.” Additionally, many countries are dependent on the ocean for food, livelihood and other benefits. “Many of these countries will face substantial increases,” Halpern said.

The authors contend that enacting policies to reduce climate change and to strengthen fisheries management could be effective ways to manage and reduce human impacts, given the outsize roles that ocean warming and biomass loss play in the estimate of future human impacts on the ocean. Likewise, prioritizing management of habitats that are expected to be heavily impacted — such as salt marshes and mangroves — could help reduce the pressures on them.

In presenting these forecasts and analyses, the researchers hope that effective action can be taken sooner rather than later to minimize or mitigate the effects of increased pressures from human activity.

“Being able to look into the future is a super powerful planning tool,” Halpern said. “We can still alter that future; this paper is a warning, not a prescription.”

Research in this paper was also conducted by Melanie Frazier and Casey C. O’Hara at UCSB; and Alejandra Vargas-Fonseca and Amanda T. Lombard at Nelson Mandela University in South Africa.

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