

Report: San Diego has unique edge to tackle climate change

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The Earth's coastal and polar areas are on thin ice, a new climate report warns, but San Diego may be in a better place than others to weather those changes if it acts swiftly, several authors said.

"The Ocean and Cryosphere in a Changing Climate," released last week by the Intergovernmental Panel on Climate Change, explored the effects of warming on the world's oceans and frozen places.

San Diego is grappling with rising seas, [coastal erosion](#) and marine heat waves, periods when seawater hits record-high temperatures. However, natural variability in the region's sea level, [ocean](#) temperature and chemistry may position coastal cities to stay ahead of future changes, several authors said. Understanding the risks specific to San Diego can help with that.

"Every community has different vulnerabilities, so it's useful to downscale these risks to your specific communities," said Mark Merrifield, a contributing author of the report and director of the Climate Change Impacts and Adaptation Center at Scripps Institution of Oceanography in San Diego.

Besides the steady ocean warming, El Nino and La Nina cycles, as well as marine heat waves, have caused wild fluctuations in ocean temperature, the report stated.

"Marine heat waves, periods of extremely high ocean temperatures, have negatively impacted marine organisms and ecosystems in all ocean basins over the last two decades, including critical foundation species such as corals, sea grasses and kelps," the report states.

San Diego experienced that firsthand starting in 2013, when parts of the Pacific soared up to 9 degrees Fahrenheit above normal under the influence of "the blob," a vast patch of warm, stagnant water that lingered off the West Coast for years. The [warm water](#) dampened normal upwelling of cold, nutrient-rich water from the deep ocean, and the effects rippled across the region, authors said.

"When waters become warmer, and they already are, there's less nutrients, so there's less phytoplankton," said Lisa Levin, an author of the study and a professor of biological oceanography at Scripps. "They are the plants of the ocean, they're fixing carbon and they feed the rest of the ocean, so there's less food. That trickles down through the food web to fish and mammals. And we've (seen) some hungry mammals in the last five years."

Starving sea lion pups stranded in record numbers between 2013 and 2017. Whales swam closer to shore, where there was better food supply, said Raphael Kudela, an author of the report and professor of ocean sciences at the University of California, Santa Cruz. That's good for whale-watching, but bad for whales, which risk ship strikes and entanglement closer to the coast, he said.

The change in temperature pushed some species northward, so market squid, normally a mainstay for Southern California, were being caught north of San Francisco, he said, while yellowfin tuna moved from Baja California, Mexico, to San Diego. Warmer water also created conditions for toxic algal blooms, which can sicken animals and people.

"The big heat wave in 2015 resulted in the big harmful algal bloom and the closure of the Dungeness crab fishery" on the West Coast, Kudela said. "We are concerned that this could be the new normal. We've got another marine heat wave starting right now, so come spring 2020, are we going to see another harmful algal bloom?"

Marine heat waves are likely to become more frequent and intense in coming years, "pushing some marine organisms, fisheries and ecosystems beyond the limits of their resilience," the report warned. Kelp forests, one of San Diego's signature habitats, are vulnerable to changes in water temperature, it stated.

But San Diego's coastline already experiences [seasonal variations](#) in oxygen and pH levels, so some marine life may be better able to cope as [climate change](#) alters ocean chemistry, Levin said.

Along the West Coast, low oxygen areas are a natural feature of the ocean environment, she said. Although many animals avoid the "oxygen minimum zones," some commercial fish, including Dover sole and black cod, have learned to live with them.

Those low-oxygen zones, found at depths of 300 and 3,000 feet, result from upwelling cycles common to the region's coastline. Seasonal winds fan the California coast, churning up water that's high in nutrients, but acidic and low in oxygen, Levin said.

Ocean acidification can interfere with shellfish development and may affect fish growth. Although this change could be devastating to coastal fisheries such as oysters, there is great genetic variability in different organisms' ability to tolerate it, and some local species are likely to hold fast, Levin said.

Moreover, oxygen and pH levels shift during naturally occurring El Nino and La Nina events, Levin said, so Southern California ecosystems already have some ability to withstand those changes.

"Some of the species in California will be more tolerant of climate changes than the species in other areas of the ocean, probably," Levin said.

As melting ice drives rising seas, coastal communities including San Diego will encounter more frequent and severe flooding, scientists said. Runoff from melting glaciers in Greenland and Antarctica, along with expansion of the warming ocean water, has doubled the global rate of sea level rise, according to the report.

"(High) water levels that used to occur once a century will occur annually or more often in many places, and San Diego happens to be one of them," said Michael Oppenheimer, a lead author of the report and professor of geosciences and international affairs at Princeton University.

Those effects are most likely to occur in low-lying areas such as Imperial Beach, and during certain inauspicious conditions, Levin said.

"When high tides interact with storm surge, we know that there's more coastal flooding," she said.

Nonetheless, much of San Diego's infrastructure is built at higher elevations, so the region may have a better buffer than areas such as San Francisco, where many buildings are constructed on low-lying stretches of reclaimed land, said Merrifield, professor of oceanography at Scripps.

"Coastal flooding is certainly a problem in certain low-lying areas, but San Diego does benefit from having most of the built environment well above sea level," he said.

Although San Diego may be more resilient to flooding than some parts of the state, its more immediate threat is bluff and beach erosion, Merrifield said.

"It might not mean that you'll get flooding, but there will have to be attention paid to keeping sand on a beach," he said.

Early warning systems will be important to heading off threats, said So-Min Cheong, a professor of geography at the University Kansas, and an author on the chapter on risk management.

By better predicting events such as marine heat waves, officials can

manage fisheries to prevent over-fishing, or shore up marine-protected areas to defend existing fish stock. Planners should work with developers to ensure that new housing can withstand risks of flood and erosion, she said.

"They need to be engaging with communities, with the construction sector, to redesign the houses, to raise houses up and make them flood-proof," Cheong said.

One of the more upbeat notes in the report concerns the role of "blue carbon," the restoration of marine plants to help slow climate change and safeguard coastlines. Kelp forests, sea grass beds, mangroves and wetlands all sequester carbon, shelter young fish, balance ocean chemistry and buffer inland areas, scientists said.

"Sea grass beds and kelp are generally a net sink for carbon," Kudela said. "They adjust the pH of the water so you don't have to. If we protected these areas and helped them expand, we can mitigate the effects of ocean warming and de-oxygenation."

Besides updating the status of the Earth's oceans and ice, the authors aim to lay out a choice.

"The report makes really, really clear, that if we act now and take on mitigation, we can limit the results of climate change," Levin said. "And things can be really severe and catastrophic in the future, with a lot of loss of life and money, if we don't act."

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