

# Climate crisis has tripled length of deadly ocean heatwaves, study finds

Hotter seas supercharge storms and destroy critical ecosystems such as kelp forests and coral reefs

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Bleached and dead staghorn coral off Heron Island on the Great Barrier Reef. Photograph: Mike Bowers/The Guardian

The climate crisis has tripled the length of ocean heatwaves, a study has found, supercharging deadly storms and destroying critical ecosystems such as kelp forests and coral reefs.

Half of the marine heatwaves since 2000 would not have happened without global heating, which is caused by burning fossil fuels. The heatwaves have not only become more frequent but also more intense: 1C warmer on average, but much hotter in some places, the scientists said.

The research is the first comprehensive assessment of the impact of the climate crisis on heatwaves in the world's oceans, and it reveals profound changes.

Hotter oceans also soak up fewer of the carbon dioxide emissions that are driving temperatures up.

“Here in the Mediterranean, we have some marine heatwaves that are 5C hotter,” said Dr Marta Marcos at the Mediterranean Institute for Advanced Studies in Mallorca, Spain, who led the study. “It’s horrible when you go swimming. It looks like soup.”

As well as devastating underwater ecosystems such as sea grass meadows, Marcos said: “Warmer oceans provide more energy to the strong storms that affect people at the coast and inland.”

One disastrous example was the intense rainfall that caused catastrophic flooding in Libya in 2023, which killed 11,000 people. It was made up to 50 times more likely by global heating, which had raised temperatures in the Mediterranean by as much as 5.5C. That resulted in more water vapour and therefore more rain.

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Satellite images show the extent of the damage caused by flooding in Derna, Libya, in September 2023. Photograph: AP

“The only solution is cutting the burning of fossil fuels. This is a very clear relationship,” said Marcos. “More than 90% of the extra heat [trapped by greenhouse gas emissions] is stored in the ocean. If you stop warming the atmosphere, you will stop warming the ocean.”

Recent major marine heatwaves include an exceptionally long event in the Pacific in 2014-15, which caused mass mortality among marine life. Intense heat hit the Tasman Sea in 2015-16 and record sea temperatures around the UK and in the Mediterranean Sea in 2023. Scientists had warned in 2019 that ocean heatwaves were increasing sharply, killing swathes of sea-life like “wildfires that take out huge areas of forest”.

Dr Zoe Jacobs at the UK’s National Oceanography Centre, who was not part of the study team, said: “Ocean heatwaves pose significant risks to society, with some individual events causing millions of dollars of losses due to impacts on the fishing, aquaculture and tourism industries. They have also been found to exacerbate heatwaves on land and have amplified extreme weather like hurricanes and storms.”

The study, published in the Proceedings of the National Academy of Sciences, built a model of sea surface temperatures since 1940 that removed the heating the climate crisis has caused. They then compared that with actual measurements from the oceans to show how global heating has pushed up temperatures. They focused on summer heatwaves, because they reach the highest temperatures and are therefore the most damaging.

The analysis revealed there were about 15 days of extreme heat a year at the ocean surface in the 1940s, but the figure had jumped to a global average of nearly 50 days a year. Some regions, including the Indian Ocean, the tropical Atlantic and the western Pacific have 80 heatwave days a year, ie one day in every five.

The seas in the tropics are already warm, so the extra heat tends to increase the duration of heatwaves. In cooler seas, the extra heat also can drive up their intensity, as seen in the Mediterranean Sea and the North Sea.

Dr Xiangbo Feng at the University of Reading, who was part of the study team, said: “As global temperatures continue to rise, marine heatwaves will become even more common and severe. Human activities are fundamentally changing our oceans. Urgent climate action is needed to protect marine environments.”