

# The oceans are heating, acidifying and choking

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We know the oceans are warming. We know they are acidifying. And now, to cap it all, it turns out they are suffocating, too. A new health check on the state of the oceans warns that they will have lost as much as 7 per cent of their oxygen by the end of the century.

The cascade of chemical and biological changes now under way could see coral reefs irreversibly destroyed in 50 to 100 years, with marine ecosystems increasingly taken over by [jellyfish](#) and toxic algal blooms.

The [review](#) is a repeat of a study two years ago by the [International Programme on the State of the Ocean](#) (IPSO), a coalition of scientists. It concludes that things have become worse since the first study.

"The health of the oceans is spiralling downwards far more rapidly than we had thought, exposing organisms to intolerable and unpredictable evolutionary pressure," says [Alex Rogers](#) at the University of Oxford, the scientific director of IPSO.

## Deadly trio

Rogers describes a "deadly trio" of linked global threats. The first is global warming: surface sea water has been [warming](#) almost as fast as the atmosphere. The second is [acidification](#) – a result of the water absorbing ever more CO<sub>2</sub> from the atmosphere. The third is [deoxygenation](#).

We learned last year that acidification is beginning to affect marine creatures – [snail shells in the Southern Ocean are dissolving](#). But [John Spicer](#) of Plymouth University, UK, says "in the lab, low oxygen has a greater effect than acidification".

The oceans are losing oxygen partly because warmer water holds less oxygen, and partly because warming is greatest at the surface, creating a buoyant surface layer that mixes less with colder layers below. This creates oxygen-poor deep water that could suffocate life on the seabed, the authors warn.

Near some coasts that deep, deoxygenated water can still return to the surface, though, carried by [upwelling currents](#), says Rogers. This could kill marine life in shallow water too. In fact, the report blames oxygen-poor water brought to the surface by the [California Current](#) for a massive loss of marine life off North America in the past decade. "This region showed no evidence of hypoxia [low oxygen levels] prior to 2000," it says.

## Ocean deserts

Meanwhile, tagging studies have shown that large fish like marlin, which need a lot of oxygen to fuel their fast metabolisms, are disappearing from some of the areas in the tropical oceans where oxygen is diminishing.

[Ralph Keeling](#) of the Scripps Institution of Oceanography in La Jolla, California, predicts using ocean models that the oceans will lose between 1 and 7 per cent of their oxygen this century.

"Low oxygen levels have occurred in previous eras when there were mass extinctions, and now we are seeing signs of a repeat," says Rogers.

Some oceanographers say the report's claims of rapid recent ocean deterioration are exaggerated. "To say things are dramatically worse than two years ago is hype," says [Callum Roberts](#) of the University of York, UK. But he agrees that the threat from the deadly trio is real. "The ocean deserts are expanding. We have a squeeze on ocean productivity that will reduce fisheries' potential in the coming decades if we don't reduce CO<sub>2</sub> emissions," Roberts says.