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Ocean Oxygen Loss: If fish could talk.

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Key points

- Dissolved oxygen in the global ocean has decreased by over 2 per cent since 1960, with some areas experiencing declines of up to 50 per cent.
- Lack of oxygen causes respiratory failure in marine wildlife and is already driving mass mortality events.
- Low oxygen zones in the ocean lead to the release of greenhouse gases, such as nitrous oxide (N_2O) and methane (CH_4), and the release of the toxic gas hydrogen sulphide (H_2S).
- The impact of deoxygenation on the ocean's uptake of CO_2 is poorly understood and warrants further, urgent research.
- Ocean deoxygenation will persist for centuries, but rapid reductions in fossil fuel use and greenhouse gas emissions can limit impacts on ecosystems and fisheries.

Detail

Ocean oxygen levels have been declining for decades

- Waters with persistently low oxygen levels at 200m depth have expanded by 4.5 million km^2 since the 1960s, corresponding to an area ~60 per cent of the size of Australia.
- Warmer surface water holds less oxygen and leads to a more stratified ocean, meaning that upper, oxygen-rich layers mix less oxygen into deeper layers.
- The largest declines are observed in the Pacific, Arctic, Southern Ocean and South Atlantic. On coral reefs, low oxygen conditions are already widespread.

Impacts on fish

- Reduced growth, delayed spawning and blindness: deoxygenation impacts the function of the light detecting cells, with damage occurring in minutes.
- Warm water increases the metabolism and oxygen demand of many species yet contains less oxygen – which can lead to respiratory failure and death.

Impacts on fisheries and ecosystems

- Many species are already shifting to new habitats to escape low oxygen waters.
- Deoxygenation causes tuna, sharks and billfish to move to shallower waters.
- Blue marlin have experienced an annual loss of vertical habitat of one metre per year, equating to a 15 per cent loss of habitat between 1960 and 2010.

Greenhouse gas impacts

- When oxygen levels are low, microbes use other chemical compounds to break down organic matter.
- This leads to increased production of nitrous oxide (N_2O), a greenhouse gas that is 273x more powerful than CO_2 on a 100-year timescale.
- Most low-oxygen zones in the ocean are already significant emitters of N_2O, with record emissions observed in recent years.
- Deoxygenation can also lead to the release of methane (CH_4) from sediments.