Biological Sciences update
DECEMBER 2025
www.hachettelearning.com/biologicalsciencesreview

Bloom and doom

A bloom of toxic algae has killed millions of marine organisms in South Australia over the last 8 months. **Liz Sheffield** explains why such blooms are posing an increasing threat to life around the globe

In a certain combination of environmental conditions, some organisms multiply so rapidly that they dominate the ecosystem. The result is known as a bloom. Several species of algae form blooms in both marine and freshwater ecosystems all over the world. They are a natural phenomenon, mentioned in the Bible and in records made by sixteenth-century Spanish explorers, but when the algae contain toxins, the effects can be devastating.

The blooms are getting larger, more frequent and lasting longer. In September 2025, one headline stated, 'UK's largest lake dying as algae blooms worsen'. This referred to toxic blue-green algae blooms that 'look like pea soup and smell like rotten eggs', which have covered much of Lough Neagh in Northern Ireland every year for the past 3 years. In the USA, a record-breaking bloom was recorded along the Pacific West Coast this year, decimating marine life and economies. Elsewhere in the USA, a headline in June was, 'Toxic algae blooms are lasting longer in Lake Erie – why that's a worry for people and pets'.

Deadly dinos

The bloom currently blighting over 20 000 km^2 of the sea off the coast of South Australia has been causing particular concern for several reasons. Scientists do not know why it formed, nor why it did not die off when sea temperatures fell in the Australian winter. The organisms causing the bloom have only very recently been identified, but despite a century of research, we still do not fully understand the mechanism of the toxicity. Perhaps the biggest reason for concern is that there is very little anyone can do to mitigate the effects of any algal bloom.

Now that we know the identity of the main culprits in South Australia – five different species of dinoflagellates called *Karenia* in various amounts at different times – we can predict that similar blooms will form elsewhere. *Karenia mikimotoi* was initially found mainly in Japan and Korea. In the late 1950s, it bloomed off the coast of the USA, and then later in Norway. Since the 1970s, it has occasionally caused mass fish deaths around the British Isles. The toxicity of *K. mikimotoi* is thought to involve reactive oxygen species. In humans, strong oxidants can irritate the eyes and airways, causing coughing and exacerbating asthma symptoms. They cause cell death in the gills of fish.

Another species, *Karenia cristata*, which had only previously been recorded in South Africa – where it

Next page

killed marine organisms and caused serious human ill health – contains neurotoxins called brevetoxins. These compounds block cell-surface, voltage-gated sodium ion channels and thus prevent nerve transmission. This can cause paralysis and ultimately death in organisms that ingest the toxin. *K. cristata* and its brevetoxin have been detected for the first time ever in Australia, causing shellfisheries to be closed and triggering government notices for fishers, surfers and beach-lovers.

Kill or cure?

What can be done to reduce the damage caused by blooms? The Australian bloom is perilously close to the breeding grounds of the giant Australian cuttlefish. Bubble curtains have previously been deployed to successfully protect salmon farms from algal blooms in Tasmania. Pipes have now been installed to surround a nursery containing 80 000 or so cuttlefish eggs and hatchlings. If the bloom reaches the breeding grounds, land-based generators will pump air into underwater feeder lines, creating a curtain of bubbles through which the bloom cannot pass.

Researchers have recently found viruses associated with a *Karenia* species that forms blooms in Florida, which they suggest could pave the way for a biocontrol agent. However, given the requirement for hosts in which to raise a supply of viral particles, it seems more likely that detection of the viruses might provide an early warning of bloom onset or decline.

Scientists agree that preventing nutrient runoff and sewage disposal (and thus eutrophication), alongside reversing climate change, are the only realistic ways to reduce the damage caused by harmful algal blooms.

A widely criticised South Australian government notice, which locals feel misleads visitors and underplays the dangers of the algal bloom

Weblinks

Murray, S. A., *et al.* (2025), 'A catastrophic marine mortality event caused by a complex algal bloom including the novel brevetoxin producer, *Karenia cristata* (Dinophyceae)', *bioRxiv*,
https://tinyurl.com/marine-mortality

Daniel Keane, 'SA Premier says algal bloom is not 'toxic', despite word appearing in official government advice', ABC News,
https://tinyurl.com/algal-toxic

Video explaining how an air bubble curtain could help protect South Australia's giant cuttlefish:
https://tinyurl.com/air-bubble

Good Living (2025), 'Everything you need to know about giant Australian cuttlefish in South Australia',
https://tinyurl.com/giant-cuttlefish

Science Daily (2025), 'Study identifies viruses in red tide blooms for the first time',
https://tinyurl.com/viruses-blooms