

Red tides

PHILIP SCHEUBERT/ISTOCK PHOTO

Some microorganisms can grow in such profusion that they turn the sea red.

Liz Sheffield explains how red tides can be fatal to other marine life and even humans

During the past month, a state of emergency was declared in Florida, USA. Beaches were closed and public health warnings were issued. The culprit was a tiny microorganism called *Karenia brevis*. This member of the phytoplankton — the photosynthetic base of most marine food chains — is not at all good to eat. The cells contain brevetoxin — a compound that blocks channels in cell surface voltage-gated sodium ion membranes and thus prevents nerve transmission. This can cause paralysis and ultimately death in organisms that ingest the toxin.

Red tides

When a particular combination of environmental conditions arises, some organisms multiply so rapidly that they dominate the ecosystem. The result is known as a bloom. Algal blooms form in both marine and freshwater ecosystems all over the world. *K. brevis* is an alga, belonging to a group called dinoflagellates. These unicellular organisms have red and brown accessory pigments in addition to chlorophyll in their photosynthetic apparatus, and in species where these pigments are present in quantities sufficient to mask

the chlorophyll, dinoflagellate blooms turn the sea red.

Red tides have been reported for many centuries — for example, in records of sixteenth century Spanish explorers and in the Bible — so they are a natural phenomenon. Temperature, salinity, and nutrients at certain levels can cause a massive increase in *K. brevis*.

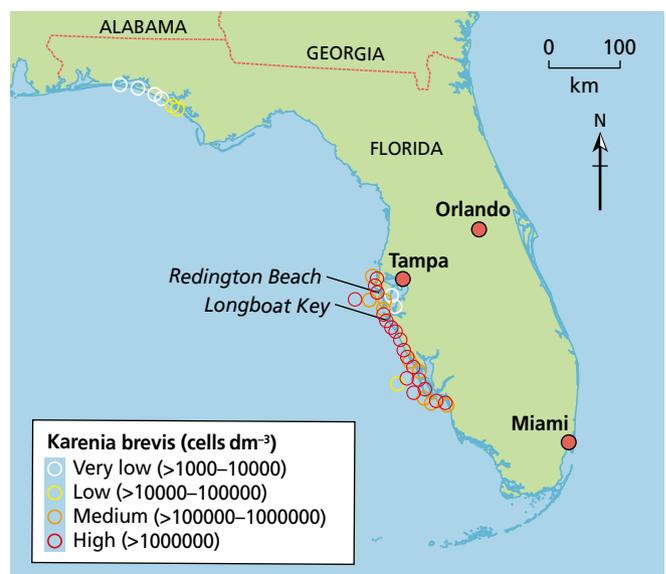


Figure 1 Concentrations of *Karenia brevis* recorded 4–11 September 2018 around the coast of Florida



STEFFSTAR/ADOBE STOCK PHOTO

No one knows the exact combination of factors that triggers this but high temperatures combined with a lack of wind and rainfall usually precede a red tide. This abundance of toxic phytoplankton has devastating effects all the way along the food chain.

When a red tide forms, the first noticeable casualties are fish, which recently washed up onto Redington Beach (see Figure 1) in such numbers that contractors were deployed with machines to pile up and remove truck-loads of the rotting carcasses. More than 5 tonnes of dead fish were removed from Longboat Key this summer. The next corpses to arrive are those of the organisms that eat fish, including sea birds and dolphins. But the casualties don't stop with carnivores. The recent red tides in Florida have claimed more than 500 turtles and 100 manatees, presumably as a result of ingesting dinoflagellates when feeding on sea grasses. We have only recently started to understand the full risks posed by *K. brevis*.

Beachgoers beware

The risk of severe health issues associated with brevetoxin-contaminated fish are so well known that there is a sophisticated array of systems that monitor red tides, test products destined for human consumption and close down fisheries or shellfisheries until the coast is clear. Members of the public who ignore red tide warnings and catch and eat their own-caught fish or shellfish risk paralytic shellfish poisoning (really dinoflagellate poisoning) and even death.

Another problem with red tides arises from aerosols. Asthma sufferers and people with respiratory problems have long been warned against visiting red tide-affected beaches, and many people who encounter red tide sea spray report irritated airways. It has only recently emerged, however, that exposure to aerosols

may be much more damaging than anyone suspected. Experiments with rats exposed to brevetoxin have revealed that the neurotoxin is converted into DNA-damaging compounds in their lungs. This implies that other mammals, including ourselves, may risk cancer as a consequence of encountering red tide sea spray. The Florida authorities are taking no chances and closing beaches badly affected by red tides. (Not good news for the author — writing this en route to the Gulf of Mexico!)

Activities

- 1 Discuss with your classmates the advantage to *Karenia brevis* of possessing red and brown pigments in addition to chlorophyll.
- 2 Brevetoxin prevents the transmission of nerve impulses by blocking voltage-gated sodium ion channels. Explain how blocking voltage-gated sodium ion channels has this effect.
- 3 Discuss with your class mates what you might do to control or prevent red tides if you were Florida's Governor (see first weblink below).

Weblinks

Florida residents clearly believe that their governor shares some of the blame for red tides — do you agree? *Washington Post*, 18 Sept 2018:

<https://tinyurl.com/y9p6uftp>

'In Redington Shores the counter attack against red tide begins' (note: this does not explain how to deal with the red tide itself but only its effects). *Tampa Bay Times*, 15 Sept 2018.

<https://tinyurl.com/y75smbmc>

Red tide: Florida powerless to stem killer algae bloom. *BBC News*, 24 August 2018:

<https://tinyurl.com/ybynm4om>

Find out more about our full range of magazines and online archives of back issues at www.hoddereducation.co.uk/magazines

Did you like this article?
Tell us what you think