Information for health professionals

Harmful microalgae

The term harmful microalgae or harmful algal blooms (HABs) are commonly used functional classifications that include true algae (dinoflagellates and diatoms) and photosynthetic bacteria (cyanobacteria also known as blue-green algae). Dinoflagellates and diatoms are generally marine organisms while cyanobacteria are more common in fresh or brackish waters, but do include some marine species.

Microalgae including harmful species are common inhabitants of natural waters. Concerns including potential human health impacts arise when algal cell numbers dramatically increase leading to algal blooms. Blooms of dinoflagellates and diatoms can lead to discolouration of water and the production of visible foams. Many species of cyanobacteria cause visible blue-green surface discolouration of water bodies but they can be brown, yellow or red. In extreme cases blooms can lead to accumulation of shore-line sludges. However, some species including *Cylindrospermopsis* do not cause surface discolouration or sludges.

A limited number of dinoflagellates, diatoms, and cyanobacteria produce toxins that can potentially harm humans. In addition, some dinoflagellates and diatoms can produce toxins that cause marine life mortalities by damaging gills or gill structures. *Karenia spp* detected recently in South Australian coastal waters is an example of a dinoflagellate that is toxic to marine life but not to humans.

There are only limited examples of human harm caused by direct exposure to toxins produced by micro-algae. However, consumption of filter feeding shellfish, which can accumulate and concentrate algal toxins, has been a source of large scale illness including mortalities. For this reason all commercial shellfish harvesting areas are monitored by the South Australian Shellfish Quality Assurance Program for the presence of harmful micro-algae and toxins in shellfish. Detection typically leads to closure of the harvesting area. This ensures that shellfish harvested in South Australia is safe to consume.

In addition to potentially causing health impacts through toxin production microalgae can also cause non-specific impacts through exposure to algal cells or algal particles. Except for exposure through contaminated seafood the non-specific impacts are far more common than those associated with toxin. None of the non-specific impacts are long lasting and all symptoms resolve within a few hours after exposure ending without medical intervention.

- for dinoflagellates and diatoms the most likely symptoms are eye irritation and respiratory symptoms such as coughing and shortness of breath due to exposure to airborne algal particles. Skin rashes may also occur from swimming in water containing high concentrations of the microalgae. Eye irritation and respiratory symptoms are resolved by moving away from sea water and beaches impacted by the organisms. Skin rashes can be resolved by washing the skin with fresh clean water.
- for cyanobacteria the most likely symptoms are eye irritation, skin rashes and gastrointestinal symptoms. Studies have shown that 10-12% of people exposed to cyanobacteria present in a water body are susceptible to developing skin rashes. Eye irritation and skin rashes can be resolved by washing the skin with fresh clean water. Gastrointestinal symptoms are transient.

People with existing conditions:

- People with preexisting asthma, emphysema, bronchitis, or other form of chronic lung disease may be more vulnerable to the respiratory effects of brevetoxin-like substances. People with asthma are advised to carry their reliever medication with them whilst on beaches where there is visible foam and discoloured water, to take their preventive medication as prescribed and check their asthma management plan is up-to-date.

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Type Species[a]	Toxin or cause of health impacts	Route of Transmission	Public Health Impacts
Marine organisms (dinoflagellates and diatoms)			
Alexandrium catenella, *minutum* or *tamarense*	Paralytic Shellfish Poison (saxitoxins)	Consumption of shellfish	• rapid tingling sensation or numbness around lips spreading to the face and neck • prickly sensation in toes and fingers • headache, dizziness, nausea, vomiting, diarrhoea • in severe cases muscle paralysis, respiratory difficulty, choking sensation; can be fatal.
Dinophysis acuminata, acuta or fortii	Diarrhetic Shellfish Poison (okadaic acid)		• rapid onset diarrhoea, nausea, vomiting, abdominal pain
Pseudo-nitzschia pungens	Amnesic Shellfish Poison (domoic acid)		• vomiting, • abdominal cramps and diarrhoea • confusion, amnesia (loss of memory) and coma may follow in severe cases. The amnesia may be permanent
Karenia brevis	Neurotoxic Shellfish Poison (brevetoxin)		• similar symptoms to ciguatera poisoning (see below), but is usually less severe and lasts only a few days.
Gambierdiscus toxicus	Ciguatera (ciguaratoxin)	Consumption of larger reef fish	• vomiting, • diarrhoea and/or abdominal (stomach) cramps, • headaches, fatigue and fainting • joint and muscle pain, • tingling around the mouth, fingers and toes • burning sensation or skin pain on contact with cold water • extreme itchiness • coma in severe cases.
Karenia mikimotoi	Algal particles	Inhalation, dermal	• eye irritation, respiratory irritation including coughing and shortness of breath • dermal contact may cause skin rashes
Freshwater organisms			
Cylindrospermopsis raciborskii	Cylindrospermopsin	Ingestion	• slow acting with liver and kidney toxicity
Dolichospermum circinale	Saxitoxins		• as above for paralytic shellfish poisons
Microcystis aeruginosa	Microcystins		• primarily hepatotoxins with some evidence of additional impact on the kidney and reproductive systems
Nodularia spumigena	Nodularins		• similar to microcystins
General cyanobacteria	Cells	Dermal/ingestion	• acute exposure causes skin rashes, eye irritation, gastro-intestinal illness

[a] the species listed are common examples but there may be other sources of harm and the listed toxins.

Further reading

- World Health Organization Guidelines on Recreational Water Quality (Chapter 5 Harmful Algal Blooms)
  https://iris.who.int/bitstream/handle/10665/342625/9789240031302-eng.pdf?sequence=1
- Food Standards Australia New Zealand *Shellfish Toxins in Food*
  https://www.foodstandards.gov.au/sites/default/files/publications/Documents/TR14.pdf
- GM Hallegraeff *Harmful Algal Blooms: A Global Overview*
  https://www.researchgate.net/publication/303918488_Harmful_algal_blooms_A_global_overview
- World Health Organization *Toxic Cyanobacteria in Water*
  https://www.who.int/publications/m/item/toxic-cyanobacteria-in-water---second-edition

Reviewed: 22 September 2025

For more information

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