

Harmful algal blooms

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Queensland
Government

What is a harmful algal bloom (HAB)?

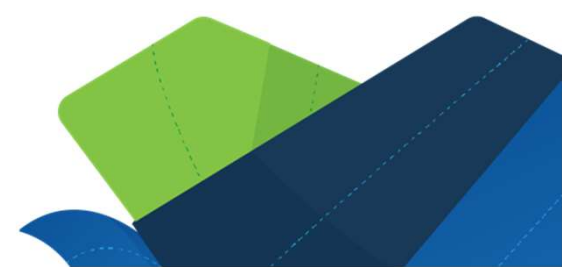
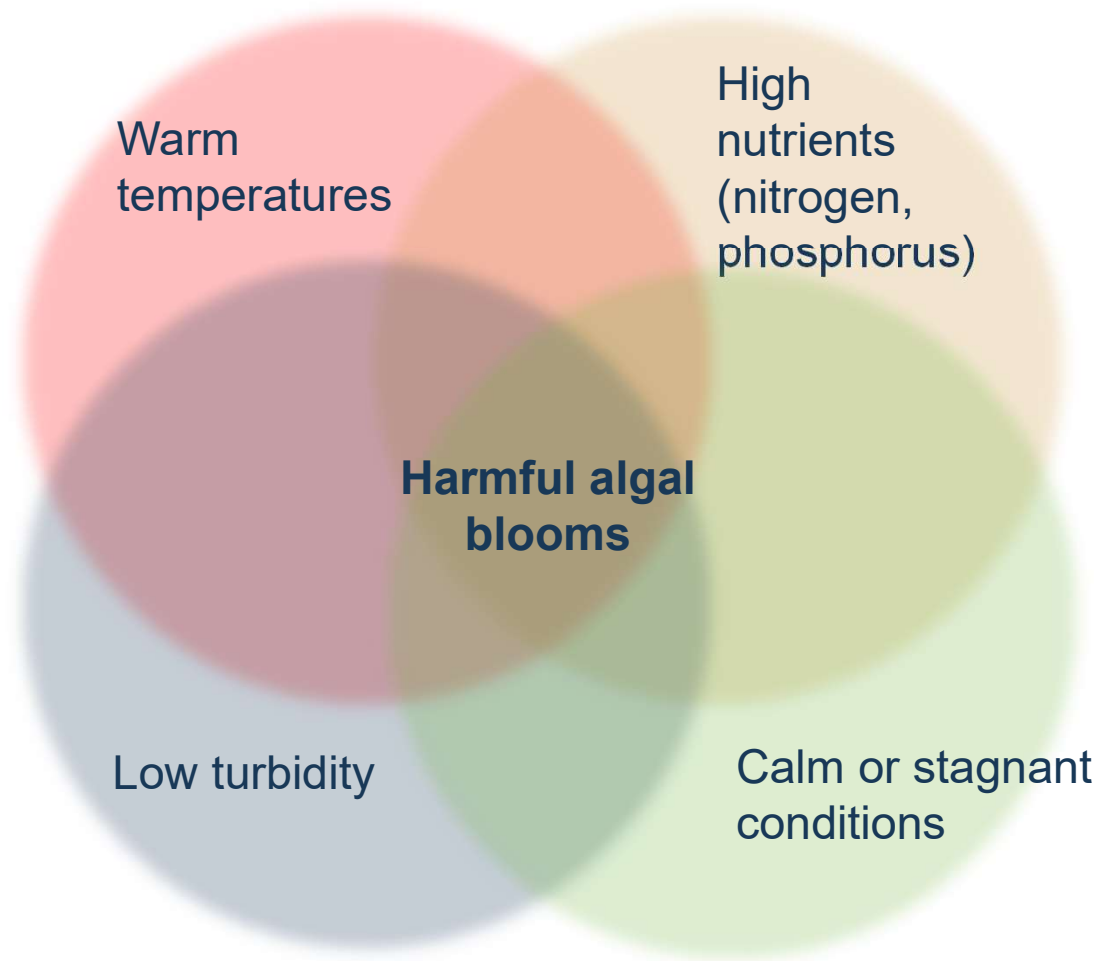
- An excessive growth of algae and/or cyanobacteria
- Cyanobacteria are bacteria that use sunlight to produce energy – they are often referred to as ‘blue-green algae’
- Blooms can impact water quality causing discolouration and the formation of scums, unpleasant tastes and odours.
- HABs can result in cyanotoxins



What is algae?



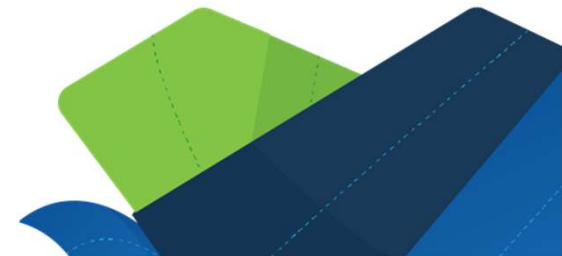
Why/when do HABs occur?



How long can blooms persist?



- Several weeks or even months
- Depending mainly on:
 - Temperature of the water
 - Concentration of nutrients
- Probability, duration and intensity can also be influenced by
 - Sewage effluent
 - Animal waste
 - Agricultural fertilisers
 - Deforested or cleared land in the catchment



Blooms can last for months over wide areas



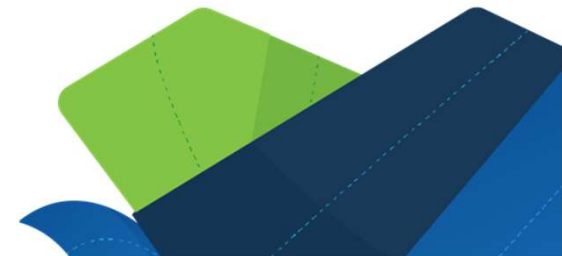
When is a bloom deemed 'harmful'?

- Certain strains of cyanobacteria can produce toxins
- It is not known what triggers cyanobacteria to produce toxins
- If toxins are produced, the rate of production can change
- The safest approach is to treat all blooms as toxic at all times
- Some species that produce toxins in one location may not produce toxins in another, emphasising the importance of local data.



More about toxins

- Toxins can exist both inside and outside cyanobacteria cells (called *extracellular* toxins).
- When cyanobacteria die off, toxins inside the cells may be released.
- Toxins can persist in the environment for months before being degraded by sunlight or other bacteria.
- Toxins cannot be inactivated by boiling water.



Toxins ≠ taste and odour compounds

- Toxins are odourless
- Harmful algal blooms often produce taste and odour compounds
- Taste and odour compounds may occur alongside toxins
- It is possible to have taste and odour compounds without toxins and vice versa



Exposure routes



Ingestion



Skin contact



Breathing in toxins

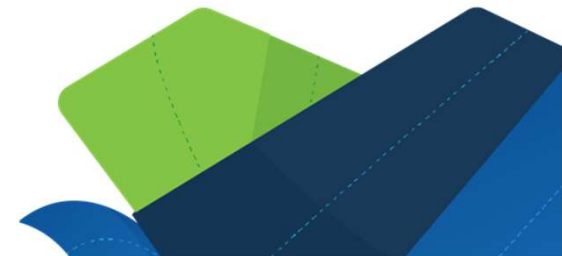


Eating contaminated
food



Common toxins in Queensland - Cylindrospermopsin

- Produced by *Raphidiopsis raciborskii* (*Cylindrospermopsis raciborskii*)
- Causes fever, headache, vomiting, bloody diarrhoea
- Multiple organ damage (cytotoxin)
- Can bioaccumulate in plants and animals
- Linked to death of livestock
- No 'antidote'
- Medical treatments focus on managing symptoms



Common toxins in Queensland - Microcystins

- Causes abdominal pain, headache, sore throat, vomiting, nausea, dry cough, blistering around the mouth, pneumonia
- Liver damage (hepatotoxin)
- May increase risk of certain cancers
- Has caused human deaths
- Can exist in multiple forms
- Can bioaccumulate in plants and animals
- No 'antidote'
- Medical treatments focus on managing symptoms



Other toxins

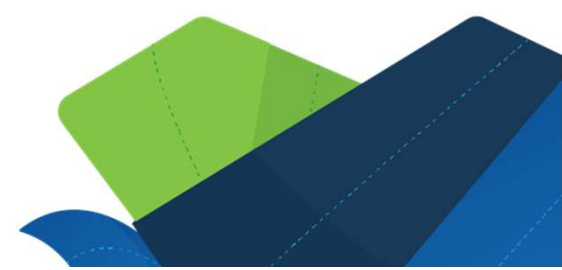
- Saxitoxin (paralytic shellfish poisoning)
- Nodularin
- Anatoxin-a
- Lyngbyatoxin
- ... and many more



Health impacts can be difficult to determine



- Symptoms can be general or vague, not “severe” enough
- Limited awareness
- Difficult to diagnose
- Limited information on some toxins

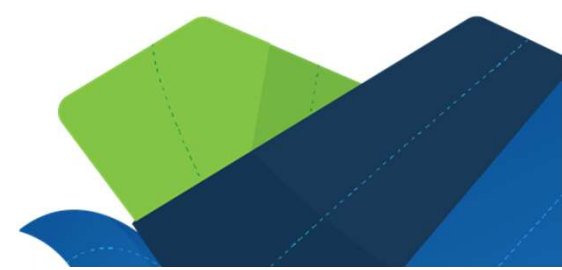
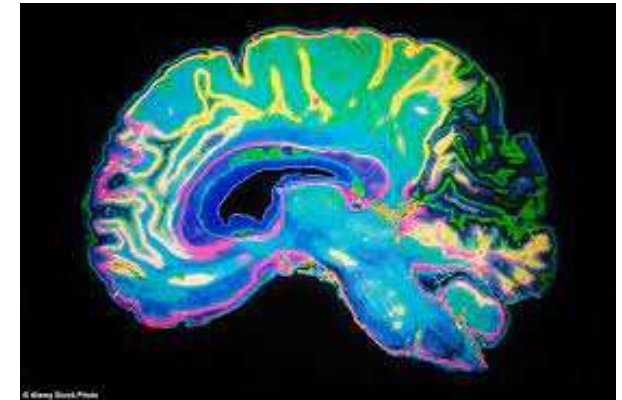


Ongoing research

- BMAA is a neurotoxin produced by some cyanobacteria
- Recent studies link BMAA exposure to neurodegenerative diseases
- Currently an active area of research

Toxic load: blue-green algae's role in motor neuron disease

Published: September 26, 2013 7:01am AEST



Ongoing research

Cyanobacteria names change

- *Cylindrospermopsis raciborskii* is now *Raphidiopsis raciborskii*
- *Anabaena cicrcinalis* is now *Dolichospermum circinale*



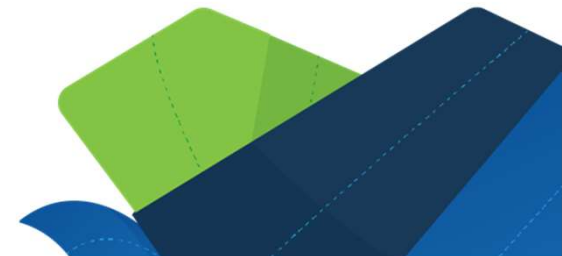
Other potential impacts of HABs

- Impacts on animal health
- Water quality – increased monitoring costs, increased treatment costs, need to use alternative water sources
- Social impacts – visual and odour impacts to recreational activities and neighbouring properties
- Environment – disruption to aquatic ecosystems



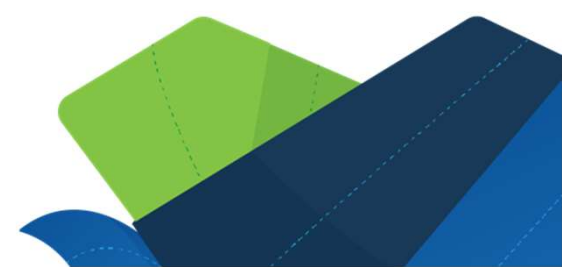
Options for preventing blooms in surface water

- Preventative measures can take a long time to establish and require a lot of maintenance.
- Catchment measures:
 - Artificial wetlands to act as a nutrient sink
 - Maintenance of vegetation around the storage to reduce input of nutrients and sediment
 - Fencing to prevent stock or human access
 - Engagement with upstream land managers to encourage them to limit inputs of nutrients into waterways



Using algicide or other treatments

- Will require WSR approval unless application is already approved under DWQMP
- Will require a new risk assessment for every application
- Need to demonstrate that WTP can produce safe water – eliminate treatment product and handle increased volume of dead cells or toxins if released
- Consider stakeholder and environmental impacts – harm to aquatic life and ecosystems
- Consider impacts of repeated use – build up of nutrients, build up of contaminants



When should the WSR be informed of a bloom?

- If a bloom is detected in source water, or a drinking water storage, the DWSP should follow the protocols set out in their approved DWQMP.
- If the plan does not yet include management of a bloom, follow the guidance in ADWG.
- ADWG contains notification and alert levels for cyanobacteria in drinking water.
- DWSP should notify the WSR if cyanobacteria results are at notification levels.
- As blooms and associated risks can increase exponentially, DWSPs should not delay notifying relevant stakeholders and seek help if required.

IF IN DOUBT PICK UP THE PHONE – IT IS NEVER TOO EARLY



1300 596 709

**Water Supply
Regulation**



How to respond to a bloom

- If a bloom is detected, the following sequence of treatment strategies is recommended:
 - physically removing or filtering intact cells first
 - adding or increasing powdered activated carbon
 - boosting oxidation.



Managing blooms via treatment processes

Treatment process	Removal of cells (and intercellular toxins)	Removal of extracellular toxins
Riverbank filtration, slow sand filtration	Effective	Effective
Coagulation and flocculation	Effective	Ineffective
Microfiltration or ultrafiltration	Effective	Ineffective
Reverse osmosis, nanofiltration	Not recommended	Effective

Treatment process	Removal of cells (and intercellular toxins)	Removal of extracellular toxins
Powdered activated carbon (PAC), granular activated carbon (GAC)	Not applicable	Effective
Ultraviolet (UV) radiation	Not applicable	Ineffective
Oxidation by chlorine, ozone	Not recommended	Effective for CYN, MC
Oxidation by monochloramine, chlorine dioxide	Not recommended	Ineffective

What happens if algae or toxins are detected in treated water or the retic?

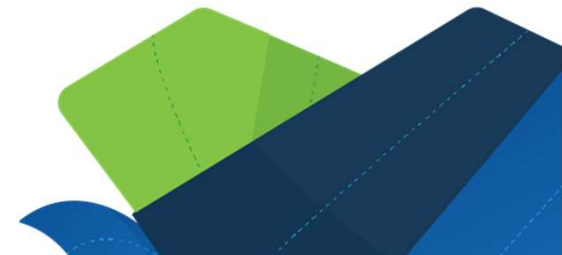
- It is difficult to deal with cells and toxins once they are in treated water storages or within the reticulation network.
- Chlorine dosing is the only effective method for removing algae and cyanobacteria from a reticulation network.
- This requires careful managing to avoid the other risks associated with high chlorine residual.
- If cells or toxins are present at levels that may cause human health effects, a do not use drinking water advisory may be required.



DO NOT USE

Summary

- Algal blooms contain cyanobacteria
- Cyanobacteria can produce toxins
- Toxins can have health impacts
- Some properties of cyanobacteria are still being researched
- Prevention is ideal
- If in doubt, contact WSR



Where to find out more

- QH FAQ
- US EPA factsheets
- American Water Works Association resources
- Other drinking water service providers
- QHFSS Laboratory staff
- WaterRA factsheets





Questions?

QH – waterquality@health.qld.gov.au

WSR – DrinkingWater.Reporting@rdmw.qld.gov.au