Blue-green algal blooms in the Myall Lakes

A widely documented and studied blue-green algal bloom occurred in the Myall Lakes system in 1999. That bloom was one of the first significant blue-green algal outbreaks to occur in a coastal brackish lake system in NSW, which had significant impacts for the commercial fishing industry, local tourism operators, businesses and recreational users. Since that time, research into blue-green algae, including new technology to better identify and analyse toxins, together with revised guidelines on the impact on water users, have allowed government agencies to better monitor and analyse algae in order to minimise the impact on the public whilst at the same time ensuring that public health and safety are maintained.

Why is blue-green algae harmful?

Blue-green algae (Cyanobacteria, Cyanophyceae or cyanoprokaryotes) is the name commonly used to describe a number of algae that produce a blue or green colour in the water. It can appear as a green paint-like scum in the nearshore edges or as green specks throughout the water. A distinctive earthy odour is often associated with the presence of blue-green algae.

All blue-green algae possess contact irritants that can cause skin, eye and nose irritation, and if swallowed, nausea and gastro-enteritis. A guideline value for this type of algae sets recreational criteria to protect swimmers and other recreational water users. Additionally, there are some species of blue-green algae that produce more harmful toxins, that if swallowed can cause more severe health impacts affecting the neurosystem, liver or other organs. These toxins, if present, have been found to accumulate in shellfish and prawns. The guideline values for these type of algae are set at recreational criteria to protect swimmers from swallowing toxins. Specific levels are also set for prawns, fish and shellfish to protect people from consuming affected seafood. The guideline levels for these ‘potentially toxic’ algae are much lower than those for the contact irritant only algae.

It should also be noted that ‘potentially toxic’ algae species do not always produce toxins and specific testing must be undertaken to determine if toxins are present in each individual bloom.

More information about algae can be found at the NSW Office of Water Web site www.water.nsw.gov.au

Why does algae seem to come and go?

Blue-green algae is difficult to monitor. It floats to the surface to photosynthesis then sinks as it becomes heavy. Apart from the ability to regulate its buoyancy, blue-green algae does not possess any other ability to move, unlike some other algae, but it is subject to mixing by the wind and is often found as scums in nearshore areas after being pushed there by the prevailing wind. After windy days and during a hot still morning, scums of algae, appearing as ‘green paint’ may be seen in the nearshore areas. Once the afternoon wind picks up this scum is often remixed within the water column. In the Myall Lakes system, algae can also be mixed in the river waters of the Lower Myall River and float towards Port Stephens. It may be seen dying and washed up on intertidal areas as green, blue and white scums. The high salinity in the tidal areas means that this algae will not survive.

What type of monitoring normally occurs?

In Myall Lakes, the Hunter Regional Algal Co-ordinating Committee (HRACC) initially undertakes reconnaissance sampling to identify the extent of the blue-green algal bloom. The sampling is then ‘refined’ - based on initial algae locations and previous studies into how water moves within the Myall Lakes system. Essentially, the water moves from the catchment into the lakes, circulates, flows into the upper lakes and then flows down the Myall River to Port Stephens. Regular sampling at sites within all the lakes and the Lower Myall River allows the HRACC to provide adequate warnings to the public and ensure that seafood is safe to eat. The sampling is normally undertaken from the top 1m of water column, as this is the area that most recreation is undertaken.
The laboratory analysis includes identifying the species present in order to apply the guidelines and the number of cells of algae (biovolume). Toxicity testing of the water is also undertaken to determine if toxins are present in the water. If toxins are present in the water, samples of fish and prawns are collected and analysed for toxins in both the flesh and the offal.

To date, no toxins have been found in the water samples or seafood as a result of the current bloom. However, algal species may change over time, which means the species may produce toxins. Regular water toxin testing is occurring.

**Why do blue-green algal blooms occur?**

**Salinity**

The 1999 algal bloom led to a range of research into the causes of that bloom. The main conditions that led to the bloom were decreased salinity for a sustained period in the lakes caused by above average and ongoing rainfall. Blue-green algae needs stable conditions to grow, as it is one of the slowest growing of the algae species. The potentially toxic species (apart from Nodularia not known to occur this far north) are far less tolerant to high salinity than other species of blue-green algae. In the 1999 bloom, and so far during this bloom, the salinity in the Broadwater is much lower than that of the top Myall Lake as it is subject to fresh water inflows from the upper Myall River and mixing with saline water from the tidal Lower Myall River. As such, the blue-green algae dominance in both lakes is different. The upper Myall Lake, which is subject to less variability in salinity maintains a stable community of algae. To date, the blue-green algae component in the upper Myall Lake has been of mostly non-toxic species and less than the recreational guideline for warnings.

After the 1999 bloom the NSW Government installed a long term salinity monitoring station in the Broadwater to provide an early warning to the conditions that may promote blue-green algal blooms. The graph at Figure 1 below shows the January – February 2012 period - as a rise in water level after rainfall (red line) and the blue line as a drop in salinity. The previous research indicated that sustained levels of salinity below 2ms cm -1 may trigger blue-green algal blooms in the Broadwater.

**Figure 1: Graph of recent salinity (blue) and water level (red) in Broadwater.**

**Catchment inflows**

River inflows have been delivering nutrients for many thousands of years into the Myall Lakes. During rainfall events catchment inflows bring in available nutrients to fuel blooms. However, the long history of nutrient inflows has also meant that the sediments in the lakes have a large store of nutrients. There are times when low oxygen levels occur in the sediment /water interface. When this happens, nutrients normally bound in the sediments become available in the water for algae to use. This was found to occur when freshwaters entered the Broadwater delivering high organic loads and when stratification occurred (salinity and freshwaters meeting creating a barrier to
mixing). Turbidity of catchment inflows was also thought to give blue-green algae a competitive edge over other species of algae due to its ability to regulate its buoyancy within the surface to optimise photosynthesis.

More information on the history of algal blooms and some of the research can be found at the NSW Office of Water website: www.water.nsw.gov.au

**How long will the blue-green algal bloom last?**

During prolonged periods of wet weather, as we have experienced this summer, conditions become favourable for an algal bloom in the Myall Lakes.

It is impossible to put a time on when the bloom will cease as the interaction between environmental conditions, water quality and temperature influence bloom longevity. However as the weather pattern shifts to a drier phase, salinity in the lakes will rise to a point where a bloom cannot be sustained. If this is coupled with autumn and winter air and water temperature decreases, algal growth is often slowed and blooms may not be sustained.

**What this means for people using the Myall Lakes?**

During a blue-green algal bloom, people are advised to avoid all contact with the affected water.

Skin contact through showering, bathing, swimming, water skiing and other recreational activities may result in skin irritation and rashes, swollen lips, eye and ear irritation, sore throat, hayfever symptoms and asthma.

Drinking water with blue-green algae in it may cause nausea, vomiting, abdominal pain, diarrhoea, liver complications and muscle weakness.

If you experience medical conditions that you think may have been caused by water with blue-green algae in it, you should visit your local doctor or hospital.

The HRACC have been testing water and seafood for toxins and to date no toxins have been found. However as species of algae and the toxins levels may change common sense would suggest not to consume fish caught in water affected by a bloom. There is some evidence that small quantities of algal toxins may enter fish flesh when a bloom produces toxins. Any fish caught in water affected by a bloom should be cleaned and washed thoroughly in uncontaminated water and any internal organs disposed of before consumption. People should not eat mussels, crayfish or the internal organs of fish from high level blue-green algae alert areas.

**Is there a way of preventing future blue-green algal blooms in Myall Lakes?**

The 2009 Great Lakes Water Quality Improvement Plan (QIP) used scientific data collection and modelling to identify the catchment activities that contribute to water quality decline and actions that will improve water quality in the Myall Lakes.

The QIP found that the Broadwater is a “slightly to moderately disturbed” ecosystem that has previously experienced potentially toxic blue-green algal blooms and loss of deepwater aquatic plant communities.

About 80 per cent of the nutrients and sediments that enter the Myall Lakes are transported into the Broadwater via the upper Myall River. Eroded river banks, unvegetated slopes, degraded wetlands, gravel roads, agricultural lands and residential areas in the catchment all contribute.

These pollution sources, coupled with long water retention times, explain the decline in the health of the Broadwater and its susceptibility to blue-green algal blooms.

The Myall Lake on the other hand, is a “high conservation value” ecosystem that is largely unmodified and in good condition, with well established aquatic plant communities. The catchment for the Myall Lake is mostly covered by native vegetation, because it is protected within the national park and the lake is little affected by the nutrient and sediment-rich water entering the system via the Myall River.
The Two-Mile and Boolambayte Lakes are generally in good condition, but are more affected by inflows from the Myall River, and have experienced some loss of aquatic plant communities and have hosted toxic blue-green algal blooms previously.

**Working together to improve water quality in the Myall Lakes**

Improved catchment management is a long term solution to reducing the number of blue-green algal blooms. The Myall Lakes catchment is made up of all of the rivers and streams that flow into the lake system including the lands adjacent to those waterways.

By better managing activities on the land that contribute soil and nutrients to the waterways, we can maintain or improve the water quality of the lake system. For example, protecting soils from erosion and maintaining good vegetation cover will lead to better water quality as less sediment and nutrients will enter waterways.

Government agencies are working in the catchment, together with the community, to implement the actions in the WQIP, to improve the water quality of the Myall Lakes (see factsheet - Implementing the Great Lakes Water Quality Improvement Plan in the Myall Lakes).

**Figure 2. Map of Myall Lakes**

![Map of Myall Lakes](image-url)