Algae in Estuaries of the Shoalhaven

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What Are Algae?

Algae are simple plants. They grow by harvesting sunlight using photosynthetic pigments. Algae do not have roots or flowers, which distinguishes them from seagrasses and mangroves, the other plants that we commonly have in our estuaries.

Types of Algae in Our Estuaries

Macroalgae, or seaweeds, are plants that are clearly visible to the naked eye. They can be free floating or attached to sand, rocks, snags or other living plants. Macroalgae are broadly classified as red, green or brown algae according to the diverse combinations of photosynthetic pigments they contain. Macroalgae vary greatly in form: they may grow as a simple sheet of cells, a long filament or with more complex structure having highly differentiated bodies consisting of blades, stalks and holdfasts for attachment.

Microalgae are extremely small plants consisting of just one or a few cells. They may live in the water column (phytoplankton) or on surfaces such as the mud or rocks on the bottom of the estuary (benthos) or on other plants (epiphytes). Individual microalgae plants are too small to be seen with the naked eye but when they are present in very large numbers they may colour the water red, green or brown or form a scum on the surface.

The Importance of Algae for Our Estuaries

The numerous species of algae that live in our estuaries are natural components of the region's biological diversity. More than 200 species of macroalgae have been described from Jervis Bay. Some algae are stunningly beautiful in appearance.

Several species of algae typically grow on the peg roots (pneumatophores) of the Grey Mangrove in our estuaries. Image by Peter Dalmazzo.

As primary producers, algae are the basis of food chains for many other forms of life in our estuaries (such as bacteria, invertebrate animals, fish and birds). As well as providing food, algae absorb carbon dioxide and produce the oxygen on which fish and air breathing animals rely. Macroalgae also provide structural habitat (a place to live) for fish and invertebrate animals.

When algae grow, they absorb nutrients from the surrounding water. This nutrient cycling can help maintain good water quality. One important example of this involves abundant, microscopic algae called diatoms.

Diatoms have a silicon case and are therefore relatively heavy, so they sink rapidly to the bed of the waterway. When they sink, they transport nitrogen compounds they have absorbed from the water into the sediments where bacteria convert them to nitrogen gas. The nitrogen gas bubbles to the atmosphere, removing this nutrient from the waterway.

What Is An Algal Bloom?

When massive amounts of macroalgae or microalgae are present in a waterway it is called an algal bloom. Not all algal blooms are caused by humans - they even occur in pristine estuaries where there are minimal human impacts. Algal blooms are triggered when environmental conditions are just right for the rapid growth and reproduction of algae. Certain species of algae respond rapidly to changes in and interactions between environmental factors including:

- nutrients
- rainfall
- light
- day length
- water clarity
- water depth
- temperature

Different kinds of algae respond to different triggers and different species bloom in different geomorphic parts of our waterways. In Jervis Bay, algal blooms are thought to occur when naturally nutrient-rich water from the deep ocean wells up and enters the bay. In our intermittently closed and open coastal lakes and lagoons, algal blooms occur in poorly flushed zones especially during periods of low rainfall. According to Dr Alan Millar of the Sydney Royal Botanic Gardens these major blooms are mostly natural phenomena and occur all over the world. The plants and animals in our waterways, including fish and prawns, have evolved in association with these natural cycles of boom, bust and nutrient cycling.

A bloom of filamentous green algae in Lake Tabourie 2009. Image by Peter Dalmazzo.

Human Impacts

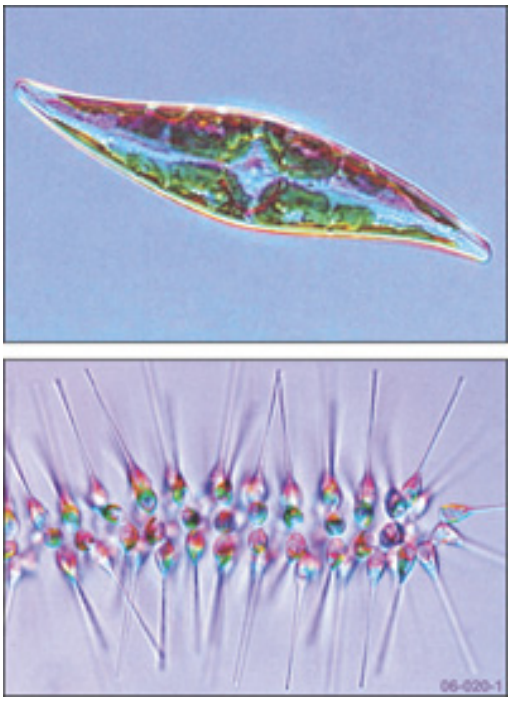
In addition to natural algal blooms, human actions that affect environmental triggers can also cause blooms of macroalgae and microalgae. Blooms exacerbated by human actions may occur more often or last longer than natural blooms.

The most common human impact leading to algal blooms is an increase in nutrients, especially nitrogen and phosphorus. Unnaturally high levels of nutrients can enter our estuaries from the following sources

- rural and urban runoff (containing sediment, animal faeces and fertilisers)
- sewage effluent
- industrial discharges.

An estuary is said to be eutrophic when the rate of nutrient addition

exceeds the rate of nutrient removal and the resulting high levels of nutrients encourage dense growth of algae. Our estuaries effectively trap sediments and nutrients from their catchments and are particularly prone to eutrophication.



Microscopic diatoms are algae that are abundant in our estuaries and are important for keeping estuaries clean. Images by L Drake & M Doblin, reproduced with permission Geoscience Australia.

Effects of Algal Blooms

Some algal blooms are toxic, but most are not. Toxic algae can affect people, pets, stock and wildlife if they come into contact with a bloom. However, even nontoxic algae can affect the environment during a bloom.

Dense algal blooms, if they persist for a long time, can affect the health of seagrasses by shading them. Seagrass beds are extremely important as fish nurseries.

When the algae in blooms start to die, the algal bodies are broken down by bacteria. If a large amount of rotting algae is present, the enormous number of bacteria feeding on the plants can use up all the oxygen in the water. Fish and invertebrates can then suffocate. In such situations, fish may be seen gasping at the surface, or may even die, with large numbers of dead fish being washed ashore. This is known as a fish kill.

Some algal blooms may also impact on the amenity and recreational use of our estuaries - smelly, slimy masses of macroalgae in places where people like to swim or fish are not popular!

The rotten egg gas odour sometimes associated with decomposing algae can be detected by our noses at extremely low concentrations, well below levels that are considered to be a health hazard.

Introduced Species of Algae

There are some species of algae present in our estuaries that are not native to the area and may threaten ecosystems. For example, *Caulerpa taxifolia* is an invasive seaweed that has been found in St Georges Basin, Lake Conjola, Narrawallee Inlet and Burrill Lake. *Caulerpa* overgrows native seagrasses, altering marine ecosystems and it is difficult to eradicate.

What Can We Do?

Enjoy the diversity and beauty of our native algae!

Macroalgae are protected plants and must not be harmed unless a permit is obtained under fisheries legislation. However, you are allowed to collect up to 20kg/day of dead, unattached, drift seaweed (wrack) from beaches or

the intertidal zone for personal use (e.g., as compost or fertiliser).

The highest priorities for controlling unwanted algal blooms rely on reducing sediment and nutrient inputs and retaining natural flushing. Harvesting of algae might be necessary in some cases where blooms are a problem but this itself can have significant environmental impacts.

You can help improve water quality and reduce algal blooms:

Actions to do more often	Actions to avoid
Sweep the gutters and driveways regularly and place the sweepings on the garden or in the compost	Washing the car in the street
Do not allow soil or mulch to be washed or blown off the garden	Hosing dirt off hard surfaces like paths and driveways, into gutters
Clean up pet droppings and dispose of them thoughtfully	Dropping packaging or cigarette butts on the ground.
Rake up leaves or lawn clippings and use them as mulch on the garden or place them in the compost	Leaving rubbish where bins are already full
Grass or replant areas of disturbed soil	Hosing leaves and grass clippings into gutters
Use the minimum amount of detergent for cleaning outside	Using too much fertiliser. Follow the instructions
Wash cars on the lawn or gravel and use minimal detergent. Empty the soapy water down the sink or toilet. Alternatively, take the car to a car wash where the water gets treated and recycled	Piling sand and soil on areas where it can be washed into the stormwater system.
Make sure sewerage pipes are not connected illegally to stormwater	Using pesticides, fertiliser and herbicides when rain is forecast for the same day
Install a rainwater tank	Disposing of oil or chemicals into the gutters
Replace concrete or other hard surfaces with permeable surfaces such as timber decks and pavers with gaps between pavers	Pouring paint, solvent or cleaners in the gutter or where they may enter drains
Get involved with bushcare or landcare projects that restore or protect local waterways	Covering large areas with impervious surfaces e.g. bitumen, concrete