1-1-1984

Algal growth and the phosphorus cycle

Arthur J. McComb
K. S. Hamel
A. L. Huber
D. K. Kidby
R. J. Lukatelich

Follow this and additional works at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4

Part of the Environmental Health and Protection Commons, Other Plant Sciences Commons, and the Terrestrial and Aquatic Ecology Commons

Recommended Citation


Available at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol25/iss3/3

This article is brought to you for free and open access by Research Library. It has been accepted for inclusion in Journal of the Department of Agriculture, Western Australia, Series 4 by an authorized administrator of Research Library. For more information, please contact jennifer.heathcote@agric.wa.gov.au, sandra.papenfus@agric.wa.gov.au.
IMPORTANT DISCLAIMER

This document has been obtained from DAFWA’s research library website (researchlibrary.agric.wa.gov.au) which hosts DAFWA’s archival research publications. Although reasonable care was taken to make the information in the document accurate at the time it was first published, DAFWA does not make any representations or warranties about its accuracy, reliability, currency, completeness or suitability for any particular purpose. It may be out of date, inaccurate or misleading or conflict with current laws, polices or practices. DAFWA has not reviewed or revised the information before making the document available from its research library website. Before using the information, you should carefully evaluate its accuracy, currency, completeness and relevance for your purposes. We recommend you also search for more recent information on DAFWA’s research library website, DAFWA’s main website (https://www.agric.wa.gov.au) and other appropriate websites and sources.

Information in, or referred to in, documents on DAFWA’s research library website is not tailored to the circumstances of individual farms, people or businesses, and does not constitute legal, business, scientific, agricultural or farm management advice. We recommend before making any significant decisions, you obtain advice from appropriate professionals who have taken into account your individual circumstances and objectives.

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia and their employees and agents (collectively and individually referred to below as DAFWA) accept no liability whatsoever, by reason of negligence or otherwise, arising from any use or release of information in, or referred to in, this document, or any error, inaccuracy or omission in the information.
ALGAL GROWTH and the phosphorus cycle

By A. J. McComb1, K. S. Hamel2, A. L. Huber2, D. K. Kidby2 and R. J. Lukatelich1

Larger algae and microscopic phytoplankton foul the waters of the Peel-Harvey estuarine system, upsetting the fishery and polluting the beaches.

These aquatic plants grow in response to phosphorus runoff from drainage, trapping phosphorus in the estuary and using it in their growth. When they die this phosphorus remains in the system to be recycled for further plant growth.

Algal pollution in the estuary can be lessened by reducing the amount of phosphorus entering the system, increasing phosphorus losses to the ocean, or in some way blocking the trapping and recycling processes.

Macroalgae

The most prominent of the macroalgae are the ball-forming green alga Cladophora ('goat weed'), the paler-green Enteromorpha, and the hair-like Chaetomorpha. These algae were not prominent in the estuarine system until the mid 1960s when massive accumulations of goat weed appeared on the beaches of Peel Inlet. Since then the amounts and type of algae have varied, with an estimated maximum of 70,000 tonnes in the estuary in 1979.

Seagrasses

Seagrasses are not algae but resemble the conventional grasses. They live submerged in the shallower waters of the estuary where they are grazed by swans and ducks. Seagrasses are important in food chains and are ecologically more desirable than macroalgae.

Seagrasses have been smothered by masses of macroalgae in some areas. They are much more prominent in Peel Inlet than in Harvey Estuary, where wind-stirring of the sediments greatly reduces the amount of light penetrating to the estuary floor. Seagrass leaves which accumulate on the shores in some seasons do not rot as offensively as do the macroalgae.

Phytoplankton

Phytoplankton are microscopic organisms suspended in the water. Under calm conditions some tend to sink, others to float; all are readily stirred into the water by wind. Two groups are particularly important in the Peel-Harvey estuary.

The first are diatoms, microscopic algae which build up large populations—blooms—in winter. Diatoms are grazed by small animals.

The other is the microscopic blue-green alga Nodularia. This alga can fix atmospheric nitrogen for its growth. Nodularia forms massive, foul-smelling blooms in Harvey Estuary, and to a lesser extent in Peel Inlet, in early summer. Fish and other animals avoid Harvey Estuary during the blooms because of the Nodularia filaments, which entangle their gills, the reduced light levels in the water, and the reduced oxygen levels.

Importance of phosphorus

Nitrogen and phosphorus are essential for aquatic plant growth. These two nutrients are required in large amounts, but are usually present at low concentrations in natural waters.

Because the blue-green Nodularia can fix atmospheric nitrogen, the amount of nitrogen available from other sources is not as critical to its growth. Provided enough light penetrates the water and the temperature is suitable, the amount of phosphorus entering the system controls the amount of plant material found in the estuarine system.

The size of the Nodularia bloom in summer is influenced by the amount of phosphorus entering Harvey Estuary the previous winter.
If phosphorus were to be stopped from entering the system in a particular winter, there should be a smaller \textit{Nodularia} bloom the following summer.

Research shows that although enough phosphorus has accumulated in the top few centimetres of the sediment to sustain \textit{Nodularia} growth for a time, a significant reduction in the amount of phosphorus entering the estuary would greatly reduce \textit{Nodularia} blooms in the relatively short term. But stopping the application of phosphorus to paddocks in the Harvey catchment would be followed by an unknown period of run-down as accumulated phosphorus is leached from the soil into the estuary, rather than a sudden significant reduction. Thus the rate of recovery of the estuary would be limited by the rate of run-down from the catchment.

\textbf{Trapping phosphorus in the system}

Diatoms and other microscopic organisms trap and use phosphorus entering the water in winter in their growth. When they die they become a part of the sediment, and help to build up the phosphorus 'bank' to fuel \textit{Nodularia} blooms in summer.

Once the \textit{Nodularia} starts to bloom, less oxygen is available at the floor of the estuary and this enhances the release of more phosphate from the sediment.

Once the \textit{Nodularia} starts to bloom, less oxygen is available at the floor of the estuary and this enhances the release of more phosphate from the sediment.

\textbf{The future}

A reduction in phosphorus accumulation—that is, an increase in the rate of loss of phosphorus to the ocean as well as a reduction in the amount of phosphorus entering the estuarine system from the catchments—will immediately lessen the severity of blue-green algal blooms. In the Harvey Estuary this will probably lead to a small increase in the amount of seagrasses and macroalgae.

In Peel Inlet smaller phytoplankton blooms will lead to better light penetration to the floor of the estuary, and a consequent increase in the amount of macroalgae, which will continue to be mechanically harvested. At a later stage, a reduction in the amount of nutrients entering the Peel Inlet will lead to less macroalgae and relatively more seagrasses.