GOVERNMENT OF WESTERN AUSTRALIA

SWAN RIVER TRUST

Fact Sheet

# *Karlodinium veneficum:* a harmful microalga

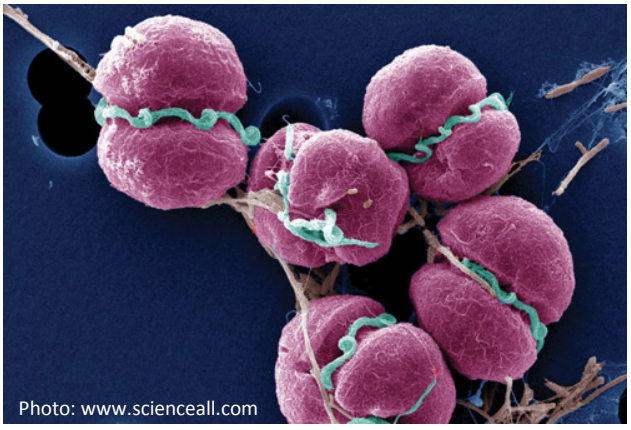
Photo: www.scienceall.com

*Karlodinium veneficum* is a single cell microscopic dinoflagellate alga. It occurs in the marine and brackish waters of the estuary and is found in coastal and estuarine systems around the world.
*K. veneficum* can photosynthesise like a plant and it can also hunt other microbes, using a toxin to stun its prey. Unfortunately, under the right conditions, this toxin is also poisonous to fish.

## Description

A single-celled dinoflagellate alga that ranges from about 8 -12 microns in length[1], which is slightly larger than a human red blood cell. These cells propel themselves through the water column using two whip-like flagellae. There are nine known species in the *Karlodinium* genus[2]. *K. veneficum* is the only species positively confirmed in the Swan and Canning estuaries however there is some evidence that at least one more species may be present.

## Distribution

*K. veneficum* has been recorded in coastal and estuarine waters in many locations all around the world and is considered a cosmopolitan species[1]. In WA, it has been recorded in the Serpentine, Murray, Harvey, Brunswick and Collie Rivers as well as the Swan and Canning estuaries.

## Habitat

*K. veneficum* is considered to be part of the plankton – a collective term for all the small, free-swimming organisms found in the water column. It is typically found in brackish or saline waters at temperatures from 17°C - 30°C. In the Swan and Canning estuaries, *K. veneficum* prefers calm, warm, sunny conditions just after rainfall, when nutrients are supplied with the rainfall run-off. Stratification[A] of the water column helps to support the growth of this alga by promoting conditions where nutrients are released from the bottom sediments.

## Biology

Unlike many algae, which only photosynthesize[B], this alga can also prey upon other microbes to gain energy and nutrients. *K. veneficum* cells produce toxins that are thought to help immobilize prey but they may also act to deter predators. Unfortunately many of these “karlotoxins” also impact fish by damaging their gills and in severe cases they may cause fish death.

A:Stratification occurs where water masses with different properties (eg: salinity, temperature) form layers that act as barriers to water mixing that could lead to low oxygen levels in the deeper layers.
B: Process of utilizing light energy to manufacture carbohydrates from carbon dioxide and water.

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## Consequences for the Swan Canning Riverpark

When conditions are favourable and *K. veneficum* densities increase sufficiently, the bloom can change the colour of the water to a reddish- brown and create a petroleum-like sheen on the water's surface. A characteristic "fishy" odour may also be present. Contact with the water in these conditions does not present a danger to human health, however a thorough rinse with fresh water immediately after exiting the water is recommended.

*K. veneficum* blooms are often associated with and promote low oxygen conditions in the water column. Such conditions cause stress to a wide range of vertebrate and invertebrate fauna.

When *K. veneficum* cells die they release their toxins into the water column. If environmental conditions trigger sudden mortality of a bloom, the combined release of toxins into the water column can result in fish deaths. Karlotoxins cause damage to epithelial cells lining a fish's gills, restricting its ability to breathe and, in severe cases, the result can be death by asphyxia[3][4].

## Management Messages

While the Trust can monitor and report *Karlodinium* densities and predict and respond to fish deaths, there are currently no methods available for direct control of these algal blooms. The Trust is addressing this by funding research and development aimed at exploring promising *Karlodinium* bloom control techniques, including the use of floccing clays.

Harmful algal blooms have been linked to higher nutrient levels in our waterways. The Trust works closely with other government agencies, local government authorities, community groups and research institutions to reduce nutrient and organic loading to the system. This is a priority issue for the waterway that has impacts on water quality, ecological health and community benefit. Nutrients and organic loading are being addressed through a catchment to coast approach that aims to:

- reduce nutrients inputs at their sources in the catchments;
- intercept nutrients and other contaminants as they travel through drains, tributaries and groundwater;
- address the in-river effects of excess nutrients and organic matter through intervention approaches, such as oxygenation and the application of Phoslock®, a nutrient binding clay.

References:


[1] Place, A. R., H. A. Bowers, et al. (2012) "*Karlodinium veneficum* - The little dinoflagellate with a big bite." Harmful Algae 14: 179-195.

[2] Guiry, M.D. & Guiry, G.M. (2014). AlgaeBase. World-wide electronic publication, National University of Ireland, Galway. http://www.algaebase.org; searched on 22 May, 2014.

[3] Deeds, J. R., D. E. Terlizzi, et al. (2002). "Toxic activity from cultures of *Karlodinium micrum* (=*Gyrodinium galatheanum*) (Dinophyceae) - a dinoflagellate associated with fish mortalities in an estuarine aquaculture facility." Harmful Algae 1(2): 169-189.

[4] Mooney, B. D., G. M. Hallegraeff, et al. (2010). "Ichthyotoxicity of four species of gymnodinioid dinoflagellates (Kareniaceae, Dinophyta) and purified karlotoxins to larval sheepshead minnow." Harmful Algae 9(6): 557-562.