# TOXIC ALGAE

## IN WELLINGTON REGION RIVERS

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

# Introduction

Toxic algae has been a major concern for river and stream users ever since five dogs died after coming into contact with toxic algae in the Hutt River, just over ten years ago. Since that time we have gathered large amounts of information on what causes it and how we might be able to manage it in the future.

## What is toxic algae?

Toxic algae (or cyanobacteria, to give it its proper scientific name) are an ancient group of photosynthetic organisms that have been around for over three billion years. There are over 2,000 species worldwide. They occur in almost every environment imaginable from deserts to Antarctic ponds, freshwater to marine habitats, and nutrient poor to nutrient rich waters.

During the last decade, toxic algal blooms have been a frequent occurrence in many New Zealand rivers and streams. The most widespread bloom-forming type of toxic algae is called *Phormidium*. It commonly forms thick leathery black/brown mats across large areas of the river or stream bed.

## Why is it a problem?

Some species of *Phormidium* produce toxins, including several kinds of neurotoxins (which affect the nervous system). Scientific investigations have identified *Phormidium autumnale* as the main toxin-producing species in New Zealand, and the species most commonly found in the Wellington Region.

If swallowed these toxins can cause vomiting, diarrhoea and severe abdominal pain. **Dogs are particularly at risk because they love the musty odour of toxic algae and will eat it.** Signs a dog has been poisoned by toxic algae include panting, lethargy, muscle tremors, twitching and convulsions. In extreme cases death can occur within 30 minutes. In the Wellington Region at least 17 dogs have died from toxic algae poisoning.

## What have we been doing about it?

Since the summer of 2005/06, when five dogs died after coming into contact with toxic algae in the Hutt River, we've been monitoring the abundance of toxic algae in rivers and streams as part of our environmental science programmes.

We also got together with local city and district councils across the region to inform river and stream users of the risks of toxic algae. An online interactive map, updated regularly during the summer season when toxic algal blooms reach peak levels, provides warnings to the public about sites which are affected by toxic algae.

The following information summarises a decade of monitoring and research on toxic algae in the Wellington Region. This information will help inform decision-makers on how to manage toxic algae in the future.

For more details, there is a full technical report available at **gw.govt.nz/technical-reports**

**MYTH**

**Toxic algal blooms are a new or 'modern' problem**

**BUSTED!**

One of the first documented cases of toxic algae poisoning was in the early 1960s in Canada. Several herds of cattle died as a result of drinking water from a lake containing toxic algal blooms.

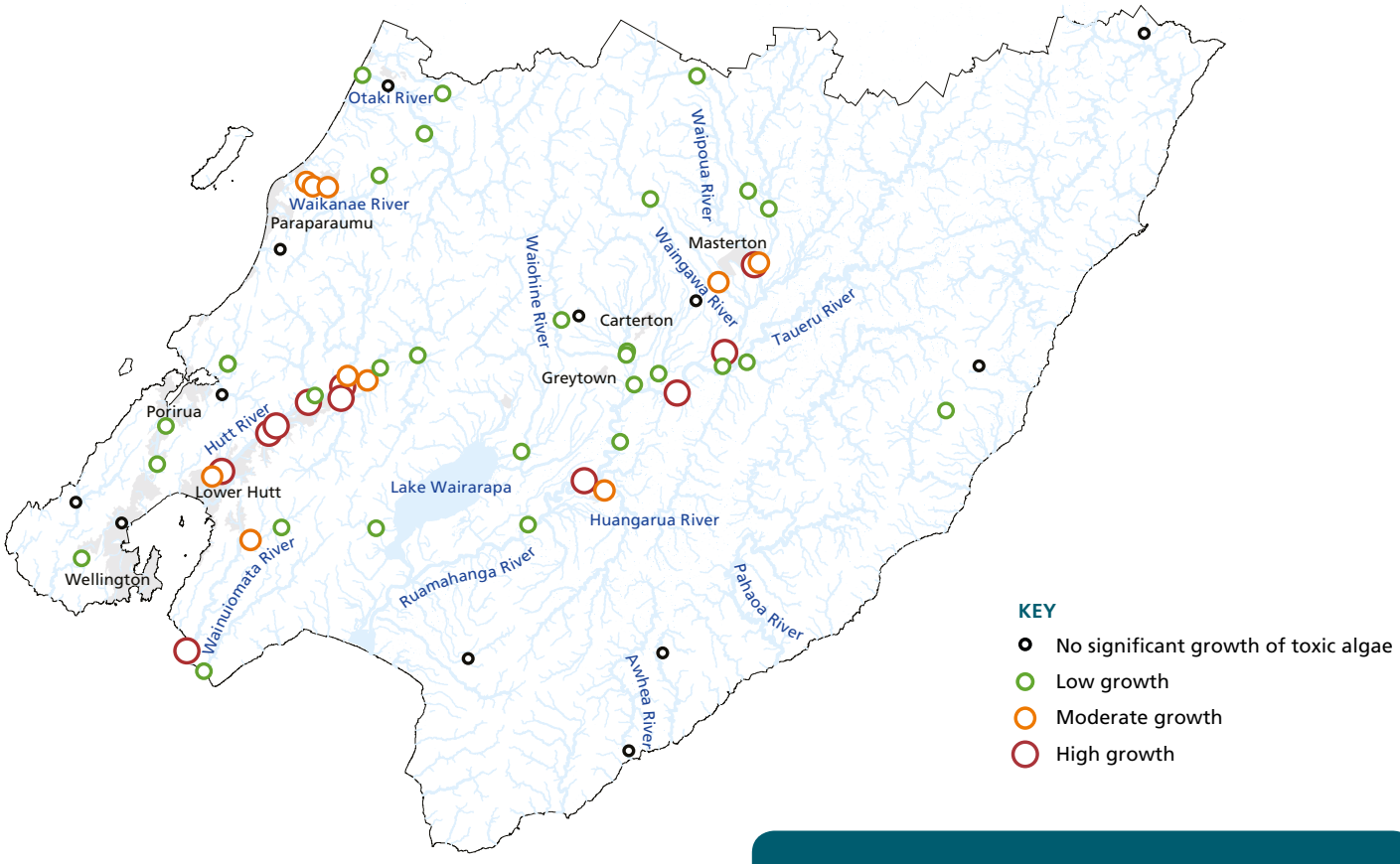
# When and where does toxic algae occur in the Wellington Region?

*Phormidium* occurs in virtually all rivers in the region, but extensive blooms tend to be limited to the large gravel-bed rivers in Kapiti, the Hutt and central Wairarapa.

The biggest and most frequent *Phormidium* blooms occur in the Hutt and Waipoua rivers during summer. However, blooms do not necessarily occur every summer.

For example, no blooms were recorded in the Hutt or Waipoua rivers in the 2013/14 or 2014/15 summers.

**Interestingly, toxic algae are not always toxic!**
There have been around 220 tests done on toxic algae samples taken from a range of river, stream and lake sites across the region. Anatoxins (a kind of neurotoxin) were only detected in 59 percent of the samples.




Toxic algae blooms tend to occur in large gravel-bed rivers, with the largest and most frequent blooms occurring in the Hutt and Waipoua rivers.

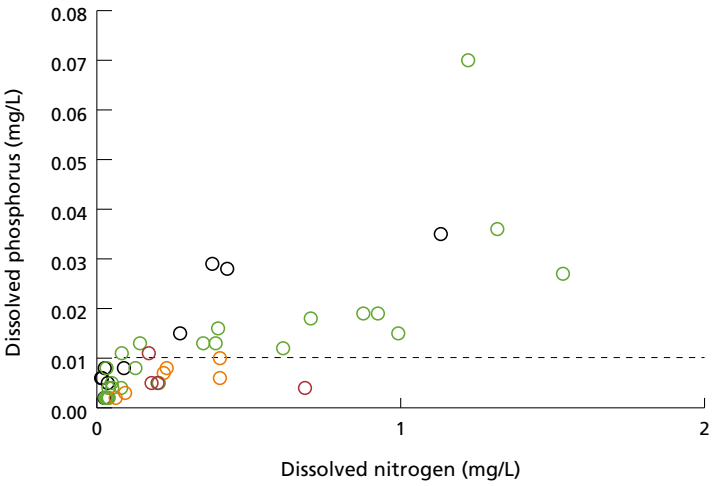
**MYTH**

**Toxic algae is not a natural part of our environment**

**BUSTED!**

Toxic algae (or cyanobacteria) are an ancient group of photosynthetic organisms that have been around for over three billion years. They occur naturally in almost every environment imaginable where they perform important ecological functions such as nutrient recycling, providing food and habitat for aquatic organisms and even producing oxygen!

# What causes toxic algal blooms?




**KEY**

- No significant growth of toxic algae
- Low growth
- Moderate growth
- High growth

*Phormidium* blooms occur under a range of nitrogen concentrations, but generally only occur in rivers with low phosphorus levels.

Toxic algal blooms generally occur in summer months when long periods of warm dry weather create a stable growing environment. However, a Hutt River modelling study revealed that a drop in flow is unlikely to be a driver of toxic algae growth, ie, low flows do not cause more blooms.

Like other types of algae, the frequency of high river flows (what we call flushing flows) is a key regulator of toxic algal growth. This is why toxic algal blooms are uncommon in winter – regular bouts of heavy rainfall ensure frequent flushing flows which flush algae out of waterways.

Contrary to popular belief, **the presence of toxic algae does not necessarily indicate poor water quality**. Assessment of water column nutrient data suggests that *Phormidium* blooms occur under a range of nitrogen concentrations (0.05 to 1.7 mg/L), but generally only occur in rivers with low phosphorus levels (less than 0.01 mg/L).

Phosphorus connected to sediment may be a driver of *Phormidium* growth. There is growing evidence to suggest that sediment particles floating in the water can get trapped in *Phormidium* mats. Unlike nitrogen, phosphorus is very 'sticky' and often strongly bound to sediment. If *Phormidium* can access sediment-bound phosphorus this would explain why toxic algae are so good at growing in rivers with low dissolved phosphorus concentrations.

**MYTH**

**Toxic algal blooms are caused by high levels of nutrients**

**BUSTED!**

Toxic algal blooms can occur under a range of nitrogen concentrations but generally only occur in rivers with low phosphorus concentrations. In the Hutt River, phosphorus concentrations remain low along the length of the river whereas nitrogen concentrations vary.

# Why are toxic algal blooms so common in the Hutt River?

Put simply, the Hutt River is a great environment for toxic algae.

Rivers with large gravel riverbeds, like the Hutt River, are the preferred habitat of toxic algae. The Hutt River also has low concentrations of phosphorus and moderate concentrations of nitrogen. This is consistent with conditions in other rivers across the region and New Zealand where *Phormidium* blooms are a problem.

What is interesting for our scientists is how the occurrence of toxic algal blooms increases with increasing nitrogen concentrations. Nitrogen concentrations increase over 10-fold between Kaitoke (where toxic algae blooms are rare) and Silverstream Bridge (where toxic algae blooms are most prolific).

So where is the nitrogen coming from? The Pakuratahi and Mangaroa rivers (where the surrounding land use is largely rural) are the biggest surface water contributors of nitrogen to the Hutt River. Surface water from these rivers, the other two major tributaries (the Whakatikei and Akatarawa rivers) and the upper reaches of the Hutt River contribute around 60 percent of the total nitrogen load.

Our investigations show that **the other major source of nitrogen is groundwater** upwelling into the river between Whakatikei and Taita Gorge. The groundwater entering this part of the river comes from the aquifer that lies underneath the urban area of Upper Hutt City. The sources of nitrogen in the groundwater are unclear but are likely to be a combination of fertiliser used on parks, gardens and golf courses, and leaky sewer pipes.

A toxic algal bloom in the Hutt River just upstream of Silverstream Bridge. The toxic algae is easily identified as the dark patches running along the left hand side of the riverbank.

**MYTH**

**Toxic algae is only a problem in the Hutt River**

**BUSTED!**

Toxic algae occur in virtually all rivers in the region although extensive blooms tend to be limited to the large gravel-bed rivers in Kapiti, the Hutt and central Wairarapa. Many New Zealand rivers experience toxic algal blooms including the Tukituki River in Hawkes Bay, the Ashley River in Canterbury and the Hokitika River on the West Coast.

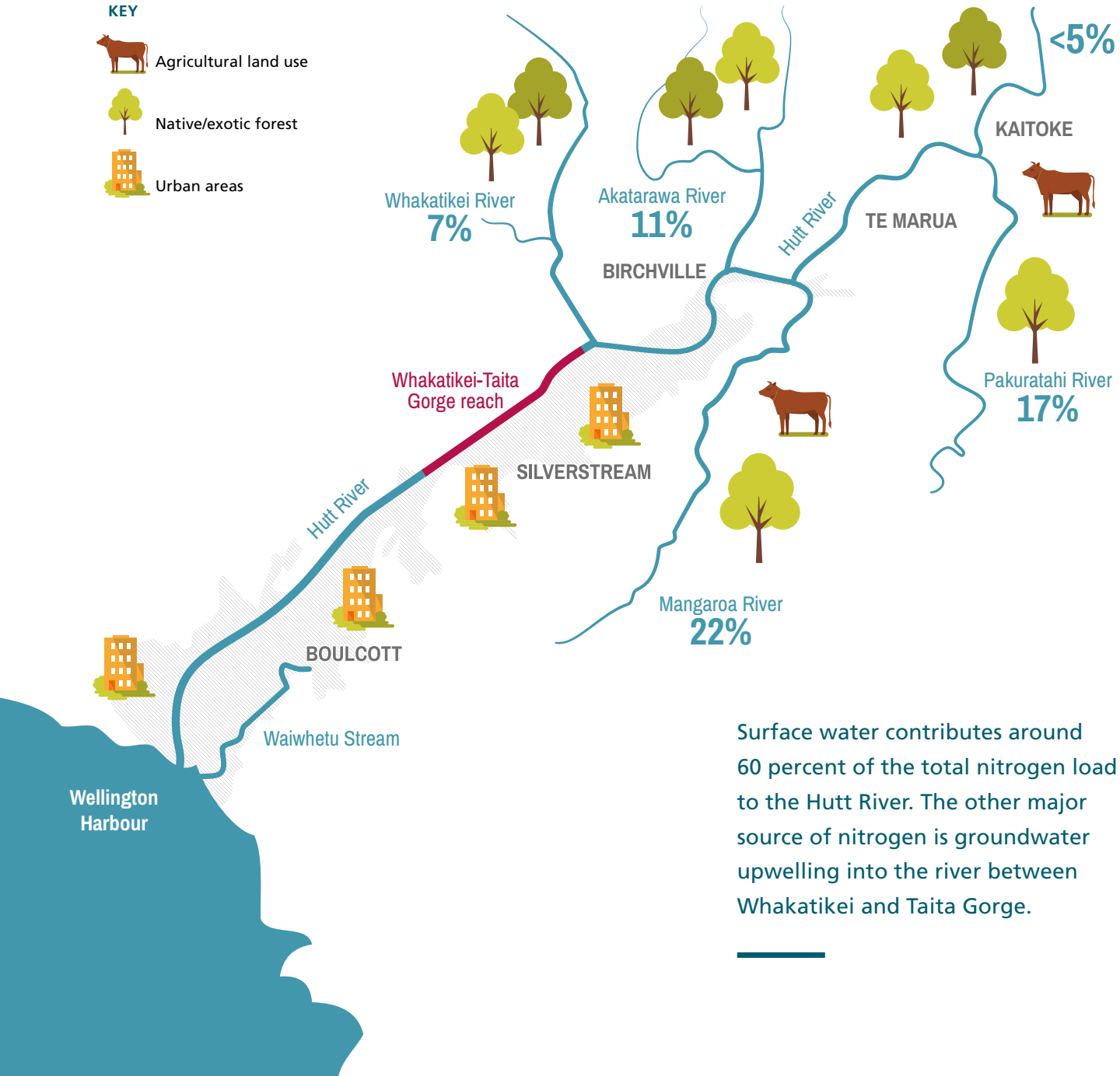
## MYTH

**Toxic algae is getting worse in the Hutt River**

## BUSTED?

We have only been monitoring toxic algae for the last decade so we simply don't know the answer to this question yet. The first confirmed dog deaths caused by toxic algae in the Hutt River occurred in the summer of 2005/06. However it is entirely possible that toxic algae-related dog deaths have occurred previously, but have been attributed to 1080 poisoning or other causes.

Although increasing nitrogen concentrations are associated with increased occurrence of algal blooms in the Hutt River, compared with similar rivers and streams across New Zealand, **nitrogen concentrations in the Hutt River are still below the norm**. Further, trend analysis has revealed that nitrogen concentrations have actually decreased over the last decade at most monitoring sites.




Surface water contributes around 60 percent of the total nitrogen load to the Hutt River. The other major source of nitrogen is groundwater upwelling into the river between Whakatikei and Taita Gorge.

# What can we do about toxic algae?

## What can you do?

The best thing you can do is to keep you, your family and your animals safe is to **know what toxic algae looks like**. Toxic algae may only be in some parts of river, other parts may be free of toxic algae and safe to use. Toxic algae is unique looking and easy to identify. If you see it avoid coming into contact with it and most importantly, do not let your dog near it – dogs love the musty odour of toxic algae and will eat it.

Be careful with how much fertiliser you are putting on your lawns and gardens. Nitrogen easily leaches out of soil and into groundwater and waterways, and it all adds up.

A typical *Phormidium* mat attached to a rock. Mats have a leathery appearance, can range from black/brown to dark green in colour and produce a distinctive musty odour.

## What could we do in future?

Unfortunately, there is no quick easy fix to the toxic algae problem in the region.

Toxic algae occurs under a wide range of conditions and there are no guarantees that even large scale changes will get rid of it, although **limiting the amount of nitrogen getting into our rivers may help reduce the occurrence of toxic algal blooms**.

A major source of nitrogen in the Hutt River is groundwater from the aquifer lying underneath Upper Hutt City. Age dating of water samples reveals that this groundwater is relatively young, approximately 2–3 years. This suggests that the results of any management actions to reduce nitrogen in the groundwater are likely to be realised within a relatively short time.

Nitrogen reductions could be achieved through things like more efficient fertiliser use in both urban areas and on farms, keeping livestock out of waterways, fixing sewer leaks and making sure septic tanks are well maintained.

Scientific evidence is building that links sediment with toxic algal blooms (as sediment could be a significant source of phosphorus). Managing sediment run-off from urban developments, forestry and rural land, as well as careful management of sediment re-suspension from river works, may help reduce toxic algae growth. More work is needed to better understand the link between sediment and toxic algal blooms.

Developing recommendations for the management of local water quality (including setting freshwater limits) will be a job for the Wellington-Hutt Valley Whaitua Committee, due to be established in 2017. The committee will make recommendations on how to manage the use of water and the discharge of contaminants.

For more information on the role of the whaitua in your community go to **gw.govt.nz/whaitua-committees**

The Greater Wellington Regional Council's purpose is to enrich life in the Wellington region by building resilient, connected and prosperous communities, protecting and enhancing our natural assets, and inspiring pride in what makes us unique

For the detailed technical report go to
www.gw.govt.nz/technical-reports

Find out more about toxic algae
www.gw.govt.nz/toxic-algae-faqs

See what toxic algae looks like
www.gw.govt.nz/photo-gallery

Check out our online interactive map during the summer months
(November – March) for up-to-date water quality and toxic algae warnings
http://mapping.gw.govt.nz/GW/RecWaterQualityMap/RecWaterQualityMap.htm

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July 2016
GW/ESCI-G-16/45

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