

Monitoring periphyton in rivers

Periphyton is the brown or green slime that grows on stones, wood or any other stable surfaces in streams and rivers. In some situations, it can form simple mats, while at other times it can flourish to form thick masses of green or brown filaments on the riverbed. Periphyton communities are complex and can include a mixture of algae, cyanobacteria, diatoms, didymo, fungi and detritus (dead organic matter).

Periphyton is the main source of food for invertebrates, which themselves become food for fish, birds and reptiles. It also purifies water by absorbing nutrients. However, if periphyton grows too much it can affect habitat for invertebrates and fish, alter oxygen levels

available in the water and degrade the aesthetic (visual) and recreational qualities of the river. Cyanobacteria (also known as toxic algae) blooms can be a risk to human health.

Why do we monitor periphyton?

Healthy rivers generally have low levels of periphyton cover. Increased dissolved nutrients in a river or stream (dissolved inorganic nitrogen and dissolved reactive phosphorus) can stimulate periphyton growth rates. Periphyton also needs light to grow, and growth

rates are higher when the water is warmer. However, grazing by macroinvertebrates will reduce periphyton. Therefore, periphyton is a useful indicator of the overall health of the waterway, as it can reflect a range of human influences.



How do we monitor periphyton?

Visual assessment of periphyton cover: This involves standing in the water and looking at the streambed using an underwater viewer (bathyscope). The amount of streambed covered by different types of periphyton (percentage of diatom mats, short and long filamentous algae, cyanobacteria) is estimated. This is usually repeated at 20 points within the river reach.

Laboratory assessment of periphyton biomass: Samples of periphyton can be taken and tested in a laboratory. The laboratory will assess the sample for periphyton biomass, which is measured as chlorophyll *a* concentration and ash-free dry mass (AFDM). The laboratory can also assess the species abundance of the sample.

Periphyton samples are typically collected from 'run' habitat within a river. Monitoring year-round on a monthly basis is useful to provide an overall picture of the amount of periphyton growth in a river, along with seasonal variation.

For more information on how to collect, preserve, transport and analyse periphyton samples, and carry out visual assessment of periphyton cover, see the relevant National Environmental Monitoring Standard¹.

For guidance on monitoring the abundance of cyanobacteria to assess risk to human health, see the interim guidelines² and any subsequent amendments. If sampling for didymo, specific protocols need to be followed. See the MPI website for further details.

EMERGING TECHNOLOGIES

As well as the traditional methods for sampling periphyton, new technologies are emerging that may provide alternative methods for sample collection. While still in various developmental stages and with potential limitations, emerging technologies include:

- **BenthosTorch** – a tool to measure benthic algal concentrations (by measuring phytobenthic fluorescence)
- **Remote sensing** - aerial imagery (captured by satellites or drones) can potentially be used to estimate periphyton type, coverage and biomass in large rivers
- **Environmental DNA (eDNA)** - biological material is collected by filtering water samples using special collection kits. In a laboratory, DNA is extracted from the material captured on the filter, analysed and compared with a reference database to provide a list of the species present in the sample. For more information, see www.wilderlab.co.nz



Sampling periphyton from rocks for biomass analysis in the laboratory.

¹ National Environmental Monitoring Standards - Periphyton: Sampling and Measuring Periphyton in Wadeable Rivers and Streams. Available from <https://nems.org.nz/documents/>

² Ministry for the Environment and Ministry of Health 2009. New Zealand guidelines for cyanobacteria in recreational fresh waters: Interim guidelines. Available from: <https://environment.govt.nz/publications/new-zealand-guidelines-for-cyanobacteria-in-recreational-fresh-waters-interim-guidelines/>

How much will it cost?

The cost of collecting and processing periphyton samples will depend on the type of sampling undertaken and level of output data required.

- **Purchase costs for equipment:**

Underwater viewer (Bathyscope).....	~\$200 + GST
Trays, sampling jars, rock scraping brushes	~\$100 + GST

- **Sampling costs:**

It usually takes about half to one hour to sample periphyton at a site with costs depending on the hourly rate of the company undertaking the monitoring and travelling times to access the site(s).

- **Processing costs:**

A number of laboratories throughout New Zealand are able to analyse periphyton samples, with costs per sample approximately:

Chlorophyll α analysis.....	\$78 + GST per sample
AFDM	\$38 + GST per sample
Species composition and abundance.....	\$178 + GST per sample
eDNA:	\$180-300 + GST per sample

For more information on the costs associated with carrying out a periphyton monitoring programme, see the Monitoring Costs document on the Monitoring Freshwater Improvements website.



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Research Team | *Te hunga i whai wāhi mai*

PROGRAMME LEADER,
IMPLEMENTATION LEAD

Olivier Ausseil
Traverse Environmental

TE AO MĀORI LEAD

Joanne Clapcott
Cawthron Institute

SCIENCE LEAD

David Hamilton
Griffith University

MATHEMATICS
LEAD

Alasdair Noble
AgResearch

PHASE 1 CO-LEAD

Rogier Westerhoff
GNS Science

WEBAPP
DEVELOPER

Mike Kittridge
Headwaters Hydrology