NZASE resource

Testing freshwater cheaply

Local streams are real-world contexts for teaching concepts of biology and chemistry which incorporate mātauranga Māori, and which also allow cross-curricular links. Testing water quality need not be expensive and can be a lot of fun for students in science classes or in environmental groups. NZASE Science Communicator Mike Stone explores the possibilities.

Often schools have a local stream nearby, even in cities, so using freshwater as a context for learning is perfectly feasible for many, and there are national organisations that can help you.

Freshwater is a taonga, vital for ecosystems and the economy. While plentiful, water is not always of good quality so we monitor it. The National Institute of Water and Atmospheric Science (NIWA), regional and city councils, and other agencies regularly monitor streams and rivers to assess water quality.

Teaching preparation

Taking students to a local stream to test the water involves some preparation, including finding the equipment needed and setting the scene for students. Teachers could -

- Use a catchment map of the area to find where the nearby streams come from and go to.
- Explore stream ecosystems – habitats, typical species, food webs.
- Research stream creatures - e.g., tuna/eel, koura/fresh water crayfish, oxygen weed, backswimmer.
- Teach students terms they will need to understand when using identification charts.
- Investigate stormwater (which ends up in streams) using resources from Waicare or from Environment Canterbury.
- Use Environment Canterbury's resource Wai Water, which could be integrated with EC's economics and geography units.
- Use Building Science Concepts booklet 1 - *The Waterways: How Rivers and Streams Work.*
- Access and explore local waterway monitoring data from regional or city councils. This will help students get used to some of the terminology and units. National data is available from Land, Air, Water Aotearoa; the Ministry for the Environment; NIWA; and NZ Water Citizens.
- Use extracts from the very readable 2012 report from the Parliamentary Commissioner for the Environment (76 pages).
- Make a stream bed viewer, or turbidity tube, or whakaweku to monitor koura.
- Identify names of NZ places that include wai and find out what they mean.
- Get students to help you fill out some parts of the safety/hazard sheet for the field work too – it makes them aware of things to be careful about.
- The OS&H Act requires private landowners

Taumarunui School students collecting water samples and observing underwater. Photo: Krysia Nowak.

Justine Newnham of the Whau River Catchment Trust collecting macro-invertebrates. Photo: Mike Stone.

to complete a hazard checklist to warn visitors of hazards on their land, so they may be reluctant to allow access. However, when you reconnoitre before bringing students, you could offer to help them and fill it in together on site.

Resources

There are plenty of resources to help teachers put this work in a mātauranga Māori context.

- If your school is building a mutually beneficial relationship with local hāpū, you can ask them about kōrero tuku iho on local streams.
- Explore kaitiakitanga in the context of streams; for example, TKI's teaching ideas or Pūtātara.
- The DVD *Guardians of the mauri* introduces a Māori perspective on waterways and is available from the National Library.
- Learning about the water cycle and catchments with strong links to Rangi and Papa, mauri and kaitiaki.
- Science Learning Hub's resources on the Waikato River.
- Science Learning Hub, 2020, Stream health monitoring and assessment.
- Testing the waters story from *Connected* 3, 2017.
- LEARNZ online field trip about river restoration, 2021.
- One kura's journey restoring the mauri to their local river.

Testing water quality

What sorts of things can students do? To start with, observe the banks, water surface and stream bed looking for erosion, plant cover, shade, rubbish, obstructions, sediment, murkiness, and smell. Sustainable Schools has good recording sheets.

Then fill a turbidity tube and take a bucket sample upstream of you, having rinsed the bucket twice first (rinse water goes on the grass, not in the stream).

Turbidity can be measured with the tube and the sample can be tested for temperature, pH, dissolved oxygen (DO), nitrogen, phosphate, and coliforms. Testing DO of a stored, sealed sample five days later allows biological oxygen demand (BOD) to be calculated. Flow can be measured with an orange or tennis ball. If the stream's average depth and width can be measured, then students can calculate a flow rate.

With a net, students can sample organisms without backbones that are visible to the naked eye (macro-invertebrates). The Waicare Field Manual has a good description of how to do this. You can identify these creatures with a good key, e.g., NIWA's for invertebrates and

Adding the reagent to test for nitrate. All uncredited photos this and next page by Mike Stone.

Checking nitrate levels in the sample tube.

Checking pH.

Taking temperature.

for algae, but it helps if students are already familiar with names of body parts.

If you don't have a net and your stream has a rocky substrate, students can just pick up rocks from the stream, place them in a tray with water and see what is on them.

A night spotlighting trip can be fun, and can also involve whānau and community. Check safety during the day first. Bring a few torches and gumboots if shallow, or stay on the banks.

Murray Brown from DNAitech works with schools to extract DNA from water samples in the field. This identifies the bacteria present, *E coli* or bloom-causing cyanobacteria. Some of the *E coli* may be from humans, but some may also be from other animals.

Equipment

Expensive reagents and detectors have been used in the past, but now it is easiest to dip test strips into a water sample. Watertest has sets of 25 multifactor test strips ($38) that will detect nitrite, nitrate, pH, alkalinity, hardness, and other factors. They also sell sets of 50 Phosphate test strips for $45.

These compare well with NIWA's SHMAK sets at over $1,000, which test for the same things. Alternatively, Hill Laboratories will test collected samples for N, P and BOD for ~$100.

Some regional and city councils have educators you can contact, and many also lend, hire or sell kits for students to use; for example, Watercare's Freshwater Detectives kit ($300).

Schools visiting the Tongariro National Trout centre can be taken through an investigation of a healthy awa, which provides a good comparison for city schools. They provide factsheets, checklists and keys, as well as padlets on koura, kākahi and macro-invertebrate lessons.

Whitebait Connection (WBC) has co-ordinators in many parts of the country who bring their own kit to test water with your students. WBC offers an inquiry programme that runs over a full school term, with the cost usually met through funding. Some co-ordinators speak te reo Māori. Enviroschools also have access to resources, facilitators and PLD to help with this theme.

Hao Feng and Justine Newnham checking turbidity, measured in mm, at the Avondale Stream in Auckland.

Freshwater shrimp from Avondale Stream.

Student observing macro-invertebrates. Photo: Whitebait Connection.

Ngā Kupu

Awa – River, stream, creek
Kāuru – Head of a stream
Kōawa – Creeks
Kōrero tuku iho – Oral tradition
Parenga – Riverbank
Pūao – Rivermouth
Tuna – Eel
Waikino – Dangerous pollution
Waimāori – Fresh water
Waimate – Dead water.

From Te Aka Maori Dictionary

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