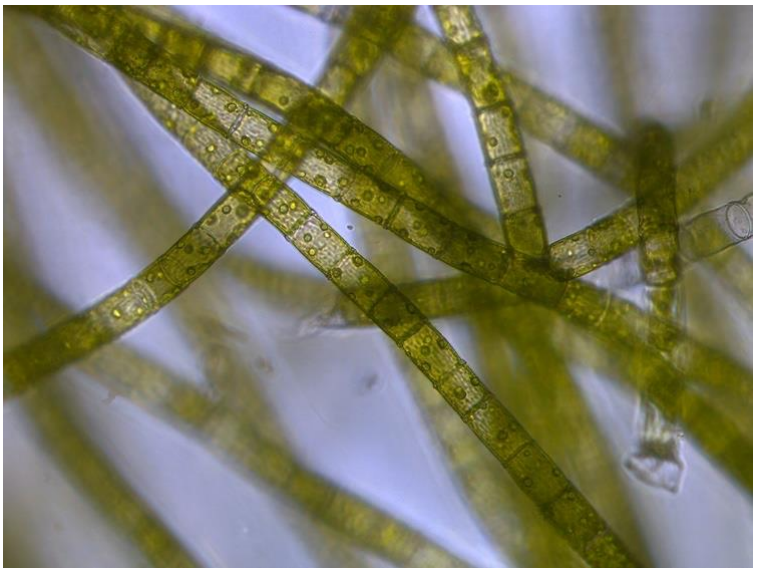
My haerenga (journey) at NIWA's Ruakura site with the aquatic pollution mitigation team, farming algae to create more sustainable solutions for wastewater treatment.

Introduction

Kia ora koutou, Ko Kaylee toku ingoa (my name is Kaylee), e ako ana au ki Te Herenga Waka (I learnt at Victoria University of Wellington). I have just spent 2 weeks being one of the two BLAKE freshwater ambassadors at NIWA Ruakura alongside Tiana Edwards. I have a BSc in Marine Biology and Environmental Science, so was immersed into a completely new area of science during my time here. I completed a large range of tasks; everything from partying with scientists at the Christmas party, to feeding algae and studying it under a microscope, as well as re-planting invasive lake species. The main experiment running at Ruakura is farming algae to create a more sustainable solution for wastewater treatment. As well as trying to find uses for the farmed algae like increased production of a tomato crop.

I was very grateful to work with a lot of people over these two weeks, under the supervision of Dr Rupert Craggs (Principal Scientist in Aquatic Pollution). The entire experience was a terrific networking opportunity which was incredibly beneficial. The first couple days were spent having hui (meetings) with staff in different sectors, learning about the range of opportunities at NIWA and the different research occurring. As well as having kai and korero with Te Kūwaha (the Māori Environmental Research team at NIWA).

Ruakura mahi



The first day at Ruakura was a bit of a shock as all the algae had died, this was not expected and changed the course of my first week, making it very problem-solving based. This gave me a real insight into what a scientist has to deal with on a weekly-basis, almost always things never quite go to plan. At the Ruakura site there are two types of algae being farmed in ponds; filamentous algae (figure 1) and microalgae (figure 2 and 3).

Figure 1: Filamentous algae with bright green chlorophyll which shows that they are healthy.

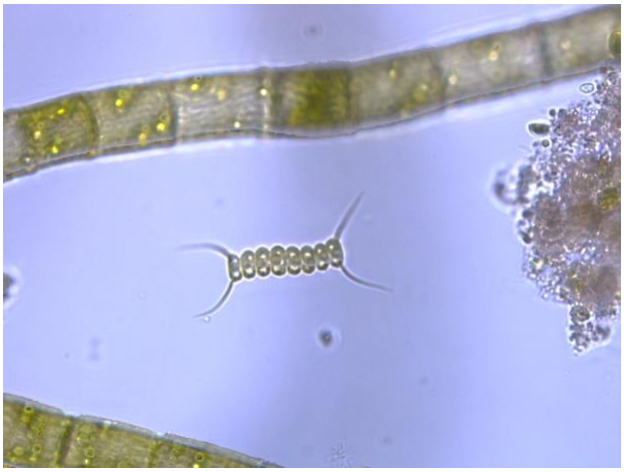


Figure 2: Microalgae species of Scenedesmus a wide-spread, non-motile, planktonic genus consisting of 4-8 cells.

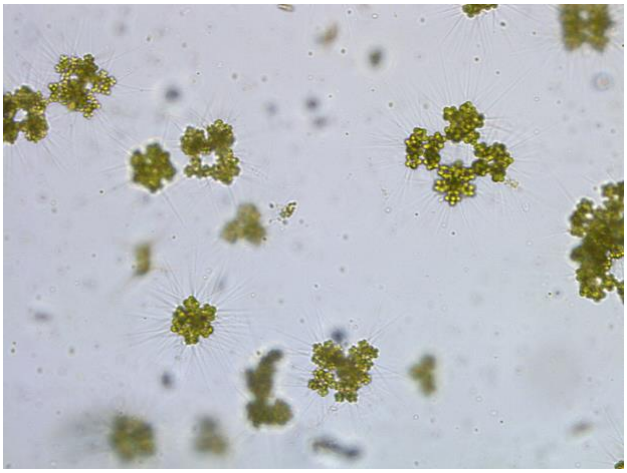


Figure 3: Microalgae species of Micractinium, non-motile and characterised by large spines.

The filamentous algae in one of the ponds died overnight so I spent alot of time working with Yeri Shim (water quality lab technician at Ruakura) studying the algae trying to understand why they were dying. These inspection techniques included ammonium testing and examining water samples under a microscope. The largest microalgae pond, called the pilot pond, also had deteriorated overnight and through investigation, the main cause was the presence of zooplankton (shown in figure 4). The specific invertebrate species is a rotifer species *Brachionus plicatilis* which feed on algae. The most efficient way to kill the rotifers is by suffocating them with a CO_2 infusion into the pond. However, the CO_2 addition limits the algae's ability to photosynthesise, so the pond should not be treated multiple times. Fortunately the neighbouring pond had a good population of algae without zooplankton, so the pond was drained instead. Draining of the ponds means a lot of messy work like vacuuming the sludge out to eliminate all zooplankton, ensuring a fresh non-contaminated pond.

Figure 2: Rotifer species Brachionus plicatilis under the microscope.

Figure 3: Pouring the herbicide into the water tanks

Working with Ben Woodward (NIWA Biogeochemist) I also aided in an experiment by adding herbicide to an invasive Hornwort species *Ceratophyllum demersum*, in controlled water tanks. This research is aimed at understanding how the herbicide treatment kills the hornwort species, but then releases fragments due to the fragmentation of this species. The experiment will help with management to ensure that it is not dispersing further in our roto (lakes) and awa (rivers) in Aotearoa.

Week two fieldwork

The second week involved travelling to Te Kuiti with Ngahuia Herangi (Te Kūwaha Environmental Researcher) to have a hui (meeting) with Te Nehenehenui about the Waikato River report card. This is a report guided by an advisory roopu (group) of Waikato River iwi, structured around eight taura (strands of a rope), that reflect the aspirations of the vision and strategy, Te Ture Whaimana for the river's restoration. The vision is about protecting the right to be kaitiaki of the river for generations of tamariki to enjoy. This is supported by indicators to describe the value of each taura, like water quality, effort and economy. The hui was mainly about the Sites of Significance taura and the missing information needed to score them, with considerations of mahinga kai (food gathering), uru pa (burial grounds) and wai (water) sites.

Tiana and I also were lucky enough spent time with James Sukias (wastewater Scientist) in Raglan at Te Kopua Whanau Campgrounds (figure 6). NIWA has created a partially- saturated vertical flow wetland (PSVF) wastewater treatment system, this combines aerobic and anaerobic treatment to remove as much nitrogen as possible all in one system. Tiana and I took samples from the first set of septic tanks, shown in figure 7 on the left side, which is cloudy greywater. Then took another sample shown in figure 7, on right side where the wastewater has percolated through the gravel material in the wetland and shows the removal of nutrients, virtually cleaning the wastewater to enter the awa again safely.

Figure 5: Two samples from Te Kopua.

Figure 4: James taking the first samples from the septic tank.

This ambassadorship has been an exciting and eye-opening experience, highlighting the critical role of nature-based solutions in tackling pressing environmental issues. It has broadened my curiosity and of freshwater ecology and the practical application of environmental science. I am really appreciative of the NIWA aquatic pollution team, BLAKE, Rupert and Tiana and all those who made this journey possible. I can't wait to do more science like this in the future!

Ngā mihi