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## Ambassador Story

### ***Following Microscopic Life Through the Glacier Melt Season***



by Ben Johnson

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Funded by  
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## GLASS Fieldwork Blog July - September 2025



This blog covers the notable moments from this year's fieldwork in Arctic Sweden for the Glacier Algal Sampling Strategies (GLASS) project. This fieldwork was carried out by Dr Chris Williamson and PhD student Ben Johnson from the Microlab@Bristol research group at the University of Bristol throughout July, August and September 2025 at Tarfala Research Station. The project is funded by a POLARIN transnational access grant with further support from Tarfala Research Station and the Royal Geographical Society. POLARIN has received funding from the European Union's Horizon Europe Research and Innovation programme under grant agreement No. 101130949. The content reflects only the authors' views, and the European Union is not responsible for any use that may be made of the information it contains. Photos © Chris Williamson and Ben Johnson.

Project website: <https://microlabbristol.org/glass-glacier-algal-sampling-strategies/>



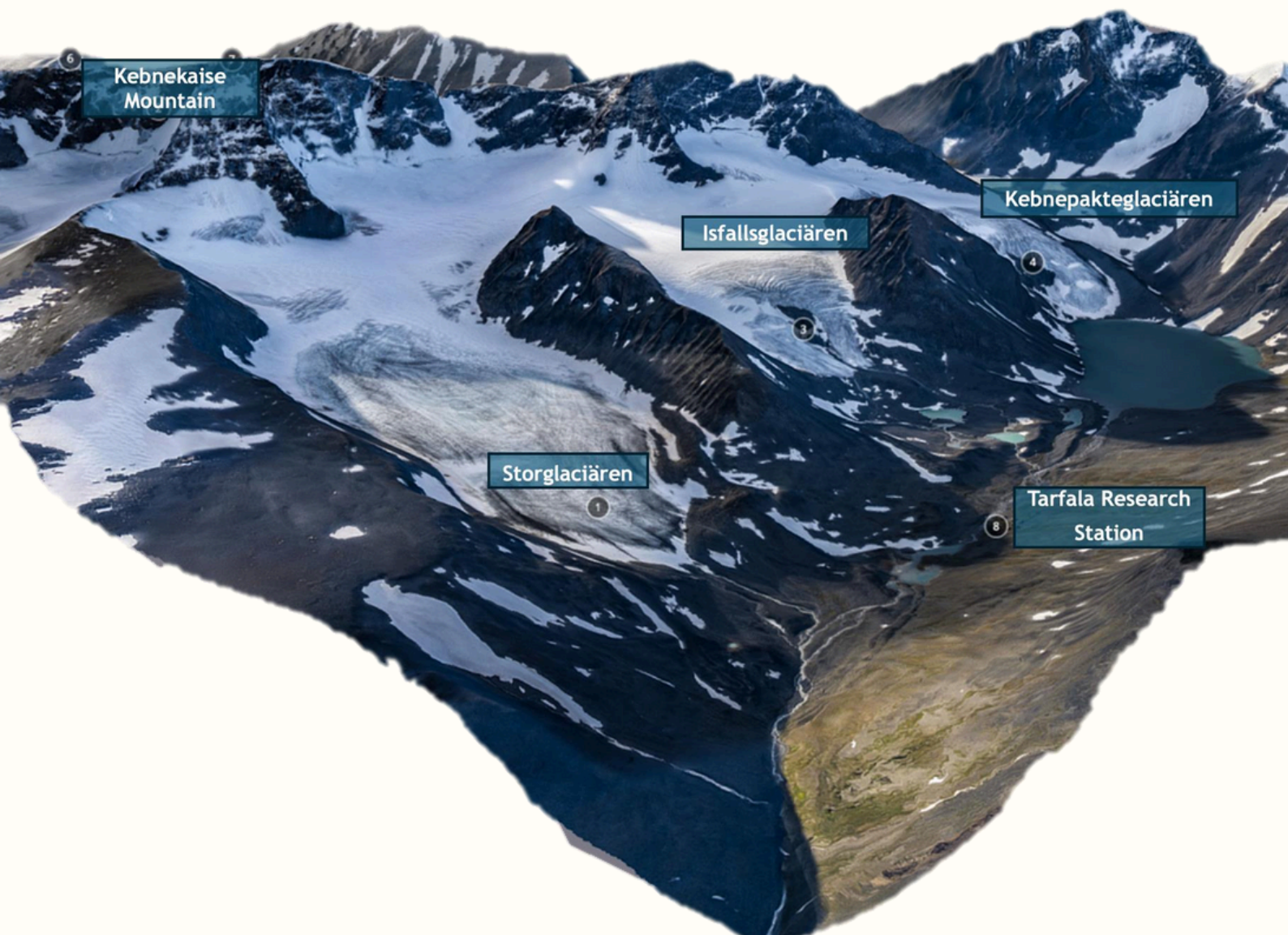
# Timeline



## Location

Fieldwork was conducted from Tarfala Research Station with Storglaciären as our study glacier. Storglaciären is a valley glacier situated in the Kebnekaise mountain range of northern Sweden, just west of Tarfala Research Station. It is one of the best-documented glaciers in the world, renowned for having the longest continuous mass-balance record, which began in 1945/46. The glacier covers roughly 3 km<sup>2</sup> and flows eastward into the Tarfala valley, where its well-defined accumulation and ablation zones make it an accessible site for studying glacial processes.

Tarfala Research Station and surrounding glaciers in August 2017:



3D model by Erik Schytt Mannerfelt (2017), available at: <https://sketchfab.com/3d-models/tarfaladalen-2017-in-sweden-066d9c37ebc9425c95fce6370d127e0d>



# July

6<sup>th</sup> July

The first of three long and arduous journeys from Bristol to Tarfala Research Station began in the early hours of the morning with a national express coach to Heathrow before we boarded our flight to Kiruna via Stockholm. Views of nothing but trees and lakes seemed to span the length of the land between Stockholm and Kiruna. We managed some sight-seeing in Kiruna which brought us to the impressive church in the old town which was in fact weeks away from being moved to the other side of the town in a controversial expansion of the iron ore mine in the region.

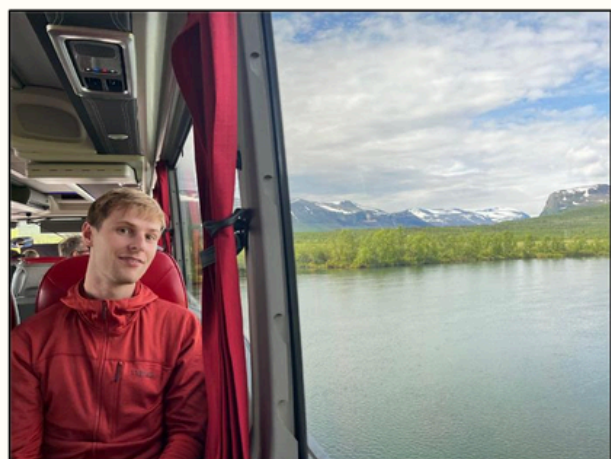


Photo © Chris Williamson and Ben Johnson

7<sup>th</sup> July

The morning quickly came around, yet it wasn't easy to tell that night had fell with the 24 hour daylight at this time of year. We boarded the coach which took us away from any sign of industry and closer to the impressive peaks of the Kebnekaise mountain range with Nikkaluokta the final stop - a Sámi village in Norbotten County belonging to the Gällivare Municipality. Within its vicinity are two Sámi communities who herd semi-domesticated reindeer in the region.

After a quick coffee and route planning session we set off on the long hike towards Tarfala Research Station (TRS) which sat 24 km west of Nikkaluokta. The hike took us through some incredible scenery as we moved through the valley. The glacier fed lake (Laukkujärvi) was a notable stop as well as the birch forests in the first section of the hike. After around 18 km we headed north into the Tarfala valley. This is where the final and toughest part of the hike began as we started to gain altitude quickly until quite soon, we had emerged out of treeline started crossing dense snowpacks.

Typical of the mountain environment, the weather suddenly changed, from clear sunny skies to low cloud and heavy rain as we approached TRS and searched for the right building to meet the team where we were warmly welcomed by Nina Kirchner (Professor of Glaciology and Director of TRS), Johanna Dahlkvist (Station Manager) and the rest of the staff.







We were given a tour of the station and shown the ropes before being shown to our rooms in one of the little red buildings. Not a bad view from the window!

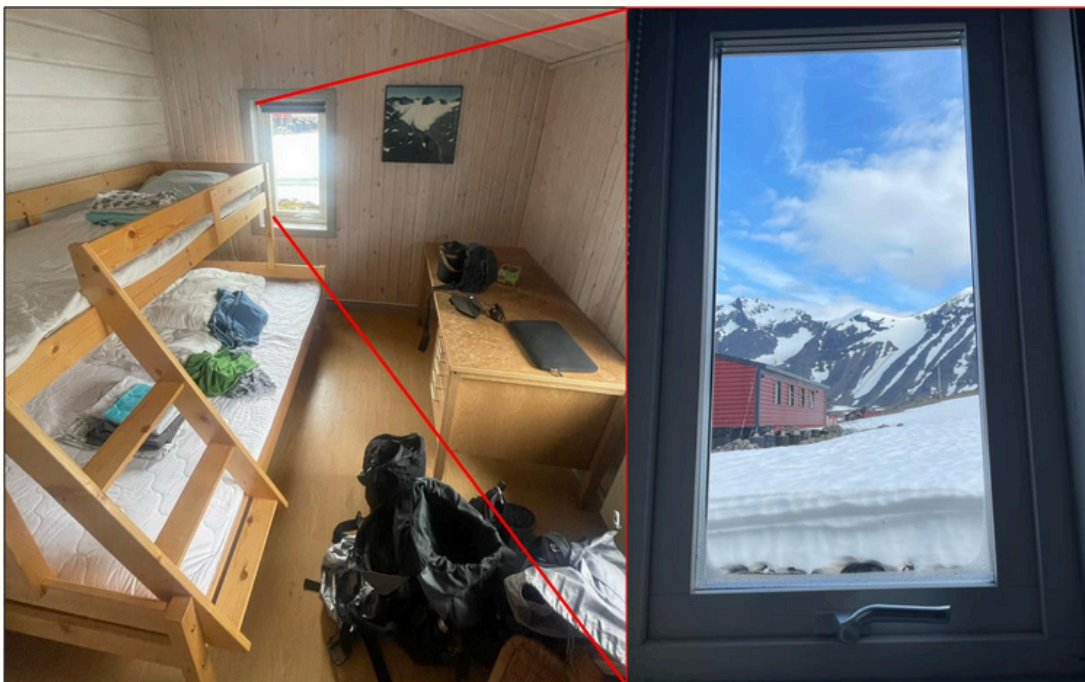


Photo © Chris Williamson and Ben Johnson



8<sup>th</sup> July

Today was about settling into the new surroundings and preparing for the summer of fieldwork ahead - starting with an all-important safety briefing. We then set up the lab and got to know TRS, including the extremely cute Swedish Lapphund and the Sauna!



Photo © Chris Williamson and Ben Johnson



9<sup>th</sup> July

Today we headed out on a site recce to assess the state of our study glacier (Storglaciären) and to look for any possible access points. This involved hiking up the lateral moraine of the glacier (see route below) to get a good view of the glacier.

Last year, Storglaciären had its highest accumulation since 1992 and the start of 2025 had been the coldest beginning to a year at TRS since 1990, with just 17 positive degree days between 1st January and 10th June - demonstrating the influence of climate change on extreme weather in the Arctic. We had planned for our first visit to capture the start of the glacier algal bloom, however this high accumulation last winter and the cold start to the year delayed the onset of the melt season and the majority of the glacier was still snow covered at this point. This meant that we could not access any of the glacier surface for safety reasons during this first visit - which was a shame, but highlights the unpredictability of fieldwork!

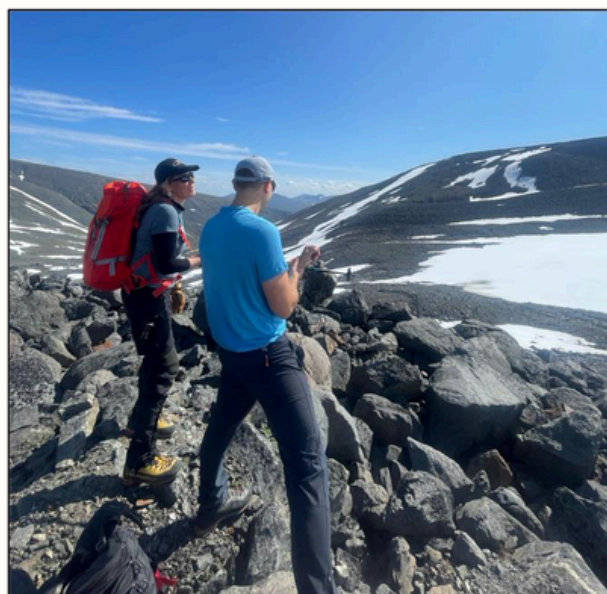


Photo © Chris Williamson and Ben Johnson

## 10-15<sup>th</sup> July

Although we could not access the glacier on this first visit, there was still plenty of time and space for science and a good opportunity for us to test the methods we wanted to use over the next few months. A Scandinavian **heatwave had hit, and temperatures reached 10-15 °C for a few days, which meant that the snowpacks around TRS were disappearing rapidly.** These melting snowpacks are home to a diverse group of microalgal species which typically change the colour of snow from white to red - giving these blooms a nickname of 'watermelon snow'. Like their glacier ice counterparts, researchers at MicroLab@Bristol are interested in these organisms and their impact on the environment. This gave us an opportunity to derive **a small study on these snow algal blooms as we are interested in similar questions surrounding how these blooms proliferate in harsh environments.**

**Over the next few days, we mapped three snowpacks hosting snow algal blooms.** To do this, we collected high-resolution, georeferenced drone imagery of the snow surface and gathered a series of physical snow samples. These samples will later be analysed in the lab for cell abundance, allowing us to ground-truth the drone imagery. By combining the on-the-ground measurements with the remote sensing imagery, we aim to build a detailed picture of the snow algal blooms over our sampling period which will help to answer a series questions.



Photo © Chris Williamson and Ben Johnson



Once all our samples were collected, we then let them melt over the course of a day before taking a small subsample, and adding a cell fixative to preserve them for microscopy analysis back in Bristol. We also filtered a few of our samples for DNA analysis to tell us exactly what species we were looking at (below).

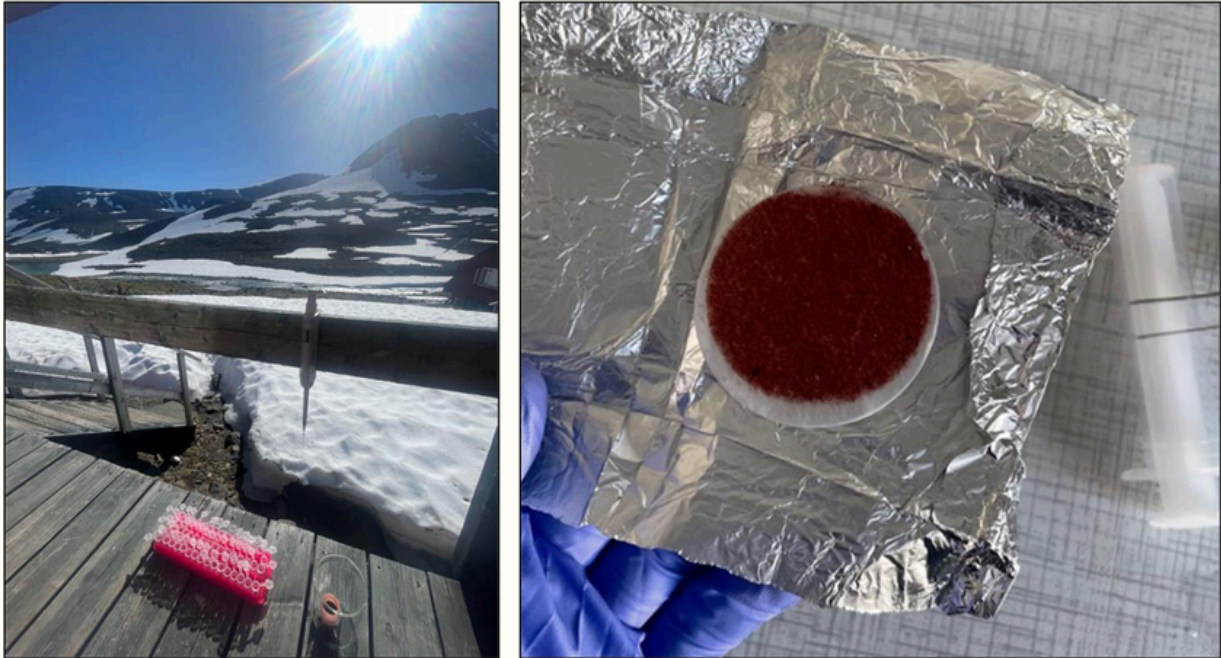


Photo © Chris Williamson and Ben Johnson

## 16<sup>th</sup> July

With all the field and lab work wrapped up for this first trip, our samples were processed and ready to be transported back to Bristol for later analysis. We spent our final day packing up and preparing for next month's visit, taking in the last views of the wintry landscape at TRS - which would look very different on our return.



Photo © Chris Williamson and Ben Johnson



17<sup>th</sup> July

With the first of our 3 trips rounded up, all that was left was to make the long hike back to Nikkaluokta with the reward of a reindeer burger at the end!

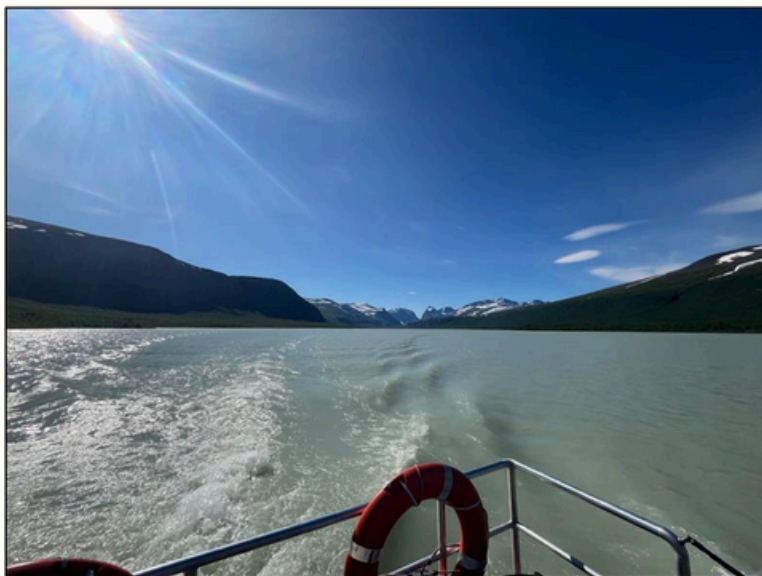
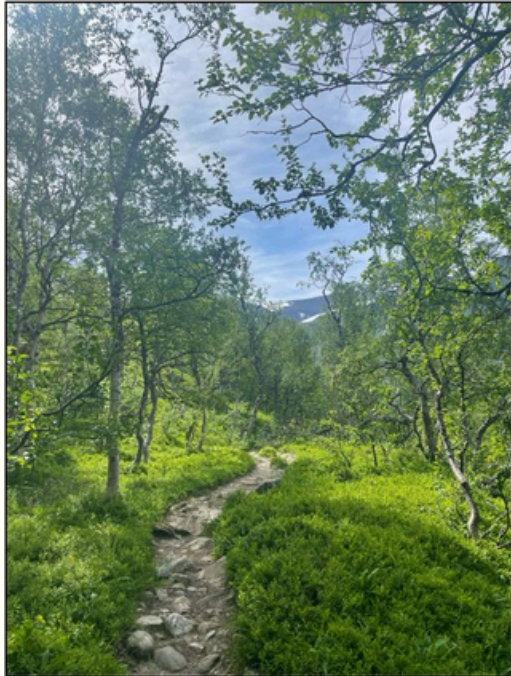


Photo © Chris Williamson and Ben Johnson



# August

9th August

Back in Sweden after some relaxing family holiday in between trips, Ben in South France and Chris on a European road trip in his van! Back to work now starting with the hike to TRS noticing less snow on the way up and the summer season in full force.

The river which runs alongside much of the route had risen considerably and was pushing its way through the valley with intimidating force, really highlighting the sheer volume of water leaving the glaciers and snowpacks at this time of year. We were again warmly welcomed by the team at TRS, with some familiar and some new faces, before settling back in.



Photo © Chris Williamson and Ben Johnson



## 10th August

It was straight to work on our first full day of our August visit, and with a **mostly snow free glacier surface we were able to do our first site recce of Storglaciären** accompanied by field assistant Torgny who helped us navigate safely onto the glacier for the first time, pointing out the well-known moulins and crevasses to avoid! On our recce we took some initial ice surface samples to help us build an idea of the bloom progression at this stage of the melt season and guide our site selection for which we settled on three sites, broadly characterised into upper, middle, and lower glacier.



Photo © Chris Williamson and Ben Johnson

## 11-13th August

Over the next three days we started our first round of sampling glacier sampling at each of our sites. **The GLASS project aims to build the knowledge around how blooms of glacier algae are structured in their environments in both space and time, with an aim to design and test best-practise methodologies for creating ground truth datasets which are needed to validate and calibrate remote sensing imagery across the cryosphere.** To help us answer these questions, we sampled the ice surface (supraglacial) at a very high resolution in each of our glacier zones (upper, middle, lower) to get an understanding of how the spatial organisation of blooms might differ across the environment.

Pictures from the daily commute ...



Photo © Chris Williamson and Ben Johnson



Our upper site with a good view of the tallest mountain in Sweden - Kebnekaise with its northern peak visible and the southern peak hidden in the clouds! The black and white squares we placed on the ice are ground control points (GCP's) - we record the GPS coordinates of these to georeference the drone imagery and so we can locate our sampling positions in the images.



Photo © Chris Williamson and Ben Johnson

Our middle glacier site was slightly lower down - it was less water saturated than the upper site and more undulating in its topography ...



Photo © Chris Williamson and Ben Johnson



Our lower glacier site was situated on the steeper part of the glacier which was more visibly discoloured by debris and algae!



Photo © Chris Williamson and Ben Johnson



Along with the physical ice sampling, we used a drone to capture imagery of each sampling area from above. From this, we can take the cellular algal abundance that we observe in our samples (under the microscope) and match this value to its corresponding pixel reflectance value with the aim to build a comprehensive map of algal abundance over the sampling area. **This technique has the potential to significantly reduce the time, effort and cost of sampling.**



Here are some of the impressive drone shots from above...



Photo © Chris Williamson and Ben Johnson



A very full fridge after 3 days of sampling ...



Photo © Chris Williamson and Ben Johnson

14-16th August

The **next few days were spent inside working through the fridge full of samples** above. We appeared to get our timing right here as it rarely stopped raining over the next few days! This involved sub-sampling a small amount of each sample and adding some fixative to preserve the cells for analysis back in Bristol. We also filtered each sample so that we can analyse the geochemistry of the ice environment that the microalgae thrive in. We will also process the drone imagery to create a 3D reconstruction of the ice topographic environment using structure from motion techniques. This additional **environmental data will help us to build a better understanding of how such ecological factors might drive bloom distribution and expansion.**

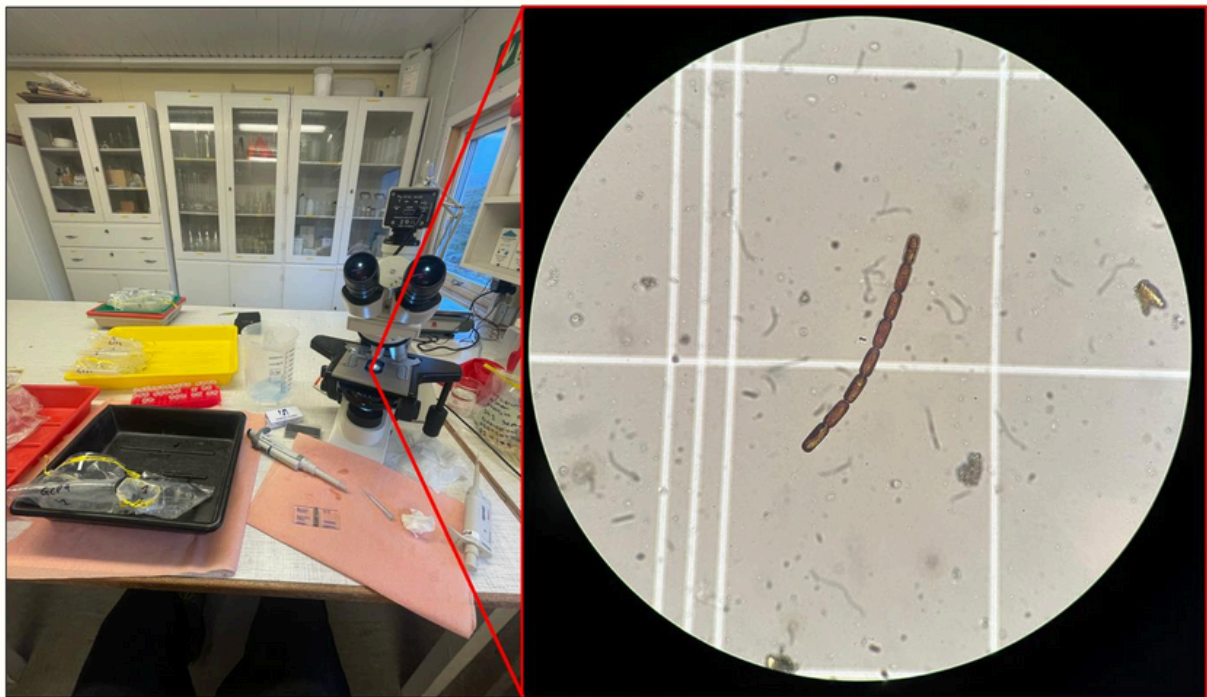


Photo © Chris Williamson and Ben Johnson



## 17th August

With all lab work done, we went out onto Storglaciaren once more for some more sampling. **On this occasion, we were interested in sampling a much larger area at a coarser resolution with an aim to get a representative zonal average of glacier algal abundance at each of our sites.** We were joined by Dr Mark Skidmore on this outing who was leading a field course with Stockholm University during our stay. The weather was particularly challenging on this day, so the extra pair of hands was much appreciated!



Photo © Chris Williamson and Ben Johnson

## 18-19th August

The final couple of days of our August visit involved processing the final samples and packing things away once more before our return in September. We were also treated to a snow day which left the mountain tops with a dusting of white and a newfound beauty.



Photo © Chris Williamson and Ben Johnson



## 20th August

With all samples packed into bags, we descended through the Tarfala valley once more on a hike that was becoming very familiar, but the scenery every changing - the seasons move fast in the Arctic!



Photo © Chris Williamson and Ben Johnson

# September

## 3<sup>rd</sup> September

Back in Sweden for our third and final visit to Tarfala and our final hike through the valley. Feeling lazy on this occasion, we decided to cut off 5 km of the walk with a boat ride through Laukkujärvi and the meandering river before completing the rest of the hike on foot. There had been a clear shift from summer to the beginnings of autumn as the leaves started to make the shift from bright greens to orange and yellows.



Photo © Chris Williamson and Ben Johnson



## 4<sup>th</sup> September

Our first full day back at TRS was spent preparing once more for this final field visit, setting up the lab, charging batteries and re-acclimatising once more! Dr Alicia Rutledge was also visiting TRS to collect some mineral and water samples for her work at Northern Arizona University - Ben was lucky enough to spend the morning helping her sample at the front of Isfallsglaciären - the glacier adjacent to Storglaciären. It was great to learn about Alicia's work and the geological processes in glacial environments.



Photo © Chris Williamson and Ben Johnson



## 5-6<sup>th</sup> September

In the next couple of days we collected the bulk of our samples for our September visit with high resolution sampling carried out at each of our sites on the glacier matched with more drone imagery. Capturing this later stage of the melt season will help to give us an understanding of how the spatial dynamics of the algal bloom might change through the season and allow us to inform adaptive sampling strategies dependent on the stage of the bloom/melt season. The commute was definitely more challenging on the way back, which involved carrying a bag full of ice!



Photo © Chris Williamson and Ben Johnson



We noticed a distinct change in the surface ice environment in between trips, our downstream analysis should reveal how the bloom responds to these changes through the season.



Photo © Chris Williamson and Ben Johnson

7 - 8<sup>th</sup> September

Once again, the next couple of days consisted of **processing the hundreds of samples we had collected and preserving them for analysis back down the line.**

We could also have a look at the live samples under the microscope to get a sense of what we were seeing at each of our sites.

Here are some images of the impressive *Ancydonema nordenskiöldii* cell filaments...



Photo © Chris Williamson and Ben Johnson



Earlier sunsets at this time of year meant for some stunning autumnal evenings ...



And an amazing midnight light show...



Photo © Chris Williamson and Ben Johnson



9 - 10<sup>th</sup> September

These were our last couple of days on the glacier for this field season and we set about collecting our final round of samples at coarser intervals to give us a broader idea of the algal abundance across each of our zones as appose to the localised sampling we were also doing.

On our last day we were joined on the glacier by the TRS team who were performing end of season mass balance measurements on Storglaciären. Rory White, a TRS field assistant, was doing a glacier wide drone survey whilst we were sampling and kindly captured some amazing footage of us from the air ...



Photo © Chris Williamson and Ben Johnson





thanks Rory!

Photo © Chris Williamson and Ben Johnson



## 11 - 13<sup>th</sup> September

The last few days at TRS were spent processing these last samples, making sure all data was downloaded and finally packing our gear away for the final time. All whilst taking in the scenery around TRS for the last time this year.



Photo © Chris Williamson and Ben Johnson



## 14<sup>th</sup> September

We said our last and goodbyes to all the amazing staff at TRS before we managed to get a helicopter lift back to Nikkaluokta - saving us one last long walk. It was really amazing to see the land from above!



Photo © Chris Williamson and Ben Johnson

And with that, our field season drew to a close. We extend our sincere thanks to: the staff at Tarfala Research Station for their incredible support over the summer taking care of our safety, offering advice and feeding us with most delicious warm meals, Stockholm University for supporting the infrastructure at Tarfala Research Station which offers a unique space for science to take place, the Sámi communities who allow us to work in proximity to important reindeer herding areas and to this work would not have been possible without the fieldwork grants from POLARIN transnational access, Tarfala Research Station and the Royal Geographical Society.

We look forward to returning one day!





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