

## Abstract for the general public in English

---

In 1672 Christopher Kirkby, a travelling English merchant, observed in what is now called Lake Tuchomskie in northern Poland, that every year during dry weather in the summer months a "...green substance... with the water drunk by any cattle, dog or poultry, causes certain and sudden death".

We can interpret these 17<sup>th</sup> century animal deaths as most likely the effect of a cyanobacterial Harmful Algal Bloom (cyanoHAB). Harmful Algal Blooms (HABs) occur when microscopic algae in water grow out of control to such high numbers and they produce a number of harmful effects on people and animals. They can do this by releasing toxins that make other organisms ill or even die, they can use up all a lot of the oxygen in the water, thus, depriving other species of it, block sunlight and prevent plants and other photosynthetic algae from photosynthesising, and when they eventually die the other microbes that decompose them use up oxygen and reduce it even further. Cyanobacteria species living in water are especially problematic because they release toxins into the environment that can cause a number of illnesses.

HABs have been observed to have been increasing since the onset of major industrialisation, and many researchers are concerned that the joint effects of anthropogenic eutrophication (increase of water productivity mainly due to excess of nitrogen and phosphorous) and climate change will cause even further increases in the intensity, magnitude, and duration of cyanoHABs. But as we can see from the quote above, HABs are also a natural phenomena and they have been observed for a long time.

While ecologists and biologists have been able to observe increases over the past few decades, just how common and how intense these blooms were in the past remains something of a mystery. The sediments at the bottom of lakes are deposited layer upon layer over time, and within each layer we can find evidence of the conditions in the environment at the time of deposition, including evidence of HABs.

To answer questions on ecological changes over time, it is becoming increasingly common to use sedimentary DNA (sedaDNA) archives to reconstruct and interpret changes in biological communities. A number of studies exist that have attempted to reconstruct histories of toxic cyanobacteria but, to date, very little work has been done applying molecular techniques to Polish lake sediments. Therefore, any insights that molecular data in particular may be able to give us about cyanobacteria of the past (such as the presence of cyanotoxin biosynthesis pathway gene clusters, or community structure from metagenomic approaches) remains unknown.

The aim of this project will to apply genetic molecular techniques alongside more established paleolimnological methods such as photosynthetic pigment biomarker analyses to gain an insight into the history of cyanoHABs in Polish lakes by extracting sediment cores from the bottom of lakes and analysing them for traces of HABs layer by layer. The intention is that the knowledge gained will be useful for effective policy making and realistic restoration goals, which will be able to be formed on the basis of an understanding of the past of these natural systems.