Environmental DNA survey of the Upper Pond Water

(Notes by Rita Drobner, illustrations from Wikipedia)

The Upper Pond of Waterlow Park is special in that it is the smallest of the three ponds, the shallowest and most shaded by trees. Additionally, half of the embankment is in complete darkness, as it is covered by a public walkway.

The accessible pond embankment makes this pond endearing to park visitors and many wildlife observations are made here.

What does the environmental DNA (eDNA) analysis tell us about the pondlife?

For one thing – it turned out that the DNA analysis is a bit “Hit and Miss”. The goldfish that have been inappropriately dumped by pet owners years back are still regularly spotted, yet their DNA was not detected; neither the DNA of the brown rats, that are regularly taking a swim.

Of the many recorded insects, Genepools only detected few non-biting midges, but not the curly little larvae of the biting midges, which are so numerous in summer. The study also missed the water fleas, the dragon flies and damsel flies…

As the study booklet explains:

“There are several reasons why some DNA might be present in very low concentrations which we weren’t able to detect. For example, eDNA only stays in the environment for a period of days/weeks before degrading. This means that if a species hasn’t visited the pond for more than month, it probably won’t show up in the sample.”

Finally, it needs to be noted, that the study did not look for plant DNA, and that the sampling took place in December – thus there is a seasonality in what has been found.

What did the GenePools study reveal?

A lot of interesting organisms which would be difficult to detect with a traditional survey!

66 different organisms were identified. For the eucaryotes (higher organisms with nucleated cells) most could be determined down to species level. The archaea and bacteria (simpler microorganisms) were determined down to family or genus level.

These cover a wide range of 21 different groups of eucaryotes and 12 different groups of bacteria and archaea in the Upper Pond.

Visible to the naked eye are the insect larvae of non-biting midges; one of them is a so-called blood worm (it is not a worm, but it does have haemoglobin to help absorb oxygen) and another unnamed relative of the non-biting midges was also detected.

The 2-spotted water hog-louse looks like a woodlouse and feeds on detritus.

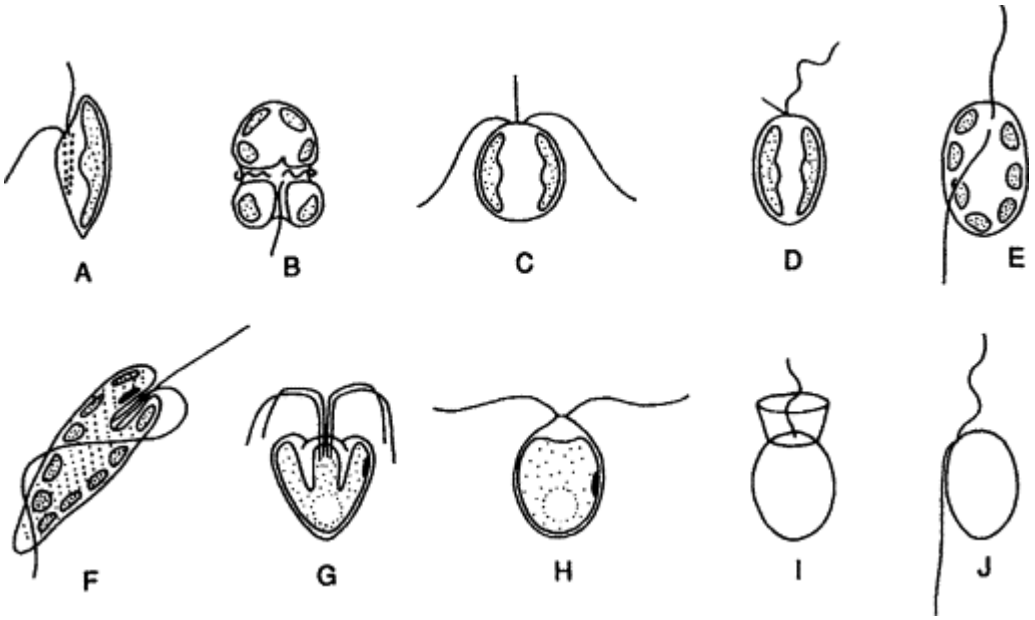
Interesting is the Green hydra fresh-water polyp, which is 1 cm in size. Fresh-water polyps are predatory animals and do not survive in polluted waters. Especially they do not tolerate high levels of heavy metals. Thus, having a hydra in the pond could be a good sign.

The Green hydra feeds on small crustaceans, small worms and insect larvae. It is green because it contains the algae *Chlorella*. In their mutually beneficial relationship, *Chlorella* provides oxygen and *Hydra* provides food and shelter.

From the microscopic organisms three types of yellow flagellate algae were detected. These *Chrysophyceae* are typical for oligotrophic ponds, meaning nutrient poor waters with low population densities. Because the yellow flagellates are quite delicate and cannot tolerate eutrophication (nutrient overload) their presence has been used as an environmental indicator.

On the other hand, the Upper Pond also has *Vorticella*, a ciliate feeding on bacteria. *Vorticella* likes nutrient rich sediment, indicating that both nutrient rich and nutrient poor spaces can be found in the same pond.

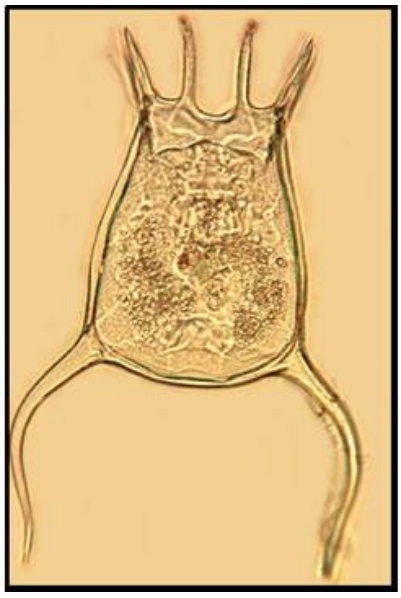
Of the drawing below of *Chrysophyceae* the Upper Pond has the types B and F and another unknown type.



Other motile creatures of the Upper Pond were predatory flagellates, colourless flagellates and dinoflagellates. Other algae are drifting in the water, unable to propel themselves.

Of the latter the *Cryptomonadales* make the headlines as a “superfood” for humans. Three types of these algae were detected in the Upper Pond.

Another beautiful animal of the Upper Pond is the *Keratella quadrata* which prefers cool and shaded ponds and lives on organic detritus. It belongs to the wheel animals which are generally important for the nutrient recycling in fresh water environments.



Bacteria and Archaea

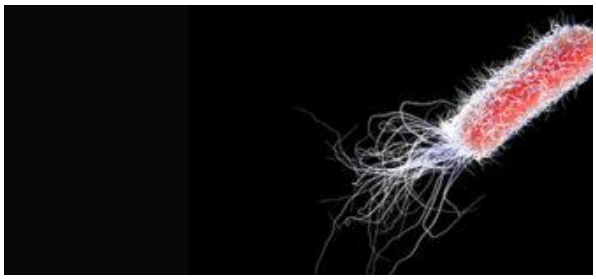
The bacteria and archaea are two genetically distinct branches of microscopic organisms. These groups contained a whole range of shapes from small spheres called cocci to long filaments, colourful through yellow, golden or purple pigments. The green *Chloroflexi* can even harvest light through green chlorosomes, similar to photosynthesis in plants.

Some of the microbes are motile, others attach themselves to surfaces, others just drift. Some live individually, others in large colonies.

In terms of the ecological niches they occupy in the Upper Pond – the detected microbes ranged from *Fusobacterium* and *Ferribacterium* which cannot tolerate oxygen to the *Campylobacters* and *Planctomycetes* which are microaerophilic and need a precise and reduced amount of oxygen to a large group of freshwater bacteria requiring well oxygenated water.

Paludibacter feeds on chitin. Chitin is an abundant energy source in nature, principally produced for the cell walls of fungi and exoskeletons of crustaceans and insects.

Sometimes the names of the microbes give a clue to whether they break down sulfates, nitrates and phospates, or otherwise assemble them.


Free living bacterium

These notes just give a taster of the organisms that the GenePools study detected in the Upper Pond. The above illustrations were copied from Wikipedia.

Many more pictures are on the internet, and video channels have short clips of these microscopic organisms in action, which can be enjoyable to watch.

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