What is going on with the microbes under the sea?

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Within the Baltic Sea, there is a hidden world of microbes, that have a very important role that can, at times, be underrated. Among these microscopic creatures, there are small algae, cyanobacteria and bacteria. Algae are the plants of the ocean, they provide energy under the form of carbon (they can transform inorganic material into consumable biomass, using the sun to photosynthesise) and because of this they are often called primary producers or autotrophs. The bacteria, on the other hand, are first-order consumers of energy produced by autotrophs, being name heterotroph. Cyanobacteria are a special class of bacteria that can produce energy through photosynthesis. Among other roles heterotrophic communities are responsible for the "recycling" of several nutrients in the water column, most notorious being carbon, nitrogen and phosphorous. As well as being the basis of the food chain, they are a crucial source of nutrients for bigger animals, such as zooplankton and smaller fish (primary consumers), which in turn serve as food for the even bigger organism (top consumer) in the water.

For this project, I focus mostly on the microbiologic community that exists on the coast of Sweden, specifically around a pier in Trosa (Stockholm). With the intent of understanding the interactions between and among the different members of the communities and nutrients consumed. A water sample was collected during the summer period and processed in the laboratory. The first step was to identify the different members, I did this by using molecular tools. We all have heard about DNA, and how it can be used to determine genetic differences, and ultimately to identify species. After a DNA extraction, through sequencing (a technique that is used to determine specific sequences in DNA fragments) I matched the sequences with already existing data bases (genome banks). I was able to identify the majority of the microbial community. The second step was to measure enzymatic activity to understand the consumption of specific substrates (containing carbon, nitrogen and phosphorous). This allows to study the nutrient cycling. More specifically the role of community interactions, on enzymes produced depending on the substrate consumed.

From the sequenced results I identified unicellular algae, one strain of cyanobacteria and several groups of heterotrophic bacteria. This coincided with already known literature for that the Baltic Proper. It was also possible to detect that algae plus picocyanobacteria tend to form a cluster of autotrophs. Additionally, the enzymatic activity analysis revealed that the highest activity was present for carbon and phosphorous and the lowest was for nitrogen. The enzymatic activity translates the availability of a nutrient, this is if they are more or less available in the water column. In this particular case, a possible conclusion is that phosphorous was a limiting nutrient, as it was readily consumed (high enzymatic activity). These results coincide with what was expected for the summer months, due to cyanobacterial blooms.

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