

The ups & downs of life in a biofilm: diatom motility recorded on sediment using an optical approach

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Despite being exposed to a highly fluctuating light climate, intertidal sediments belong to the most productive ecosystems on Earth. The main primary producers in this habitat are large motile diatoms, which can form dense photosynthetic biofilms in the upper layers of silty sediments during favourable conditions. During unfavourable conditions, however, such as damaging high light, the diatoms migrate vertically into the sediment. Besides moving away from high light, diatoms can also protect themselves by making use of physiological mechanisms. Although a trade-off between physiological and behavioural (downward migration) is suggested for intertidal diatoms, it has not been demonstrated so far.

For testing this hypothesis we developed a new method to record diatom motility on sediment. By illuminating samples by both monochromatic red and near infrared light and recording the reflected images with a CCD-camera we can calculate an image based on the Normalized Difference Vegetation Index (NDVI). This index is based on the fact that diatom cells strongly absorb light in the red part of the spectrum whereas near infrared light is scattered. By applying this method we can estimate the amount of diatom biomass present in the upper layer of sediment samples at different time points during high light exposure and as such record diatom motility. This approach has the advantages that it is non-destructive and that it can easily be combined with pulse amplitude modulated fluorometry, a method to probe the photophysiological status of the biofilm.