Use of a fluorimetric probe for river periphyton quantitative and qualitative assessment: Tests and potential applications

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Fig1. The BenthoFluor in use (A.C. Martins-Azevedo)

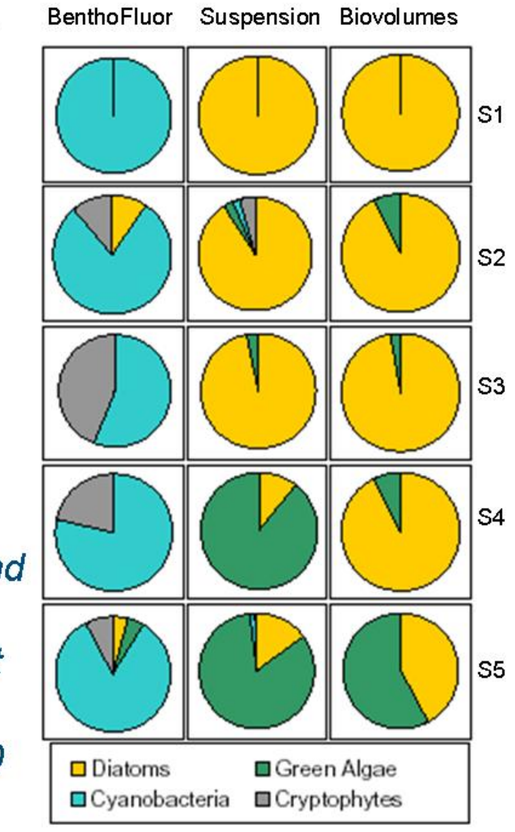
1- Introduction

The FluoroProbe (bbe, Moldaenke GmbH) was tested with its benthic adapter (BenthoFluor, fig1) on natural and artificial biofilms. The two outputs of the device were evaluated after a calibration for the substrate : microalgal biomass and distribution into main algal groups. Finally the application of the probe for the monitoring of eutrophication was studied.

2- Determination of biofilm chlorophyll *a* density

Chl *a* density estimation by the probe corresponded approximately to spectrophotometric measurements with artificial biofilms (2 species, fig2a) but was 3-fold higher with natural biofilms (fig2b). Moreover a saturation effect at high Chl *a* densities was observed with natural biofilms in spite of an internal correction of the device for biofilm thickness. Nevertheless the probe appeared more sensitive than spectrophotometric method (fig2c) and showed a high repeatability of measurements (fig2d).

Fig2. Correlations between BenthoFluor and spectrophometric Chl a measurements for artificial (a) and natural (b) biofilms (in µg Chla.cm^{-2}). (c) Comparison of the 2 methods for very low chl a densities. (d) Coefficient of variations of Chl a density determination on stones (Field) and glass slides (Experimental) based each on 10 measurements.



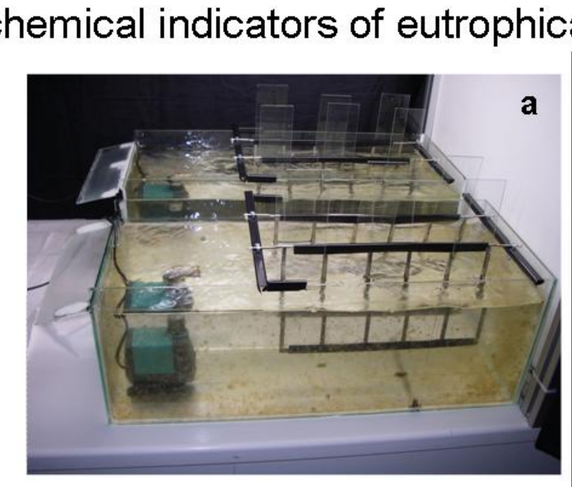
3- Estimation of the proportions of algal groups

The BenthoFluor failed to recognize the 2 algal groups present in an artificial biofilm (fig3). After biofilm scraping and resuspension in water, the groups were identified but not precisely quantified by the probe in planktonic mode, as compared to the microscopic determination of biovolumes.

Fig3. Algal composition of 5 artificial biofilm samples according to 3 different methods: BenthoFluor, FluoroProbe after biofilm resuspension and microscopic biovolume determinations.

4- Application for monitoring eutrophication

Using the BenthoFluor, a faster colonization of glass slides by natural biofilm extracts was evidenced in a microcosm with 10-fold higher nutrient concentrations than the control (fig4). On the field, the microalgal biomass on stones from 4 stations (fig5) was related to the average total Phosphorus and Nitrogen concentrations in water. The mean Chl *a* concentrations (several stones) was positively correlated to the 2 chemical indicators of eutrophication.



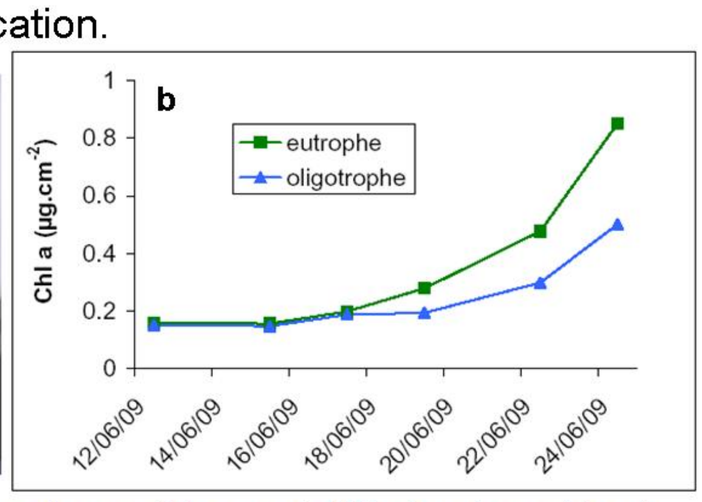
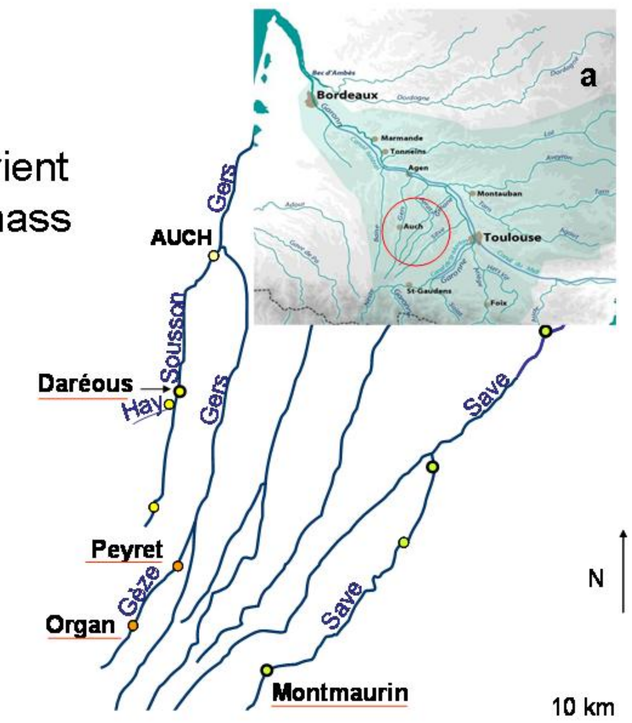
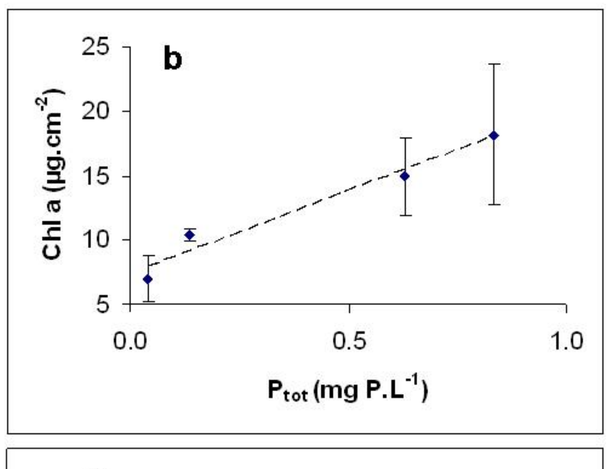


Fig4. (a) Microcosms containing glass slides and differing in nutrient concentrations by a factor 10 (oligotrophe and eutrophe). (b) Periphyton growth on the glass slides as measured by the BenthoFluor.





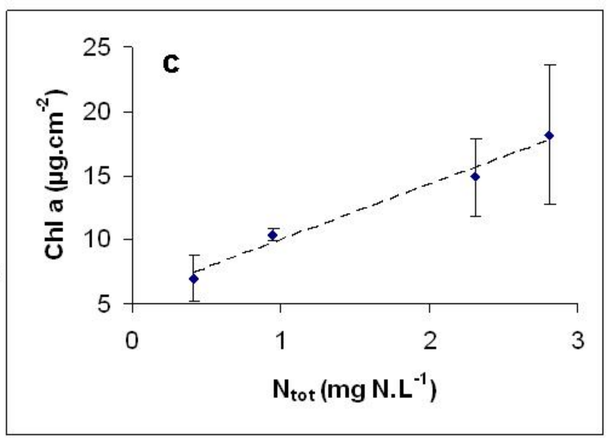


Fig5. (a) Localization of the 4 stations of BenthoFluor use. Correlations between Chl a density (mean of 3 stones) and average total phosphorus (b) and nitrogen (c) concentrations (average from 6 campaigns in 2008).

5- Conclusion

The BenthoFluor seems to be a reliable and sensitive tool for direct *in situ* estimation of periphyton biomass though a factor calibration for natural biofilms is needed. The discrimination of algal groups works in the planktonic mode of the probe but not directly with the BenthoFluor. It can give indications about the dominant groups without replacing a microscopic examination. The BenthoFluor may be used for the monitoring of river eutrophication as a complement to chemical measurements.

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