Using diatom life-forms and ecological guilds to assess organic and nutrient concentrations in rivers : a case study in rivers in south-eastern France)

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Abstract

The Water Framework Directive (WFD) of the European Union has set a target of achieving good ecological status for aquatic environments in Europe by 2015. In order to achieve this we need to determine the quality of aquatic environments at present, and to do this we can use biological indicators such as diatoms. There are several indices based on diatoms, such as the Biological Diatomic Index and the Pollution Sensitivity Index, but these indices can be difficult and time consuming to use.

We investigated whether the biological traits of diatoms in watercourses could be used to assess aquatic environments, especially at the saprobic and trophic levels. We used three kinds of biological traits: life-forms, size classes, and ecological guilds. We wanted to find out whether there was any significant difference in the distribution of these biological traits in watercourses with differing quality.

The saprobic level was estimated using the Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Dissolved Organic Carbon, NH_4^+ and NO_2^-. The trophic level was estimated using the concentrations in NO_3^-, PO_4^{3-} and total phosphorus.

We worked on a large data set including the distribution of 315 diatoms species in 2007, determined at 328 stations located on 212 watercourses, plus several abiotic parameters. This was the first time that the biological traits of diatoms had been investigated using such a large data set.

Our investigations have shown that the abundances of some biological traits differ significantly between the different quality classes. This was particularly true of the stalked diatoms, the motile and low-profile guilds. Their responses were as significant as those of the indices currently used as the reference values.

The study reported shows that the biological traits of diatoms could be used as bioindicators of the saprobic and trophic levels of environments, and highlights their advantages: the resilience of the ecological profiles, the fact that they provide information about the structure and architecture of biofilms and quicker species identification. In the future, our goals will be firstly to refine our research into the impact of the size of watercourses on different biological traits. Secondly, to use combinations of biological traits to enhance the distinction between saprobic and trophic levels, and finally to look at biological traits in other settings, such as in the presence of micropollutants, a WFD priority, or conductivity, for" which indices have already been developed using diatoms.