Published research paper

Title:	**The fractionation of phosphorus in UK chalk stream surface waters and its relevance to the regulation and management of water quality**
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Authors:	P.J. Shaw[a], K.C. Leung[a], D.Clarke[b].
Affiliation:	[a] School of Geography and Environmental Science, Faculty of Environmental and Life Sciences, University of Southampton, Highfield, Southampton, SO17 1BJ, UK b [b] School of Engineering, Faculty of Engineering & Physical Sciences, University of Southampton, Southampton Boldrewood Innovation Campus, Burgess Road, Southampton, SO16 7QF, UK
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Highlights:	• Monitoring P in rivers should be viable for regulators and scientifically meaningful. • P in chalk streams is mainly in soluble and reactive form, and routinely monitored. • Non-regulated forms typically account for 15–20% of reactive P in chalk streams. • Non-regulated forms of P merit assessment when effects or levels of P are anomalous.
Abstract:	The regulatory management of river water quality requires measurements of phosphorus that are operationally viable and meaningful in terms of insight into its effects. This need is a particular concern in globally rare and ecologically sensitive chalk streams. P data pertaining to rivers are commonly limited to soluble reactive P; other fractions of P may be of concern but are not routinely monitored. This study seeks to establish the nature and extent of non-regulated forms of P in UK chalk streams. Whilst soluble reactive P in two southern English chalk streams was found to comprise the majority of reactive P in surface waters in the majority of samples, 15–20% of the total reactive P was within other size fractions greater than 0.22 μm. The contribution of reactive P to the total P was highly variable. We conclude that, with some adjustments, the established method of regulatory monitoring of P in UK rivers is viable and valuable. In cases where the levels of reactive P are not consistent with ecological status and/or expected outcomes of programmes of measures, we recommend that targeted analysis of non-regulated forms of P is undertaken as a means to guide and focus management interventions.
Conclusions:	This study demonstrates the complexity and variability of P fractionation in chalk streams and reinforces the challenges of implementing regulatory management whilst balancing the needs for scientific meaning and resource constraints. It is recommended that monitoring comprises complementary elements: routine monitoring and diagnostic monitoring. We propose that analytical processes for monitoring are harmonised, with particulate materials being allowed to settle out of suspension prior to colourimetric analysis for a prescribed period. Where there is an apparent decoupling between the levels of reactive P present and the status of a river and/or mitigation measures undertaken do not result in predicted outcomes, we recommend implementation of diagnostic monitoring. A catchment inventory and desk-based research lead to a programme of sampling and analysis that is targeted to potential sources of P identified, and with the intention of providing evidence to guide remediation.