



## **The sensitivity of early life stages of mayfly to elevated fine sediment and orthophosphate**

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The ecological effects of elevated fine sediment and phosphate have been identified as key pressures influencing faunal community structure and composition in rivers. However, while the response of adult and larval life stages to environmental stressors is relatively well established, there has been very limited research on their eggs. This is despite the fact that eggs are potentially the most vulnerable life stage of many invertebrates to pollution.

In this study, the eggs of the mayfly *Serratella ignita* (Ephemeroptera) were collected and raised to hatching over 8 months in laboratory aquaria under differing concentrations of inert suspended sediment (SS) and orthophosphate (OP), both individually and in combination. The mortality of egg masses and individual eggs was recorded monthly and compared to controls.

Egg mortality in control treatments was 6% compared to 45% in treatments with the highest dose of SS (25 mg/l) and 52% in the highest OP dose (0.3 mg/l). Even modest levels of each pollutant (10 mg/l SS; 0.1 mg/l OP) increased egg mortality significantly over control treatments. SS displayed a greater effect on egg survival than OP when dosed in isolation. However, results indicated that SS and OP had greater effects on egg hatching when dosed in combination than when either were considered in isolation.

Concentrations of SS and OP found to significantly impact egg development are below legal threshold values and commonly occur in English rivers. The Environment Agency (EA) recorded 32,549 spot measurements of OP across England in 2015 and 52% were above 0.1 mg/l, with 22% of those above the highest dose of 0.3 mg/l. Monthly spot measures of SS were made at 1812 locations and 22% had annual average values higher than 25 mg/l and over half had average concentrations above 10 mg/l.

The mechanism leading to the detrimental effects on egg development is not fully understood but is likely to be complex. Suspended sediment settled onto eggs and dislodged them under high dosage (> 20 mg/l) and high concentrations of OP (> 0.2 mg/l) fuelled hyphomycete growth. However, increased mortality occurred at lower concentrations of both pollutants and without these phenomena taking place. Therefore, more research is required to assess the impacts of pollution on invertebrate egg development given their different sensitivity and exposure pathways compared to other life stages. In addition, the results support calls for legal levels of SS to be reassessed.