Sediment and Nutrient Fluxes in the River Bandon & Owenabue Catchments, Ireland

Joe Harrington[1], John Gamble[1], Sean Harrington[1]

[1] Cork Institute of Technology, Rossa Avenue, Bishopstown, Cork, Ireland Phone: +353-(0)-21-4335460
E-mail: joe.harrington@cit.ie

Introduction:
Fine sediment plays a key role in the transport of contaminants in rivers and quantification of suspended sediment and nutrient flux is important to understand and manage river catchments in the context of the EU WFD (2000/60/EC).

For Ireland, work in this area has been very limited and annual fluxes based on continuous data have not been presented. European studies have identified Ireland as having a paucity of sediment and sediment associated pollutant concentration data.

This paper presents work undertaken in recent years for sediment and nutrient fluxes based on continuous data on two river catchments in the South Western River Basin District in Ireland; the Rivers Bandon and Owenabue catchments. The River Bandon has a catchment area of 608 km^2 and average flow of 15 m^3 s^{-1}. The River Owenabue has a catchment area of 105 km^2 and average flow of 2.29 m^3 s^{-1}. Both catchments are primarily agricultural with some pockets of forestry and urban development.

Methods:
Continuous turbidity monitoring using a Campbell Scientific OBS 3+ probe connected to a CR800 logger recording at 15 minute intervals has been in place on both rivers at Irish OPW hydrometric stations since 2010. Continuous data has been supplemented by manual suspended sediment sampling using the surface grab and depth integrating techniques and an automatic sampler.

Manual grab samples were also tested for a range of nutrient parameters: total phosphorus (TP), particulate phosphorus (PP), total reactive phosphorus (TRP), soluble reactive phosphorus (SRP), total dissolved phosphorus (TDP), total nitrogen (TN), particulate nitrogen (PN), total inorganic nitrogen (TIN), dissolved inorganic nitrogen (DIN) and total dissolved nitrogen (TDN).

Linear regression analyses were undertaken to correlate manually sampled suspended sediment concentration and nutrient concentrations and continuously recorded turbidity data.

Sediment and nutrient fluxes were estimated as:

$$L_s = \int_{t_1}^{t_2} Q_t \, SSC_t \, dt$$

where L_s is the load over a time period $(t_2 - t_1)$, Q_t flow rate at time t, SSC_t parameter concentration at time t, and dt the time interval $(t_2 - t_1)$.

Results:
Turbidity was found to be a suitable surrogate for suspended sediment concentration and for some species of nutrients.

Suspended sediment and nutrient fluxes and yields were then determined for both rivers based partly on the continuous monitoring data. The results are analysed on both a seasonal and an annual basis.

Storm based events are also analysed to assess the disproportionate impact of infrequent high flow events on sediment and nutrient transport in both river systems.

This work contributes to a greater understanding of fine grained sediment and associated nutrient fluxes within river basin systems. Such work will assist river basin managers and decision makers (and society) in assessing the impact of fine grained sediments on river systems including in the context of national and international legislation including the WFD.

Acknowledgements: This work was funded by the IOTI Technological Sector Research Programme, Byrne Looby PHMcCarthy and the Irish OPW.

Key words:
- Sediment - Methodology –Turbidity -
– Fluxes - Nutrients

Theme:
Sediment and society
Understanding sediment fluxes and budgets on a river basin scale