Geophysical Research Abstracts,
Vol. 11, EGU2009-7684, 2009
EGU General Assembly 2009

The particulate fraction of nutrients transported in river loads in the South West River Basin District (SWRBD), Ireland

S. Harrington (1) and J. Harrington (2)

(1) Department of Civil, Structural & Environmental Engineering, Cork Institute of Technology, Rossa Avenue, Bishopstown, Cork, Ireland, phone: +353 21 4326469; fax: +353 21 4345244; e-mail: sean.harrington@cit.ie, (2) School of Building & Civil Engineering, Cork Institute of Technology, Rossa Avenue, Bishopstown, Cork,+353 21 4326313; fax: +353 21 4345244; e-mail: joe.harrington@cit.ie

Abstract

Nutrient and sediment budgets help river basin managers devise and implement appropriate strategies and methods to manage river basins. The enriching effects of nutrients are well documented, and quantifying nutrient loads can help predict algal blooms and thus minimise their occurrence. Many studies concentrate on the dissolved fraction of nutrients whilst ignoring the particulate proportion. Other studies fail to differentiate between particulate and dissolved forms.

This paper reports on the results of the first investigation on Irish rivers concerning the fraction of nutrients that are found in particulate form, as well as nutrient riverine loads. Seven rivers in three different catchments in the South West River Basin District (SWRBD), as defined under the Water Frameworks Directive (200/60/EC, WFD), in the Republic of Ireland were investigated. The rivers investigated were the Lee, Shournagh, Glashaboy and Owenabue which discharge to Cork Estuary; the Bandon River which discharges to Kinsale Estuary; and the Blackwater and Bride rivers which discharge to Youghal Estuary. Thirty five water samples (five on each river) were collected for nutrient analysis between January and September 2008. Nutrients tested included; total dissolved P (TDP), total particulate P (TPP), dissolved orthophosphate, particulate orthophosphate, total dissolved N (TDN), total particulate N (TPN), dissolved nitrate and particulate nitrate.

Results show that phosphorus transport in all catchments is largely dependent on suspended sediment concentration and flow rate. The fraction of total load for nitrogen and phosphorus that was found to be particulate varied largely between catchments. Nutrient loads were calculated for each river. Annual TN loads ranged approximately between 655 tonnes and 17,000 tonnes. TP loads ranged from as little as 12 tonnes to almost 1,400 tonnes. The fraction of TP found to be particulate varied from 16% to 81%, with an average of 50%. TPN had a range of 20% to 69% with an average of 40% of TN load. Nitrate was found to be on average 19% particulate, with a range from 7% to 26%, indicating that nitrogen is least dependent on sediment. Orthophosphate was found to be on average 45% particulate with a range of 21% to 84%.

A suspended sediment sampling program was conducted between October 2007 and October 2008. High flow events, which are generally more sediment laden, were included in the sampling programme. The effects of an hydroelectric dam on one river were clearly observed, where suspended sediment concentrations were significantly lower and particulate phosphate was also lower. Higher concentrations were found for higher flows which showed that more sediment became available during storms, inferring that the systems were all transport limited. However, hysteresis was encountered during prolonged storm events. Riverine suspended sediment loads discharging to estuaries varied approximately from 11,000 to 84,000 tonnes per annum. Annual TN loads were between 3,000 tonnes and 19,000 tonnes per annum, while nitrate comprised an average 30% of the TN load. Annual TP loads ranged from 110 tonnes to 1,525 tonnes, with orthophosphate accounting for 30% of the load on average. Comparing annual particulate nutrient loads to suspended sediment loads showed that the particulate nutrients accounted for between 6% and 22% of the suspended sediment loads.

Uncertainty was propagated taking into account stream flow measurement, sample collection, sample storage and

laboratory analysis. Suspended sediment uncertainty also included an initial attempt to quantify uncertainty due to the rating curve, by utilising the standard error of estimate. The uncertainty analysis showed that uncertainty for suspended sediment loads was higher than the uncertainty for nutrient loads. Sample collection was carried out using random time, surface grab sampling enhanced by specific storm event sampling. This method produced the largest source of uncertainty in the total propagated error. The average uncertainty for suspended sediment loads was 32% with a range from 27% to 41%. Nutrient uncertainty differed little for the different nutrient parameters with the uncertainty ranging from 18% and 27%, with an average of approximately 23%.