

First of all, we would like to thank the referee for his/her positive and constructive comments on the present manuscript.

“As high-resolution monitoring reveals the temporal variability and heterogeneity in river water chemistry, questions arise as to the efficacy of existing regulatory monitoring approaches for determining the requirement for, and effect of, mitigation measures in reducing nutrient loss to surface water systems. The cost of any given monitoring approach needs to be weighed against the expense of unnecessary mitigation where nutrient fluxes are overestimated, and ecological damage where fluxes are underestimated and measures not implemented. Accuracy is important and environmental agencies with responsibilities for water quality need to ensure that monitoring strategies are optimised to suit the scales of variation in each river system, and provide value C2869 for investment. With these issues in mind, this paper compares three approaches for nutrient monitoring in rivers – grab sampling, time-proportional composite sampling and passive flow-proportional samplers- tested both in controlled flumes and 2 rivers in Denmark. The costs of each approach (in terms of investment, installation, transport, power, time and analysis) are compared and evaluated against their efficacy in estimating nutrient loads, providing a real insight into the factors which need to be considered in developing monitoring strategies and identifying viable new technologies and sampling approaches. The paper falls well within the scope of HESS and will be of interest to its readership. It is clearly structured, well-written and could be published as is. There are a few places where some clarification might be helpful though and I have detailed these below.”

“Section 2.3 and 2.4: It would be useful to have more information on water chemistry and discharge for the flumes and rivers Odderbaek and Gelbaek. For the flume tests it would be useful to know the set up for the flume experiments in a little more detail. It is not clear whether all the SC samplers were deployed at the same time in each flume –which would give a similar concentration exposure for the duration of the deployment? It might also be helpful to list the 6 flow rates used, rather than just the range. It appears that all are shown in Figure 2a, although two have very similar velocities ($\sim 0.12\text{m/s}$), yet differ in responses in terms of tracer salt loss, so it would be interesting to know if there was any physical difference between these flumes.

This leads to a further query regarding the linear relationship shown between cartridge throughflow and P and N accumulations (figure 2b and 2c; Page 7593 lines 11-13) which is provided as further confirmation of the flow-proportionality of the samplers. For a linear relationship with throughflow to exist it is assuming that the concentration profile would be the same in each flume for the duration of the

multiple deployments. Some additional information on the concentration ranges in the stream feeding the flumes and during the deployment periods would be useful.”

We apologize for the lack of clarity in the description of the experimental setup. All six flumes received water from the same stream, i.e. with the same water chemistry, and the SC samplers were all deployed at the same time in the flumes. The substrate in the flumes was the same, only velocities differed, therefore no physical difference was expected. This experiment was done in summer, at base-flow condition, when the concentrations were rather stable.

In the revised manuscript, the experimental design will be clarified, the velocities in each flume will be listed, and more details about the range of concentration will be given.

“It would also be interesting to know if there were any deployments in the flumes for longer than a week, given that the river deployments were for 2 weeks? Could the sequestration of N and P deteriorate in time if the pore space in the SC-sampler becomes clogged and how might that have affected the longer duration river deployments? Would a 1 week SC-sampler deployment in the rivers have performed any better?”

This a very good point raised by the referee. Only few SC samplers (4) were deployed in the flumes for 2 weeks and therefore it was difficult to interpret the data with confidence which is the reason why these data are not shown. However, based on these data, the assumption of flow proportionality of the samplers seemed valid. Nevertheless, it is not possible to exclude that deployment time has an effect on the performance of the SC sampler and therefore this point will be added to the discussion.

“Likewise for the river sites it would be informative to know the base flow concentrations of N and P and to give some idea of the flashiness of river discharge, for example the q5:q95 ratio.”

We thank the referee for these suggestions, more information on the flashiness of the rivers and nutrient concentrations at base flow will be added to the manuscript.

“Was there any variation in the thalweg in the rivers at different stage heights which might have led to the SC-samplers being located in a lower or higher velocity part of the river cross-section at different flows and thus impact on the flow proportionality?”

We thank the reviewer for raising this issue. We will revise and include in the new manuscript that the passive samplers were installed at 0.6 x water height to ensure installation at average flow velocity as a comparable position in the logarithmic velocity profile in the channel cross-section. Hence the position was adjusted according to water depth at every sampling date.

“Finally just a small query on laboratory costs – were the SC-samplers analysed in house or transported to the manufacturers for analysis and was that part of the transport costs or included in analysis costs?”

In our study the SC-samplers were sent by post to the manufacturer for analysis. However, in our cost calculations we assumed that the transport costs included the delivery to the laboratory. If the SC-samplers are sent to the manufacturers the cost is about 4€ at every sampling and therefore this can slightly increase the total cost.

“Technical Corrections

Page 7586 Line 4: via water supplies –doesn’t need the “the”

Page 7587 Line 6: via drinking water supplies

Page 7587 Line 13: change “of 19 000 t N” to “by 19 000 t N”

Page 7587 Line 23: “in cooling box” to “in a cooling box”

Page 7587 Line 19: Kronvang et al 1993 – there is nothing in the references corresponding to this

Page 7588 Line 3: “with power supply” to “with a power supply”

Page 7589 Line 2: “when the water” to “when water”

Page 7590 Line 17: Should reference be just Strahler, 1957?

Page 7591 Line 11: “transducer by establishing” to “transducer and establishing”

Page 7595 Line 19: suggest changing “Especially” to “In particular”

Figure 6: Proportional misspelled in both x-axes.”

All the technical corrections will be incorporated in the revised manuscript.