

## Spatio-temporal variation of phosphate concentration at river mouths in the Lake Hachiro watershed, Akita, Japan

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[Aim] The present study was conducted to elucidate spatio-temporal variation of phosphate (PO<sub>4</sub>) concentration at river mouths of 5 main rivers entering to Lake Hachiro.

[Materials and Methods] Study sites were at river mouths of 5 main rivers (MTN, BBM, IKW, TYK, BFM) entering to Lake Hachiro at Akita prefecture, Japan. Surface and bottom (about 10 cm from the riverbed) of river water at each site was sampled once a month from May to December in 2012. River sediments were also collected from the top 10 cm of the riverbed at the same time of the water sampling. Dissolved gases in stream water were collected to measure N<sub>2</sub>O and CH<sub>4</sub> concentration. Water and sediment samples were placed on ice, transported back to the laboratory, and refrigerated until denitrification assays and water analysis. Sediment incubation was conducted to evaluate the effect of temperature (10, 25 deg C) and oxic or hypoxic conditions on PO<sub>4</sub> release from the sediments. Fractionation of sediment phosphorus (soluble and loosely bound P, Al-P, Fe-P, reductant soluble P, and Ca-P) was also determined at each site. Phosphorus concentrations in the various solutions were determined using the molybdenum blue method. The denitrification assays of the sediments were determined using the acetylene inhibition technique, which inhibits the final step in the conversion of N<sub>2</sub>O gas into N<sub>2</sub> gas. To determine the difference among sites in the amount of organic C available to the denitrifying organisms, we defined denitrification potential (DP) as the denitrification rate that occurred under anaerobic conditions with abundant NO<sub>3</sub><sup>-</sup> at 25 deg C.

[Result and Discussion] Riverine PO<sub>4</sub> concentrations had a large spatio-temporal variation, which increased from summer to autumn at three rivers (IKW, TYK, BFM). PO<sub>4</sub> concentrations in bottom water tended to be higher than that in surface water, which indicated part of PO<sub>4</sub> was from the riverbed during summer and autumn. In contrast, NO<sub>3</sub><sup>-</sup> concentrations decreased likely by denitrification of which DP was higher in the three rivers, causing lower DIN/DIP ratios in river water during the summer. Higher dissolved CH<sub>4</sub> concentrations in the bottom water indicated the riverbed was under anoxic condition in summer at the three river mouths. The results of the sediment incubation clearly demonstrated that PO<sub>4</sub> was released from the sediments at 25 deg C with hypoxic condition, especially from the three river's sediments. Fe-P contents in the sediments also had a spatial variation among sites and correlated positively with PO<sub>4</sub> concentration in the river water. In conclusion, Fe-P in the river sediments had a large impact on the river water and would result in the spatio-temporal variations of PO<sub>4</sub> concentration in river mouths in the Lake Hachiro watershed.

Keywords: phosphorus, river sediment, eutrophication, denitrification, Fe-P