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Benthic primary producers are promoted by groundwater-borne nutrient inputs to an oligotrophic lake

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Nutrient-rich groundwater may contribute significantly to the nutrient influx to lakes. We hypothesized that benthic primary producers may benefit from these nutrients and store them at the sediment-water interface, thus potentially preventing eutrophication processes in the open water. To test this hypothesis, we performed measurements and experiments in the shallow littoral areas of the oligotrophic Lake Stechlin in Germany (4.25 km^2, maximum depth 70 m).
Periphyton grown on artificial substrates for four weeks was sampled at three different locations with groundwater influx and three respective locations without groundwater influx in summer 2013. A comparison between these zones with and without seepage revealed that groundwater discharge increased periphyton dry weight by 56 % and its areal phosphorus accumulation by 41% in 2013. Phosphorus stored in periphyton and macrophytes accounted to up to 46% of the phosphorous present in the epilimnion in summer.
In addition, we conducted experiments with flow-through chambers installed in the sediment of an area with intense groundwater influx. We measured seepage, sampled pore water and compared the biomass of periphyton grown on artificial substrate and of submerged macrophytes (Potamogeton pectinatus L.) planted in open and closed-bottom (control) chambers. In open chambers with groundwater influx, periphyton dry weight increased up to 27% and macrophyte growth rate up to 52 % in comparison to closed-bottom chambers.