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Assessing the contributions to the phosphorus load delivered to lake Iseo.

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Lake Iseo is a 256-m deep basin which underwent a dramatic deterioration of water quality since the 80ies, to the point that it now shows the most worrying environmental conditions of all the deep lake in northern Italy, with anoxia and 160 µg/l of total phosphorus (TP) below 100 m. In this lake, a permanent chemical stratification has established, preventing deep mixing and trapping the larger part of the incoming TP in the monimolimnion. The increase in air temperature foreseen for the Iseo watershed will further enhance the stability of the water column and further reduce the efficiency of the outflow in the removal of TP. In order to rationally guide future choices of remediation strategies, a quantification of the main sources of external and internal TP load to the lake is thus essential.

At this purpose, in the period 2016-2019 the research project ISEO (Improving the lake Status from Eutrophy towards Oligotrophy) was developed, comprising field monitoring, laboratory and experimental activities. The contribution of the main watershed (covering about 80% of the whole drained area) was quantified as 111 tonns TP/year, by measuring the TP concentration at high temporal resolution in main tributary through a bank-side auto-analyser. These measurements revealed that about 50% of this load is generated by acute, storm-dependent events, in which high TP concentrations in particulate form are delivered to the lake over short periods. The contribution of the combined sewer overflows (CSO) was quantified as 7 tonns TP/year, by coupling an hydraulic model of the sewer system along the shore of the lake with the measurements of the nutrients discharged in wet periods through the sewer spillways of 3 representative CSOs. This load was foreseen to increase by 10% in a climate change scenario with amplified intense storms. With regard to the internal load, soluble reactive phosphorus (SRP) fluxes were determined across the sediment–water interface from centimetre-scale pore water SRP concentration profiles using passive pore water samplers in 3 different lake locations. The average monimolimnion-wide flux was thus established 28.7 tonns SRP/year. Interestingly, the size and speciation of the phosphorus-bearing sediment fractions at each station revealed that the available mobile TP in the sediment under the monimolimnion was only 45 tonns, so able to sustain the actual release for only ~ 1.6 years without constant renewal. These data allowed to

address the current contribution of the different nutrient sources to the TP budget in lake Iseo, and to argue about their possible temporal evolution and distribution in the lake in a climate change scenario.