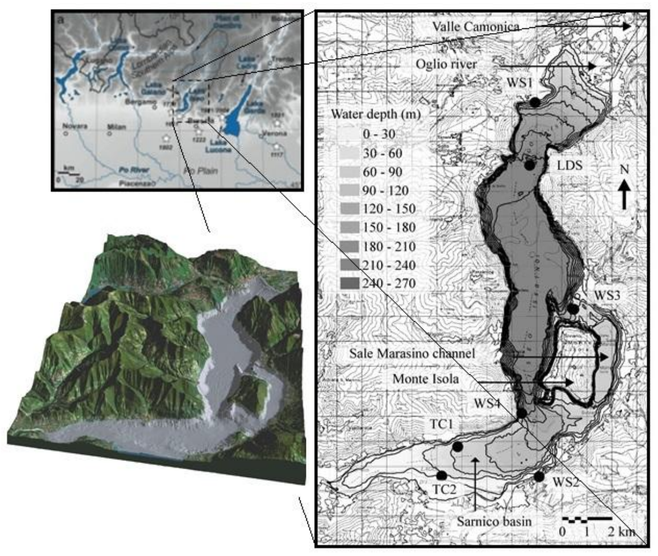
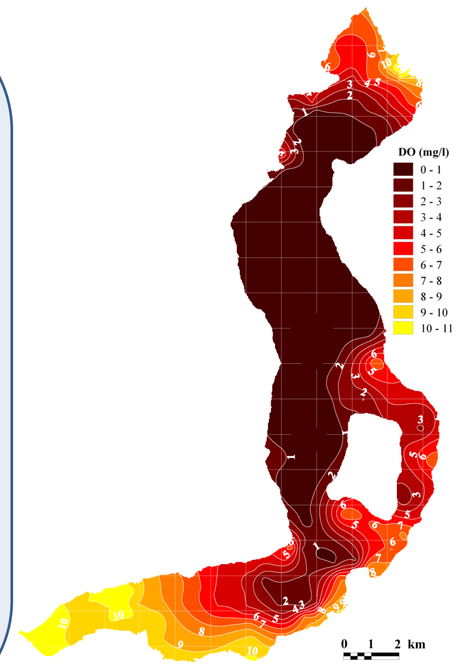
Project ISEO (2016 – 2019)
Improving the lake Status from Eutrophy towards Oligotrophy

REASONS OF THE RESEARCH



Regione Lombardia hosts 65% of the overall volume of Italian lakes, in one of the most densely populated and industrialized zones in Europe. The depth and the actual water renewal time of these lakes reinforce their sensitivity to pollution and climate change effects. During the second half of the 20th century Lake Iseo (max depth = 250m, surface area = 60 km^2) underwent a dramatic deterioration of water quality, with a transition from oligotrophic to an eutrophic condition. As a result, the oxygen content of the bottom waters has decreased from 9 mg/l (in 1967) to zero from mid 1995s till mid 2000s. This situation is going on and the fully oxygenated layer is shrinking. In order to quantify the mechanisms that drive this negative evolution, the main objective of the ISEO project is the identification and quantitative assessment of local pressures and their synergic effects along with global warming. This aim will be persued by quantifying the relative contribution of sediments, littorals, tributaries and sewage overflows to the overall phosphorous load of Lake Iseo.



Dissolved oxygen measured in the 10m above the lake bottom on July 2011

AIMS AND METHODS

1) PHOSPHOROUS FROM THE WATERSHED

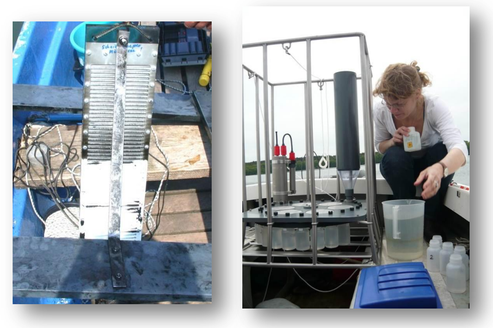
How much nutrients are entering from the drained watershed ? Are the figures so far obtained by monthly sampling at the Oglio mouth really representative ? Continuous, real-time measurement of the total phosphorous concentration in the Oglio River will provide the answer, exploring the consequence of intermittent pulses during high flows. These data will be compared with the one coming from phosphorous budgets in the upstream catchment, as well with the ones extrapolated from the traditional monthly sampling.

2) PHOSPHOROUS FROM THE SEWER OVERFOWS

What is the actual efficiency of the peripheral combined sewer at the light of the lake's quality? How much nutrients do the effluents from the sewer overflows (CSOWs) in rainy periods convey to the lake? The most impacting devices will be identified and the qualitative and quantitative characterization of the nutrients concentrations of the outflowing water will be accomplished to quantify the nutrients still delivered to the lake from this source.

3) PHOSPHOROUS FROM THE SEDIMENTS

How much is the internal load with respect to the external one? The sediments at the bottom of the lake release phosphorous to the overlying waters. To quantify this contribution, the phosphorous exchange between sediment and water will be quantified by laboratory experiments with undisturbed sediment cores from the lake and in-situ measurements of the vertical flux rates by sedimentation traps and by high resolution sampling of pore water.

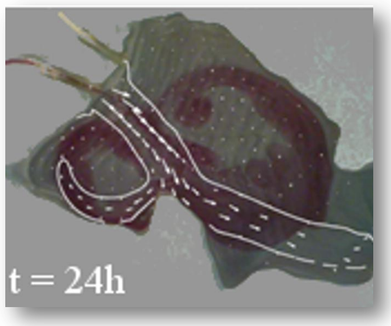


4) ROLE OF THE MACROPHYTES

Can the dense submerged aquatic vegetation (SAV), which forms a belt in the shallow coastal areas, provide a buffer capacity against nutrients in the lake? The SAV will be mapped and their ecology will be evaluated to exploit their diagnostic power to evaluate nutrient contamination/sources and to assess their capacity to retain and contrast the inflowing phosphorous.

5) REMOTE SENSING

How does an algal bloom looks like? Where does the water coming from the inflows go? To answer these questions, a remote monitoring of the lake surface will be set up, integrating satellite images of the lake surface with the high resolution images taken from a webcam. This will allow to monitor the extent of potential acute pollution events and algal bloom, to track the incoming plumes of the Oglio River and to verify the extent of macrophytes distribution in the littoral area of the lake.



6) NUMERICAL MODELING

How long will it take to Lake Iseo to restore a "good" quality status according to the Water Framework Directive? Are there any way to enhance this recovery process? Future scenaria will be investigated by using an hydrodynamic-ecological model of the lake and an hydraulic model of the sewer system. All these models will use as input the data measured from the previous activities.

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istituto per il rilevamento elettromagnetico dell'ambiente