by capping the sediment is one of the possibilities to reduce the internal loading. In most cases a thin layer of phosphate binding agents like Phoslock, alum, poly aluminium chlorides, iron chlorides or waste materials was applied (chemical capping). Another possibility is capping with a thick (20-50 cm) layer of sand or soil (physical capping). Both methods influence the internal loading, but in a different way.
Work undertaken: Lake Bergse Plassen, Rotterdam (NL), consists of two parts connected by a small canal. In 2001, the western lake was covered with 25 cm of sand. Ten year after the western part was capped, also the eastern lake was capped, but then a 20 cm sand layer was applied on top of the sediment and part of the eastern lake got a combined physical-chemical treatment: polyaluminium chloride was added to the lake directly before capping with sand, resulting in a chemically reactive layer of aluminium hydroxides between the sediment and the sand. Surface water quality and pore water quality were monitored. Sediment cores were taken before and directly after treatment, and also after 2 and, in the western lake, after 10 years. Supporting laboratory experiments have been performed: a) diffusion experiments in undisturbed sediment columns, and b) sand + aluminium hydroxide columns flushed with a continuous flow of phosphate solution.
The water quality in Lake Bergse Plassen has improved strongly, but this was the result of a combination of measures. We focused on the effect of capping. A top layer consisting of only sand strongly changed the pore water profiles in the field compared to the original sediment, suggesting that a sand layer does not only provide a physical barrier but also alters the chemistry. The dissolved iron concentrations in the sand layer were significantly higher, also 10 years after capping, which might have a beneficial effect on the binding of P when the iron is transported to the overlying surface water where it is oxidised to iron hydroxide.
The laboratory experiments revealed that a sand layer reduced the phosphate flux significantly, but that sand/Al-hydroxide was significantly more effective. The pore water profiles in the field cores showed that the addition of Al-hydroxides between the original sediment and the sand layer reduced the $P_{porewater}$ at the sediment-sand interface strongly compared to the area that was only capped with sand. The aluminium addition did not affect the pore water profiles in the sand layer very much.

40-O Manipulating nutrient limitation using modified local soils: a case study at Lake Taihu (China).

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Nutrient limitation dictates the strategies and costs involved in eutrophication management. An attempt to manipulate nutrient limitation/cycling was studied in comparable whole ponds in Lake Taihu using geo-engineering materials of chitosan modified local soil (MLS) in October 2013. Approximately 20 kg MLS were sprayed onto the whole water pond (400 m^2) and *Chlorophyll-a* (*Chl-a*) concentration was decreased from 42.49 to 17.53 μg L^{-1} within 2 hours. In the following 15 months, *Chl-a* remained less than 20 μg L^{-1} in the treatment pond, compared to the average of 35.71 μgL^{-1} in the control pond. In situ nutrient addition bioassay experiments indicated that the nutrient limitation was shifted from N+P co-limitation to P limitation from October 2013 to March 2014, where phytoplankton biomass and growth rates showed no increase by adding nitrogen (N) but significant increase by adding phosphorus (P) in the treatment pond, meanwhile, either N or P addition led to phytoplankton growth in the control pond. In the summer 2014, a strong N limitation was observed in the treatment pond, however, the maximum biomass and growth rate of phytoplankton were 2.23 and 1.65 times lower than the control pond under adequate N addition. The control pond remained *Cyanobacteria*-dominated state, while *Chlorophyta*, *Bacillariophyta*, *Cyanobacteria* and other algae coexisted in the treatment pond. The upper limiting concentration of DIN was enhanced from 0.8 to 1.5 mg N L^{-1} and SRP from 0.1 to 0.3 mg P L^{-1} compared to the control pond. This study indicates that nutrient limitation in some waters can be manipulated by changing P, N, and phytoplankton composition and their ratio using MLS technology, which may provide new strategies for eutrophication mitigation.

40-O Ecological restoration of Lake Orta (Northern Italy), one of the largest world's acidified lakes.

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With a surface area of 1814 ha, a depth of 143 m, and a volume of 1.29 km^3, Lake Orta, is among the largest lakes in Italy. Lake Orta also has a disturbing history of severe industrial pollution, and, given its volume, it can be considered one of the largest lake to have undergone acidification in the world. The fish fauna, the biotic component most visible to the public, was heavily damaged and any potential recovery was compromised by the construction of impassable dams along the lake's outlet, dams which prevented any possible natural recolonization from the neighbouring Lake Maggiore and River Po Basin.
Beginning in 1926, the lake was polluted by ammonium and copper sulphate from a rayon factory. So serious was the algicidal effect of copper salts, that the whole food web of the lake, including its plankton, benthos and fish fauna, was seriously damaged within a few years (Monti, 1930). The situation then worsened in three ways. In the 1950s, Cu, Cr, Ni and Al discharges from metal plating and manufacturing industries in the watershed contaminated the lake with additional metals, and the oxidation of ammonia both consumed profundal oxygen and inexorably acidified the lake. Indeed the pH of the lake had fallen to 3.9 by 1985. The recent situation is Lake Orta has improved dramatically. The water quality of the lake has been restored, both because of reduced pollutant inputs and a massive liming intervention carried on in 1989-1990. However, still after two decades, the fish community is far to be fully restored. Indeed recent fish investigations have shown the absence of truly pelagic fish species, such as European whitefish *Coregonus lavaretus* and landlocked shad *Alosa agone*, typical profundal cold water species such as burbot *Lota lota* and arctic char *Salvelinus alpinus*, and migratory ones such as marble trout *Salmo marmoratus*, which were abundant in the years predating the lake pollution and dams construction. According to the recent picture of the fish community, priorities for ecological restoration were set and first restoration activities were started. Artificial reproduction of European whitefish began in January 2014 and ca. 2 millions of pre-fed larvae reared in illuminated cages have been introduced in the lake in the last two years. The status of whitefish population was not quantitatively assessed still, but adult whitefish were already captured during preliminary sampling activities done by anglers. Data of somatic growth and body condition of whitefish are satisfactory and similar to the neighbouring Lake Maggiore indicating that the environment of Lake Orta provides suitable conditions for a successful re-establishment of pelagic fish species.

40-O Predicting sediment contaminant flux: why accurate baz measurements are important (and not your only concern!)

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Sediment Profile Imaging (SPI) is an innovative "optical coring" technique that takes an undisturbed cross-sectional image of the upper 20 cm of sediment. It has been used extensively in the marine environment for the past 30 years and has just started being used as a monitoring tool in freshwater environments for both dredging and dredged material disposal studies as well as contaminated sediment investigations.
Selection of acceptable sediment remedial alternatives for contaminated sediment sites are strongly influenced by results from flux models that look at the sediments as a source of contaminants to the water column. The flux rate is highly dependent on the depth of the biologically activity zone (BAZ), which is one of the major drivers for geochemical exchanges across the sediment-water interface. Published studies on the burrowing depth of freshwater infauna show the majority of invertebrates are restricted to the upper 10 cm of sediment, with most activity in the top 5 cm. Examples from several SPI surveys in both river and lake settings from Canada, Italy, and the United States will demonstrate why one should not rely solely on average BAZ estimates derived from literature values. Our results have frequently shown that the BAZ was much greater than published averages, and in many cases, site-specific physical or geochemical processes were equally important as a sediment mixing force. Using rapid reconnaissance technology such as SPI now makes it possible to collect site-specific information for cost-effective resource management decisions.

40-O Restoration of two chinese subtropical shallow eutrophic lakes: special focus on the interactions between fish and submerged macrophytes.

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Abstract: Biomanipulation based on removal of coarse fish, piscivorous fish stocking and sometimes also planting of submerged macrophytes has been used to restore temperate eutrophic shallow lakes. However, in warm lakes