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Cold-season climate change versus anthropogenic nutrient input: signals preserved in chrysophyte stomatocyst assemblages from annually laminated sediments (AD 1940 – 2004) of high-Alpine Lake Silvaplana (Switzerland)

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Chrysophytes (classes Chrysophyceae and Synurophyceae) are mainly euplanktonic, freshwater algae. Their siliceous resting stages (stomatocysts) are often well-preserved in lake sediments. Chrysophytes were shown to have limited tolerance to changes in lake-water pH, water temperature, salinity, conductivity, trophic status and pollution. They can therefore be used to reconstruct past environmental conditions such as winter/spring (cold season) climate or anthropogenic nutrient input. To disentangle the relative influence of climatic changes versus anthropogenic nutrient inputs on stomatocyst assemblages, stomatocysts from annually-laminated (varved) sediments of high-Alpine Lake Silvaplana (south-eastern Swiss Alps, 1792 m a.s.l.) were studied. Using an environmental scanning electron microscope, more than 130 stomatocyst types were identified in 64 samples covering the period AD 1940 – 2004. Multivariate statistical analysis revealed that major changes in stomatocyst assemblages were primarily driven by climatic factors, in particular mean October to March air temperatures. Biogenic silica and diatom-inferred total phosphorus, both indicating anthropogenic nutrient input, were shown to have a secondary, yet significant impact on stomatocyst assemblages. This nutrient input did not appear to interfere with the cold-season climate signal preserved in the stomatocyst assemblages.