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Use of Stable Isotopes in Studies of C and N Dynamics in Eutrophic Lake Planina

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Stable isotopes of carbon and nitrogen have proven to be useful indicators of biogeochemical processes in aquatic environments. However, available data on seasonal dynamics in eutrophic mountain lakes are scarce. In this study we used stable C and N isotope analyses of dissolved inorganic carbon (DIC) and particulate organic matter (POM) in combination with chemical analyses (i.e. dissolved oxygen concentrations, alkalinity, nitrate and ammonium) to study C and N dynamics in the water column of Lake Planina, a small eutrophic mountain lake in the area of Triglav National Park in north-western Slovenia.

Lake Planina is dimictic lake of postglacial origin situated 1430 m a.s.l. with a surface area of 1.6 ha and a maximum depth of 11 m. The water column is stratified most of the year and hypolimnion is dysoxic to anoxic during the stratified period. Since the area of Triglav National Park is protected, direct pollution is expected to be limited, however lake is easily accessible. Therefore many human activities like woodcutting and Alpine dairying took place around the lake in the past and nowadays tourism is very popular. As a consequence of human activities more nutrients and terrigenous organic matter were introduced into the lake. A response to human activities was induced process of eutrophication.

Substantial variations in all chemical and isotopic parameters were observed with time and water column depth. During stratified period, dissolved oxygen concentrations progressively decrease while alkalinity and ammonium concentrations increase with depth. With the development of dysoxic to anoxic conditions in the bottom waters isotopic compositions of DIC and POM also decrease. Isotopic composition of DIC varies between –5.5 at the surface to –13.2 per mill at the bottom of the lake while

isotopic compositions of carbon and nitrogen in POM vary between –34.3 and –50.6 per mill and +2.5 and –6.4 per mill, respectively. Variations in isotopic composition of carbon and nitrogen are related to biogeochemical changes in stratified eutrophic lake and indicate the influence of photosynthesis, respiration and decomposition of organic matter during sinking to the lake bottom. Very negative isotope values indicate that with increasing depth aerobic/anaerobic bacteria utilizing as carbon and nitrogen source methane and ammonium derived from decomposition of organic matter play an important role.