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INTERSTITIAL WATER OF DEEP, STRATIFIED LAKE
AS POTENTIAL SOURCE OF INTERNAL PHOSPHORUS LOADING –
IMPLICATIONS FOR PREVENTING EUTROPHICATION**

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The contemporary development of societies is connected with the increase of anthropopressure on various ecosystems. Inland waters are extremely susceptible to degradation, both due to the increase in pollution (sewage, runoff from agricultural areas and urban development) as well as recreational pressure (bathing, fishing, sailing).

The main problem of lakes is the eutrophication process, caused by an excess of biogenic substances, mainly phosphorus and nitrogen. In high trophic conditions, planktonic algae form harmful blooms and the organoleptic quality of the water deteriorates. There is a decrease in the population of submerged macrophytes, which lose competition with algae (especially cyanobacteria) and cease to play the role of stabilizing the ecological balance of the lake. The consequence of the decomposition of excessive algae biomass is the disturbance of aerobic conditions. In superficial layers (epilimnion), supersaturation (up to 150 and more percent) is observed, while at the same time in deeper layers (hypolimnion, in extreme cases also metalimnion) oxygen deficits or total disappearance of this element occur. In the case of lakes with advanced trophies, rich in fertile bottom sediments, deoxidation causes secondary pollution with phosphorus released from the bottom. The scale of this phenomenon depends on the composition of bottom sediments (content of organic matter and components of the sorption complex, especially iron, aluminum, calcium) and the forms in which phosphorus is present in the sediment. The first symptom of phosphorus release from the bottom is the increase in concentrations of this element in interstitial water.

The paper presents the case of the Lake Świąte in Obra (Wielkopolskie Lake District, Poland, area 23.3 ha, maximum depth of 15.3 m), for many years contaminated with organic and biogenic matter from agricultural sources. The main point source of pollution is the stream flowing through the lake. Despite the small flow (water exchange time of 1.6-1.7 years), it carries a significant load of nitrogen and phosphorus, exceeding the self-cleaning capacity of the lake. Research conducted in 2017 indicates that the bottom waters of this reservoir are deprived of oxygen in the summer, and the phosphorus content in interstitial water (0.7-9.2 mgP/dm³) many times exceeds the concentrations found in hypolimnion waters and surface layers. Deoxidation is favored by the difficult mixing of water associated with the high relative depth of the lake. It has been observed that oxygen deficits in hypolimnion appear already at the beginning of the summer. The paper analyzes environmental factors that favor this phenomenon and spatial variability of phosphorus occurrence in sedimentary waters. It was shown that the increase in the amount of this element occurs with the increase of the depth of the bottom and the largest is in the profundal sediments. In addition, these sediments are characterized by a large immediate oxygen demand, which is associated with a relatively large amount of organic matter (about 20% of dry weight). In the littoral, coastal sediments, both the amount of organic and biogenic matter was small. The obtained data allowed to calculate the potential internal loading of this element that can be displaced to the water column. The results were confronted with the content of this element in water and solid fractions of bottom sediment.

Unfavorable hydrochemical conditions in the lake make it necessary to intervene. The work proposed directions for revitalization activities. They should be directed at limiting the further inflow of pollutants, followed by the improvement of aerobic conditions and limitation of the possibility of phosphorus release from the sediment to interstitial waters and to the water column.