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ENVIRONMENTAL CONDITIONS OF THE GROUP OF LAKES  
NEAR OSTRÓDA, (POLAND) USED FOR FISH FARMING**

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The research was conducted on four Polish lakes, located on Masurian Lakeland, nearby Ostróda city (N: 53 ° 41 ', E: 19 ° 57'): Szelaż Wielki (677.5 ha, H max = 35,5 m), Morlińskie (57.5 ha, H max = 19,5 m), Pauzeńskie (218 ha, H max = 2 m) and Paskierz (12.5 ha, H max = 10,6 m). These waterbodies differ significantly in terms of surface area, maximum and average depth, water dynamic and ichthyofauna, and they present different types of fishery classification, respectively: whitefish – type, bream – type, zander – type and crucian – type. In these lakes, the fish farming is provided (stocking and catches). The fish hatcheries is located on lake Szelaż Wielki, where intensive fish farming is conducted. In order to increase the fertility of ponds, natural fertilizers are used. The fish are fed with a high-protein granulates. The farm collects and drains water from and to lake Szelaż Wielki.

The lakes differs from each other in the way of catchment use, too. The largest part of lake Szelaż Wielki catchment (55 %) is forested, the forest occupies 35% of the direct catchment of lake Morliny. The catchments of lakes Pauzeńskie and Paskierz are mainly urbanized.

The aim of this work is to compare environmental conditions, especially the trophic state based on basic indicators (concentration of nutrients, chlorophyll a, Secchi disc visibility) and the integrated TSI. Additionally thermal-oxygen profiles were made and the content of organic matter as BOD and COD-Mn were determined. Water samples for analyses were taken four times, from June to November 2017, from a sampling stations located over the deepest site in each lake. Stations were found with the use of bathymetric maps and a GPS receiver. Water samples from the ponds (fish hatchery) were taken twice. Physicochemical analyses were done in accordance with the standard methods used in surface water examinations.

In comparison to the lakes, the water in the pond was characterized by a higher content of organic matter (on average: COD-Mn = 27.1, BOD<sub>5</sub> = 17.3 mg O<sub>2</sub> dm<sup>-3</sup>). The concentration of organic nitrogen (2.0 – 3.29 mg N dm<sup>-3</sup>) and organic phosphorus (up to 1.097 mg P dm<sup>-3</sup>) also was higher.

Based on thermal-oxygen profiles, it was found that shallow lake Pauzeńskie is a homothermic and homoxygenic polymictic waterbody. During the research period, in the summer, the temperature of entire mass of water was similar to the temperature of epilimnion in the other lakes. The intensive primary production process in the entire mass of water was indicated by oxygen oversaturation (118% O<sub>2</sub>) and confirmed by the increased reaction of water (pH = 8.9) and a low Secchi disc visibility (SD = 0.3 m). In October and November visibility increased to 0.5 m, and oxygen saturation decreased to about 83% O<sub>2</sub>.

The other lakes are thermally stratified. Epilimnion in lakes Szelaż Wielki and Morliny, was oxygenated (>115 % O<sub>2</sub>) and oxygen was rapidly depleted in metalimnion. Hypolimnion was deoxygenated, which indicates the possibility of internal supplying. In lake Paskierz, the oxygen deficit occurred throughout the entire research period.

The TSI (TP) values in all these lakes was the highest. Especially in lakes Pauzeńskie and Paskierz it was characteristic for hypertrophy. The values of the others partial TSI in these lakes indicate advanced eutrophy. In addition, the primary production process in lake Pauzeńskie was limited by the presence of nitrogen (TSI (CHL) – TSI (N) > 0 and TSI (N) – TSI (P) < 0). This is confirmed by the relatively low concentration of chlorophyll a (7.78 – 18.08 µg dm<sup>-3</sup>), and TN/TP = 11.5 indicates the growth of undesirable cyanobacteria. The concentration of organic matter (COD-Mn) in the surface layer of water was high (14.5-19.5 mg O<sub>2</sub> dm<sup>-3</sup>) and the ratio COD/BOD > 1 indicates it's inflow from the catchment.

The eutrophic nature of lake Morliny the water was confirmed by all partial TSI values. Visibility of Secchi disc (1 – 1.8 m during the summer) was lowered by phytoplankton (23.25 µg dm<sup>-3</sup>), it's biomass could be limited by zooplankton or by the presence of toxic compounds. The fertility of water in Lake Szelaż Wielki corresponded to mesotrophy. The relationship TSI (Chl) < TSI (SD) indicates that the low water transparency (SD 1.5- 1.9 m) was caused by high concentrations of organic matter. This may result from the fact that water is discharged from fish ponds where natural fertilizers and fish food are used.