Summary

Święte lake restoration plan has been set based on the obtained biophysiochemical parameters during a one-year monitoring program (2017-2018) for the lake and its surrounding catchment. The unsatisfactory limnological parameters of Święte lake left the lake unable to defend itself against its own productivity, as pollution has reached a critical level and this situation sustains an excessive primary production, including algae blooms.

The obtained results of the abovementioned monitoring program, Święte lake considered as a trophic reservoir and its ecological condition was rated below good. It resulted from both internal supply of nutrients from bottom sediments and their supply from the catchment basin mainly via the surface inflow. Hydrogen sulphide was present in the hypolimnion of the lake in exceptionally high concentrations of 8.5 - 10 mg HS^- /l. A probable significant source of this gas is the bacterial reduction of sulphates, where sulfur bacteria were present in concentrations up to 136 mg /l.

Święte lake restoration approach have been implemented by Department of water protection engineering and environmental microbiology at University of Warmia and Mazury in Olsztyn and Department of Hydrobiology of University of Szczecin, that consists of following stages:

A. regulating the directions of water flow through the lake hydrological network, and cut its connection with Berzyńskie lake.

B. construct an innovative pipelines system: a) filling pipeline, which directs the water flowing directly from the surface of the Pintus directly to the bottom of the northern deep, b) discharging hypolimnion water from the southern deep to the surface of the Pintus, and c) partially divide the hypolimnetic water by underwater curtain. The pipelines system were launched in October 2020.

C. biomanipulation process that consists of: a) systematic lake stocking with species of predatory fish, and b) regulatory catches which selectively focused to elimination of small cyprinids.

- The restoration activities planned to be completed by phosphorus inactivation using PIX 111 iron coagulant and PAX 18 aluminum coagulant. But in view of the tangible effects of the conducted restoration activities and the increase the iron mean content percentage in

sediments from 0.24% before the operation of the pipelines system to 0.79% by the end of the research period (2020-20) meaning a more sediment absorption capacity for phosphorus (P).

Water transparency before the application of the restoration activities ranged between 1.90 m and 1.82 m for the inflow and outflow zones, respectively. The visibility range registered up to 5 m by end of the research period, December 2022.

The most pronounced effect of the applied restoration process is the improvement of the oxygen conditions in the lake. Phosphorus (P) and nitrogen (N) as main nutrients showed a change of their concentrations. The deep-water layer of Święte lake, showed a significant reduce of their levels for both sites. The obtained results for the deep waters concentration of P and N, indicate the effectiveness of the applied restoration measurements. Both pipelines, filling pipeline and the discharge one, are functionally sufficient to reduce the amount of the stored nutrients at the hypolimnion layer. This took place by discharging the nutrient rich hypolimnetic water from outflow zone, and by enhancing the redox potential at inflow zone. Hydrogen sulfide concentrations did not exceed 1.19 mg HS^-/ l.

Reducing the abundance of small cyprinids will assist to relieve the formed graze pressure by it on zooplankton communities. The introduced predators fish species as, zander and asp through the biomanipulation process will enhance the lake' trophic pyramid and limit its disturbance for the coming years.