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HYDROCHEMISTRY OF THE LAKE ŚWIDWIE (WATER-MARSHES BIRD RESERVE) IN 2004

HYDROCHEMIA JEZIORA ŚWIDWIE (REZERWAT PTACTWA WODNO-BŁOTNEGO) W 2004 R.

Abstract: “Jezioro Świdwie” Reserve is an exceptional wetland and marshland area of international importance and it was as one of five Polish reserves that was listed in the “Ramsar” International Convention. Świdwie Lake research was conducted in 2004 in: spring, summer, and autumn. Chemical analysis included basic water quality indicators, such as: dissolved oxygen, per cent oxygen saturation, organic matter content (BOD₅, COD_{Cr}), nutrient contents and extent of mineralization (Cl, SO₄).

Keywords: Lake Świdwie, hydrochemical conditions, nutrients

Świdwie Lake is an ornithological nature reserve located approximately 20 km to the West from Szczecin within the borders of Police and Dobra districts. It was established in 1963, spreading over an area of 382 ha and enlarged to 891,28 ha in 1988. It encompasses Świdwie Lake along with the rushes, meadows, peat land and forest belt surrounding the lake. The combination of a shallow water area with vast aquatic and waterside vegetation creates exceptionally favourable breeding conditions for water birds and mud birds. There are approximately 240 species nesting within the reserve. In 1984 the reserve was entered into the list of the “Ramsar” Convention on Wetlands [1].

Świdwie Lake is a shallow, strongly eutrophicated water area, largely overgrown with bulrush and reed, which divides the water surface into two separate water areas of the approximate size 50 ha and 26 ha. Currently the maximum depth of the larger water area is 2.4 m, average depth 0.7 m, and its maximum length 157 m [2, 3]. The aim of the research was to define current hydrochemical conditions of Świdwie Lake.

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Material and methods

Świdwie Lake research was conducted in 2004 at 5 sites: 1 – N53°33.490'; EO14°22.665', 2 – N53°33.573'; EO14°22.411', 3 – N53°33.659'; EO14°22.279', 4 – N53°33.592'; EO14°21.891', 5 – N53°33.330', N53°33.330'; EO14°22.544' (Fig. 1).

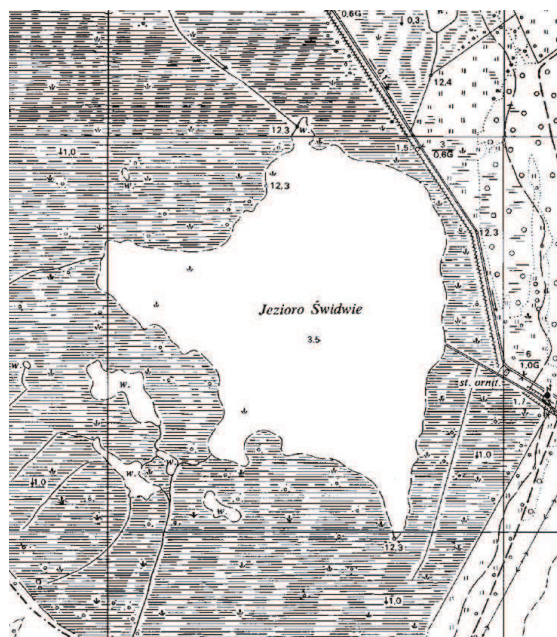


Fig. 1. Locations of sampling sites on Lake Świdwie

At sites 1, 3, 4, 5 water samples were taken from near-surface layer (0.5 m), whereas at station 2 from near-surface layer (0.5 m), as well as from near-bottom layer (0.5 m above the bottom) using Ruttner water bottle. Sampling was performed on days allowing to observe changes that are characteristic for particular climatic seasons (23.03.2004, 04.06.2004, 13.07.2004, 05.10.2004 and 24.11.2004).

Hydrochemical analysis included basic water quality indicators such as: dissolved oxygen, per cent oxygen saturation, organic matter content (BOD₅, COD_{Cr}), nutrient contents and extent of mineralization. Chemical laboratory analysis was conducted in accordance with the Standard Methods recommended by the State Inspectorate for Environmental Protection for lake waters analysis [4, 5]

Results

Świdwie Lake waters were overoxygenated during spring and summer (100.2–112.4 % O₂) at sites 1, 2, 5 and underoxygenated during autumn (76.7–96.2 % O₂) at all sites. The worst oxygen conditions in the course of the entire research period were

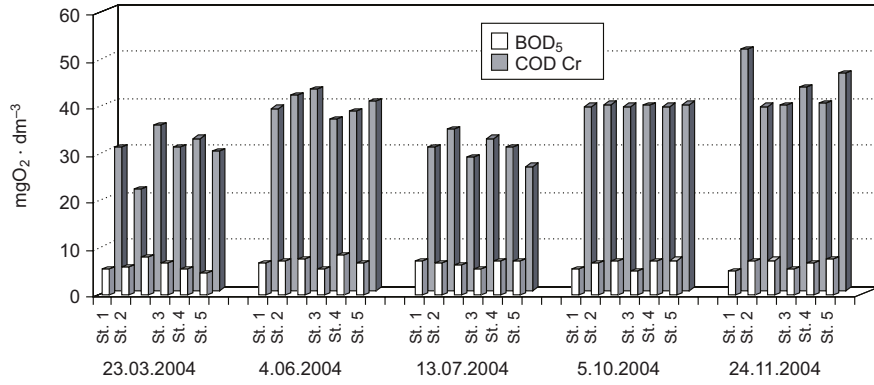


Fig. 2. Organic matter load in Lake Świdwie water

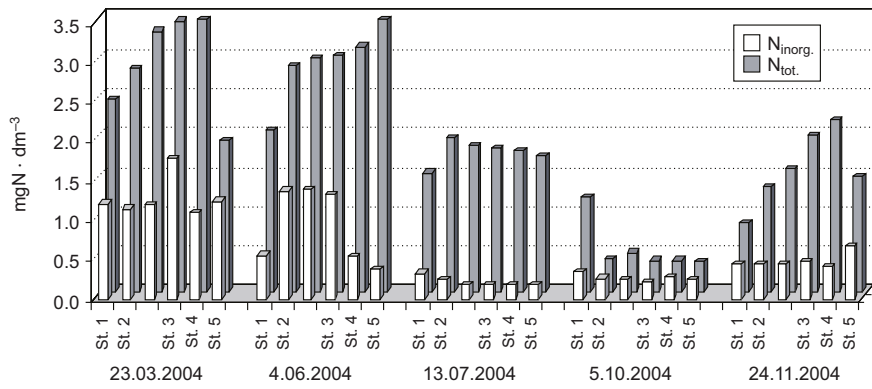


Fig. 3. Variability of inorganic nitrogen and total nitrogen contents in the Lake Świdwie water

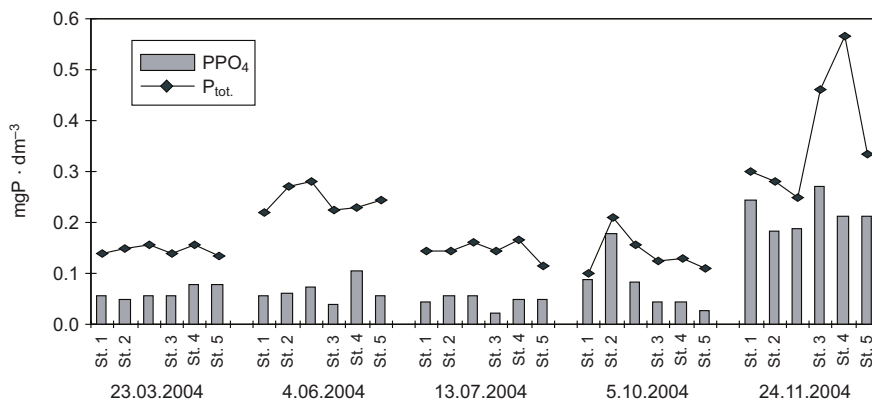


Fig. 4. Seasonal variability of orthophosphate and total phosphorus contents in water of Lake Świdwie

noted in the near of site 3 (76.7–84.1 % O₂). The factors characterizing total organic material content in water (BOD₅, COD_{Cr}) had the values from 5.0 to 8.5 mgO₂ · dm⁻³ and from 21.6 to 51.2 mg O₂ · dm⁻³. Site 2 was the most loaded with organic material (Fig. 2). The concentration of phosphate phosphorus was within the range of 0.022–0.245 mg PPO₄ · dm⁻³. Whereas the concentration of total phosphorus was from 0.1 to 0.565 mg P_{tot.} · dm⁻³ (Fig. 4). Mineral nitrogen concentration was within the range of 0.174–1.178 mgN_{inorg.} · dm⁻³ and the dominant form was nitrate nitrogen. The values determined for total nitrogen concentration oscillated between 0.372–3.453 mg N_{tot.} · dm⁻³ (Fig. 3). The values determined for chlorides and sulphates in the waters of the water region researched amounted to respectively: 28.4–71.0 mg Cl⁻ · dm⁻³ and 13.33–49.52 mg SO₄²⁻ · dm⁻³.

The results of hydrochemical analysis enabled to evaluate the current state of the water quality in the lake under discussion.

Water oxygenation in percentage values is a coefficient of the intensity of assimilation and dissimilation processes taking place in natural waters. If processes of photosynthesis predominate in a water basin, then the waters are overoxygenated, but if dissimilation processes predominate, the waters are underoxygenated [6, 7].

Świdwie Lake waters were overoxygenated in the spring and summer seasons and underoxygenated in the autumn season. This phenomena is characteristic for water basins with high trophy. Also, high organic material load and high phosphorus compounds concentrations are typical for fertile lakes and they qualify this water region to class III of water purity [4, 8]. Mineral nitrogen concentration and total nitrogen concentration are within the range stipulated for class II of water purity and waters unclassified [4]. The degree of mineralization of the analyzed waters was characteristic for the lakes of Western Pomerania [9].

Świdwie Lake is a non-stratified, polymictic water region, which is indicated by: lack of temperature gradient in the summer season and small maximum depth. It has unfavourable morphological and morphometric conditions, which makes it vulnerable to degradation (III water purity class, III vulnerability class) [4].

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**HYDROCHEMIA JEZIORA ŚWIDWIE
(REZERWAT PTACTWA WODNO-BŁOTNEGO) W 2004 R.**

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Abstrakt: Rezerwat „Jezioro Świdwie” to wyjątkowy obszar wodno-błotny o międzynarodowym znaczeniu, jako jeden z pięciu polskich rezerwatów ujęty w Międzynarodowej Konwencji „Ramsar”. Badania Jeziora Świdwie prowadzono w 2004 r. na 5 stanowiskach w sezonach wiosennym, letnim i jesiennym. Badania hydrochemiczne obejmowały następujące wskaźniki jakości wody: tlen rozpuszczony, procentowe nasycenie wody tlenem, zawartość materii organicznej (BZT₅, ChZT_{Ct}), stężenie biogenów i stopień mineralizacji.

Słowa kluczowe: Jezioro Świdwie, warunki hydrochemiczne, biogeny