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## FORMS OF NITROGEN AND PHOSPHORUS IN ŚWIDWIE LAKE IN 2004

### FORMY AZOTU I FOSFORU W JEZIORZE ŚWIDWIE W ROKU 2004

**Summary:** Świdwie Lake is an ornithological nature reserve listed in the International "Ramsar" Convention in 1984. The research of Świdwie Lake in 2004 was conducted at 5 sites in spring, summer and autumn seasons. Hydrochemical analyses involved the following water quality indicators: mineral nitrogen (ammonium nitrogen, nitrate(III) nitrogen, nitrate(V) nitrogen), total nitrogen, phosphates, total phosphorus, dissolved oxygen content, per cent oxygen saturation, organic matter content and mineralization degree.

**Keywords:** Świdwie Lake, nitrogen, phosphorus

Świdwie Lake Reserve is located on the southern edge of the Wkrzańska Forest within the area of Police and Dobra district. It has been known for many years as a waterfowl and marshland bird sanctuary, as well as the place where great bird migratory routes cross. It was legally established in 1963 in the area of 382 ha and subsequently enlarged up to 891.28 ha in 1988. It comprises Świdwie Lake together with the surrounding belt of rushes, meadows, peat bogs and forests. It is a habitat and a reserve for nearly 240 bird species nesting here permanently and breeding or staying here temporarily during their migrations [1].

Świdwie Lake is a shallow reservoir, largely overgrown with bulrush and reed, which causes a division of the lake surface into two separate reservoirs with the area of approx. 50 and 26 ha. Currently the maximum depth of the larger reservoir amounts to 2.4 m, average depth is 0.7 m, and its maximum length amounts to 157 m [2, 3].

Świdwie Lake Reserve has been recognized as an exceptional wetland and marshland area of international importance and it was one of five Polish reserves that was listed in "Ramsar" International Convention in 1984 [1].

### Materials and methods

The research of Świdwie Lake was conducted in 2004 at 5 sites with the following geographical situation: 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).

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

Chemical research involved the following water quality parameters: mineral nitrogen (ammonium nitrogen, nitrate(III) nitrogen, nitrate(V) nitrogen), total nitrogen, phosphates,

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total phosphorus, dissolved oxygen content, per cent oxygen saturation, organic matter content and mineralization degree.

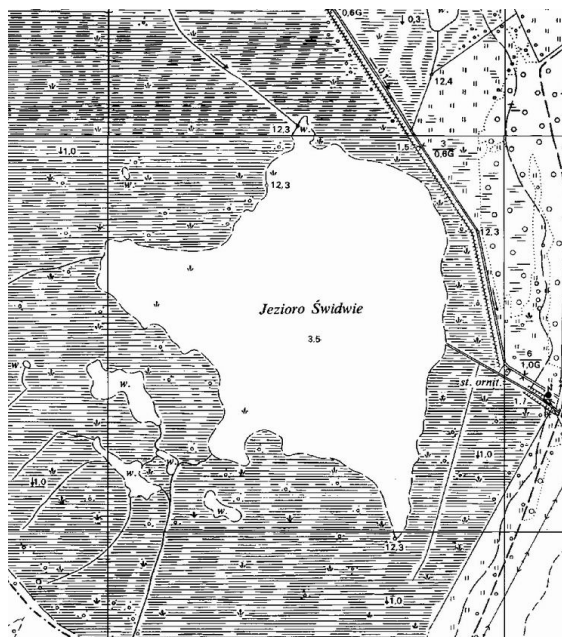


Fig. 1. Locations of sampling sites on Lake Świdwie

Chemical laboratory analysis was conducted in accordance with the Standard Methods and the System of Lake Quality Assessment published in Guidelines to basic lake monitoring [4, 5].

## Results

The results of chemical analyses showed seasonal changeability in the values of the analyzed indicators. The determined concentrations of mineral forms of nitrogen ranged between:  $0.001 \div 0.074 \text{ mgN-NH}_3 \cdot \text{dm}^{-3}$ ;  $0.026 \div 0.066 \text{ mgN-NO}_2 \cdot \text{dm}^{-3}$ ;  $0.118 \div 3.453 \text{ mgN-NO}_3 \cdot \text{dm}^{-3}$ . The dominant form of mineral nitrogen at all sites and on all testing days was nitrate(V) nitrogen. Ammonia nitrogen constituted the least numerous fraction (except in November).

Whereas the analyzed values of total nitrogen were ranging between:  $0.372 \div 3.453 \text{ mgN}_{\text{tot}} \cdot \text{dm}^{-3}$ . In March a maximum concentration of nitrate(V) nitrogen and total nitrogen was determined at all sites. Minimal concentrations of mineral forms of nitrogen were found in July and of total nitrogen in October (Fig. 2).

The determined values of phosphate phosphorus ranged from  $0.022$  to  $0.245 \text{ mgP-PO}_4 \cdot \text{dm}^{-3}$ , while the values of total phosphorus ranged from  $0.1$  to  $0.565 \text{ mgP}_{\text{tot}} \cdot \text{dm}^{-3}$ . The highest concentrations of phosphate phosphorus and total phosphorus in the waters of Świdwie Lake occurred in November and the lowest in July (Fig. 3).

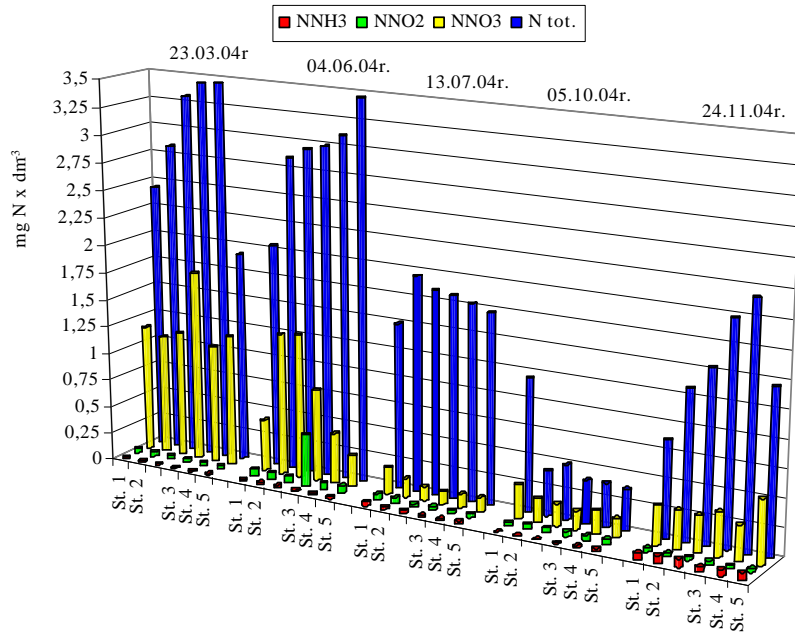


Fig. 2. Seasonal concentration of mineral nitrogen and total nitrogen in the waters of Świdwie Lake

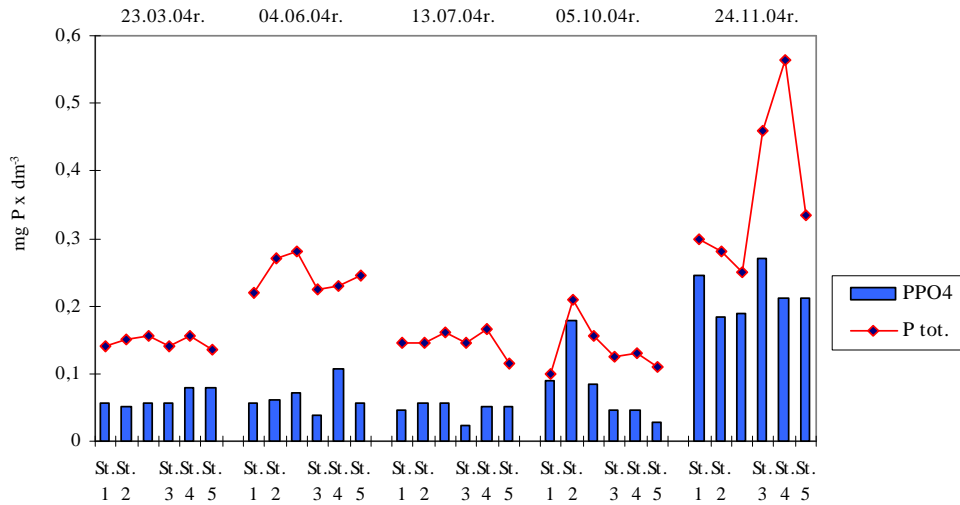


Fig. 3. Concentration of phosphates and total phosphorus in the waters of Świdwie Lake

Seasonal changeability of nitrogen and phosphorus concentrations is caused by their decrease during the months favourable to water vegetation development [6].

No significant differences in water quality were found between individual sites in all analyzed seasons.

Świdwie Lake is a strongly eutrophicated, polymictic (lacking thermal stratification) reservoir.

The concentrations of phosphorus compounds are typical for fertile reservoirs and they fall within the norms determined for the third water purity class [7].

Concentrations of mineral forms of nitrogen meet the requirements of the second water purity class. Whereas the values of total nitrogen classify the waters of the reservoir under analysis as unclassified waters. Substantial organic matter load and per cent oxygen saturation further prove the high trophy levels of Świdwie Lake.

Moreover, the analyzed reservoir has unfavourable morphometric and catchment area conditions, which causes the reservoir to be easily degradable (susceptibility to degradation category III) [5].

## References

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## FORMY AZOTU I FOSFORU W JEZIORZE ŚWIDWIE W ROKU 2004

**Streszczenie:** Jezioro Świdwie to ornitologiczny rezerwat przyrody ujęty w Międzynarodowej Konwencji „Ramsar” w 1984 roku. Badania jeziora Świdwie prowadzono w 2004 roku na 5 stanowiskach w sezonach wiosennym, letnim i jesiennym. Badania hydrochemiczne obejmowały następujące wskaźniki jakości wody: azot mineralny (amonowy, azotanowy(III), azotanowy(V)), azot całkowity, fosforany(V), fosfor całkowity, tlen rozpuszczony, procentowe nasycenie wody tlenem, zawartość materii organicznej i stopień mineralizacji.

**Słowa kluczowe:** jezioro Świdwie, azot, fosfor