

**INFLUENCE OF DIFFERENT AREAL POLLUTION
SOURCES ON SOME COMPOUNDS CONTENT
IN WATER OF DEJGUNY LAKE**

Danuta Domska, Marek Raczkowski, Krzysztof Stankiewicz

Chair of Foundations of Safety
University of Warmia and Mazury in Olsztyn

Key words: Dejguny Lake, water, mineral compounds content.

Abstract

The purpose of the work was determination the area pollution influence on mineral compounds content in water of north and west part of Dejguny Lake. There was studied total-P, dissolved $\text{PO}_4^{-3}(\text{V})$, NH_4^+ , NO_3^- , NO_2^- , total-Mg, total-Fe, SO_4^{-2} and Cl^- concentration in water. The most compounds content was in I class of water cleanness. The higher content of nitrate compounds was near the recreation area of Kronowo village and, ammonium and nitrate nitrogen, total phosphorus, ortho dissolved reactive phosphates and magnesium(II), near agricultural area depend on their content in water near the forested area. Moreover, in lake near agricultural area water side was higher content of sulphates(VI) in II class of water cleanness.

**ODDZIAŁYWANIE OBSZAROWYCH ŹRÓDEŁ ZANIECZYSZCZEŃ NA ZAWARTOŚĆ
NIEKTÓRYCH ZWIĄZKÓW W WODZIE JEZIORA DEJGUNY**

Danuta Domska, Marek Raczkowski, Krzysztof Stankiewicz

Katedra Podstaw Bezpieczeństwa
Uniwersytet Warmińsko Mazurski w Olsztynie

Słowa kluczowe: jezioro Dejguny, woda, zawartość substancji mineralnych.

Abstrakt

Celem pracy było określenie wpływu obszarowych zanieczyszczeń na zawartość mineralnych związków w północnej i zachodniej części masy jeziora Dejguny. W badaniach oznaczono zawartość w wodzie P ogólnego, PO_4^{-3} (V) rozpuszczonych, NH_4^+ , NO_3^- , NO_2^- , Mg ogólnego, Fe ogólnego, SO_4^{-2} i Cl^- . Stwierdzono, że nagromadzenie większości badanych związków było niskie i mieściło się w normach I klasy czystości wód. W porównaniu z ich zawartością w wodzie w okolicy zalesionej większe nagromadzenie związków azotu występowało przy terenie przeznaczonym na rekreację w pobliżu wsi Kronowo, a azotu amonowego i azotanowego oraz fosforu ogólnego, ortofosforanów rozpuszczonych i magnezu(II) przy gruntach użytkowanych rolniczo. W wodzie jeziora przy brzegu użytkowanym rolniczo znaleziono ponadto więcej siarczanów(VI) w ilościach odpowiadających II klasie czystości wód.

Introduction

The water properties, mainly the kind and quantity of the dissolved chemical substances are decided about usefulness and possibilities to utilize for economy, living or recreation purposes (SZCZYGIELSKI 1996, KOC, SKONIECZYK 2007). In the case of the surface waters it depends not only on water kind, location of it or weather conditions but also on the area adaptation and the economy activity of this area. There is showing on the influence of the neighbouring area, particularly with agricultural activity or adapted for recreation, on some mineral compounds content (VOLLENWEIDER 1989, SZOSZKIEWICZ, SZOSZKIEWICZ 1997, RACZKOWSKI, WARECHOWSKA 2002, DOMSKA et al. 2005, PULIKOWSKI et al. 2005, DOMSKA et al. 2006, KOC, SIDORUK 2006). There is particularly dangerous too higher phosphorus and nitrate nitrogen content, not only on account of water quality deterioration but also on the risk to the degradation of the surface waters (SZOSZKIEWICZ, SZOSZKIEWICZ 1997).

The purpose of the work was the estimation of the different area pollution influence on phosphorus (total-P and PO_4^{-3} dissolved), mineral nitrogen (NO_3^- , NO_2^- , NH_4^+), sulphates(VI), chloride and some metal (Fe and Mg) content in water of some part of Dejguny Lake.

Experimental Procedures

The material of our investigation was Dejguny Lake (Figure 1) situated about 8 km from Giżycko. It is connected of the narrow canal with Mamry Lake, which is the second lake in Poland on account of the size. The maximum length of Dejguny Lake is 7.3 km, the breadth – 2.3 km, the surface – 8.36 ha, the average depth – 12 m and the maximum depth – 33 m (TOEPPEN 1995). The shore line is diverse, particularly flat in the south lake part and high, sometimes steep in the north lake part.

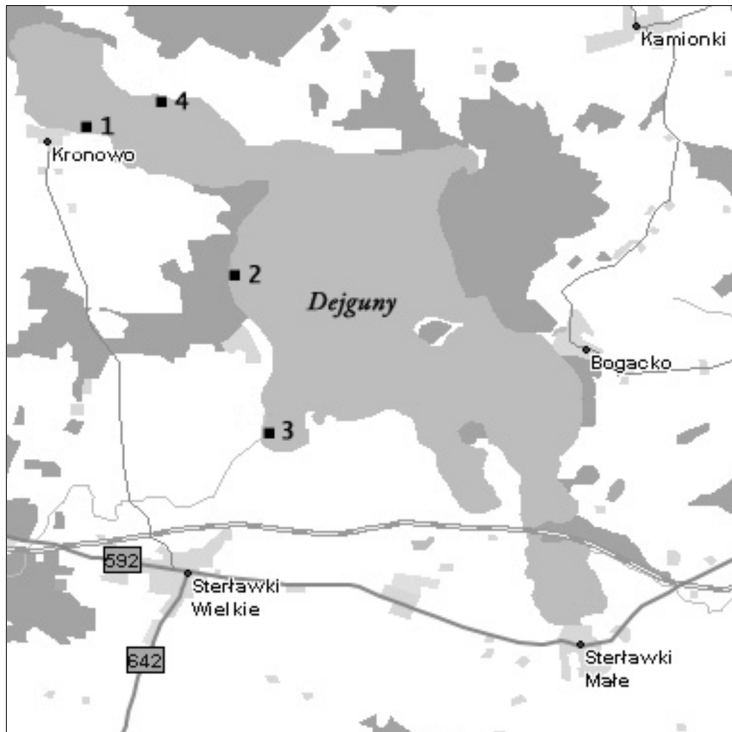


Fig. 1. Location of research sites: 1 – recreation area, 2 – forest, 3 – meadow, 4 – arable area

The studies were conducted in 2008 year. For determination of the area influence on water quality, there was sampled water in north and western part of the reservoir Dejungy Lake from 0.2 m depth and in place with lake depth not more than 1 m according to standard of *Jakość wody...* PN-EN ISO 5667-4. The water was sampled on April, every day, from 1-st to 5-th. The research sites location (Figure 1) was into direct contact with lake shore near the recreation area section of Kronowo village (site 1), forest (site 2) and agricultural areas – meadow and arable area (sites 3 and 4).

The study compounds content was determined immediately after water sampling. In the analytical methods have been used the universally accepted ways (DOJLIDO et al.): colometric (total-P, PO_4^{-3} , NO_2^- , Fe, Mg), titration (NH_4^+ , Cl-), potentiometric (NO_3^-) and balance (SO_4^{-2}) analysis. The average results of 5 water samples were showed in the tables.

The obtained results was statistically calculated by Tukey test of the variant analyse at the considerable differences of the confidence interval $p = 0.05$.

Discussion of Results

There was showed that in time of the conducted studies were the significant different of some compounds content in water of Dejguny Lake (Table 1). Phosphorus compounds content, like to surface waters another water reservoirs (SZOSZKIEWICZ, SZOSZKIEWICZ 1997, DOMSKA et al. 2005) was low from 0.064 to 0.129 mg dm⁻³ of total phosphorus and from 0.03 to 0.26 mg dm⁻³ of phosphates. Total phosphorus and also reactive ortho-phosphates dissolved higher content was in lake water near agricultural areas (sites 3 and 4), particularly near meadow (site 3), but it was not higher than I class of water cleanness standard (Rozporządzenie MOŚ... 2004). DOMSKA et al. (2006) were showed higher phosphate content in water Narie Lake in II class of water cleanness near arable areas. BARTOSZEWICZ (2005) is also showing on the big influence of the intensive fertilized areas which are cultivated arable fields, on phosphate content in the surface waters. Moreover, PETERSON and AMIARD (1998) and ZACHMAN et al. (2004) were showed the big influence of the lacustrine bottom deposits on the biogenes concentration in water, particularly in time of the summer stagnation with the higher bacteria activity. At the same time of the summer stagnation and of the anaerobic conditions, compounds of phosphorus connected with iron, after reduction Fe(III) to Fe(II) are set free from lacustrine bottom deposits to water bottomless and gradually migrated to surface waters.

Table 1
Phosphorus and nitrogen concentration in water of Dejguny Lake [mg dm⁻³]

Research site	Total – P	Phosphates PO ₄ ⁻³	N-NH ₄ ⁺	N-NO ₃ ⁻	N-NO ₂ ⁻
1	0.064	0.003	0.020	0.124	0.124
2	0.083	0.003	0.030	0.060	0.060
3	0.129	0.029	0.260	0.224	0.224
4	0.100	0.015	0.200	0.250	0.200
LSD <i>p</i> = 0.05	0.019	0.008	0.009	0.010	0.005

The determined mineral nitrogen and phosphorus compounds content in Dejguny Lake water was low and it was in standard I class of water cleanness (Table 1). There was ammonium nitrogen content from 0.02 to 0.26 mg dm⁻³, nitrate nitrogen(V) – from 0.06 to 0.25 mg dm⁻³ and nitrate nitrogen(III) – from 0.060 to 0.224 mg dm⁻³. Depend on another studies (DOMSKA et al. 2005, 2006, WOJTAS, DĄBEK 2006) there was a relatively lot of nitrate nitrogen(V) content in Dejguny Lake water. The most ammonium and nitrate(III) nitrogen

content was in water near the lake shore with the perennial arable land, i.e. meadow (site 3) and nitrate nitrogen(V) content near arable field (site 4). The mineral nitrogen compounds content was also higher near the recreation area of Kronowo village (site 1) depend on the forest neighbourhood (site 2). Another authors were also showed the immediate influence of the agricultural areas, especially the ploughland or the intensive tourism on some mineral nitrogen compounds content. So, DOMSKA et al. (2005) were obtained a lot more nitrates content in water of Chełmżyński Lake with the shore near the recreation area. However, there one should to remember that nitrogen content in water much changed in year time (PULIKOWSKI et al. 2005). Among other things, WOJTAS and DĄBEK (2006) were remarked on the deciding influence of the vegetation time on nitrogen compounds content in water Olecko Wielkie Lake where nitrate nitrogen(III) and ammonium nitrate content decreased in spring and summer time and nitrate nitrogen(V) content was higher in summer time. Successively, DOMSKA et al. (2005) were showed that ammonium nitrogen content in water of the western part of Chełmżyński Lake reservoir was very low in the vegetation time and this nitrogen form was a little more in autumn time in water of lake shore near arable areas.

In the conducted studies was determined iron, magnesium(II) and chloride content in water of Dejguny Lake (Table 2). Iron content (0.20–0.25 mg dm⁻³) and chloride content (13.0–15.5 mg dm⁻³) was not different depend on the

Table 2
Iron, magnesium, sulphates and chlorides total concentration in water of Dejguny Lake [mg dm⁻³]

Research site	Fe	Mg	SO ₄ ⁻²	Cl ⁻
1	0.20	10.1	147.9	15.5
2	0.20	10.2	146.9	13.0
3	0.25	13.9	155.3	13.2
4	0.25	12.8	160.3	13.5
LSD <i>p</i> = 0.05	0.05	1.8	3.4	2.5

location of water site and chloride content in water was lower than in RACZKOWSKI and WARECHOWSKA (2002) studies. These authors were showed the essential influence of the pollution points sources (storm basins) on chloride content in Jeziorak Mały Lake. Magnesium content in water Dejguny Lake was higher (about 3–4 mg dm⁻³) near the acreage arables (sites 3 and 4). KRUK (1996) was showed that outflow of the mineral compounds, mainly metals ions to water, first of all, is from the boggy areas and it was higher than from the agricultural basins. The own results are showing that there was clear effect of the kind of the agricultural area adaption on sulphates(VI) content

in water of Dejguny Lake. In this case, sulphate content was 155.3 and 160.3 mg dm⁻³ and it was in II class of water cleanness and, it was considerably higher than in water near forest or recreation area. In contrast to these results, according to (1996) KRUK, there is a considerable risk of the intensive tourism and the area adaptation for the recreation.

Conclusions

1. The most compounds concentrations (total-P, ortho-phosphate (PO₄⁻³) dissolved, Mg and Fe) in surface water of studied part of Dejguny Lake were low in standard I class of water cleanness.

2. In the lake water near the recreation area was higher mineral nitrogen compounds content but it was not higher than standard I class of water cleanness and, there was considerable more sulphates(VI) in the standard II class of water cleanness.

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