# INFLUENCE OF HYDRAULIC CONNECTION OF LAKE – SEA SYSTEM ON FLORA AND FAUNA OF THE COASTAL LAKES, AREA "SLOWINSKI NATIONAL PARK", POLAND

## INFLUENȚA CONEXIUNII HIDRAULICE LAC –MARE ASUPRA FAUNEI ŞI FLOREI DIN LACURILE DE COASTĂ, ZONA „PARCULUI NAȚIONAL SŁOWIŃSKI", POLONIA

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***Abstract.*** *This paper presents studies and research on spatial hydrotechnics Słowiński National Park area in order to protect the environment. The main goal of the research in this paper is to realize the importance of undertaking regeneration work in small river valleys, in the section of the Baltic Sea coast and to increase current knowledge about the importance of ecohidologice operating conditions of these ecosystems. The two lakes coastal studied have different levels of communication with the sea and the various morphometric parameters. Creating environmental conditions in the two areas located to the existing fauna and flora by limiting lake-sea connection.*
***Key words:*** *community site, conection hydrologic, rehabilitation, regularization works*

***Rezumat.*** *Lucrarea prezintă studiile şi cercetările privind amenajarea hidrotehnică a zonei Parcului Național Słowiński, Polonia în scopul protecției mediului prin renaturalizarea brațelor de râu. Scopul principal al cercetărilor, în prezenta lucrare este de a realiza importanța efectuării lucrărilor de regenerare, în văile râurilor mici, în secțiunea de coasta a Mării Baltice precum şi de a creşte stadiul actual al cunoştințelor despre importanța condițiilor ecohidrologice de funcționare a acestor ecosisteme În cadrul acestor două lacuri se aplică diverse tehnologii biologice pentru realizarea şi dezvoltarea unui habitat specific sitului natural.*
***Cuvinte cheie:*** *situri naturale, conexiune hidrologică, reabilitare, lucrări de regularizare*

## INTRODUCTION

The coastline of the South Baltic Sea is rich in numerous and diverse bodies of water hydrology. These include lakes, coastal lakes genetic belonging. Baltic is located in the temperate climate zone.

Each of these lakes varies considerably from one another on biological and morphometric parameters. The differences are associated with the straight line distance to the sea Lake basin and the intensity of wave power caused the sea surface, morphometric parameters, the coefficient of exhibition, water quality and

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water level in the lake basin. (Cieśliński, 2004; Trojanowski, 1990; Trojanowski *et al,*. 1991)


**Fig. 1** - Coastal estuaries of the Polish Baltic Sea

Polish Baltic Sea coast has a number of smaller or larger lakes such as Gardno, Łebsko, DOLGA Wielkie (lakes located in the Słowiński National Park) and Jamno, Kopan, Wicko, Sarbsko, Resko, Koprowo (outside the park) . In spite of similar areas of location, they vary in type and geomorphological genesis, both in terms of hydrological conditions and the hydrochemical (Paturej, 2006).

## MATERIAL AND METHOD

Old river arms are analyzed lakes formed by meandering river or sea that have been closed. They can be supplied and drained in certain circumstances the hydrological regime. Structure and functioning of wetland ecosystems, including lakes is achieved in close interconnection directly or indirectly with a water source or an emissary. This interconnection is closely linked to fluctuations of water levels in source or emissary during floods or flow pulsations. (Junk *et al.,* 1989, Tochen *et al*, 2000).

Hydrological processes involve changes in the chemical composition of water from lakes and its migration to other areas due to interchange water - sediment.

**Lake Gardno**

Gardno Lake is located in the middle part of the Polish coast and is part of Słowiński National Park. Considering this is the second lake area coastal lagoons compared to Poland.

Lake Gardno is connected to the Baltic Sea from Łupawa channel with a length of 1500 m. It is separated by the sea water by a sand barrier it has a width of about 800-2000 (Trojanowski, 2003b).

Łupawa Channel and several smaller rivers: Bagiennica, Grabownica, Brodniczka and Brodna lakes supplying with water the lake Gardno. Total river inflow to the lake was estimated at 9.07 m s-1. In conclusion, Łupawa River provides about 90% of the total inflow of surface water from the basin, represented by about 286 • 106 m3 annually. (2468.1 ha Olsztyn IRS 1966).

Gardno lakes are shallow, with average depth about 1.3 m (maximum depth 2.6 m). The lake covers an area of approximately 25 km² large. Emergency macroflora relates to 4% of the area of the lake.

The lake has two interconnections type Gardno lake - river. The first interconnection is Łupawa River in the east, south protected by a small pier.

This resulted in a moderate decline in river levels with damage and loss of habitat for many species of flora and fauna of value. The habitat was affected including floodplain (floodplain of the river).


**Fig. 2** - Location of Gardno lake: a - the location of sampling sites.
SOURCE: www.national-geographic.pl

**Fig. 3** - View of channel Łupawa - spill in the Baltic Sea

**Wicko lake**

Locating the lake is in Słupsk Pomeranian Region near town Jarosławiec. Wicko lake is a lake who has two connections coastal hydrology.

The first connection is with the Baltic Sea by a canal and the second in the west is connected via a canal to Kopan lake regeneration. Wicko lakes are triangular with an area of 1059 hectares.

A number of coastal lagoons and lakes are located along the entire southern part of the Baltic Sea. One of the largest lagoons is Wicko lakes.

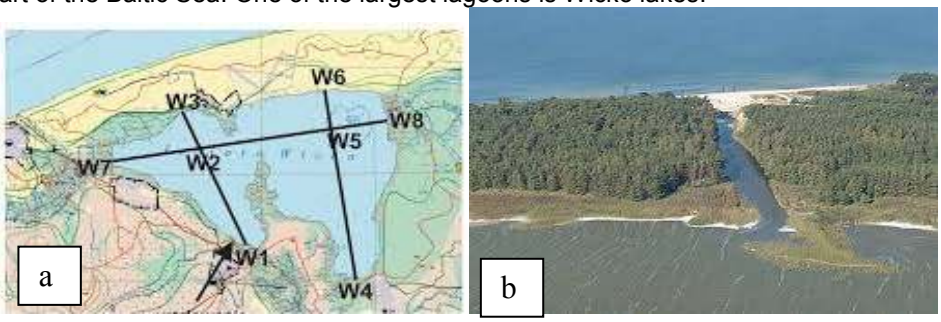


**Fig. 4** - Location of Wicko lake: a - the location of sampling sites .b - general view of the Baltic Sea connection. SOURCE: www.national-geographic.pl

Ecological improvement of surface water must meet and maintain a normal relationship with the aquatic flora and fauna.

In the first phase were carried out research on the habitat condition affected areas without applying the regulation work to achieve interconnectivity.

## RESULTS AND DISCUSSIONS

Achieving regulation work for ensuring the interconnectivity with power sources and lakes with emissaries were allowed providing the conditions for growth of the habitat. The regularization of ecological achieved were integrated very well into the aquatic environment.

A first effect of achieving inter-connectivity was changing habitat conditions. This change is represented by changing parameters of water quality in lakes. A first result is the development of a number of existing species.

The result of the analysis of samples of biological material taken from the field and analyzed in the laboratory for the Gardno lake are shown in Fig. 5.

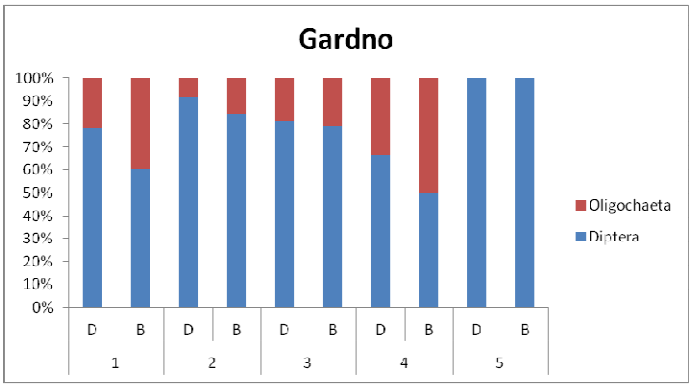


**Fig. 5** - The structure of macrozoobenthos regarding the density and biomass in Gardno lakes

Following laboratory analysis was determined the following: sample 1, Plateaus Diptera density is 80% and 20% Oligochaeta; Biomass Diptera is 60% and Oligochaeta 40%. In sample 2, the density of the Diptera is 90% and 10% Oligochaeta; Biomass Diptera is 80% and 20% Oligochaeta. In sample 3, the density of the Diptera is 80% and 20% Oligochaeta; Diptera biomass is 78% and 22% Oligochaeta. In sample 4, the density of the Diptera is 70% and 30% Oligochaeta; Diptera biomass is 50% and 50% Oligochaeta. In the sample 5 and the biomass density of the Diptera is 100%.

The result of the analysis of samples of biological material taken from the field and analyzed in the laboratory for the Wicko lake are shown in Fig. 6

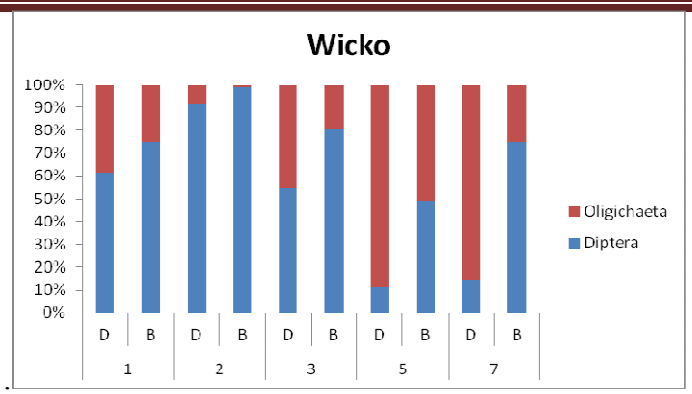


**Fig. 6** - The structure of macrozoobenthos regarding the density and biomass in Wicko lakes

In coastal lakes close to the Baltic Sea (Gardno, Wicko) was found by field and laboratory research densely Diptera and Oligochaeta (Fig. 5, 6, Table 1). They have adapted to the environment in lakes and have proved to be more tolerant with water that has a higher salinity.

*Table 1*

**Density of macrobenthos in the area studied indv/m ²**

| Taxon | Gardno | Wicko |
|---|---|---|
| *Diptera* | 3,795.56 | 654.81 |
| *Oligochaeta* | 506.67 | 823.70 |
| *Hirudinea* | - | - |
| *Crustacea* | - | - |
| *Gastropoda* | - | - |
| *Bivalvia* | - | - |
| *Trichoptera* | - | - |
| *Ephemeroptera* | - | - |

Research has shown that Gammarus sp. It is affected by chemical quality of the water in both lakes. Degradation of habitat mainly influences the aerobic conditions. Mention that Gammarus sp. is the basic nutrition for migratory fish. It follows in this context the importance of achieving interconnectivity work and regularization of the riverbeds and lakes.

## CONCLUSIONS

1. Ensure optimal conditions for live in natural sites imposes the making a work regulation of lakes, rivers and canals. Between lakes must be provided a interconnectivity with power supply and emissary and adjusting hydraulic parameters.

2. The two lakes studied (Gardno, Wicko) are supplied with brine who the life parameters degrading the life parameters of habitat and ecological environment.

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