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MARSHES AND WETLANDS ON THE WOLIN ISLAND – SELECTED AREAS ENVIRONMENTAL DESCRIPTION

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Abstract

The paper presents a naturalistic study (geomorphology, soils, biocenosis) concerning two of the five selected wetland areas and marshes in the Wolin Island. The wetlands and marshes of the Przytorska Spit and of the islands of the retrograde delta of the Świna River, as well as wetlands and marshes within the Warnowsko-Kołczewskie Lakeland. The study indicated considerable diversity of these areas as regards biotopes and biodiveristy.

Key words: Wolin Island, Wolin National Park, wetlands, marshes, natural environment, biocoenoses.

INTRODUCTION

Studies of the marsh and wetland ecosystems are of topical importance nowadays and extremely up-to-date (Żurek 1999). Marshes and wetlands, because they are difficult for people to access and what is even more important due to favourable habitat conditions, serve as safe refuges, and this has enabled the survival of numerous animal and plant species. These areas help to sustain biodiversity. Simultaneously they undergo various transformations - biotope and biocoenotic evolution that occurs as a result of changes in climatic conditions and, unfortunately, due to alterations in the natural environment induced by man (meliorations and drying of the soils, chemical pollution of the natural environment).

Wetlands and marshes located on the Wolin Island and belonging to the Wolin National Park (WNP) as well as those situated in the nearest vicinity of the WNP, have been studied since a fairly long time as regards soil and flora (Jasnowski 1962, Borowiec 1959, 1961, 1965, 1969, 1974) and plant cover (Piotrowska 1955, 1966). At present the studies of the environment of the Wolin Island are carried out by a number of scientific centres and research teams (Kostrzewski 1992a, 1993, 1994, Popiela et al. 1992, Nowacki 1994a, Poleszczuk 1994, Ciaciura – master`s thesis, Stańczyk 1998 and Kaczmarczyk 1998, Borówka 1999), and also by student

scientific circles – among which the Student Geographers Scientific Circle at the Adam Mickiewicz University in Poznań can take pride in the greatest achievements in this field (Kostrzewski 1977, 1986, 1989, 1992b). Investigations of the studies of the Wolin Island environment conduct Chemistry Chair on University of Szczecin to (Poleszczuk *et al.* 2002, 2003). This Chemistry deals mainly with the chemical composition of waters - including surface waters, subsurface and underground waters on the Wolin Island. This work presented on the subject staff of marshes and wetlands of the Wolin Island is here a literature study preceding the research efforts planned to comprise the surface and subsurface waters of the marshes and wetlands of the Wolin Island. The objective of the research is a detailed study of processes of brackish water transport infiltration into the inland areas, as well as of the possible processes of the mineralised subcutaneous water ascension to the surface soil layers.

I. Marshy and wetland areas of the Wolin Island

Five marshy and wetland areas can be pointed out (Fig. 1):

1. Meadows and marshes of the Przytorska Spit, including the archipelago of the islands surrounding the Lake Wicko Wielkie.
2. Marshes and wetlands situated by the lakes within the Warnowsko – Kołczewskie Lakeland, along Pojezierna (Lewińska) Struga (Pojezierna/Lewińska Rivulet), though excluding the areas located around the Lake Koprowo.
3. Wetlands and marshes located in the vicinity of the Lake Koprowo.
4. Wetlands located in the central part of the island, drained by the irrigation system pumping water over to pumping station in Darzowice.
5. Wetlands of the Rów Peninsula.

Eight polder catchment areas (Tab. 1) are located in the described marshy and wetland areas. Drainage waters from these catchment areas are pumped off the whole year round. The largest, as regards the area, is the catchment of the central part of the Wolin Island. Drainage waters from this catchment are pumped out by the pumping station in Darzowice. The pumping station in Darzowice carries the effluents to the Dźwina Strait and collects water from the catchment areas, where utilised meadows dominate. The meadows are constantly water-logged, intermittently inundated and they are mainly composed of peat soils (lowland peatbogs) of acid reaction (Kolodziej–Nowakowska 1992). Within the borders of the WNP, waters from the polder located between the city of Międzyzdroje and the embankment of the national road nr 3 are pumped. The pumping station located nearby the weir by the bridge on the road nr 3, pumps the waste water from the municipal sewage-treatment plant in Międzyzdroje, combined with water from the storm drainage system of this town and with the effluents from the drainage system of a polder covering an area of 100 ha. Two pumping stations operate in the nearest vicinity of the WNP - in Ognica and in Przytor. They pump over the waters from the polders to the Old Świna River strait, which is located very close to the borders of the WNP.

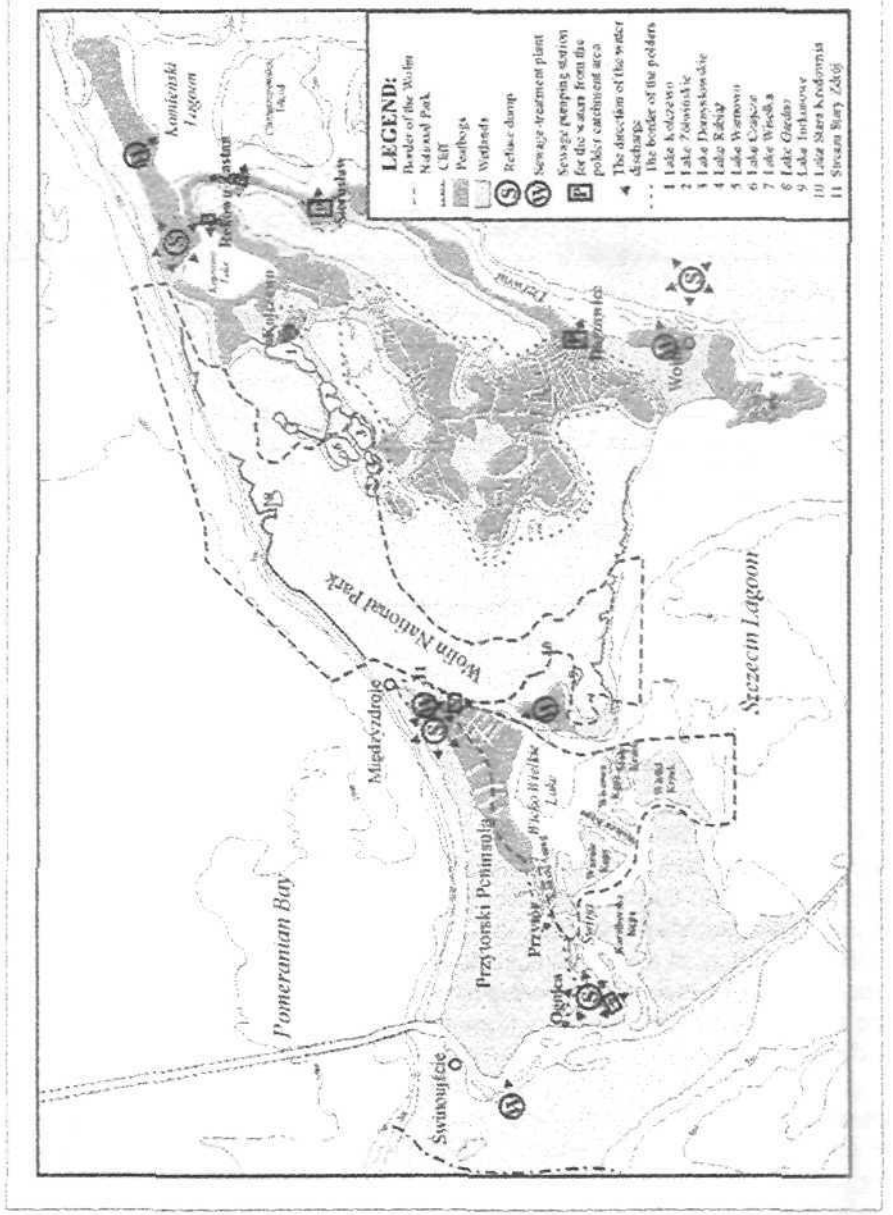

Fig. 1. Wetland and marshy areas of the Wolin Island

No.	Locality of sewage pumping station for the waters from the polder catchment area	Surface of the catchment area [ha]	Water region that receives the discharge of the waters from the polder	The amount of waters pumped over from the polder [m^3/24h]
1.	Ognica	330	The Old Dźwina Strait	4600
2.	Przytór	150	The Old Dźwina Strait	3 050
3.	Darzowice	1630	The Dźwina Strait	21 600 – 90 720[2)] ca. 58 000[3a)] 55 000 – 110 000[3b)]
4.	Sierosław	40	Kamień Pomorski Lagoon	2 880 – 9 600[4)] ca. 3 600[3a)]
5.	Zastań	38	Kamień Pomorski Lagoon	4 600
6.	Kołczewo	75	Kołczewo Lake	6 100
7.	Rekowo	ca. 5	Koprowo Lake	4 600
8.	Międzyzdroje (sewage pumping station situated on a stream Stary Zdrój nearby motorway nr 3)[5)]	ca. 100	Wicko Małe Lake	2 700 – 4 300[6)]
			Total:	ca.90 000 (average) (according to [7)] 96 000)

Notations:
[1)] according to data quoted in Jakuczun and Nowacki (1994b),
[2)] in the years 1987-1990, depending on the amount of the annual precipitation, according to Jakuczun and Nowacki (1994b),
[3a)] Nowacki (1994b), p. 187,
[3b)] Nowacki (1994b), p. 189,
[4)] defined according to data quoted in Jakuczun and Nowacki (1994b),
[5)] data acquired from the City Council Międzyzdroje,
[6)] according to data acquired from the City Council Międzyzdroje, including the amount from 1 500 to 3 500 m^3 of treated effluents from the sewage-treatment plant in Międzyzdroje, the remaining part comprises waters from the municipal storm water drainage and drainage waters from the polder,
[7)] Nowacki et al. (1994)

From an ecological point of view, the presence of these pumping stations poses considerate environmental threat because within the Ognica polder area a municipal dumping site of the city of Świnoujście is located. Rain water and effluents that come from the area of the dumping site may flow into ditches situated on the polders of Ognica and Przytór, and further on and finally enter the waters of the Wolin National Park. The total amount of waters that are discharged from the drainage systems of the island, to the surface waters that surround the island, ranges from 50,000 to

10,0000 m^3 a day (from *ca.* 0.60 to *ca.* 1.75 m^3/s). Taking into account the fact that according to the measurements, done in Gozdowice by the Institute of Meteorology and Water Managment in Poznań, during summer 200 to 400 m^3/s of waters flows down the Oder River, which means that, at a rough estimation, the drainage waters from the Wolin Island compose *ca.* 0.3 to *ca.* 1.0 % of the total amount of inland waters discharged into the estuary of the Oder River. No records concerning the chemical composition of the Wolin Island drainage waters have been fund in the thematic literature.

All the wetland and marshy ecosystems on the Wolin Island that have been pointed out and described as regards their environment, are located on geological foundations of varying qualities, hence they possess different soils and phytocoenoses.

II. Environmental description of the selected areas

II. 1. Wetlands and marshes of the Przytorska Spit and of the islands surrounding the Lakes Wicko Wielkie and Wicko Małe.

Geomorphology. The Przytorska Spit was formed on Holocene deposits typical for the Brama Świny (Świna River Gateway), *i.e.* the area between the plateaus of Wolin and Uznam Islands. The Holocene deposits are composed of sands and gravels, which turn into fine-grained and loamy sands closer to the ground surface. The thickness of these layers ranges from a couple to 15 m. Flat-lie clays, loams and alluviums with interbeddings of finegrained sands and elemnts of peats are found above the sands. The clays, loams and alluviums were formed in shallow floodings and peatbogs. The thickness of the clay layers does not exceed a couple of meters. In the Brama Świny (Świna River Gateway), there lay varigrained sands above the layers that may be called lake-peatbog layers, and they contain interbeddings of loams that contain calcareous remains of marine fauna of bivalves and snails.

The spits of the Brama Świny (Świna River Gateway) were formed by the shore-debris of the Wolin and Uznam plateaus, carried by the sea. The sandy material of these spits, located outside the range of the sea-waves' influence, was exposed to the action of wind. As the result of this process another dune ramparts were formed.

Sandy dune ramparts stretch from the south to the north, and they lay parallel to the coastline. Peats occur locally between the ridges of the former dunes (Ruszała and Wdowiak 1997, Latałowa 1989, Majewski 1980). The age of the peats, are situated in the depressions located between the dunes of the Przytorska Spit, ranges from 4420 ±300 years, thus the oldest brown dunes must have been formed here earlier (Borówka *et al.* 1999).

Soils. A wide range of sandy dunes – so-called brown dunes – covered with a thin layer of soil rich in organic matter and afforested stretches along the seacoast in the northern part of the Przytorska Spit. In the southern part of the Spit, the afforested dunes turn into wetland meadows on a sandy, and further south - peat substratum

(rushy peat). Further south, the area of the Spit is composed of organogenic soils that are a mixture of peat and alluvial material accumulated by the waters of the Lakes Wicko Wielkie and Wicko Małe, which often flood these areas. Floodings are connected with the fluctuations of the lakes' water level that reach up to several centimeters (Prusinkiewicz 1961, Borówka *et al.* 1999).

Biocoenoses. It is assumed that phytocenoses of this part of the island are the best recognised (Jakuczun 1999), and particularly well recognised is the flora of the coastal bands, which was thoroughly studied in the second half of 1960s (Garbacik–Wesołowska 1969). It is also assumed that this well-recognised part of the island has not undergone significant changes as regards species composition and populations. Zoocenoses are not as well examined as phytocoenoses. The published papers, regarding invertebrates, deal only with selected species (Musial 1988). Comprehensive and meticulous papers on avifauna are worthy of attention (Osiejuk et al. 1993).

Phytocenoses. In the northern part of the Spit, an area of sandy dunes stretches, forming a wide band along the seacoast. The dunes are covered with a rather thin layer of soil rich in organic matter and afforested. Here the associations of suboceanic fresh coniferous forest *Leucobryo-Pinetum* (W. Mat. (1962) 1973) predominate. In its southern part, the dune-band turns into an assemblage of wetland meadows, frequently flooded with brackish waters from the Lakes Wicko Wielkie and Wicko Małe.

This area serves also as a plentiful habitat for numerous species of halophilous plants. It is the result of intermittent flooding of salty backflow, because these areas are situated below the sea level. Sea aster (*Aster tripolium* L.), saltmarsh rush (*Juncus gerardii* Lois., also known as: saltmeadow), sea arrow grass (*Triglochin maritimum* L., also known as: shore arrowgrass), sweet gale (*Myrica gale* L., also known as: Dutch myrtle, bog myrtle), royal fern (*Osmunda regalis* L.) and others (Jakuczun 1999) can be mentioned as the halophilous plants characteristic of this area.

The littoral zones of the Lakes Wicko Wielkie and Wicko Małe are thickly overgrown with vascular plants (Garbacik – Wesołowska 1969).

From the west, the area of the Spit is bordered by a number of islands that are strongly water-logged and thus almost completely overgrown with reed. It is often difficult to clearly determine the border between the water and the land, especially when the water level is high. From the northern and eastern side, the Lake Wicko demarcates the borderline of the mainland of the Wolin Island (here the border water–land is clearly discrenible). The bottom of the lake is slimy and covered with shells in many places.

The Islands: Mały Krzek, Wiszowa Kępa, Trzcinice and Warnie Kępy are almost completely overgrown with reed, which enters the water in strips that are up to 20 m wide. Narrowleaf cattail (*Typha angustifolia* L.), with an inconsiderable addition of broadleaf cattail (*Typha latifolia* L.), grows in tufts close by the shores of the islands, often mixed with reed and common club-rush. Around the island, *Schoenoplectus lacustris* (L.) Palla grows in circular tufts, the diameter of some of the tufts

exceeds 150 m. One can also encounter tufts that comprise a number of *Bulboschoenus maritimus* (L.) Palla specimens. *Nymphaeidae* assemble close to the shore, growing among the common club-rushes. The underwater meadow is composed of common hornwort (also known as: coontail) (*Ceratophyllum demersum* L.S.S.) and two species of pondweeds (shining pondweed - *Potamogeton lucens* L. and claspingleaf pondweed - *Potamogeton perfoliatus* L.). In the channels connecting the Lake Wicko with the Świna River, single specimens of *Batrachium circinatum* (Sibth.) (common name: fan-leaved water-goosefoot), *Batrachium fluitans* (Lam.) Wimm (common name: river water-crowfoot), pondweeds (*Potamogeton natans* L. and *Potamogeton fluitans* Roth. P. P.) can be encountered. In the inlet of the Warnie Kępy Island, an occurrence of two assemblages of brittle waternymph (*Najas minor* All.) was recorded. Most probably, this is a sole station of the waternymph within the Szczecin Lagoon.

The foreland of the Koński Smug Island and the northern bank of the Lake Wicko (as far as the Lake Wicko Małe) are completely overgrown with reed (*Phargamites australis* (Cav.) Trin. Ex Steud.). The reed grows in the form of an even strip, interrupted only in the small bays, the average width of this reed strip is ca. 60 m. Tufts of cattails - broadleaf cattail and narrowleaf cattail (*Typha latifolia* L. and *Typha angustifolia* L.), branched bur-reed (*Sparagimum ramosum* Curtis) and sparse tufts of *Butomus umbellatus* (L.) are encountered here as well. An even and uninterrupted strip of common club-rush (*Schoenoplectus lacustris* L. Palla) spreads from the water towards the lake banks. The gaps in between the tufts of the common club-rush and the reed are filled with yellow waterlily (*Nuphar luteum* (L.) Sm.), common white waterlily (*Nymphaea alba* L.) and fringed water-lily (*Limnanthemum nymphoides*). The largest concentration of the fringed water-lily that attains up to 600 m^2 was recorded near the foreland of the Koński Smug Island. The plant arrangement is different in the multiple little bays in the island. The common club-rush (*Schoenoplectus lacustris* L.) comes first from the open water surface, next there is a strip of reed, beyond the reed - broadleaf cattail and narrowleaf cattail and sweet rush (*Acorus calamus* L.), and beyond these - reed appears again. In the end parts of the bays, water surface is thickly covered with water soldier (*Stratiotes aloides* L.), which is accompanied by sago pondweed (*Potamogeton pectinatus* L., also known as: the fennel-leaved pondweed), star duckweed and duckweed (*Lemna trisulca* L. and *Lemna minor* L.), common hornwort (*Ceratophyllum demersum* L.S.S., also known as: coontail). Single specimens of pondweeds (*Potamogeton filiformis* Pers. and *Potamogeton compressus* L.) were also recorded there.

Deep underneath the water surface, on the inward side of the common club-rush strip, vast underwater meadows stretch, formed by shining pondweed (*Potamogeton lucens* L.).

The shore of the Lake Wicko Małe has recently been reinforced, and only in some parts of it tufts of narrowleaf cattail (*Typha angustifolia* L.) occur.

The shore of the Lake Wicko is not covered with vegetation from the side of the locality Lubiń.

Zoocoenoses. Avifauna. Over 140 bird species nest within the area of wildfowl refuge. Many of these species are rare and endangered, such as: aquatic warbler (*Acrocephalus paludicola* L.), dunlin (*Calidris alpina* L.), western curlew (*Numanius arquata* L.), shelduck (*Tadorna tadorna* L.), northern pintail (*Anas acuta* L.), common crane (*Grus grus* L.), three species of harriers, goosander (*Mergus merganser* L.), oystercatcher (*Haematopus ostralegus* L.), bearded reedling (*Panurus biarmicus* L.), and others. The refuge is a frequented repose site of the migratory birds like bean goose (*Anser fabalis fabalis* L.), crane (*Grus grus* L.), goosander (*Mergus merganser* L.), cormorants (*Phalacrocorax carbo* L.) and many plover species (Osiejuk et al. 1993).

This area is also the feeding ground of predatory birds, such as: white-tailed eagle (*Haliaeetus albicilla* L.), red kite and black kite (*Milvus milvus* L. and *Milvus migrans* L.), sparrow hawk (*Accipiter nisus* L.), northern hobby (*Falco subbuteo* L.), montagu's harrier and pallid harrier (*Circus pygargus* L. and *C. macrourus* L.), oriental honey buzzard (*Pernis apivarus* L.), common kestrel (*Falco tinnunculus* L.), and many other - singing birds, waterfowl species and plover birds. Since some yearsa restitution of the following species: eagle owl (*Bubo bubo* L.), common goldeneye (*Bucephala clangula* L.) and osprey (also known as: fishhawk) (*Pandion haliaetus* L.) is carried out in the Wolin National Park (Jakuczun 1999).

II.2. Wetlands and marshes in the Warnowsko–Kolczewskie Lakeland, along Struga Pojezierna – Lewińska (Lakelandic- Lewińska Rivulet), excluding the areas surrounding the Lake Koprowo

Geomorphology. Warnowsko – Kolczewskie Lakeland, together with the catchment basin of the Lakelandic Rivulet, is located on the grounds composed of varigrained sands that lay on boulder clay. In the eastern part of the rivulet, the area of moraines is cut across by a system of glacial channels. These channels – very pronounced in the morphology – present a NE-SW course. The channels of the Lakes Wiselka and Kolczewo combine in a lowering, formed in the process of the glacier melting. It is occupied by the Lakes Domysłowskie, Czajcze and Żółwińskie. Due to direct contact with the moraine, one of the erosion channels was diverged and as a result of this process an isolated fragment of moraine was formed. Escarpments of the erosion channels are built of fluvioglacial material, which forms kame terraces. The plane of the terraces is situated 30–40 m above the sea level and it is suspended 15-20 m above the bed of the erosion channels. The terraces are built of fluvioglacial sands and gravels, which lay on glacitectonic structures and are stratified to a large extent. Beds of erosion channels located in the vicinity of the lakes are filled with organogenic material - mostly peat and in some places gyttija.

Between separate lake basins there lay kame tablelands and eskers. They form an association typical for the areal deglaciation. These tablelands and eskers are composed of stratified sand-gravel sediments, which in some places are covered with ablational clay. Accumulation of these sediments took place under conditions of the alternating flow of fluvioglacial waters. The kame terraces turn into an accumulation horizon composed of varigrained sands. It is a clear indication that the forms of these sediments were formed at the same time.

The geomorphological structure assumed its final form during the Holocene sedimentation cycle, when the sands and lake loams, eolic sands and organogenic deposits were formed. Lake deposits occur on the beds of contemporary lakes and in their shore parts (shores of contemporary lakes are completely covered up by soil and overgrown, *e.g.* between the Lakes Wiselka and Czajcze or in the vicinity of Domysłowo), sporadically they occur in depressions devoid of flow, which are located on the frontal moraine. The thickness of these deposits attains a few meters as a maximum. Most often the lake deposits comprise humic fine-grained and loamy sands, bronze and grey, slightly silted and with insertions of organogenic deposits. Eolic deposits are accumulated west from the Lake Warnowo (Latałowa 1989, Kostrzewski 1994, Ruszala and Wdowiak 1977).

Soils. In the areas in question peat soils of lowland peatbogs and half-bog soils occur. The peat soils of lowland peatbogs occur in four terrain depressions near the Lakes Warnowo, Domysłowo and north-east from the Lakes Domysłowskie and Czajcze. On the north-eastern shore of the Czajcze Lake, peat soils of lowland peatbogs occur on gyttija. Peat soils were formed of sedge-rush-peatbogs with neutral or slightly acid reaction. The water level of these soils remains at a depth of 50 meters most of the time.

As regards the half-bog soils, they occur in depressions located around all the lakes of Warnowo. These soils are mineral-organic and humic, they contain froma few to tenths percent of mineral matter mixed with loose sand. Half-bog soils have been created as a result of rotting that takes place in dehydrated ground-gley soils, the roof of which is composed of peaty and peat deposits. This process also occurs in shallow peat soils, where the peat-bog layer, due to the process of mineralisation, has diminished its thickness to less than 30 cm. The process of rotting that takes place in the half-bog soils transforms the peat into peat earth, which presents a characteristic grained or cloggy structure. Admixtures of mineral matter composed of sand gives the peat earth a specific dark-grey colouration. Acidic organic matter causes the acidic reaction of the surface layers of half-bog soils and the pH between 4.0-5.2 and within the sandy area – underneath it 5.0-6.5. The thickness of these layers is usually 20-30 cm but at times it reaches even up to 60 cm. The ground water level changes depending on the location and season and oscillates between 40 and 115 cm, often below 125 cm (Borowiec 1974, 1994).

Biocoenoses. The biocoenoses of the Warnowsko-Kołczewskie Lakeland are not well recognised. Literature provides only the results of studies of phytocoenoses occurring in this region (Popiela et al. 1992).

We assume that other biocoenoses still await "to be discovered" and the willing researchers that will discover, study and describe them.

Phytocoenoses. Vegetation in the wetland areas of the glacial channel of the Warnowsko–Kołczewskie Lakeland is dominated by reed-rush, which borders and interweaves with assemblages of aquatic bank vegetation. Within the studied area, numerous assemblages of aquatic bank vegetation were identified (Popiela *et al.* 1992,

Kaczmarczyk 1998). Patches of *Phragmitetum* association Gams (1927) Schmalle 1939 occur in the littoral zones of all the studied water basins; patches that reach the depth of 130 cm on the mineral substratum, at times they occur also on mineral-mud substratum. Patches of the discussed association are floristically poor - a detailed survey indicated the presence of 2 to 4 species. *Phragmites australis* (Cav.) Trin. Ex Steud is the main component and the most characteristic species of this association at the same time.

Phytocoenoses of *Scripetum lacustris* All. (1922) Chouard 1924 were recorded in four of the studied water basins. These phytocoenoses also proved to be rather poor (2 - 4 species). They occupy small areas situated at the depth of 30–70 cm, on mineral or mineral-mud substratum.

Phytocoenoses *Schoenplecus lacustris* (L.) Palla form borders from the open-surface of water with vegetation having floating leaves and belonging to the class of *Potamogetonetea* R. Tx. Et Prsg. 1924. Ffrom the land side these phytocoenoses border with reed-rush.

Phytocoenoses *Equisetetum fluviatilis* Steffen 1931 develop in the shallow parts of the Lake Czajcze on mud substratum. They develop in the form of two, floristically very poor, patches, where *Equisetetum limosum* L. dominates.

Patches of the association *Heleocharitetum palustris* Šennikov 1919 develop in strips on mud substratum. Plant coverage in these phytocoenoses attains from 25 to 70%. In the Lake Gardno, rushes composed of branched bur reed border from the land side with sedge-rushes, and from the water side with assemblages of plants that have floating leaves. *Dryopteris thelypteris* (L.) A. Gray, *Phragmites australis* (Cav.) Trin. Ex Steud and *Typha latifolia* L. are the main species that compose phytocoenoses of the association *Thelypteridi-Phragmitetum* Kuiper 1957. Besides those, other rush species occur here as well. Plant coverage reaches up to 80 to 100%, and a detailed survey indicated the number of species in the range from 3 to 12. These phytocoenoses develop at 5 to 60 cm depth. Vast patches of *Thelypteridi-Phragmitetum* occur on the northern shores of the Lakes Warnowo and Rabiąż. These two basins are connected with each other by an overgrowing isthmus, they are also highly eutrophic.

Phytocoenoses of the *Aalnetea glutinoseae* class Br.-Bl. et R. Tx. 1943 that contain a substantial share of *Alnusglutinosa* (L.) Gaertn. and *Salix cinerea* L., have developed from the land side - beyond the above mentioned phytocoenoses. Vegetation of the phytocoenoses *Thelypteridi-Phragmitetum*,with dominating *Thelypteris palustris* Schott, develops on highly hydrated organic deposits, where it forms double- and triple-layered tufts. Among these tufts water pools are located, reaching the depth of a few to a few tenths of centimeters.

III. Other wetlands and marshes on the Wolin Island – some remarks

A relatively small number of data concerning other wetland and marshy areas selected for this study have been found described in the available literature. Apart from comprehensive data concerning the structure of surface geological layers, the only other data found was dating back to some decades ago and concerning soils and types

of vegetation that occupy the area of the Wolin Island, though that vegetation must have undergone significant transformations in the time being.

Wetland areas of the central part of the Wolin Island, that stretch from the Warnowo watershed, which spreads from the west to the east, are mostly composed of water-logged meadows on peat substratum (lowland peatbogs). The meadows stretch very far, reaching the southern shores of the island (Fig.1). Wetland areas of the central part of the Wolin Island undergo the processes "re-building" the phytocoenoses. These processes were initiated in the 1970s when the irrigation system was activated and started draining the central part of the island, they are also propelled by continuous rotting of the soils. A drastic example of the occurring changes is the drying out of marshy areas in the Łuniewo near Warnowo. This used to be a refuge for aquatic birds in the past, and nowadays it no longer serves the function of a habitat for wading birds and a refuge for migrating aquatic birds. Dehydration of the central part of the Wolin Island, particularly the transformation of these areas into a polder zone, has led to permanent salination of the waters of the Lake Koprowo. The Lake Koprowo is indirectly incorporated into the draining system. The waters of the lake are constantly supplied by brackish waters that flow in through the Lewińska Rivulet from the Kamień Pomorski Lagoon. Before the 2nd World War, the closing up of the weir on the Lewińska Rivulet protected the Lake Koprowo against accidental inflows of salt waters that occurred during back-flow surge of sea waters. Since post-war times, the system does not operate any longer (Jakuczun and Nowacki 1994a). As a result, the surface and subsurface waters in the adjacent areas undergo progressing salination, which in turn causes the re-building of phytocoenoses into halophilous ones.

The Rów Peninsula, located south of the town of Wolin, is a special division area, composed of soils of the lacustrine bog type. The average elevation of the peninsula above the level of the surrounding waters, of the Szczeciński Lagoon and of the Dźwina Strait, is 50 cm. Hence the area of the peninsula is often flooded. These grounds are inhabited by halophilous vegetation, which forms here very interesting assemblages (Kostrzewski 1992 b).

CONCLUSIONS

The analysis revealed that:

1. The ecosystem of wetlands and marshes of the Wolin Island, due to their habitat diversity and biocoenotic diversity, compose a significant part of the natural environment of the island.
2. As a result of climatic changes and due to anthropopressure (draining procedures and pollution) most of the ecosystems on the Wolin Island display habitat changes that lead to transformations of the biocoenoses.
3. It seems that these areas - even though they are an object of studies of various scientific centres and research teams - are still not sufficiently recognised and described.

4. An overview of the thematic literature seems to indicate that practically there exist no publications that would present research results concerning the chemical composition of ground and subsurface waters within the wetland and marshy areas of the Wolin Island.

REFERENCES

Borowiec, S. 1959. Gleby powiatów wolińskiego i kamieńskiego na tle warunków przyrodniczych (Soils of the poviat of Wolin and the poviat of Kamień Pomorski against the background of environmental conditions), Mat. Zach.-Pom., Szczecin, 5: 9-24 (in Polish).

Borowiec, S. 1961. Gleby brunatne i bielicowe na terenie Wolińskiego Parku Narodowego oraz powiązanie ich z siedliskowymi typami lasu (Brown and podsolic soils within the area of the Wolin National Park and their relation to the sylvan biotope types), Sylwan, 7: 19-30 (in Polish).

Borowiec, S. 1965. Zmiany w morfologii profili glebowych spowodowane przez erozję wietrzną na terenie Wolińskiego Parku Narodowego (Changes in the morphological soil profiles caused by wind erosion in the Wolin National Park), Zesz. Nauk. WSR Szczecin, 18: 131-136 (in Polish).

Borowiec, S. 1969. Zagadnienia gleboznawczo-siedliskowe Wolińskiego Parku Narodowego (Issues pertaining to soil-science and biotopes in the Wolin National Park), Stud. Soc. Scient. Stetin., 31: 1-57 (in Polish).

Borowiec, S. 1974. Gleby Wolińskiego Parku Narodowego (Soils of the Wolin National Park), Sylwan, 5: 43-52 (in Polish).

Borowiec, S. 1994. Wyniki i perspektywy badań gleboznawczych na obszarze Wolińskiego Parku Narodowego (The results and perspectives of the pedologic studies within the Wolin National Park), KLIFY, 1: 25-32 (in Polish).

Borówka, R.K., Piotrowski, A., Wiśniowski, Z. (red., red.) 1999. Przewodnik LXX Zjazdu Naukowego Polskiego Towarzystwa Geologicznego (A guide of the LXX Scientific Conference of the Polish Geological Association), Wyd. Polskie Towarzystwo Geologiczne, Szczecin, 300 pp. (in Polish).

Czubiński, Z., Urbański, J. 1952. Park Narodowy na wyspie Wolin (The National Park on the Wolin Island), Chr. Przyr. Ojcz., 7: 3-56 (in Polish).

Garbacik-Wesołowska, A. 1969. Roślinność Zalewu Szczecińskiego (Vegetation of the Szczecin Lagoon), Prace MIR w Gdyni, Gdynia, 15A: 103-119 (in Polish).

Jakuczun, B. 1999. Woliński Park Narodowy (The Wolin National Park), in: M. Landsberg-Uczciwek (red.), Raport o stanie środowiska w województwie zachodniopomorskim w latach 1997-1998 (Environmental quality report concerning the state of zachodniopomorskie voivodeship in the years 1997-1998), Bibl. Monitor. Środowiska, Szczecin, s. 154-157 (in Polish).

Jakuczun, U., Nowacki, F. 1994a. Program kompleksowych przedsięwzięć proekologicznych na wyspie Wolin (The programme of complex environmental protection measures on the Wolin Island), w: (in:) M. Frankel, B. Jakuczun (red., red), 1994, Mater. Warsztatów Ekologicznych: Program zagospodarowania i rozwoju wyspy Wolin. (Proc. Ecological Workshop: The programme of ma-

nagement and development of the Wolin Island), Międzyzdroje 6-7 października 1994, Wyd. Woliński Park Narodowy, Międzyzdroje, s. 49-105 (in Polish).

Jakuczun, U., Nowacki, F. 1994b. Problemy krążenia wód wyspy Wolin, korzystania z zasobów oraz ich ochrony (The problems of the Wolin Island waters circulation, the use of natural resources and protection of these resources), Mater. Warsztatów Ekologicznych: Program zagospodarowania i rozowju wyspy Wolin (Proc. Ecological Workshops: Programme of management and development of the Wolin Island), Międzyzdroje 6-7 października 1994, Wyd. Woliński Park Narodowy, Międzyzdroje, s. 137-165 (in Polish).

Jasnowski, M. 1962. Budowa i roślinność torfowisk Pomorza Szczecińskiego (Structure and vegetation of the Szczecin Pomeranian Region's vegetation). Wyd. Szcz. Tow. Nauk., Szczecin 340pp. (in Polish).

Kaczmarczyk, A. 1998. Flora roślin naczyniowych okolic Wisełki, praca magisterska Kat. Taksonomii i Fitogeografii Uniw. Szczecińskiego (The flora of vascular plants located in the vicinity of Wisełka, MA thesis, The Chair of Taxonomy and Phytogeography in University of Szczecin), Szczecin (in Polish).

Kołodziej-Nowakowska, M. 1992. Szata roślinna i świat zwierzęcy gminy Wolin (The plant cover and the world of animals of the gmina of Wolin), w: (in:) A. Kostrzewski, Środowisko przyrodnicze i przestrzenna struktura społeczno-ekonomiczna miasta i gminy Wolin (The natural environment and the spatial socio-economical structure of the town and the gmina of Wolin.), Wyd. UAM w Poznaniu, Poznań, p. 45-61 (in Polish).

Kostrzewski, A. (red.) 1997. Studia z geografii fizycznej i ekonomicznej wyspy Wolin (Studies on physical and economical geography of the Wolin Island), Wyd. UAM w Poznaniu, Poznań, 152pp. (in Polish).

Kostrzewski, A. (red.) 1986. Woliński Park Narodowy (monografia geograficzna) (The Wolin National Park – geographic monography), Wyd. UAM w Poznaniu, Poznań, 208pp. (in Polish).

Kostrzewski, A. (red.) 1989. Środowisko przyrodnicze i przestrzenna struktura społeczno-ekonomiczna miasta i gminy Międzyzdroje (monografia geograficzna) (The natural environment and the spatial socio-economical structure of the town and the gmina of Międzyzdroje - geographic monography), Wyd. UAM w Poznaniu, Poznań, 185pp. (in Polish).

Kostrzewski, A. (red.) 1992a. Charakterystyka fizyczno-gograficzna geoekosystemów wodnych Wolińskiego Parku Narodowego (Physico-geographical description of the aquatic geoecosystems of the Wolin National Park), Wyd. UAM w Poznaniu, Poznań, 90pp. (in Polish).

Kostrzewski, A. (red.) 1992b. Środowisko przyrodnicze i przestrzenna struktura społeczno-ekonomiczna miasta i gminy Wolin (monografia geograficzna) (The natural environment and the spatial socio-economical structure of the town and the gmina of Wolin - geographic monography), Wyd. UAM w Poznaniu, Poznań, 212pp. (in Polish).

Kostrzewski, A. (red.) 1993. Geosystemy wodne Wolińskiego Parku Narodowego (Aquatic geosystems of the Wolin National Park), Wyd. UAM w Poznaniu, Poznań, 102pp. (in Polish).

Kostrzewski, A. 1994. Aktualny stan badań geomorfologicznych na terenie Wolińskiego Parku Narodowego (The present state of geomorphological studies in the area of the Wolin National Park), KLIFY, 1: 15-24 (in Polish).

Latałowa, M. 1989. Type region P-u: Baltic Shore, IV part: Wolin Island. Acta Palaeobot., 29(2): 11-120.

Majewski, A. (red.) 1980. Zalew Szczeciński (The Szczecin Lagoon), WKiŁ, Warszawa, 323pp. (in Polish).

Musial, J., 1988. Ważki (*Odonata*) Wolina i południowo-wschodniego Uznamu (Dragonflies – *Odonata* of the Wolin and the south-eastern Uznam), Bad. Fizjogr. nad Polską zach., 37: 23-46 (in Polish).

Nowacki, F. 1994a. Bilans wodny i zasoby wodne wyspy Wolin i Wolińskiego Parku Narodowego (The water balance and water resources of the Wolin Island and Wolin National Park), KLIFY, 1: 119-136 (in Polish).

Nowacki, F. 1994b. Formy retencji wód Wyspy Wolin, stopień degradacji i możliwości odbudowy (Forms of water retention of the Wolin Island, the level of degradation and possibilities of reconstruction), Mater. Międzynarodowej Konf.: Ochrona i rekultywacja jezior i zbiorników wodnych, (Proc. Inter. Konf.: Protection and recultivation of lakes and aquatic reservoires), Międzyzdroje 24-25 listopada 1994, Wyd. Biuro Inf. Gosp., Szczecin, s. 183-191 (in Polish).

Nowacki, F., Kreft, A., Jakuczun, U. 1994. Problemy szczegółowego bilansowania zasobów i formowania warunków korzystania z wód małej zlewni na przykładzie wyspy Wolin (Problems related to detailed resource balancing and creating conditions that would enable the exploitation of small catchment area shown on the example of the Wolin Island), Zesz. Nauk. AR we Wrocławiu, 248: 207-217 (in Polish).

Osiejuk, T.S., Cenian, Z., Czereszkiewicz, R., Kalisiński, M., Włodarczyk, A. 1993. Avifauna wyspy w delcie Świny w sezonie 1990/1992 (The island's avifauna in the delta of the Świna River during the season 1990/1992), Przegl. Przyrodniczy, 4: 17-37 (in Polish).

Piotrowska, H. 1955. Zespoły leśne wyspy Wolin (Forest complexes of the Wolin Island), PWN, Poznań 168pp. (in Polish).

Piotrowska, H. 1966. Stosunki geobotaniczne wyspy Wolina i południowowchodniego Uznamu (Geobotanic relations of the Wolin Island, and the south-eastern Uznam), Monogr. Bot., PWN Warszawa 250pp. (in Polish).

Piotrowska, H. 1966a. Chronione gatunki roślin naczyniowych w Wolińskim Paku Narodowym (Protected vascular plant species in the Wolin National Park), KLIFY, 3: 7-104 (in Polish).

Piotrowska, H. 1996b. Zagrożone i specyficzne gatunki roślin godne lokalnej ochrony w Wolińskim Parku Narodowym (Endangered and specific plant species worthy of local protection in the Wolin National Park), KLIFY, 3: 105-159 (in Polish).

Piotrowska, H., Celiński, F. 1965. Zespoły psamofilne wysp Wolina i południowo-wschdoniego Uznamu (Psamophilic associations located one the Wolin Island and the south-eastern Uznam), Bad. Fizjogr. nad Polską Zach., 16: 123-170 (in Polish).

Poleszczuk, G. 1994. Ekosystemy wodne Wolińskiego Parku Narodowego (Aquatic ecosystems of the Wolin National Park), KLIFY, 1: 99-118 (in Polish).

Poleszczuk, G. 1998. Środowisko abiotyczne toni wodnej Zalewu Szczecińskiego (The abiotic environment of the Szczecin Lagoon), Stud. Rozp. Uniw. Szczecińskiego, 292: 1-207 (in Polish).

Poleszczuk, G., Domagała, J., Markiewicz, I. 2002. Ekosystemy wód przybrzeżnych Wolińskiego Parku Narodowego – jako odbiorniki wód odpadowych (Ecosystems of Coastal Waters of Woliński National Park – as Receiver of Wastewater), Rocz. Ochrona Środowiska 4: 403-417 (in Polish).

Poleszczuk, G., Jakuczun, B., Kosowska, B., Stachlewska, K. 2003. Badania chemizmu wód źródliskowych na wyspie Wolin (Investigations of the sources waters on the Wolin Island), Chem. Inż. Ekol. 10: 139-150 (in Polish)

Popiela, A., Prajs, B., Sotek, Z. 1992. Roślinność szuwarowa jezior Wolińskiego Parku Narodowego (Rush-plants of the lakes in the Wolin National Park), Zesz. Nauk. Uniw. Szczecińskiego, 91: 59-67 (in Polish).

Prusinkiewicz, Z. 1961. Zagadnienia leśno – gleboznawcze na obszarze wydm nadmorskich Bramy Świny (Issues related to forest – and soil-science in the area of the littoral dunes of the Świna River Gateway), Bad. Fizjogr. nad Polską Zach., 7: 26-127 (in Polish).

Ruszała, M., Wdowiak, M. 1977. Szczegółowa mapa geologiczna Polski. 1:50000. Arkusz Świnoujście i Międzyzdroje (A detailed geological map of Poland. 1:50000. Map sheet of Świnoujście and Międzyzdroje), Wyd. Geol., Warszawa (in Polish).

Stańczyk, A. 1998. Osobliwości przyrodniczo-florystyczne nadleśnictwa Międzyzdroje, praca magisterska, Kat. Taksonomii Roślin i Fitogeografii Uniw. Szczecińskiego. (Environmental and floristic curiosities of the forest division Międzyzdroje, MA thesis, The Chair of Taxonomy and Phytogeography in University of Szczecin), Szczecin (in Polish).

Żurek, S. 1999. Geosystemy Bagienne Strefy Przybałtyckiej (Marshy Geosystems of the Baltic Coastal Zone), w: (in:) R.K. Borówka, Z. Młynarczyk, A. Wojciechowski (red., red.), Ewolucja Geosystemów Nadmorskich Południowego Bałtyku (The evolution of Coastal Geosystems of the Southern Baltic Sea), Bogucki Wydawnictwo Naukowe, Poznań – Szczecin, s. 187-198 (in Polish).

TERENY BAGIENNE I PODMOKŁE NA WYSPIE WOLIN - CHARAKTERYSTYKA PRZYRODNICZA WYBRANYCH OBSZARÓW

Streszczenie

Obszary bagienne i podmokłe na wyspie Wolin zajmują ok. 50 % jej powierzchni. O ile ekosystemy lądowe i wód otwartych wyspy są przedmiotem zainteresowania licznych badaczy i istnieje dość bogate czasopiśmiennictwo na ich temat, to ekosystemy bagienne i terenów podmokłych, jak się wydaje, rozeznane są w mniejszym stopniu.

Poszczególne ekosystemy bagienne i terenów podmokłych wyspy Wolin są istotnie zróżnicowane, jeżeli chodzi o położenie geograficzne, fizjografię, warunki glebowe i hydrologiczne oraz biocenozy. Występują tu, np. tereny podmokłe mikrozlewni polderowej w pobliżu Międzyzdrojów, gdzie występuje m.in. silne wymywanie związków żelaza i manganu z gleb murszowo-darniowych. Obszary podmokłe Mierzei Przytorskiej, o glebach piaszczystych narażonych na ascenzję wód słonych, ze zbiorowiskami roślinności słonolubnej, a także obszary centralnej części wyspy, o glebach torfowych na podłożu piaszczystym, z dużą zawartością kredy pojeziornej, które są poddane – po uruchomieniu systemu odwadniającego ze spływem wód do przepompowni w Darzowicach - procesom degradacji glebowej typowym dla odwodnionych torfów. Łączy się to z postępującą przebudową biocenoz na tych terenach. Wreszcie obszary podmokłe w północno-wschodniej części wyspy, w otoczeniu jeziora Koprowo, którego wody po ograniczeniu dopływu wód słodkich wskutek odwodnienia zlewni centralnej części wyspy Wolin, co spowodowało napływ do jeziora wód estuaryjnych z Zalewu Kamieńskiego – stały się słonawe. Powoduje to postępującą stopniowo salinację tych terenów.

Na specjalną uwagę zasługują także tereny półwyspu Rów na południe od miasta Wolina otoczonego wodami Zalewu Szczecińskiego o zmieniającym się sezonowo składzie chemicznym.

Przygotowanie studium ma na celu wskazanie na znaczenie tych jakże różnorodnych i cechujących się znaczną bioróżnorodnością ekosystemów.