

**OPEN WATER ECOSYSTEMS OF WOLIN NATIONAL PARK -  
- NATURAL CHARACTERIZATION**

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**Abstract**

Natural characterization of unique reservoirs of Pomeranian Bay and Szczecin Lagoon open waters with adjacent Wicko Małe and Wicko Wielkie lakes and a part of archipelago of backflow delta Świna river. These areas were included in Wolin National Park (Wolin Island, NW of Poland) in 1996.

**Key words:** Wolin National Park, Wolin Island, Pomeranian Bay, Szczecin Lagoon, waters ecosystems, phytocenosis, zoocenosis, ichtyofauna.

**INTRODUCTION**

As a result of including in Wolin National Park (WPN) (Fig. 1.) in 1996 (Decree dated 1996) sea waters of Pomeranian Bay and internal sea waters of Szczecin Lagoon, WPN has gained a status of first Polish maritime national park. Poland, as a first country has accomplished the recommendations of Helsinki Convention in the matter of system of Baltic Sea Protected Areas (BSPA) establishment (Lewicki 1994, 2000; Jakuczun 1996).

The area of Wolin National Park grew up to 10937 hectares. In Park area following ecosystems has been included:

1. Open coastal waters of Pomeranian Bay 1 N. mile wide (1 Nautical mile = 1852 metres)
2. 400 metres broad belt of Szczecin Lagoon open waters from Lubin to Karno-cice.

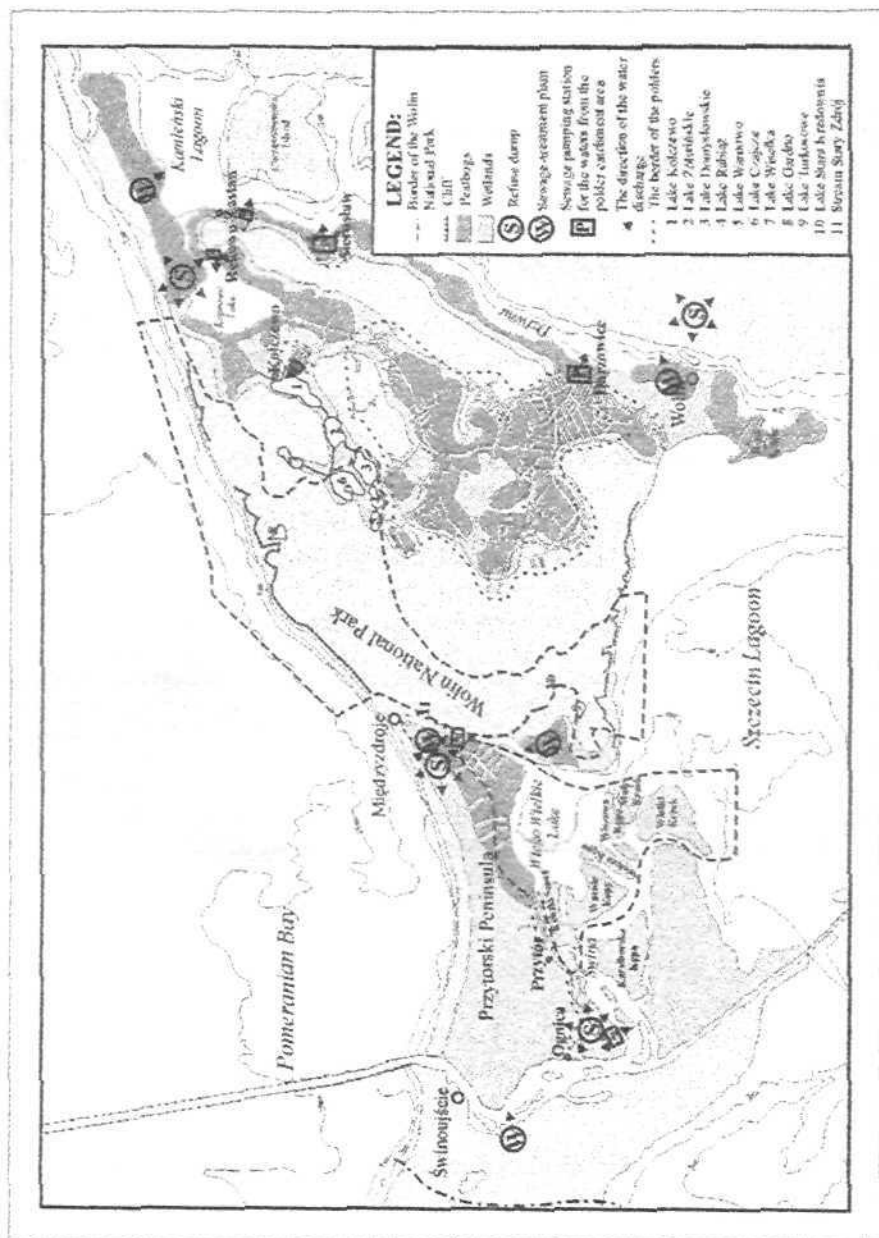


Fig. 1. Wetland and marshy areas of the Wolin Island

3. Part of Szczecin Lagoon waters, surrounding from the south islands of backflow delta Świna river. Wicko Wielkie and Wicko Małe lakes (half of Wicko Wielkie lake to the west from the fairway Szczecin-Zalesie near Międzyzdroje; second part belongs to Międzyzdroje town) and the channels of eastern parts of delta Świna river with Stara Świna water-course.
4. Waters of hydrographic ecosystem (natural water-courses, ditches and canals) of Stary Zdrój nearby Międzyzdroje and ditches of Przzytor Peninsula draining off waters to Wicko Wielkie and Wicko Małe lakes.

Jointly, 2179 hectares of open sea and approximately 2000 hectares of internal seawaters of Szczecin Lagoon were embraced by the legal protection.

The buffer zone of Wolin National Park encompasses the parts of forest district of Międzyzdroje and narrow belt of delta Świna waters (Decree dated 1996).

The objective of the present work is presentation of brief natural characterization of open water ecosystems incorporated in WPN in 1996.

## II. Characterization of natural resources of open water ecosystems of Wolin National Park included in Park area in 1996.

Water ecosystems of coastal waters of Pomeranian Bay, northern parts of Szczecin Lagoon, with adjacent Wicko Wielkie and Wicko Małe lakes, with ecosystems of backflow delta Świna river belong to most interesting ecosystems in Odra river estuary. They are so interesting not only because of varied physiography and varying biotops but most of all because its biodiversity. Consequently, these ecosystems have been extensively studied from the beginning of fifties of the previous century.

The physiographic and hydrological surveys were carried out on coastal waters of Pomeranian Bay and Szczecin Lagoon, which joined with the Wolin National Park area in 1996. Results of these studies were published in monographs of Majewski (1974, 1980). Outcomes of studies and investigations on chemistry of water were presented in monographs of Chlubek (1975) and Poleszczuk (1997b, 1998). Results of studies on these biotops are available in papers of Wiktorowie (1961), Chlubek (1975 a, b), Wiktor (1976), Żmudziński (1978), Trzosińska et al. (1988), Poleszczuk et al. (1992, 1995), Poleszczuk (1993, 1994 a, b, 1995, 1996 a, b, c, 1997 a, b, 1998), Poleszczuk and Sitek (1993, 1995, 1997), Garbacik-Wesołowska (1994), Mutko et al. (1995), Tadjajewski and Kubiak (1996), Chojnacki (1999), Poleszczuk and Piesik (2000).

Complex researches on biocenosis were carried by: Wiktor and Wiktor (1959), Żmudziński (1978), Chojnacki and Drzycimski (1979), Chojnacki (1984, 1987, 1989, 1999), Drzycimski (1986, 1987, 1989), Piesik (1992). Phytoplankton researches: Zembruska (1962), Ringer (1967, 1976), Pliński (1972), Chojnacki (1989, 1999), Chojnacka (1991), Piesik (1992). Zooplankton researches: Świeżawska-Wiktorowa (1957), Wiktor (1959, 1961), Różańska (1967), Chojnacki (1973, 1975, 1984, 1987, 1991), Gruszka (1999).

Macrophytes studies were carried by: Garbacik-Wesołowska (1969). In research work of Wiktor and Wiktor (1954), Wiktor (1962, 1963, 1969), Giziński et al. (1980), Radziejewska (1984), Świerczyński et al. (1986), Radziejewska and Drzy-

cimski (1988, 1990), Wolnomiejski and Grygiel (1989, 1992, 1994), Masłowski (1992, 1993) Piesik et al. (1994), and Wolnomiejski (1994) studies of benthos were presented.

Researches on ichthyofauna are included in papers of Wiktor (1954, 1957), Pęczalska (1962), Wiktor and Żukowski (1962), Żukowski (1962), Domagała et al. (1982, 1993), Kompowski et al. (1991), Garbacik- Wesołowska and Adamski (1993), Wiktor and Garbacik-Wesołowska (1993), Garbacik – Wesołowska (2000), Porębski and Szkudlarek – Pawełczyk (2000), Wysokiński (2000), Szkudlarek – Pawełczyk (2002).

Unique character of investigated water environments results from its varied and unrepeatable physiography. The regions in question are: sea and lagoon waters surrounding, on the north, cliff coasts of Wolin island and Wicko Wielkie and Wicko Male gulf lakes of Szczecin Lagoon on the south, part of delta Świna river complex, rich in varied biotops and diverse biocenosis of these water environments. Waters in question are highly mineralised, abundant in numerous species of plants and animals (some of them existing only here). Amongst 290 taxons existing in these ecosystems, 215 taxons of phytoplankton and 74 taxons of zooplankton were determined. 68 species of ichthyofauna among which 23 were taken into total or partial (seasonal) protection, occur here. 230 birds species were recorded here, as well. Biocenosis of these water regions are characterised by varying quantity of species and altering population size during vegetation season as well as in consecutive years. Simultaneously the increase of pollution in Odra river estuary in the last half-century, that has been observed, accelerated the succession processes of species characteristic for natural ageing of water reservoirs.

## II.1. Waters of Pomeranian Bay belonging to Wolin National Park – natural characteristics.

**Physiographical, morfological and hydrological essay.** Coastal waters of Pomeranian Bay, included to Wolin National Park (WPN), adjoin the strongly eroded cliff coast, 90 metres above sea level high (Gosań hill). Sea bottom is made of hard, packed loam, completely uncovered in some places, largely covered with coarse-grained sand, gravel, roundstones or, with debris of glacial xenoliths - especially in the area of Świdna Kępa. Stone bed is spreading to 3/4 of nautical mile from the coast into the sea; further the gravel-sand bottom alternately with stone bed is spreading. At the greater distance the sand bottom dominates over the area of Pomeranian Bay, far away from the beach. The depth of Pomeranian Bay on the Park area is gradually, monotonically growing from 0 (beach) to 10-11 metres.

**Biotop.** Pomeranian Bay waters are influenced by continuous exchange of riverine and seawaters and the whole area has exceptionally stable salinity, which amounts 7-8 ‰, incidentally decreasing to 6-6,5 ‰, due to increased riverine outflow in the coastal zone of Pomeranian Bay. Simultaneously the increase of salinity to dozen or so promilles (12-14 ‰) occurs as an effect of back flow of waters from the sea, due to long-lasting northeastern circulation. Inflow of riverine waters into coastal areas of

Pomeranian Bay is exceptionally high during the winter but also at springtime. During summer and autumn the influence of Baltic Sea waters is distinctly clear. Coastal waters of Pomeranian Bay are eutrophic to some degree. Eutrophication is manifesting by over oxygenation of coastal waters reaching 120 % of oxygen level in the periods of phytoplankton blooms in the summer time.

### Biocenosis.

Phytocenosis. Shallow stone bed constitutes a soil for Baltic macro-algae belonging to green algae (i.e. *Enteromorpha*, *Cladophora*), brown algae (*Fucus*, *Pylaiella*) and red algae (*Ceramium*, *Polysiphonia*). Mentioned macro algae were not extensively studied in this Baltic region. They are a perfect habitat for many crustaceans, particularly *Gammarus* and other groups of invertebrates belonging to group of *M. edulis*.

The same situation occurs in the case of phytoplankton (particularly near the Świna outlet), which in the spring and summer time is dominated by blue-green algae (*Cyanophyta*), mainly *Microcystis* spp. and among diatoms (*Bacillariophyceae*) by *Melosira* spp. and *Cyclotella* spp. - all of them growing in masses in Szczecin Lagoon. In both water regions green algae (*Chlorophyceae*) are a numerous group although species of *Oocystis* genus and *Monoraphidium* are highly represented in Pomeranian Bay whereas Szczecin Bay waters are abundant in *Scenedesmus* spp. Most of marine species can be recorded in November but even during summer blue-green algae bloom, typically marine Peridinales, like i.e. *Gonyaulax* or *Gymnodinium* are present.

Zoocenosis. Diversity of the bottom area causes occurring of two associations of benthic macrofauna, specific for shallow regions of south Baltic. One of them is *Mytilus edulis* association (epifauna) occupying mainly on the stone-bed but in some places also the sand-bed and *Macoma balthica* association (infauna), typical for sand-bed.

Common mussel (*Mytilus edulis*) cumulations are accompanied by the algae attached to it, i.e. *Fucus vesiculosus* or *Enteromorpha intestinalis* and sedentary animals like barnacle (*Balanus improvisus*), Bryozoa (*Bryozoa*), i.e. *Electra crustulenta*, Hydrozoa (*Hydrozoa*) and active animals like *Gammarus* (*Gammaridae*) and other Amphipodas (*Amphipoda*), Jaera spp., belonging to the order Isopoda (*Isopoda*), also belonging to flatworms (*Turbellaria*), in some places bristleworms (*Polychaeta*) - mainly nereid (*Hediste diversicolor*) and snails (*Gastropoda*) like Laver spire shell (*Hydrobia ulvae*) and even *Priapulida*. *Hediste diversicolor* and *Hydrobia ulvae* are ones from the main representatives of sand-bed infauna, especially of slimy-bed. Apart from dominating *Macoma balthica* other bivalves like *Mya arenaria* and *Cardium glaucum* are common herein. Oligochaetes (*Oligochaeta*) and Polychaetes (*Polychaeta*) like *Pygospio elegans* and *Merenzellaria viridis* (species new for Polish fauna, which appeared in Baltic sea in the half of eighties) are numerous in some places. In coastal waters of Pomeranian Bay *Corophium volutator* - the representative of *Amphipoda* and *Crangon crangon*, found also on very shallow bottom are present. Mentioned species are very important components of that association, occurring also in shallow sandy-stone bed under the cliff coast.

For most shallow regions of sandy bed, distant from rivers mouth, specific are crustaceans from *Amphipoda* order - *Bathyporeia pilosa*, occurring in masses.

To the north from the cliff coast, *Nematoda* dominates in meiofauna. The important role is played by the following taxons like *Turbellaria* and *Gastroticha* and in some periods *Bivalvia* and *Polychaeta*. Other constituents of meiobentos, existing in that region are *Foraminifera*, *Hydrozoa*, *Oligochaeta*, *Ostracoda*, *Harpacticoida*, *Amphipoda*, *Halacaroida*, *Tartigrada* and *Gastropoda*.

Holoplankton (plankton organisms carrying on development cycle in depths of water) of coastal waters is dominated by several species of *Copepoda* and its larval stages (nauplii). Most common belong to *Acartia* genus, especially *Acartia bifilosa*. The others are *Temora longicornis*, *Eurytemora* spp. and *Centropages hamatus*. The second important constituents of plankton are rotifers (*Rotatoria*) - *Synchaeta* genus. In spring *Cladocera* are observed in great masses. Among them most frequent are *Evadne nordmanni* and *Pleopsis polyphemoides* and their presence was recorded even in autumn. In coastal waters, particularly in summer, numerous cumulations of another crustacean *Neomysis integer* are observed. In summer common jellyfish (*Aurelia aurita*) develops in masses. Sometimes *Cyanea capillata* can also be spotted. In coastal waters *Rotatoria*, *Copepoda* and *Cladocera* are represented by fresh-water species, especially in spring. Although these species come from Szczecin Lagoon, they exert a strong influence on region of Pomeranian Bay.

The next zooplankton components are larvae of most of fish species existing in mentioned ecosystems. They constitute elements of spring and summer plankton of coastal waters of Pomeranian Bay. Larvae of some benthic animals (meroplankton) are periodically occurring here. Larvae of *M. edulis*, others *Bivalvia*, *B. improvisus*, *C. crangon* and *H. ulvae* are spreading numerously on the turn of the spring and summer, whereas they are not occurring in winter at all. Otherwise, larvae of *M. viridis* - *Polychaetes* new to Baltic Sea have been recorded in great masses at the end of autumn and in the beginning of spring.

Many interesting species of fishes exist here, i.e. Shorthorn Sculpin (*Myoxocephalus scorpius*), Straightnose pipefish (*Nerophis ophidion*), Cyclopterus lumpus, Sea Stickleback (*Spinachia spinachia*) and *Gobidae*. Ichthyofauna of this region consists also of eelpout (*Zoarces viviparus*). Among freshwater species, frequently occurring are perch (*Perca fluviatilis*), zander (*Stizostedion luciperca*), roach (*Rutilus rutilus*) and Baltic whitefish (*Coregonus lavaretus*). Shallow sand-bed s a feeding ground for fish fry of Flounder (*Platichthys flesus*) and turbot (*Psetta maxima*). It s also a habitat of lesser sandeel (*Ammodytes tobianus*) and greater sandeel (*Hyperoplus lanceolatus*). Coastal waters of Pomeranian Bay serve as spawning site for spring-race herring (*Clupea harengus membras*), laying eggs on shallow sea-bed. The cod (*Gadus morrhua callarias*) is found here, as well.

Pomeranian Bay waters are one of few places where sea seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) have been recorded.

## II.1. Ecosystems of open coastal waters of Szczecin Bay, Wicko Wielkie Lake, Wicko Male Lake and Świna river floodings.

### Physiographical, morphological and hydrological essay.

Water regions of Szczecin Lagoon and adjacent land regions, included to Wolin National Park, create extraordinarily varied physiographical water and land environment. Studied environment embraces open coastal waters of Szczecin Lagoon on the sector from Lubin to Karnocice. This sector is adjacent to morainic plateau of Wolin island, which descends here, forming 30-40 metres precipice that falls directly into 1-1,5 metres water depths. The bottom here is slimy on the sandy ground. In the water regions located to the south (Wyskok Krzecki shallow) from archipelago of backflow delta Świna river, the bottom is slimy on the sandy and peat ground, placed alternately on the same depth. Islands of delta Świna river belonging to WPN, slightly emerge above the sea level. They are luxuriantly grown with rush-plants and wetland vegetation. Narrows and canals between the islands have varied depths - from 1 -6,5 metres (Stara Świna and Stara Głębia canals) In the borders of Wolin National Park two gulf lakes of Szczecin Lagoon are located: Wicko Wielkie and Wicko Male lakes. Wicko Wielkie (11 km<sup>2</sup>) is relatively shallow (2,5 m deep). In the western part of Wicko Wielkie lake slimy sediments prevail whereas sandy sediments are predominant in the eastern part. Wicko Male lake, 2 metres deep, is elongated longitudinally with bottom covered with thick layers of slimy sediments. The lake receives municipal sewage from Międzyzdroje town. The areas surrounding mentioned water regions from west and north, similarly to islands of archipelago are uplifted 0,5 - 1 metres above the sea level. On the other hand, on the north and north-east the moraine hills of Wolin island (90 metres above sea level) are rising above water surface. The neighbourhood of moraine hills shapes the specific conditions of adjoining waters.

**Biotope.** All these water regions are flow-through due to the outflow of water from Szczecin Lagoon to Pomeranian Bay. They have a character of freshwater, partially mineralised (salinity fluctuating from 0,5 to 3‰) as a consequence of mixing with seawaters, which flow back to less salinated and lighted waters, mainly along the channel of watercourse from Szczecin to Świnoujście. During seawater intrusion from Pomeranian Bay, due to northwestern winds, occurring largely in autumn at low water level in Odra River, the sea waters are inflowing along the Świna and Stara Świna canal and salinity of water in the backflow reaches 6‰. Thus, the waters of discussed regions are characterised by changeable salinity. Simultaneously, the fresh waters flowing through these areas bring a big load of dissolved organic components and biogenic elements so it is water of high trophic status. This character of water is generating the eutrophication processes, which are highly intensive in northern parts of Szczecin Lagoon (Wicko Wielkie and Wicko Male lakes) in comparison to other regions of Odra river estuary. There is a considerable impact of luxuriant plants overgrowing islands of archipelago and great areas of aquatic plants on flowing waters of Szczecin Lagoon. Simultaneously, the present writers are combining the nutrient-enrichment and eutrophication processes occurring on large scale with inflow

of biogenic elements and dissolved organic matter from local, terrestrial sources of pollutants (for instance: impact of municipal wastes discharged from Międzyzdroje town on ecosystems of Wicko Wielkie and Wicko Male lakes).

**Biocenosis.** Most of organisms living in those ecosystems are representatives of species typical for estuarine ecosystems of high salinity and considerable trophic level.

**Phytocenosis.** Vascular plants are exuberantly growing in Szczecin Lagoon along its northern coast. Vegetation is composed of 3 species: common reed (*Phragmites communis* L.), narrow-leaf cattail (*Typha angustifolia* L.) and common bulrush (*Scirpus lacustris* L.). These plants are creating fully-stocked homogenous communities. Combined bushes of those species are very rarely found. Submerged plants are growing on areas put forward into the water area.

Among underwater meadows on shallow water areas (coastal regions) three species draw attention: *Stratiotes aloides* L., *Ceratophyllum clemersum* L. I *Myriophyllum* sp. In deeper places pondweeds occur. Amongst seven determined species most often are *Potamogeton perfoliatus* L. and *P. lucena* L.

Predominating blue-green algae, diatom and green algae represent plankton algae as far as quantity and population size are concerned. Mutual quantitative relations are changing during various seasons. Among blue-green algae some species like *Microcystis aeruginosa*, *M. viridis*, and *Apharothece* genus are appearing during all season. Cumulation of their development occurs on summer and early autumn months.

Szczecin Lagoon waters are abundant in other blue-green algae: *Oscillatoria radecei*, *Oscillatoria. Rubescen*, and *Oscillatoria. Limnifca*. Some blue-green algae like *Anabaena*, and *Aphanizomena flos aque* are appearing only periodically.

The second group, considering the amount of plankton algae, living in water depths are green algae. The component of that group, most often appearing is *Scenedesmus*, represented by several species and *Actinastrum hantschii coelastrum sphaericum*.

Diatoms, predominating in phytoplankton are represented by relatively few plankton species (*Asterionella formosa*, *Diatona elongatum*, *Staphanodiscus hantzschii melosira granulata*) but as a consequence of large-scale development in some periods of the year they determine the phytoplankton function.

**Zoocenosis.** The major components of freshwater benthic fauna of Szczecin Lagoon are *Oligochaeta* and larvae of *Chironomidae*. *Dreissena polymorpha* and related to it *Gammarus spp.* are also found. *Asellus aquaticus*, *Hirudinea* and *Hydracarina* occur as well. Occasionally increase of *Gammaridae* is observed, due to expansion of snail *Valvata piscinalis*.

Makrozoobentos of Stara Świna channel is enriched in inhabitants of Baltic fauna: *Corophium volutator*, *Cyathura carinata*, *Gammaridae*, *Cardium glaucum*, *Mya arenaria* and *Hediste diversicolor*.

Structure of slimy-bed benthos groups (20 thousands individuals/ m<sup>2</sup>) is quantitatively predominated by *Oligochaeta (Tubificidae)*, whereas in biomass *Chironomus f.l. plumosus* is plentiful. Stable elements of fauna biomass are larvae of *Procladius*.



although they are not abundant. Closer to the shore, taxons of littoral forms of benthos are prevailing but the biomass of these forms is considerable in habitat of sandy slime, which is homologous of sublittoral zone. The considered organisms are *Mollusca* (*Sphaeriidae*, *Potamopyrgus jenkinsi* and *Valvata piscinalis*) and also larvae of *Glyptotendipes*. The main role in that habitat is played by larvae of *Chironomus* sp. („*Semireductus*”), dependant on larval form of *plumosus*.

On sandy bed, concentrations of 50 000 of individuals / m<sup>2</sup> are observed. Among them larvae of *Glyptotendipes* e.g. *gripekoreni* are predominating as far as quantity and mass is concerned. In spite of high concentration, *Chironomidae* are not big parts of that habitat's biomass.

On sandy bed, poor in high concentrations of *Dreissena polymorpha* (350 individuals and 0,3 kg of biomass/m<sup>2</sup> on the average) other changes of macrofauna structure are recorded - we can observe the decline of *Oligochaeta* and increase of *Gastropoda*, mainly *Bithynia tentaculata*.

In spite of high quantity of *Cladotanytarsus* larvae (to 4000 individuals per 1 m<sup>2</sup>), its presence in biomass does not exceed 2 %.

On sandy bed with dense shoal of *Dreissena* (9000 individuals and 5,5 kg of biomass/m<sup>2</sup> on the average) the abundance of benthos rises. Most plentiful are larvae of *Glyptotendipes*, constituting more than half of quantity and biomass of all benthos organisms. Exceptionally plentiful are larvae of *Dicretotendipes* gr. *Nervosus* with 21 % participation in biomass. On the other hand, *Hirudinea* compose 14% of fauna biomass in that habitat.

Abundance of benthos is an evidence of suitable habitat conditions, particularly appropriate oxygenation of surface levels of bottom sediments in discussed water areas.

Main components of meiofauna in Szczecin Lagoon are *Nematoda*, *Ostracoda* and *Harpacticoida*.

In zooplankton predominate freshwater crustaceans: *Cladocera* (first and foremost *Daphnia cucullata* and *Bosmina coregoni coregoni*), *Copepoda*, mainly cyclops, especially *Cyclops lilljeborgii* and *C. leuckartii*. Periodically, particularly in autumn, depths of that part of Szczecin Lagoon is inhabited by Baltic species, for instance: *Acartia* spp., *Bosmina coregoni maritima*, and even *Aurelia aurita*. Since the end of eighties, in autumn, on whole Szczecin Lagoon area, larvae of *Marenzelleria viridis* are colonizing the bottom of Lagoon.

Amongst the rotifers the stable element of zooplankton are *Keratella cochlearis* and *Keratella quadrata*. *Chydous sphaericus*, *Daphnia cucullata*, *Cyclops* sp., *Nauplius* sp. are frequent in the group of plankton crustaceans.

Ichthyofauna is represented mainly by freshwater species like: perch (*Perca fluviatilis*), zander (*Stizostedion lucioperca*), ruffe (*Gymnocephalus cernuus*), roach (*Rutilus rutilus*), bream (*Abramis brama*), blue bream (*Abramis ballerus*), baltic vimba (*Vimba vimba*), rapacious carp (*Aspius aspius*), pike (*Esox lucius*), burbot (*Lota lota*), sunbleak (*Leucaspis delineatus*), Threespine stickleback (*Gasterosteus aculeatus*) and fishes like: eel (*Anguilla anguilla*), European Smelt (*Osmerus eperlamus*), Baltic whitefish (*Coregonus lavaretus*), bulltrout (*Salmo trutta morpha trutta*) and salmon (*Salmo salar*). Flatfishes (*Pleuronectiformes*), herring (*Clupea haren-*

gus) and sprat (*Clupea sprattus*) are also found in Szczecin Lagoon coming with salt waters flowing back from Pomeranian Bay to.

Regarding other elements of biocenosis, delta of Świna is a breeding site of legally protected waterbirds, for instance: common tern (*Sterna hirundo*), black-headed gull (*Larus ridibundus*). It is also a habitat of many valuable bird species.

## SUMMATION

Ecosystems of open waters included to Wolin National Park in 1996 are differentiated. In spite of geographical neighborhood considerable distinctions between them have been observed. Coastal waters of Pomeranian Bay (1 nautical mile broad belt, running from Międzyzdroje to Świątoujście) have stable salinity (7-8 ‰) over the years. From the beach at the cliff coast of depths exceeding 10 meters, stone-bed dominates, habited by comparatively rich biocenosis with specific group of species.

Coastal waters of Szczecin Lagoon laying under moraine hills on the south of Wolin island, waters of Wicko Wielkie and Wicko Male lakes and waters of canals dividing the islands of backflow delta Świna river have incessantly altering salinity (from 0,5 - 3 ‰). These reservoirs are shallow (max 2 metres deep except Stara Świna - 6,5 metres deep) with slimy bed on sandy ground, overgrown with aquatic bank vegetation and floating plants. There are also underwater meadows constituting biocenosis with numerous valuable plant species. Most of organisms living in aforesaid ecosystems are representatives of species typical (at these geographical latitudes) for estuarine reservoirs of low and changing salinity and considerable trophic status. Predominating organisms are freshwater plant and animal species that have found excellent habitat on areas, we are considering. 230 bird species and 68 species of ichthyofauna were recorded here, with 23 taken into strict or partial protection. Periodically (in consecutive years) and seasonally changing amount of species and also altering population size during the year were observed in biocenosis at hand. Acceleration of succession processes of species connected with natural ageing of water reservoirs, due to increase of water pollution in Odra river estuary, had been observed.

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## EKOSYSTEMY WÓD OTWARTYCH WOLIŃSKIEGO PARKU NARODOWEGO – CHARAKTERYSTYKA PRZYRODNICZA

### Streszczenie

Na mocy Rozporządzenia Rady Ministrów z dn. 03.01.1996 (Dz. U. Nr4, poz.30) w 1996 roku do Wolińskiego Parku Narodowego włączone zostały unikatowe przyrodniczo ekosystemy wód otwartych Zatoki Pomorskiej i Zalewu Szczecińskiego z jeziorami Wicko Wielkie i Wicko Małe, a także część wysp archipelagu i akwenów wstecznej delty Świny. Zwięzłą przyrodniczą charakterystykę tych ekosystemów przedstawiono w niniejszej pracy. Ekosystemy wód otwartych Zatoki Pomorskiej i Zalewu Szczecińskiego są siedliskiem dla m.in. 290 taksonów, w tym 215 taksonów fitoplanktonu i 74 taksonów zooplanktonu. Bytuje tu 68 gatunków ichtiofauny w tym 23 objętych stałą lub okresową ochroną, a także 230 gatunków ptaków. Ekosystemy te będące częścią otwartych ekosystemów: morskiego i zalewowego, o wodach napływowych i przepływowych, narażone były, są i będą na oddziaływanie zanieczyszczeń docierających tu z odległych źródeł. Chodzi tutaj przede wszystkim o sływ zanieczyszczeń z całego estuarium Odry. Równocześnie zagrożone są zrzutem zanieczyszczeń ze źródeł lokalnych.