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ECOLOGICAL FACTORS INFLUENCING BIODIVERSITY PRESERVATION IN THE SHATSK NATIONAL NATURAL PARK

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A b s t r a c t. The present state of diversity in the fauna of the Western Polissya has been described. Three-hundred-and-thirty-three species occur vertebrates there, among them 30 fish, 12 amphibians, 7 reptiles, 250 birds species and 44 species of mammals. *Eupalasiella percnura* and *Carassius carassius* are ones among the rarest fish species, *Bufo calamita* – among amphibians and *Emys orbicularis* and *Coronella austriaca* – among reptiles. One oat species (*Myotis myotis*) was found for the first time in the territory of the Shatsk National Park, the Volynske Polissya. *Mustella erminea, Meles meles, Lutra lutra, Felis sylvestris, Eptesicus hilssoni* are ones among the rarest mammal species found there. They are all listed in the Red Data Book. Ninety-five species of birds from four international conservation categories are present in the ornithocenosis.

K e y w o r d s: biodiversity, ecological factors, protection, Volynske Polissya Region

INTRODUCTION

Significant ecological changes took place in the study region during the last half-century mainly due to anthropogenous influence to exerted upon the natural ecosystems. Peat and meadow ecosystems suffered the greatest changes together with some lakes influenced by draining. Disturbances in the old biocenotic connections caused a decrease in the number of animal species. Twenty-nine vertebrates (one amphibian and reptile, 21 bird species and 6 mammals species listed in the National Red Data Book occur in the territory of the Shatsk National Park. The general richness and biodiversity in the Volynske Polissya is related to a unique landscape diversity, forest and bog ecosystems with a dense net lakes. However, the ecosystems are under a permanent influence of the anthropogenous transformation [9]. Therefore, a strong fluctuation in the number of many animal species is recorded.

Some species become rarer or extinct. The protected areas of the Shatsk National Natural Park play an important role in the conservation of rare and valuable species. The material collected has become the basis for a proposal for the rare species list to be published in the new edition of the National Red Data Book of Ukraine. A unique landscape diversity of the Shatsk National Park favours creation of rare zoocenose valuable for Ukraine. Thus, conservation of this biodiversity of the Volyn Polesie is an actual task of the National Park nowadays.

MATERIAL AND METHODS

Field studies in the territory of the Western Polissya in the Luboml and Shatsk District of the Volynska Province were started already before the Shatsk National Park was founded (Fig. 1). The most detailed studies were carried out during the period of 1982-2001 in the territory of the park and its neighbourhood. The study of the present state, changes in the number and density of the vertebrates under the influence of different ecological factors, have been the main tasks undertaken. Results were obtained by a special counting of the number of representatives of various vertebrate classes of vertebrates with a further mapping of the amphibian breeding sites, bird nests, reptiles and mammals sets. Ichthyological data were collected. They were compiled on the base of analyses of sport and industrial fisheries, direct observation and underwater counting.

Twenty-six bird species were chosen for a more detailed study (Table 1). They are all included into one of the four SPEC-categories with have an international conservation status. They are: *Tetrao tetrix*, *Ciconia nigra, Bubo bubo, Asio flammeus*, *Aythya nyroca, Anas strepera, Coracias garrulus, Picus viridis, Picus canus, Dendrocopos medius*, *Grus grus, Crex crex, Gallinago media, Tringa totanus, Limosa limosa, Numenius arquata, Philomachus pugnax, Chlidonias niger, Chlidonias hybridus, Milvus migrans, Haliaeetus albicilla, Circaetus gallicus, Aquila pomarina, Circus pygargus, Falco tinnunculus* and *Lanius excubitor.*

Most of the species studied are globally threatened by extinction in Europe. They are good indicators of the environmental changes in the ecosystem. Maps to a scale of 1:25 000 were used in the field conditions for studying of the number of breeding birds [2].

Most parts of the field studies were carried out during the compilation period of the regional Atlas of Birds Breeding (1982-1986) and during the execution of the international programme "Atlas of European Breeding Birds" [8].

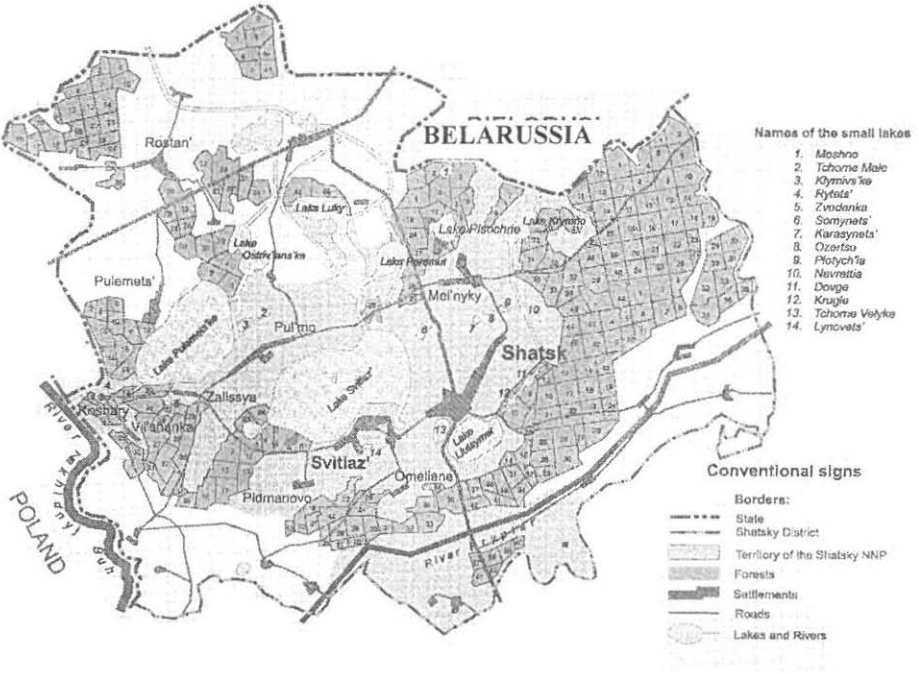

Fig. 1. Sheme of the Shatsk National Park

RESULTS AND DISCUSSION

Lowland landscapes with a mild slope towards the north with an altitude of 160-180 m dominate in the research territory. Pine forests 50-70 years of age with mosses and *Vaccinium myrtilus* are found in the predominant part of the fo-rests. An essential part of the territory is composed by eutrophous bogs. The whole territory of the Shatsk National Park includes 4% of bogs (1 900 ha), 6.8% of meadows (3 300 hectares), 14.2% of aquatic habitats (7 000 ha), 50% of forests (24 500 ha) and 25% of arable lands and other anthropogenous landscape [1].

The anthropogenous influence upon vegetation in the region caused by a wide scale reclamation works was noted a long time ago. Pine forests were replaced by birch forests and deciduous forests were replaced by aspen.

A decrease in the level of ground waters, a decrease of the marsh area, destruction of peats caused by a wide-scale draining of the soils in the Polesye, are the predominant changes noted in the Western Polesye ecosystems [3,21]. All the

Table 1. Rare and endangered vertebrate species that occur in the territory of the Shatsk National Park

Species	Red Data Book of Ukraine [13]	Endangered species [20]		
		Spec 1	Spec 2	Spec 3
Amphibia				
Budo calamita	+			
Reptilia				
Coronella austriaca	+			
Aves				
Acrocephalus paludicola	+			
Alauda arvensis				+
Alcedo atthis				+
Anas querquedula				+
Anas strepera				+
Aqula pomarina	+			
Asio flammeus				+
Athene noctua	+			+
Aythya nyroca	+	+		
Botaurus stellaris				+
Bubo bubo	+			+
Caprimulgus europaeus			+	
Chlidonias niger				+
Ciconia ciconia			+	
Ciconia nigra	+			
Circaetus gallicus	+			
Coturnix coturnix				+
Crex crex		+		
Emberiza hortulana			+	
Falco tinnunculus				+
Galerida cristata				+
Gallinago media			+	
Grus grus	+			
Hieraaetus pennatus	+			
Hirudo rustica				+
Ixobrychus minutus				+
Junx torquilla				+
Lanius collurio	+			+
Lanius excubitor				+
Limosa limosa			+	
Lullula arborea			+	
Merops apiaster				+
Milvus migrans				+
Muscicapa striata				+
Numenius arquata	+			+
Perdix perdix				+
Picus canus				+

Table 1. Continued

Species	Red Data Book of Ukraine [13]	Endangered species [20]		
		Spec 1	Spec 2	Spec 3
Picus viridis			+	
Phoenicurus phoenicurus			+	
Riparia riparia				+
Saxicola torquata				+
Scolopax rusticola				+
Sterna albifrons				+
Streptopelia turtur				+
Tetrao tetrix	+			+
Tringa totanus			+	
Mammalia				
Meles meles	+			
Mustella erminea	+			
Nyctereus procynoides	+			

above changes occurred in the ecosystems of the area studied had a great impact on the qualitative composition of the present zoocenose.

Changes in the chemical composition of the lake water undoubtedly influenced the zooplankton state and vegetation, which in turn, caused changes in the population structure of the freshwater fish in the lakes of the Shatsk Park. The artificial reconstruction of the *Anguilla anguilla, Cyprinus carpio, Carassius auratus gibelio,* populations carried out by the fisheries in the lakes of the Park enhanced the changes. However, reproductive abilities of the local species, i.e.: *Eupalasiella percnura* and *Carassius carassius*, became lower as a result of an interspecific competition. The species introduced and cultivated (*Ictalurus nebulosus, Hypophthalmichthys molitrix, Ctenopharyngodon idella*) had their impact on the vegetation in the aquatic ecosystems and changed the breeding conditions of many local species.

Construction of holiday resorts on the banks of the lakes within the territory of the Shatsk Park had a negative influence on the reprodutive conditions of amphibians and reptiles, and especially *Natrix natrix*. However, the most suitable conditions for an increase in the number and distribution of *Bombina bombina* and *Bufo bufo* were created when holiday houses were built. On the other hand, all the factors listed had a negative impact on the breeding result of *Bufo calamita*. The only agrocenosis maize fields, which supports conservation of this species is maize. A rapid decrease of the number of *Vipera berus* is due to a general draining, particularly

of the marsh forests. This resulted in an increase of the death ratio of these animals during frosty winters. An increase in the population of *Emys orbicularis* was related to peat's draining. However, a gradual renewal of the population of this reptile-species was noted during the last few years. It was probably due to the renewal of the marsh ecosystems in the territory of the Park.

Thirty-three bird species listed in the Red Data Book of Ukraine occur in the territory of the Shatsk National Park (50% of the total number of bird species in the Red Data Book) [13]. *Ciconia nigra, Aythya nyroca, Circaetus gallicus, Hieraaetus pennatus, Aquila pomarina, Grus grus, Numenius arquata* are birds breeding in the territory of the Park.

Pine forests with moss and *Vaccinium* undercover play the main role in the formation of dendrophylous zoocenoses of the Shatsh Park. These zoocenoses changed when the level of the ground waters decreased because of the reclamation of the territory. It caused frequent forest fires which had a negative influence on small rodents, amphibians and reptiles. It also caused a decrease of the number of birds of prey [4]. Periodical fires have an impact on the feeding resources of such bird species as *Pernis apivorus*, *Circaetus gallicus* and *Buteo buteo*. A significant decrease in the number of the above species was noted during last two decades.

The main part of the territory of the Shatsk National Park is covered with eutrophic marshes. However, due to a wide scale draining in the park, condition marsh ecosystems deteriorated. This had a negative influence on the population of vertebrates whose breeding biology depends on these habitats [21].

Populations and communities of warders such as *Limosa limosa*, *Numenius arqata*, *Tringa ochropus*, *Tringa totanus* depend on marsh habitats. Populations of birds listed above decreased during the last decade in all marsh territories of the Park. Some species became extinct [15]. Such species as *Limosa limosa* and *Numenius arqata* stopped breeding the territory of the Park for some years because as it was not humid enough in humidity [6]. Nearly 25% of the territory of the Shatsk National Park is covered with an arable land and other anthropogenous habitats. These habitats are intensively used for the reproduction of amphibians and waterbirds, particularly *Charadriiformes* such as: *Tringa totanus* and *Vanellus vanellus*. Specific sinantropisation of warders show a lack of the sufficient natural breeding sites, high density of the breeding pairs in the natural habitats of the Park.

The significance of the Shatsk National Park for the protection of vertebrates was already discussed several times in literature [5,16]. Local breeding populations of rare birds species (*Ciconia nigra*, *Aythya nyroca*, *Circaetus gallicus*, *Hieraaetus pennatus*, *Aquila pomarina*, *Grus grus*, *Numenius arquata*) are sup-

ported within the limits of the Park. Those rare bird species are characteristic of the Polesye zoocenose. Conditions of the National Park are the most suitable for their conservation.

Peat bogs and flood meadows are the most vulnerable ecosystems of the Shatsk National Park. Therefore, their ornithocenose are under the heaviest anthropogenous influence. Fluctuations in the populations of the following species: *Circaetus gallicus*, *Circus pygargus*, *Milvus migrans, Lyrurus tetrix*, *Crex crex*, *Vanellus vanellus*, *Limosa limosa, Numenius arqata*, *Gallinago media*, *Asio flammea*, *Anthus pratensis*, *Acrocephalus paludicola* [13,17,18] were the strongest. A rapid decrease has been recorded in the population of most water-birds from the beginning of the eighties. This process is characteristic not only of the local breeding communities but also of the migrating flocks which stop at lakes of the National Park during autumn migration every year [4,21]. More than 20 000 ducks and *Fulica atra* used to stop at the lakes in October untill 1986-1987. The number of these birds decreased by more than 50% during the last decade.

Ninety-five species of breeding birds have an international conservation status and are globally threatened in Europe. *Crex crex* and *Aythya nyroca* belong to SPEC-1 category. Nine species belong to SPEC-2 category. Thirty-three species of birds that were found on the territory of the Park belong to SPEC-3 category. Thirty-nine more species belong to the SPEC-4 conservation category [20].

Chlidonias niger became totally extinct in the territory of the Park in the last years. This was caused by dry springs and complete reclamation of marshes [7]. A decrease in the numbers of *Vanellus vanellus, Tringa totanus, Gallinago gallinago*, *Limosa limosa* was recorded in the territory of the Park. The latter is probably related to the decrease of meadows and pastures most frequently used for building.

An enrichment of the ornithocenose of the Park was carried out at the expense of certain lakes became covered with vegetation. Mixed breeding colonies of *Larus ridibundus, Podiceps nigricollis*, *Aythya fuligula, Chlidonias hybridus* were formed in the Klymivske lake. The two latter species have started to breed in the territory of the Western Polesye only recently [5]. A visible increase in the number of *Upupa epops*, *Locustella luscinioides* populations was noted. Dry climatic conditions enhance their spreading. The use of the new brick buildings instead of old wooden in the village construction enhanced the spreading and increase in number of *Delichon urbica* and *Phoenicurus ochruros* and a decrease in the number of *Hirundo rustica*, *Riparia riparia*. The number of species occurring in the sparse forest and forest glades (*Tetrao tetrix, Đicus viridis*, *Lullula arborea*, *Emberiza*

hortulana) notably decreased in the National Park as a result of decrease of meadows and forest glades with high vegetation

Active forestry works in the territory of the Park and its neighbouring areas caused an increase of disturbing factors. The latter had a negative impact and cause a decreased in the number of certain rare species occurring in the forest, e.g.: *Pernis apivorus, Tetrao tetrix, Tetrastes bonasia, Coracias garrulus, Dendrocopos leucotos*.

The absence of an old forest does not favour breeding of rare birds of prey (*Haliaeetus albicilla, Aquila chrysaetos*, *Pandion haliaetus*). However, they were recorded in the territory of the Park [4,19].

People often start fires of reeds and other vegetation in the lakes in the neighbourhood of the Park, most frequently during winter and early spring. This have a negative influence on the protectional abilities of the biotopes used by many bird species for nestling. The number of breeding water-birds notably decrease in such cases. Also phaenological breeding stages of many species change. Fires in the drained peat-bogs have a negative impact on the population of meadow bird species such as: *Limosa limosa, Crex crex, Porzana porzana*, *Vanellus vanellus, Anthus pratensis, Saxicola rubetra*.

The breeding success of *Aythya nyroca* occurring on the lakes near the Pishcha village depends on local hunting. Early hunting have a negative influence on the number of younger individuals of this species. Therefore, it is desirable to provide a strict control of hunting in the whole territory of the Park. It is necessary to create a management plan for agricultural works on the meadows and pastures to ensure a successful support of the breeding population of *Crex crex*. It is related to recommendations for haymaking terms in different ecosystems (food meadows, lowlands, bogs, dry meadows, pastures, forest glades, arable lands). The haymaking in the flood meadows and peat-bogs is usually carried out in the second half of June, as grass grows rather quickly in this territory. This have a negative impact on the breeding success of *Crex crex* hence later haymaking is required. Haymaking is necessary in the areas with the highest density of the breeding pairs of *Crex crex* near the Grabovo village and the "Unytchi marsh", as these territories are in danger of a complete covering with bushes. The latter could negatively influence density and general state of the breeding population of *Crex crex*. The management plans should be composed for such protected areas in order to support a stable state of the existing protected sites and survival of globally endangered SPEC-1 species [11]. It was found out that cattle grazing positively influences successful feeding and nestling of *Ciconia ciconia*, *Sturnus vulgaris*, *Motacilla*

flava, and regional haymaking supports favourable conditions of the breeding habitats for *Limosa limosa*, *Numenius arqata*, *Tringa totanus*, *Vanellus vanellus* in next years.

Summer sets of many bats (*Plecotus auritus*, *Myotis daubentonii, Nyctalus noctula, Pipistrellus pipistrellus*, *Eptesicus serotinus*, *Eptesicus nilssonii*) were found in the territory of the Shatsk National Park. These species can actively adopt to various types of constructions near the lake coasts. *Myotis myotis* was found in June 2000 for the first time in the territory of the Volyn Polesye.

An increase in the number of prey mammals was noted in the the Western Polesye. This caused changes in the zoocenoses and a decrease in the number of many other animals [10,12,14], especialy local populations of *Mustela erminea*, *Meles meles*, *Mustela putorius*, *Vulpes vulpes*, *Nyctereutes procyonoides* which were negatively influenced by the breeding success of many birds. *Martes martes* had a great impact on small hollow-breeding birds and some forest birds of prey. The number of the large mammals, especially hoofed mammals, decreased significantly in the territory of the Park an in the whole territory of the Polesye. The Number of *Alces alces* decreased rapidly in the Western Polesye during the last decade under the influence of uncontrolled hunting.

CONCLUSION

The biodiversity of the Shatsk National Natural Park resulting in its unique landscape diversity is expressed by 343 species occur vertebrates there, among them 30 fish, 12 amphibians, 7 reptiles, 250 birds species and 44 species of mammals. *Eupalasiella percnura* and *Carassius carassius* are ones among the rarest fish species, *Bufo calamita* – among amphibians and *Emys orbicularis* and *Coronella austriaca* – among reptiles. One oat species (*Myotis myotis*) was found for the first time in the territory of the Shatsk National Park, the Volynske Polissya. *Mustella erminea, Meles meles, Lutra lutra, Felis sylvestris, Eptesicus hilssoni* are ones among the rarest mammal species found there. They are all listed in the Red Data Book. Ninety-five species of birds from four international conservation categories are present in the ornithocenosis.

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EKOLOGICZNE CZYNNIKI WPŁYWAJĄCE NA STAN I OCHRONĘ BIORÓŻNORODNOŚCI SZACKIEGO PARKU NARODOWEGO

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S t r e s z c z e n i e. Podano przegląd stanu faunistycznej różnorodności zachodniej części Wołyńskiego Polesia. Tutaj wyróżniono 343 gatunki kręgowców, w tym: 30 gatunków ryb, 12 gadów, 7 płazów, 250 ptaków, 44 ssaków. Wśród rzadkich gatunków ryb znaleziono: *Eupalasiella percnura*, *Carassius carassius*; płazów – *Bufo calamita*, gadów – *Emis orbicularis* i *Coronella austriaca*. Po raz pierwszy na terytorium Szackiego Parku Narodowego i ogólnie dla Wołyńskiego Polesia stwierdzono nowy gatunek nietoperza: *Myotis myotis*. Z najrzadszych ssaków spotykamy tutaj: *Mustela erminea*, *Meles meles*, *Lutra lutra*, *Felis silvestris*, które wpisane są do Czerwonej Księgi Ukrainy. W ornitocenozach regionu stwierdzono 95 gatunków ptaków, które należą do czterech międzynarodowych przyrodoochronnych kategorii.

S ł o w a k l u c z o w e: melioracje, kregowce, zoocenozy, Polesie Wołyńskie