

# Resource assessment and a strategy for the protection of wetland fauna



70

## THE EXEMPLE OF THE BIEBRZA NATIONAL PARK

*The Biebrza Wetland is the largest and best preserved lowland peat complex in Central Europe. It is situated in north-eastern Poland, a region relatively little transformed by human use compared to the rest of the country. The area has a poor level of industrial development, an absence of large urban centres, a low population, is extensively farmed and has mostly poor sandy soils. This, combined with a considerable proportion of forest and the presence of numerous wetland areas, is an asset to naturalists. The Biebrza River Valley occupies a broad lowland belt, about 2 000 sq. km in area, extending from the Polish-Belarussian border to the River Narew. In the north it borders the Augustowska Forest and in the south the Knyszyńska Forest. The valley is over 120 km long and its width varies from 1.5 to 40 km.*

As a result of river flooding, a number of transverse zones with different ecological conditions can be easily distinguished in the valley. Moving away from the river and towards the edge of the valley, there are four such zones: An immersion zone, associated with prolonged flooding and dominated by *Phragmition* communities; an immersion-emersion zone with communities of the *Magnocaricion* and *Caricion fuscae*; an emersion zone with a community of the *Caricion lasiocarpae*, *Betuletum humilis* and alder carrs; and a marginal zone with outwash and plateau areas occupied by mixed coniferous forests and linden-oak-hornbeam forests. Relict mineral elevations (low sandy dunes, sites where extensive moss and sedge communities are diversified by willow or other scrub prior to development of *Quercus-Carpinus betulus* forests) can be seen in the wetland zones.

The value of the site lies in the occurrence of rare and near-extinct animal species associated with vast open wetland areas. Of particular value are the breeding and migratory communities of waterfowl. It was due to the presence of these that the area of the Biebrza Wetlands was declared a national park in 1993.

At present it is the largest national park in Poland, occupying an area of 59 223 ha. In 1995 it became a Ramsar site (added to the list of very valuable wetland areas protected under the RAMSAR convention).

**Figure 1.**  
*The Biebrza River has never been regulated and there is a system of old riverbeds at different stages of succession. The river and its tributaries support a rich community of fish (36 species) and one species of lamprey. Photograph by Meeri Andersson.*



**Figure 2.**  
A characteristic view over the open wetland area of Biebrza in the middle of the summer. The large haystacks are symbols of an old agricultural landscape formed by man. Photograph by Leif Andersson.

**FIG. 3**



**Figure 3.**  
Map of the Biebrza area.

**STATE OF KNOWLEDGE OF THE FAUNA**

Much more information is available regarding the vertebrate fauna of the Biebrza Wetlands, (with 177 papers published on different taxa), than regarding invertebrates, with 127 papers published (Sterzyńska *et al.* 1998). By far the largest number of papers to date have been concerned with mammals (95) and birds (58). With respect to the avifauna, accurate estimates of population size are known, together with records of changes in the populations for over 20 years (Dyrca *et al.* 1972, 1984, 1985). There are also abundant data on the mammal fauna (Fedyk *et al.* 1984, Raczyński *et al.* 1984, Gębczyńska & Raczyński 1989) and ichthyofauna (Kózikowska 1983, Witkowski 1984). By far the least is known about herpetofauna and the majority of invertebrate taxa. More than a half of all vertebrate species ever recorded in Poland have also been found in the Biebrza National Park, including 63% of bird species, 52% of mammal species, 81% of amphibian and reptilian species, and less than 10% of invertebrate

species (Table 1). Data are still lacking for a number of taxa of invertebrates.

Many rare and endangered species are quite abundant in the area. A number of these can be found in the Polish Red Data Book, including 5 species of mammals, 39 species of birds (with 20 endangered and vulnerable), 1 species of *Cyclostomata*; as for invertebrates, there are 31 species of *Lepidoptera*, *Cerambycidae*, and *Buprestidae* alone (Table 2).

**TABLE 1. NUMBER OF SPECIES RECORDED IN THE BIEBRZA NATIONAL PARK AND IN POLAND**

Taxon	Number of species	
	Biebrza	Poland
Vertebrates	362	608***
Mammals	48	93
Birds	255	403*
Reptiles & Amphibians	22	27
Fishes & Cyclostomata	37	63**
Invertebrates	2000	30000***

\* after Tomiałojć 1990

\*\* only freshwater species, after Brylińska 1986

\*\*\* after Andrzejewski, Weigle 1993

**TABLE 2. NUMBER OF SPECIES RECORDED IN THE BIEBRZA NATIONAL PARK INCLUDED IN THE POLISH RED DATA BOOK**

Category of species	Mammals	Birds	Other vertebrates*	
			Invertebrates*	
Endangered		6		3
Vulnerable		14		9
Rare	4	12	1	17
Indeterminate		4		2
Out of danger	1	3		

\* only *Lepidoptera*, *Cerambycidae*, *Buprestidae*

## POPULATION SIZES AND NICHE DIFFERENTIATION

The Biebrza River valley is a unique area on a European scale, especially due to the occurrence of particularly valuable bird species. Riparian areas are important sites of bird aggregations, especially for geese and ducks during their migrations. A number of species have particularly abundant breeding populations here, including *Limosa limosa* (L.) with about 600 breeding pairs, *Grus grus* (L.) with 247 breeding pairs, *Numenius arquata* (L.) with 132 breeding pairs, *Bubo bubo* (L.) with about 25 breeding pairs, and species under threat of extinction in their entire range, such as *Aquila clanga* Pall. with about 15 breeding pairs, *Crex crex* (L.) with about 1200 males and *Acrocephalus paludicola* (Vieill.) with about 3000 males. Most of the Polish population of *A. paludicola* nest here, contributing about 5% of the world population of this species. Comprehensive ornithological research aimed at estimating the population size of certain valuable species was started in the late 1960's, so that now it is possible to determine long-term patterns of change in abundance. A large number of species have decreased in numbers (*Anas penelope* L., *A. crecca* L., *A. querquedula* L., *A. acuta* L., *Aythya nyroca* (Guld.), *Circus cyaneus* (L.), *Calidris alpina* (L.), *Larus minutus* Pall., *Tetrao tetrix* (L.), *Limosa limosa* (L.), *Coracias garrulus* L., *Acrocephalus paludicola* (Vieill.), *Philomachus pugnax* (L.)). The following species are now more abundant: *Anser anser* (L.), *Circus aeruginosus* (L.), *Grus grus* (L.), *Chlidonias hybridus* (Pall.), *Bubo bubo* (L.), *Panurus biarmicus* (L.), while the abundance of *Numenius arquata* (L.), *Gallinago media* (Lath.) and *Chlidonias leucopterus* (Temm.) has fluctuated over the study period.

The Biebrza valley has long been an important refuge for elk *Alces alces* (L.). At present the south-western limit of its range cuts across Poland. The population of this species in the Biebrza National Park is estimated to be the largest in Poland. In the early 1980's it numbered about 800 individuals, while recent aerial surveys have confirmed the presence of about 400 individuals only. The most abundant ungulate mammal is the roe deer *Capreolus capreolus* (L.), reaching densities over of 100 individuals per 1000 ha in a pine forest growing along the edge of the valley. The density of wild boar *Sus scrofa* L. in the park's forests has been estimated at approximately 4 individuals per 1000 ha. Recent years have seen a marked expansion of red deer *Cervus elaphus* L. into the Biebrza valley. This species did not use to be part of the community of ungulate mammals inhabiting this area. About 15 years ago it started to colonise the wetland forests of the Biebrza valley. At present accurate data clarifying the reasons for the expansion of this species and its role in the biocenosis are still lacking.

The group of predatory mammals in the area is quite well developed. 2-3 families of the wolf *Canis lupus* L. are present, numbering at most a dozen or so individuals. There are numerous populations of otter

*Lutra lutra* (L.) and beaver *Castor fiber* L. These populations have recently been increasing in numbers, as can be seen not only from a growing number of observations but also from signs of penetration into a larger number of habitats, including suboptimal ones, such as regulated tributaries of the Biebrza or minor canals. Beaver is found locally at high densities (up to 2 families along 1 km of the river) and its range has been expanding rather rapidly. The most spectacular abundance changes among predators have been observed in mink *Mustela vison* Schreber. Individuals of this species were first reported from the area in the early 1980's (Romanowski *et al.* 1984). Over the last 20 years this species has become the most numerous representative of the *Mustelidae* and the most abundant predatory mammal, along with fox *Vulpes vulpes* (L.). Winter transect surveys in 1999, based on counting the number of tracks, showed as many as 52 tracks along 1 km of one of the tributaries.

The *Micromammalia* of the Biebrza National Park is rich both in number of species and abundance. Species from this group occur at the highest densities in typical alder carrs and low mineral elevations within marshes as well as in some rush communities. Near the edge of the valley can be found relatively rich communities of bats and tree-dwelling rodents. The former decreased considerably in numbers in the 1960's and 1970's, their European population being reduced several times over that period. Surveys made at large hibernation sites in the Biebrza valley (Oswiec Fortress) revealed one of the most abundant communities of bats in Poland. The most abundant species include *Myotis daubentonii* (Kuhl), *Nyctalus noctula* (Schreber), *Eptesicus serotinus* (Schreber), *Plecotus auritus* (L.) and *Barbastella barbastella* (Schreber). Not many data are available regarding the density of the tree-dwelling rodent *Muscardinus avellanarius* (L.), a species typical of wetland forests, but judging from its proportion in the diet of tawny owl *Strix aluco* L. (up to 3% of prey items) it can be supposed that an abundant population inhabits this area.

The population resources of amphibians are very poorly known. The frog *Rana temporaria* L. is the dominant species at sites studied to date, and *Hyla arborea* L. and *Bombina bombina* L. form relatively abundant communities. No data are available on reptiles.

The Biebrza River has never been regulated and there is a system of old riverbeds at different stages of succession. The river and its tributaries support a rich community of fish (36 species) and one species of lamprey. Fish communities are less diverse in the old riverbeds, with up to 14 species recorded. Compared to other rivers in the Polish lowlands, the Biebrza supports a lower number of fish species. What makes this site different from others is the high abundance of fish including a considerable proportion of predators, amounting up to 20% of total fish abundance. Among predators, dominant species include pike *Esox lucius* L., perch *Perca fluviatilis* L., burbot *Lota lota* (L.), *Leuciscus cephalus* (L.) and L.

*idus* (L.). The species composition, the dominance structure of fish communities, and the state of the populations of individual species seem to show that despite many years of anthropogenic pressure from fishermen, anglers and poachers, the fish fauna has changed little.

The park is home to numerous species of invertebrates closely associated with wetland habitats. There are numerous populations of hygrophilous species, living on aquatic and riverside plants, whose populations are scarce both in Poland and in Europe. The diversity of the wetland landscape afforded by the relict mineral elevations encourages the development of xerothermophilous and psammophilous (sand-living) species e.g. *Titanoeca psammophila* Wunderlich (Araneae). Low peatlands of the Biebrza valley function as refuges for pleniglacial fauna associated with tundra formations. There are a number of boreal-montane species with disjunctive distributions, such as *Tetracanthella fjellbergi* Deharveng (Apterygota, Collembola), and Siberian relicts at their western-most ranges, for example *Phleophagus turbatus* Schoenherr (Coleoptera, Curculionidae). The Biebrza valley is the northern limit for a number of invertebrate species. There are numerous species classified as endangered in Europe and Poland, subject to legal protection or included in the Polish Red Data Book e.g. *Vaccinia optilete* Knoch, *Aricia artaxerxes* Fabricius, *Euphydryas maturna* L. and *Cabera leptographa* Wehli (all four species are Lepidoptera).

### NATURE CONSERVATION PROBLEMS

**Threats.** The most severe hazard to the fauna of the Biebrza National Park is progressive plant succession. This results in a reduction in the area of open wetland, leading to a disappearance of the most valuable habitats functioning as faunal refuges that make the park a unique area. In the past, plant succession in the Biebrza valley was effectively hindered by mowing and grazing by cattle, which took place in both the emersion and immersion zones in the valley. The expansion in growth of bushes and trees onto the low peatlands results in a reduction in the numbers of species and individuals of breeding communities of birds, mammals, as well as numerous invertebrate taxa.

Species such as *Acrocephalus paludicola*, *Philomachus pugnax*, *Aquila pomarina* Brehm, *Asio flammeus* (Pont.), *Circus cyaneus* (L.), *Limosa limosa*, *Tringa totanus* (L.) have decreased their densities or abandoned breeding places. The structure of Micromammalia communities has also been changing, with *Microtus oeconomus* becoming less abundant and *Soricidae*, mainly the genus *Sorex*, increasing in numbers. This results in a reduction in the available food resources for predators - some species of birds (e.g. *Asio flammeus*, *Aquila* spp.) and predatory mammals (fox *Vulpes vulpes* (L.), *Nyctereutes procyonoides* (Gray), ermine *Mustela erminea* L., weasel *Mustela nivalis* L.), whose diet consists mainly of *Microtus oeconomus*. The stenotopic invertebrate fauna of wetlands is disappearing,

with a reduction in the range size of valuable species of butterflies, e.g. *Lycaena helle* (Denis & Schiffermüller), *Maculinea alcon* (Denis & Schiffermüller), *Catocala pacta* (L.), and elimination of ground cover-associated species of spiders. Habitat barriers are being overcome in many groups of invertebrates and ubiquitous species are becoming dominant.

A number of species are threatened because of the drying up of their habitats. Wetland areas are the feeding and breeding grounds of waterfowl. Tree-dwelling rodents are endangered because of the drying up of linden-oak-hornbeam (*Glis glis* (L.)) or alder stands (*Muscardinus avellanarius* (L.)). The drying up is probably the reason why the wetlands are being colonised by red deer *Cervus elaphus*, a potential rival of the native wetland-associated species of elk *Alces alces*. Amphibians are dependent on a high level of ground water and the drying up has considerably reduced their numbers.

Uncontrolled fires are a danger to both vertebrates (due to the destruction of habitats, especially breeding sites, e.g. of birds) and invertebrates (due to the destruction of habitats and direct killing of adults, larvae and eggs).

Big hoofed and hare-like mammals, as well as some birds, particularly *Tetrao tetrix* and predatory species, are the victims of poachers. One especially devastating form of poaching is the collection of eggs from the nests of valuable species of predatory birds (with the aim of breeding hunting birds). Intensive hunting in neighbouring areas is also considered the main cause of the decrease in the population size of elk *Alces alces* in the park.

A major threat, especially to vertebrates, comes from tourists disturbing animals in their refuges. For example, frequent visits of bird-watchers to breeding sites of birds increases breeding losses (because of birds leaving their nests, cooling of eggs and increased exposure to predators).

Exotic animal species also disturb the functioning of biocenoses. At an initial stage of colonisation by exotic species, their numbers usually increase rapidly, afflicting considerable losses to the populations of their victims. The mink *Mustela vison*, for example, is a threat to waterfowl.

**TABLE 3.**  
**MAIN THREATS TO FAUNA OF THE BIEBRZA NATIONAL PARK**

Threats	Vertebrate fauna	Invertebrate fauna
Ceasation of management, plant succession	●●●	●●●
Drying up of habitats	●●●	●●●
Uncontrolled fires	●●	●●●
Poaching and hunting	●●	
Mass tourism	●●	●
Environmental pollution	●●●	●●●
Introduction of exotic species	●●	●

Level of importance :

●●● very high, ●● high, ● low



**Figure 4.** "The most severe hazard to the fauna of the Biebrza National Park is progressive plant succession due to a decrease in management practices such as grazing and mowing. The expansion in growth of bushes and trees onto the low peatlands results in a reduction in the numbers of species and individuals of breeding birds and mammals as well as numerous invertebrate taxa.



**Strategy for protection of fauna.** In order to conserve the wetland areas in the Biebrza National Park as faunal refuges with abundant valuable communities of species associated with wet habitats, it is necessary to control ground water levels and the duration and extent of river flooding. By shaping the wetland habitat in this way, it will be possible to stop or decrease the rate of succession and prevent colonisation of the wetland area by generalist species with a wide ecological tolerance from the surrounding habitats. It is also essential that natural conditions are restored in some tributaries of the Biebrza and that drainage canals, which accelerate the rate of water flow, are closed.

Another major objective in faunal conservation is to maintain or increase the area of open low peatlands hosting *Magnocaricion* and *Caricion fuscae* communities. The overgrowing of the sedge beds with reeds, bushes, and, in later stages, with forest plants, is not welcome in terms of the protection of faunal species diversity as it leads to a reduction in the heterogeneity of the landscape. Long-term observations of the avian fauna of the Biebrza valley have demonstrated that the natural succession of plants is the major factor responsible for unfavourable transformations in avian communities. Due to a rapid decrease in the area of open wetland habitats all over Europe, the ranges of a number of waterfowl species are declining so that the birds may be in danger even of global extinction. A gradual discontinuation of mowing and grazing led to the disappearance of the optimal habitat heterogeneity necessary to sustain a considerable diversity of bird species. For this reason, the primary guideline would be to resume mowing and cattle grazing in selected areas of the park. An ornithological evaluation (after Dyrz, Lontkowski, Stawarczyk, Witkowski [in] Sterzyńska, Lesiński

1999) of the park has made it possible to select the most valuable and most severely endangered areas within the park, where restoration of the agricultural practices is a priority. However, it must be remembered that very intensive, mechanical hay collecting in the peatland can pose a threat to most animal species associated with herbs and soil. The measures for preventing plant succession proposed in this paper are based on extensive agricultural practices that used to be undertaken in this area before it was declared a national park.

Burning used to be carried out in this area as part of agricultural management. However, since this is a controversial method that results in drastic transformation and destruction of biotopes, and is not regulated by law at present, it is currently not recommended for use in the Biebrza National Park. The ecological consequences of fires, and the optimal time for controlled burning should be investigated before a decision is made as to the feasibility of this method for the purposes of limiting plant succession in the park.

An important goal of the faunal protection in the Biebrza Wetlands is also to conserve other unique habitats that function as refuges for valuable animal species. These include relict mineral elevations in open and periodically flooded sedge beds as well as causeways cutting across these sedge beds. These are key measures for improving the survival of land fauna during prolonged flooding and for increasing species diversity of animal communities because the interface of wetland and permanent land areas encourages the formation of ecotone zones. Wetland forests occupying large areas (alder carrs *Carici Ribetum* and birch woods *Betuletum pubescentis*) are of great value as faunal refuges for rare birds and predatory mammals, which have their sanctuaries there (eg. *Aquila clanga* Pall., *A. pomarina* Brehm., *Haliaeetus albicilla* (L.), *Bubo bubo* (L.), *Canis lupus* (L.). Another essential element of the faunal diversity conservation programme in the Biebrza valley is the conservation of microhabitat heterogeneity. This enhances the survival of numerous valuable species of invertebrates due, for example, to the presence of patches of specific plants, dead tree stumps and fallen trunks, etc.

The methods for controlling the impact of the expansion of exotic species on the functioning of animal communities in the Biebrza National Park have not been developed. The appearance in the Biebrza Valley of a new predator, mink *Mustela vison* Schreber, has significantly increased the pressure on waterfowl and has resulted in changes to the functioning of bird communities and may serve as an example. It is mainly hazardous to the existence of birds forming dense colonies, such as *Chlidonias leucopterus* (Temm.), *Ch. niger* (L.) or nesting in loose colonies. It is probably only during the initial stages of carnivore expansion that the number of birds in colonies or their breeding success may fall drastically. It may be expected that long-term observations will reveal a reduction in pressure from these predators and adaptation of the prey to a new type of pred-

ator. The ecological niche of the mink is only slightly different to that of the extinct native species - *Mustela lutreola*, which used to inhabit these areas (B. & W. Jędrzejewski, oral communication). Thus, a decision to control the population of mink *Mustela vison* should not be taken without prior careful consideration.

Faunal monitoring is another important element of the nature protection strategy for the Biebrza National Park. Protective measures should be initiated or modified on the basis of the findings of monitoring studies. Monitoring is of particular importance for valuable and endangered species as well as those whose population growth is not naturally balanced, as is the case with excessive growth of the population of beaver *Castor fiber* L. or the mass appearance of invertebrate populations •

#### BIBLIOGRAPHY

- Andrzejewski, R. & Weigle, A.** (Eds.) (1993). Polskie studium różnorodności biologicznej. Narodowa Fundacja Ochrony Środowiska, pp. 186.
- Brylińska, M.** (1986). Ryby słodkowodne Polski. PWN, Warszawa.
- Dyrcz, A., Okulewicz, J., Tomjałojć, L. & Witkowski, J.** (1972). Ornitofauna łęgowa Bagien Biebrzańskich i terenów przyległych. *Acta orn.* 13: 343-422.
- Dyrcz, A., Okulewicz, J., Witkowski, J., Jesionowski, J., Nawrocki, P. & Winiecki, A.** (1984). Ptaki torfowisk niskich Kotliny Biebrzańskiej. Opracowanie faunistyczne. *Acta orn.* 20: 1-108.
- Dyrcz, A., Okulewicz, J. & Witkowski, J.** (1985). Changes in bird communities as the effect of peatland management. *Pol. ecol Stud.* 11:79-85.
- Fedyk, S., Gębczyńska, Z., Pucek, Z., Raczynski, J. & Sikorski, M.** (1984). Winter penetration of mammals of different habitats in the Biebrza valley. *Acta theriol.* 29: 317-336.
- Gębczyńska, Z. & Raczynski, J.** (1989). Distribution, structure and social organization of moose in the Biebrza river valley, Poland. *Acta theriol.* 34:195-217.
- Kozikowska, Z.** (1983). Analiza populacji ryb w rzece, dopływach i wybranych starorzeczach. *Acta Univ. Wratislaviensis. Prace Zool.* 28: 87-91.
- Romanowski, J., Kaszuba, S. & Koźniewski, P.** (1984). Nowe dane o występowaniu norek (Mammalia, Mustelidae) w Polsce. *Przeegl. Zool.* 28: 87-91.
- Sterzyńska, M., Dyrcz, A., Gębczyńska, Z., Lesiński, G., Raczynski, J., Romanowski, J. & Wiśniewolski W.** (1998). Review on the faunistic study of Biebrza National Park - bibliography. *Fragm. faun.* 41: 213-232.
- Sterzyńska, M. & Lesiński, G.** (1999). Management Plan of the Biebrza National Park - section protection of fauna (in Polish).
- Tomjałojć, L.** (1990). Ptaki Polski. Rozmieszczenie i liczebność. PWN, Warszawa.
- Witkowski, A.** (1984). Structure of the communities and biomass of ichthyofauna in Biebrza river, its old river beds and affluents. *Pol. ecol. Stud.* 10: 447-474.

MARIA STERZYŃSKA

Museum and Institute of Zoology, Polish Academy of Sciences,  
00-679 Warsaw, Wilcza 64, Poland  
E-mail: majka@roba1.miiz.waw.pl

GRZEGORZ LESIŃSKI

Dept. of Vertebrate Ecology, Institute of Ecology,  
Polish Academy of Sciences, 05-092 Łomianki, Poland  
E-mail: vertecol@poczta.onet.pl

