Polish Wetlands and Marshland Birds: Looking for Undisturbed References

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Source: Ardea, 98(3) : 301-308

Published By: Netherlands Ornithologists' Union

URL: https://doi.org/10.5253/078.098.0304

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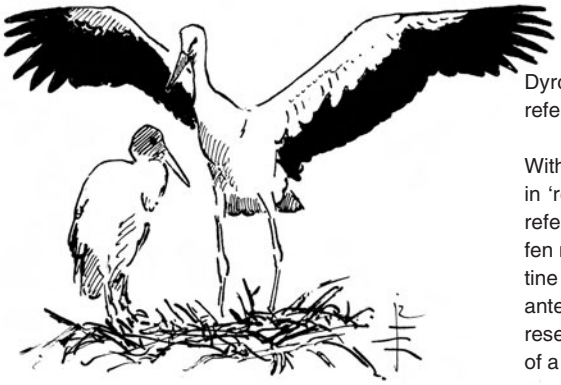

Dyrcz A. 2010. Polish wetlands and marshland birds: looking for undisturbed references. Ardea 98: 301–308.

With the loss of natural wetlands in western Europe, conservationists involved in 'restoration projects' become increasingly interested in eastern Europe for reference. In Poland, for example, still some 5% of the country is covered by fen mires, raised peat bogs and other types of wetlands. Although not in a pristine state anymore, size and quality of these wetlands are still sufficient to guarantee high biodiversity and a buffer against stochastic events. If anything, these reserves show that size really matters, and also that any attempt at 'restoration' of a pristine state is doomed to failure.

Key words: wetlands, Poland, human disturbance, marshland birds

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Over the centuries, and particularly during the 20th century, undisturbed large wetlands have become a rare and vanishing complex of natural habitats all over Europe as a consequence of increasing human activities exploiting the usually fertile soils around estuaries, river deltas and lake and marsh areas. Intensifying agricultural land use has led to better drainage systems, causing the desiccation of peat bogs and other swampy areas and safety for human settlements has called for a strict control of surface water movements, banning tidal influences and seasonal floodings from large areas. However, nowadays in many European countries people have begun to realise the magnitude of the losses of natural values and serious plans are being developed to ecologically restore wetland ecosystems. So, it is illustrative to present data from some Polish wetlands and marshes still preserved in more or less natural state and look into the composition of their bird fauna.

Wetlands in Poland, including all types of fen mires, raised peat bogs and other marshy areas, cover approximately 15,000 km^2 which is about 4.8% of the whole of Poland (Jasnowski 1975). From an ornithological point of view, the most interesting areas are open wetlands harbouring many rare and endangered breeding species. Open wetlands comprise mainly various kinds of fens and marshy meadows. These habitats cover c. 2% of Poland. However, only about one third of this area is preserved in its natural state. The remaining part has been more or less altered by partial drainage, grazing by cattle and horses and mowing. For comparison: mires in France cover c. 0.2% of the country, in The Netherlands 0.2–0.3%, but in Finland no less than 19% (Grimmett & Jones 1989). Fen mires rich in nutrients are distributed mainly in lowland, in the valleys of small and medium sized rivers and at the edges of some eutrophic lakes. Fen mires in Poland form a kind of archipelago of 'islands' distributed mainly in the north-eastern part of the country. Usually acid and poor, raised peat bogs are less interesting from an ornithological point of view. However, it is worth to mention that up to the 1940s mountain mires on the plateau of Karkonosze Mountains in south-western Poland (altitude 1300–1400 m) harboured a breeding population of Eurasian Dotterel *Charadrius morinellus* (Heyder 1960, Dyrcz 1973). This bog resembles the northern tundra.

STUDY AREAS

Four large areas in north-eastern and eastern Poland are considered as study areas for this review.

Biebrza marshes

The most important fen mire preserved in a more or less natural state, not only in Poland but in the whole

of central and western Europe, is found in the Biebrza marshes in the north-eastern part of the country (Fig. 1). The area includes the entire course of a medium-sized river, the Biebrza, of c. 164 km long. The fen area covers c. 900 km^2 and has a roughly elongated shape, c. 90 km long and from several to c. 15 km wide. Three basins can be distinguished. The Upper Basin comprises the upper course of the river. Peat deposits are thick but form a relatively narrow belt. No spring flooding occurs. Natural moss fens and sedge–moss fens can still be found here. The Central Basin was partially drained in the 19th century. It comprises a mosaic of open and bush-overgrown sedge fens and grassy communities. Natural, wet Birch *Betula* spp. forests cover considerable areas. In spring, only medium-sized areas alongside the river are flooded. In the Lower Basin, fens have been preserved in their natural state. They form a belt of about 30 km long and from 5 to 12 km wide. In spring, large and long-lasting floodings occur here. The basin also has a comparatively wide belt of alluvial terrain with numerous oxbow lakes. Tall sedges *Magnocaricetum* are dominant. Other important vegetation types include riverside areas covered by a low vegetation or by Reed *Phragmites australis* beds. Farther out, moss-sedge fens of the non-flooded (emersion) zone extend themselves, followed by fens more or less overgrown by bushes. Swamp alder woods also occur there, covering an area of about 3400 ha. The whole area is protected since 1993 as Biebrza National Park.

Narew National Park

Most valleys of larger and medium size rivers in Poland have been substantially changed. One of the exceptions besides the Biebrza is a part of the Narew Valley in its middle course (c. 210 km^2) in north-eastern Poland (Fig. 1). In 1996 Narwianski National Park was created in this area. It was a completely natural, permanently flooded lowland river valley with the labyrinth of river anastomoses and oxbows covered mainly by vast reed beds with willow *Salix* spp. thickets, rushes, *Glyceria, Phalaris* and swamp alder forests. This completely natural habitat was disturbed in the 1970s and 1980s, when the upper part of the river in today's national park was partially drained and the main channel was straightened. Recently, some efforts have been made to rehabilitate this part by the construction of small dams in the river channels and old river beds.

Łęczna–Włodawa Lake District

The Łęczna–Włodawa Lake District is another important Polish wetland (c. 154 km^2) situated north-east of Lublin (Fig. 1). Its most natural part is protected since

Figure 1. Geographical position of the Polish wetland areas mentioned: (1) Biebrza Valley, (2) Narew National Park, (3) Łęczna–Włodawa Lake District, (4) carbonate fen mires near Chełm.

1990 as Poleski National Park (9647 ha). The area comprises fen mires, including the large Durne Bagno and Bubnów fens, with sedges, a mosaic of dense *Salix/Betula* scrub and open *Cladium mariscus* fens. There are also eutrophic lakes with extensive reed beds, surrounded by shrub and open sedge fens; distrophic lakes and swamp alder woods. Some parts of the area are mown for hay.

Fen mires near Chełm

Some fen mires in the vicinity of the town of Chełm (south of the Łęczna–Włodawa Lake District) represent a peculiar type of mires on calcareous soil dominated by *Cladium mariscus* and partly overgrown with willow and birch scrub. In the wettest places reed beds and tall sedges predominate. Many small chalk 'islands' are covered by steppe plant communities or by willow, birch an poplar *Populus* spp. bushes. The surrounding meadows are used for hay production. Old drainage ditches still exist in most of the area. There are five isolated marshes, three of which are protected as nature reserves. The remaining two are incorporated into a landscape park. The total fen mire area amounts to about 1700 ha.

RESULTS

Marshland birds and their habitat use

In the Biebrza area c. 279 bird species have been recorded (P. Marczakiewiez in. litt.), including 159 breeding species and 19 for which breeding is likely.

The Biebrza marshes constitute the most important breeding grounds in Europe outside the former Soviet Union for Great Snipe *Gallinago media*, Corncrake *Crex crex*, Spotted Crake *Porzana porzana*, Spotted Eagle *Aquila clanga*, White-winged Tern *Chlidonias leucopterus* and Aquatic Warbler *Acrocephalus paludicola*. There are considerable breeding populations of Common Crane *Grus grus*, Lesser Spotted Eagle *Aquila pomarina*, Common Redshank *Tringa totanus*, Black-tailed Godwit *Limosa limosa*, Eurasian Curlew *Numenius arquata*, Short-eared Owl *Asio flammeus* and Eagle Owl *Bubo bubo*. This has been the only inland breeding ground of Dunlin *Calidris alpina* in Poland. There are breeding records of such rare species as Short-toed Eagle *Circaetus gallicus*, Golden Eagle *Aquila chrysaetos*, Booted Eagle *Hieraaetus pennatus* and Jack Snipe *Lymnocryptes minimus* (Dyrcz *et al.* 1972, 1984, Pugacewicz 1995a,b).

The Narew National Park constitutes an important breeding ground for species as Great Bittern *Botaurus stellaris*, Garganey *Anas querquedula* (up to 700 pairs before drainage, c. 20 pairs recently), Hen Harrier *Circus cyaneus*, Spotted Crake (200–400 pairs before drainage), Black-tailed Godwit, Common Redshank, Black Tern *Chlidonias niger* (700–1000 pairs before drainage, 41–64 pairs recently), Thrush Nightingale *Luscinia luscinia* (c. 400 pairs), Savi's Warbler *Locustella luscinioides* (1500–2000 pairs in the past, c. 200 pairs at present). During migration flocks of up to 4000 Ruffs stopover in this area (Lewartowski & Piotrowska 1987, Gromadzki *et al.* 1994).

In the Leczna-Wlodawa Lake District area some rare bird species breed, although in rather small numbers, including Montagu's Harrier *Circus pygargus* (a dozen or so pairs), Lesser Spotted Eagle, Spotted Crake, Little Crake *Porzana parva*, Corncrake, Ruff, Black-tailed Godwit, Eurasian Curlew, Short-eared Owl and Aquatic Warbler (c. 200 singing males) (Dyrcz *et al.* 1973, Gromadzki *et al.* 1994).

The fen mires in the vicinity of Chełm are well known as breeding ground of a substantial population of the Montagu's Harrier (33–45 pairs), which is the subject of a long-term study. Worth mentioning are also small breeding populations of Spotted Crake, Little Crake, Corncrake, Great Snipe (16 displaying males), Black-tailed Godwit (19–67 breeding pairs in different years), Eurasian Curlew (5–8 pairs), Short-eared Owl (up to 11 pairs) and Aquatic Warbler (170–200 singing males) (Buczek & Buczek 1993, Dyrcz & Czeraszkiewicz 1993, Gromadzki *et al.* 1994).

A comparison of the number of breeding wetland bird species in the four areas shows the highest figure in Biebrza (Table 1). The difference between Biebrza and the other three areas is even more striking when the numbers of breeding pairs of each of the species is taken into consideration. As a rule, breeding numbers are higher in Biebrza than elsewhere. The reasons for these differences are twofold. Since Biebrza is the largest area of natural wetlands, it comprises the highest number of different habitats. For example, the vast areas of reed beds support a considerable population of Great Bittern, the vast and moist open areas of sedges and grassland without upgoing vegetation support c. 1000 breeding pairs of Black-tailed Godwit, while the hundreds of square kilometres of open sedge-moss fen mires hold an internationally important breeding population of Aquatic Warbler.

The special importance of open fen mires for breeding wetland bird species of special conservation concern is demonstrated in Table 2. It includes species of all habitats (not only wetland species). Some endangered large raptors are clear examples of species, which benefit from the habitat diversity in Biebrza, although within their global distribution range they are not necessarily limited to wetlands.

Focus bird species

Black Stork *Ciconia nigra*. Present on Biebrza with 24–26 breeding pairs, resulting in a high density of 1.9–2.6 pairs per 100 km^2 (Pugacewicz 1994), in Narew National Park with 1 pair and in Łęczna–Włodawa Lake District with several pairs. The entire Polish population was estimated at 950–1100 pairs in the early 1990s (Profus 1994) and at 1100–1200 pairs in the late 1990s (Tomiałojć & Stawarczyk 2003). On Biebrza it breeds in forests and forages mainly along the streams, ditches and rivulets in open marshes. It is a rather shy bird which does not tolerate a high density of humans.

Northern Pintail *Anas acuta*. Present on Biebrza with probably about 50 breeding pairs in the 1980s, in spite of marked decrease in comparison to the 1960s (Dyrcz *et al.* 1984). Narew National Park held, before the water level was lowered, 7 pairs; at present probably extinct here (Gromadzki *et al.* 1994). The Polish population was estimated at c. 100 pairs in the 1980s (Jakubiec 1992), but had declined to 40–60 pairs in the late 1990s (Tomiałojć & Stawarczyk 2003). As a bird of vast open marshy areas in river valleys, it is especially endangered by habitat loss in entire western and central Europe.

Lesser Spotted Eagle *Aquila pomarina*. Present on Biebrza with 53 breeding pairs, thus representing a relatively high density (5.1 pairs per 100 km^2) in the Middle Basin (Pugacewicz 1994a). Does not breed in

Table 1. Occurrence of breeding bird species in four eastern Polish wetlands: (1) Biebrza Valley, (2) Narew National Park and immediate surroundings, (3) Leczna–Wlodawa Lake District, (4) carbonate fens near Chelm.

Species	1 126,047 ha	2 21,000 ha	3 15,400 ha	4 1700 ha
Little Grebe *Tachybaptus ruficollis*	+	+	+	-
Great Crested Grebe *Podiceps cristatus*	+	+	+	-
Red-necked Grebe *Podiceps grisegena*	+	+	+	-
Black-necked Grebe *Podiceps nigricollis*	+	-	+	-
Great Bittern *Botaurus stellaris*	+	+	+	+
Little Bittern *Ixobrychus minutus*	+	+	+	-
Grey Heron *Ardea cinerea*	+	-	+	-
Black Stork *Ciconia nigra*	+	+	+	-
White Stork *Ciconia ciconia*	+	+	+	+
Mute Swan *Cygnus olor*	+	+	+	-
Whooper Swan *Cygnus cygnus*	+	-	-	-
Greylag Goose *Anser anser*	+	+	+	-
Eurasian Wigeon *Anas penelope*	+	-	-	-
Gadwall *Anas strepera*	+	+	+	-
Common Teal *Anas crecca*	+	+	+	-
Mallard *Anas platyrhynchos*	+	+	+	+
Northern Pintail *Anas acuta*	+	+	-	-
Garganey *Anas querquedula*	+	+	+	+
Northern Shoveler *Anas clypeata*	+	+	+	+
Common Pochard *Aythya ferina*	+	+	+	-
Ferruginous Duck *Aythya nyroca*	(+)[a]	(+)[a]	+	--
Tufted Duck *Aythya fuligula*	+	+	+	-
Common Goldeneye *Bucephala clangula*	+	-	+	-
Red-breasted Merganser *Mergus serrator*	(+)[b]	-	-	-
Goosander *Mergus merganser*	(+)[b]	-	-	-
Black Kite *Milvus migrans*	+	+	+	-
White-tailed Eagle *Haliaeetus albicilla*	+	-	+	-
Short-toed Eagle *Circaetus gallicus*	+	-	+	-
Western Marsh Harrier *Circus aeruginosus*	+	+	+	+
Montagu's Harrier *Circus pygargus*	+	+	+	+
Water Rail *Rallus aquaticus*	+	+	+	+
Spotted Crake *Porzana porzana*	+	+	+	+
Little Crake *Porzana parva*	+	+	+	+
Corncrake *Crex crex*	+	+	+	+
Common Moorhen *Gallinula chloropus*	+	+	+	-
Eurasian Coot *Fulica atra*	+	+	+	-
Common Crane *Grus grus*	+	+	+	+
Little Ringed Plover *Charadrius dubius*	+	+	+	-
Northern Lapwing *Vanellus vanellus*	+	+	+	+
Dunlin *Calidris alpina*	+	-	-	-
Ruff *Philomachus pugnax*	+	+	+	+
Jack Snipe *Lymnocryptes minimus*	+	-	-	-
Common Snipe *Gallinago gallinago*	+	+	+	+
Great Snipe *Gallinago media*	+	+	+	+
Eurasian Woodcock *Scolopax rusticola*	+	+	+	-
Black-tailed Godwit *Limosa limosa*	+	+	+	+
Eurasian Curlew *Numenius arquata*	+	+	+	+
Common Redshank *Tringa totanus*	+	+	+	+
Green Sandpiper *Tringa ochropus*	+	+	+	+
Common Sandpiper *Actitis hypoleucos*	(+)[c]	-	(+)	-
Little Gull *Larus minutus*	+	-	-	-
Black-headed Gull *Larus ridibundus*	+	+	+	-
Common Tern *Sterna hirundo*	+	+	+	-
Whiskered Tern *Chlidonias hybridus*	+	-	+	-
Black Tern *Chlidonias niger*	+	+	+	-
White-winged Tern *Chlidonias leucopterus*	+	-	-	+
Short-eared Owl *Asio flammeus*	+	+	+	+
Common Kingfisher *Alcedo atthis*	+	+	-	-
Sand Martin *Riparia riparia*	+	-	+	-
Meadow Pipit *Anthus pratensis*	+	+	+	+
Blue-headed Wagtail *Motacilla flava*	+	+	+	+
White Wagtail *Motacilla alba*	+	+	+	+
Thrush Nightingale *Luscinia luscinia*	+	+	+	+
Bluethroat *Luscinia svecica*	+	+	+	+
Whinchat *Saxicola rubetra*	+	+	+	+
Grasshopper Warbler *Locustella naevia*	+	+	+	+
River Warbler *Locustella fluviatilis*	+	+	+	+
Savi's Warbler *Locustella luscinioides*	+	+	+	+
Aquatic Warbler *Acrocephalus paludicola*	+	+	+	+
Sedge Warbler *Acrocephalus schoenobaenus*	+	+	+	+
Marsh Warbler *Acrocephalus palustris*	+	+	+	+
Reed Warbler *Acrocephalus scirpaceus*	+	+	+	+
Great Reed Warbler *Acrocephalus arundinaceus*	+	+	+	+
Bearded Reedling *Panurus biarmicus*	+	+	-	-
Penduline Tit *Remiz pendulinus*	+	+	+	+
Scarlet Rose-finch *Carpodacus erythrinus*	+	+	+	+
Common Reed Bunting *Emberiza schoeniclus*	+	+	+	+
Total number of species	**75**	**61**	**66**	**39**

[a]Probably extinct.

[b]Probably breeds sporadically.

[c]Probably irregular breeder.

Narew National Park and Chełm marshes, but a dozen or so breeding pairs still occur in the Łęczna–Włodawa Lake District. The Polish population was estimated at 1700–1900 pairs in the late 1990s (Tomiałojć & Stawarczyk 2003). On Biebrza, the mosaic of forests, open fens and moist meadows constitutes a good habitat for the species.

Spotted Eagle *Aquila clanga*. Eastern Poland is situated on the western limit of the European population. In the early 1990s, 10–12 pairs were still breeding in Biebrza (Pugacewicz 1995b; G. Maciorowski, pers. comm.), while in Poland as a whole at most 20 pairs remain (Tomiałojć & Stawarczyk 2003). The presence of vast open marshes in river valleys is essential for foraging (G. Maciorowski, pers. comm.).

Spotted Crake *Porzana porzana*. Biebrza's population of this species amounts to several hundreds of breeding pairs and is the most important one in Poland. Before the water table was lowered in Narew National Park, the population there was estimated at 200–400 pairs, but then decreased to 1–4 pairs (Gromadzki *et al.* 1994). Fen mires in Łęczna–Włodawa Lake District support a population of about 100 pairs and the Chełm marshes some 5 pairs. Poland as a whole holds at least 3000 males (Tomiałojć & Stawarczyk 2003). The Spotted Crake prefers rather open marshes.

Little Crake *Porzana parva*. The largest breeding population of Little Crake was known from Narew National Park before the lowering of the water level (80–230 pairs), but afterwards the population has strongly decreased (Gromadzki *et al.* 1994). Several dozens of pairs probably breed in Biebrza and in the Łęczna–Włodawa Lake District, while only 5 pairs are found near Chełm (Gromadzki *et al.* 1994). The Polish population has been estimated at a minimum of 500 pairs (Lewartowski & Pugacewicz 1992), and at 1200–2000 pairs (Tomiałojć & Stawarczyk 2003). Generally, this species occurs in a wider range of habitats than Spotted Crake (Cramp & Simmons 1980).

Corncrake *Crex crex*. Biebrza is considered as the most important breeding ground in entire central and western Europe, with an estimated 2100 males on 300 km^2 of the best habitat (Tomiałojć & Stawarczyk 2003). The Corncrake is less numerous in the Łęczna–Włodawa Lake District and in Narew National Park. In the latter place, before the lowering of the water level, the breeding population was said to consist of about 150 'pairs'. In the vicinity of Chełm only few birds breed and they are mainly confined to cultivated meadows bordering fen mires (J. Krogulec, pers. comm.).

Common Crane *Grus grus*. In the 1980s, Biebrza supported a population of 180 breeding pairs (Gromadzki *et al.* 1994), with another 4–6 pairs in Narew National Park (Gromadzki *et al.* 1994), about 20 pairs in Łęczna–Włodawa Lake District (Dyrcz *et al.* 1973 and unpubl. data) and 2 pairs in the Chełm marshes (J. Krogulec, pers. comm.). The expansion of shrubs into the fen mires seems to favour this species. For the whole of Poland, the estimate in the 1980s was 800–900 breeding pairs; since then, the species showed a steep increase to 5000–6000 pairs in the late 1990s (Tomiałojć & Stawarczyk 2003).

Dunlin *Calidris alpina*. The breeding population of the form *schinzii* has declined considerably in recent years (Cramp & Simmons 1983, Jonsson 1988), and this concerns especially the inland populations. Biebrza holds the only Polish inland population left nowadays, a dozen pairs or so strong (Dyrcz *et al.* 1984 and unpubl. data), declining to a few pairs in the Biebrza Marshes, middle Narew and possibly along the Bug during the 1990s (Tomiałojć & Stawarczyk 2003). The Biebrza birds breed on alluvial meadows, grazed by cattle and horses and situated close to the river.

Jack Snipe *Lymnocryptes minimus*. Nesting of this arctic species was proved on Biebrza, which is situated far away from its regular geographic range. In 1977 two nests were found and 18 displaying birds were observed in sedge–moss open fen mire in the emersive zone of the Lower Basin (Okulewicz & Witkowski 1979). Before 1977, as well as afterwards, there were some additional records of Jack Snipe during the breeding season, indicating that the species may be a

Table 2. Distribution of bird species of conservation concern across four main breeding habitats of the Biebrza Valley. The score for each habitat was calculated by adding up the number of points assigned to each of the species of European conservation concern according to the following rules (Tucker & Heath 1994): category 1: 4 points, category 2: 3 points, category 3: 1 point. Species included in the Polish Red Data Book of Animals (Glowacinski 1992): 3 points. If a species is listed in both books, the highest score was chosen.

	Banks of rivers and old river beds	Open wetlands (flooded and non-flooded)	Shrub fens	Woods and forests
Number of species	10	19	9	19
Score per habitat	22	53	15	42

more or less regular breeder in the Biebrza Valley (Dyrcz *et al.* 1994, Tomiałojć & Stawarczyk 2003). There are also some old records concerning the breeding of Jack Snipe in the Łęczna–Włodawa Lake District (Taczanowski 1882).

Great Snipe *Gallinago media*. This species is still relatively numerous in Norway and Sweden (Cramp & Simmons 1983) and has, therefore, not been listed in Table 3. However, it is extinct in western and central Europe except for eastern Poland, where the population size was estimated at 700–800 displaying males in the 1990s (Tomiałojć & Stawarczyk 2003), including 400–450 males in Biebrza marshes (Pugacewicz 2002). There are also small populations in Narew National Park of 6–8 males, in Łęczna–Włodawa Lake District of c. 30 males (Gromadzki *et al.* 1994) and on fen mires near Chełm of 22 males (Buczek & Buczek 1993). However, only the Biebrza population seems to be large enough to sustain itself, avoiding island effects. The displaying grounds of the Great Snipe in Biebrza are found mostly in relatively open fen mires (with some bushes) in the non-flooded zone, but also on alluvial meadows closer to the river (Dyrcz *et al.* 1972, 1984).

Aquatic Warbler *Acrocephalus paludicola*. The Aquatic Warbler is a habitat specialist limited mainly to rich fen mires in river valleys. In Europe, this habitat has been destroyed nearly completely by drainage. One example of this habitat is formed by beds of *Cladium mariscus* in the region of Chelm. Halophytic meadow-reed associations with scattered reeds on the sea coast in the region of the Odra estuary constitute a somewhat different habitat (Dyrcz & Czeraszkiewicz 1993). During detailed surveys in the Biebrza Marshes in 1995 and 1997, respectively 2041 and 2082 males were recorded, constituting the majority of the Polish population of 2900–2950 pairs (Tomiałojć & Stawarczyk 2003). In the upper Narew Valley 118–133 males were reported (Tomiałojć & Stawarczyk 2003), in the Łęczna–Włodawa Lake District 137–440 singing males (in different years) and near Chełm 715–770 in 1986 and 1988 (Tomiałojć & Stawarczyk 2003). Biebrza was recognised as one of the most important breeding area in the entire geographical range of the species, until recently some large populations were discovered in Belarus (7300–13,000 pairs in 1996–1998; Kozulin & Flade 1999). The highest density of simultaneously active nests and singing males (9.8 and 10.9/ha respectively) were found on Biebrza open fen mires in the unflooded zone with medium-sized sedges (Dyrcz & Zdunek 1993). As second-choice habitats, high sedge beds in the flooded (immersion) zone and marshy meadows with *Molinia caerulea* can be listed. In connection with uniparental (female) nestling care in Aquatic Warbler (Dyrcz 1993), the abundance of relatively large insects and spiders is a prerequisite for the existence of an Aquatic Warbler breeding population (Schulze-Hagen *et al.* 1989).

DISCUSSION

There are nine wetland bird species (Table 3) for which the Polish populations are important, not only on the central and western European scale but also on a pan-European scale (including eastern Europe and Scandinavia). All these species have strong populations in eastern Poland. In comparison to other parts of western and central Europe, in eastern Poland relatively large

Table 3. Endangered, vulnerable and rare European wetland bird species with substantial populations in Poland.

Species	Size of breeding populations in Europe (pairs) (Tucker & Heath 1994)	Size of breeding population in Poland (various sources)	Percentage of European population breeding in Poland	Population trend in Poland
Great Bittern *Botaurus stellaris*	19,000–43,000	1100–1400	3.3 – 5.8	Stable
Black Stork *Ciconia nigra*	6500–19,000	950–1100	5.8 – 14.6	Stable
White Stork *Ciconia ciconia*	120,000–150,000	30 500	20.3 – 25.4	Stable
Gadwall *Anas strepera*	7500–120,000	1200–1700	1.4 – 1.6	Stable
White–tailed Eagle *Haliaeetus albicilla*	3300–3800	180–240	5.5 – 6.3	Increasing
Corncrake *Crex crex*	92,000–200,000	6600–7800	3.9 – 7.2	Decreasing
Common Crane *Grus grus*	52,000–80,000	2300–2600	3.2 – 4.4	Increasing
Black–tailed Godwit *Limosa limosa*	140,000–270,000	6000–8000	3.0 – 4.3	Decreasing
Aquatic Warbler *Acrocephalus paludicola*	3700–18,000	2500–7500	41.7 – 67.6	Decreasing

areas of more or less natural wetlands have been preserved. This is especially true in the case of fen mires which still harbour substantial populations of species, such as Great Snipe or Aquatic Warbler, which have become extinct in western Europe. In addition, the endangered species are represented in Biebrza in large numbers, which, thanks to the large surface area of this wetland, makes them less vulnerable to extinction caused by isolation.

On the other hand, even in eastern Poland completely undisturbed wetlands do no longer exist. For example, in the second half of the 19th century the Middle Basin of Biebrza was partially drained in order to obtain pastures and hay meadows. In the past, expansion of bushes into the open fen mires in the unflooded parts of the Southern Basin was slowed down by hand-scything and burning. Hay, which consisted largely of sedges, was put onto stacks on platforms and brought to the villages in winter using sledges. This kind of traditional farming was beneficial to habitat diversity, e.g. to keep areas more or less open, favouring the breeding of ducks (especially Garganey), waders (among others Black-tailed Godwit, Ruff, Common Redshank and Great Snipe), White-winged Tern and other species. Grazing cattle also kept some areas open, and pastures with moderate densities of grazing animals constitute the preferred habitat for breeding Dunlin. Most of the practices mentioned have recently vanished, which has resulted in bush expansion. The rarest and most unique species are strictly limited to habitats that disappear when human control over natural hydrology increases in the wake of agricultural intensification. In intensively cultivated meadows in the vicinity of the Biebrza Valley (the former Wizna fen mires), the dominant breeding species used to be Skylark *Alauda arvensis* (47% of the local breeding bird fauna), followed by Whinchat *Saxicola rubetra* (12%). There were also some pairs of Garganey, Black-tailed Godwit and Northern Lapwing *Vanellus vanellus* breeding, but their nest losses were very high and probably their nesting was possible only because of the vicinity of the natural Biebrza fen mires serving as a source area (Dyrcz *et al.* 1985).

Large-scale wetlands form a better guarantee for maintaining habitat and breeding bird diversity than wetlands of a smaller scale, regardless of the degree of human disturbance (Table 1). This does not only apply to strict wetland bird species. The larger species of birds, in particularly eagles (*e.g.* Lesser Spotted Eagle, Spotted Eagle, Golden Eagle, Booted Eagle and Short-toed Eagle, all of which breed – or bred – in Biebrza), also need large areas, both for undisturbed nesting sites (in forest) and for sufficiently large feeding areas (in open wetlands). The same applies to the Eagle Owl which probably reaches its highest breeding density within Poland in the Middle and Lower Basins of Biebrza (Pugacewicz 1995a). Relatively small and dispersed natural carbonate fen mires near Chelm, although still supporting unique and endangered species as Aquatic Warbler and Great Snipe, show a considerably lower species diversity than the other three wetlands discussed (Table 1). Because of the smaller size of the Chełm area, some important habitat types like forests and water bodies are lacking.

Taking into consideration that even in Poland most of the wetlands have been negatively influenced by human interference, it would seem unrealistic for wetland restoration projects in western Europe to try to restore pristine conditions. Nonetheless, evidence from the remaining remnants of Polish wetlands shows that, when large enough, even these modified remnants may still serve as strongholds for important populations of rare and threatened wetland bird species.

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SAMENVATTING

Oorspronkelijke moerasgebieden zijn schaars geworden in Europa. Ontgonnen of dusdanig door omringende ontginningen beïnvloed zijn ze als sneeuw voor de zon verdwenen of radicaal veranderd. Om te zien hoe het was, moeten we tegenwoordig naar Oost-Europa reizen, waar nog substantiële fragmenten min of meer oorspronkelijk moeras zijn uitgespaard. In Polen betreft dat een kleine 5% van de oppervlakte van het land, ofwel 15.000 km^2. In dit overzicht wordt ingegaan op de moerassen van de Biebrza (een rivier van 164 km lengte), het Nationale Park Narew (de middenloop van een rivier in het noordoosten van Polen), het merendistrict Leczna–Wlodawa nabij Lublin en de venen bij Chelm. Deze gebieden herbergen een hoge biodiversiteit aan vogels. Daaronder zijn tal van soorten die inmiddels in West-Europa zijn uitgestorven. Bovendien zijn de lokale populaties vaak van dusdanige omvang dat uitsterving als gevolg van toevallige negatieve invloeden niet erg voor de hand ligt. Dat neemt niet weg dat ook de Poolse moerasreservaten te kampen hebben met de nadelige inwerking van menselijke activiteiten in en rond de moerasgebieden. Het is daarom weinig realistisch Polen als voorbeeld te nemen bij het ‘herstel’ van moerasgebieden in West-Europa. De oorspronkelijke toestand zal nooit meer worden bereikt, iets wat ook in Polen al een gepasseerd station is. Maar door te kiezen voor grote eenheden kan er wel voor worden gezorgd dat lokale populaties voldoende veerkracht en omvang hebben om tegenslagen het hoofd te bieden.