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**Application of the mapping method in the marshland habitats**

**Zastosowanie metody kartograficznej w bagiennych środowiskach**

**Применение картографического метода в биотопах заболоченных территорий**

**Abstract.** From 1966–1970 a quantitative study with the mapping method was carried out on the largest Polish natural peat-bogs. Owing to high effectiveness of single counts in this open biotope, only 4 or 5 visits per season are recommended. In the case of *Charadriiformes*, the importance of nest finding and observations of birds giving alarm calls or showing distraction display are emphasised. Also the difficulties arising from marked fluctuations in water level are discussed.

This study was carried out from 1966 to 1970 in the largest Polish marshlands. Two papers were published (see references). These marshlands represent a low and transient type of peat-bog and are very rich habitats. Two study areas were chosen: firstly, the Biebrza river marshes (northeast Poland), and secondly, eastern parts of Lublin province. In the Biebrza area we see a natural succession of habitats, from the river itself to the upland valley slopes. The wettest areas are flooded for a long time every spring, while the less wet ones are flooded only for a short time. Most of these habitats in quite natural conditions represent a brief stage of succession, the climax of which is the forest. But this intermediate stage is here artificially prolonged because the meadows are scythed every third year or so, and the trees cannot grow. The whole surface of Biebrza marshes is about 1,000 square kilometers. Most of the Lublin peat-bogs derive from large lakes. However, some of them are not primeval bogs, but appeared after the forests were removed. Because only a few studies have been carried out in such habitats, we should like to discuss methodological difficulties met with, and also to present briefly some results of our studies.

We adopted the mapping method, but specific territorial conditions and also the composition of bird communities forced us to introduce some modifications. The size of a single census plot was 10 ha. This seems to be sufficient, taking into consideration the high local bird population density. The plots were rectangles 200 × 500 m. They were marked by poles at every 100 m. On the visit maps all poles and some other landmarks were marked. Ten census plots were studied in the Biebrza and seven in the Lublin area. On every census plot 4 or 5 counts were made in the period 12th May to 23rd June. In both regions the study was carried out during two successive seasons. Four or five counts in one season seem to be sufficient as the effectiveness of one count in this open landscape is high. Each count was done by two or three persons simultaneously. The observers were in sight and auditory contact with one another, and moved parallel to each other, tracing a zigzag path. One count lasted from 1 1/2 to 3 hours, the time spent depending on the abundance of bushes in the areas. In contradistinction to the wooded areas, here in the marshes sight records are the most important. In the marshes we usually fixed breeding territories on the basis of observation of adult birds with food in their beaks, adults displaying restlessness and alarm, foraging families and nests found. The waders (*Charadriiformes*) represent up to 60 % of the avifauna in the marshland communities. With this group, the best method appeared to be registration of restless or displaying birds together with finding as many nests as possible. To find nests the observer walks slowly, searching out place by place. It is difficult to find a better method for *Charadriiformes* for the following reasons.

1. The birds are very shy and in open landscape rise at a long distance, making it difficult to locate the exact spot where they took wing the first time. This concerns especially the Curlew [*Numenius arquata* (L.)], Black-tailed Godwit [*Limosa limosa* (L.)], Redshank [*Tringa totanus* (L.)] and Lapwing [*Vanellus vanellus* (L.)]. The Snipe [*Gallinago gallinago* (L.)], when flushed, shows a tendency to alight nearby, usually again in the census plot, so that there is a risk of counting the same specimen several times. The number of Ruffs [*Philomachus pugnax* (L.)], was estimated mainly by counting restless females circling round the observer uttering their alarm calls, a dull "gegegegege". This behaviour is strongly manifested in the early days after the hatching of young, but at the beginning of the breeding season it might be misleading in the vicinity of display grounds. We found that in this case most of the females so behaving had no nests; we could find only unlined "scrapes" in which nests were never made. Probably at this phase of the breeding season the females show restlessness even at the place of tentative breeding. In an area of high Ruff population density, nest finding appears to be most important. Great Snipe [*Gallinago media* (LATH.)] gave a lot of trouble as this bird displays in groups and the number of breeding pairs had to be estimated exclusively on the basis of the number of nests found. But the nests of this species are very difficult to find because the incubating bird takes wing only when the obser-

ver approaches very close. Consequently the results concerning this species are probably underestimated.

2. Another difficulty with the waders is their tendency to semi-colonial breeding. Because of their habit of collective defence of breeding sites, it is difficult to estimate the number of breeding pairs in a loose colony without finding nests. Over the observer are circling and crying not only the local birds but also others from the neighbourhood. This holds especially in the case of the Black-tailed Godwits, Lapwing and Redshank. In such loose colonies the nests found should be marked by small poles.

3. The wader families show a tendency to move just after hatching to wetter places which offer better foraging conditions. The more elevated spots, which in early spring offer attractive places for nesting, are too dry during the hatching period owing to the lowered water-level. The families of Godwit, Redshank and Ruff desert the nesting places about 10th June and gather in wetter depressions and in old river beds. The registration of restless and circling adult birds indicates the presence of the nest only in May and at the beginning of June. Later the birds showing this behaviour might be far from their breeding sites.

In respect of the marshland passerines we can offer some similar remarks. Walking through the census plot one flushes the birds more easily than in woodland habitats. For example, a pair of Whinchats [*Saxicola rubetra* (L.)] on the bog with scattered bushes, when flushed, went at a distance of 100–200 m and alighted. Consequently one pair might be counted several times. When the fledglings of the first brood are still being fed, the male might already be singing and displaying in the vicinity. In this case one pair might be registered as a pair plus one singing male. This concerns mainly the Meadow Pipit [*Anthus pratensis* (L.)]. The Sky-lark (*Alauda arvensis* L.) respects territory boundaries only when flying low above the ground. However, already in the middle of May one can meet full grown Sky-lark youngsters, which are recognisable by the more mottled and lighter plumage. In the case of the Reed Bunting it is essential to remember that males may go several hundred meters off their territories for food, to open marsh or meadows, while the females forage only close to the breeding territory (J. OKULEWICZ — pers. comm.). The situation with Aquatic Warbler (*Acrocephalus paludicola* VIEIL.) is rather puzzling. In spite of the abundance of singing males we very rarely met birds showing restlessness and only two nests were found. It seems that in this species males predominate over females in number.

The main problem in a quantitative study in marshland is the marked influence of the oscillation of water level on the number of breeding birds, since it has a strong influence both on the distribution of the breeding pairs and the time of breeding. In the years 1967 and 1970 the water level was unusually high. Early breeding species built their nests on the few elevations protruding above the water. On these elevations they bred at a very high density.

For example, on one such "island" of 2 hectares, 22 Lapwings nests were found, the distance between some nests being only 2–5 meters. On 20th May 1970 in the 10 ha area, 45 nests of *Charadriiformes* were found, including 28 nests of Ruff, 10 of Black-tailed Godwit, 4 of Lapwing and 3 of Snipe. In the same places in other, dryer years, the density of the breeding population was from three to five times lower. Even the birds nesting in the reed beds were influenced. When the reeds are flooded the Sedge Warbler [*Acrocephalus schoenobaenus* (L.)], Aquatic Warbler, Savi's Warbler [*Locustella luscinioides* (SAVI)] and Water Rail [*Rallus aquaticus* (L.)] appear in the breeding season in the neighbouring habitat covered with *Carex* and osiers (*Salix cinerea* L.). We have also noted a two to five times increase in the number of Red-backed Shrikes (*Lanius collurio* L.) and Barred Warblers [*Sylvia nisoria* (BECHST.)] in the bog osier scrub in a dry year in comparison with a wet one. In dry years an increase in the duck population is also noted. From the observed frequency of families and restless females we estimate this increase to be about five times. The same phenomenon affects even the raptors like Common Buzzard [*Buteo buteo* (L.)], Kestrel (*Falco tinnunculus* L.) and Short-eared Owl [*Asio flammeus* (PONT.)].

Summarising: the influence of high water level is twofold.

1. A part of the bird population is forced to breed in sub-optimal habitats.
2. The breeding density is locally very high and breeding is delayed, or the birds which start early suffer high brood losses caused by water level oscillations, strong waves and the lack of suitable nest shelters secured from predators.

## RESULTS

The breeding density of the avifauna in this "single floor" habitat is high, ranging from 23 to 46.5 breeding pairs per 10 ha. It is similar to the densities known in rich, old woods. The figures we have obtained are several times higher than figures reported by other authors from the high peat-bogs situated to the north and east of our study region. They are also higher than figures shown by some authors (e.g. OELKE, 1968; KRÄGENOW, 1968; SCHNEIDER, 1969) in similar but more artificially changed habitats in Western Europe. On the other hand USPENSKIJ (1969), who carried out quantitative studies on the breeding avifauna in natural tundra in Yamal Peninsula, found on average 40–60 breeding pairs per 10 ha, similar to our results. Moreover, the composition of the bird communities is also similar in both regions, provided that one takes into consideration the replacement of certain species by other representative ones.

As mentioned already, in the Biebrza marshes there exists a natural succession of marshland habitats going from the river bed to the upland surrounding

valley. With this succession corresponds in some degree the succession of bird communities. In this succession, the central position is occupied by an avifauna of open, true peat-bog in its natural state. The plant community is *Caricion canescenti-fuscae* and *Caricion lasiocarpae*. Unexpectedly these communities also occupy the central position in the biotope, being situated half-way between alluvial meadows along the river and bushy marshes bordering the upland. This uniform bird community on Biebrza, resembles closely the avifauna of similar open bogs in the Lublin marshes. Major differences occur between the bird communities inhabiting various types of peat-bogs of the same area. The stability and similarity of bird communities in the open bog suggests that this community is the natural one.

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## STRESZCZENIE

W artykule omówiono pewne trudności (sposoby ich ominięcia), jakie napotymano przy stosowaniu metody kartograficznej w badaniach awifauny torfowisk niskich w Kotlinie Biebrzy i na Pojezierzu Łęczyńsko-Włodawskim. Trudności te dotyczą zwłaszcza ptaków siewkowatych (*Charadriiformes*). Podkreślono znaczenie wyszukiwania gniazd i stosowania indywidualnych metod

dla niektórych gatunków w zależności od ich biologii rozrodu. Specyficznym dla środowisk bagiennych problemem w badaniach ilościowych jest wpływ różnic poziomu wody w różnych latach na rozmieszczenie gniazd i porę rozpoczęcia lęgów. W zależności od stanu wód, zagęszczenie i liczebność różnych grup ekologicznych ptaków były w różnych latach bardzo odmienne.

## РЕЗЮМЕ

В статье рассмотрены в основном определенные трудности, возникшие при исследованиях по орнитофауне низинных торфяников котловины реки Бебжи и Ленчинско-Влодавского поозерья картографическим методом, и способы их избежания. Эти трудности особенно имеют место при изучении ржанкообразных (*Charadriiformes*). Подчеркнуто значение отыскивания гнезд и применения для некоторых видов индивидуальных методов, в зависимости от их биологии размножения. Специфической проблемой при количественных исследованиях в болотистых биотопах является влияние различий в уровне воды в отдельные годы на начало гнездового периода и размещение гнезд. Плотность и численность различных экологических групп птиц были очень различны в отдельные годы в зависимости от уровня воды.