Evaluating the effectiveness of faunal mapping, forest and marshland bird censuses for monitoring environmental changes

András Báldi, Csaba Moskát & András Zágon

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There are many potential major taxa suitable for monitoring environmental changes. Birds are usually included, because of their high position in the trophic chain, popularity, and well-established census methodology. However, there is a great variety of potential methods, and it is not always obvious which one is best, particularly in large and heterogeneous areas. We compared three methods of monitoring avifaunal changes in the Szigetköz region, a riparian area along the River Danube in northern Hungary, where construction of a reservoir seriously decreased both the water flow of the original river and the water table in at least half the area. We censused breeding birds by the line-transect method in five marshlands (1994), by point counts at 46 points (1994), and we conducted a faunal mapping over sixty-two 1x1 km quadrates (in 1994 and 1996). There were no considerable changes detected in the forest bird communities. Although marsh-living birds responded to changes of the water level, no clear tendency was detected at the regional (Szigetköz) scale due to the low number and small size of marshlands and to other disturbances. Faunal mapping showed the best results. The presence/absence of bird species clearly reflected the water level in channels and marshes of a given quadrate. Although faunal mapping required more effort than the other two methods, its results indicated environmental changes much better than those, through the species-specific reaction of birds.

Key words: riparian area, reservoir, hydroelectric power-station, birds, monitoring, faunal mapping, bird census.

1. Introduction

Although riparian landscapes are the most productive and the most threatened landscapes all over the world (DÉCAMPS 1993; MALANSON 1993), a hydroelectric power-station has been built on the Danube River along the Hungarian-Slovakian border. The implemented plan of the reservoir and the powerstation included the construction of a long bypass channel, parallel to the Danube. Therefore, the original river now contains only about 10 % of its natural water volume. As a consequence, the upper parts of the river section concerned suffer from serious water deficiency. Large areas suffered from at least 3 m decrease of the water table, and the loss of dead tributaries. The results of such dramatic changes immediately influence wildlife and wildlife habitats. However, a new channel system (water replenishment system) was constructed to provide water for the dried parts. To survey and monitor such drastic changes in wildlife is an apparent and urgent task.

2. Study area

River Danube constitutes the boundary between Hungary and Slovakia along ca. 180 km. The Szigetköz region is located in NW Hungary along the River Danube (Fig. 1). It is composed of hundreds of small islands, surrounded by side-branches and meanders. The other side of the Danube (the Csallököz region, Slovakia) is similar, but we did not include it into the monitoring. The Szigetköz area is heavily managed by forestry, at least 70 % of the original forest stands were replaced by hybrid poplar (*Populus* sp.) plantations. Both the water level and the water table decreased in the upper Szigetköz in 1993 after the

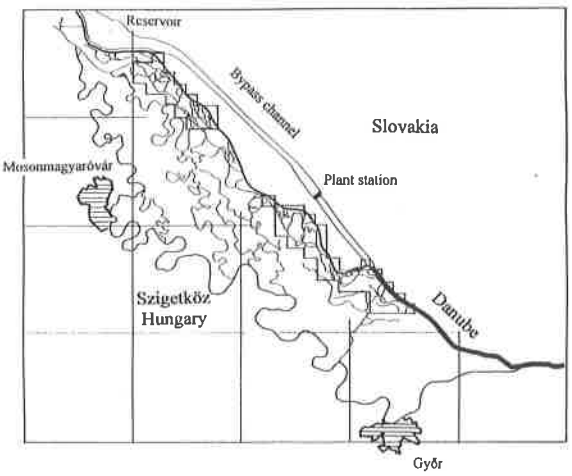

Fig. 1. Scheme of the Szigetköz region, Hungary. The small blocks indicate the sixty-two 1x1 km cells used for the faunal mapping.

construction of the bypass-channel. In 1995 a water replenishment system was established and it partly increased the water level.

We applied four approaches to monitor changes of the avifauna. This monitoring project started in 1993, but other ecological investigations on birds have been carried out here since 1989 (e.g. WALICZKY 1992; MOSKÁT *et al.* 1993; BÁLDI & KISBENEDEK 1994; BÁLDI & MOSKÁT 1994; BÁLDI *et al.* 1995; MOSKÁT & FUISZ 1995; MOSKÁT *et al.* 1996).

3. Methods

We applied the following standard bird census techniques (according to BIBBY *et al.* 1992):

(1) Monitoring of the wintering waterfowl. Method: point count technique and line transect method. Sampling sites: 18 sampling point along dead tributaries, and 3 sampling point and a 10 km long transect along the main course of the river. Time of sampling: every year 2-3 times during winter.

(2) Monitoring of the breeding passerine birds in marshland areas. Method: line transect method. Sampling sites: 3 sampling sites in marshlands outside the dam of the flood plain, and 2 sampling sites inside the flood plain. Time of sampling: twice a year (April, May) to detect early and late breeders.

(3) Monitoring of the forest birds in the breeding season. Method: the Danish point count technique (5-minute counting of birds at fixed points within the "hearing distance" of their song). Sampling sites: 46 counting points in willow and poplar forests. Time of sampling: once a year (May).

(4) Faunal mapping of breeding bird species. Method: qualitative (presence/absence) registration of bird species over a 1x1 km grid system. Sampling sites: 22 cells in the upper part of the region, 22 cells in the intermediate part, and 18 cells in the lower part. The study area included only the flood area of the Danube, within the band of dams (Fig 1). Time of sampling: twice every other year (April and May).

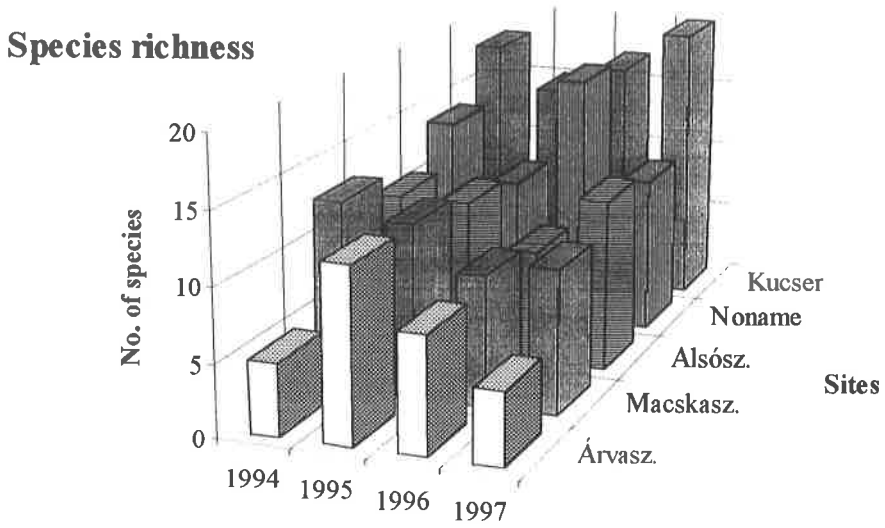

Fig. 2. Species richness of breeding passerines in five marshland sites in the Szigetköz region, Hungary.

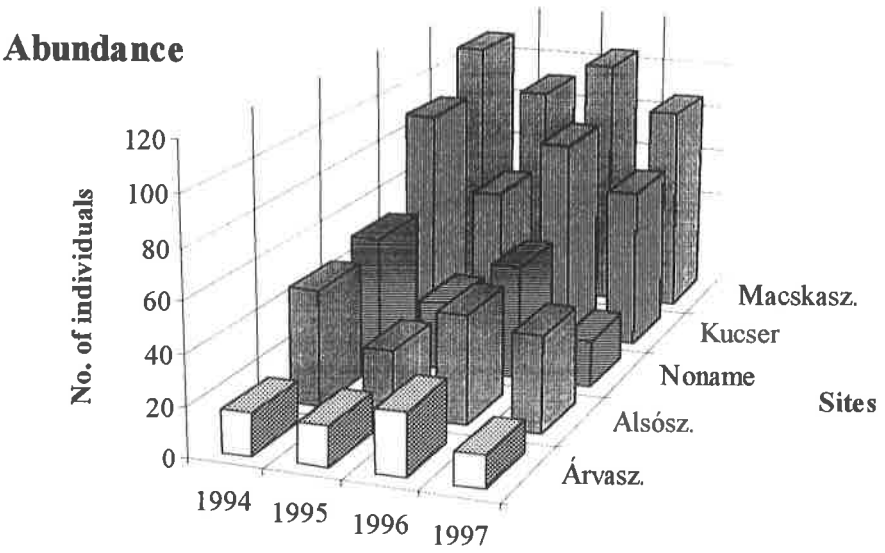

Fig. 3. Abundances (number of observations) of breeding passerines in five marshland sites in the Szigetköz region, Hungary.

4. Results

Some of the results have already been published (BÁLDI 1995, BÁLDI *et al.* 1998), or are available in internal reports. Below, we summarize our results, and evaluate the applied methods.

(1) Monitoring of the wintering waterfowl: The number of diving ducks decreased after the main river was diverted, but later we did not detected any trend in changes of wintering waterfowl.

(2) Monitoring of the breeding passerine birds in marshland areas: We did not detect clear trends in changes of marshland living passerine birds (Fig. 2, 3), mainly because the size of marshlands was too small for establishing stable populations.
(3) Monitoring of the forest birds in the breeding season: No trend was revealed.
(4) Faunal mapping of breeding bird species: The regional distribution of several bird species indicated the water level changes. Wetland birds (e.g. *Acrocephalus schoenobaenus*, *Emberiza schoeniclus*) aggregated in the lower Szigetköz in 1994, but spread more evenly in 1996, after the operating of the water replenishment system (Fig. 4). Species of gravel shores (*Tringa hypoleucos*, *Charadrius dubius*) were aggregated on the upper parts in 1994, and spread more evenly in 1996 (Fig. 4). Water birds (*Podiceps ruficollis*, *Podiceps cristatus*, *Fulica atra*) were very rare in 1994, but more abundant in 1996 (Fig. 4).

5. Discussion

We found that faunal mapping was the most sensitive method for detecting environmental changes in the Szigetköz region. No clear trends were detected by the other methods. The following factors may be responsible for the lack of changes: (A) marshland habitats changed unexpectedly and in an unnatural way due to water level modifications and reed harvesting. (B) The structure of forests did not changed significantly during the relatively short time period, thus,

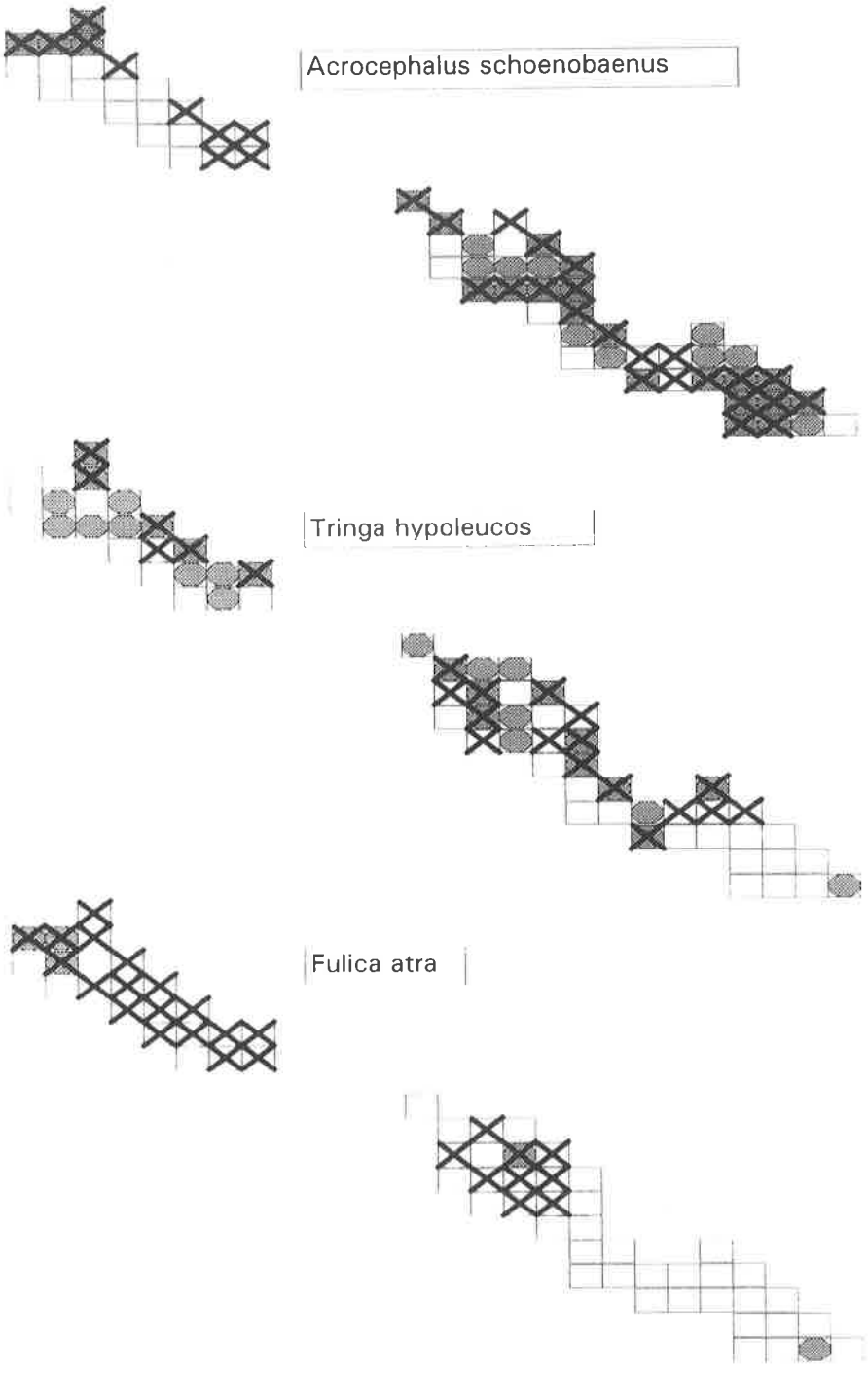

Fig. 4. Presence of the Sedge Warbler *Acrocephalus schoenobaenus*, Common Sandpiper *Tringa hypoleucos* and Coot *Fulica atra* in 1x1 km cells in the Szigetköz region, Hungary. Grey dot: occurred in 1994, after the diversion of the main waterflow; black X: present in 1996, after the construction of the water replenishment system.

forest bird communities were not affected. (C) The lack of any tendency in the number and species composition of wintering waterfowl may be the consequence of changes in the huge water reservoir in Slovakia. In addition, weather factors may significantly influence the site selection of waterfowl.

We propose that faunal mapping should be used when (1) the most appropriate indicator species can not be selected a priori, (2) the affected area is large (>50 km²), and, most importantly, (3) when the area is heterogeneous and environmental perturbation selectively affects different parts of the area.

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6. References

Báldi, A. 1995: Bird communities in the Szigetköz after the diversion of the Danube. Aquila 102: 133-149.

Báldi, A. & T. Kisbenedek 1994: Comparative analysis of edge effect on bird and beetle communities. Acta Zool. Hung. 40: 1-14.

Báldi, A. & C. Moskát 1994. Effect of the edge on the structure of bird communities in Hungarian riparian forests. In: Hagemeijer, E. J. M. & T. J. Verstrael (eds): Bird Numbers 1992. Distribution, monitoring and ecological aspects. Statistics Netherlands, Voorburg/ Heerlen & SOVON, Beek-Ubbergen.

Báldi, A., C. Moskát & A. Zágon 1998: Faunal mapping of birds in a riparian area of River Danube after construction of a hydroelectric power station. Folia Zool. 47: 173-180.

Báldi, A., A. Zágon & A. Bankovics 1995: Status of the avifauna in the Szigetköz riparian area: an ornithological evaluation for nature conservation. Misc. Zool. Hung. 10: 127-136.

Bibby, C. J., N. D. Burgess & D. Hill 1992: Bird Census Techniques. Academic Press, London.

Décamps, H. 1993: River margins and environmental change. Ecol. Appl. 3: 441-445.

Malanson, G. P. 1993: Riparian Landscapes. Cambridge Univ. Press, Cambridge.

Moskát, C. & T. Fuisz 1995: Conservational aspects of bird-vegetation relationship in riparian forests along the River Danube: a multivariate study. Acta Zool. Hung. 41: 151-164.

Moskát, C., A. Báldi & Z. Waliczky 1993: Habitat selection of breeding and migrating populations of the Icterine Warbler *(Hippolais icterina)*: a multivariate study. Ecography 16: 137-142.

Moskát, C., T. Fuisz & J.-Y. Park 1996: Comparison of habitat selection characteristics of the Robin *(Erithacus rubecula)* and the Dunnock *(Prunella modularis)* in riparian forests along the River Danube. Ornis Hung. 6: 15-22.

Waliczky, Z. 1992: Structure of avian communities in the forests of Szigetköz, Hung. Ornis Hung. 2: 25-31.

András Báldi & Csaba Moskát, Animal Ecology Research Group, HAS, Hungarian Natural History Museum, Budapest, Baross u. 13. Hungary, H-1088. E-Mail: *baldi@zoo.zoo.nhmus.hu.*

András Zágon, Zoological Department of the Hungarian Natural History Museum, Budapest, Baross u. 13. Hungary, H-1088.