Habitat Selection of Nesting and Migrating Birds in the Hortobágy

Ph.D Thesis

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Debrecen, 2000

1. Introduction and objectives

Besides analysing the habitat selection of conservationally important bird species the aim of the present thesis is to provide recommendations for managing the Hortobágy National Park by evaluating bird habitats on alkaline steppes.

The necessity for carrying out such a study was promoted by considerable habitat alterations in the past few decades, population changes of protected species and conservational management needs arising from them. Since similar studies were already carried out in the Hortobágy National Park decades before its foundation, the aim of the present thesis is to widen the spectrum of national conservational researches based on internationally accepted experiences.

Since the avifauna of the Hortobágy National Park is exceedingly important among its conservational values, the interests of this group is highly emphasized in conservation management plans. The decreased level of grazing as well as the creation of fishponds resulted in habitat alterations in the Hortobágy. However, there are only a few studies analysing the effects of such processes on species of conservational concern.

The field studies of the thesis form a group of case studies in which the most important alkaline steppe bird habitats are evaluated (natural and artificial wetlands, dry grasslands, forests and agricultural areas) based on the the habitat selection of some bird species of conservational importance. Afterwards the results of it are translated into the terms of practical conservation to be built into conservation management plans. Accordingly, natural and artificial wetlands are evaluated followed by the analysis of the roost site selection of the Common Crane (Grus grus), the habitat selection of migrating waders (Charadriidae) as well as the nest site selection of the Spoonbill (Platalea leucorodia), marsh terns (Whiskered, Black and White-winged Black Terns [Chlidonias hybrida, nigra and leucoptera]) and Aquatic Warbler (Acrocephalus paludicola); recommendations for managing steppe forests are based on analysing the nest site selection of the Red-footed Falcon (Falco vespertinus), while the analysis of the feeding area selection of the Common Crane can help managing agricultural areas.

The results of the thesis are intended to be built into conservation management plans by providing recommendations for managing various habitat types as well as by modifying the present, internationally induced zone limits to

match the needs of the above-mentioned species.

2. Study areas and methods

The field work of case studies serving as a basis for the present thesis was carried out in the Hortobágy National Park from 1995 to 2000 between March and November. Both extremely dry and floody seasons are included in the studied period, therefore this interval is thought to be representative to be able to draw conclusions. It was an intention during the investigations to obtain spatially representative results as well, i.e. the study areas include proportional amounts of habitats of bird species in question.

The following case studies are included in the thesis:

1. Migrating species
    - 1.1. Roost site selection of the Common Crane
    - 1.2. Feeding area selection of the Common Crane
    - 1.3. Habitat selection of migrating waders
2. Breeding species

2.1. Nest site selection of the Spoonbill
2.2. Nest site selection of the Red-footed Falcon
2.3. Nest site selection of marsh tern species
2.4. Nest site selection of the Aquatic Warbler

The roost site selection of the Common Crane, the habitat selection of migrating waders, the nest site selection of the Spoonbill and marsh tern species were studied in alkaline marshes (Bolboschoenotalia) and fishponds of the Hortobágy National Park, the nest site selection of the Aquatic Warbler was studied in wet alkaline meadows (Puccinellietalia), while the nest site selection of the Red-footed Falcon was studied in forests of dry alkaline meadows.

In each case study the maximum number of possible physical (numeric and categoric), as well as dependent (characteristic for the species in question regarding the type of investigation) variables were recorded. One of the most characteristic types of analyses was the decreasing of the number of variables and at the same time the eliminating of correlations between them using factor analysis. The correlation between dependent and extracted variables was measured by computing Spearman rank correlation coefficients. The relation between categoric and dependent variables was analysed by Mann-Whitney or Kruskal-Wallis tests depending on the number of categories. The parameters of habitat selection were thus given by the above-mentioned analyses. Statistical procedures were carried out by SPSS 9.0 for Windows.

1. New scientific results

1.1. Results of case studies

1.1.1. Roost site selection of the Common Crane

1.1.1.1. The phenological analysis of the migration of the Common Crane was carried out in the study. The spatial distribution of the roost sites are mapped with its type and physical variables recorded that has not yet been done in previous studies carried out in Hungary.

1.1.1.2. I have shown that the optimal roost sites are relatively deep, steep-banked wetlands far from human settlemennts and traffic, while the role of the distance from feeding areas is not so important in the roost site selection of the Common Crane.

1.1.1.3. It became evident that the protection status of the wetland has a significant effect on the roost site selection of cranes: the peak number of cranes was significantly different between protected and non-protected areas which can be possibly explained by the lack of waterbird hunting.

1.1.1.4. I have shown that the most preferred type of natural wetland used for roosting is the flooded alkaline meadows with patches of reed.

1.1.1.5. I have called the attention that cranes select even smaller ones from almost undisturbed natural wetlands, while only larger ones are selected from highly disturbed fishponds.

1.1.2. Feeding area selection of the Common Crane

1.1.2.1. During my study I have identified the types of feeding areas of cranes migrating in the Hortobágy, as well as these are ranked according to the preference of the Common Crane according to flock densities and feeding activities.

1.1.2.2. I have estimated the proportion of youngs in migrating flocks, as well as I have characterised the differences between the feeding strategies of families and non-breeding birds.

1.1.2.3. I have given a new example for antipredation strategies by analysing the relation between flock size annd actively feeding cranes.

3.1.3. Habitat selection of migrating waders

3.1.3.1. During my study I have given the species composition, quantity and its temporal dynamics of waders migrating in the Hortobágy in spring and autumn in large sample areas.

3.1.3.2. I have characterised the habitat alterations resulting in changes of the migration volume of several species.

3.1.3.3. I have shown that dependent (characteristic for waders), numeric variables strongly correlate with an extracted variable typical for small, ungrazed wetlands with wet barren surfaces, large densities of manure and without tall vegetation (i.e. smaller drained fishponds) and another variable typical for large, ungrazed wetlands with medium manure densities and rich in barren suurfaces (i.e. large drained fishponds and some larger marshes).

3.1.3.4. I have shown that mixed flocks of waders prefer shallow grazed marshes.

3.1.3.5. According to my results it became clear that the number of waders was significantly different between fishponds and marshes (greater in the former one), which is due to the high manure content and the larger extent of mudflats of fishponds, according to the results of factor analysis.

3.1.4. Nest site selection of the Spoonbill

3.1.4.1. I have analysed the population changes of the Spoonbill from its first year of breeding in the Hortobágy as a function of habitat alterations.

3.1.4.2. I have described the types of nesting habitats of the Spoonbill in the Hortobágy as well as the other species breeding in mixed colonies together with Spoonbills.

3.1.4.3. According to my investigations it can be shown that the maximum colony size and duration of occupation of the colony strongly correlate which may be due to

the long-livedness of large colonies of colonial birds.

3.1.4.4. I have shown that hunting activities have a negative impact on the formation of large Spoonbill colonies.

3.1.5. Nest site selection of the Red-footed Falcon

3.1.5.1 I have mapped the spatial distribution of rookeries and nests occupied by Red-footed Falcons in the western and eastern part of the National Park.

3.1.5.2. During my investigations the nest types used by the Red-footed Falcon are described and ranked according to preference.

3.1.5.3. I have shown that neither the species of tree supporting the nest nor the nest height plays an important role in the nest site selection of the Red-footed Falcon.

3.1.6. Nest site selection of marsh terns

3.1.6.2. During my investigations I have mapped the colonies of marsh terns in the southern and western part of the National Park in 1999 and 2000.

3.1.6.3. According to the results of my analyses the breeding success and number of breeding pairs (either that of each species or the sum of them) positively, significantly correlated with extracted factors typical of large, deeper (stagnant) wetlands with sparse vegetation.

3.1.6.4. According to my statistical analyses significant differences among dependent variables grouped by wetland and vegetation types could have only been found in the Whiskered Tern.

3.1.7. Nest site selection of the Aquatic Warbler

3.1.7.2. During my investigations I have mapped the distribution of the Aquatic Warbler in the Hortobágy.

3.1.7.3. I have characterised the population changes of the Aquatic Warbler as a function of habitat alterations.

3.1.7.4. According to my investigations it became clear that the correlation between the

number of singing males and the size of habitat was significant.

3.1.7.5. I have found this species breeding in habitats not mentioned in previous studies. I have surveyed the population density of singing males in various types of habitats, as well as these were ranked according to preference.

3.2. Conclusions

1.2.1. Roost site selection of the Common Crane

1.2.1.1. According to the results of my investigations it can be shown by the discriminant analysis performed on extracted factors that roost sites most preferred by cranes can be characterised as follows: (1) large, protected and situated far from human settlements and motorways (2) relatively deep up to 0,40 m) (3) close to feeding areas

1.2.1.2. According to the results of my study the marshes selected for roosting are medium-sized (45-110 ha), protected and generally far from human settlements (3-8km), and not typically close to feeding areas. Selected fishponds are typically large (74-794 ha), often close to human settlements (1,5-5 km), and nearer to feeding areas than marshes (0.2-5.5 km). It might be due to the fact that marshes arre generally smaller than fishponds, so more susceptible for human disturbance.

1.2.2. Feeding area selection of the Common Crane

1.2.2.1. According to the results of my studies the most important type of feeding area of the Common Crane is the maize field selected by more than 80% of feeding flocks; the largest flocks could have been observed in the same type.

1.2.2.2. My results showing that families feed in isolated, loose flocks are in a good accordance with investigations carried out in wintering grounds in Spain.

1.2.3. Habitat selection of migrating waders

1.2.3.1. I have shown that there is a seasonal asymmetry in the habitat selection of migrating waders in the autumn and spring migration periods due to asymmetrical migration strategies.

1.2.3.2. According to my results the significant correlation between the extent of mudflats and number of waders shows the opportunistic way of selecting habitats in waders which is in aggreement with results of other studies.

1.2.3.3. I have shown that the input of organic material in wader habitats plays an important role in habitat selection which might be due to the presence of rich invertebrate fauna of mudflats.

1.2.4. Nest site selection of the Spoonbill

1.2.4.1. According to my results the colonies of fishponds were generally larger and used for a longer period, i.e. older colonies were larger.

1.2.5. Nest site selection of the Red-footed Falcon

I have suggested that the preference of Magpie's nests of Red-footed Falcons can be explained by the fact that falcons can form nesting colonies with the increasing number of Magpies (in solitary pairs the breeding success is much lower than in colonial pairs).

1.2.6. Nest site selection of marsh terns

1.2.6.1. According to my results marsh tern colonies seggregated since the distance and size of colonies correlated significantly. Mixed colonies were larger than single-species ones, that can be explained by higher antipredator vigilance of mixed colonies.

1.2.6.2. I have shown that colony size correlated positively, significantly with the size of wetland that can be explained by the fact that larger habitats provide more possibilities for breeding and feeding.

1.2.6.3. According to my results the colony size correlated significantly with water depth that can be due to an adaptation to dry seasons. The size of colonies correlated significantly with the size of the nearest colony that led to common antipredator behaviour suggested by field observations, as well as shown by a high degree of correlation between breeding success and the size of the nearest colony.

1.2.6.4. Based on my studies it could have been verified that the size of colony and the breeding success correlated negatively, significantly with vegetation cover, which is due to a preference for sparsely vegetated water bodies.

1.2.6.5. I have shown that all three marsh tern species prefer large, sparsely vegetated marshlands, where the high density of colonies result in a larger breeding success.

1.2.7. Nest site selection of the Aquatic Warbler

1.2.7.1. The number of singing males did not correlate significantly with the distance between the its territory and the first Aquatic Warbler habitat. Furthermore, there was no correlation between the number of singing males and duration of occupation of the habitat, however more singing males were found in areas occupied earlier. Although the correlation between the density of singing males and independent variables was not significant, larger habitats tended to have smaller population densities.

1.3. Recommendations for the nature conservation management

Natural wetlands. Based on the results of case studies natural wetlands must be managed as follows: In breeding species: (1) For the conservation of the Spoonbill unharvested reedbeds with deep stagnant water must be preserved and let them expand, as well as shallow, open wetlands must be created between

february and november.(2) For the protection of marsh terns shallow water bodies or those of medium depth sparsely covered by patches of floating sea-weeds must be created (3) For the conservation and expansion of the Aquatic Warbler marshy meadows must be left uncut. In migrating species: (1) For the protection of the roost sites of Common Cranes and for the possibility to let other roost sites come into existence undisturbed, deep, open wetlands far from human settlements and motorways, but close to feeding areas. (2) For the protection and creation of habitats of migrating waders shallow, large, unvegetated, strongly grazed wetlands with high concentrations of organic manure must be preserved.

Therefore there is some contradiction between the ways of managing natural wetland, i.e. for Spoonbills and Aquatic Warblers it would be ideal to keep stagnant water in alkaline marshes to be able to expand, while for marsh terns, waders and cranes it would be necessary to have sparsely vegetated, only temporarily flooded and grazed marshes. Since only 10% of the 80,000 ha large National Park is covered by alkaline marshes, the following way of managing natural wetlands can be recommended:

1. Since there are only a few Spoonbill colonies on fixed sites, alkaline marshes including them must be kept under deep water from ice-melt to the end of the breeding season (late July) with only renewal-cuttings performed in the reedbeds. For preserving reedbbeds it is not suggested to keep such habitats dry for a longer period.
2. Since the Hortobágy plays an important role in the conservation of the population of the Aquatic Warbler, the preserving of their habitats hust have a higher priority in management plans. Therefore it is necessary to keep shallow water on these habitats with inhibiting stands of reed reedmace to expand to be able to sustain their population and help them expanding. No haycutting must be allowed, while a lower degree of grazing might be possible without damaging their habitats.
3. In alkaline marshes without the above-mentioned species suitable nest sites for marsh terns and feeding areas for waders can be obtained by grazing and temporarily filling them up. It can be recommended to keep them dry in late summer-autumn to slow successional processes.
4. In natural wetlands the forming of roost sites of Common Cranes and habitats of migrating waders can be sychronised by filling up marshes dried out in summer with shallow water, that provides excellent roost sites for cranes arriving in mid-September.

Artificial wetlands. In this section the recommended way of managing fishponds is described, based on the results of the case studies: In breeding species: (1) For the conservation of the Spoonbill reed-islands or larger unbroken stands of reed must be left uncut with filling up ponds containing such habitats between February and July. (2) For the protection of marsh tern species (in fishponds other species than Whiskered Tern breed only exceptionally) fishponds rich in floating vegetation must be kept under deep water between April and July without cutting stands of sea-weeds. In migratory species: (1) For the protection of roost sites of the Common Crane large ponds far from human settlements and motorways and close to feeding areas must be drained between September and November. (2) For migrating waders as many fishponds as possible must be drained between March and April, as well as between late July and late October.

Therefore there is a contradiction between ways of managing fishponds: while Spoonbills and Whiskered Terns need deep, stagnant water between February and July, waders migrating in spring want drained fishponds between March and May. Since there are 75 fishponds on 6000 hectares in the National Park, their management plans can be recomended to modify as follows: fishponds regularly occupied by Spoonbills, egret and heron species as well as marsh tern colonies must be fulfilled from ice-melt to mid-July. In blocks indicated on Fig.8. at least one fishpond must be kept drained from ice-melt to mid-May, as well as from late July to late November. Besides fishponds regularly occupied by cranes when roosting, must be drained from late July to late November every year, thus providing habitats for migrating waders as well.

Dry alkaline grasslands. According to the previous analyses of the nest site selection of the Red-footed Falcon the local breeding population of this species can be strengthened by a higher degree of grazing in alkaline grasslands.

Forests of alkaline grasslands. Based on the results of the analyses of the nest site selection of the Red-footed Falcon it ir important to preserve the forests of alkaline grasslands with rookeries and Magpies to be able to conserve colonies of Red-Footed Falcons. However, this activity is contradictory to the idea that forest plantations must not be sustained because of landscape-protection measures. On the other hand this species got extinct from natural alkaline oak forests (Ohati- and Tilos-forests) after the extinction of rookeries, therefore nature conservation management must take into consideration the new situation. In sites where Red-footed Falcons breed in groups of Magpie's nests, the protection of Magpies is also important.

Agricultural areas. For the conservation of the feeding areas of the Common Crane it is necessary to create maize-fields suitable for them (short and sparse) in agricultural areas inside the National Park. It can be also important to buy agricultural fields near possible roost sites in the buffer zone of the National Park. Therefore the spatial distribution of 'crane-fields' is recommended as shown by Fig.4.

It must be emphasized, that recommendations based on the above case studies concentrate only on the interests of species in question. Although the needs of several species of conservational importance can be different. Therefore it is to be recommended to study the habitat selection of other species as well, with the results and conservational evaluation of it embedded in the management programs of state organizations and NGOs with a higher priority.