

ORNITHOLOGICAL OBSERVATIONS IN SOME BIOTOPES OF THE UPPER-TISZA INUNDATION AREA

A. LEGÁNY

János Kabay Primary School, Tiszavasvári
(Received 10 January 1973)

Abstract

A study was made of the avifauna of the Tisza inundation area from Tokaj to Záhony in 1971—1972. The paper analyzes ornithological problems of the pastures, orchards, arable land, swamps and flood-defence embankments. The woods have been dealt with specially in a separate publication. The inundation area forms a mosaic complex, where the individual biotopes alternate, and with involved feeding relations. It can be said in general that the nesting avifauna of the habitats examined is poor as regards both species and individual numbers. The biological energy produced is not utilized appropriately, and this raises the possibility of rational bird-settlement, which at the same time would also increase the biological protection of the area.

Introduction

The considerable surface transformation due to human activity in the past 100 years includes the regulation of the river Tisza. The once vast rushy swamps, the barely penetrable woods and the neglected river-beds now belong in the memories of the past. The river and its flood waters now flow between embankments, and man has created biotopes with new aspects in the place of the old wild world. These anthropogenic areas can today be found not only outside the embankments, but also inside them. The aim of the present paper is to study, analyze and explain their avifauna. In the course of this it is desired to deal with the avifauna of orchards, pastures, arable land, swamps and embankments, and the related observations. The woods of the inundation area have already been treated separately in an earlier paper. It will be seen that these areas are species-poor biotopes, as a direct result of their anthropogenic origin. Their investigation is important, however, as they are parts of the large mosaic-complex of the Tisza inundation area, and as their energy leads to their being feeding areas for many species. They are thus incorporated as organic parts in the food gradient which has developed on the inundation area. Accordingly, our picture of the whole of the inundation area, and of the biological role and value of the ornithology living there, will be complete only when the investigation of the woods has been supplemented by the investigation of these biotopes too.

Region examined and method

Observations were made on the inundation area from Tokaj to Záhony in 1971 and 1972. This is a section covering about 86 river km. With regard to the great physiognomic variety of the biotopes, the methods of observation and data collection had to be applied accordingly. In the orchards, 1 hectare characteristic of the area was designated, and in this the species and individuals were counted. In the open pastures the square was much larger, at ca. 25 hectares. Just because of the openness, there are far fewer birds here, and the feeding individuals flee from a large distance.

An unit area was not marked out in the swamps, and coenological recordings were not performed. This will be returned to later. Here all the observed species were recorded without reference to unit area. A similar procedure was employed on the arable land, where such a recording could not be made because of the great poorness in birds.

On the flood-defence embankments, however, the well-applicable band-recording method was used. It must be noted here that (as will be treated in more details later) the quantitative and qualitative relations of the band-recording, and this probably holds for other recordings too, depended decisively on the period of the day in which they were made.

The numbers of species and individuals per unit area was established on the basis of the nests, singing males young-feeding parents and visible individuals observed on traversing the areas several times. Thus, the number of nesting pairs at each observation site could be determined with approximative accuracy. The analyses were based primarily on the nesting pairs, for these are in the greatest harmony with the area and for just this reason are in the closest biological connection with the ecosystem there. In order to obtain the average characteristic of the biotope, observations were made at each habitat type at many points of the inundation area. The fauna lists reported in the paper are the results of the summation and averaging of these observations. However, it must be noted that these are all open biotopes, and only feeding areas for many species, and therefore it is extremely important that the quantitative and qualitative relations of these species should also be taken into account. Special reference is made to this in each case. Because of their complexity, it is now desired to analyze the ecological conditions of the individual biotopes in parallel with the analysis of the avifauna.

Avifauna of the pastures

Pastures of various sizes are found along the entire length of the inundation area from Tokaj to Záhony. They are generally flat or gently undulating, with filled-in river-valleys and swamp vestiges. The vegetation is the lawn-association typical of the inundation area, with *Alopecuretum pratensis* grass-meadows on their higher parts, and *Agrostetum albae* marsch-meadows on the lower, wetter parts. They are in the main tree- and bush-tree, and old *Populus nigra* residual trees are found only in a few places. The biotope is used by man as pasture, and in merely a small number of sites was the mowing of the grass observed, and in very low amounts. The molestation of the area is thus constant, but is of such a nature as is readily endured by the birds, and indeed certain species even require it. It was observed that there were practically no, or only a very few birds in the pastures where the grass was high (40—50 cm). They were associated mainly where the grass-cover had been eaten short. There may be two reasons for this. One is that the careful bird can in this way keep a watchful eye on the environment, which offers little protection, and can flee in time. The other is that the food can more easily be collected in the short grass.

The recordings revealed 31 bird species on this biotope. Of these, only 8 species (23.6%) were nesting, the other 23 species (76.4%) merely visiting the area to feed. The distribution of the species is given in Table 1, where the non-nesting species are denoted by +.

The bulk of the breeding species and pairs on unit area (25 ha) exhibit relatively high constancy: degree III—V. This confirms that they are in perfect harmony with the area. For this reason too, the number of pairs here is higher: 2—3/25 ha.

Table 1. *Bird species observed on the pastures and their constancy relations, referred to an area of 25 ha*

No.	Species	Nesting pairs per 25 ha	Constancy degree
1	<i>Ardea cinerea</i> L.	+	II
2	<i>Egretta garzetta</i> L.	+	I
3	<i>Ciconia ciconia</i> L.	1	I
4	<i>Ciconia nigra</i> L.	+	I
5	<i>Anas platyrhynchos</i> L.	+	I
6	<i>Accipiter gentilis</i> L.	+	I
7	<i>Buteo buteo</i> L.	+	I
8	<i>Falco subbuteo</i> L.	+	I
9	<i>Falco vespertinus</i> L.	+	I
10	<i>Falco tinnunculus</i> L.	+	III
11	<i>Perdix perdix</i> L.	1	III
12	<i>Coturnix coturnix</i> L.	1	III
13	<i>Phasianus colchicus</i> L.	+	I
14	<i>Vanellus vanellus</i> L.	3	III
15	<i>Asio otus</i> L.	+	I
16	<i>Merops apiaster</i> L.	+	I
17	<i>Coracias garrulus</i> L.	+	I
18	<i>Alauda arvensis</i> L.	2	V
19	<i>Hirundo rustica</i> L.	+	II
20	<i>Riparia riparia</i> L.	+	II
21	<i>Corvus cornix</i> L.	+	V
22	<i>Corvus frugilegus</i> L.	+	V
23	<i>Coloeus monedula</i> L.	+	I
24	<i>Pica pica</i> L.	+	II
25	<i>Saxicola torquata</i> L.	1	I
26	<i>Motacilla alba</i> L.	+	II
27	<i>Motacilla flava</i> L.	+	I
28	<i>Sturnus vulgaris</i> L.	+	III
29	<i>Carduelis carduelis</i> L.	+	I
30	<i>Emberiza calandra</i> L.	1	II
31	<i>Emberiza citrinella</i> L.	+	I

Taking the averages of the individual recording areas as basis, it was found that in general there are 3.1 species per unit area, represented by 5.3 pairs. This means on average a biomass of 2026 g; behind this there is a very large spread, depending on the disturbance to the area, and over what extent. On the long, narrow pastures, for example, far fewer species were found. If the species arriving to feed are also included, then these values increase of course. The number of observed species becomes 8.5, and the value of the biomass 45262 g. There is similarly a large spread here. This is mainly due to the fact that the crows do not seek out every pasture, but only those close to habitations.

As a result of its special nature, the biotope is favourable for those species nesting at ground level. 7 of the nesting species (87.1%) and 10 of the pairs (91%) breed their young on the ground. There was only one species, *Ciconia alba*, which represented the species nesting at tree-foliage level; this nested on a very large poplar in one of the pastures. The terricolous species therefore enjoyed absolute dominance.

The distribution of the species according to feeding is very interesting. Here too a separate study was made of the nesting species and those arriving only to feed. The relevant data are given in Table 2.

The nesting species could be allocated to three categories. The most significant of these were the insectivore and herbivore species; the only carnivore species was

Table 2. *Distribution of the species on the basis of the food consumed*

Feeding form	Nesting species			Feeding species	
	no.	%	wt. % g/25 ha	no.	%
Carnivorous	1	12.5	73.4	8	34.8
Insectivorous	4	50.0	15.5	8	34.8
Herbivorous	3	37.5	11.1	4	17.4
Mixed-feeding	—	—	—	3	13.0

Ciconia alba L. It can also be seen from Table 2, and the earlier biomass data too are indicative of this, that a very important role is played in the turnover of the biological matter in the pastures by the species arriving only to feed. By this means food passes out of the area, is incorporated into the communities of other biotopes, and is converted into new living matter and biological energy. This phenomenon makes the ecosystem of the pastures open, and underlines the assumption that the birds primarily treat these areas as feeding grounds. The areas demand a considerable degree of adaptation to the special conditions on the part of the nesting species, and as we have seen few of the species are capable of this. This is perhaps the reason why no species was observed, either among the nesters or among the feeders, which occurred in every pasture area. Thus, the value of the species-identity was obtained as zero. In contrast, the value of the life-form-identity (feeding-form-identity) turned out to be 25%.

Avifauna of the orchards

Orchards are found throughout this inundation area of the Tisza. They occur in patches of various sizes on the right bank from Tizsakarád on, and on the left bank from Gávavencsellő on. It might be said that they comprise the most significant branch of agriculture in the inundation area. They occupy a much larger territory than the arable land. From Szabolcsveresmart to Záhony 70% of the left bank inundation area is covered by apple orchards. It must be noted at once that, regardless of whether older or younger orchards are considered, the apple is predominant. In comparison, other fruit, such as the plum, although it can be found, is present in negligible amounts. From an ornithological point of view, the orchards can come into consideration only when there is already a developed foliage on the trees. In the experience of the author, however, this can be expected only in the old, decaying orchards. As a consequence of the systematic pruning, spraying, curing and cultivation, primarily the settlement of cavity-living species can be reckoned with, and this requires old orchards. Nevertheless, because of the constant disturbance, only a very sparse bird population is established. The species arriving to feed are more significant here too. They comprised 13 of the observed 17 species (76.4%). Only 4 nesting species (23.6%) were found. The distribution of these species is given in Table 3.

On the basis of the averages average for the individual observation sites, 1 ha generally contains 1.9 nesting species, represented by 3.3 pairs. The biomass of the nesting species attained a previously never observed low level, 252 g, while with the feeding species, as seen for the pastures too, the values rise. The number of species per hectare is then 4.0, and the value of the biomass is 3500 g. This tremen

Table 3. Bird species observed on orchards and their constancy relations, referred to an area of 1 hectare

No.	Species	Nesting pairs per ha	Constancy degree
1	<i>Perdix perdix</i> L.	+	II
2	<i>Phasianus colchicus</i> L.	+	I
3	<i>Streptopelia turtur</i> L.	+	I
4	<i>Upupa epops</i> L.	+	I
5	<i>Picus viridis</i> L.	+	I
6	<i>Dendrocopus major</i> L.	1	III
7	<i>Corvus cornix</i> L.	+	II
8	<i>Corvus frugilegus</i> L.	+	I
9	<i>Coloeus monedula</i> L.	+	I
10	<i>Pica pica</i> L.	+	II
11	<i>Garrulus glandarius</i> L.	+	I
12	<i>Parus major</i> L.	1	II
13	<i>Sylvia curruca</i> L.	+	I
14	<i>Sturnus vulgaris</i> L.	2	III
15	<i>Passer montanus</i> L.	2	V
16	<i>Chloris chloris</i> L.	+	I
17	<i>Emberiza citrinella</i> L.	+	I

dous difference arises from the fact that the relatively heavy pheasants, partridges and crows also gladly seek out this biotope.

It is worth noting how much better the constancy relations of the nesting species are than those of the feeding species. This may arise from the fact that the area is suitable for the former, and satisfies their demand perfectly. The latter group is only an occasional guest; it is not a standard member of the avifauna.

It was pointed out earlier that the limitations to the nesting conditions explain the poorness in species observed here. The breeding species all nest at tree-trunk level, that is they are cavity-dwellers. Only this defends the birds from the interference by large-scale treatment of the fruit-trees. If this sequence of thought is continued, it automatically emerges that by the use of artificial nesting cavities it would be possible to settle useful, insect-destroying birds in such orchards. Unfortunately, however, examples of this were not observed anywhere.

How valuable this would be can be seen from the fact that the bulk of the nesting species (75%) are insectivores, and 25% are mixed-feeders. Indeed, even on the examination of the weight dominance the balance lies in favour of the insectivores. They comprise 80% of the biomass, and only 20% is due to the mixed-feeders.

In the group of birds arriving only to feed, herbivores are present in addition to the previous two categories. The distribution of the groups is even, the insectivores comprising 31%, the herbivores 31%, and the mixed-feeders 38%.

Similarly to the previous one, therefore, this habitat is open, for the food is removed from the area by the guest birds. This fact proves that the food reserve (the production) is greater than its utilization. Accordingly, the flow of material to other biotopes is possible, and for this reason bird settlement would be necessary.

In an interesting way this habitat possesses a more uniform nesting community, if it can be termed a community at all. While the value of the species-identity on the pastures was zero, here it is 25%. The life-form (feeding-form) identity attained 50%.

The orchards thus possess a specialized, mainly insectivorous fauna of low biomass, the characteristics and biological value of which could be successfully increased by bird settlement.

Avifauna of arable land

Strictly speaking, by arable land is understood the plough-land. This is without exception flat, and can be found throughout the entire length of the inundation area. Plant production is continued on this land, but predominantly those crops which require only a short growing time. The frequent spring floods mean that it is often possible to work on these areas only later, at the end of April and in May. Accordingly, the commonest crops are maize, fodder plants and potatoes. As a consequence, the areas are uncovered in spring and autumn. At such time they do not provide hiding places, nesting sites or food for the birds. Further, in the course of the summer the continuous treatment of the plants means such a strong disturbing effect that this land is not suitable for the terricolous nesters. This biotope provides no possibilities for other nesting species.

Here too an attempt was made to make coenological recordings in a similar way as at the other habitats, but the results were so poor that the author contented himself with simply noting the observations, without reference to any unit area.

It is possible that if this biotope had been concentrated on, a nesting species too would have been found, but previous visits to this area had not revealed a single bird which could conclusively, or even with high probability, be shown to have hatched on the ploughland. The customary analyses are thus not possible here.

Based on experience, therefore, this habitat can be regarded only as a feeding ground. Altogether 4 species were observed; these were hunting for insects and collecting food on the ploughland. These species were: *Phasianus colchicus* L., *Corvus cornix* L., *Corvus frugilegus* L. and *Pica pica* L. In addition to the low number of species, there were also only few individuals. On each occasion a maximum of 1—3 specimens per species was seen. On the above basis it appears justified to conclude that the avifauna of the inundation area does not play a significant role in the biological protection of the ploughlands in this area. For just this reason the food material produced here is not appropriately utilized. The thought may arise, therefore, of the artificial breeding of game birds, which might make this biologically fairly inactive area more mobile. Pheasants raised here would be able to find shelter during the winter in the coverts of the inundation area.

Avifauna of the swamps

The extensive inundation area investigated is relatively poor in swamps. The bend cut off in the regulation of the river generally turned into swamps or became filled in. The few swamps which remained are in the main not favourable for birds, as the vegetation-free, bare banks and water-surfaces do not provide possibilities for nesting. Another continual disturbing factor is the constant fishing activity of man.

However, the area does include some swamps suitable for the settlement of birds. Nevertheless, their low number and small extents mean that their avifauna is not sufficient to influence the overall picture of the ornithology of the inundation area to any degree. The swamps are typified not by the hydrophilic, but by the mesophilic and xerophilic species. Accordingly, and also in part because of the difficulties of recording, recordings relating to a unit of area were not made in the case of the swamps either; instead, data-collecting observations were made on several occasions at 3 swamps suitable for the settlement of birds. The results obtained are reported in Table 4.

Table 4. *Bird species observed in the swamps*

No.	Species	Timár I swamp		Timár II swamp		Marótzug swamp	
		nesting	feeding	nesting	feeding	nesting	feeding
1	<i>Ardea cinerea</i> L.		+				+
2	<i>Egretta garzetta</i> L.						+
3	<i>Ciconia ciconia</i> L.				+		
4	<i>Ixobrychus minutus</i> L.		+				
5	<i>Anas platyrhynchos</i> L.		+		+		+
6	<i>Anas querquedula</i> L.		+				+
7	<i>Aythya nyroca</i> GÜLD.						+
8	<i>Circus pygargus</i> GM.		+		+		
9	<i>Fulica atra</i> L.		+		+		+
10	<i>Vanellus vanellus</i> L.			+	+		
11	<i>Tringa totanus</i> L.		+				+
12	<i>Gallinago gallinago</i> L.		+				
13	<i>Philomachus pugnax</i> L.		+				
14	<i>Chlidonias niger</i> L.		+				
15	<i>Hirundo rustica</i> L.		+		+		
16	<i>Acrocephalus arundinaceus</i> L.		+				
17	<i>Acrocephalus scirpaceus</i> L.		+				

These swamps can in general be regarded as closed ecological units. They form a self-providing and self-maintaining ecosystem, in which a significant migration of nutrient matter (as in the preceding biotopes) is inconceivable. As a consequence of their hydrophilic natures, the species living here adhere to their habitat, with regard to both nesting and feeding. This is the reason why food and bioenergy are taken to other biotopes by only a few species: *Ardea cinerea* L., *Egretta garzetta* L. and *Hirundo rustica* L.

The richness of the fauna depends on the size of the swamp, on its vegetation, and on the extent of the disturbance. Since the nesting community is strongly independent of the ecosystems of the other biotopes of the inundation area, and there is little connection via the transport of biological material, a detailed analysis is considered unnecessary.

Ornithological role of the flood-defence embankments

These form one of the most characteristic biotopes of anthropogenic origin in the inundation area. From an ornithological point of view they must be considered primarily as feeding areas, but in this respect they are very important. It emerged that certain species preferably seek out the embankments for the purpose of feeding. Similarly, they use the telephone poles and wires which are to be found everywhere on the embankments as look-out sites. This ecological combination is in all respects of human origin, and has been excellently adapted by several species to their advantage. The grass-covers of the embankments provide a very good habitat for numerous small mammals (e.g. *Microtus arvalis*), ants and other insects. These are significant as food, and attract the birds to these sites. Certain species indeed specialize on the embankments, and can almost definitely be found there at certain times of the day.

This observation stimulated the author to count the individuals of the characteristic species by proceeding along the embankment by motor-cycle. In the course

of this work, however, it turned out that a recording made in the early morning revealed quite different qualitative and quantitative relations than one prepared in the middle of the day. On all occasions, therefore, it was necessary to take into consideration the times when birds were active. For example, *Upupa epops* L., *Picus viridis* L. and *Pica pica* L. appeared in much larger numbers in the early morning recordings than in those made at around noon. On the other hand, *Lanius collurio* L. was then completely absent. It may be a matter here of the thermophilia and psychrophilia of the birds and the food. The essence is, however, that an approximately correct result is obtained if the activity period of the given species is known, and the recording is made accordingly. In this way it was found that on one section of the embankment the recording had to be made between 7 and 9 a.m., and on another between midday and 2 p.m. The survey of the birds then feeding on the embankment thus approximates to the realistic value in all respects.

Of course, the counting did not extend to all of the species on each occasion, but only to the most characteristic ones. Of these, only *Sturnus vulgaris* L. was omitted; this occurred in such large groups that it was not possible to count them from a moving motor-cycle. The results obtained are illustrated in Table 5.

Table 5. Results of band-recordings on the flood-defence embankments

No.	Species	1*	2	3	4	5	6
1	<i>Falco vespertinus</i> L.		1	1			
2	<i>Falco tinnunculus</i> L.	6	12	9		18	1
3	<i>Perdix perdix</i> L.					24	13
4	<i>Phasianus colchicus</i> L.					5	2
5	<i>Cuculus canorus</i> L.				11		
6	<i>Coracias garrulus</i> L.	12	12	8	1		
7	<i>Upupa epops</i> L.	4	14	3	9	17	1
8	<i>Picus viridis</i> L.		13	1		15	5
9	<i>Corvus cornix</i> L.					42	14
10	<i>Coloeus monedula</i> L.						30
11	<i>Pica pica</i> L.	11	32	10		65	26
12	<i>Lanius miror</i> GM.		32	33			
13	<i>Lanius collurio</i> L.			37			
14	<i>Motacilla alba</i> L.					6	2

* The data relating to the recordings are as follows:

1. From Zemplénagárd to Tiszabercel ferry, 46 km, 14 June 1972.
2. From Tiszabercel to Komoró, morning, 41 km, 15 June 1972.
3. From Komoró to Tiszabercel, noon, 41 km, 15 June 1972.
4. From Vencselló to Veremszeg swamp, 19 km, 10 April 1971.
5. From Tiszabercel to Záhony, 57 km, 9 April 1971.
6. From Tiszabercel ferry to Révleányvár, 38 km, 11 April 1972.

It can be seen from this Table that reasonably large numbers were found, and these in fact do not mean all of the birds! There can not be many problems with the utilization of the production of the embankments, and with their biological protection. As proof of this, it is possible to consider two recordings, made in the early morning and at midday, which thus provided the most useful data. These are recordings 2 and 3. Here the numbers of individuals of the observed species were calculated for a 10 km section of the embankment (see Table 6).

This means an active biomass of about 4132 g. If it is now considered that of this 3445 g relates to the insectivorous birds, which consume a very large mass

Table 6. Number of individual birds on 10 km section of embankment between Tiszabercel and Komoró

No.	Species	Individuals/10 km
1	<i>Falco vespertinus</i> L.	0.2
2	<i>Falco tinnunculus</i> L.	2.9
3	<i>Coracias garrulus</i> L.	2.9
4	<i>Upupa epops</i> L.	3.4
5	<i>Picus viridis</i> L.	3.2
6	<i>Pica pica</i> L.	7.8
7	<i>Lanius minor</i> GM.	8.1
8	<i>Lanius collurio</i> L.	9.0

because of their rapid digestion and of the indigestible chitin, then it can be understood why it was stated earlier that there can not be many problems here with the biological equilibrium.

The recordings to date have been few in number and of an informatory type, but even so they draw attention to the fact that it would be worth while to make similar recordings, extending if possible to all species, in order to obtain a satisfactory picture of the turnover of biological material in these areas.

Species observed on the river Tisza

The entire region with its characteristic ecology owes its existence to the Tisza. By means of its flood-waters and its surface-forming activity, the river has given rise to a number of biotopes suitable for the settlement of birds. At the same time, however, the river itself serves only as a source of food for merely a few birds. An attempt was also made here to carry out a regular recording, but the appearance of the avifauna was so irregular and so seasonable that this was not possible. The only choice was to record occasional observations. The river-water involves biological conditions quite unlike those dealt with so far, and it has such a strong selecting effect that only a very few bird species develop a direct connection with it. *Anas platyrhynchos* L. pairs were observed in a number of places, and on one occasion *Anas querquedula* L. was encountered. Throughout the summer individual specimens of *Actitis hypoleucos* L. were observed on several occasions, hunting for insects on the bank of the Tisza along the whole of this section. Similarly, individual specimens of *Larus ridibundus* L. and *Chlidonias niger* L. were observed as they flew above the water collecting their food. A more massive bird-movement on the water was not seen anywhere.

The individual biotopes were examined independently, and isolated from their environments, but only so that their essence could more readily be apprehended. At the same time, however, these are parts of the inundation area, a large ecosystem built up from mosaics, influenced by an almost inextricable network of close and loose connections. The aim of this investigation was to continue the work begun earlier, in order to get nearer to the ornithological problems of this biologically and economically extremely valuable area, in a search for the ways and means to enhance the forest and biological protection and the production. The work is not completed, and further observations, recordings and analyses are necessary. These will be continued next year.

References

- BALOGH, J. (1953): A zoocönologia alapjai (The fundamentals of zoocoenology). — Budapest.
- BALOGH, J. (1958): Lebensgemeinschaften der Landtiere. — Berlin.
- HORVÁTH, L. (1956): Communities of breeding birds in Hungary. — Acta Zool. Acad. Sci. Hung. 2, 319—331.
- LEGÁNY, A. (1967): Vergleichende ornithologische Untersuchungen an drei Altwässern entlang der Tisza. — Tiscia (Szeged) 3, 93—103.
- LEGÁNY, A. (1968): Erdőtelepítések madártani jelentősége (Ornithological significance of forest-plantations). — Állattani Közlemények 55, 65—73.
- LEGÁNY, A. (1970—71): Data on the ornithological conditions of the inundation area Tiszafüred-Kisköre. — Tiscia (Szeged) 6, 41—55.
- LEGÁNY, A. (1973): Adatok a felsőtiszai erdők madárvilágához (Data on the avifauna of the Upper-Tisza woods). — Állattani Közlemények 60, 79—93.
- VERTSE, A. (1955): Madárvédelem (Bird-protection). — Budapest.