

The vertebrate fauna of the Hortobágy

Introduction

The vertebrate fauna of the hortobágy will be discussed according to taxonomic order and grouped by habitat types. The taxonomic order will not be necessarily followed in case of species of higher importance or in species pertaining to some particular logical system. Although all kinds of habitats will be described, it does not replace in being familiar with the the part of the present work dealing with plants, since most of the habitat types are categories of plant associations at the same time.

1. Loess areas and loess pastures

Loess areas form a network of isolated patches due to the peculiar topography development conditions of the Hortobágy. Plant communities different from those of surrounding alkaline areas occupy nutrient-rich soils. Besides many valuable plant species some special members of the vertebrate fauna can be found in the loess areas.

Amphibians are distributed on the alkaline meadows depending on water conditions, thus higher loess-banks are occupied by them only in cases of deep water conditions. The Sand Lizard Green Lizard is the only reptile living on loess soils.

Originally Partridges, Quails and Great Bustards bred on loess banks, however nowadays they prefer agricultural areas. On the other hand the displaying grounds of the Great Bustards can invariably be found on loess meadows grazed short, since after winters with much snow these areas are the only ones remaining dry. Besides the displaying grounds are traditional - at least for some decades. Some bird species are connected to loess areas for other reasons - the quality of the loess soil is very good producing large plant biomass, which makes their grasshopper fauna very rich. As a result of it many White Storks, Red-footed Falcons, Curlews and Lapwings feed on them in late summer in dry meadows - especially in loess areas. In loess areas the most important vertebrate species is the European Souslik. This is a protected species partly because it is the main food item of Saker Falcons, Long-legged Buzzards, Imperial Eagles. The population of the Saker Falcons - the sacred raptor of the old Hungarian mythology - was less than 30 pairs in the early eighties, now this amounts to 120 pairs in the whole country with 20 pairs breeding in the Hortobágy. This population increase could be achieved by putting an end to robbing the nests by guarding them; the proportion of the population breeding in the Great Plain is continuously increasing. The population of the Imperial Eagle is also increasing and expanding in the Great Plain. However it can be seen only in migration in the Hortobágy. Long-legged Buzzards started to breed in Hungary only in the past decade with the Hortobágy being chosen first. Of course many other raptor species prey upon European Sousliks. The Steppe Polecat can also be found on loess areas which also feed on European Sousliks. It is important to note that their vicarious species can be found on the North American prairies: the Prairie Dog which is closely related to the European Souslik, the Prairie Falcon related to the Saker and the Black-footed Polecat related to the Steppe Polecat. Moles are relatively common in loess areas.

2. Alkaline meadows

Although this type of habitat is divided into three subtypes, this division is also reflected in the composition and habits of the vertebrate fauna:

- Achilleo-Festucetum and Artemisio-Festucetum meadows
- Puccinellietum and Camhorosmetum associations

It is typical for these habitats that they are flooded for a longer period varying from type to type from snow-melt to mid April. It was more pronounced before the water regulation program carried out in the second half of the XIXth century since the Hortobágy was flooded by the River Tisza three times in many years. There was another characteristic of the alkaline grasslands in the past century which is different from the present situation: it was heavily grazed. The number of grazing animals is much smaller than that in the first half of the XXth century. The areas covered by barren alkaline soil decreased a lot as a result of undergrazedness which had a negative impact on some wader species. Furthermore marshes drying out in late summer are much less grazed which resulted in a profound change in the structure of them: the marshes used for so-called grazing lakes which had barren shorelines and open water in the past became wetlands overgrown by reed and catstail with nearly having no shoreline. The positive effects of this transformation will be discussed in marshes. At any rate one of the most important tasks of the Hortobágy National Park of managing habitats is to increase the number of grazing animals and coordinate its spatial distribution in a way that results in an even distribution of grazed alkaline areas.

It seems to be strange, but fish turn up in alkaline grasslands: in flooded areas they can get to the deeper water from duck's feet - mostly False Rasbora that reached Hungary from the East not a long time ago.

Although the reptilian fauna of the alkaline areas is relatively poor, one can regularly meet Sand Lizard and Grass Snake in dry seasons. Grass Snakes and European Pond Terrapins often lay eggs on top alkaline banks.

The breeding members of the avian fauna of the Hortobágy is characterised by a small number of species with high numbers of individuals. The Quail population has fortunately strengthened a lot in the past decade. Although Great Bustards breed in alkaline areas only occasionally, most of the displaying grounds can be found in such habitats. Stone Curlews nest on totally barren alkaline spots. Its population is stable with 20-25 pairs. The Collared Pratincole is one of the few species that have disappeared from alkaline grasslands in the past decade since the barren alkaline areas have decreased a lot because of the lack of grazing. They are occupying now agricultural areas. The Kentish Plover has disappeared because of the same reason, however it did not move to arable lands since it needs the proximity of water as well. Anyhow breeding attempts can be observed in some years. The Lapwing is a common breeder, although its population has much decreased in the past few decades. The Sky Lark is probably the commonest passerine of the Hortobágy: its population density reaches two pairs per hectare in some areas. The Short-toed Lark, which was previously thought to be a subspecies endemic in Hungary has disappeared from the Hortobágy as a breeding species in the late nineties also because of the lack of grazing. It was in the same period that an important population of probably some hundreds of pairs was discovered in sandy-loessy agricultural fields in Eastern Hungary. This species originally breeds in stony-sandy semideserts, so the Hortobágy was occupied by them when it was grazed the most intensively. On the other hand it breeds in similar agricultural areas in Europe. The population of the Tawny Pipit is increasing, mostly in alkaline areas close to unploughed arable lands. The number of birds migrating and feeding in the alkaline grasslands is very spectacular: in springs when large areas are flooded, like in the flooded periods of 1999-2000, grebes, cormorants, herons, egrets, geese, ducks, waders and gulls feed in the shallow waters of greater pools. In the two years mentioned above a large area of alkaline grassland used for water reservoir in flooded areas was occupied by more than three thousand pairs of marsh terns. All three species of marsh terns bred there with more than 2000 pairs of White-winged Black Terns in the year 2000, which is usually an invasional breeder in small numbers. The post-breeding gathering of some species is also very spectacular in late summer: the grasslands are covered by large flocks of White Storks, Lapwings, Curlews, Black-headed Gulls and Yellow-legged Gulls searching for grasshoppers. A small part of the grasslands in the southern part of the Hortobágy is known as the only known continental moulting-place of Dotterels breeding in Scandinavia. Up to 250 individuals spend here some weeks from mid August to mid November. Large flocks of sometimes many thousands of Golden Plovers migrate mostly in late autumn and early April.

The grasslands are very similar to the tundras in wintertime not only as a landscape but regarding the species composition of wintering bird communities: sometimes a couple of dozens of Hen Harriers are hunting in a grassland, White-tailed Eagles are sitting near a carcass found by themselves or found in 'eagle-tables'; large flocks of Twites are circling around twittering continuously; here and there smaller flocks of Snow Buntings and Meadow Pipits flush from a hunting Merlin; Lapland Buntings rush in *Pholiurus pannonicus* grasslands; after sunset only Short-Eared owls fly around with noiseless wingbeats.

Mammals are represented by only a few species, but by large numbers of individuals in the alkaline grasslands. Eastern Hedgehogs and mole-casts can often be observed in dry areas. Shrews are represented by mostly the Bi-coloured White-toothed Shrew and Lesser White-toothed Shrew in these habitats. Bats also migrate in alkaline grasslands: mainly Common Pipistrelle and Noctule Bat. The Brown Hare population is slightly increasing. In years of Common Vole gradation large quantities of prey is provided for White Storks, Common Cranes and raptors. The Red Fox is very common because of the lack of wolves; the population of Eurasian Badgers is heavily increasing. Golden Jackals expanding from the South could have also been observed in the past few years in the alkaline areas of the Hortobágy. The population of Roe Deers could not have so far overcome the population decrease caused by poaching during the change of the political system. The Red Deer is expanding from the mountains down to the lowlands, so it is more often to be observed in the grasslands.

3. Marshy meadows and marshes

The Hortobágy was the temporary floodland area of the Tisza up to the middle of the XIXth century - i.e. the start of the water regulation programme - so that marshes and higher areas in larger floodings were flooded.

The transition between alkaline grasslands and marshy meadows is sometimes sudden,

sometimes continuous. The marshy meadows are the former oxbows of ancient rivers filled up to different degrees. The depth of water can be between 5-50 cm in them. They are characterised by temporary floodedness, thus they dry out in mid or late summer in years of average precipitation.

Large concentrations of amphibians can be found in marshy meadows: incredible numbers of Common Spadefoots, European Tree Frogs, Fire-bellied Toads, Green Toad, Smooth newt and Warty Newt lay eggs here. Reptiles like Grass Snakes and European Pond Terrapins also used to feed in these habitats. Marsh Harriers are regular breeders in marshy meadows, while Montague's Harriers breed in small numbers here. Spotted Crickets are regular, or locally common breeders, which can be easily recognised by its whistling call. The Baillon's Cricket is very rare and breed in the shallowest zone of the marshy meadows. Little Crickets prefer

the deepest parts of marshes with scattered stands of cat-tail, thus more common in fishponds. The characteristic breeding species of the marshy meadows are waders: Lapwings, Black-tailed Godwits, Common Snipes and Redshanks build their nests on the shoreline or on top of tussocks. In the barren, overgrazed parts of the shorelines of the marshy meadows Avocets and Black-winged Stilts may breed. The latter species is breeding in an increasing number. In years of vole gradation or following the fluctuations of the populations in Northern Europe invasionary Short-eared Owls breed in relatively large numbers in marshy meadows. In some years a couple of dozens may breed in the Hortobágy. These types of habitats are also effected by the undergrazedness mentioned in alkaline grasslands: tussocky habitats overgrown by tall grass are forming instead of barren, trampled marshes with open water. Accordingly the wader species mentioned above lose habitats while other - and also very important - species have the opportunity to expand: the Aquatic Warbler, the rarest breeding passerine in Europe has appeared in a few pairs in the early seventies. Now its population is over 650 singing males, which number can be many times higher in the future having large enough habitats for them. Its population is increasing only in Hungary, where the only population breeds in the Hortobágy. The Yellow Wagtail, which is one of the commonest breeding passerines in the Hortobágy, nest in marshy meadows.

After winters with much snow large areas of grasslands may be flooded in the springtime, so practically all kinds of waterbirds mentioned in the alkaline grasslands may turn up in marshy meadows. Herons, egrets, Spoonbills, Glossy Ibises, geese, ducks and waders can find here abundant food even in dry years since these habitats used to be more flooded than alkaline meadows.

The marshes of the Hortobágy were formed in former beds of floodland areas of rivers. Large areas useless for agricultural production were turned into fishponds. The remaining marshy areas are highly important habitats of the National Park. Besides marshland reconstructions were started to be carried out from the 1980-ies in the area of the Hortobágy National Park resulting in the multiplication of wetlands with the existing network of canals helping the aquatic organisms to spread out all over the area. As a result of it there is no difference between the piscine fauna of original and reconstructed marshes. However it is easy to follow the populating of them with fish.

The piscine fauna of the marshes is identified primarily by the degree and temporal characteristics of water cover. It is interesting that some individuals of species remaining after floods or introduced accidentally - mostly by birds - are almost always to be found in areas covered by temporary inundations. Characteristic species here are the Gibel Carp, Crucian Carp, Sunbleack, False Rasbora, Mud Loach. These species are rarely to be found in the same area. The Csattag -, and Hagymás - reconstructed marshes are areas like that. Low numbers of species can typically be found in stagnant, deep water bodies. These areas that are mostly covered by beds of reed, cattail, bulrush and aquatic weed are characterised by typical piscine communities consisting partly of stagnophile (Crucian Carp, Mud Loach, Sunbleack), partly invasionary and adventive (Gibel Carp, False Rasbora, Amur Goby) species. Native species occupy mostly less disturbed habitats. It is also characteristic that typical marsh species can be replaced by adventive ones in marshy areas. So it is important that regarding the piscine fauna a marshland habitat with only a few species can be very important for the nature conservation or not at all. Small-sized species connected to aquatic vegetation appear as well in constantly flooded wetlands with open water areas, e.g. Bitterling, Roach, Rudd, Tench, Perch, Redfin, Perch, but other adventive species are also characteristic (Brown Bullhead, Black Bullhead, Pumpkinseed). A typical predatory species in the marshes is the Pike. (The Kunkápolnás- and Fekete-rét marshes are areas like this).

Although the transition zone between marshy meadows and marshes is often continuous, there is a difference between them in hydrodynamics and the composition of plant associations: besides open water areas one can find stands of reed and cat-tail in marshes mixing with marshy meadow types depending on water conditions. Different grebe species prefer different depths of water and vegetation cover: Black-necked Grebes breed in shallow, densely overgrown spots, Little Grebes breed in densely covered deep water areas, Red-necked Grebes breed in sparsely vegetated and deep water areas, while Great Crested Grebes breed in almost unvegetated, deep water areas. Large colonies of Great White Egrets, Night Herons, Purple Herons and Spoonbills form in the extensive reedbeds of marshes. In the past two years with large floodings Cormorants started to breed in marshes with trees accompanying heron colonies. The populations of Bitterns and Marsh Harriers are also considerable in the marshes. Sometimes colonies of Black-headed Gulls form in marshes together with rare Mediterranean Gulls. The forming of marsh tern colonies is one of the most important events in the marshes for the nature conservation: in years with large floodings many thousands of marsh terns may breed in the Hortobágy as was mentioned in alkaline grasslands. Different marsh tern species breed in different habitats: White-winged Black Terns prefer shallow, tussocky marshy meadows, Whiskered Terns breed in open and deep water areas, while Black Terns prefer intermediate zones. Migrant species are the same which were described in fishponds and marshy meadows. Some larger, undisturbed marshes provide suitable roost-sites for tens of thousands of cranes if filled up with water in autumn.

Marshes and marshy meadows are also inhabited by birds in the wintertime: Hen Harriers and Short-eared Owls roost in tussocky marshes; the former species sometimes form roosting flocks of nearly 200 birds. Water Pipits overwinter near marshes.

The most valuable mammal species is the Otter. Since every constant waterbody is occupied by fish, sooner or later marshes filled up artificially for longer periods soon become suitable for Otters. Water Shrew and Muskrats are common in marshes. Wild Boars prefer to feed in marshes.

4. Rivers and floodland areas

The topography of the Hortobágy region was formed by the Tisza as it was its temporary floodland area. The north-western, western borderline of this smaller geographical region is constituted by the 120 km long reach of the Tisza between Tiszalök and Kisköre. This reach of the river shows middle-course characteristics: wide and flat bends are typical here. The slope of the river is around 3.5 cm/km decreasing to 2.5 cm/km near Kisköre. The river has lost most of its natural flooding characteristics since it is effected by the dams of Tiszalök and Kisköre. There is a considerable difference between the water output measured in shallow and deep water conditions, so the annual value of the water level fluctuations is very high (around 10 m). The river-bed is sandy in the flowing center, but the amount of clay is also significant. The accumulation of organic mud is also important in some sites, e.g. near rewinding whirlpools behind constructive works. This reach of the Tisza provides diverse habitats for the fish, the number of species that occur here is around 50. Majority of these species has a Euro-Siberian distribution, but the proportion of Ponto-Caspian species is also high. The most important species for nature conservation are the endemic species in the Carpathian Basin: European mudminnow, Balcan Spine Loach, Stripped Ruffe, and Balon's Ruffe, Zingel, Streber. This reach of the river belongs to the Bream sector of the upper carp region. Limnophilous species are the commonest ones which are closely connected to flowing water and reproduce in the inundations of the river. These are the Silver Bream, Pointed-snout Bream, Common Bream, Carp, Pike-Perch. Many reophilous species live here as well: White-eyed Bream, Orf, White-finned Gudgeon. The composition of piscine fauna is coloured by the high frequency of reophilous species of the Barbel sector, e.g. the White-eyed Bream, Orf, White-finned Gudgeon, Caspian Vimba, Burbot. Some species of higher sectors turn up more rarely due to floodings, e.g. the Gudgeon, Streber, Brown trout, Rainbow trout, or the typical marsh species of ox-bow lakes and artificially dug out smaller water bodies, e.g. Mud Loach, Sunbleack. Considerable amounts of artificially or accidentally introduced species occur in this reach partly due to introduction programmes, partly escaping via the draining canals of fishponds. The commonest species are the introduced Silver Carp - or mostly the hybrids of them - (*Hypophthalmichthys molitrix* x *nobilis*), Grass Carp, Black Bullhead, Brown Bullhead, or the Ponto-Caspian Tubenose Goby that appeared in the 1990-ies expanding spontaneously from the lower course of the Danube. The Amur Goby is a good example of light-minded fish introduction programmes. This species was described in 1998 and has become widely distributed up to now. This species was formerly distributed between the Amur region and Central China, 20-25 cm long and very tough.

The Lake Tisza was constructed in the floodland area of the Tisza by damming the reach of the river between Kisköre and Tiszavalk. It is the second largest stagnant water body of the Carpathian Basin with an area of 127 km². After the damming it was possible to set the river barrage of Kisköre going. The present form of the Lake Tisza is the result of a long process that resulted in the forming of water bodies differing from each other in characteristics of appearance, hidrology and hidrobiology. The Lake Tisza as a whole can be included among reservoirs of shallow lake types, but the high degree of its mosaicity is characterised by the presence of marshes, shallow lakes, large- middle- and small water-courses with Bream sections. The topography of the river-bed was significantly transformed as the result of the damming; the choking up is also considerable with the changing of the composition of the river-bed. The proportion of macrophyte vegetation is gradually increasing at the expense of open areas in the reservoir after the damming. Presently around 55 % of the whole surface of the reservoir is covered by vegetation. The most numerous species are the Water Chestnut in aquatic weed populations and the Reed in the vegetation of marshes. The cattail species Lesser Bulrush, Common Bulrush, and the Water whirgrass are typical marsh species. The most widely distributed species is the Water Chestnut, however it is important to note the presence of populations of *Nymphoides peltatae* (where Floating Heart dominates) and *Nymphaeetum albo-luteae* (where White and Yellow Water Lily are dominating) that are characteristic for the reservoir.

The changes resulted by damming and storing in the reservoir of Kisköre has considerably changed the population composition of the piscine fauna in the reach of the Tisza between Kisköre and Tiszabólna. The decrease of the number of individuals and species is generally characteristic in the river. A habitat-complex more diverse in many respects than the former one has been formed as the result of the damming but rather of the flooding, the characteristics of which were partly favourable for the reproduction of limnophilous species living in this sector, partly promoted the primer and secondary production and the increase of the piscine biomass by this means. The reach of the river in the reservoir belongs to the lower part of the Bream-zone on the basis of the species composition of the piscine fauna. Its nature conservational values are given by the uniquely diverse piscine communities that resulted in the high mosaicity of the reservoir. The piscine fauna of ox-bow lakes in the reservoir, the river-bed, and the reservoir are different because of the environmental conditions. The commonest species in the dammed bed of the river are the Silver Bream, Gibel Carp, and the commonest species of economical importance are the Carp, Wels and the Pike. The higher number of species is due to rare reophilous species, that make the fauna of this region more diverse even in our days. The number of species is less in the reservoir and the ox-bow lakes, where limnophilous species adapted to stagnant water conditions dominate Bitterling, Pumpkinseed; the Asp is also very common besides the Pike and Pike-Perch. The proportion of species connected to vegetation in the more closed water bodies of ox-bow lakes is considerable (Bitterling, Rudd, Redfin Perch) and the frequency of (Tench, Crucian Carp, Crucian Carp, Spined Loach) is also higher.

The piscine fauna of the ox-bow lakes in the floodland area of the Tisza and outside it must be separately discussed, however its outline is similar to that of the ox-bow lakes of the Lake Tisza. The piscine fauna of them is

identified by the state of choking up of the river-bed, the possibilities of water-supply and their economic utilisation. Their role in supplying the piscine fauna of the Tisza should be emphasized. It is not accidental that the quantity of the piscine fauna of the Tisza is multiplied in years with large floodings. The piscine fauna of ox-bow lakes with continuous water-supply is richer, since besides limnophilous and stagnophilous species rheophilous species get in with the supplying water, e.g. Pointed-snout Bream, White-eyed Bream, or the Chub and the Caspian Vimba that live in the Barbel-section. Only species adapted to the low level of oxygen can survive in temporarily flooded ox-bow lakes. There are only one or two dominating species in these water bodies, that are found sometimes in large numbers. Characteristic species are the Gibel Carp, Roach, Sunbleack, Bitterling, Spined Loach, Mud Loach. The composition of the piscine fauna of ox-bow lakes used for angling and the traffic of materials in the water is determined by the way of introduction.

The floodland areas are rich in amphibians: Common Toads, Common Spadefoots, Agile Frog *Rana dalmatina*, members of the Marsh-Edible-Pool Frog species family (*Rana esculenta-ridibunda-lessonae* species complex), European Tree Frog, Moor Frog, Fire-bellied Toads, Green Toads, Smooth newts and Warty Newts live here. Many reptilians live here: besides many Sand Lizards, Grass Snakes and European Pond Terrapins. The most important bird protection areas alongside the Tisza near the Hortobágy are called Lake Tisza as well as Kis-Kácsa and Nagy-Kácsa floodplain forests. Quite a few colonies of Cormorants, Spoonbills, Great White Egrets, Little Egrets, Grey Herons, Night Herons and Squacco Herons exist there. Besides Pygmy Cormorants have also started to breed in a mixed heron colony in the past few years. Nature conservation managements concentrate on breeding raptor populations, since quite a few White-tailed Eagles nest in the floodplain forests, Black Kites breed close to heron colonies besides lots of Goshawks and Common Buzzards. Several woodpecker species live here: Black Woodpeckers, Green Woodpeckers, Grey-headed Woodpeckers, Middle Spotted Woodpeckers, Greater Spotted Woodpeckers and Lesser Spotted Woodpeckers. Colonies of thousands of pairs of Sand Martins, smaller colonies of Bee-eaters and single nestholes of Kingfishers can be found in the loess-banks of the Tisza.

The birdlife of the Tisza during migration is characterised by passing and feeding flocks of geese and ducks. Many thousands of geese and tens of thousands of ducks are present in September-November, and February-March which is similar to the movements observed in fishponds.

The most valuable members of the mammalian fauna are the Beavers that appeared a decade ago in the floodland area and their population was strengthened by introduced individuals; Otters are present everywhere. Wild Boars, Roe Deers and Red Deer turn up regularly in the floodplain forests.

5. Fishponds and canals

The hydrogeography determining the topography of the Hortobágy is the result of water regulation and draining programmes influenced by agricultural and economical requirements; the latter have changed a lot in our days. Irrigation was necessary because of the considerable drying out of the region and the fact that this region is the driest in Hungary, e.g. the poorest in precipitation. This was the reason of constructing the irrigation system of Tiszalök, that receives water from the Tisza via the Keleti-főcsatorna (Eastern Main Canal) with the water flowing off from here gets back to the Tisza. Part of this irrigation system is the Nyugati-főcsatorna (Western Main Canal) branching off from the Keleti-főcsatorna and running alongside the northern borderline of the Great Plain that provides water for the agricultural areas of the western part of the Hortobágy.

The water-courses of the Hortobágy are mostly artificial and straight with small inclination and water output. These are supplied directly or indirectly from the Keleti-főcsatorna that is the main thing of the system constructed for lightening the economical problems of Eastern Hungary regarding demands of water. Presently the only natural water-course is the Hortobágy river that has lost most of its natural characteristics because of the water regulation programmes. The diversity of habitats of the man-made water-courses of the Hortobágy are small - including the Keleti and Nyugati Main Canals and the Hortobágy -river as well - since these are artificial. The most important habitats are the vegetation bordering the banks and the heaps of stones around flood-gates. This vegetation is characterised by macrophyte bordering with reed dominating in it. Besides Water whirgrass Great-sweet-grass and cattail species Lesser Bulrush, Common Bulrush, (*Typha laxmanni*) can also be found here. The canals are characterised by floating and fixed aquatic weed communities with different degrees of cover depending on the quality of the eutrophication process; the most important elements of it are the Yellow Water Lily, the submerging shoots of Branched Bur-reed, a pondweed species Loddon Pondweed, Hornwort Rigid Hornwort, Frogbit, Floating Fern, Great Duckweed and Duckweed Common Duckweed. The piscine fauna of them is determined by the distance from the Tisza and the Keleti Main Canal, their connection with other water bodies (e.g. fishponds), the quality of influent or infiltrating water, the speed of water, the river-bed and the vegetation cover of the edge of the banks. Regarding the above facts the fauna of smaller water bodies are poorer in species and mostly constituted by euryecious species living in Hungary or adventive ones tolerating disturbance.

The number of piscine species are the highest - altogether 42 - in the Keleti and Nyugati Main Canals among the artificial water-courses of the Hortobágy. The piscine fauna of the Keleti Main Canal is richer that is indicated by the presence of species with special habitat requirements. Such species are the rheophilous Barbel, Caspian Vimba, Nase, Zingel and Volga Pikeperch, or the stagnophilous European Mudminnow, Crucian Carp and Mud

Loach. The effect of the decrease of the speed of water on the piscine fauna of the given water body is clearly indicated by both canals. In consequence of the continuously decreasing speed of water there are differences between the piscine fauna of the reaches of both canals. The frequency of reophilous species is decreasing downwards or their occurrence is becoming isolated to be more precise, therefore they occur in oxygen-rich areas near flood-gates where the speed of water is higher. The proportion of species tolerating currents is decreasing downwards. The frequency of the Silver Bream, Bleak, and is greater in the upper reaches. The proportion of Balon's Ruffe and White-finned Gudgeon are larger here. The proportion of species connected to vegetation is increasing towards the lower reaches. The proportion of the Bitterling, Redfin Perch and the Tench characteristically increases. Some species occur in similar proportions in the whole longitudinal profile in consequence of the quasi-stagnant water conditions at the bordering vegetation of canals, e.g. the Roach, and Rudd. The proportion of the Pike-Perch and the Pike, is high among predatory species but the Wels is also common. The piscine fauna of smaller irrigation canals is more simple, the number of species living here is around 15-20. The commonest ones are the Roach, Bitterling, Bleak, *Perca fluviatilis*, as well as the Pike. The piscine fauna of irrigation canals can be modified by fish introductions, the speed of water and the vegetation as well. The proportion of the Carp, the Silver Carp and the Grass Carp.

The supplying canals of fishponds are more lacustrine, but stagnophilous species can occur in higher numbers. This is the result of direct and indirect effects of fishponds determining the structure of the piscine fauna of these water bodies. Escapes and introductions are considered as direct effects. As a consequence of it the proportion of the False Rasbora, Gibel Carp, a Brown Bullhead, the Grass Carp and Silver Carp is much higher than in irrigation canals. Indirect effects are caused by higher concentrations of organic material coming from the fishponds. In consequence of it the vegetation cover of draining canals can be as high as 100 %. The forming of piscine communities in marshes with small number of species are caused by it in such waters. The characteristic species here are the Roach, Bitterling, Gibel Carp, Sunbleack, Spined Loach and Mud Loach.

The piscine fauna of the Hortobágy differs from that of the irrigation canals in many respects. Partly the diverse habitats result in diverse piscine fauna, partly the natural piscine fauna is modified by artificial effects. The river suffers from industrial contaminations from time to time since all watercourses arrive here in the region, but the fish can be often killed by large quantities of organic material of agricultural or communal origin as when letting it flow in. The piscine fauna of the river is further modified by the fish coming from the draining canals of fishponds. In consequence of the contaminations there is no constant piscine fauna in the upper reaches of the Hortobágy-river (above the Kadarcs-Karácsonyfoki canal). The species occurring here, the Roach, False Rasbora, Bitterling and the Gibel Carp indicate disturbed or unfavourable environmental conditions of water. The number of species and individuals of the piscine fauna suddenly increases below the Kadarcs-Karácsonyfoki canal. The piscine fauna is identified by fish introductions and fish that come from the draining canals of fishponds up to the Nine-arches Bridge. The proportion of the Carp and both Silver Carp species or rather their hybrids Silver Carp is increasing here. Below the bridge the commonest species are the reophilous Silver Bream and the False Rasbora and Gibel Carp as the result of the Borsósi- and Malomházi-fishponds. The fluvial characteristics are emphasized by the more common occurrences of the Chub, the small frequency of the Bitterling and the Rudd. A dominant predatory species in the area is the Pike-Perch. It is important to note, that this reach is effected by agricultural contamination. Therefore lots of dead fish were observed in 1997 and 1998.

The fish production in fishponds is more than one hundred years old. The first fishponds - the central fishponds nowadays - started to work in 1918. The presently used, 6000 ha large area of the fish farm was created by the building of many more fishponds in the 1950-ies and 1960-ies including more than 80 fishponds of eleven fishpond units and situated in the northern and central part of the Hortobágy. The fishponds were created by building dykes around former marshes. The environmental conditions of the surrounding areas are effected by the fishpond in consequence of their large size; however their real conservational value is given by their ability to provide habitat for breeding and migratory bird species connected to water. The diversity of their populations forms and survives for a long time in consequence of fishpond managements. The ecosystems of fishponds, which is different from natural ones - come into existence in consequence of fishpond management during fish production. It is characterised by the level of trophicity held at a higher value by extracting considerable part of the input organic material when catching out the fish. Thus this system is in a quasi-balanced ecological state in opposition to natural wetlands. (Of course it should not be ignored that the water flowing away from the fishponds contains large amounts of organic material that results in the accumulation of nutrients in natural wetlands receiving the water.) Therefore the predomination of planktons is an important characteristic of the fishponds, the life of which is based on dissolved nutrients easy to intake. This state is maintained by the piscine populations themselves, artificial inventions provide only primary conditions (e.g. cutting the aquatic weed, fertilizing). It is clearly indicated by the fact that homogenous reedbeds and short willow associations form in filled up lakes without fish populations. Large populations of all members of the food chain form in the consequence of the increased nutrient input supporting large quantities of animals and plants. Other peculiarities of the fishponds also differ from those of natural wetlands: annual draining, the succession of filling them up, since these are annual events and the different states of habitats (dry, deep water or shallow water conditions) can be observed simultaneously, in a relatively small area and generally last for longer periods.

The piscine fauna of the fishponds is obviously identified by introductions. Three-years cycles are typical in Hungary: in the first year young fish of 20-100 g, in the second year breeding fish of 200-500 g, and the third year

marketable fish of 1000-2000 g are produced. The fishponds are populated by mixed populations, which means that different fish species of the same ages are put into the fishponds: about 65% Carp, 30-35% Silver Carp, Grass Carp, and a small proportion of predatory species Wels, Pike-Perch, Pike).

The natural fauna of the fishponds is constituted by the young fish that gets in from supplying canals during the filling up. The commonest species are the Gibel Carp, False Rasbora, Brown Bullhead and Black Bullhead, in relatively large numbers: Roach, Rudd, Silver Bream, Common Bream, Ruffe and Redfin Perch. The Mud Loach and the Tench are characteristic in reedbeds. It is interesting that there could be a large difference in the frequency of different species due to the different timing of the filling-up process, thus the young of different species can get into the fishponds.

The borderlines of fishponds with stands of reed and catstail which are the most important habitats for amphibians: one of the few habitats for Common Toad which is rare in the Hortobágy. The Common Spadefoot *Pelobates fuscus* is relatively common on dykes. Large numbers of Fire-bellied Toads, many European Tree Frogs and Moor Frogs *Rana arvalis*, Smooth newts *Triturus triturus* and Warty Newts *Triturus dobrogensis* live in shallow zones near dykes in fishponds. Members of the Marsh-Edible-Pool Frog species complex (*Rana esculenta-ridibunda-lessonae* species complex) prefer deeper water.

Although there are just a few species of reptiles living in the Hortobágy, the number of individuals is quite high which makes them an important group of animals. Large numbers of Grass Snake live in fishponds, while European Pond Terrapin is locally common. Sand Lizards can be regularly observed on dykes.

The most important conservational values of the fishponds is constituted by birds in the Hortobágy. There are 380 species of birds observed so far in Hungary, with 325 species accepted for the Hortobágy. There are 266 species recorded in Hortobágy-Halastó fishponds with 68 breeding species. One of the most important types of nature conservational values are heron colonies. All European heron and egret species except for the Cattle Egret, Spoonbills, Glossy Ibises and Pygmy Cormorants breed in these colonies. One of the largest Spoonbill-colonies in Europe can be found in the Hortobágy in the reed-islands of fishponds. The total population of Spoonbills is around 4-500 pairs in the Hortobágy. The population of Great White Egrets in Hungary was less than 30 pairs in the early eighties. Nowadays there are more than 800 pairs only in the Hortobágy. While the population of Glossy Ibises is very much fluctuating, the population increase of the Pygmy Cormorant is really wonderful: it started to breed in 1991 in one of the wooded reed-islands on treetops (2 pairs); its population started to increase rapidly in the following years reaching 110-120 pairs in 4-5 colonies in the Hortobágy. Accordingly 840 (!) birds were observed at the peak of autumn pre-migration gathering in late October in a roost site in 2000. In the past few years some successful breedings were observed in other spots in Hungary possibly due to the population increase in the Hortobágy. Although one of the most important Moustached Warbler areas in Hungary can be found in marshes of the Hortobágy, some dozens of pairs breed in catstail-stands of fishponds. This is a species distributed in Southern Europe. The breeding populations of Little Grebes, Great Crested Grebes and Greylag Geese - the only breeding wild goose species in Hungary - are also considerable. One of the strongholds for breeding of the highly endangered Ferruginous Ducks can be found in the Hortobágy. Otherwise large part of its European breeding population is concentrating in Hungary itself. The Marsh Harrier, one of the commonest raptors of the Hortobágy breed in reedbeds. Waterrails and Little Crakes are regular breeders in stands of catstail. Colonial Whiskered Terns build their nests on floating vegetation - mostly on Water Lily and Floating Heart. Some hundreds of pairs breed in open water bodies of fishponds. Bearded Tits and several species of reed warblers breed in large densities in reedbeds: besides Moustached Warblers mentioned above Savi's Warbler, Sedge Warbler, Reed Warbler and Great Reed Warbler. Penduline Tits breed on willow trees alongside dykes.

The importance of fishponds for breeding species is similar to that of migratory species. This is facilitated by the draining of fishponds: large fishponds can be fished only if there is a smaller and deeper part of the fishpond - so-called fish-beds - where all fish are forced to swim into when draining the fishponds, so that they can be caught by nets. The muddy bottom of fishponds full of organic material is revealed by the time of draining coinciding with the peak of autumn migration. These mudflats full of invertebrates provide abundant food resources for large numbers of migrating birds.

The roosting of Common Cranes in fishponds has become an event of European importance because of drainings, since up to 55 thousand Cranes roost in drained lakes. It can be explained by the fact that Cranes choose only undisturbed, large wetlands with shallow water in them not to be approached unnoticed by humans and terrestrial raptors. It is also important to note that only 3,000 Cranes were observed in the early eighties during the peak of migration - late October - in roost sites in fishponds. This number has increased to 65 thousand in the early nineties and stabilized after that. A wintering site and migration route of many cranes ceased to exist some years before near the Black Sea. The reason is unknown. This new strategy may have developed based on the banning of wildfowl hunting in fishponds, the timely draining of fishponds and the existence of abundant food resources. These conditions are constant for more than ten years. The first larger flocks of cranes arrive in the first half of September staging here up to the first long-lasting frosts or late November. Their spring migration is more dynamic: often without stopping since the first ones arriving in the breeding grounds occupy the best habitats thus having larger expected breeding success. Lastly it is important to mention that the number of oversummering birds consisting mostly of immatures is increasing from year to year: in the year 2000 it was above 600. Besides it is a widely known fact that the breeding population is increasing

everywhere in Europe indicating the possibility of breeding in Hungary in the future. Movements of other species are also very spectacular in the fishponds: the migration of wild geese, ducks and waders. Geese used to return with the melting of the ice in the springtime and leave for their breeding grounds in Northern Europe not later than mid April. Larger amounts of them pass over in springtime in the Hortobágy (max. 200 thousands) than in autumn (max. 50 thousands). More than 60% of migratory geese are Greater White-fronted Geese, while Greylag Geese and Bean Geese are also common. More and more Red-breasted Geese turn up in migration (a flock of 72 geese in 2000). The Hortobágy provides suitable feeding and roosting sites for highly endangered Lesser White-fronted Geese, however its population is unfortunately decreasing (max 50-60 individuals).

The migration of ducks is also spectacular: it lasts from ice-melt to early May in springtime and from late August to the freezing of lakes in the autumn. The greatest part of swimming ducks consists of Mallards, Teals sometimes in flocks of tens of thousands, while other swimming ducks like Garganeys, Shovelers, Pintails, Wigeons and Gadwalls turn up in flocks of hundreds. The commonest dabbling duck is the Pochard, Tufted Ducks and Ferruginous Ducks in post-breeding gatherings can be seen in smaller numbers. Scoters are only accidental in the Hortobágy in late autumn.

The peak of wader migration lasts from early April to late May and from mid August to mid October. Tens of thousands of them are attracted to mudflats of drained fishponds. It is highly important for them to feed and stage for a while in the Hortobágy since the fat reserves for supplying energy for covering thousands of miles between the breeding grounds in the far North and the wintering grounds can be refuelled abundantly here. Of course this is true for many other migrating species. The commonest migrant waders are Black-tailed Godwits and Ruffs in springtime while Lapwings, Curlews and Dunlins are commonest in autumn.

Similar to waders gulls also prefer drained fishponds. Large flocks of Black-headed Gulls sometimes amounting tens of thousands used to roost in such fishponds like Yellow-legged Gulls do. Many individuals of the latter species stay in the fishponds during the day feeding on shells.

Although fishponds and dykes are not especially wooded habitats, the rows of trees on dykes serve as excellent ecological corridors for passerine species connected to forest associations during migration. The largest numbers of passerines are consisted of Starlings: several tens of thousands of them roost in the reedbeds of fishponds making a large noise.

Although some species migrate in smaller numbers, their presence is characteristic in the birdlife of the Hortobágy. One can meet divers, swans, Smew, Red-breasted Merganser and Goosander. Ospreys are regularly to be seen in migration.

The birdlife of the fishponds in the wintertime is of a different mood: sometimes more than twenty White-tailed Eagles can be observed feeding on fish on frozen fishponds. It is also in the winter that Bitterns can often be observed near smaller unfrozen parts of the lakes. Flocks of Bearded Tits and Penduline Tits search for food among frost-covered stalks of reed.

The most protected mammal species of the fishponds is the Otter, which has fortunately occupied all possible habitats, thus its population is stable for more than a decade. According to owl pellet analysis Bi-coloured White-toothed Shrews and Water Shrews occur near fishponds. One can meet Common Pipistrelle and Noctule Bat drinking from fishponds during migration. The population of introduced Muskrats has decreased a lot in the past decade. Stoats, Weasels, Western Polecats, Red Foxes, Wild Boars and Roe Deers turn up regularly on dykes. It is interesting that among mammals only Stoats prefer the dykes of fishponds and canals and it is very uncommon to meet it anywhere else.

6. Rice-fields, goose-, duck- and sewage farms

Although these habitats are the results of rude transformations and destroying of Nature, many conservational values are carried by them, thus they should not be omitted from the list of habitats of the Hortobágy. The construction of rice-fields was carried out mostly in the fifties. The job was to divide large areas of sometimes hundreds of hectares to small rectangular parts of sometimes only one or two hectares. As a result of it a total of more than 1500 kilometers of dykes were created in the National Park. Natural waterways are obstructed by these dykes which results stagnant water on barren alkaline areas in some spots or makes marshy meadows drained in other areas. It is among the medium-term goals of the National Park to plane them. However rice-fields of a couple of hundreds of hectares are still in use near Karcag in non-protected areas. Unfortunately geese- and duck farms still existed in the first ten years in the life of the National Park. Considerable damage was made by them by destroying original vegetation as well as causing immense concentrations of organic material in the soil. These areas need many decades to recover. The sewage-farms can be found in non-protected areas with only one exception. These are not larger than a couple of hectares. All these three types are characterised by constant water and large concentrations of organic material except for rice-fields.

Its amphibian fauna is the same as found in marshes. However there is a difference in reptiles: large densities of European Pond Terrapin can be found in some sewage farms.

Rice-fields provided excellent feeding areas for herons, egrets, ducks and waders while in use. The existence of large forest heron colonies was the result of the presence of rice-fields. The present role of working rice-fields outside the National Park is to provide abundant food resources for Collared Pratincoles nesting in arable lands as well as migrating Spoonbills and herons. In some areas goose and duck farms took the role of alkaline lakes full of nutrients and with barren shorelines attracting large amounts of breeding and migrating waders similar to fishponds. Many examples of it still exist in non-protected areas. Avocets, Black-winged Stilts, Lapwings, Redshanks and Black-tailed Godwits are common breeders in habitats like this. Any wader species may turn up here in migration: large flocks of Ruffs, Black-tailed Godwits, Avocets as well as North-American stragglers. The sewage farms are totally different habitats: the water is deeper in them and also very rich in nutrients. Accordingly all four grebe species breeding in Hungary may nest in a sewage pond of three or four hectares. Colonies of thousands of Black-headed Gulls can form in them as well as large colonies of Black Terns. Large flocks of swimming and dabbling ducks turn up in sewage ponds, while Common Scoters are less common. Smaller areas with shallow water may form in sewage farms if desiccation has more stages. Communities of waders similar to that of marshy meadows may nest in habitats like this.

7. Artificial wetlands for nature conservational purposes

The first artificial floodings for nature conservation in the Hortobágy were carried out already a couple of years after the founding of the National Park (November 1975 and March 1976) based on the ornithological studies of László Vilmos Szabó who studied birds since the fifties in the National Park. The planning of floodings later were based on the results of it and experiences obtained from ornithological studies carried out in fishponds, rice-fields and duck farms. There are two main types artificial floodings:

* autumn and late-winter floodings: the role of them is to ensure flooding for the springtime; there is not always enough time for that early in the spring since e.g. Greylag Geese occupy territories already with the melting ice.

* summer floodings: these provide feeding and roosting site for Spoonbills, Glossy Ibises, herons, egrets, geese, ducks and waders in post-breeding gathering and migration.

After the first successful floodings it was thought to be necessary to reconstruct marshes, i.e. the constructing new waterways and setting them to work for marshes that have lost their natural waterways as a result of the water regulation programme. First the Feketerét-marsh was reconstructed in the early eighties. The next ones were the creation of a new alkaline pond in Angyalháza and a wader habitat from previous rice-fields. The latter one was managed by the Hortobágy Society for Nature Conservation. In the year 2000 the wetland reconstruction programme of Zám-pusztá has finished and the preparation of that of Angyalháza- and Szelencés-pusztá was started.

The amphibian and reptile fauna of the habitats mentioned above is similar to that of the marshes since the goal of these reconstruction programmes was to create marshy habitats. However they are different regarding the birds, because the vegetation structure of these marshes transform into the climax association in a few steps in the years after reconstruction, i.e. in case of insufficient grazing stands of reed and cat-tail form in the deeper parts, while shallow areas are dominated by tussocky marshy meadows. Accordingly species-rich breeding communities of waders form in the first two years: Avocets, Lapwings, Black-tailed Godwits and Redshanks nest on the shorelines, colonial White-winged Black Terns build nests on tussocks. However after two years these habitats become overgrown by dense marshy vegetation resulting in the habitat loss of waders and the forming of the first colonies of Great White Egret and the first appearance of singing Aquatic Warblers. Since it is the task of nature conservation to preserve all these species, a mosaic-like system of habitats suitable for all of them can be created and managed only by the spatial and temporal regulation of grazing in reconstructed marshes.

8. Forests

According to recent studies forests could only survive in floodplain forests in the Hortobágy. The alkaline oak forests in the National Park: the Ohati-forest, the Tilos-forest near Újszentmargita and the Malomházi-forest are alkalized floodplain oak forests. The fact that there were no trees on alkaline soils are not only suggested by geological studies, but is indicated by many 30-40 years old dying trees with dry treetops planted during the forest plantation programme on alkaline soils carried out in the communist regime. The northern part of the Hortobágy is more wooded. One can find rows of trees only alongside rivers and canals in the southern part of the National Park. In spite of the fact that all woods in the Hortobágy is planted except for the ones mentioned above many of them are important in the point of nature conservational view: lots of members of the avian raptor fauna of the Hortobágy is connected to them. One of the most important of them is the White-tailed Eagle that has appeared as a breeding species in the past few years, the Saker which occupies artificial nests or Red-footed Falcons nesting colonially in rookeries or Magpies' nests. It is important to mention that the majority of heron colonies were to be found in forests some decades ago. However more and more heron colonies moved to reed-islands and large reedbeds from year to year insofar as species formerly known as forest-breeders nest together with reed-nesting egrets, herons, Glossy Ibises and Pygmy Cormorants. This is good for the nature conservation since colonies like this can be better preserved as well as the possibilities for expansion are almost unlimited. One can meet breeding passerines mostly in oak plantations with dense undergrowth. Wood Pigeons, Turtle

Doves, Cuckoos and Long-eared Owls occupying Magpie's nests, Greater Spotted Woodpecker and Lesser Spotted Woodpecker, Tree Pipits, Blackbirds, Nightingales, Blue Tits, Great Tits, Lesser Grey Shrikes and Red-backed Shrikes are common in woods. The number of breeding Rooks has decreased from 30 thousand pairs in the seventies to less than 3,000 pairs in the late nineties. The reasons for that are quite complex and not exactly known. However mostly the intensive use of land for agricultural production, increased use of pesticides, the shooting of them up to the late nineties and collecting the young of weak populations for eating were the most important factors in the population decrease. As a result of it Red-footed Falcons formerly breeding almost exclusively in Rookeries were forced to breed in solitary Magpie's nests where the number of fledged young is smaller. On the other hand the population of Magpies increased so much - probably because of the banning of use of pesticides - that in some wooded areas dense groups of Magpie's nests formed. Besides it is also important to mention that a Magpie's nest is much more stable than that of the Rook: it is built in dense, prickly trees (generally *Eleagnus angustifolia*) close to stronger branches, roofed and the bottom of it is covered by clay, which not only makes it more difficult for raptors to approach the nest but probably generates better microclimatic conditions which may increase the breeding success - which is the most important point in nest site selection. Thus it is an important task for nature conservation to keep the population of Magpies stable where Red-footed Falcons breed so that they can find enough nests.

The mammalian fauna of forests consists of Eastern Hedgehogs, Bi-coloured White-toothed Shrews and Lesser White-toothed Shrews, Noctule Bats in holes of trees, Striped Field Mice, Wood Mice, Red Foxes, Pine Martens in larger forests, Wildcats, the largest population of which can be found in Eastern Hungary in the country, Wild Boars, Roe Deers and sometimes Red Deers; on one occasion an Elk was also observed.

9. Agricultural areas

All possible areas were ploughed in the communist regime as part of the programme 'Let's conquer the Nature!', so only smaller patches of loess soil remained unploughed. In spite of the fact that these are artificial habitats, they are important in conserving some endangered species. In years of vole gradation alfalfa fields provide excellent feeding areas for Great White Egrets, Grey Herons, White Storks, Common Buzzards, Hen Harriers and Common Cranes. The geese staging for more than three months in a year in the Hortobágy - the number of which may reach 200 thousand in spring - refuel their fat reserves needed for covering many thousands of miles. By the time of Crane migration - from mid September to the second half of November and from mid March to late April - the most important food of Cranes are the waste maize seeds left behind after harvesting. In the point of nature conservational view these feeding areas are highly significant providing abundant food for filling up the energy resources of Cranes migrating from Northern Europe at least to Tunisia. The agricultural areas are also of greater importance in saving Great Bustards: although their displaying areas can be found on natural steppe, they prefer agricultural areas when breeding or wintering. Alfalfa fields are the most suitable ones for nesting, while rape fields are used often for feeding during the winter. In cooperation with the Hortobágy Society for Nature Conservation the Hortobágy National Park helps Great Bustards by cultivating alfalfa fields for breeding and rape fields for wintering. Since Bustards are resident birds, they could be attracted to protected areas for the whole year which will hopefully result in the increasing of their population that has been stable so far. Regarding agricultural areas saving Collared Pratincole populations is also an important question, since this species formerly breeding in barren alkaline areas moved to arable lands - mostly of alkaline soil with wet parts - probably as a result of less grazing in the steppe. However it is important to note, that Pratincole populations in South-Spain breeding in highly overgrazed areas also occupy agricultural areas. In Hungary populations breeding in arable lands can only be preserved by making special agreements with farmers i.e. not to cultivate fields in the breeding season where Pratincoles nest which would result in the destroying of clutches. Thus it is necessary for saving Pratincoles to monitor agricultural areas and protect colonies in a way mentioned above besides raising the number of grazing animals and reconstructing marshes having barren shorelines. Of course many other, more common species breed: Grey Partridges prefer mostly weedy arable lands of smaller size. Tawny Pipits and Stone Curlews breed on uncultivated agricultural areas.

The mammals in agricultural areas are represented by Bi-coloured White-toothed Shrews, Lesser White-toothed Shrews, in some years large amounts of Hamsters, Common Voles, Red Foxes, Western Polecats, Wild Boars and Roe Deers.

10. Human settlements and their surroundings: villages, farms, shepherd's lodgings

Since many species with endangered ones among them live exclusively near human settlements, this sort of habitat should also be discussed. Human settlements have also significantly transformed in the past few decades: the nomadic way of rearing animals has ceased to exist that used only temporary huts and wind-shades made of reed and were replaced by concrete-based buildings like summer lodgings for the shepherds, barns and large farms with walls made of brick. Accordingly species preferring the proximity of man appeared in the puszta. White Storks nest on chimneys of many farm-buildings and barns. The roofing of abandoned barns are sometimes occupied by Kestrels. At least one pair of Little Owl can be found almost in every barn. 8 to 10 pairs of Barn Owls breed in the Hortobágy in the lofts. Hoopoes regularly nest in farms. Crested Larks are characteristic passerines in farmyards. While sometimes a couple of dozens of pairs of Swallows breed in a barn, Mouse

Martins prefer large farm-buildings. White Wagtails and Northern Wheatears breed in the neighbourhood of almost all buildings in the puszta. Most chimneys in the puszta with its hole left open are occupied by Jackdaws, while roofings are inhabited by Starlings. Invasory Rose-coloured Starlings appear in intervals of a couple of decades and may breed in up to two thousand pairs - like in 1994-1995 - in roofings of barns, houses, old Russian army buildings, bridges and heaps of stones.

The mammals near human settlements are represented by Beech Martens in the lofts, European Squirrels and Western Polecats around the houses besides rats and mice.