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Wintering ecology

Lesser Spotted Eagle and Red-billed Quelea

The survival of the Lesser Spotted Eagle in Germany, threatened with local extinction, is dependent not only on the conditions in the breeding area but also in the passage and wintering regions. Until a few years ago data and observations from the latter were scarce. Since 1992, within the framework of a long term project by the World Working Group on Birds of Prey, 88 Lesser Spotted Eagles were tagged with satellite transmitters in order to study their migration and wintering behaviour. In parallel, in the various countries where the bird spends the winter, principally in South Africa, Namibia and Zambia, ornithologists conducted on-site studies that included the species' wintering behaviour, diet and local ecological conditions.

Our first visit to locate wintering Lesser Spotted Eagles was made to Zambia where, according to satellite fixes, many birds spend the winter months. We were however astonished to find hardly any Lesser Spotted Eagles. Only after we searched for the wintering area of a male bird, which unusually for the species had only a small home range that we visited in subsequent years, did we discover that most of the birds spend the winter together in communities of hundreds to thousands of individuals. The discovery of such a gathering of the species is almost impossible without the use of telemetry.

Satellite telemetry as a means of studying wintering ecology

The telemetry studies show that Lesser Spotted Eagles usually cover vast distances during their wintering stay in Central and Southern Africa, although it is difficult to comprehend what ecological conditions cause this behaviour. The birds fly mostly very rapidly over vast distances, making attempts to follow and directly observe them impossible (DER FALKE 2009, H. 10).

The evaluation of telemetry data on habitat use in the wintering area by a Lesser Spotted Eagle pair, combining a blend of location fixes with satellite images, established that the birds visited three different habitat types. The largest proportion was represented by cultivated areas (29 %) followed by natural habitats such as open deciduous woodland (27 %) and bush with individual deciduous trees (25 %). Open bush (10 %) and dense woodland (4 %) were also used but to a lesser extent.

According to observations by ornithologists in Africa, the Lesser Spotted Eagle prefers areas after rain has fallen. The relevant literature states in the main that "they follow the rain fronts". Apart from sporadic observations, there is no evidence in the form of systematic studies that this is indeed the case.

The results of the first evaluations of satellite fixes of four Lesser Spotted Eagles support this thesis however. The study looked at whether regional vegetation conditions and their seasonal variations influence the choice of habitat. For this purpose NDVI data (Normalized Differentiated Vegetation Index) from the NOAA-AVHRR-Satellite platform was used. The NDVI is a non-dimensional index

between the values 1 and -1 that depicts the proportion of green vegetation using the different absorption rates of chlorophyll in the red (xred) and infrared (xnir) light spectra. High NDVI values indicate a high proportion of green vegetation. The NDVI data lie within a spatial resolution of 8 x 8 km and are available as 10 day composite periods. Every 10 days a mean value per pixel is calculated in order to exclude cloud cover.

A blend of telemetry data with the 10 day NDVI maps provided indications on the influence of vegetation density on wintering behaviour. From these it can be deduced that the Lesser Spotted Eagle favours visits to regions where it has rained a short time previously. The lusher vegetation probably offers the birds more food resources (insects). Studies by other researchers also showed a positive relationship between precipitation in African savannah and grassland areas and insect abundance. This fluctuating availability of food in Africa has an influence on birds of prey in particular. In the wet months, semi-arid areas provide very good dietary conditions with a food surplus. Following precipitation there is an increase in numbers of termites, grasshoppers and small vertebrates, whose life cycle is adapted to these fluctuating climatic conditions.

The Lesser Spotted Eagle's winter diet

There have been no systematic studies on the Lesser Spotted Eagle's diet in its wintering areas. On 11 February 1994, in Northern Namibia, we caught an almost adult female, 1920 g in weight, in order to fit it with a transmitter. The bird's large crop was full of frogs. Small mammals, birds and reptiles are probably also part of the species' dietary spectrum. In the relevant literature however, the diet primarily consists of termites and the young of the weaver bird.

Termites are taken as prey as they fly out of their often enormous nest towers. These are males and females, poor flyers, which are potential new kings and queens and founders of new termite colonies. Until they leave the nest, in the larvae state they are particularly well fed within the colony, accruing several months of fat reserves. They are therefore particularly nutritious. They fly out usually at dusk shortly after rainfall. The eagles wait on the ground outside the nest entrances and catch the termites as they depart. We were able to observe this very effective behaviour by Lesser Spotted and Steppe Eagles in great detail in the Kruger National Park.

Grasshoppers, but locusts only exceptionally, probably also represent a regular food source. The phenology of the different species is different, so that some species are very common in any season of the year.

It is of course assumed that food availability is the decisive factor determining movement within the wintering area. Habit undoubtedly plays an additional role, as many birds use the same area year after year and behave in a similar fashion. This was true in the case of an adult female, the first Lesser Spotted Eagle to be fitted with a GPS-capable transmitter, which has spent to date six winters in the same vast area the size of Bavaria in Northern Namibia and North-western Zimbabwe (DER FALKE 2009, H. 7). Other individuals cover even greater distances, but a few birds have only a very small winter home range.

Observations in a Red-billed Quelea breeding colony

During a stay in South Africa in January 2010 we were informed of a large Red-billed Quelea breeding colony in the Kruger National Park where many Lesser Spotted Eagles spend their time. Visitors to the National Park, one of the oldest and largest in the world, are not normally permitted to leave the prescribed tracks or to dismount from their vehicles. After being issued with a special permit to enter the colony on foot, we decided to observe closely the feeding Habits of the Lesser Spotted Eagles in the colony, as practically no detailed reports exist on this matter.

The colony (coordinates 23°27' S/31°26'E, 381 m a.s.l., habitat 'mopane shrubveld') is located seven kilometres north-east of Camp Mopani and is some 12 kilometres from the Mozambique border. The colony covers an area of about 4 km². The Red-billed Quelea breeding pairs must number several hundred thousand, if not over a million birds. We estimated that some 2,000 eagles were present. Of these some 90 to 95 % were Lesser Spotted Eagles, with the remaining 5 to 10 % Steppe Eagles.

The eagles spent most of the time on roost trees. As a rule these were the tallest trees, mostly dead or with dead branches in the crown, in which we counted up to a total of 15 eagles. Some 2 hours after sunrise, about 7.30 am, many of the birds began circling.

The birds could be observed feeding at almost any time of day, although less frequently in the hot midday hours. The prey was clearly only the nestlings of the weaver birds. Some nests contained up to four young.

During feeding the eagles were very cautious and shy and therefore not easy to observe. This was undoubtedly due to the fact that they had great difficulty in extricating themselves from the dense bushes and trees. They often flew away before we were able to spot them among the dense branches. The nests hung on the end of thin branches in the very dense and thorny Acacia (incl. *Acacia nigrescens*) trees. The Lesser Spotted Eagles therefore experienced great difficulty in gaining access to the nests. The thin branches did not support the weight of the birds, or only just, and in most cases the bird had to support itself with its wings on adjacent branches. This must have been very uncomfortable for the birds due to the many sharp thorns. The small side entrances to the nests did not allow direct access to the nestlings. The eagles therefore had to employ a great deal of effort to remove the roofs of the nest with their beaks or claws, at the same time vigorously balancing themselves with their wings. As we found out for ourselves, the nests are very robust structures, and we had great difficulty in opening them. Most times we observed several eagles in a single bush containing nests. The eagles also often stood on the ground underneath the nests, as the chicks fell to the ground when the nests were opened, to be harvested by the birds on the ground as they fell. As the nests contained up to four chicks weighing some 15 to 25 g, an eagle's daily ration was probably met by opening one or two nests. This explains the long rest periods of the eagles during the day. It was estimated that Lesser Spotted Eagles, depending on their numbers in a weaver bird colony, account for 0 to 60 % of the chicks. In the case of a single colony this would amount for example to some 42,000 individuals or 9 % of the birds.

The taking of chicks from closed nests is unusual behaviour for birds of prey. It would be interesting to know how young eagles learn the technique. Hunting behaviour, e.g. of small mammals, is clearly inherent, the young eagles do not learn it from their parents. The practice of taking unseen prey from a closed nest is a different matter however, and the young eagles probably learn this technique from other, older birds.

On 15 January, at 7.30 am, more eagles than usual began to circle. Within only half an hour an estimated half of all the birds present flew off in a southerly direction. Two hours later this huge flock of about a thousand individuals was sighted by park rangers some 40 km further to the south. How so many Lesser Spotted Eagles manage to communicate with each other, or how the withdrawal was 'decided' on and whether there is a 'commander' or 'leader' etc. remains a mystery.

During our stay in the colony we tried to observe and photograph as many eagles as possible, to determine their age and whether they were tagged or ringed. The flight initiation distance of individuals differed greatly. In some cases the eagles could be approached on foot to within 20 to 30 metres, in other cases even the approach in a vehicle triggered off flight at a much greater distance. No sight observations of birds with rings or transmitters were made. Later, when zooming the photographs taken, it was established that a single bird wore a ring from a ringing station. Lesser Spotted and Steppe Eagles of all ages were represented.

Simultaneously reading of telemetry data and observation

In the course of our stay in South Africa we also studied the telemetry data of Lesser Spotted Eagles from Germany. Three adult males visited South Africa, one of them only for a short time, and another was not seen in the Kruger National Park. A third male with transmitter No. 74996, which bred near Templin north of Berlin, visited the park repeatedly but concentrated on an area further to the south, also on the Mozambique border. Unfortunately we were unable to gain access to this area. Interestingly enough, this eagle only spent the winters 2008/2009 and 2009/2010 in the National Park. In the winter of 2007/2008 it visited only a small area in the extreme north of South Africa.

Spring migration and breeding success

Lesser Spotted Eagles normally arrive back at their breeding sites in Germany in mid-April. Over the past 15 years, with the help of satellite telemetry, we have been able to establish that sometimes many Lesser Spotted Eagles not only arrive later in the breeding area, but also delay their departure from the wintering areas.

The arrival date plays an important role in reproduction however. Very late arrival can lead to eggs not being laid, something that has been observed repeatedly in recent years. This occurs in particular when both partners arrive back late. The most notable example of this was in 1997, when the majority of pairs arrived back in Germany very late and only about one third (32 % in Mecklenburg-Western Pomerania, 20 % in Brandenburg) bred successfully. Most pairs did not lay eggs.

1997 was therefore a completely catastrophic year for the Lesser Spotted Eagle, not only in Germany but also in Latvia. Lesser Spotted Eagle specialists wrongly attributed the two week delay in spring migration to extreme climatic conditions in Turkey, which held up White Stork migration and led to a catastrophe for the reproduction of this species. The climatic conditions in Anatolia were not however responsible for the late arrival of the Lesser Spotted Eagles.

We believe that in many instances, as was also the case for the individuals fitted with transmitters, the departure from winter quarters began too late. Unsuitable climatic conditions on spring migration were therefore not responsible for late arrival in the breeding area.. A possible explanation is the sharp decline in precipitation levels since 1970 in the wintering areas in South Africa as a consequence of the El Niño climatic phenomenon. This almost certainly led to a lower density of prey for the Lesser Spotted Eagle, and probably compels the birds to remain longer in their winter quarters in order to accumulate the necessary energy reserves for migration. This unfavourable climatic trend continues. As a result, the southern part of Africa has become a region chronically afflicted by water shortage. Because of its significance for breeding success, and therefore population development, it is vital that further study of this question is carried out.

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The Red-billed Quelea - an important element in the Lesser Spotted Eagle's diet

The Red-billed Quelea (*Quelea quelea*) belongs to the family of weaver birds. Its distribution range covers the greater part of Africa south of the Sahara, apart from the rain forests and parts of South Africa. The name comes from the red bill of the male bird during the breeding season. The male's non-breeding plumage is more or less similar to that of the female, which is beige in colour. The bird is some 12.5 cm long and weighs 29 g. It breeds as a rule after rainfall, which promotes the growth and fruiting of grass species important for the bird's diet. The Red-billed Quelea lives mainly in steppe and savannah habitats, but is not shy of the company of humans. Every day the birds fly long distances to forage. Its food consists of grass seeds and cereal corns. Immediately after sunrise the birds flock in great numbers and search together for a feeding site, which they immediately descend on as soon as one is found. At midday they rest in the shade and occupy themselves with plumage preening. In the evening they again go foraging.

The Red-billed Quelea breeds in large colonies. The breeding season begins with the rainy season. The displaying males weave half oval nests from grass and straw stalks. As soon as the chosen female has inspected and approved the construction, and copulation has taken place, both partners weave the rest of the nest, which hangs down from a branch, with an entrance at the side. In contrast to other weaver species, the Red-billed Quelea requires fresh, long grass stalks to build the nest. The female lays two to four light blue eggs and incubates them for 12 to 14 days. After the chicks hatch they are fed with caterpillars and other protein-rich insects rich. Later the parents feed the young principally with seeds. The young fledge after some two weeks in the nest.

During the nestling period the chicks are threatened by large birds, especially eagles and the Marabou Stork, but also by snakes. Access to the chicks by predators is made difficult by the narrow side entrance and the position of the nests at the tip of a branch.

The species is regarded as the most common wild bird species in the world, with an estimated total population of 1.5 thousand million individuals. The Red-billed Quelea, which descends upon cereal and rice crops in massive numbers, is seen as a pest by farmers and the species is therefore massively combated by means including fire bombs, flame throwers and spraying of the colonies with poison. In the latter case the insecticide Fenthion is used, which is extremely poisonous for birds. This endangers birds of prey and other wildlife in a wide surrounding area.

As they not infrequently inflict great damage to crops, the species has earned the byname *African Locust Bird*, as when a flock of millions of these birds swoops down on a field of cereal crops the result is a wasteland within minutes. The species is named in the Guinness Book of Records as the most harmful bird species for mankind.

PHOTOGRAPH AND ILLUSTRATION TITLES

Part view of the Red-billed Quelea breeding colony with 15 Lesser Spotted Eagles on a roost tree.

The adult Lesser Spotted Eagle is clearly identifiable amongst other characteristics by its amber coloured iris.

Weaver bird nests are built as a rule very close together and, because of the long thorns on the bushes and trees, access by man and animal predators is extremely difficult.

The conspicuous red bill of the male during the breeding season can be seen well here. Outside the breeding season the male's plumage is very similar to that of the female, which is beige in colour with a black facial stripe.

The chicks in the Red-billed Quelea nests are threatened by large birds as well as snakes. The narrow side entrance hole however makes access to the nest difficult.

Lesser Spotted Eagles are quite social outside the breeding season. They spend most of their time in the weaver bird colonies in the Kruger National Park, perched close to one another on roost trees.

A rare photo of a Lesser Spotted Eagles (adult) in close proximity to the weaver bird nests. The eagles are very cautious while feeding, as when danger threatens they have problems extricating themselves from the bushes and trees.

Four Lesser Spotted Eagles on a bush poised to raid the numerous weaver bird nests. They are waiting for others of the species to leave the nests before they have their turn.

A Lesser Spotted Eagle fitted with a transmitter.

Wintering record of the adult male with transmitter No. 74996, which breeds near Templin to the north of Berlin. The November movements are shown in pink, in December green, in January blue, in February light pink and in March light blue. This winter the bird reached the most southerly extent of its range.

Wintering record of the same male in southern Africa in the winter of 2008/2009. Movement legend see above. In contrast to the other two years the eagle visited areas far to the west as far as the Okawango Delta in Botswana.

Wintering record of the same male in southern Africa in the winter of 2007/2008. Movement legend see above. In contrast to the other two years the wintering home range was small. The Kruger National Park and adjacent areas were not visited.

Wintering record of male eagle with transmitter No. 74996 in the Kruger National Park and adjacent areas. The red dot marks the Red-billed Quelea breeding colony which was visited and studied by us in January 2010. The eagle did not visit the colony. Movement legend see above.

In this photo the typical identification characteristics of the white carpal patch and the light coloured, and in some cases whitish uppertail-coverts area, can be seen well. The often characteristic light brown upper coverts, in comparison to the darker secondaries and primaries are not so marked on this bird and can be seen better on the title photograph**.,**

An atypical coloured Lesser Spotted Eagle. The light coloured iris indicates advanced age, the juvenile plumage patches speak for a younger bird.

A one to two year old Lesser Spotted Eagle with its still darker iris.

The authors

Prof. Dr. Bernd-Ulrich Meyburg, Chair of the World Working Group on Birds of Prey and head of the NABU Federal Working Group on Bird of Prey Protection, has concerned himself intensively with the Lesser Spotted Eagle since 1968. Since 19992 he has fitted a large number of Lesser Spotted Eagles and other birds of prey with satellite transmitters, most of them in Germany. Together with his wife **Christiane Meyburg**, who manages the comprehensive data bank and conducts many of the evaluations, he has published to date part of the on-going studies. The published articles can be accessed at www.Raptor-Research.de.

Joachim Matthes has also been involved with birds of prey since the 1960s, in particular extensive study of the Lesser Spotted Eagle at the north-west edge of its distribution range in Mecklenburg-Western Pomerania, where many breeding occurrences were discovered by him. He took part in many joint trips to Southern Africa.

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References:

Biggs D 2001: Observations of eagle congregations at a Red-billed Quelea colony in the Kruger National Park. Bird Numbers 10: 25–28.

Kemp A 2000: Concentration of non-breeding Lesser Spotted Eagles *Aquila pomarina* at abundant food: A breeding colony of Red-billed Quelea *Quelea quelea* in the Kruger National Park, South Africa. Acta ornithoecol. 4: 325-329.

Meyburg B-U, Meyburg C 2009: Satelliten-Telemetrie beim Schreiadler (*Aquila pomarina*). Labus, Naturschutz im Landkreis Mecklenburg-Strelitz, Sonderheft 13: 16- 44. [pdf: www.Raptor-Research.de]

Meyburg B-U, Ellis DH, Meyburg C, Mendelsohn JM, Scheller W 2001: Satellite tracking of two Lesser Spotted Eagles, *Aquila pomarina,* migrating from Namibia. Ostrich 72: 35–40. [pdf: www.Raptor-Research.de]

Meyburg B-U, Meyburg C, Matthes J, Matthes H 2007: Heimzug, verspätete Frühjahrsankunft, vorübergehender Partnerwechsel und Bruterfolg beim Schreiadler *Aquila pomarina*. Vogelwelt 128: 21-31. [pdf: www. Raptor- Research.de]

Pienaar U de V 1969: Observations on the nesting habits and predators of breeding colonies of red-billed queleas *Quelea quelea lathami* (A. Smith) in the Kruger National Park. Bokmakierie 21: suppl.: xi–xv.

Thiollay J-M 1989: Natural predation on quelea. In: Bruggers RL, Elliott CCH (ed.): *Quelea quelea.* Africa's Bird Pest, pp. 216–229. Oxford University Press, Oxford.

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www.argos-system.org/manual/

www.Raptor-Research.de