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The Situation of the Lesser Spotted Eagle *Aquila pomarina* in Germany: The need for an Action Plan and active Conservation

Bernd-U. Meyburg, Torsten Langgemach, Kai Graszynski and Jörg Böhner

ABSTRACT

Since about 1800 the total breeding area of the Lesser Spotted Eagle *Aquila pomarina* in Germany has shrunk by some 90 % from a then 83,000 km^2 to a small residual area today of some 10,000km^2. The western border of the breeding range has shifted several hundred kilometres eastwards.

The reasons for this decline were a massive annihilation campaign of shooting and egg theft. Increasing habitat loss became a negative factor only in the course of the 20th century.

At present the species breeds only in the federal Länder (States) Mecklenburg–West Pomerania, Brandenburg and Saxony–Anhalt in relatively small areas of 6,600, 3,600 and. 13km^2 respectively. In 2001 the total population consisted of some 115 breeding pairs.

Today the reasons for the continuing decline are principally habitat changes and hunting on migration routes. As long as the causes of the present population limitation persist, and protection measures are not intensified, the negative trend in Germany will continue, in the worst case until the species becomes extinct.

An action plan to rescue the species is therefore urgently required. The protection measures determined must also be implemented rapidly in order to prevent a further population decline and, if possible, promote an increase.

INTRODUCTION

Situated on the western edge of its range, Germany bears a special responsibility for the conservation of the Lesser Spotted Eagle (LSE), not least

because the area of distribution has shrunk considerably during the past two centuries and the rump of the population still shows a steady decline. The reasons for the decline in preceding centuries were principally deliberate human persecution through systematic hunting and egg theft.

Changes in agricultural practice during the past 10 years, which have led to a massive intensification of agricultural and forestry management, have impaired the LSE's habitat. The proposed action plan will therefore also be of importance for the new EU member countries whose area comprises the main distribution of the species and which are about to rapidly introduce western economic forms.

In addition to the risks caused by the worsening of the situation in the breeding grounds, a considerable hazard for the species exists along the migration routs. LSEs migrate over long distances and winter in the south of Africa. They use thermals and therefore avoid the open Mediterranean, concentrating instead on its eastern edge. Here they are vulnerable to intensive and uncontrolled hunting, especially in the south of Turkey, Lebanon and Syria.

Present-day distribution and population of the species

The LSE populates the eastern part of Central Europe, further to the east Belarus and western Russia and, in the north-east, the Baltic region. In the south-east it is to be found in the Balkans and throughout Turkey as far as the Caucasus and the South Caspian Plain in Iran (Meyburg 1994). The extent of the easterly distribution range in Europe is still insufficiently well-known. The species is today to be found somewhat further east in Russia than was earlier believed. The world population consists of only about 20,000 breeding pairs (Meyburg 1996; Meyburg *et al.* 2002).

Present German population and distribution

Today (with the exception of an isolated instance in Saxony–Anhalt of only two breeding pairs in 2003) the LSE is confined to only a very small breeding area in the extreme north-east of Germany, in the federal Länder (States) of Mecklenburg-West Pomerania (MWP) and Brandenburg covering some 10,000km_. Of the 115 breeding pairs recorded in 2001, 80% were to be found in MWP (Langgemach & Sömmer 1996; Meyburg 1996, 2001; MLUR in press; Scheller & Meyburg 2001; Scheller *et al.* 2001).

Table 1: Number of breeding pairs of the LSE in Germany in 2001

Federal State	Territories occupied known	Area occupied (in km^2)
Mecklenburg-West Pomerania (MWP)	84	approx. 6.600
Brandenburg	27	approx. 3.600
Saxony-Anhalt	4	approx. 13
Germany in total	115	approx. 10.000

Former distribution outside the present breeding area

The present-day breeding area in MWP and Brandenburg represents the rump of a much larger region in the North German Plain, which previously

extended further west into Lower Saxony, Saxony-Anhalt and Schleswig Holstein.

During the 19th and 20th centuries Saxony, Thuringia, Hesse and North Rhine Westphalia were evidently not populated by the LSE.

From about 1800 until the present day the range of the LSE in Germany has shrunk from a good 83,000 km^2 to a small rump of about 10,000 km^2, some 90% of its original size!

Previously a breeding population also existed in southern Germany (Wüst 1981). This, in the Bohemian Forest during the 19th century, was undoubtedly part of a population that extended its range across the border. Not many years ago an isolated population of 3-4 pairs, which has now become extinct, still existed here in the Czech Republic (T. Belka pers. comm.). The main population in Germany was, however, always to be found on the North German Plain.

There are no exact figures available for the former size of the population; but written records indicate that it must have been thriving. The Elbe riverine forests, the broad Weser-Aller valley and the Droemling nature reserve near Wolfsburg in Lower Saxony were a core area for the species. It was so numerous around Brunswick that in 1850 three pairs bred in a radius of only 20km from the city and at least 10 pairs were present in the whole area, all of which vanished between 1870 and 1910. In 1900 some 20-25 breeding sites were known in the Hannover area and its environs, e.g. around Lueneburg. The last ones vanished in the 1920s. On this basis Berndt & Nagel (1989) estimated that around 1850 some 50-100 pairs of LSEs bred in Lower Saxony, about the same size as the present-day MWP population.

The last breeding instance for Lower Saxony, in the Lucie nature reserve in Hannover Wendland, vanished in 1928 (Meier 1969). No pairs of LSE have been recorded for West Mecklenburg since the 1930s. Apart from single breeding instances in 1964-67, no regular breeding has been recorded for the Lewitz (Ludwiglust region) since 1926 (Kaiser & Zimmermann 1969; Scheller *et al.* 2001).

The reason for the enormous decline of some 90% in the breeding range during the past century and a half was an unparalled campaign of annihilation through shooting and egg theft. Many former breeding instances can be reconstructed only through the few remaining egg clutches and skins in museums. Increasing habitat loss became an additional negative factor in the course of the 20th century.

Kuhk (1939) writes about the western, abandoned, LSE territory in Mecklenburg as follows: "…around 1830 the LSE was almost as common as the Buzzard in our woods, a statement which was still valid for neighbouring Pomerania in the 1850s. The persecution, to which all eagle species were subjected, even in Mecklenburg because of the high bounties paid on them, caused terrible devastation. In the Grand Duchy hunting grounds of Mecklenburg-Schwerin alone, during the hunting seasons 1841/42 to 1852/53, a total of 412 White-tailed Eagles, Golden Eagles and LSEs were bagged, and probably an equal number in private hunting grounds. As the most common species the LSE would have accounted for the greater part of the total."

Figure 1. Breeding sites of *A. pomarina* around 1800. Hatching = present breeding area (SH = Schleswig Holstein, MWP= Mecklenburg-West Pomerania, LS=Lower Saxonia, SA=Saxony-Anhalt, BB=Brandenburg)

Figure 2. Breeding sites of *A. pomarina* in the north German lowlands (black points) around 1875. Abandoned breeding sites in white. Further explanations see Figure 1.

Figure 3. Breeding sites of *A. pomarina* during in the north German lowlands (black points) at around 1900. Abandoned breeding sites in white. Further explanations see Fig. 1.

The LSE was equally numerous in the Mark Brandenburg, even in the areas where it does not occur today: "*A. naevia* is numerous in the whole area wherever there are forests with extensive moors, large lakes and swampy woods. In the immediate neighbourhood of Berlin we have found it nesting, and we observed it near Neustadt, Ratzeburg and Altum, in the Priegnitz, near

Figure 4. Breeding sites of *A. pomarina* in the north German lowlands (black points) around 1930. Abandonned breeding sites in white.

Friesack, Wusterhausen and Fehrbellin; the species is numerous in the Uckermark and Neumark as well as in the Niederlausitz" (Schalow 1876). As late as 1919 Schalow wrote: "*Aquila p. pomarina* breeds everywhere in the province although it is often overlooked." But he also wrote at the time: "The days when five nests in close proximity to one another could be found in Brieslang near Spandau are some 50 years back." Today there are no breeding LSEs to the south, west and north-west of Berlin, even though there are still eminently suitable habitats in the Spreewald, Dubrow, the Rhinluch and elsewhere.

Why is a German Action Plan required for the LSE?

Dramatic habitat changes are taking place at the present time in the LSE breeding area. These include increasing fragmentation and development of the countryside to an extent not previously experienced. Of particular significance is the road network development ranging from small country roads linking villages to the federal motorway A 20 through MWP and Brandenburg.

Further restrictions are created by the new wind turbines which are being erected almost everywhere. In Brandenburg alone there are nearly 1,400 such installations ranging from small isolated projects to large wind farms. Many of them are within LSE territories and some indeed within the 3,000m radius around the nest which is vitally important for the species. The number of wind turbines in the Uckermark is scheduled to be increased from 230 at present by a further 289 (G. Heise pers. comm.).

The increasing tourist and leisure infrastructure, from the connecting of isolated regions to the development of large scale projects, is a further disturbance factor. This includes not least an increasingly denser network of approved nature, cycle and horse riding trails, in addition to other developments such as an increase in light and model aircraft traffic.

In the isolated "island" rump populations of the LSE, these developments can lead to destabilisation of complete part-populations. In those parts of the countryside which are heavily fragmented and contain human settlements only breeding Common Buzzards *Buteo buteo* , but not a single instance of a LSE, are to be found.

Despite several projects designed to improve water resources on a wide scale, the LSE's requirements of a wet habitat are being decreasingly met. A water improvement project in the Trebetal in MWP led to problems for the five resident pairs of eagles as it was associated with a cessation of agricultural land usage. Two of the pairs abandoned their nest sites as a result and three pairs have not bred again. (W. Scheller pers. comm.). Farmland meadows, regardless of the type of use, are better for the LSE than abandoned meadows.

The increase in intensive farming methods following the political changes in 1990, with more rapid crop rotation, loss of fodder areas, de-structuring of agricultural land and influencing of the water table, has caused further negative results. Today's less than optimal situation in the feeding areas can be concluded from the fact that the size of the home ranges are twice as large as those in Latvia (Scheller *et al.* 2001).

Changes in forestry management are also of great significance. The privatisation of a high percentage of the forested area and change of ownership of a large proportion of the LSE woods – out of the complete wooded area of Brandenburg – is often associated with a new form of management. Many of the wooded breeding territories are ripe for the axe. The pressure is especially high in the extensive old beech woods in MWP. Here Oak (45%) and Red Beech (18%) are the main breeding tree species followed by European Alder and Spruce (both 13%). Even the state forests are not free from danger. Because the nest site is changed frequently – up to 400m in 50% of cases, and in extreme cases as far as 2.7km^2 nest protection zones are of little practical use. It is therefore necessary to designate complete forest protection zones for the LSE as is now planned to occur in MWP. In addition, all actual and former nest sites are being listed and recorded in detailed forest maps. The precise aims are currently still being determined. The forestry protection zones will not be totally protected areas; but will be subject to different management methods, for example less logging activity and then only every five years.

On the whole there is a continuing decline in the proportion of land which fulfils all the requirements essential for the LSE as established in the studies in MWP, Brandenburg and Saxony-Anhalt (Scheller *et al*. 2001; Langgemach *et al.* 2001): unfragmented countryside, little human presence, low intensivity of land usage and a high water table.

There are clear warning signals from the population ecology data: a declining population trend over more than a hundred years, increasing instability of many part-populations, more frequent changes of nest site and a poor reproduction rate for a substantial number of pairs, a loss of breeding territories resulting in an abandonment of cohesive breeding areas. The distribution pattern also sends significant warning signals: a shift in the westerly range limit of several hundred kilometres to the east – the species has vanished in Lower Saxony, Schleswig-Holstein, Bavaria and West Mecklenburg. Of the previously large area of over 29,000km_ in Brandenburg less than 5,000km_ is still populated, although Brandenburg was the core of the distribution range a century ago. The isolated population in Saxony-Anhalt, which was repopulated in 1979 after a break of about 100 years, threatens once again to disappear. The previous mainly cohesive distribution area has shrunk immensely and is now fragmented into island populations. A threat of further isolation and even a further shift of the westerly distribution range eastwards, is not far off. In the medium term there is a high risk of the species becoming extinct in Germany!

Additional risk factors

The low reproduction rate, late reproduction maturity, dependence on particular habitat structures (very pronounced under the conditions in north-east Germany) must all be seen as species-specific risk factors, i.e. indicators of a K-strategy of reproduction.

There is a further high risk through losses due to human influence on migratory routes, in particular shooting on the eastern edge of the Mediterranean. Of the raptors breeding in Germany, the LSE is the one which regularly migrates the furthest. Many individuals migrate over a distance of more than 10,000km

(Meyburg *et al.* 1995). This subjects the species to a high level of threat. Losses due to shooting, especially on the part of the route between Turkey and Egypt, are very high (Danko *et al.* 1996; Leshem 19985; Meyburg *et al.* 1995, 2004; Woldhek 1980). There are regrettably almost no concrete figures or local studies for these losses available.

In 1992 and 1993 three young eagles were fitted with satellite transmitters in MWP. Not one of them reached Africa (Meyburg *et al.* 1993, 1995). A nestling fitted with a transmitter on 30.07.93 was tracked over a distance of 2,921 km. It was shot down promptly on arrival in North Lebanon on 7th October. There were four locations from the area up to the beginning of March 1994 followed by a further five later from the area of the capital, Beirut. In May 1994 we were sent the transmitter and ring, with an accompanying letter from a Lebanese doctor, confirming the shooting. The transmitter contained a piece of shot. Locations from the Lebanon in December, together with other telemetry data, indicate that the second young eagle from 1993 was also almost certainly shot down over Lebanon

Experienced adult birds also suffer heavy losses. At least two adult males fitted with transmitters were almost certainly shot down during the autumn migration. An adult male fitted with a transmitter on 23.07.00 in MWP, as well as a male fitted in Poland on 12.07.01, could be tracked only as far as the Near East. Neither arrived back at the breeding site in the following spring and the nest site in Poland was abandoned (Meyburg *et al.* unpublished). Breeding territories which are suddenly not re-occupied in spring after years of successful breeding are a typical indication of shooting during migration.

There is, unfortunately, little published information on the extent of the persecution in the Mediterranean region. According to estimates by Woldhek (1980), which give an overview of the situation in all Mediterranean states, some 15-20 million birds are shot annually in the Lebanon alone.

Population forecast

The negative population trend of the last decades has persisted into the most recent past. The population in 2002 in MWP had declined to only 84 pairs. There is a constant and significant decline in the number of pairs by more than 15% in Brandenburg within the past 10 years or so (see Fig. 5). The isolated but stable population of four pairs, which was for many years established in Saxony-Anhalt (Hakel forest), had in 2003 declined to two pairs.

The changes associated with development and use of the countryside since the 1990s, the continuing persecution of migrating LSEs in the Mediterranean region and breeding loss due to human disturbance hold out little hope of a positive change in the population development. There is no expectation of population pressure from areas to the east, not least because the expected land usage change in the countries acceding to the EU tends to support a negative prognosis. As long as the reasons for the present population trend persist and protection measures are not intensified, the negative trend in Germany will continue until the species becomes extinct (see Figs. 6 and 7).

For the Brandenburg population different possible developments were simulated using the computer programme Vortex (each with 1,000 iterations

over 50 years), developed by the Conservation Breeding Specialist Group of the IUCN (Lacy 2000; Miller & Lacy 2003). The parameter values shown in Table 2 and used for the simulation resulted in a population growth rate of - 0.016 and therefore matched the actual development exactly (also an annual decline of 1.6 %, or growth rate r of - 0.016, analysed by means of a egression analysis; see Figure 5). On the basis of this main scenario, the effects of a different proportion of successfully breeding pairs or of additional 2nd fledglings (see below) were simulated. Further details about the simulation can be found in Böhner & Langgemach (2004).

Figure 5. Number of pairs of LSE in Brandenburg from 1994 to 2003. The regression line (y = 998 – 0.485 x) indicates a statistically highly significant decrease (F-test, p < 0.01).

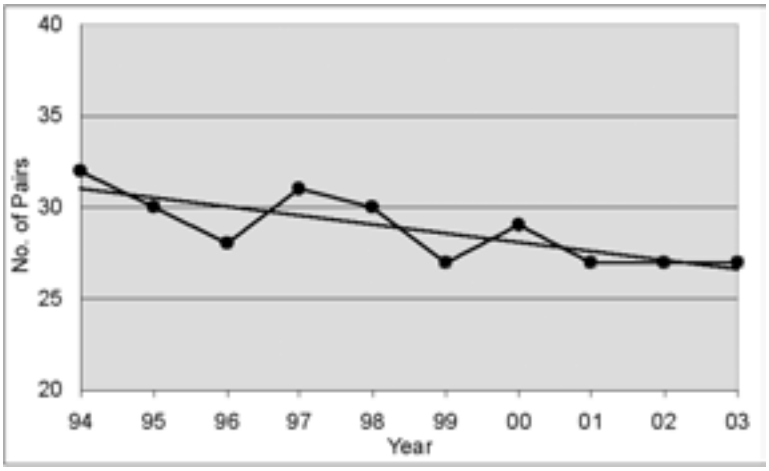


Figure 6 shows that the present value of 60% successfully breeding pairs in Brandenburg leads to a constant decline. If this proportion could be raised to 67% (currently 18 pairs or two more fledglings), almost no decline would take place. As can be seen from Figures 5 and 6, 16 Brandenburg pairs (60%) breed successfully at present, leading to a constant decline. If 18 pairs were to breed successfully, or two more young were to fledge successfully, almost no decline would take place. From 19 annual fledglings upwards the population would become stable or show a slight increase. A definite increase could be expected with a value of 74%, corresponding at present to 20 fledglings. On the other hand, an annual reproduction rate of only 52% (which equals 14 pairs or nestlings at present) or less would speed up the present decline. In the case of 44% the population would fall below 10 individuals, i.e. 5 pairs at best, within the next 50 years and would be close to extinction. The population is therefore at a watershed.

Aim of the German Action Plan

In the medium term there is a high risk of the species becoming extinct in Germany. The aim of the action plan is to secure a favourable conservation state of the species in accordance with the requirements of the EU bird guidelines. The detailed protection, conservation and development aims are as follows: -

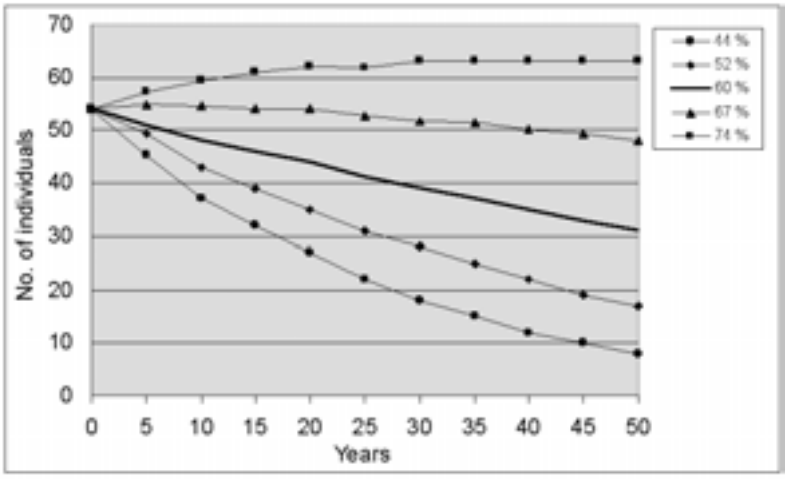
Conservation of unfragmented and relatively undisturbed countryside regions in the LSE's distribution range, and protection and wide-ranging conservation of its habitats in the at present occupied territories: expansive and little-used deciduous and mixed deciduous forests with a high water table and low disturbance potential.

Table 2: Parameter values which explain best the current population dynamics in Brandenburg and which were used for the basic simulation scenario

Parameter	Value	Source
min. breeding age __ and __	4 years	Assumption according to Glutz *et al.* 1971, no data available yet
max. breeding age	20 years*	Danko *et al.* 1996
Breeding method	Monogamy	Meyburg 1970
Ratio of successful pairs	60 % (+/- 10 %)	Monitoring data from Brandenburg
Young per successful brood	1 (or 2 using young bird management)	Meyburg 1970, 1971
Sex ratio (at hatch)	1:1	assumption
Mortality in 1st year.	60 % (+/- 10 %)	Meyburg *et al.* 1993, 1995
Mortality in 2nd year	10 % (+/- 3 %)	assumption
Mortality in 3rd year	8 % (+/- 1 %)	assumption
Estimated habitat capacity in Brandenburg	100 individuals / 50 pairs	assumption

* = ring recoveries up to 27 years of age.

Figure 6. Effect of the proportion of successfully reproducing pairs (currently 60 % = 16 pairs) on the population dynamics of the LSE in Brandenburg.



Conservation of former as well as potentially suitable habitats in Germany, especially in the north-east,

Ecological improvement of present, former or potentially suitable habitats, in particular by low or moderate land usage, suited to the area,

Reduction or deliberate steering of disturbance factors and improvement of the water household,

Ensuring the successful reproduction of the highest possible proportion of resident pairs through a comprehensive package of current or planned protection measures, as the population is unlikely to be reinforced from the east,

Ending the population decline and avoidance of a further island isolation of part-populations,

Stabilisation and step by step increase of the population, resettlement of abandoned breeding areas and a general regional expansion through nestling management.

The planned German National Action Plan should be harmonised with the "European Species Action Plan for the Lesser Spotted Eagle (*Aquila pomarina*)" (Meyburg *et al.* 2001) of BirdLife International on behalf of the European Commission, with detailed annexes specific to Germany.

In preparation for the German National Action Plan for the LSE a meeting of some 45 experts took place at the nature protection station in Woblitz on 17th November 2002. The basic content and aims of the National Action Plan were discussed at this meeting.

Management of nestlings

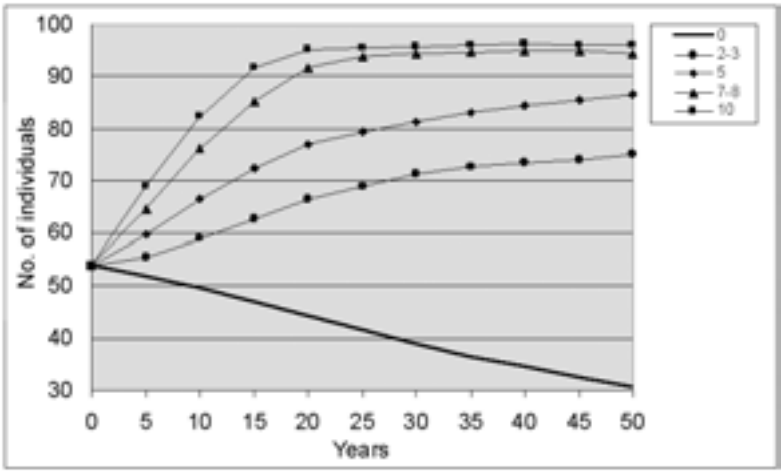
In view of the known facts on the intensive persecution of LSEs on migration routes, the methods for artificially increasing the reproduction rate should be reintroduced accompanied by scientific monitoring, above all the use of satellite telemetry, within the framework of a practical pilot project. The scientific value of this consists of finding out if this method is suitable to assist in achieving a population stabilisation and increase. Long-term monitoring of the success should be achieved by the use of suitable marking methods in addition to telemetry. A gain of additional data on the shooting threat to young birds on their first migration flight can be expected.

The method is based on increasing the number of fledglings by avoiding Cainism (Meyburg 1971, 1978 a,b). The LSE is one of the eagle species in which Cainism is obligatory, i.e. in most nests two young hatch but only one survives to fledging. The many factors responsible for this are comprehensively described in the relevant literature (Meyburg 1970, 1974, 2002). If the second chick (or egg) is removed from the eyrie in time and reared in captivity, ideally by a foster bird, it can be reintroduced to its sibling in the original nest without risk shortly before fledging. At this stage the aggressiveness between the young birds, which causes Cainism, has disappeared. In this way the reproduction rate can be almost doubled with relatively little effort.

On the basis of the parameter values shown in Table 2, the effects of a different number of additional fledglings, which also means the number of pairs rearing two young, were simulated.

The results (see Figure 7) show that nestling management by avoiding cainism can be a very effective means of reversing the present negative trend. This can be achieved in principle with only 2-3 additional nestlings annually. With a higher number (7-8 or even more) there is a good chance that population increase will be apparent within the next few years.

Figure 7. Effect of the number of nests with a second fledgling (currently 0) on the population dynamics of the LSE in Brandenburg.



Preventing dangers on migration routes

At the same time an attempt must be made to reduce the risks on the migration routes. This problem must clearly be studied more closely on an urgent basis. More precise details on shooting "hot spots“ and other pertinent circumstances must be collated.

It is clearly urgently necessary to consider migration risks comprehensively within the scope of the action plan. Germany must, as a “wealthy” country, be above all active in this field and provide financial and personnel support to diminish the risks. The best habitat protection is of little avail if the birds are shot down in passage through the Near East.

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Prof. Dr. Bernd-U. Meyburg
Wangenheimstr. 32
14193 Berlin
Germany
E-mail: WWGBP@aol.com

Dr. Torsten Langgemach
Akazienweg 1
14715 Stechow,
Germany
E-Mail:
torsten.langgemach@lua.brandenburg.de

Prof. Dr. Kai Graszynski
Schreberstr. 8 A
14167 Berlin
Germany
E-mail: kai@graszynski.de

Prof. Dr. Jörg Böhner
Alfred-Fritz-Str. 12
14513 Teltow
Germany
E-Mail: joerg.boehner@tu-berlin.de