International Advisory Group for Northern Bald Ibis

newsletter 3

July 2004

An update on current projects involving wild and captive Northern Bald Ibis

Edited by Christiane Boehm

Introduction

The interest in the fate of the Northern Bald Ibis (*Geronticus eremita*) is increasing and so is the hope that we will be able to save this beautiful bird species from extinction. The last remaining wild colony in Souss Massa NP is well monitored and managed and a new colony, although with only fragile numbers and future, was detected in Syria in 2002. In addition a large and healthy captive population exists in European, Japanese and American zoos and at the moment four different research projects are trying to establish a working release method. These are very promising signs for this critically endangered bird species.

With so much activity and progress the International Advisory Group for the Northern Bald Ibis (IAGNBI) tries to keep up with the most recent data and developments and wants to share this information with all persons and institutions concerned about the NBI – hence our third newsletter.

First of all I want to express my sincere gratitude to all authors for their contributions and many thanks to Catherine King and Chris Bowden who helped to revise the English.

The newsletter is arranged in five parts. In the first section you will find information about IAGNBI itself and its objectives (e.g. conservation priorities). The second part updates the status and future plans of research and releasing projects. The third section reports the situation of the wild colonies and programs and problems which have to be faced there.

Part four contains reports about recent scientific meetings dealing with the NBI. In the final section historical data on migration, the former distribution in Algeria, information about problems and techniques keeping the NBI in captivity and a complete bibliography of the NBI are compiled.

Opinions given in the articles represent of course the view of the authors. The idea of the newsletter is not only to give a complete and recent overview of the NBI situation but also to encourage an open discussion. Therefore we will be happy to receive any feedback and contribution in this vein.

Christiane Boehm, Innsbruck July 2004

1. What is IAGNBI ?

1.1 IAGNBI its role and committee

IAGNBI was created on 12th March 1999 at the "International workshop on a strategy for the rehabilitation of the Northern Bald Ibis" held in Agadir, Morocco. The primary objectives of the committee were to ensure international co-ordination and co-operation on Northern Bald Ibis projects. At this meeting in Innsbruck the mission statement, terms of reference and committee were discussed and revised as detailed below:

Mission statement:

"Promoting the conservation of the NBI through international co-ordination and co-operation"

Terms of Reference for the IAGNBI

- Focusing attention on the priority conservation problems of the wild populations
- Facilitating communication and co-operation between concerned groups
- Encouraging applied scientific research to close gaps of knowledge on NBI and updating what the most urgent are
- Contribute to the SAP for the NBI
- Produce release guidelines for the NBI
- Review propositions for all NBI release/re-introduction projects/trials in relation to release guidelines produced for the species
- Support fund raising for the priority projects
- Produce regular newsletters

Committee composition - July 2003

Chair person / Secretary
Chris Bowden
IUCN / Reintroduction
Mike Jordan
Captive population
Christiane Boehm/Cathy King
Veterinary
Miguel Quevedo/Andrew Cunningham
Research Biology
Karin Pegoraro/Kurt Kotrschal
Moroccan population
Mohammed El Bekkay/Said Hajib
Turkish population
Taner Hatipoglu/Nurettin Ozbagdatli
Syrian population
Gianluca Serra

The committee would like to express a vote of thanks for all their hard work and commitment to Northern Bald Ibis conservation over the last four years to **Koen Brouwer** and **Ali Aghnaj** who are standing down from the IAGNBI committee.

1.2 **Statement for conservation priorities for the Northern Bald Ibis**

(updated during the workshop meeting in Innsbruck, July 2003)

1 An overview of the current status of the critically endangered wild population of Northern Bald Ibis clearly shows the overriding importance of maintaining the Souss-Massa wild population (South-west Morocco) which is subject to numerous threats and pressures. It is however fairly stable and increasing slowly.

2 In 2002 a small NBI colony was discovered in Syria. This population of three pairs bred successfully, but may well be the last remnant colony of the Eastern population. Efforts to maintain this population and especially its protection from local hunting pressures are an immediate priority.

3 In the view of the fact that colonies in Syria remained undetected until so recently, the urgent need to survey other potential countries in the region e.g. Yemen, Eritrea, Somalia and Iraq, for colonies is clear.

4 As a priority it was agreed that a Species Action Plan (SAP) for the Northern Bald Ibis is urgently needed. The UNEP/AEWA secretariat has agreed to offer support for this process which should put into context the conservation role of wild, semi-wild and captive populations. The 1997 action plan for the conservation of Northern Bald Ibis in the Souss-Massa region should be significantly updated and enlarged to form a national (Moroccan) Species Action plan following on from the production of the International SAP: Both SAPs should then be adhered to and fully implemented.

5 Cleary defining the former distribution of the Northern Bald Ibis will affect consideration of introduction or reintroduction in the future. The meeting agreed it is very likely that the species occurred quite widely around the Mediterranean in the past. Although historical site records are unlikely to give an accurate complete picture. This issue is in need of discussion relative to the IUCN guidelines for reintroduction, but it was agreed that local current conditions should be considered ahead of exact historical sites records in determining suitability of potential release sites.

6 The possibility of supplementing the wild population at Souss-Massa was already considered and rejected at the IAGNBI workshop in March 1999 in Agadir. This question was reconsidered in Innsbruck along with the possibility of similar action in Syria and both were rejected. The risks are considered currently unacceptable and no clear methodology exits for attempting such an exercise.

7 It was recognised that there are two distinctive and separated populations, an Eastern and a Western form and their respective ranges should be respected. With the discovery of the in Syria, further work on genetic differences between these, Turkish and Moroccan birds are necessary.

8 The importance of the semiwild colony in Birecik is recognized. However there is an urgent need to improve standards for hygienic and husbandry in the aviaries. A target of increasing the population to 150 birds was agreed, before any attempts to use these birds in large-scale release should be contemplated. Recommendations made at the meeting held in Birecik in November 2002 were endorsed with some additional suggestions outlined in the Innsbruck IAGNBI workshop report.

9 Work at Gruenau in Austria has shown that techniques are now available for establishing a sedentary free flying colony. Similar techniques for establish migratory populations are not yet clear, although there is some significant and promising research in this area. Any release guidelines developed by IAGNBI must be regularly updated in the light of experience and ongoing research and must be followed during any and all programmes involving release / reintroduction of the Northern Bald Ibis.

10 A healthy, reproducing and well managed captive population of Western origin Northern Bald Ibis exists. Sufficient birds from this captive population can be made available for potential release or reintroduction programmes over the next 10-20 years, but cooperation between holders is still essential to control inbreeding and maintain genetic variability.

11 The genetic status and the likely potential inbreeding problems of the captive population are unclear. There is an urgent requirement to assess these issues.

12 The main opportunity to increase the range of Northern Bald Ibis in a significant manner is by reintroduction. Any reintroduction programme should have the goal of creating additional, self-sustaining wild populations of the Northern Bald Ibis. It was noted that, as there is no immediate urgency for reintroduction, and in view of the fact that a detailed and tested release method for a migratory population has not yet been identified; a need for caution in areas close to the wild colonies is paramount.

13 The recent appearance of skin problems in the captive Northern Bald Ibis is a number of zoos, should be taken into consideration for any free-flying trials (no such birds should be used), and reiterates the importance of good studbook records and veterinary monitoring.

14 In order to ensure international co-ordination and co-operation, it was decided to create the International Advisory Group for Northern Bald Ibis (IAGNBI) with the Terms of Reference given above.

Contacting the committee:

Correspondence should be directed via the Chairman:
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2. Ongoing research and release projects: updates of 2003

2.1. **The Austrian Bald Ibis Migration 2002-2004:** A story of success and failure

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The source of information that a bird needs to successfully migrate varies from genetically determined to socially learned (ALERSTAM, 1993; BERTHOLD, 2002). Social traditions are risky because the bird must depend on experienced conspecifics to gain information. On the other hand, a social tradition is more flexible than genetic information (SOL, 2003).

Experiences with the Gruenau population of Northern Bald Ibises (NBI) indicate that knowledge of migration routes is mainly passed as a social tradition in this species (KOTRSCHAL, 1999, 2001). Thus, the aim of this Austrian project is to experiment with methods to establish a new migration tradition in NBI, linking recently suitable summer and winter habitats by choosing an appropriate migration route. Information on wintering grounds used by the historical European population is unavailable (PEGORARO 1999, PERCO 2001).

The methodological key to establishing a new migration tradition is to imprint captive-born NBI on human foster parents. Appropriate hand-raising methods (e.g. contact with only to two or three foster parents, optimal food composition, natural nest appearance, asynchronous age composition of chicks reared together) produces NBI which have high cognitive abilities, show species specific behaviours and are not sexually imprinted on humans (THALER et al., 1992; TUCKOVA 1999; BÖHM et al. 2003).

Picture 1: Angelica Fritz, one of the foster parents, interacting with a bird. A close social relationship due to professional hand raising is the basis of our work.

Hand-raised birds follow their foster parents as they would their biological parents. With appropriate training they even can be taught to follow a foster parent sitting in a microlight airplane. During summer we train juvenile birds to follow us in microlights and by the middle

of August, when the migration season for the NBI in Europe starts, the birds are guided southwards to new wintering grounds.

Picture 2: Isabel Meran, one of the foster parents, with the birds in front of our two microlights at the airfield Scharnstein.

The first two years:

The project was initiated in spring of 2002 by hand-raising a group of 11 birds received from different European zoos. During the summer of 2002 we performed 16 regional training flights for up to 40 km, or 440 km in total. We never lost the birds, although the minimum speed of the microlights was about 20 km/h faster than the maximum speed of the birds, which is about 60 km/h (FRITZ, 2003).

A second group of 10 birds was raised at zoos for the project in 2003. However, due to a misunderstanding, these birds were hatched in an incubator fed by many different people and were more than eight days old when we received them.

After fledging, these juveniles lacked the strong social bond to their foster parents that is typical of NBI reared by foster parents from a younger age. Therefore, the immature ibises were not willing to follow their foster parents, even when using a new, slower plane. After a few hundred metres they repeatedly turned back, returning to the site where they were reared after joining the project. This was in strong contrast to the behaviour of the first year generation, which had followed the microlight reliably just two weeks after fledging. Thus we were hardly able to train any birds during summer 2003.

Migration journey 2003

Nevertheless, in the middle of August 2003 we started the first migration attempt with both generations of birds, in total 21 NBI. Our plan was to cross the Alps to Italy, passing Venice and the Po-Delta and finally crossing the Apennine into Tuscany. The route follows striking geographical features such as valleys, rivers and the Adriatic coast for more than 1000 km, terminating in the Nature Reserve Oasis Laguna di Orbetello, run by WWF Italy (FRITZ & REITER, 2003).

Picture 3: In 2003 we did some stages from Scharnstein, Upper Austria, down to the Lido di Venezia. From there we had to transfer the birds by car via the Po Delta to the Laguna di Orbetello, where they wintered. This season, 2004, we plan to migrate over about 1000 km along the same route.

Our initial flights started from Windischgarsten southward. The birds followed the microlight more than 10 km until the ascent for the first pass across the Alps (Pyhrnpass). We then lost sight of the birds and had to turn back to the meadow from which we started. We decided to transfer the birds across the Alps by car, assuming that it would be almost impossible to cross the elevated mountain region with so few training flights during the summer.

South of the Alps the coordination between the birds and the pilots became increasingly better, culminating with a flight of about 35 km from Caorle along Lido di Jesolo to Lido di Venecia (31.8.03).

Our major problems were caused by malfunctioning of the microlights. Once we had to turn back due to a failure of the radio set, once due to a lack of fuel in one of the microlights and finally we had to terminate the journey at Lido di Venecia due to irreparable engine problems. However, it should be taken into account that the microlights had to be adopted to the specific needs, and that this journey was a first test run.

None of the foster parents had a pilot licence. Therefore we had to use a double seated microlight with a foster parent in the backseat, equipped with a specially adapted low speed wing. Nevertheless, the microlight was still 5-10 km faster than the ibises, requiring a zigzag flight and regular circling to stay in contact with the birds. This flight style is risky and fuel consuming. We also experimented with a one seated microlight with which we could fly as slow as or even slower than the birds (32-55 km/h). The plan in 2004 is for at least one foster parent to be a pilot in order to use this slow plane.

During the flights we repeatedly lost birds reared in 2002. These subadults seemed to be stressed and disoriented. In contrast, the flexibility and learning ability of the 2003 hatched ibises were remarkable. Despite lack of flight experience with the microlights the young birds were quickly able to cope with these. For example, our pilot needed to fly a zigzag course in order to maintain contact with the birds. The ibises initially followed this lead but soon began again flying a straight course. They also quickly habituated to the presence of a helicopter which joined us with a TV team on board.

Picture 4: Flight formation: One of our microlights flying with the birds. The birds follow the microlight because of the foster parent in the back, who permanently interacts by calling the birds.

The ibises appeared to use different flight techniques in relation to different terrain. They regularly circled when flying over land, whereas they flew a straight course just a few metres above sea level when flying along the shore. Analysis of our extensive film material indicated that they may take advantage of various kinds of upwind, either caused by thermions or by sea breeze streaming over waves along the shore. However, during the regional flights in 2002 the birds followed the microlight on land in a straight line without circling, over distances up to 40 km. Thus, circling by the insufficiently imprinted and trained birds in 2003 may have been caused by a motivational conflict rather than energetic advantage. This question cannot be answered without further experience with a new generation of birds.

Finally, we must emphasise that we did not permanently loose a single bird. The ibises all arrived in the wintering area in good condition. Public awareness and support during the flight were high and very positive, in Austria, Italy and elsewhere.

Data collections in the wintering area

We transferred the birds by car from Lido di Venecia to the Laguna di Orbetello, Southern Tuscany. This famous and old nature reserve run by WWF Italy has many wintering bird species. Our NBI had roosting platforms in an aviary in the reserve. A foster parent and an additional person cared for them and went outside with the ibises when weather conditions were moderate.

A study was undertaken on the Italian wintering grounds in collaboration with the Konrad Lorenz Research station Gruenau. The project focussed on feeding ecology and habitat use to define ecological needs of NBI. Additionally, meteorological parameters were collected daily. The birds mainly fed on two meadows with low vegetation (< 5 cm), one grazed by sheep and donkeys year round, the other one mowed by humans. The NBI dug in the vegetation and up to 10 cm into the soil. The main sensory systems used seem to be touch and taste, both located on top of the elongated beak. The ibises can therefore utilise resources mostly unavailable to other wintering bird species.

The diet consisted mainly of adult and larval snails and their eggs, as well as various worms (*Annelida*). Beetles are the insects predominantly fed on. Crickets and grasshoppers (*Saltatoria*), abundant until the beginning of the colder period in January, were underrepresented in items taken. Lizards, blindworms, snakes, mice and frogs were rarely taken.

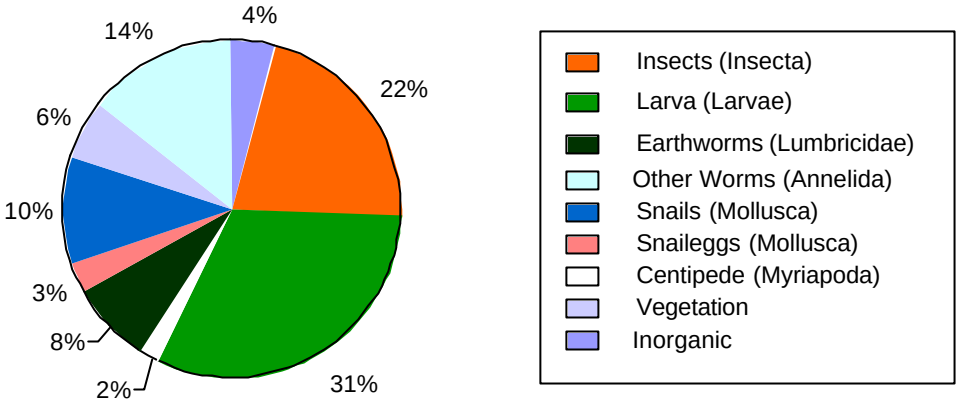

Fig. 1 Feeding ecology in the in the Laguna di Orbetello, Tuscany: Percentage of food items from different categories; 4.5 hours (mean) focal sampling per individual during 33 days of data collection; October 2003 till February 2004; n = 21 birds out of two generations (2002/2003); free flight and data collection was standardised for three hours per day; snail eggs were counted as n=1 per nest; inorganic was mainly stones and parts of snail shells; vegetation was mainly the sprout of a *monoptera*, numerous small items could not be categorised.

	Nov.03	Dec. 03	Jan. 04	Feb.04	Mar. 04
N	17	21	19	19	31
Mean	**17,0**	**13,9**	**11,0**	**12,8**	**13,4**
STD	2,3	4,2	3,6	2,2	2,5
Min	13,2	6,8	4,4	8,0	6,4
Max	21,2	19,4	16,0	16,6	16,2

table1: Noon temperature (0100 pm) at Laguna di Orbetello, Tuscany, during winter. N = number of standardised measurements per month. Mean = mean temperature per month. STD = standard deviation; Min. = minimum temperature measured; Max = maximum temperature measured.

Most of the other bird species foraged on the laguna wetland whereas the NBI never foraged there. Vice versa, the only other bird species which could regularly be seen feeding on the meadows used by our NBI were Cattle egrets (*Bubulcus ibis*).

The Cattle egrets were always in company with sheep and donkeys. They seem to feed mainly on startled insects, particularly *Saltatoria*, tracked down by the grazing animals. When the temperatures decreased by the beginning of January (see table1), these moving insect species became scarce, and the Cattle egrets disappeared, probably moving southwards to the region of Rome (pers. comm. FABIO PERCO).

NBI in contrast, never stay in close contact with the grazing animals themselves. They take advantage of the grazed areas as habitats in which they can effectively dig for food. The abundance of the NBI`s prey species seems to be affected less by decrease in temperature than prey of Cattle egrets. The invertebrate species preyed on by NBI make a vertical movement, going downwards daily to avoid the low surface temperature over night, and move up during day, when the temperature increases again (the soil surface was regularly frozen over night, but the lowest temperature measured at noon was +4°C).

A systematic comparison of these two birds feeding behaviour and ecology will be made next winter.

Continuation of the Project

During a NBI conservation and reintroduction workshop in Austria, July 2003, there was agreement that reintroduction of NBI is of significant relevance. Furthermore, it was agreed upon that the European Alps might have a promising potential for reintroduction in the future, provided that a technique to establish a migratory population is available. A release of young guided birds was recognised as the only promising method, and hand-rearing of chicks in groups with contact to human foster parents currently is the only technique with convincing results (BOEHM et al. 2003).

These statements justify a continuation of our project. If we succeed with establishing a new migratory tradition, the methodological tools are available to reintroduce NBI into the European Alps and elsewhere.

Flying with human-imprinted birds offers a broad range of options for bird conservation and scientific research (BERTHOLD, 2002). For example, Japanese ornithologists are interested in our work because our method may be suitable for reintroduction of the Oriental crested ibis (*Nipponia nippon*) in Japan. There is also potential for behavioural and physiological research in the context of bird flight and migration (FAABORG, 2002). Fortunately there are other ongoing projects to develop this method for other avian species, and we hope that it will become more and more efficient and established in conservation and scientific research projects.

Up to date information on the continuation of our project is available via our homepage or via a NEWS list (contact see below). A documentary of our migration trip 2003 is available as DVD (German/English) or as book (German).

Acknowledgements

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2.2. News from the the Gruenau Semi-wild Colony of Waldrapp Ibis

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Reproduction of the Grünau Colony of Northern Bald Ibis
We have demonstrated that it is possible to establish a local, free-flying, reproducing and partially self-sustaining colony of Northern Bald Ibis (NBI) from zoo offspring. For good reasons, the method chosen was socially-adapted hand-raising over 4 consecutive years, 1997 to 2000. In spring 2003, 25 experienced birds were roaming our valley.

In spring 2001, colony members started reproducing although the only fledgling of 2001 died during the winter. In spring 2002, the colony succeeded in its first full reproductive bout, with 9 nests, 22 eggs and, 4 fledged young, which were raised with only marginal supplemental food. Probably due to major social turmoil we had only one fledged young in 2003, from two late nests with a total of just 3 eggs. Because two birds were lost in 2003, colony size decreased to 24 in spring 2004. Despite a severe and long winter, nesting started early. By the end of April, we had 8 nests with more than 20 eggs. To the best of our knowledge, no birds left the valley over the past 2 years and the maximal excursion range has been to Scharnstein, 15km to the North of KLF. However, there were a few exceptions in early April 2004, when 4 unmated female birds repeatedly left the valley and in different combinations. They were seen in a radius of approx. 50km, from the NE to the NW, but always came back on their own.

Plans for 2004
For 2004, we plan to monitor the reproductive events and publish the data collected in previous years on hormones and behaviour, natural foraging and scrounging. If only a few young of the year will join the colony, we may decide to keep the aviary open all year round and not enclose the birds in during fall migration time as in previous years. We predict that the adults will stay, but young of the year may leave. If the number of fledged young exceeds 3-4, they will probably form a group of their own and may be prone to fly away in fall, as recent experience has shown. Hence, if many young birds fledge in 2004, we may still decide to close the aviary in fall, so as not to lose these birds.

If colony size exceeds 30 birds in fall, we plan to split off part of the colony (e.g. 4 adult breeders, 2 juveniles, 3 young of the year) and transfer the birds as a group to Herberstein Zoo (SE Styria/Austria, approx. 150km to the S of Grünau) where they will be habituated in a South-facing aviary on a hilltop. In late winter, the aviary will be opened and the birds allowed to fly freely. Management will be similar to the Grünau colony. There may be three possible outcomes of this experiment. In the worst case, birds will fly away, disperse, and get lost. This is unlikely, as the migration experiment by J. Fritz et al. (www.waldrappteam.at) 2003 showed that a free flying group had no difficulties orientating and returning to the point of release even in an area new to the birds. Our experience has shown that stray birds will be reported (they carry rings with a telephone number) and can easily be retrieved. The desired outcome is that birds will stay in the area and resume reproduction either the following spring or two years later. If this is the case, colony splitting will be a relatively cheap and easy alternative to hand-raising for establishing new colonies of Northern Bald Ibis. Finally, all or some of the birds may return to Grünau in spring. This would probably be the most exciting

outcome, because it would then be a tool for establishing networks of colonies over intermediate distances.

Why the Grünau colony was established

The purpose for establishing such a sedentary colony of NBI at the Konrad Lorenz Forschungsstelle in Grünau/Austria (KLF) was twofold, 1) to establish a third bird model, besides geese and ravens, for basic research in social mechanisms and 2) to gain knowhow for re-introductions. For the first few years the preferred method was socially adapted hand-raising (based on earlier pilot studies by E. Thaler et al, Zoo Innsbruck), leading to socially human-imprinted and thus, manageable birds. Initially, losses were severe, but after two years, spatio-temporal patterns stabilized. Considerable effort and funds had to be invested (approx 200 000€ in the first 6 years). The experience gained and the benefits of having a free-flying, semi-wild group for basic research and conservation management made the investment worthwhile. A single bird was picked up approx. 100km to the NW of the KLF and was returned to the colony by car. The aviary is open all year long apart from at migration time, between September and November. Depending on the number of fledglings, we may keep the aviary open all year long from 2004 on.

According to our experience, mid-and southern Europe could be a prime target area for re-introduction. However, re-introduction of NBI in historical ranges north of the Alps necessitates introducing new and safe migration routes south to safe and suitable wintering areas. Starting with 2002, J. Fritz and co-workers attempt to teach specifically hand-raised birds such a migration route behind ultra light planes (www.waldrappteam.at). Even though it proved difficult, results of 2002 and 2003 are promising. Although such pioneer work is being carried out to re-introduce NBI in mid-Europe, quite clearly, this should not distract from the fact that priority needs to be given to conservation of the last remains of wild populations.

Development of the Grünau Northern Bald Ibis Colony

From 1997 to 2000, hatchlings from Zoos were carefully hand raised in the attic of a barn from where they later fledged. This method establishes close bonds between the raisers and the birds. Such, birds develop a spatial bond via social bonds to their ”foster parents” and can be managed (for example can easily be taken into the aviary in adverse conditions). This allowed social traditions to develop, which now enable birds to cope with the conditions in our valley. For details of our approach see Kotrschal (1999, 2004), Tintner and Kotrschal (2002) and Tuckova et al. (1998).

In spring 1997, 11 of 12 nestlings from the Zoos Innsbruck and Vienna fledged, but only 4 survived into the following year. Most losses were due to local predators (eagle owl) or long-distance dispersal flights in fall. Discouraging as this was, there were also interesting aspects, such as 3 birds returning from their long distance flights on their own. One was seen in East German Frankfurt an der Oder, 600 km to the North of Grünau and was back 2 days later. This showed that the mechanisms needed for migrations are still intact in these Zoo-bred and hand-raised birds and they could survive for weeks without supplementary feeding.

In 1998, 16 of 17 nestlings, again from Innsbruck and Vienna zoos fledged successfully, resulting in a group of 20 free-flying birds in early summer. Again birds left for long-distance flights towards the Northeast of Europe between Sept. 30 and Oct. 5. Only few of them could be retrieved from Poland and Hungary, and most vanished in bad weather. One was found dead at Kaliningrad, approx. 1600 km to the Northeast of Grünau! Actually only 2 of the birds raised in 1997 and 4 from 1998 survived into spring 1999. In fact, 24 of our 30 birds raised during the first two years were dead and we seriously considered terminating the project. In

the end we decided to try a third season and also changed some of our management practices. Birds were taken into their "colony site" (the attic) during the night. Also, we closed the aviary in August and opened it again end of October to avoid heavy losses due to dispersal/migration which we had had in the first two years.

In 1999 12 of 13 chicks from Innsbruck Stuttgart Zoos and the Schmieding bird park (Wels/Austria) fledged successfully and joined our 6 experienced birds. The group developed regular spatio-temporal movement patterns and left their colony site for foraging (despite supplementary food, they spent many hours per day probing local meadows and pastures for insects, snails and small vertebrates) at distances of up to 20 km, but they usually returned in the evening. Only during severe weather conditions (e.g. heavy rainstorms) they were left in the aviary. Not a single bird was lost. From mid - August to November 16th the group was kept in the aviary and then allowed to fly again during the day in winter.

In spring 2000, 4 of 6 hatchlings from the Erfurt Zoo fledged and joined the group of 18. No bird was lost until spring 2001, resulting in 22 increasingly experienced birds. As the original facilities were insufficient to maintain this colony, we built a huge Waldrapp-aviary (400m2) in summer 2000, with a tall central building containing the ledges where birds roosted at night and built nests on a South-facing slope of the nearby Cumberland-Game Park. The sheltered ledges can be kept above freezing when night temperatures drop below -8°C. This building also has a 8m high tower which allows the birds to easily exit and enter the aviary. The group immediately accepted their new aviary as a colony site and never attempted to return to their previous, smaller night roost at the KLF.

No hand-raising was done in **2001**. However, probably stimulated by a few old birds present (6 individuals which had been in a park aviary before), the young hand-raised birds formed pairs and made a few nesting attempts. The only resulting fledgling died over winter.

In spring 2002, we observed a lot of courtship behaviour and pair formation in our still young birds. Unexpectedly soon for their age, of the 22 birds, 9 pairs built nests by the end of April and laid a total of 22 eggs. From the onset of breeding, birds were kept totally unrestrained (the aviary was also kept open during the night) and feeding was reduced to 1/5th of the birds daily need. This forced them to obtain the majority of food via natural foraging around the village of Grünau, some 8 km north of the breeding site. Finally, 4 young fledged. This is a relatively low number, but the pairs were first-time reproducers and also had to forage for themselves and for their young. In addition, a few hatchlings were contributed to the flight project (www.waldrappteam.at). One female shortly after hatching of her young did not return from a foraging excursion. This left 21 experienced hand-raised birds plus 4 ibis-reared fledglings (hence, a total of 25 birds), which integrated smoothly into the flock.

In spring 2003, there was again lot of courtship, but also an almost total changeover of pairing between partners. We had only two late nests (mid-May) with a total of only 3 eggs and a single young fledging in mid-July (!), which developed very well. One experienced male disappeared in August, and a female in December. As both birds disappeared without trace, the may have fallen victim to predators. Hence, group size at the beginning of 2004 was 24.

Spring 2004: Despite a severe and long winter, nesting started early. End of April, we had 8 nests with more than 20 eggs. The first young are scheduled to hatch beginning of May. As the years before we will cease feeding end of April, when natural forage is sufficient food.

The years before, hardly any bird ventured farther from the colony site than 15km. In early April 2004 however, 4 unmated female birds left the valley repeatedly and in different combinations of individuals. Birds stayed away for up to a week. They were seen in a radius of approx. 50km, from the NE to the NW, but came back on their own, except for one bird which was retrieved from Mondsee, 100km to the NW of Grünau.

A Few Results in Brief

Our project already contributed a lot of useful knowhow towards re-introductions (Anon. 1999, Kotrschal 1999, 2004). There is also great potential for learning more of the basic behavioural science. In the following, a selection of results is given

- Even hand-raised individuals tend to disperse (fly away) 1-3 months after fledging. The birds from Grünau flew N or NE to up to 1600 km (Kotrschal 1999, Tintner & Kotrschal 2002).
- In some cases, young dispersed birds returned on their own, as also was the case with several adult stray females in April 2004, suggesting that orientation mechanisms in these captive-bred individuals are intact, but need to be developed by post-fledge free flight.
- We also conclude from our 1997 and 1998 experiences that migration routes may be passed on as a tradition, such as in geese or cranes (Kotrschal 1999, Tintner & Kotrschal 2002).
- Dispersers of 1997 and 1998 which were finally retrieved or returned on their own were in good physical condition even after 4 weeks without supplementary feeding (Kotrschal 1999, Tintner & Kotrschal 2002).
- The flock developed regular spatio-temporal diurnal and annual patterns within the valley. Birds usually stay within 15km of their night roost and return every evening.
- With the introduction of birds into the new, highly functional aviary in the Cumberland-park in the year 2000, which serves as a night roost and nest site, birds no longer show tendencies to stay outside overnight, which improves safety against predation, notably by eagle owls.
- The 4 ibis-raised fledglings of 2002 and the one fledgling 2003 stayed in the company of their parents at meadows close to the aviary the first 3 weeks after fledging and then joined the flock in their foraging excursions to the meadows at the village of Grünau. Fledglings did not form a group of their own, but integrated into the main group within a few weeks after fledging and hence, assumed the group habits and traditions. At the colony site (aviary) ibis-raised individuals tolerate human caretakers nearly as close as the hand-raised individuals do.
- The 6 older aviary NBI (6-10 years of age, always previously kept in an aviary) of the Cumberland park also left the aviary upon permanent opening in spring 2002, but neither joined the well-orientated flock of hand-raised birds, nor returned to the aviary. All of them dispersed within 3 months of release. This showed once more, that 1) birds of different origin (different cultures) may not form a coherent flock, even after a long period of being kept together and 2) that aviary birds are unsuitable to be released probably due to the need to make early post-fledging experience to be able to fly in a socially and spatially orientated way.
- Naturally asynchronous hatchlings grow better and are less stressed (shown by excreted corticosteron levels) than relatively synchronized hatchlings (Tuckova 2000)
- Social versus solitary rearing in the nest only 3 weeks after hatching significantly affects growth, behaviour and socialization within the group (Tintner & Kotrschal 2002).
- The Grünau NBI group socially (pairs, clans) at the colony (night roost), but less so during foraging up to 10km off colony. They tend to forage as producer-scrounger

dyads, with the producers being mainly female, and the scrounger mainly male (Meran 2002, Koth 2002, Kirnbauer 2003). Scrounging may be severe and may constrain formation of foraging groups (and hence safety against predation), particularly at low food density.

- NBI prefer soft substrates for foraging (actually avoiding gravel) and use simple enhancement mechanisms and scrounging to profit from the competence of flock mates during foraging (Meran 2002, Koth 2002).
- The Grünau NBI only utilized wide and open meadows close to the village of Grünau, approx. 5-8 km north of the breeding site for foraging, where vegetation height did not exceed 15 cm. All of these meadows are organically fertilized for producing cattle feed. For collecting the mean daily requirement of 250g of prey (mainly earthworms and beetle larvae) of individuals not feeding young, birds had to forage 6-8 hours. NBI even continued foraging during periods of heavy rains (up to 3 days in a row; Koth 2002). Individual success was slightly more than 1 item per minute (on average, weighing less than 1g), and older birds are significantly more successful than juveniles. Actually birds spent between 5 and 10 hours per day foraging (Kirnbauer 2003), depending on foraging success (prey density) and need (i.e. whether or not they had to feed young).
- Within the pair, cooperation over reproduction is relatively symmetrical (pilot studies by Schnapp 2002, Hölzl 2002), with males and females taking similar shares in incubation and feeding of the young.
- Within the pair, females and males excrete similar amounts of testosterone metabolites during the reproductive phase (Dorn, Sorato, unpubl.). Either females in the competitive colony situation need particularly high T, or males maintain low T not to constrain their paternal behaviour. Symmetrical T levels would explain the symmetry in size and colour intensity, of the bare red skin of head and throat.

A few Conclusions: Why Re-introduction in Europe?

Our experience suggests that mid-and southern Europe could be a prime target area for re-introduction, because:

1. Northern Bald Ibis always lived in close proximity to humans in central Europe
2. The habitats of the remaining wild populations of NBI are ecologically sub-optimal and hence, relatively marginal habitats for NBI due to degradation over the past 2000 years and even the past 20 years,
3. Central Europe and the circum-Mediterranean area was probably an NBI speciation centre. (This is supported by feeding eco-morphology, as NBI is equipped with a vibration-sensitive probing bill and prefers soft soils for foraging)
4. NBI cope well with the feeding conditions in areas of extensive agriculture (see above)
5. Global warming, particularly in the Alpine area (which warms twice as fast as the world average) favours re-introduction.
6. There is little or no expected conflict with human interests (see above)
7. The NBI could be used as a symbol of the relationship between nature and culture in Central Europe and hence, has the potential of becoming a symbol for European integration
8. Mid Europe is a comparatively safe haven for NBI and has a well-educated, benevolent human population which can easily be reached and informed via the media.

However, re-introduction of NBI in historical ranges north of the Alps necessitates teaching of new and safe migration routes south and locating a safe wintering area (www.waldrappteam.at). Even though there are difficulties, the results are promising.

Although such pioneer work to re-introduce NBI **is being carried out** in central Europe, quite clearly, this should not distract from the fact that priority needs to be given to conservation of the last remains of wild populations.

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2.3. A study of different release techniques for a captive population of Northern Bald Ibis *(Geronticus eremita)* in the region of *La Janda* (Cadiz, Southern Spain)

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Background

The Northern Bald Ibis (NBI, *Geronticus eremita*) has declined dramatically over the past 50 years. With about 318 birds remaining in the wild (EL BEKKAY, 2003), this species is classified as critically endangered, the highest threat category according to IUCN criteria (BirdLife 2000). The Souss-Massa region near Agadir (SW Morocco) holds the last known viable breeding population of NBI. In April 2002 a small colony, formed by 7 adults, was discovered in Syria (SERRA et al. 2002). The future of this eastern population is uncertain as only 5 adult birds returned to Syria colony in 2004 (SERRA, per. com.). The species disappeared from the European Alps more than 400 years ago and from Turkey in 1989 (AKÇAKAYA et al. 1992), although a semi captive population is found nearby Birecik, Turkey. Occasional records from Yemen and Eritrea suggest that an isolated population might exist in that region but this must be confirmed. Hunting, direct persecution by humans, lost of foraging areas and pesticide poisoning (especially in the Turkey population) have been the main reasons for the species' decline (CRAMP & SIMMONS 1977, HIRSCH 1977).
During the "International workshop on a the strategy for the rehabilitation of the Northern Bald Ibis" held in Agadir, Morocco, 8-12 March 1999 it was concluded that it would be useful to perform studies on releasing techniques to attain a non-migratory and viable population of this species outside its current range. In cooperation with the IUCN/SSC Reintroduction Specialist Group, the workshop developed specific guidelines for a release/reintroduction program, assuming that reintroduction may have an important role in avoiding extinction of the Northern Bald Ibis. The International Advisory Group for Northern Bald Ibis (IAGNBI) was created to invite international co-operation in this area.
A workshop of the International Advisory Group for NBI (IAGNBI) was held in Innsbruck (Austria) in July 2003. A set of conservation priorities for the Northern Bald Ibis were formulated at this meeting, in which it was stated that any release guidelines developed by IAGNBI must be regularly updated in the light of experience and ongoing research, and should be followed during any and all programmes involving release/reintroduction of this species. The "Proyecto Eremita" revised its release methodology plans in view of the outputs from the Innsbruck meeting.
A Species Action Plan (SAP) meeting for the conservation of the Northern Bald Ibis was held in Madrid (Spain) in January 2004. The main threats affecting conservation of the Northern bald Ibis in its current sites were identified during this meeting.

Objectives

A Main objective
"Proyecto Eremita" aims to evaluate the efficacy of different releasing techniques in *La Janda* area, Southern Spain, following the release guidelines developed by IAGNBI. The success of

this study will be assessed by the establishment of a sedentary, self-sustained, free-flying colony in this area during the time of the project.

B Specific objectives

1. Perform an area survey. The selected area should have suitable foraging grounds, availability of nesting places (i.e. cliffs) and absence or minimum potential risks (use of pesticides, predators, human disturbance, etc.). Consequences of the release on this area will also be considered.
2. Build an aviary for hand rearing and acclimation of the birds.
3. Release 20 – 25 hand-reared ibises per year. The birds will be hand-reared using different methods.
4. Monitor released birds.
5. Capture the birds at the end of the project.
6. Carry out campaign, with two main components: awareness on the status of the species in the wild and highlight the ecological interest of *La Janda* area.
7. To produce communications, research and scientific papers.

General methods

Study area

Sierra El Retín (South-western Cádiz province) is a mountainous area used by the Spanish Navy as a training camp. This area presents clear benefits for the species: (1) seashore cliffs at "Parque Natural de la Breña y Marismas del Barbate"; (2) abundant foraging areas surrounding the releasing site. In recent times, La Janda (a large wetland area) was drained and now pastures and agriculture fields are available allowing the birds to feed all the year around; (3) due to the military use, the access of unauthorised personnel to the area is restricted; and (4) good climate with mild winters and hot and dry summers. Dominant eastern winds provide favourable humidity conditions during the severe summer drought. All these conditions are similar to those in habitats used by the extant Moroccan population.

Veterinary procedures

Veterinary procedures will be based on the "Veterinary Protocol in the Reintroduction of Northern Bald Ibis (*Geronticus eremita*)", Kirkwood J.K & Quevedo M.A. 1999.
Birds coming from ZooBotánico Jerez have been under veterinary surveillance since 1991 and can be consider as having been "in quarantine" over such a long period of time.
All the aviaries built will be cleaned and carefully checked for possible foreign material that could be ingested and cause illness.
There will be established surveillance of released birds to monitor for any signs of disease or mortality during the project. Dead birds will be thoroughly analysed (post mortem study).

Origin and selection of the specimens

Northern Bald Ibises used in this project will mainly from ZooBotánico Jerez. Our population (N=50 to date April 2004) has been in existence since 1991. All the ibises are individually marked (metal and plastic rings), the social structure is stable and parentage well established. In addition, the colony includes 5 out of 7 blood lines recognised in the entire captive population. If necessary, specimens from other European Endangered Species Program (EEP) facilities could be used according to the EEP-coordinator.
At least 17 pairs are nesting in 2004 (own data) in the ZooBotánico Jerez colony, from which nestlings for project hand-rearing will be obtained.

Eggs from Cattle egrets (*Ardeola ibis*) will be collected either from captive breeding at ZooBotánico Jerez or from a colony nesting at Cañada de los Pájaros (Coria del Río, Sevilla). These options have received approval form Consejería de Medio Ambiente, Junta de Andalucía, the local authority in this matter.

Management conditions

The food, provided twice a day, will consists of a mixed diet including minced chicken with bones, calf heart, commercial food for insectivorous birds, a small amount of dog food and multivitamins. During the breeding season (February – July), mice, migratory locust (*Locusta migratoria*) and mealworms (*Tenebrio molitor*) will also be included in the diet. During the release period, live prey such as crickets, locusts, snails and mice will be offered to improve foraging techniques in nature.

Characteristics of the enclosures

The facility will be built up in a U-shape with a NW orientation to protect the birds from the strong eastern winds common in the area, and from exposure to the sun during the breeding period (winter and summer). The facility has three aviaries characterized as follows:

- **Central aviary:** The 18 x 6 x 4 m aviary can be divided in two other enclosures using a central door, if needed. A 23 mm thick wooden wall (resistant to unfavourable weather) is firmly attached to the back by metallic 4-m tall girders designed to support the whole structure. A number of nesting platforms with 0.8 x 0.8 m wooden cages are built on this wall to facilitate nesting and roosting. Another nesting platform is available outside the aviary but in the same wall, which may be used by free-flying birds as a roosting place. Perching structures are also provided in the aviary. A pond (2 m in size, 0.30 cm in depth) will be located on the ground for drinking water and bathing. The whole enclosure will be built using a 5x5 cm metallic mesh. A structure to provide shadow will be built in the upper surface of the aviary.

- **Lateral aviaries**: Two 14 x 6 x 4 m attached aviaries (defined as **left** and **right**) forming the arms of the "U" are available for release attempts. Nesting platforms with 0.80 x 0.80 wooden cages are available for the hand-reared nestlings. Perching structures are also provided. A pond, similar to that of central aviary, is located in the middle of the aviaries. The same metallic mesh and shadow structures are used (see above). Large doors in the front walls will facilitate release of birds.

- **Central yard**: This is an open space in the middle of the U-shape facility. The roof of the central yard is covered by metallic mesh (see above) but the front is open (without doors). Perching structures, a water pond and food will be provided in this yard. The yard will hopefully provide a suitable place for capturing the free-ranging birds if needed, using a trapping net (drooped).

A perimeter fence (electric fence) surrounding the facility will exclude predators.

Methodology and releasing technique proposal:

Background

Previous release attempts (Austria, Israel and Turkey) were unsuccessful (THALER et al. 1992, PEGORARO & THALER 1994, MENDELSSOHN 1994, KOTRSCHAL 1999) for a number of reasons (e.g. adverse weather, lack of foraging areas, lack of experience of the released birds in coping with new environmental conditions). The project carried out in Gruenau (Austria) has

shown that new techniques to establish a sedentary free-flying colony of Northern Bald Ibises are promising, although these birds remain dependent on human care, particularly food provisioning in autumn and winter (KOTRSCHAL 2004).

The "Proyecto eremita", scientifically assisted by Estación Biológica Doñana, CSIC (a well-known and prestigious scientific institution devoted to biological conservation), aims to analyse the efficacy of different releasing techniques (with up to 2 groups of animals reared under different conditions) in *La Janda* area, Southern Spain, a climatically suitable habitat for the species. These releasing techniques have been reviewed by IAGNBI and were revised in the light of the fruitful discussion carried out at the Innsbruck meeting in July 2003.

Releasing technique in the first year: Hand-rearing

Some of the conclusions reached at the Innsbruck meeting regarding the guidelines of releasing techniques are:

- Hand-rearing of a group of nestlings by human foster parents appears to be a valuable tool for Northern Bald Ibis release.
- Rearing in a group prevents sexual imprinting on humans.
- Hand-rearing with company of a sedentary species may be useful.

While "Proyecto Eremita" focuses on NBI, Cattle egrets will also be included in the project. Cattle egrets are a highly terrestrial, colonial nesting, gregarious species with ecological requirements (food, foraging areas, etc.) similar to those for NBI. We hope that the Cattle egrets, which are sedentary and abundant in this area, might guide Northern Bald Ibis to find foraging, roosting and breeding sites.

Hand-rearing will be undertaken in the first two years of the project, however the project protocol will be updated in the light of experience, results and ongoing research. This re-evaluation process may lead to use of other soft release methods.

In order to compare success of different techniques, NBI and Cattle egrets chicks will be hand-reared in two groups during the first year:

(a) *Group A*: 12 NBI chicks.
(b) *Group B*: 12 NBI chicks + 10 Cattle egret chicks. The idea is that Cattle egret chicks behave as "guide species" of NBI once they are released. A test mixed group of 4 NBI and 6 Cattle egrets were hand-reared at ZooBotánico Jerez in 2002 to analyse the effects and consequences of rearing the two species together. Results were promising. There was neither abnormal behaviour nor aggression between species and they all successfully integrated into the NBI captive population. These birds have been kept in the NBI aviary at ZooBotánico Jerez to study relationships and sexual behaviour.

Birds will be raised until they are approximately 20 days of age. At this time, all the chicks will be transported to the outdoor aviaries located at Sierra El Retín (Barbate, Cádiz).

Methodology

Birds will remain in the El Retín aviaries until they fledge (generally fledging occurs at 45 – 47 days of age). The location and methods used there are as follows:

(1) **Right aviary:** birds from *group A* (NBI). These birds will be released as soon as they fledge.

(2) **Left aviary:** birds from *group B* (NBI + CE). These birds will be released as soon as they fledge. Hopefully the NBI will recognise the CE as "guides" once they are liberated.
(3) **Central aviary:** A number of "resident" NBI will be kept In this aviary, during the whole study period. None of these birds (12 breeding pairs) will be released. This population will be used to encourage site-attachment and to serve as an attraction point of the free-flying birds.
(4) **Central yard:** Food and water for use by released birds will be provided *ad libitum*. Released animals could be trapped, possibly using a curtain net, if needed.

Dispersal of juveniles and its control

Dispersal normally occurs around 1 month after fledgling and again at the time of autumn migration. To avoid dispersal of the juveniles released from right and left during the migratory period they will be contained for 2 – 3 months (from mid-August to November). The release process will be continued thereafter.

Monitoring
All the birds will be individually marked using a standard aluminium ring plus a plastic colour ring with an alphanumeric code. Terrestrial radio-transmitters will be used with some birds. Satellite radio-transmitters are planned for use in specific cases. Monitoring will start with the first released birds.

Trapping and capture of birds
It is planned to recapture the birds, using different trapping methods, once the project has finished. Recapture methodology is based on that used in Bireçik; e.g. right and left aviary, central yard, gun-nets, etc.

PLANNING

1st year: March 2003 to May 2004
- Habitat survey (field study) in *La Janda* area; this is almost completed.
- Selection of the sites for the aviaries

2nd year: March 2004 to March 2005
- Information and education campaigns
- Building the aviaries
- Transfer and adaptation of birds to the aviaries
- First releases, tracking and monitoring, behavioural studies
- Evaluation of releasing methods

3rd year: March 2005 to March 2006
- Information campaigns
- Release of birds and tracking, behavioural studies
- Evaluation of release methods

4th year: March 2006 to March 2007
- Information campaigns
- Release and tracking. Behavioural studies

- Evaluation of release methods
- International workshop for Northern Bald Ibis in Jerez, Spain (July 2007)

5th year: March 2007 to November 2008

- Information campaigns
- Release and tracking, behavioural studies
- Evaluation of result, report writing
- Capture of birds
- Demolition of infrastructures made for the study

EXPECTED RESULTS

- To improve knowledge of the species.
- To develop an effective technique for releasing NBI from captive populations in order to establish a sedentary, stable, self-sustained free-flying population in the *La Janda* area.
- Increase cooperation among IAGNBI and different organisations, institutions and sectors associated with conservation of this species.
- An indirect benefit would be increased public awareness on endangered species conservation.

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2.4. Waldrapp Project „Bschar el Kh-ir“ in Ain Tijja in Morocco

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Introduction
In 1997 the forest department of Morocco asked the GTZ (Deutsche Gesellschaft für technische Zusammenarbeit GmbH) to evaluate whether a potential reintroduction of the Northern Bald Ibis was possible at historical sites in Morocco, mainly because the decrease of the last remaining wild colonies in Agadir (then about 200 birds) was viewed with concern. At the same time the GTZ was asked to make a survey on the historical distribution of the Northern Bald Ibis in Morocco (finished in June 1997, GTZ project AGRN, Hajib Said).

Based on the data of all historical breeding colonies and potential sites they decided for the region of Mezguitem in the Northwest of Morocco. All requirement of the NBI seems to be met there.
The best place for a release project was the remote end of the Ain Tijja valley with a small artificial lake in the Rif Mountains close to the village of Mezguitem in Northeast of Morocco. The Northern Bald Ibis was breeding at this site until 1985. The steep rocks and hills of the Queds Msoun and Moulouya, which carry water, provide potential breeding sites. The landscape is wide and hilly and the farmers make only low intense use of this area with its rich fauna. There are small mammals, ground breeding birds, insects, worms, scorpions, spiders, reptiles, amphibians, tadpoles and molluscs which are potential food for the Northern Bald Ibis. The arid steppe close to the end of the valley (more than 1000km^3) is used as pastures for sheep and goats and corn growing. Farmers do not use herbicides and pesticides because it is not profitable for them. Former quarries which are supposed to be the reason why the NBI disappeared are closed down because they are not profitable any more. Now the area of Ain Tijja is used by forestry and is protected. Although the area is rather remote it can be easily logistically managed.

In 1998 Prof. Dr. Wiesner, director of Tierpark Hellabrunn Munich and Dr. W. Grummt, an ornithologist from Tierpark Berlin-Friedrichsfelde reviewed the area in Mezguitem/Ain Tijja and found it suitable for the NBI project.

On 24th November 1999 an agreement between the Moroccan forest department and the delegated listed was signed:

- forest department DREF of Taza (direction Régional des Eaux et Forêts) Arbeitsgemeinschaft Waldrapp (AgW) of the zoological gardens of Munich, Vienna, Berlin, Nuremberg and Bern
- NGO society of environment of Taza (ATED)
- the society “les Ciments de l’Oriental” (HolCim)
- the community of Mezguitem

This national project to evolve a releasing method of the NBI in Mezguitem is financed by the AgW and the Moroccan sponsor HolCim. The ATED of Tazekka is responsible for the organization, implementation and management of the project. The Zoo Rabat carries out the veterinarian survey and supervises the bird keepers. The training of special staff members can be done by the AgW.
The official opening of the NBI station took place in Mezguitem on the 21st October in 2000 which was attended by the Moroccan minister of agriculture and the Governor of Taza.

Facilities in Ain Tijja

Two aviaries each with a size of 180m^2 and 9 m high were built. The aviaries are so close that the birds of each aviary may have contact. The aviaries are erected in a steep slope and have natural rocks in their back with potential breeding sites in different sizes. Between the aviaries there is a room that enables to enter the aviaries and to observe the birds. Furthermore it is used for breeding insects (mealworms, crickets, grasshoppers).

The birds can enter a third aviary which is erected at the back of aviary 2 through a 6 x 1m opening at the upper part close to the breeding sites. Food is provided there every day to get the birds used to entering that aviary. Due to a special construction the roof of aviary 3 can be opened quickly, which could be part of the releasing method. A release however will only take place if all conditions necessary are fulfilled and a cooperation of the Moroccan government and national and international scientific authorities give their consent. However the number of birds needed is still too small due to external problems and therefore building up a population will need some more years.

An artificial fountain supplies the birds as well as the villagers with drinking water. The fountain is also used as "donkeys parking". In summer more than 60 families go with their domestic stock (donkey and mules) there every day to get their drinking water. The people know that due to the NBI their every day water supply is guaranteed. Furthermore they have the chance to get jobs if they help to construct the NBI station. This is an important reason why a lot of people have not left the area. The NBI is therefore a well appreciated and loved bird species. The name of the NBI station which was given by the local people is "Bschar el Kh-ir" which means "Bearer of the good".

In the house of the station where the keepers and wardens of the project live is supplied with solar electricity. Close to the house an information and training centre was erected as the parents of the pupils parents of Mezguitem wished. This construction will be finished this year and is powered by the HolCim society. Furthermore every pupil of Mezguitem gets school equipment at the beginning of his classes. HolCim provides the NBI project with that material.
In the information centre a small living and working area for researchers and workers was set up. Depending on the number of visitors who will come to the Mezguitem project additional rooms will probably be necessary.

An agreement that all studies needed for environmental and scientific questions regarding the NBI will be done by students of GRDUR without any costs was signed by the environmental society Tazekka (ATDE) and the « Groupe de Recherche et des Etudes de Développement Urbain et Rural (GREDUR) of the « Institut Scientifique Cheriffien de Rabat ». This will guarantee a scientific basis for the release of the NBI. The environmental society of Taza (ATDE) will supervise and organise all activities of the NBI project in Ain Tijja.

Number of NBI in Ain Tijja:

AVIARY 2:
2000:
November 2000 10 Birds of NBI were brought from Germany: **1.1**.adult birds (age 5 years), **0.0.8** young birds (1 year old). One young bird's head was injured when released in the aviary and it died the next day.
End of 2000: 9 birds (1.1.7)

2001:
The adult birds had eggs, two chicks hatched and one was raised. 6 of the 7 young birds paired and started to build nests however they did not lay eggs.
End of 2001: 10 birds (1.1 adult birds (age 6), 7 young birds (age 2) and 1 chick (7 months old)

2002:
The adult birds and two pairs of the younger birds started to build nests. This summer no chicks could be raised due to extreme temperatures (down to 0^0C and up to 45^0C) and strong winds, climatic conditions that have not been reported before.
End of 2002: 10 birds (1.1. - 7 years, 0.0.7- 3 years old, 0.0.1-2 years old)

2003:
The adult NBI pair raised 1 chick successfully. In January the bird hatched in 2002 died because of the extreme cold temperatures (about -3 ^{0}C).
End of 2003: 10 birds (1.1 - 8 years, 3.3 - 4 years, 0.0.1 – 4 years)

2004:
8 of the birds started to build nests and laid eggs. On the 27th April 10 NBI of Vienna Zoo and Nuremberg arrived in Ain Tijja. Although it was very rainy during the transport the birds arrived safely and were given in aviary 1. The Veterinarian of Rabat checked the birds. Three days after the arrival one bird died because of an accident.
End of 2004: 19 birds, (4 pairs)

Although Rabat was asked several times to provide birds for the project they did not put any bird at dispersal. All imported NBI were ringed, chipped and checked for diseases before the transfer. They have got veterinarian permits, certificates of origin and the CITES permits. All observations concerning the behaviour and physical condition of the birds and all occurrences around the station are put down in a daily report.

3. Wild colonies: updates of the programmes, situation, projects

3.1. **The Bald Ibis in Souss Massa Region (Morocco)**

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The annual meeting of the Souss-Massa National Park's Bald Ibis conservation project committee was held at the Park's headquarters in Agadir in late February 2004. The main aim of these meetings is to evaluate the results of the research of the preceding year, and by taking these and other developments into consideration, plan the activities and any further research needed for the current year. These involve all senior park staff, Eaux et Forets staff from Rabat and from the region, as well as BirdLife staff from RSPB, SEO and the new wetlands office in Rabat.

The research team of the project gave short presentations to explain the latest results and activities, as well as an overview for Morocco and elsewhere to give the international context. It was agreed that the NBI population is the most intensively studied bird population in the country. One of the studies planned for 2004 is developing and finalising the NBI diet study. The work has recently concentrated on the calibration of known food items passing through the NBI at Temara Zoo. 1400 faecal samples were collected for this purpose, and should be analysed by July this year.

picture 1:Two birds resting on the nesting cliffs

The breeding season began as usual in February. Six wardens are responsible for the fieldwork and monitoring: three wardens on each site (Tamri and Massa), plus one more for a major roost-site. A participative training day was organised for the wardens, in order to standardise the methods and the modalities of doing the field work. The training was very successful, and each warden shared his experience with the others.

More than eighty breeding pairs have so far been counted at the two sites: Forty-five nests at the Tamri colony, and forty-three at the park's colonies. It seems that the situation is very similar so far to last year. The majority of nests have at least two chicks, and five nests have four chicks in the park's colonies. If no incidents, troubles are registered, we hope that the productivity may be as high as last year: 110 fledged chicks.

Picture 2: Chicks on the nests

For the Tamri colony, the analysis of the breeding data for the last four years showed that the importance of nocturnal disappearance of chicks, which occurred mainly between the end of March to mid-April. For this reason, on 26 March, the infra red camera was installed in the site. Three wardens take care of the equipment between them. After two weeks, no predation had been registered.

Picture 3:The Infra Red Camera installed in front of the nests

Up until now, the NBI dispersal after the breeding season remains a mystery, and it's a real threat for the conservation and the protection of the birds. This "migration" of adults and juveniles, concerns an important proportion of the Moroccan NBI population. Conscious of the amplitude of this phenomenon, the project tried, two years ago, to catch some NBI in order to ring them, and to use satellite transmitters for two ibis. The activity hasn't yet succeeded, mainly because it was very difficult to attract birds to a small trapping area. One intention this year is to develop a methodology to attract the ibis to the trapping area by using plastic water points, and by increasing the number of water points late in the breeding season. Let's hope we succeed this year!

3.2. First month of Ibis Protection programme in 2004 in Syria : never a dull moment…

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The first detection of the return of the Northern Bald Ibis to their nesting grounds in **Palmyra**, Syria was symbolic of the main threat to these eastern survivors: on the evening of 18 February a party of hunters from the Arabian Gulf states described a flock of "strange" birds fitting the description of Northern Bald Ibises that were roosting on a small cliff near where the hunters were camping. The surveying team was immediately pervaded by a mix of joy and anger. Hunting was once again confirmed as one of the greatest threats to these few remaining Syrian Northern Bald Ibises, in contrast to Morocco and Turkey.

The ibises came back in two separate groups this year: a first group of three arrived on the evening of 17 February, followed two days later by a second group of two. The "reunion" of these birds was spectacular and emotional for us, as humble observers – and especially for the participants in the OSME waterfowl expedition (performing the first major winter bird count for Syria!), that arrived on site exactly on time.

The dismaying decrease in returnees every year (in 2002 they were 7, in 2003 6, in 2004 5), and lack of recruitment despite brilliant breeding results the past two years indicates that discovering where and how the birds spend their time during the non-breeding season is of highest priority in saving these birds. Would it be more risky to try immediately to trap a bird and fit a transmitter to it in order to track the mysterious routes or to wait to do so? This dilemma was recently put forth by IAGNBI chair Chris Bowden to all the IAGNBI members for discussion. Good news is that AEWA is willing to finance the tagging operation this year through the RSPB, and that the best candidate in Europe (i.e. satellite "guru" Lubomir Peske) has already agreed to take this difficult task on.

We immediately conferred with Chris and Lubomir on how to trap the birds this year. Adeeb Al Assaed, a Palmyra falcon trapper working in the project team for the past three years has been heavily involved in this matter right from the beginning. We all agreed that the best option would be to construct water sites suitable for trapping the birds as quickly as possible, and hope the ibises become accustomed by using them. The water sites are designed to be sheep and dog proof. We set up a net close to the sites and a hide constructed of stone approximately 20 m from it.

As in the previous year, and presumably because of persisting low temperatures, the ibises did not initially roost on the usual breeding cliff (cliff 1). Instead they used another cliff (cliff 2) at a lower altitude, 20 km SE from cliff 1. The ibises constructed nests on cliff 1 and fed in nearby pastures during the day, returning to cliff 2 before sunset ♣.

Between 20 February and 20 March we were busy setting up a Bedouin tent in front of cliff 1, selecting three Bedouin families to work with us as guards, placing signs to warn hunters not

♣ Have you ever asked yourself what can be the cruising flying average speed of a (sleepy) bald ibis ? The answer is: about 80-100 km / hr (they were spotted while leaving cliff 1, and while arriving at cliff 2 by another observer + the distance covered was known).

to kill the ibises, and building six traps for the trapping attempt. Meanwhile the birds were spending increasingly more time building their nests on cliff 1 – and they began roosting on cliff 1 as well. Nevertheless, between 15 and 20 March we noticed that one of the two pairs sometimes again roosted on cliff 2.

We did not have the time to celebrate completion of an intense field work session (i.e. everything was finally ready to begin the routine protection work, and personally I was ready for a deserved holiday break), when we suddenly realized that the birds were going to breed on cliff 2 this year (!): on 21 March we found one of the pairs incubating eggs in a nest at cliff 2, and the next day the rest of the colony (i.e. the 2nd pair + the lone individual) also moved there. The reason for this totally unexpected "decision" was probably reoccurrence of low temperatures at cliff 1 just before the first pair was ready to produce its eggs, as two nights before the first pair "decided" to change breeding cliffs, the night temperature dropped below 0^0C (we found frozen water for breakfast).

This meant that we had to begin again with setting up the tent and traps, hiring new guards etc. It was particularly difficult to stop working with the Bedouin guards we had already hired and who we knew well from protection programmes. They of course would not move to a different area, occupied by a different (and hostile) tribe. However by 28th March everything was again operative at the new site.

Finally, due to the efforts of the Syrian Society for Conservation of Wildlife (and most particularly its representative Walid Attar, who participated in the Madrid meeting), and also due to "high" contacts made by the OSME expedition, a wave of enforcement of hunting regulations has swept the whole country during the past months. According to the newspapers this new zero-tolerance policy has brought several hundred hunters to jail, including some influential hunters from the Arabian Gulf states.

During the same time, our collaborator and (ex-)hunter Adeeb Al Assaed has made significant progress in convincing Palmyrean hunters to stop accompanying poachers from the Arabian Gulf states and even to stop renting guns to them. Because of all these recent developments, hunters are rarely seen within the Palmyrean steppe these days. On the other hand rumours are quickly spreading out that a bounty on our heads has been placed in the Arabian Gulf states … A new question is: will the Palmyra wildlife team become extinct before the birds that they are trying to protect?

4. Meeting reports

4.1. Report on the Northern Bald Ibis *Geronticus eremita:* Conservation and Reintroduction Workshop, Innsbruck July 2003

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The Northern Bald Ibis (*Geronticus eremita,* NBI) is a critically endangered species. Alarmed by the situation in the wild and the growing idea of releasing birds, three meetings with the main topics of NBI conservation and reintroduction were already held in the 1990s. The main conclusions of all these workshops were that whilst the priority should remain the safeguard of the wild population, reintroduction potentially offers a chance to increase the Northern Bald Ibis population.

For the NBI exists a large and managed captive population. With this background, to release captive birds seems to be a clear-cut solution for conservation of the NBI. Unfortunately though, the biology and behaviour of the NBI are more complex than for most species and are not readily compatible with release efforts. Experience of various failed release projects clearly indicates that simply releasing a group of NBI will not work. It seems that NBI have to be well prepared and trained before released, that learning is restricted to only a few early years of the birds´ life, and possibly certain sensitive periods within this time.

Since the beginning of the 1990s more studies and experiments were made on the methodology of release of the NBI, and findings from these efforts are promising. But given the situation with several independent groups working in different countries with different methods to solve one major problem, we felt it was time to bring various ideas and knowledge together, increase the level of contact between the people and institutions involved. Hence the idea to have a further meeting. The meeting was organised by the Alpenzoo Innsbruck-Tirol, which coordinates the NBI European studbook since founded and IAGNBI.

23 persons followed the invitation of the IAGNBI and the Alpenzoo. Representatives of Zoos, WAZA, IUCN, AEWA, the countries where the NBI still exists in the wild, project leaders, RSBP and Birdlife Spain attended the workshop.

The main goals of the meeting were to:

- gain an updated overview of the situation of the wild NBI colonies (Morocco, Syria) and of the semi wild population in Turkey
- review the advances in methodology from ongoing work
- assess all ongoing releasing projects
- discuss the aims as well as the strengths and weaknesses of each release project
- review the activities of IAGNBI and discuss its future structure and work
- develop NBI release guidelines and priorities

IAGNBI

The role of IAGNBI and its conservation statements were reviewed during the workshop (see 1.1 and 1.2.). Seven new members joined the committee. Chris Bowden was appointed as Chairman.

WILD COLONIES

Talks given updated the overview of the wild colonies in Morocco, the newly found colony in Syria and the semi-wild population in Birecik. All three colonies are monitored and managed. In October 2002 a workshop in Birecik took place to improve the husbandry of the Birecik population. The birds have been ringed two years ago and breeding partners are recognized. Now in 2003 75 birds are housed in the breeding center in two seperated aviaries. 25 birds of the Eastern population are in kept in Turkish zoos.

NBI PROJECTS

There are four research and/or release projects which are carried by the

- Konrad Lorenz Research Station, Gruenau, Upper Austria;
- waldrappteam.at, Austria, Upper Austria;
- Mezguitem project: Ministry of Forestry of Morocco and the Arbeitsgemeinschaft Waldrapp
- Spain project: Zoo Jerez, the Junta de Andalucia, Parque Natural Breña y Marismas del Barbate in Retin Sierra, Southern Spain

Representatives of the projects reported on their experiences, results and future plans.

Further there were talks about the former release trials, disease considerations if the NBI will be translocated, diseases and health problems known for the NBI, fundamental considerations for release projects, the history of IAGNBI and an overview on the status of the NBI in captivity.

RELEASE GUIDELINES

According to the experience of former and ongoing release trials release guidelines could be gained.

Release strategy

A hard and soft release of adult and young birds were tested and failed. Cross fostering seems with the experience of other rather social species not very promising. The only technique that obtained promising results is hand rearing a larger number of nestlings with close contact to humans. Raised in a larger group prevent sexual imprinting on humans. Hand rearing in groups with a second species and colony splitting obtain possible potentials but requires testing.

Dispersal and migration movements are still a crucial problem when birds are released because the captive bred NBI still have the ability to migrate. Dispersal/migration is not initialised by external circumstances like weather or lack of food abundance. More data on wild dispersal would assist this process but are still not quantified at present. At the moment it is only possible to establish a sedentary colony.

Post release monitoring

It will be essential to monitor success or failure of a release, i.e. to monitor biological data (survival, social and breeding behaviour, diseases etc.) When released at a site where the NBI has been absent for a long time the impact on sympatric species will have to be controlled. For monitoring classic and new techniques (rings, microchips, radio and satellite tracking, DNA) will have to be used. Daily monitoring should be carried out for a period possibly as

long as 2 years post-release, then the possibility exists to down-scale monitoring programme depending upon outcomes.

Site selection criteria

Potential releasing sites have to be within the former home range of the NBI. Considerations should be mainly given to protected areas were the legal status and ownership is well known as well as long term plans about the site. Post monitoring programs should be possible. According to the dispersal/migration ability of the NBI the distance to existing wild colonies have to affect the release site selection. At sites where the NBI has been absent for rather long time a risk assessment on the likely impact of the released birds on existing species has to be made.

At the end of the workshop the delegates visited the free flying colony at the Konrad Lorenz Forschungsstelle and the project of the waldrappteam.at in Gruenau, Upper Austria.

4.2. Species Action Planning Meetings for the Northern Bald Ibis, Madrid, Spain, January 2004
Species Action Planning Meetings for the Southern Bald Ibis, Wakkastroom, South Africa, November 2003

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SPECIES ACTION PLANNING MEETING NORTHERN BALD IBIS

A workshop was held in Madrid 8-11 January 2004 to draft the first Species Action Plan for Northern Bald Ibis. AEWA largely funded the meeting, which was hosted by SEO, the Spanish BirdLife Partner, at their offices in Madrid. The meeting comprised a relatively small group, keeping things workable, and certainly the outputs from Innsbruck meant that a lot of ground on the reintroductions aspects had been largely covered there. The outputs of the meeting should strengthen the role and recognition of IAGNBI and help IAGNBI to develop as a body that can target resources for the conservation of the species.

The list of delegates included representation from the three key countries, Morocco, Syria and Turkey, as well as the main proposed release and experimental programmes in Spain and Austria, IUCN, the European BirdLife Partnership, and specialist expertise from Alpenzoo, RSPB and SEO. In addition, it was very pleasing that Bert Lenten and Elisa Rivera attended most of the meeting from AEWA and Bonn Convention indicating a new level of interest in the species.

Photo of delegates

Steven Evans of BirdLife South Africa facilitated the meeting, and together with SEO is responsible for producing the Action Plan document. The participants' draft is currently being circulated, and will be circulated more widely to other parties around the time this newsletter appears. It is hoped that the document will not only channel and coordinate efforts and resources for the conservation of the species, but also stimulate more interest from potential funding agencies to bring resources to address the most urgent priorities.

AEWA stands for African-Eurasian Migratory Water Bird Agreement which is the largest agreement developed so far under the Convention of Migratory Species.

SPECIES ACTION PLAN MEETING SOUTHERN BALD IBIS

A meeting hosted by BirdLife South Africa was held at Wakkastroom, South Africa in November 2003 to draft a Species Action Plan for the only other Geronticus species, *G. calvus*. Although this species is less seriously threatened than NBI, it is largely dependant on threatened grassland habitats, and is classified as 'Vulnerable' by IUCN. There are thought to be between 8,000 and 12,000 individuals in the wild. Funding for the meeting was largely provided by Eskom (the main electricity company in South Africa), and two IAGNBI members were able to attend, Mike Jordan and myself.

The first draft is due for circulation in the near future. Despite the very similar taxonomy and breeding ecology of the species to NBI, the knowledge of the species and population trends is very far from complete, highlighting the need for and the importance of monitoring. The movements and habitat use by SBI is still poorly understood, and a large part of the action plan will be highlighting the research and monitoring needs for the species. One fascinating puzzle is why the species should have disappeared from over a third of their former range in southern South Africa around 80 years ago, when no major habitat changes occurred.

It was agreed at the meeting that a working group is needed for the species, which would be coordinated by Steven Evans. It was also thought that once established, this group should have a formal link with IAGNBI to benefit from mutual experience, and promote the exchange of ideas. Further details of the outputs will be given in the next IAGNBI newsletter.

4.3. **The status of the Northern Bald Ibis within the EAZA Ciconiiformes and Phoenicopteriformes Taxon Advisory Group (TAG)**

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Thirty ciconiiform taxa (7 members of Ciconiidae, 12 members of Threskionithidae, 10 members of Ardeidae and the only member of Scopidae, the hamerkop) are included in the European Ciconiiformes and Phoenicopteriformes Regional Collection Plan. Only two of these 30 taxa, the Northern Bald Ibis *Geronticus eremita* and the Oriental White Stork *Ciconia boyciana*, have European Endangered species Program (EEP) management status. The EEP is the highest, most intensive management category within the EAZA structure. Taxa designated for EEP management are primarily threatened species for which a captive breeding program is deemed necessary or useful. An EEP generally has a coordinator, a species committee, and also a group of advisers to the committee, that provide participants with guidance in management of the taxon. Zoos and other facilities that participate in an EEP agree to provide information to the EEP Coordinator and to follow recommendations made by the EEP species committee. Should a participant and the committee not agree on a proposed action, either party can approach higher levels of the EEP structure, including the TAG, for mediation.

The Northern Bald Ibis EEP is one of the longest running of the now more than 150 EEP's within the EAZA structure, and its initiation in 1988 predates the formation of the Ciconiiformes TAG in 1991. The Northern Bald Ibis has long been cited as an example of a species whose numbers would be perilously small without the contribution of the captive population to serve as a safety net for the wild population. The combination of the huge number of Northern Bald Ibis in captivity, the precarious state of the wild population and availability of sites within the former range of this species creates an intense pressure from some stakeholders to more actively pursue options for reintroduction and/or supplementation of individuals to the wild- after all, that is why this captive population exists, isn't it? Unfortunately little is currently known concerning potential consequences of many actions, and many other stakeholders, particularly nature conservation NGOs, would prefer a more cautious approach.

There are few species for which such a dramatic and emotionally charged situation exists. Managing the Northern Bald Ibis EEP population is a balancing act, requiring careful manoeuvring between what different stakeholders want and will accept, using the knowledge we have and trying to get more information, to make the best possible decisions that will satisfy the most stakeholders and will most benefit the Northern Bald Ibis. If this was not challenging enough, management of the Northern Bald Ibis EEP is more difficult than for many species simply because Northern Bald Ibises are colonial, and there is still much to be worked out regarding effective long-term genetic management of colonial species. Historically, identifying biological parents and even individuals within a colony at a distance was difficult. Persuading many Northern Bald Ibis holders to use the more recently available methods to improve record keeping on individuals so that colonies can be more intensively managed often requires much effort.

The role of the EAZA Ciconiiformes and Phoenicopteriformes TAG is to support the Northern Bald Ibis EEP in all ways possible, e.g. providing a forum to disseminate information among EAZA members, encouraging EEP participants to follow management recommendations, using the TAG network to facilitate cooperation and communications with external parties, drawing on expertise of TAG members and advisors to help solve problems, mediating when appropriate should disagreements within the EEP arise, and by steering inquiries relevant to management of the EEP to the appropriate party (usually the EEP Coordinator, Christiane Böhm). Christiane has worked tremendously hard on most effectively managing this very difficult EEP, and deserves much credit for her efforts. She gave two excellent presentations at the EAZA Ciconiiformes and Phoenicopteriformes Meeting held 20 September 2004 in Leipzig Germany, both of which are summarized below.

The Northern Bald Ibis EEP

The Northern Bald Ibis EEP started with 333 birds in 40 institutions and now includes 845 living birds in 49 institutions. The annual birth rate is now 2 - 4 times higher than the annual death rate, and approximately half of the young are transferred to non-EAZA institutions every year. A total of 1308 chicks were produced between 1988 – 2002. The fifteen oldest males out of 250 now living are between 26-39 years of age, and the fifteen oldest females are 25-30 years of age. Most reproduction occurs among ibises 5 - 20 years of age, but individuals have bred as early as 1 - 2 years of age, and as late as 24 - 28 years of age.

All Northern bald ibises in the EEP are of stock from Morocco. Three bloodlines are present in the population; these are from Basle Zoo, Rheine Zoo and Zoo Rabat. Of the last 18 birds brought into captivity, nine are still alive but only three are individually marked and have reproduced. Most zoos have at least two of the three blood lines in their collections, but more genetic work is urgently needed to assess the genetic status of the EEP population. Husbandry guidelines are available from Christiane. There is a need for behavioural enrichment for this species and also for better husbandry.

The Northern Bald Ibis Conservation and Reintroduction Workshop, an International Advisory Group for Northern Bald Ibis (IAGNBI) meeting.

A short review was given on that workshop held in Innsbruck (summary see 4.1) Copies of the conference proceedings for interested parties were handed out and the conference proceedings are also available from C. Boehm (alpen.boehm@tirol.com).

5. Extras

5.1. **Prevention of bumblefoot in a critically endangered bird, the Northern Bald Ibis (*Geronticus eremita*)**

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Bumblefoot (pododermatitis) is a serious welfare problem affecting many species of captive birds. If left untreated it can become chronic, progressive, invasive, and eventually disabling, resulting in death. The major contributing factors to bumblefoot development are the bird's weight, the substrate surface type, and most commonly, an abnormally sedentary lifestyle. The latter can be a particular problem for birds in captivity.

This study investigated the effects of feeding enrichment on the activity levels of a captive colony of seven Northern Bald Ibis (Geronticus eremita) at Tilgate Nature Centre, in Sussex, with the specific aim of encouraging a more active lifestyle in order to prevent the development of bumblefoot. Since the causes of bumblefoot are management-related and treatment it complicated and protracted, prevention is extremely important.

The enrichment device consisted of a 40cm long wire mesh triangular tube suspended from a branch and pegged into the ground. The holes in the wire mesh measured 25mm x 12.5mm as it was advised that the holes should not be any smaller than this to prevent damage to the ibis's beaks. Twenty whole one day old poultry chicks were placed inside the tube (dead!). The idea was that because a whole chick would not fit through the holes in the tube the ibis would have to pull/peck off small pieces at a time; the added movement from the suspended tube made acquiring the food even more difficult.

The ibis in this study responded significantly to the implementation of feeding enrichment. One of the key findings was that, after the device was introduced, the amount of time spent inactive was significantly reduced, as was the time spent on perches. As a consequence of the decrease in stationary behaviour, time spent engaged in active behaviours such as walking, probing and flying increased significantly during the enrichment period; time spent on the ground also increased significantly. Additionally, this method of feeding enrichment reduced levels of aggression among individuals within the colony. The suggested reason for this is that because the feed was provided throughout the afternoon there was ample time for all the birds to have access to it. Indeed, this method of feeding the ibis the day old chicks (which were highly desired) actually resulted in a fairer distribution of the resource as prior to enrichment it was simply scattered on the rocks and quickly eaten by the more dominant birds.

Importantly, the use of the enrichment device did not decline as a consequence of long-term use and, even after an extended period of time, enrichment was still having a positive influence on the ibis's behaviour. The increased activity of the ibis also engaged the visitors for significantly longer at the exhibit, thus increasing its educational impact. Hopefully, more people will stop to read the signs revealing how critically endangered these birds really are.

This study has successfully demonstrated that the introduction of a simple feeding enrichment device can significantly alter the behavioural time budgets of a captive population of Northern

Bald Ibis. The resultant behavioural changes suggest that there will be a considerable reduction in the risk of bumblefoot development in these birds. The welfare implications of this study are that the lengthy and somewhat distressing treatment of this potentially debilitating condition is prevented.

5.2. Husbandry guidelines for the Northern Bald Ibis in captivity

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1 BIOLOGY

The Waldrapp Ibis or Northern Bald Ibis (NBI) is a highly terrestrial Ibis species. The birds are day active however on cold days they may start leaving their sleeping sites rather late. The most active hours are the late morning and late afternoon. Cold temperatures (<10°C), rain and snowfall generally reduce their activity.
In captivity the NBI can reach an age of 25-35 years. However there is a difference in sexes: on average males live longer; females seem to suffer under the stress during the breeding season (egg laying might be energetically intensive) and hardly reach ages over 30 years.

Sexual distinctions

Male and female NBI cannot be distinguished with regard to plumage and colour. Both sexes have black feathers with a metallic green and purple sheen. The head and throat are bald and they have a crest (feathers up to 90mm long). The skin of the bald head Ibis shows very conspicuous black or grey patterns that change only during the first 2-3 years. Although these patterns cannot be used to estimate age or sex they are different in every bird. So due to their head pattern it is possible to distinguish the birds individually. On the average female Waldrapp are smaller than males, having smaller bills and shorter wing feathers.

	MALES	FEMALES
WEIGHT		1080-1230g
HEIGHT		750mm
TAIL LENGTH		187-210mm
BILL LENTGH WESTERN POPULATION	14115 ± 4,6mm,	133,5± 4,6mm
BILL LENTGH EASTERN POPULATION	129,0 ±2,3mm	123,6 ± 2,4mm
WING LENTH	403-420mm	390-408mm
LONGEVITIY (CAPTIVITY)	24-37Y	23-30Y

Tab.1: Measurements of the Northern Bald Ibis (Eastern and Western birds). Data from BAUER& GLUTZ 1966, KLEINSCHMIDT 1899, KUMERLOVE 1960, PEGORARO 1996, SAFRIEL 1980, WACKERNAGEL 1963.

2 DESIGN OF NORTHERN BALD IBIS AVIARIES

Space

5-10m^2 spaces per bird in an aviary are appropriate. To guarantee dry and sunny conditions the aviary should be covered (at least one quarter) by a roof and south exposed. This may spare an extra winter enclosure for the NBI. If the birds are kept outdoors during winter the feeding site and water pool need to be kept free of frost. If the birds are kept outdoor properly they will do even better than kept exclusive indoor during winter. If the indoor enclosure is connected to the summer aviary the doors can be kept open during winter that the birds can choose where to stay. The NBI prefers temperate sleeping sites but love to be outdoor even for a short time of the day.

Fencing, mesh

In big aviaries soft wires are preferable. Acceptable diameter size is 50x50mm, however

better experience is made with smaller sizes like 20x20mm or15x15mm.

Habitat structure

The NBI prefers open areas and need sufficient space to fly. Thick bushes may be used as a cover but 2-3 big bushes and/or trees in an aviary are sufficient. Thick (>10cm) horizontal branches are appreciated for social preening, roosting and sun bathing. Branches attached from 0.5-2m above the ground are most preferred. Piles of stones are also used as roosting places or perches.

Sand, gravel (2/3) and grass (1/3) are the best substrates, however the grass should be kept short (not over 15 cm) because the NBI avoid vegetation higher than 20-25 cm. Foraging behaviour is encouraged by substrates like twigs, stones piles or large mud patches. As bathing facilities (best a surface of 5-8 m^2) shallow pool banks are recommended so that the NBI can enter and leave the water pool easily and safely. The feeding sites should easily accessible for several individuals simultaneously thus not allowing the dominant birds to feed exclusively there for longer periods.

Nest

In the field the Northern Bald Ibis prefers ledges in steep rocks or cliffs as nesting sites. PEGORARO (1996) found 38% of the ledges covered. In aviaries boxes or better ledges with room for 2-3 nests have proved to be preferred nesting sites. One should allow 1 m^2 per nest in order to diminish quarrels about nest material and space. Before the birds start to build a new nest they try to remove the old nest material. Therefore the nest sites should be cleaned before the breeding season (January, February) starts. When constructing the nest the NBI first takes thicker branches and finish with remarkably huge amounts of dry or fresh grass as lining material for the hollow. Sufficient amounts of branches for the first two weeks and later thinner twigs and dry grass should be given every or every second day as the birds are very choosy about the nest material. As NBI replaces the inner nest material during breeding constantly dry grass should be provided during whole breeding season.

breeding (d)	28 DAYS
nestling (d)	42-51 DAYS
egg size (mm)	62,5/42,3 - 66,6/45,4
egg weight (g)	58,5-68,0 g
clutch size	3-4 (5,6)

Tab.2: Breeding data of the Northern Bald Ibis. Data from BAUER& GLUTZ 1966, HARTERT 1903-1922, PEGORARO 1996, WACKERNAGEL 1963;WITTMAN & RUPPERT 1984.

2 GROUPING

Group size and enclosure mates

The size of a captive NBI colony should exceed ten individuals. This number of birds is easy to manage in terms of the amount of food required, cleaning and observations of the group. Groups with less than six specimens have never bred in captivity.

The NBI is –like all ibises – a very social bird and is gregarious in its breeding, roosting and feeding behaviour. It previously occurred in remarkable flocks of hundreds and even thousands of birds. However mixed aggregations with other species of ibises or herons have seldom been reported. Nevertheless NBI in captivity are often kept in mixed-species enclosures, especially with herons, other ibis species, galliformes or crows. Competition for food, nesting or roosting places with these other species often occurs and may cause severe problems e.g. accidents and disturbance at breeding sites and failure in breeding

success. As a consequence it is recommend keeping the NBI colony in single species enclosures or with species, which hardly interfere with feeding, roosting, breeding etc.

Age structure

The age structure within a NBI group is very important for a calm and successful colony atmosphere. Two thirds to one half of the colony should consist of adult birds (3 years and older) and the rest of young birds.

The colony members know each other very well. The NBI does not have a very strong hierarchy; however there are dominant individuals which always have first access to the feeding places and the preferred nesting sites. Although severe fighting about these spots is rarely observed there will be fights to establish a new ranking for a short period when a dominant bird dies or if new specimens are transferred into the colony. Within the colony pair bonds kinship should be as well considered and good breeding partners should not be separated in most cases even if this seems desirable for genetic reasons.

Pair bonding and pairs

A well-balanced sex ratio (1:1) works best. The ibises are faithful to their partners (at least during one breeding season) and nesting sites. In Alpenzoo Innsbruck 61.5% of the pairs remained together for one, 19.2 % for two, 15.4 % for three and 3.9 % for four years within 12 years of observation (PEGORARO 1996). However, if there are more females in the colony, males often copulate with non-paired females, when their own females are already breeding (PEGORARO & THALER 1992). In the colony of Zoo Zurich none of the offspring were from other parents than the behavioural ones. "Egg dumping" may occur but could not be proved (SIGNER et al. 1994). Despite these uncertainties marking and ringing of zoo colonies will help a lot in following individual histories and establishing a satisfying pedigree for many locations. It is thus strongly recommended that the NBI in zoo colonies are individually identifiable.

The breeding season starts in March-April depending on the location of the zoo and its climates. The beginning of pair formation is signalled by highly increased greeting behaviour. Greeting is defined here as raising the head and bill up to 90° followed by a jerky lowering of the head to deep between the legs. The crest is erected and the greeting display is nearly always accompanied with the "chrup" call. The male often starts the greeting and a willing female joins the "chrup" calling. Both are calling as in a "duet". Greeting duets stimulate other individuals and pairs to start greeting and it seems that this behaviour aids in synchronisation of colony breeding attempts. The better synchronised a colony is the more calmly breeding proceeds and the more successful it is (PEGORARO 1983).

Parent-offspring relationship

The nestlings are brooded for 14 days by both parents. Social preening of the nestlings and cleaning of the nest are common parental behaviours. The nestlings fledge between day 42 and 51 but the contact between the fledglings and their parents remains close. The parents guide the first flight attempts and defend their offspring against colony members, which are too curious or aggressive (THALER et al. 1981). The parents feed their offspring another seven weeks after fledging (PEGORARO 1996). The contact decreases during autumn and winter but increases again at the beginning of the breeding season. Therefore if there is enough space in the enclosure parents and offspring should not be separated for at least one year.

3 RINGING

Coloured aluminium or Darvic rings are best for ringing. The recommended size is 14mm in diameter. Ringing the nestlings is best when the oldest chick is about 10-14 days old and

starts to stand up. At this age they stay in the nest and do not yet start to walk along the ledges and build up kinder gardens with other chicks. As about 80-90% of the behavioural parents are the genetical parents you will get well informed about family lines and bonds by the ringing. The unique black patterns on the heads help to distinguish the individuals; however it is rather difficult to get familiar with these features.

4 NUTRITION

A basic daily diet of minced meat and one-day-old chicken (without the yolk) in 1:1 proportions and cottage cheese mixed with dried insects works well. Some colonies are fed with fish as well especially when kept together with spoonbills. However it seems that an amount of over 30% fish in the daily diet may cause liver damage. Therefore fish feeding should be reduced, 10% fish sounds reasonable. The NBI lives in dry habitats, it usually feeds on terrestrial insects, like large beetles, grasshoppers and locusts, spiders, scorpions, snails, small amphibians, reptiles and rodents. Sometimes it takes bird eggs and even carrion. Mice (adult ones are better because each bird needs more time to swallow them and thus more birds reach at least one mouse!) and insects (Mealworm, crickets, beetles) are an appreciated additional food. Fruits such as bananas and watermelons are liked and can be given as a variation 2-3 times a week.

In the non breeding season feeding twice a day is sufficient (in the morning between 9-10 am and 2-3 pm), however during breeding season food should be offered ad libidum which is guaranteed by feeding 3-4 times a day.

5 BREEDING SUCCESS, DEATH CAUSES

The breeding success within the EEP is good. About 100-150 offspring are reported every year and out of 50% of all EEP colonies breed.

Death causes are rarely reported. Accidents that result in breaking of the bills and wings or severe head injuries seem to be the most important death cause in aviaries (37%). Swallowing of unsuitable objects is the second most often reported death cause (22%) in adult birds. Nestling mortality can be high: 32% of all dead birds since 1988 were under 50 days of age, 60% of the birds which died between 1988-1998 were younger than 5 years. Some colonies had to be euthanised due to tuberculosis. Parasites, intraspecific competition, foxes or martens have been incidentally reported death causes. If older birds are not transferred to another zoo they seem to have a good chance of getting rather old.

6 BEHAVIOURAL ENRICHMENT

The adult NBI is a rather shy and anxious bird species, which hardly accustoms to new structures brought into an aviary. Therefore it seems hard to imagine behavioural enrichment activities for such a behaviourally inflexible species when old. However, young birds up to 1-2 years of age are rather curious and love to get to know new objects and structures. As the NBI seems to be able to learn only in its early years, yearlings should get to know as many structures as possible. Thereafter the birds will use these structures for their entire life.

In preserving a species for potential releasing programs it is not only important to maintain genetic variability but also behavioural variability. Therefore behavioural enrichment of the NBI should encourage any ability of this species to accommodate as many as different structures and food types as possible.

Habitat structures

To train the ibises to be more flexible in using new structures, which are difficult to access, one could offer:

- different kinds of branches: solid ones that vary in thickness and pliable ones, which are not that easy to access

- piles of stones to sit on

Foraging structures

- long tubes, coconuts with variable sizes of holes which are filled with mealworms, zophobas or crickets on some days but are left empty on other days
- small pile of stones, different kind of branches that the birds can explore for food
- whole fruits: like bananas, watermelon (which also help to keep the bills clean)
- different sizes of gravel (also helps to prevent bumble foot)

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5.3. **A short review of the historical distribution of the Northern Bald Ibis (*Geronticus eremita*) in Algeria**

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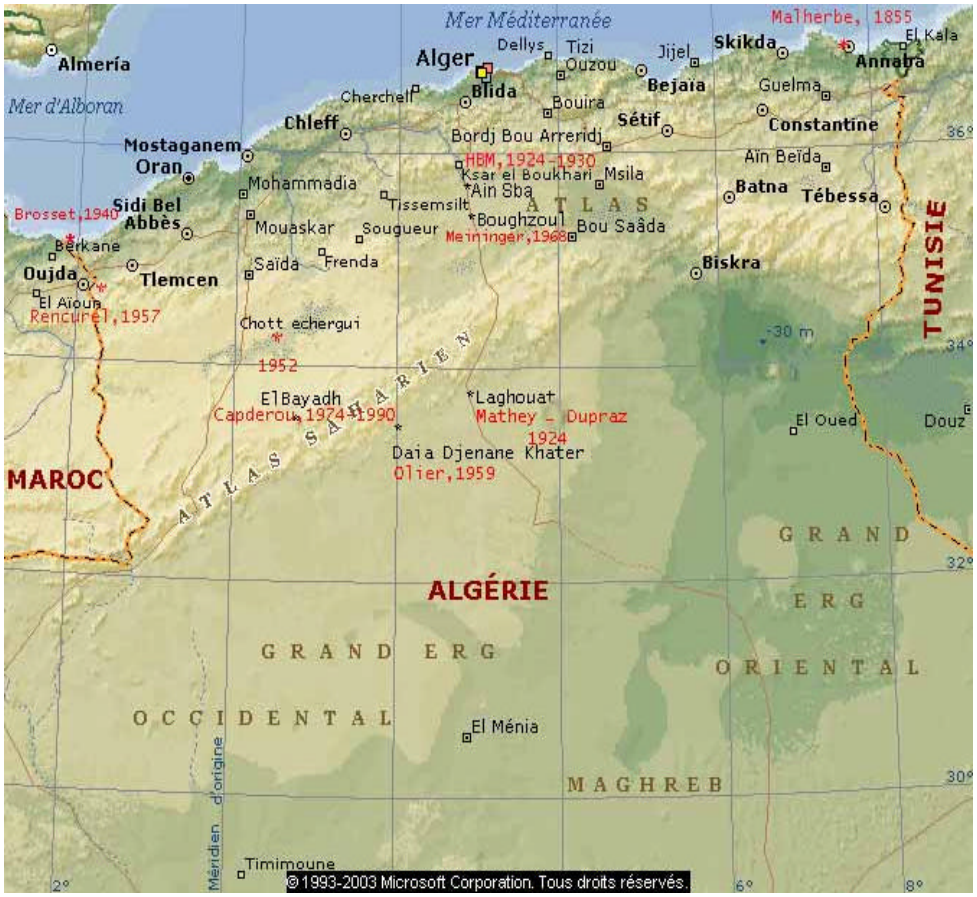

Historic distribution of the Northern Bald Ibis in Algeria

Only very few data are available of the status of the Northern Bald Ibis in Algeria. We have tried to identify the oldest and most recent observations and reports of this critically endangered bird species.

In 1855 the first reported Algerian birds were caught by MALHERBE in **Bone** (actually **Annaba**) in the North Eastern part of the country in a costal, sub humid area (HEIM DE BALZAC & MAYAUD 1962). HEIM DE BALZAC (HBM) in 1924 rediscovered a colony of a dozen of pairs in the south of **Ksar El Boukhari.** This colony was first mentioned by LOCHE & TRISTAM in the end of the 19th century (HEIM DE BALZAC 1926). During the same period MATHEY –DUPRAZ found 5 birds in the south of **Laghouat** in a semi arid area (MATHEY-DUPRAZ 1925).

In 1940 BROSSET reported a colony the western coast on an outcrop near **Marsat Ben M'hidi** (BROSSET 1958 in ISENMAN & MOALI 2000).

Most of the data during the 50s of the last century are from a semi arid region in the **Chott Echergui** (November 1952, COLLAR & STUART 1985). RENCUREL reported in 1957 pairs of Ibises in the area of **Tlemcen.** These ibises must have been crossed the Moroccan border (RENCUREL 1974 in ISENNMAN & MOALI 2000). In 1959 OLIER observed 9 birds in the **Daïa of Djenane Khater,** 80km east of Laghouat and 90 km of El Bayadh (HEIM DE BALZAC & MAYAUD 1962).
MEININGER reported 4 birds in **Boughzoul** (LEDANT & al. 1981).


photo1: last reported breeding area at El Bayadh


photo2: breeding rocks at El Bayadh

The longest surving NBI colony of Algeria was first discovered by CAPDEROU in 1974. This colony was located 20 km south of **El Bayadh** (LEDANT & al. 1981). In 1974 a dozen of pairs were observed there, 36 birds (adults and juveniles) in 1982 (BELLATRÉCHE 1994). Censuses made in 1984 and 1986-87 revealed that only a small group of 6 or 7 birds had remained in that area, however the ibses were not reproducing. At the beginning of the 90s no more birds were seen there. During spring 2002 we visited this site and can confirm that the breeding cliff is not currently used.
Many of these former authors report of periods of 2-3 years with no reproductive activity of the colony followed by a year with successful breeding. This indicates that these birds were breeding irregularly.

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5.4. Bibliography of the Northern Bald Ibis *Geronticus eremita*

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The following bibliography shall provide an overview of the existing literature on Northern Bald Ibis. I want to thank all IAGNBI members who sent me their publication lists. However such a work can never be complete. Books in which the species might appear only by name or in shortest notes and/or talks that were not published are not included. As there are many papers published in German language I give a short explanation of the titles in English (**bold** at the end of the citation).
I tried to classify the main topics of the papers, indicated by the letter at the beginning of the citation). Very few did not fit into the scheme or I do not remember/know them.

Abbrevations used:
B ? behaviour and behavioural ecology
C ? conservation
D ? former and recent distribution outside of Europe
E ? former occurrence in Europe, release trials and re-introduction ideas
G ? genetics
H ? health and morphology
M ? Morocco
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5.5. Northern Bald Ibis (*Geronticus eremita*) Necrospsy protocol

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Introduction

The Northern Bald Ibis is a critically endangered species with only a few hundred individuals surviving in the wild. In contrast, close to 2000 individuals are living in captivity. All the information obtained from specimens in zoos is quite valuable. Any institution housing this species should have established a continuous veterinary monitoring programme. Registering cases of disease and compiling post-mortem reports will help to gain knowledge and improve the health status in captivity.

Storage: a carcass should be examined by a suitably qualified person as rapidly as possible, preferably on the day of death. If there is to be a delay, the carcass should be kept refrigerated until examination. It must not be frozen (freezing damages the tissues and can kill certain pathogens) unless it is unlikely to be examined by a veterinarian within 3 days.

"Skin problems in NBI": a syndrome found in captive Northern Bald Ibis appears as a chronic ulcerative dermatitis characterized by loss of feathers, rawness and ulceration. It is found on the back, neck, and underside of the wings. The cause of this disease remains speculative. Lesions have been detected in a number of birds in European **and American** zoos. This syndrome has never been reported in the wild.

Necropsy protocol

A thorough necropsy should be performed on Northern Bald Ibises, which die at institutions housing this species. In addition to (or instead of) the institution's regular necropsy protocol, the following protocol should be followed.

A- Standard Northern Bald Ibis (*Geronticus eremita*) Necropsy Protocol

1. Note important clinical history previous to death.
2. It is recommended that dead ibises are radiographed prior to necropsy (for detection of foreign bodies in the digestive tract, traumatic lesions to the skeleton, etc.).
3. Record body weight (in grams) of the carcass.
4. Describe gross findings.
5. Collect samples for microbiology.
6. Collect a small section of all major tissues in 10% buffered formaline (heart, lung, liver, proventriculus, ventriculus, intestine, kidney, spleen, bone marrow, muscle, brain, skin as well as any tissue with obvious gross lesions) for histopathology.

B- In suspected cases of "Skin problems"

1. Collect 2 sections of effected skin, 2 sections of healthy skin, a section of liver, spleen, kidney and any tissue with obvious gross lesion. Tissues should be frozen at –30 to –70 degrees ºC (if possible) for future isolation of a virus or another infectious agent.
2. It is suspected that a viral agent might be involved in the skin problems. It seems that main areas to look for inclusion bodies (IB) are around the feather quill and the

adjacent skin. Some IBs has been found in feathers, which looked thicker and abnormal (F. von Houwald, pers. com.).

NECROPSY PROTOCOL QUESTIONNAIRE FOR NORTHERN BALD IBIS (*Geronticus eremita*)

Institution:_____

Date :_____

Contact person:_____

Fax/e-mail:_____

ARKS, Identifcation	**Sex**	**Age**	**Date of death**	**Cinical symptoms of illness or unusual circumstances prior to death**	**Post-mortem findings**	***Histopathology Observations***

5.6. **Movements of the eastern population of Northern Bald Ibis *Geronticus eremita* in the Middle East**

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It has long been assumed that the Northern Bald Ibis breeding in Turkey and Syria migrated south to wintering grounds in East Africa, principally Eritrea and Ethiopia, as birds left their breeding sites in mid-summer (June/July) and reappeared in late winter or early spring (February/March) the following year. However, as there are no ringing recoveries the evidence for such a migration is circumstantial. Occasional records of birds in southern Arabia, primarily Saudi Arabia and Yemen, further complicate the issue and has lead to speculation that there may be undiscovered breeding populations in countries bordering the southern Red Sea.

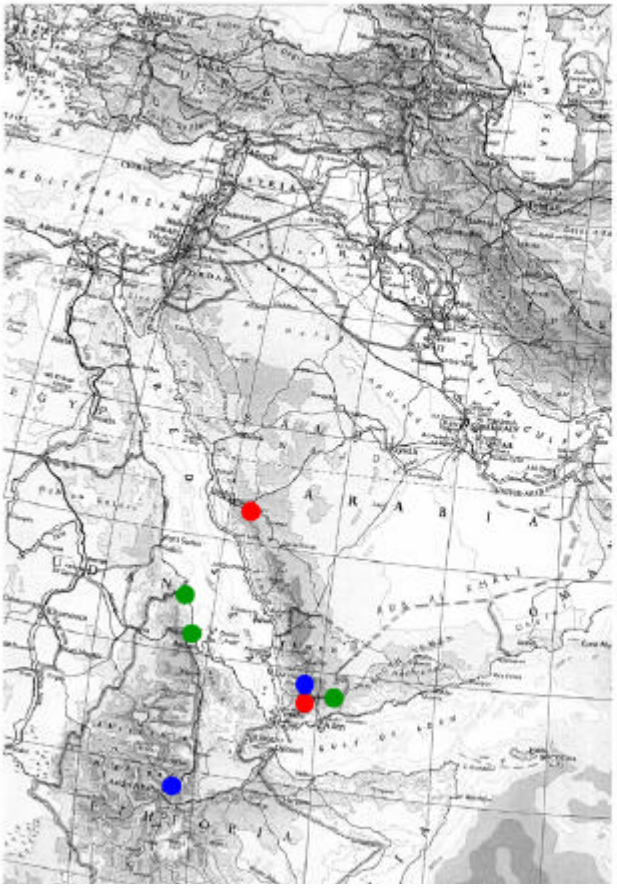
In an attempt to clarify the situation, since the mid-1990s we have been collating records of Northern Bald Ibis and currently have a database containing 307 references spanning the period 1835 to 1998, 167 of which relate to the eastern population. In addition to the published literature – journals, handbooks, avifaunas etc – we have also had access to original correspondence held by BirdLife International in Cambridge and K D Smith's diaries in the Edward Grey Institute in Oxford.

Prompted by Chris Bowden to carry out a preliminary analysis of the information, we have produced the following maps which show the recorded distribution of the species in the Middle East by month throughout the year. The records for each month are divided into three time periods – pre-1960, 1960 to 1989 and post 1989. The 1989 date is chosen as it is the year when the last fully wild Northern Bald Ibis returned to the breeding colony at Birecik in Turkey.

The total number of accurately dated records which could be plotted at specific locations was 59 – 19 from pre-1960, 25 from 1960 to 1989 and 15 post-1989.

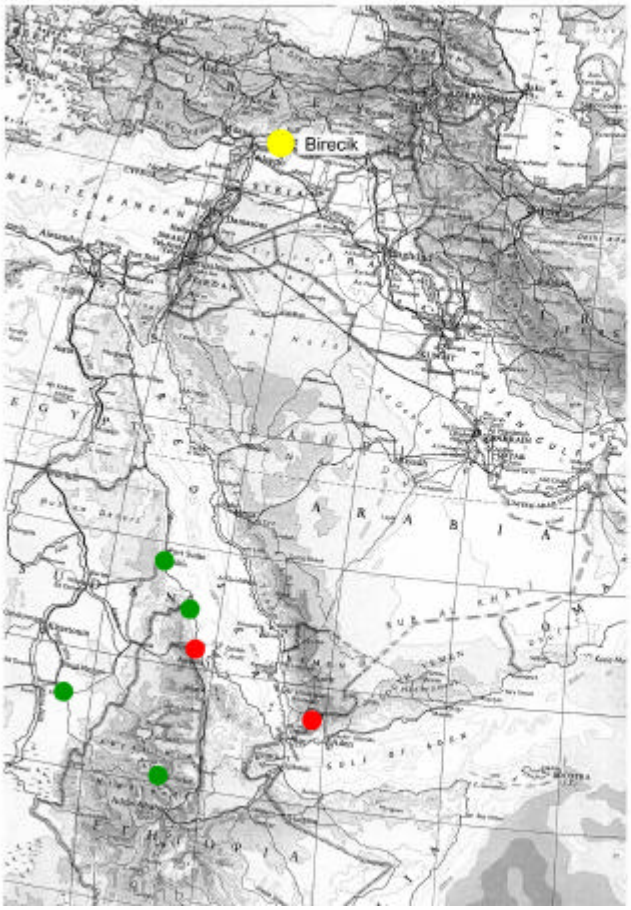
Although the data set is small and the results still speculative, it does appear that there was a north-south movement of Northern Bald Ibis along the Red Sea so the presumed migration pattern may be correct. However, until there are definite sightings of ringed birds or satellite tracking data, the true situation must remain speculation. Current research on the tiny population recently discovered breeding in Syria may be the only hope we have clarifying the situation once and for all.

We would welcome any unpublished records of Northern Bald Ibis in the Middle East to add to the database.



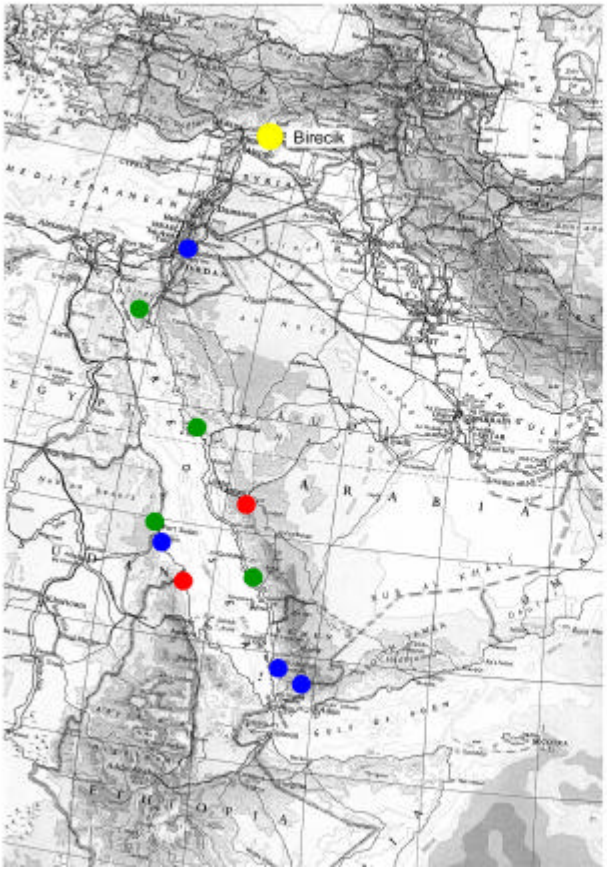
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - January

- pre-1960
- 1960 to 1989
- post-1989



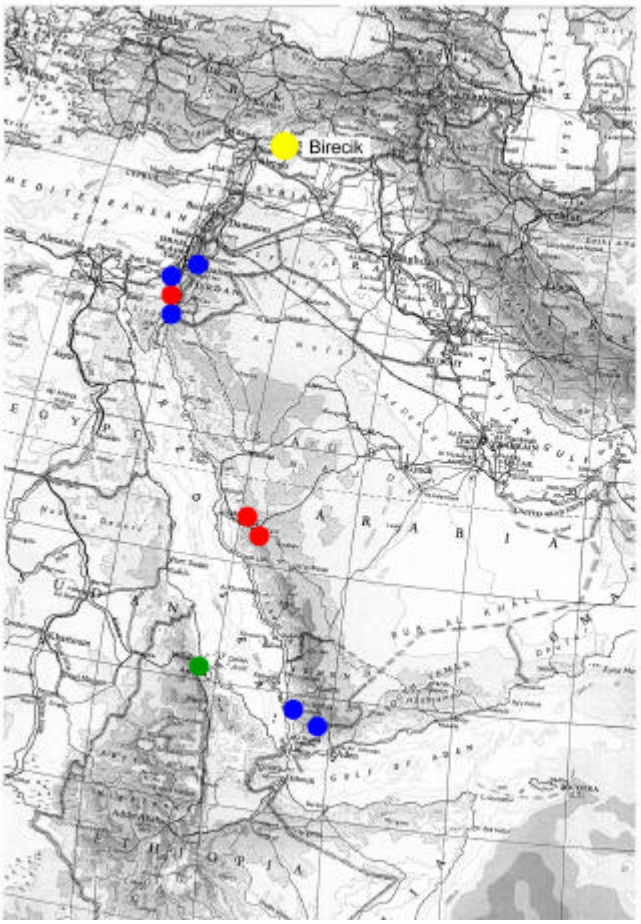
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - February

- pre-1960
- 1960 to 1989
- post-1989



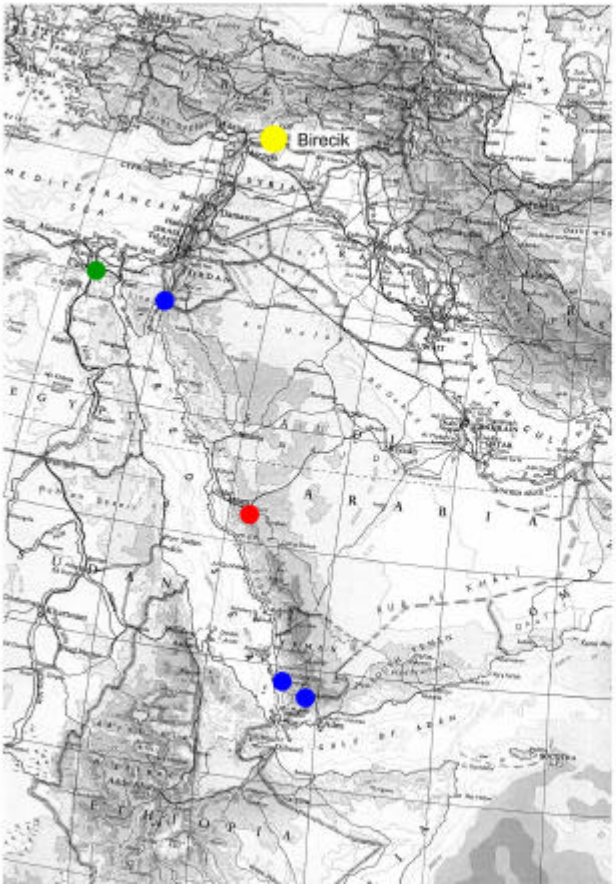
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - March

- pre-1960
- 1960 to 1989
- post-1989



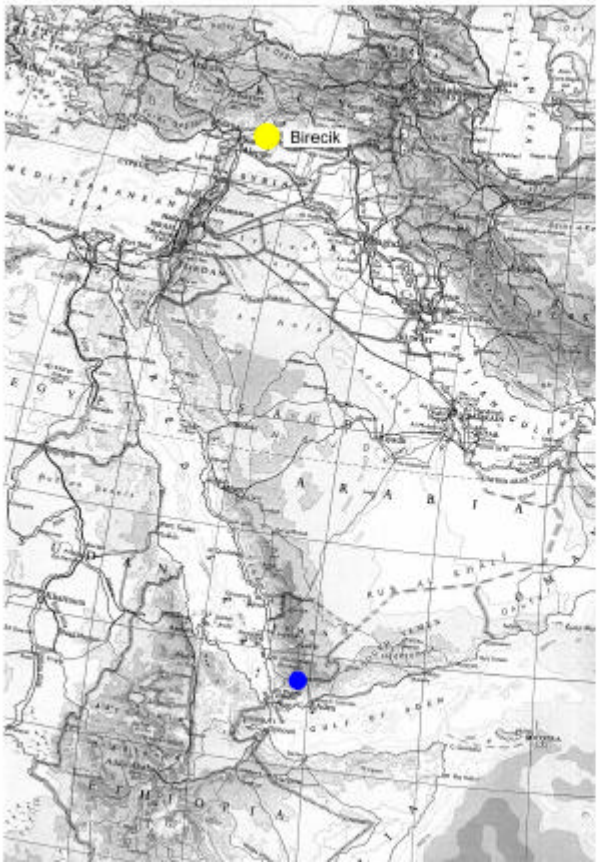
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - April

- pre-1960
- 1960 to 1989
- post-1989



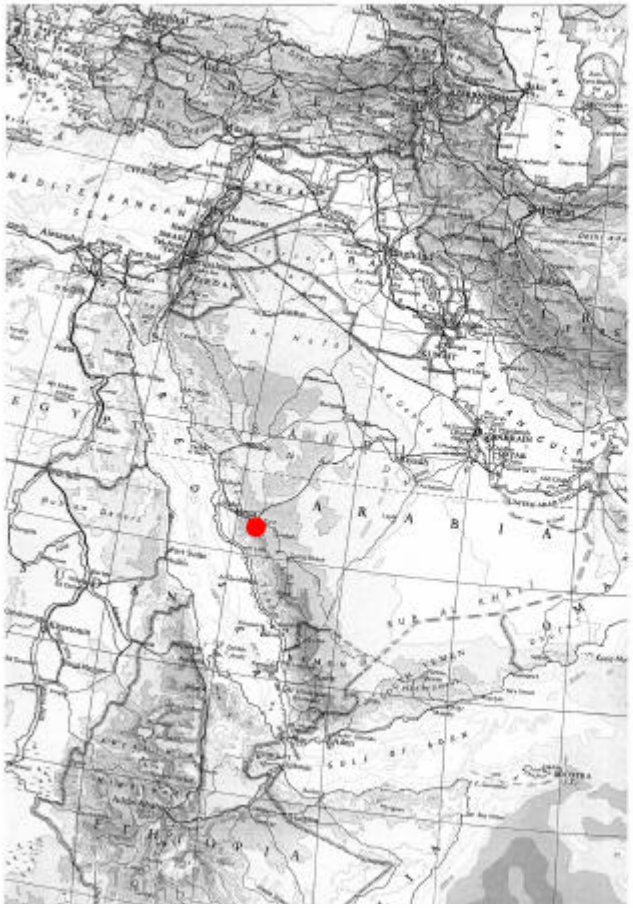
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - May

- pre-1960
- 1960 to 1989
- post-1989



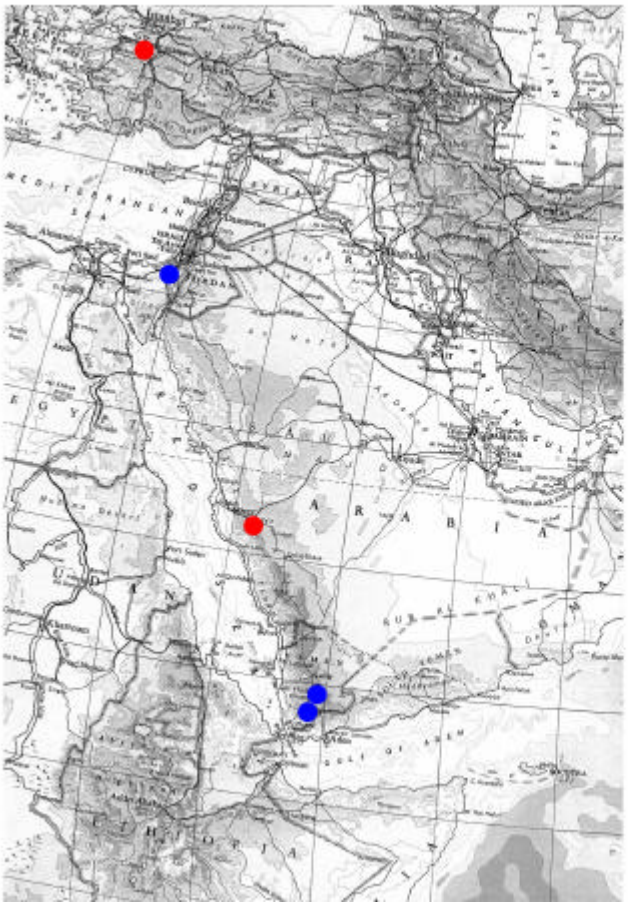
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - June

- pre-1960
- 1960 to 1989
- post-1989



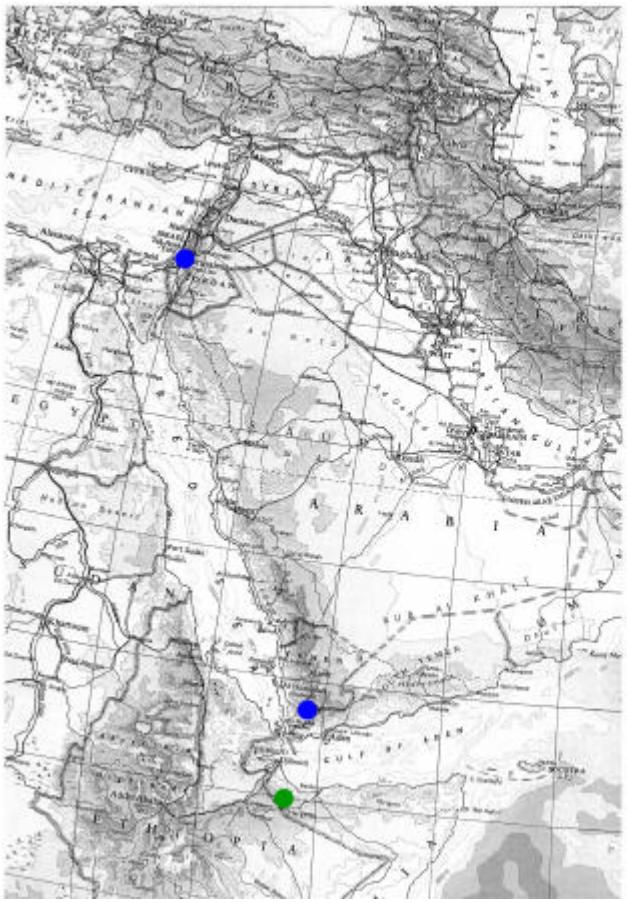
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - July

- pre-1960
- 1960 to 1989
- post-1989



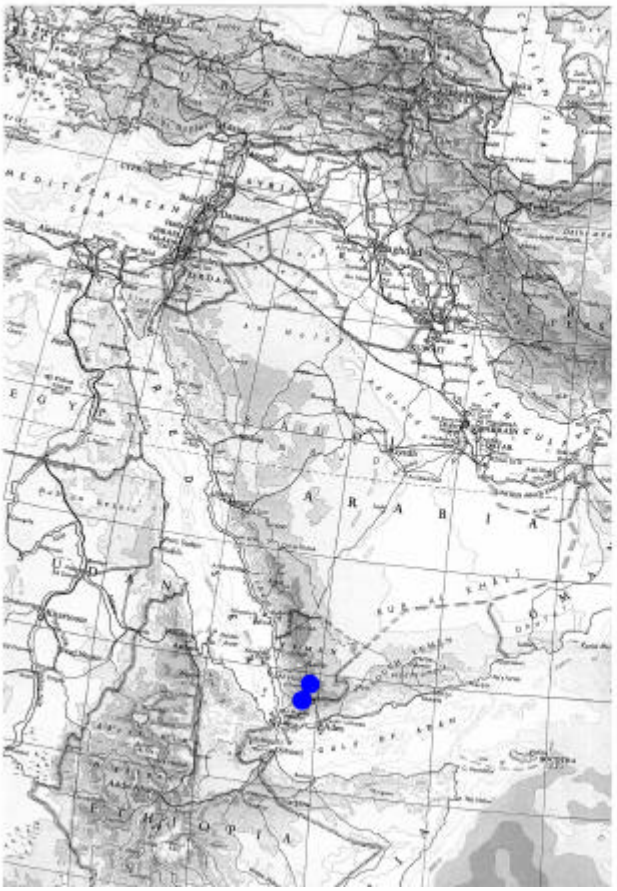
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - August

- pre-1960
- 1960 to 1989
- post-1989



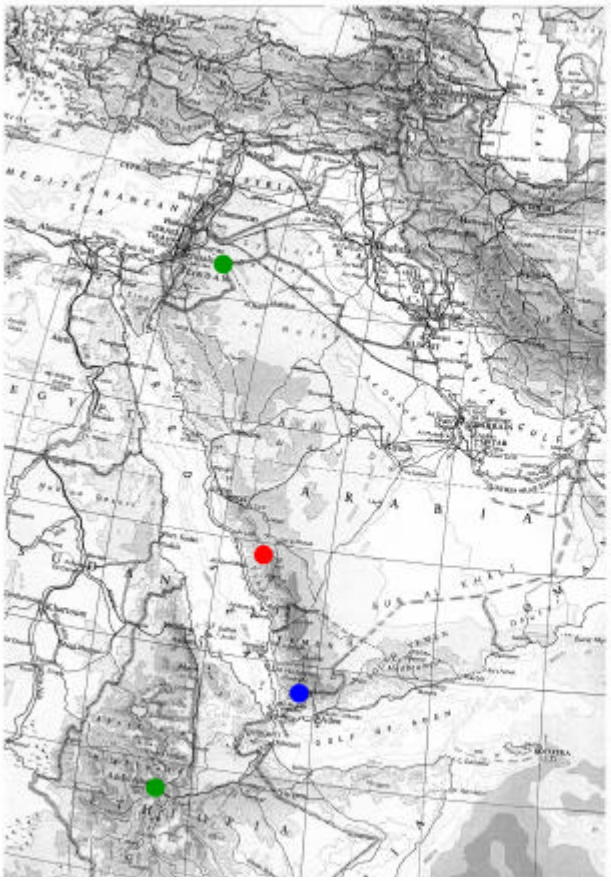
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - September

- pre-1960
- 1960 to 1989
- post-1989



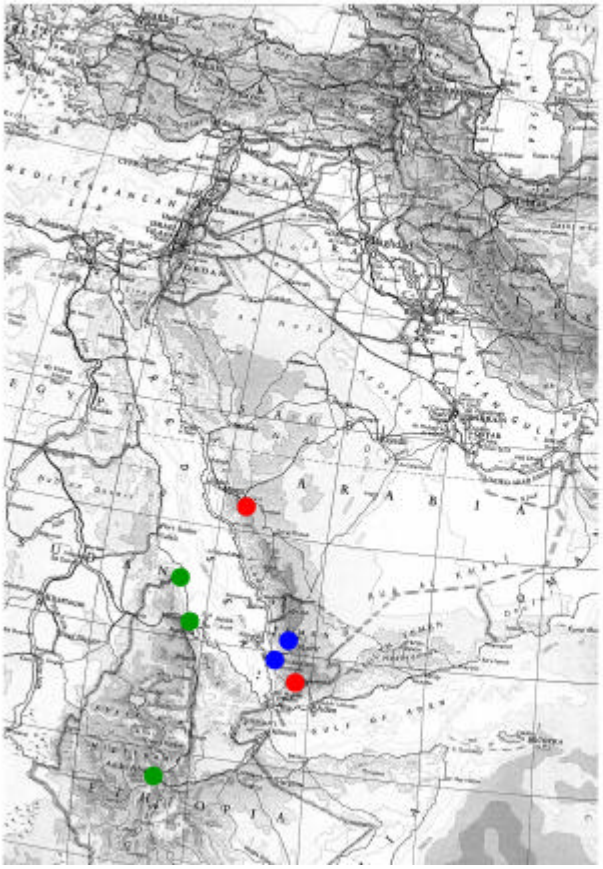
Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - October

- pre-1960
- 1960 to 1989
- post-1989



Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - November

- pre-1960
- 1960 to 1989
- post-1989



Middle Eastern Northern bald ibis *Geronticus eremita* records (1835 to 1998 dated published and unpublished data only) by month - December

- pre-1960
- 1960 to 1989
- post-1989