

I.A.G.N.B.I. Newsletter 1.

September 2001

International Advisory Group for Northern Bald Ibis

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

Edited by Chris Bowden

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What is IAGNBI?

1. *Introduction to I.A.G.N.B.I.*

Who we are and mission statement:

In order to ensure international co-ordination and co-operation on Northern Bald Ibis projects, it was decided to create the [International Advisory Group for Northern Bald Ibis \(IAGNBI\)](#) with the following Terms of Reference:

- receive propositions for all Northern Bald Ibis release/re-introduction projects
- review propositions according to the IUCN and workshop guidelines and a potential Northern Bald Ibis action plan (the group will seek advice from other experts as appropriate, and give advice only, not permits)
- ensure information exchange/*act as an* information centre
- give advice if required *regarding* release methods, habitats, emergencies, etc.
- submit release/re-introduction proposals to IUCN (RSG)
- encourage *adapted* scientific research to close gaps of knowledge on Northern bald ibis

Current group composition:

Koen BROUWER -- Chair person IUCN (SSISG) [Chair person]
Ali AGHNAJ/Chris BOWDEN -- Souss-Massa population [Secretary]
Miguel A. QUEVEDO -- Veterinary
Karin PEGORARO -- Research Biology
Christiane BÖHM -- Captive Breeding Community
Okan ARIHAN -- Eastern population

Creation of IAGNBI

The group was created on 12 March 1999 at the 'International workshop on a strategy for the rehabilitation of the Northern Bald Ibis' held in Agadir, Morocco 8-12 March 1999. The following recommendations were made at the workshop:

1. An analysis of the current status of the critically endangered wild population of Northern Bald Ibis was undertaken. It was concluded that the unique Souss-Massa population (South-west Morocco) is currently stable but is not increasing.
2. As a priority it was agreed that the 1997 action plan for the conservation of Northern Bald Ibis in the Souss-Massa region should be regularly updated and implemented.
3. The possibility of supplementing the Souss-Massa population was considered and rejected for the time being as the risks are considered unacceptable.
4. The only chance to increase the number and range of Northern Bald Ibis in a significant manner is by reintroduction. Any reintroduction programme should have the goal of removing this species from the critically endangered list by creating additional, self-sustaining wild populations of Northern Bald Ibis. It was noted that, as there is no urgency for reintroduction, and in view of the fact that a detailed and tested release method has not yet been identified, so caution is urged. However, it is urgent to intensify research on release methods and to test them to gain sufficient experience.
5. It was recognised that there are two distinctive populations, an Eastern and a Western form and their respective range should be respected. In view of the very successfully managed captive Western population, sufficient birds can be made available for potential release or reintroduction programmes over the next 10-20 years.
6. The workshop developed specific guidelines for release/reintroduction of Northern Bald Ibis based on the IUCN/SSC Reintroduction Specialist Group recommendations. The guidelines developed by the workshop must be regularly updated in the light of experience and must be followed during any programmes involving release/reintroduction.
7. 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 joint secretary:

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2. Gaps in knowledge for the potential reintroduction of a self-sustaining population of Northern Bald Ibis *Geronticus eremita* into the wild.

Introduction

One aim of the IAGNBI committee is to encourage adapted scientific research to close "gaps in knowledge for the reintroduction of self-sustaining populations". Before this can be addressed, we first need to agree and identify a list of the main gaps, and the committee together with advice from all the other experts has collaborated to produce the list below:

List of the main gaps in knowledge which when filled will significantly improve the probability of successful release of a self-sustaining northern bald ibis population into the wild.

Captive population:

1. Interactions and other potential consequences of relocating birds and thereby changing group structure have not been studied.
2. There are few documented life histories for captive birds.
3. No study has documented space and habitat utilisation within aviaries.
4. There is no list of diseases (infectious or non-infectious) or other medical problems recorded from post mortems.

5. There is no information on pathogens carried by captive birds that can cause disease-related problems without necessarily producing clinical signs.

Release methodology:

1. Post-fledging dispersal behaviour is not fully understood.
2. Trials for cross-fostering with Glossy Ibis *Plegadis falcinellus* (or other appropriate species) in aviaries to investigate the potential of such a method have not been carried out.
3. The phylogenetic relationship (DNA studies) between the eastern and western populations has not been clarified thus it is uncertain whether western origin birds should be used for release trials in eastern areas.

Wild population and habitat:

1. There is no precise definition of the total area of feeding habitat used throughout the year by the wild population with:
 - a clearer definition of 'good steppe' as feeding habitat:
 - a more precise definition of max/min % cover in suitable steppe
 - documentation of plant species composition for most favoured areas/and the seasons when used
2. There is no quantification of prey abundance in feeding areas, or tested management techniques for increasing the prey abundance
3. It is not known which prey are exploited in each month of the year (a study is now in progress), and specifically the food items fed the chicks while they are in the nest and for first few months after they fledge.
4. It is not established whether movements at the end of the breeding season or at other times are linked to food availability or to a more automatic mechanism - monitor/check food availability at the time.

5. There is inadequate understanding of the impact of land use changes and which activities are more compatible with the existence of the ibis.
6. There is insufficient understanding of the group dynamics and population structure for wild population.
7. No information has been documented on natural diseases affecting wild birds - there have been few causes of death diagnosed for single deaths, or even more importantly, for multiple deaths.
8. There is no information on normal parasite burdens.
9. The microbial flora of healthy captive birds and how their microflora differs from that of wild birds have not been analyzed, nor has there been an appraisal of how differing microflora might affect the wild population if captive birds come into contact with the wild population through releases.

The situation in Turkey:

1. There is a lack of monitoring data for the Bireçik semi-wild colony with regular observations on:
 - number of adults, first year birds and immatures;
 - number of breeding pairs, clutch size, successfully hatched chicks, chicks reared to fledging;
 - social structure of the colony;
 - summer disappearances (precise information on dates of disappearance, number and age class of the disappearing birds);
 - diet;
 - habitat use;
 - prey abundance.
2. There has been no ringing of the semi-wild Bireçik birds to establish their ultimate fate during migration/disappearances.

3. The effects of the construction of the Bireçik dam on the ibis foraging habitats and how this affects behaviour of the ibis has not been researched.
4. The amount and types of pesticides used in the Bireçik area has not been monitored. The likely consequences of increased irrigation on land use and pesticide application after the dam has been completed has not been assessed.
5. Knowledge of the sensitivity of the ibis to each of the pesticides used in the Bireçik area is lacking.
6. There is no integrated management plan for Northern Bald Ibis in Turkey.

Ongoing Projects

1. Conservation Project for the wild population in Souss-Massa region - SW Morocco

The Souss-Massa National Park together with RSPB and more recently SEO (UK and Spanish Partners of BirdLife International) has been carrying out research and management actions that emerge from this work together with finding ways to involve local Moroccan people and link the future of the ibis with their own livelihoods. Getting sound data for such actions was seen as the first priority.

Collecting baseline information on the Northern Bald Ibis population in SW Morocco for the development of practical and sustainable management actions.

Chris Bowden, Ali Aghnaj, Ken Smith, Mohamed Ribí & Jorge Fernandez

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With about 250 birds remaining in the wild, the Souss-Massa region near Agadir in south west Morocco holds the last known breeding population of the Northern Bald Ibis *Geronticus eremita*. The scenically spectacular cliffs on the Atlantic coast provide inaccessible ledges that this threatened species needs for nest-sites. The adjacent coastal belt of dune-steppe and unintensified agriculture provides suitable habitat for the few remaining individuals to search for food.

The Northern Bald Ibis has undergone a dramatic decline over the centuries. It disappeared from the European Alps over 400 years ago, but most alarmingly it became extinct in the wild in Turkey in 1989, and is no longer found throughout most of its former range in Morocco and Algeria. A small free-flying population of wild origin exists at Birecik in Turkey, but the birds

have to be fed and taken into captivity each winter. Occasional recent records from the southern end of the Red Sea (e.g. Yemen and Eritrea) provoke speculation that an isolated breeding population might still exist in that area, but this may be a forlorn hope.

There are many reasons for the decline of the Northern Bald Ibis. Hunting and other forms of direct persecution have wiped out some populations, the loss of steppe and low-intensity agricultural areas have reduced availability of feeding areas, and human disturbance at the breeding sites has undoubtedly led to reduced productivity. Pesticide poisoning has had disastrous consequences, most notably in Turkey in the late 1950s when hundreds were killed outright by DDT, and the survivors subsequently suffered very low breeding success. In May 1996, 40 of the Moroccan birds died in nine days - despite analyses and tests the cause remains a mystery, but intoxication from an obscure source remains a possibility. It emphasises how vulnerable the population is.

The average clutch of the Northern Bald Ibis is three eggs but very rarely do they all result in fledged chicks. Our research has shown that, on average, each breeding pair fledges barely one chick per year. The nest sites, narrow ledges of the sheer but fragile and rapidly eroding sea cliffs, are well protected from most predators and people. Unlike the Northern Bald Ibises in most of the populations that have now gone extinct, the ibises in this area are not migratory and remain within the region.

Souss-Massa National Park holds just over half of the birds, with the rest in another coastal area 100km further north at Tamri. The National Park was created in 1991 with the ibises in mind, and they use most of the length of the park at different times of the year. The park is a coastal strip 5-10 km wide and 75 km long (area 33,800 ha). Mohamed Ribí, the park director, was instrumental in its creation and has been responsible for managing the area for over 20 years. The park was developing its management plan in 1994, when BirdLife International joined with the Moroccan Administration d'Eaux et Forêts et de la Conservation des Sols to undertake a research programme that would identify the actions needed to conserve the ibis. It was agreed that these would then be incorporated into the park's management plan. The RSPB (BirdLife Partner in the UK) supplied a researcher and resources to carry out the work through the BirdLife Partnership, and the park provided offices, a counterpart and support.

The research priorities were to find out where the birds feed, roost and breed, and to identify what critical features make these sites suitable for the ibis. This has involved following the birds to their feeding grounds, mapping those areas, recording vegetation and documenting land use. Different areas have been important in different years, so the study needs to be continued for several years to get a full picture. The breeding cliffs have been studied (with help from University of Derby geomorphologists) to see whether more sites should be created and kept free from disturbance. Perhaps the most important activity has been monitoring every breeding attempt: recording laying, hatching, fledging information and all predation or disturbance that might have an adverse effect on breeding productivity. This has led to specific interventions in some cases.

As part of this process, we've engaged and trained local villagers to warden sites and to collect much of the monitoring data. Already, awareness and pride in the ibis in the adjacent villages has grown, but the task of keeping the breeding sites undisturbed by stray tourists or fishermen can be a delicate business. Progress has been made, but increasing human populations and tourism are growing pressures, which will not go away. Most of the wardens, formerly fishermen themselves, know many of the people who might potentially disturb the birds. This makes it possible to avoid most problems by informal discussions over cups of mint tea. A small grant from EURONATURE (European Natural Heritage Fund) covers some of the cost of employing the wardens.

The wardening and data collection of breeding success has already kept human disturbance to a minimum. The observations made showed that a single pair of Ravens *Corvus corax* had specialised in taking ibis eggs at one site, and that Cormorants *Phalacrocorax carbo* had disrupted another colony by competing for nest sites. However, there have been indications that an insufficient food supply has been an even more important cause of chick mortality. This year (2001) we have intervened by persuading the Cormorants to breed elsewhere and by culling the Raven pair. We are testing whether the provisioning of water points can help to improve chick productivity, and the indications are very promising. This has the added benefit that water quality can be assured, thus reducing risks of the ibises drinking from a contaminated water source.

One of our first actions was to modify cliff ledges at one breeding site. This was carried out by a team from the British Mountaineering Council to test whether birds were being prevented from breeding because of insufficient suitable ledges. The modified ledges remained unoccupied until this year when birds finally moved in from another site, so although total numbers have remained unchanged, the number of options is clearly limited and this has demonstrated an option in future management. Monitoring at the major roost-site away from the breeding colonies has shown that fencing the roosting area off may be the only way to tackle the problem of human disturbance at this site. While we are working towards this, education and sensitisation are important first steps to make sure that local people are supportive of such management tactics.

While active management measures such as those described above may be enough at least to help such a precariously small population them recover from the latest setback, enormous care is needed to avoid introducing other risks or disrupting natural behaviour.

A growing threat to the ibises is the fact that nearby Agadir is a major tourist centre, and there are plans for more hotel developments in the area. A proposal to construct a recreational-hotel complex within the park boundaries adjacent to an important ibis feeding site has been made, and the park will need political support at all levels to prevent future habitat loss. (see 'Stop Press' section below)

Plans to promote eco-tourism within the park that will directly benefit local people are under way. These plans will include the ibis as an eco-tourism feature, but only at the feeding areas.

Decisions still need be taken on how the plans will be carried out without risking disturbance to breeding or roosting birds.

Whilst eco-tourism or other such activities must be planned carefully, unless local people do benefit in such ways, the growing pressures will undoubtedly become too great for coexistence between the people and the ibis. With the park becoming more established, and many data being collected on the birds, such developments can be planned. Although the ibis still has a precarious future because its numbers are at such a low level, we can be optimistic that solutions can be found.

Unfortunately, disturbance at the breeding sites by visiting birdwatchers is a real threat. As well as being a direct disturbance, tourists are often followed by local people, a problem which could very quickly escalate to serious disturbance levels. Fortunately, most birdwatchers understand these problems, and only try to view the birds responsibly in the feeding areas described in birding guidebooks. Few people who stay for a full day go away disappointed, as the birds are often very easy to see. We are planning to provide more guidelines for birders as part of the eco-tourism programme and to promote ways in which the tourists can buy produce locally to aid the local economy?

The first data-gathering phase of the project ended with a workshop in 1997 to discuss the results, plan ahead and start the actions that we've demonstrated are urgent. Involving local people and seeking ways in which they can benefit from continuing presence of the ibis are paramount in all future actions.

The main hope for the continuing existence in the wild of the Northern Bald Ibis is to build on local pride and develop ways in which this ibises' continued presence can be of direct benefit to the people living alongside them.

Five years on from the death of 40 birds in 1996, the population has almost fully recovered. With increasing local and national awareness, the actions under way, and with the wardens now more established, there is renewed hope that this last wild bald ibis population will survive in a truly wild state.

Population (no. of pairs that laid eggs) in Souss-Massa and Tamri since 1980

Year	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
Pairs	75	56	68	-	-	56	-	48	60	59	63	-	48	49	65	74	77	59	62	60	65	69

2. Konrad Lorenz Institute behaviour and release methodology project - Austria

The Konrad Lorenz Institute has been carrying out and supporting behavioural research on Northern Bald Ibis for more than five years, but this research programme has become increasingly oriented towards finding suitable methods for releasing well adapted birds into the wild. The work originally focussed on imprinting and conditioning the birds, but is now moving on to looking at large-scale trials – which Kurt Kotrschal summarises here.

The Grünau project is in its 5th year: How to establish a Waldrapp *Geronticus eremita* colony from scratch

By Kurt Kotrschal

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Background of the Grünau project

The Waldrapp or Northern Bald Ibis is a critically endangered species with only a few hundred surviving in the wild, but maybe ten times as many in captivity. Thus, it seems logical to consider re-establishing colonies in suitable habitats; the only question is how. This was the main topic of our 1999 Agadir meeting (Anon. 1999), where it also became clear that all attempts up to now to release birds from captivity had failed. However, a pilot project of the Innsbruck Zoo in the early 1980s, involving handraising of nestlings and releasing these socially human-imprinted birds had revealed promising results (Thaler *et al.* 1992).

The Grünau approach

Hence, we started an experimental project along these lines in 1997 to establish a local colony of semi-tame birds at the Konrad Lorenz Forschungsstelle in Grünau/Austria. Our aim was twofold, 1) to have, besides Greylag Geese *Anser anser* and Common Ravens *Corvus corax*, a third bird model available for our investigations into the mechanisms of social life and 2) to collect know-how for establishing Northern Bald Ibis colonies elsewhere, in climatically more suitable

habitats. Particularly in the first years, this developed into an expensive, labour-intense “blood-sweat-and tears” project. Now, nearly 5 years later, 22 experienced birds are roaming our valley. We consider this to be partially successful and have plans to expand.

Young ibis hatched in zoo colonies were carefully handraised in the attic of a barn from where they later fledged. The handrearing process established close bonds between the raisers and the birds. The handraised ibises develop a spatial bond via social bonds to their “foster parents” and can be managed, for example they can easily be taken into the aviary during adverse conditions. This allowed social traditions to develop, which now enable birds to cope with the conditions in the valley. For details of our approach see Kotrschal (1999) and, Tintner and Kotrschal (2001) and Tuckova *et al.* (1998).

A summary of the events 1997-2001

Of 12 nestlings received from Innsbruck Zoo and Vienna Zoo in spring 1997, 11 fledged, of which 4 survived into 1998. Most losses were due to local predators (Eagle Owl *Bubo bubo* or accidents in 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, handraised birds and that they could survive for weeks without supplementary food. Observations revealed that our birds, which are pretty tame towards some (not all) persons at their “colony site” are nearly as wary as their wild Moroccan conspecifics when encountered off the KLF.

In 1998, 16 of 17 nestlings- again from Innsbruck Zoo and Vienna Zoo- fledged, resulting in a group of 20 free-flying birds in early summer. The ibises left on long-distance flights towards north eastern Europe between Sept. 30 and Oct. 5. Only a 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! Only 2 of the birds raised in 1997 and 4 from 1998 survived into spring 1999. This was sobering. In fact, 24 of our 30 rare birds raised with so much devotion during the first two years were dead. We considered terminating our project. However, we also had the feeling that we had reached some threshold. So we decided to try a third season and change the management of the birds. As before, birds were taken into their “Colony site” (the attic) during the night, but we decided to take them into the aviary in August and to release them again end of October to avoid heavy losses due to dispersal/migration incurred in the first two years.

In 1999 12 of 13 chicks from Innsbruck Zoo, Stuttgart Zoo and the Schmieding Bird Park fledged and joined our 6 experienced birds. The group developed regular spatio-temporal movement patterns and left their colony site to forage. Despite supplementary food being available, the group spent many hours per day probing local meadows and pastures for insects, snails and small vertebrates) at distances of up to 20 km from the colony site, but the ibises usually returned in the evening. They were restricted to the aviary during extreme weather

conditions (e.g. severe rainstorms). Not a single bird was lost. The group was kept in the aviary . from mid August to mid November but was allowed to fly again during the days in mid winter.

In spring 2000 only 4 of 6 hatchlings from the Erfurt Zoo fledged and joined the group of 18. No bird was lost through the spring of 2001, so we now have 22 increasingly experienced birds. As the original facilities were insufficient to maintain this colony, we invested lots of time, effort and experience over the summer of 2000 to build a huge and tall Waldrapp-aviary on a south-facing slope in the nearby Cumberland-Game Park. The aviary has sheltered ledges where the birds roost overnight. These can be kept frost-free when night temperatures drop below -10 C. We also built an 8m high tower on top of the hill in conjunction with the aviary which facilitates the birds' arrivals and departures being a more open site. The group immediately accepted its new aviary as a colony site and never attempted to return to its previous, smaller night roost at the KLF. No hand-raising was done in 2001. We now observe courtship behaviour, but first reproduction will probably be later than in other colonies, because there are no experienced, older birds to stimulate younger birds.

The total amount of money spent in 5 years in this project is approaching \$100,000 (excluding our new aviary). We were splendidly supported by Ernst August, Duke of Hannover, by the Cumberland Game Park, by the Society of Supporters of the Schönbrunn Zoo, by family. Heiß, by the Austrian Science Ministry, by the Government of Upper Austria and by a number of private donors. Our project would have had no chance without their contributions.

Scientific results

Our project has already provided a lot of know-how with respect to potential re-introductions (Anon. 1999, Kotrschal 1999). But there is also potential for basic behavioural science. Hand-raising, for example, can also be used as a controlled experiment to ask scientific questions. We investigated the effect of hatching asynchrony on nestling aggression in 1997 (Klara Tuckova). The ontogeny of substrate preferences and social integration were research topics in 1998 (Maartje Kijne, unpubl.). In 1999, Angelika Tintner looked into the effects of being a solitary nestling from hatching to week 3 (a common situation in the wild when the food supply is insufficient) versus being a group-raised nestling. It showed that this had a significant and long-lasting effect on socialization. Initially solitary birds tended to develop rather exclusive dyadic relationships, whereas group-raised birds socialized more widely.

It is not easy to summarize our results and experiences very briefly. We have learned to be increasingly sceptical towards the "genetic determinism" (the dogmatic focus on the genetic stock of the animals used) which can still be found in conservation management. Instead, our work with Waldrapp, but particularly, with geese and ravens, has taught us to appreciate the overwhelming importance of ontogenetic processes.

At present, a PhD student (Angelika Schneider) is investigating the ontogeny and ecological context of Waldrapp foraging behaviour in comparison with a number of other ibis species. This is a joint project with Prof. Bergmann, Univ. Osnabrück. A second project on the social context

of foraging is being investigated by a masters student (Isabel Meran). In particular, we are interested whether, and what, the ibis learn from one another when foraging, how they compete and how the social relationship between individuals affects the formation of foraging groups. In the future we will (in parallel to our present focus on geese and ravens) investigate hormonal and early stimulus effects on the development of coping styles (proactive-reactive), etc.

A new Waldrapp project in Fagagna/Italy

Our example suggests that introduction could be done. And in areas better suited for the Waldrapp (somewhere around the Mediterranean) the prospects for success in establishing a truly independent, self-sustaining colony are even better. Therefore, we are very happy that Dr. Fabio Perco and his colleagues will start establishing a free-flying colony at Fagagna, near Udine, Italy in 2001, along the lines of our experiences and in close cooperation with the KLF Grünau.

Wild dreams for 2002 ...

Former KLF PhD student Dr. Johannes Fritz is right now (April 2001) training to fly an ultralight plane. In spring 2002 he and Angelika Reiter plan to raise 15 nestlings at the Scharnstein airstrip (near Grünau). They plan to lead the ibis crossing the Alps behind two planes in August. Then via Udina, Venice and Florence (with a number of suitable stop-off areas along the route) they plan to reach a potential wintering area on the Italian West Coast (near the Maremma). This is conditional on a planned film project (and the acquiring of lots of sponsorship funds) going smoothly.

We are well aware that this is an entirely experimental project. Such projects have, however, worked for geese and cranes and we see no reason why it should not work with the Waldrapps. This would be the only way of establishing new functional migration routes, which are, as far as we know, family traditions in the Waldrapp (as in geese and cranes, but not in storks and many songbirds). The Waldrapp in Europe always lived in close proximity to people. It probably only entered the Alpine area together with the first pastoralists.

Considering the ecological and cultural background of the Waldrapp ibis, we see no reason why migratory populations of this ibis cannot be brought back to Europe. But, of course, we would like to intensely discuss this matter with the international expert group and with the major bird organizations. We need critique, but also beg for more constructive support than previously experienced from the international animal conservation community. There are certainly many potentials for failure and hence, for not engaging in such a programme. But the only means of knowing will be by trying it, as was exemplified by the Grünau project.

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3. Proposed release programme - Northern Morocco

This project was discussed at the 1999 workshop, and we understand that birds are now in situ in cages at the release site near Teza in Northern Morocco.

Unfortunately, no more details are currently available.

4. Release trials - Israel

Much of the early research on release was carried out in Israel, and ideas of hacking with Glossy Ibis parents were discussed at the workshop in 1999.

No news has been received about subsequent work, although Bill Woodley reports that no advances have been made.

5. Semi-wild population - Bireçik, Turkey

The semi-wild population at Bireçik is managed by the Ministry of Forestry and apart from a few additional birds in Turkish zoos represents the main stock of Eastern origin birds. They are free-flying for five months of the year. Arihan (1998) summarised the situation and a new initiative to monitor and develop the population is at an early stage:

Outline of a proposed collaborative project to monitor and develop the Bireçik semi-wild Northern Bald Ibis population

By Nurettin Ozbagdatly¹, Taner Hatipoglu², Bahtiyar Kurt¹, Okan Arihan³, Jose Tavares⁴ & Chris Bowden⁴

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Bireçik, in southeast Turkey is unique in supporting the only semi-wild Northern Bald Ibis population, since the wild Turkish Bald Ibis (*Geronticus eremita*) population declined to extinction in 1989 (summarised comprehensively by e.g. Akcakaya 1990). The Game and Wildlife Department, General Directorate of National Parks (MP) in the Ministry of Forestry has been managing this population for over twenty years.

The captive breeding station was established in 1977 by MP, when 34 birds returned from the wintering grounds. The number of birds returning each spring consistently declined, until finally in 1990 just one bird returned. Since then, no bird is thought to have returned to Bireçik, despite a good number of ibis disappearing before the flock was rounded up in the cages each summer (Arihan 1998).

Breeding success has been low in recent years, and the lack of understanding of the reasons for this underline the need for more detailed monitoring and research. In 1998, only 6 chicks were reared to fledging (4 of which were removed to Bursa zoo the same year); in 1999, only 1 chick fledged and in 2000, no chicks fledged at all (Bowden 1998, Bowden & Tavares 2001). There is also a need to know more about the movements and foraging of the free-flying birds as well as more detail on how the birds are currently managed.

In December 2000, MP, RSPB-Royal Society for the Protection of Birds -BirdLife UK partner and DHKD- Dogal Hayati Koruma Dernegi, the BirdLife Turkey partner arranged a meeting in Ankara. They agreed on some preliminary monitoring for 2001, with a view to taking necessary conservation actions in future. The monitoring began in May 2001, with the appointment of Nurettin Ozbagdatly who remained at the breeding station for much of the time until July. The main aims for this year were to monitor the 2001 breeding season and pull together the stakeholders.

The first visit to Birecik has been made with the participation of Taner Hatipoglu (Veterinary researcher of MP), Jose Pedro Tavares (RSPB Country Programmes Officer for Turkey) and Nurettin Ozbagdatly (Project officer of DHKD, funded by RSPB) in May. The purpose of the visit was to introduce the project officer to local officials and to give him some initial training.

Subsequently, Ali Aghnaj, the Moroccan Bald Ibis Research Project Officer, visited the Birecik colony on 3rd to 9th of July. Ali Aghnaj, Taner Hatipoglu and Nurettin Ozbagdatly spent a week discussing the Birecik colony and developing the monitoring methodology.

Lastly, observations and discussions with stakeholders and local people were carried out from May to the end of July, and these have also been presented in a DHKD report (Nurretin 2001)

The report includes the detailed observations on breeding, feeding and injured birds, as well as information on how the birds are cared for, caught up at the end of the summer etc. Some of the key stakeholders' ideas are also presented in the report.

All the project expenses including the staff salary were funded by RSPB, but managed by DHKD and with full support of MP.

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6. Genetic studies

Two pieces of work are currently in progress, and the authors have submitted the following summaries of their findings to date.

6.1 Studies on the phylogeny of ibises with special emphasis on the Northern Bald Ibis *Geronticus eremita*

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The ibis genus *Geronticus* consists of two recent species. While the Waldrapp ibis (or Northern Bald Ibis) *Geronticus eremita* inhabits northern Africa and the wild population in the Middle East was extinct only a few years ago. The Southern Bald Ibis *G. calvus* is restricted to the southernmost parts of the African continent. Contrary to their separated geographical distribution, both species share many behavioural and ecological features: in contrast to other ibises they nest on stony cliffs their pairing displays and breeding behaviour being adapted to this special breeding situation (Hancock *et al.* 1992). Moreover, they both inhabit mostly dry areas, which lead to distinctive adaptations in foraging behaviour if compared to other ibises (Manry 1982, Pegoraro 1996).

Due to these common characteristics the two species have mostly been considered close relatives, although it has to be mentioned that characteristics of obvious ecological importance may not be a powerful tool to resolve taxonomic or phylogenetic relationship.

We analysed two segments of the mitochondrial DNA (total 835 bp) of the two *Geronticus eremita* populations, of *Geronticus calvus*, eight other species of ibises and several species of related taxa.

Total DNA was extracted from feather bases of living or freshly died birds using Chelex 100 (BIO-RAD) and standard protocol. Primers used for amplification of cytochrome b were cytbL 5'-CCATCCAACATC-TCAGCATGATGAAA-3' and cytbH 5'-CCCCTCAGAATGATA-TTTGTCCTCA-3' (Kocher *et al.* 1989); for 16S rDNA were 5'-

CGCCTGTTTATCAAAAACAT-3' (16sar) and 5'-CCGGTCTGA-ACTCAGATCACGT-3' (16sbr; Kessing *et al.* 1989).

PCR was carried out on a 9600 GeneAmp Thermal Cycler (Perkin Elmer); protocols were 94°C for 30 s, 50°C for 45 s, and 72°C for 90 s for 34 cycles for cytochrome b and 94°C for 30 s, 52°C for 45 s, and 72°C for 90 s for 34 cycles for 16S respectively.

After purification sequencing reactions were performed in a 9600 GeneAmp Thermal Cycler (Perkin Elmer) using the ABD (Applied Biosystems) Prism Dye Terminator Cycle Sequencing Ready Reaction Kit with AmpliTaq DNA Polymerase FS (Perkin Elmer); 96°C for 15 s, 50°C for 15 s, and 60°C for 2 min for 25 cycles. Each template was sequenced from both directions. Controlled sequences were aligned to the mitochondrial genome of the chicken. The distance matrix between the species was calculated using PAUP Version 3.1.1 (Swofford 1993).

We tried to resolve the phylogenetic positioning of ibises and spoonbills (*Threskiornithidae*) by the use of mitochondrial DNA sequences. This avian family is traditionally placed within the storks (*Ciconiiformes*), but has been suggested to be related to waders (*Charadriiformes*). Our analyses resolve the ibises and spoonbills as a sister taxon to the new world vultures, showing no close relationship to the other two avian families generally accepted as ciconiiform birds (storks *Ciconiidae*, herons and egrets *Ardeidae*). Moreover, our results corroborate the notion that the Ciconiiformes - mainly characterized by morphological characters related to their ecology - may represent an artificial assemblage and should be redefined by a comprehensive study of different independent behavioural, morphological and molecular features.

Within the Threskiornithidae a deep split could be detected between *Plegadis* and *Platalea* as more ancestral lineage and the other ibises included in the sample which were resolved as the most recent branch. Within this advanced branch the *Geronticus* species are the most recent lineage.

The two *Geronticus* ibises are only separated by six transitions in the 16S rDNA segment and by two transitions in third codon positions in the cytochrome b segment. Both point mutations in the cytochrome b segment do not lead to changes in the amino acid sequence of the protein.

We examined the same segments of the mitochondrial genome of Moroccan and Turkish Waldrapp. One point mutation could be detected. This is the first indication for a genetic differentiation between the two populations. The consequences of this finding for conservation of the highly endangered bird have to be discussed and additional studies are urgently needed. Presently we recommend to use only birds of known origin and the geographically adequate populations in future captive breeding and releasing programmes.

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6.2 Genetic diversity in the last remaining wild population of Bald Ibis (*Geronticus eremita*); preliminary results inferred from mtDNA sequence data

Progress report to IAGNBI, received 24 May 2001

Damien Broderick, Amal Korrida, and Youssef Idaghdour.

The International Foundation for Conservation and Development of Wildlife.
P. O. Box 116, Inezgane, Morocco

Monitoring the wild population of the last remaining Northern Bald Ibis *Geronticus eremita* colony raises a number of sampling problems, as they are not subject to any marking program that involves their capture. This is because *G. eremita* is highly sensitive to disturbance and any direct interference with these social birds is currently avoided. There are three sources of material from which we can non-evasively extract DNA i) tissue samples from dead birds, ii) feathers and iii) faecal samples. These represent progressively more difficult sample sources from which DNA can be extracted. The available tissue samples from mortalities are too few in number to reliably estimate population genetic variation in the flock but they do function as useful controls for DNA extraction from other more challenging material. While feathers are a better source of DNA we believe that sampling faeces will allow us to sample a greater proportion of the flock and lead to better estimates of genetic diversity. Initial trials to extract DNA from Bald Ibis faeces are encouraging though further technical refinements are required. The new watering points at the colonies represent the easiest way to get fresh faecal samples for further trials.

Our initial investigations using molecular markers have focused on 15 specimens originating from mortality incidents. We were able to sex all 15 Bald Ibis specimens held at the Veterinarian Lab in Agadir using molecular sexing markers. Moreover, both molecular sexing techniques (Griffiths *et al.* 1998 and Ellegren 1996) trialed gave the same results. We were pleased with the performance of these molecular markers as sexing all the specimens via conventional examinations was not possible due to their poor condition.

Our first investigations of genetic variation in Northern Bald Ibis used ten birds originating from the mortality incident. We amplified and sequenced 881 b.p. of the mtDNA control region using primers we have designed in our laboratory. We identified eight maternal lines that are closely related differing by only 1-6 bases in every 1000 (nucleotide diversity $\pi = 0.0011-0.0057$; mean

$\pi = 0.0021$). The majority of the variation is due to changes in fragment length by the insertion and deletion of nucleotides which is a common feature of mtDNA in this region.

During the primer development phase we discovered a microsatellite towards the end of the control region. Several other taxa, including other Ciconiiformes, have microsatellites in this region. This region is likely to be very informative but we need to design more primers before we can use it for routine screening of variants. Existing primers can amplify over 2000 b.p. of mtDNA spanning the entire control region and cytochrome B genes. We have not assessed the levels of variation in the cytochrome B gene but given the low levels of diversity uncovered in control region, it is unlikely that this region will be informative for our work on the colonies. In the longer term we will sequence this region as it will be useful for future taxonomic comparisons among Threskiornithidae.

Although we are in the very preliminary stages of this study, the genetic results are encouraging for two reasons. Firstly, not all of the genetic diversity has been lost despite the populations' rapid decline in numbers. Secondly, the frequency of the DNA variants in the population may be useful to differentiate between birds of wild and captive origin. The later application will have a particular relevance if captive birds are released in Morocco or adjacent countries.

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(See also stop press section below)

7. Veterinary investigations and a request for information from zoos

Some progress has been made with reference to the gaps in knowledge in relation to veterinary knowledge, which this contribution covers. In addition, there has been some work in Morocco (as part of the project based in Agadir) by Dr Andrew Cunningham to review the 1996 mortality, clarify autopsy protocols and focus on disease risks for the wild birds. A report on this work is in preparation.

Results of a mortality survey of adult Northern Bald Ibis held in captivity

Preliminary report to IAGNBI - May 2001

By Miguel Quevedo

**Jerez Zoo, Jerez, Spain
Email: mangel@viautil.com**

A number of gaps in knowledge identified by the committee are directly related to veterinary aspects of the birds, both in captivity and in the wild. My own role on the IAGNBI committee is as veterinarian, and one of my tasks is therefore to compile all the available information regarding diseases, clinical problems, causes of mortality, etc, in captivity.

In 1999 a mortality survey for adult birds (it was decided not to include mortality of chicks, except where pathological causes are diagnosed) was sent to all EEP members holding this species. Unfortunately the response was not as comprehensive as I had hoped and a few problems were encountered:

- Only 18 of the 42 EEP Institutions responded.
- The survey was sent again in 2000 to those EEP members that had not responded to the first letter.

- Some questionnaires were not filled in correctly. The information or the cause of death was often uncertain or a detailed post-mortem was not always performed.
- Some causes of death were not specific or various causes were diagnosed, so only certain and clear causes were taken into consideration.
- In other cases the answer described the kind of lesion found in the post-mortem report (eg hidropericard, hepatitis, gastritis, etc) but the cause of death is not given.
- Only 151 results, out of a total number of 207 analysed specimens, were useable for the purposes of the study.
- Thanks to the 18 institutions that responded to this survey, they were: Basel, Bern, Edinburgh, Erfurt, Goldau, KLF and Univ.Vienna, Heidelberg, Jerez, DWCT-Jersey, Lisbon, Tama, Walsrode, Alpenzoo, Zurich, Moscow, Helsinki, Duisburg and Berlin. I am very grateful to all of them for their time and consideration.

The following results were obtained:

<u>Cause of death</u>	<u>n</u>	<u>% of total</u>
EUTHANASIA	32	21.1 %
TRAUMA	22	14.5 %
SEPSIS	18	11.9 %
FOREIGN BODY INGESTION	14	9.2 %
ENTERITIS	14	9.2 %
RENAL DISORDER	9	5.9 %
CARDIAC FAILURE	8	5.2 %
Pneumonia	8	5.2 %
Avian tuberculosis	4	2.6 %
Linfoproliferative process	3	1.9 %
Senil degeneration	3	1.9 %
Salmonellosis	3	1.9 %
Erysipela infection	2	1.3 %
Aspergilosis	2	1.3 %
Adverse reaction Levamisol	2	1.3 %
Clostridiois	2	1.3 %
Hepatitis	1	0.6 %
Fibrosarcoma	1	0.6 %
Starved	1	0.6 %
Acute bleeding	1	0.6 %
Ruptured of the aorta	1	0.6 %
Reasons unclear	56	
Total	207	

DISCUSSION:

More detail is given below for some of the results, but a full synopsis will be prepared in future.

EUTHANASIA

It was the most common cause of mortality, 21.1 %. The reasons for euthanasia were mainly irreversible disorders such as:

- Chronic skin lesions: 40 %
- Fracture of mandible or beak: 26.6 %
- Bumblefoot: 13.3 %
- Elderly bird: 3.3 %
- Epidermoid cyst: 3.3 %
- Frostbite: 3.3 %
- Foot problem : 3.3 %
- Severe Injury on wing: 3.3 %
- Feather disorder: 3.3 %

TRAUMA

It was the second highest cause of mortality 14.5 % mainly due to accidents. It has been related to some degree of disturbance provoking flying against hard objects, such as mesh or part of the aviary. Within the cases reported are: predator got into aviary, leg hanging from the mesh, flew into hard object, dislocation of mid-neck, hemoperitoneum, liver rupture, contortion of whole body, killed by other bald ibis

SEPSIS

Generalised infection or septicemia 11.9 %. In this case it was not clear whether the bacterial infection was the primary cause of disease or secondary to another concurrent process. Some of the bacteria isolated are: *E. coli*, *Aeromonas* and *Staphylococcus*.

FOREIGN BODY INGESTION

One of the more common cause of death associated with management in zoos. Northern Bald Ibis have the capability to find and swallow pieces of tree branches and metal things (wires, nails) especially in new or reconstructed aviaries. Once these foreign bodies are ingested, they can cause obstruction or perforation of the stomach wall producing perforative gastritis and eventually peritonitis.

ENTERITIS

Digestive disorder due to enteritis was found in 9.2%. Some of them directly related to infectious enteritis. *E. coli*, *Clostridium perfringens*, *Pseudomonas* are among the bacteria found. In other cases only the lesion itself was found: Hemorrhagic enteritis or pseudomembranous enteritis.

RENAL DISORDER

5.9% of the total cause of mortality. The lesions found were: glomerulonefrosis, glomerulonefritis, nephropathy, tubulonephrosis and nodular abscess

CARDIAC FAILURE

5.2% of deaths were related to some degree of cardiovascular disorder. Heart failure, rupture of aorta, endocarditis valvularis, miocardosis, hidropericardia.

LINFOPROLIFERATIVE PROCESS

3 cases of suspected avian leucosis were seen in one institution. No other case of linfoproliferative process in this species has been described in the consulted bibliography.

ADVERSE REACTION TO LEVAMISOL

Levamisol was administered to the whole group of birds kept in an institution as a de-worming procedure. The dose given was 40 mg once P.O.. Of the 25 birds treated 2 died the day after the treatment.

REQUEST!!!

I would like to take this opportunity to ask any keepers of captive Northern Bald Ibis to **send me information concerning the cause of death of birds**. This information is badly needed to build up our understanding. I will send you a questionnaire to fill in or use the form below:

MORTALITY SURVEY FORM OF THE NORTHERN BALD IBIS
(Geronticus eremita)

Please return this form to: mangel@viautil.com

INSTITUTION:

CONTACT PERSON:

FAX/EMAIL:

DATE:

Arks identification number	date of birth	date of arrival	sex	clinical symptoms or circumstances of illness prior to death	date of death	post-mortem findings

Recent publications on Northern Bald Ibis that have come to our notice

Some publications and proceedings related to Northern Bald Ibis that have appeared since 1998.

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Stop press

1. Updates on threat to the wild population by proposed development within the Souss-Massa National Park

Updated 31.07.01

Threat to Northern Bald Ibis The BirdLife International situation fact sheet

- BirdLife International is very concerned at the prospect of the loss of the last wild population of the Northern Bald Ibis *Geronticus eremita* in Morocco. A proposed tourist development on the coast next to Tifnit village, within Souss Massa National Park, will threaten the main winter feeding grounds of the Ibis if it goes ahead without very careful planning
- Northern Bald Ibis is critically threatened with only 65 breeding pairs left in the wild. The entire population depends on the Souss-Massa National Park and the unprotected Tamri area, within 60 km of Agadir, SW Morocco.
- Souss-Massa National Park was officially designated in 1991 with the conservation of the Northern Bald Ibis as a primary aim.
- Since 1993, BirdLife International (initially RSPB, the UK Partner and more recently SEO, the Spanish Partner) has had an ongoing research and conservation project working directly with the Souss-Massa National Park, and the Moroccan Administration Eaux et Forêts.
- As a result of these efforts, the population is rising for the first time in many years, although the population is still at a critically low level. The primary threats and causes of decline for the species have been the loss of feeding habitat, human disturbance at the breeding sites, direct persecution (hunting), and pesticides such as DDT.
- A long-term research programme has identified the most important feeding areas for the ibises, and among these is a steppe area near Tifnit village. The birds are followed from their roost sites to the feeding areas, and their locations marked on to aerial photos and subsequently onto a digitised map of the park (video footage available of technique, and of the birds).
- An area of 200 Ha at Tifnit was allocated to SONABA (Agadir regional development body; a Moroccan development group) before the creation of the Park. Unfortunately, this includes an extremely important Northern Bald Ibis feeding area, used during many months of the year, but generally outside the breeding season. Systematic recording of where the birds feed has shown this very clearly in successive years, and many records involve a large proportion of the total ibis population.
- Since the start of the ibis project, there have been fears that development will occur in this SONABA area, and indeed there were already electricity poles in place in 1994. None of the plans or rumours have materialised up to now.

- In 2000, the first interest in the Tifnit area by Club Mediterranean was registered. There were also other potential developers interested.
- In January 2001, a contract was signed with the Moroccan Government, agreeing to major investment in Morocco by Club Med. to establish new holiday villages in Al Hoceima, Tangiers, Marrakech, Dahkla and at Tifnit.
- The Tifnit area site originally proposed to Club Med was that owned by SONABA, which has for many years been looking for tourist developers to take up this opportunity. Club Med does not consider this area as ideal for them, and after discussions with the Ministry of Tourism and Finance, a coastal area slightly to the north has been agreed upon.
- The northern area Club Med proposes to develop for tourist villages is currently about 100 ha. The suggested number of beds is approximately 7000 due to the fixed costs of the infrastructure. Club Med proposes to develop 2 villages with 3000 beds and invite offers from other developers to develop the rest. The rest of the coastal area to the south (SONABA) is also approx. 100ha.
- Monitoring of bald ibis by BirdLife International has shown that the SONABA area (particularly the inland section) is in fact extremely important for the species with a concentration of records in the steppe areas around the bay. The new coastal area north of SONABA has been used on occasions, but the number of records is relatively low.
- BirdLife International has had high level contacts and discussions with the Moroccan government (Eaux et Forêts) and Club Med and expressed its concern about the proposed tourist development, particularly the need for a proper Environmental Impact Assessment (EIA).
- The most recent discussions with Club Med took place on 19 July in Paris, and involved Club Med development managers and their representative in Morocco (Groupe Alliance) and representatives of the BirdLife Partners from France, Spain and the UK together with the BirdLife Secretariat. At this meeting, senior representatives of Club Med management stated to BirdLife International that Club Med understands the concerns of BirdLife International and shares them 100%.
- Club Med has hired a consultancy company, Carex, to carry out an EIA. BirdLife International has been informed that this should be ready by end of July.
- GTZ (a German Development Aid Co-operation) is also paying for an EIA, which is due to be ready by mid August. This is to be the official EIA for the E & F ministry
- Club Med has proposed a meeting with BirdLife International (secretariat and Partners involved) and the other partners (National Park, Eaux et Forêts, GTZ) at the end of August in Agadir to discuss the findings of the two ongoing EIAs.
- BirdLife has been assured that no further decisions on the tourist development will be taken during the month of August.
- BirdLife recognises that there were longstanding agreements in place before the creation of Souss-Massa National Park that permit limited tourist development however BirdLife is against any development which might threaten the interest of the National Park, and in particular the Bald Ibis.
- BirdLife is still hopeful that the issue can be resolved. The Northern Bald Ibis is a flagship species for the BirdLife International partnership and its members have closely followed the developments of the joint BirdLife/ National Park Bald Ibis recovery project. BirdLife has a responsibility to its

partners and they in turn are responsible to their members, which total 2.5 million world-wide. Therefore, BirdLife will continue to follow this development very closely, to ensure that the Bald Ibis is not put in danger of extinction.

Further update: 15.10.01

- The proposal to build a holiday development within the Souss-Massa National Park, southern Morocco was discussed in more detail at a meeting held in Rabat, 10th October. The Park Director and the BirdLife International Partners concerned (SEO, RSPB, LPO) were invited by the Ministries of Tourism, and Eaux et Forêts to discuss the procedure, together with Club Med, the developer, their ground agents 'Groupe Alliances', and the authors (CAREX Environnement and a private consultant) of the two Strategic Environmental Assessments (SEA) carried out in July-August on the initial development proposal .
- The two studies have exposed the major constraints and concerns. It was, however, agreed that a full Environmental Impact Assessment (EIA) is still needed once the detailed plans of the development (which will include the actual running of the village(s) and their consequences for the surrounding area) have been presented. The provisional plans have already been modified to avoid construction near the area of pristine steppe, which is most important for the ibis - much of which had been designated for future development in 1988, prior to the creation of the Park. This area would be re-designated and included as part of the Park, in exchange for the area to the north (currently inside the Park) but less frequently used by the ibis. Use made of this area by the ibis comes from data collected over more than five years by the Park and BirdLife as part of the research and monitoring programme.
- Discussions included the creation of a buffer-zone within the development area as well as numerous other environmentally orientated restrictions. Club Med has indicated that it is willing to contribute financially to significant compensation measures for the ibis within the Park
- Club Med stated that 3,000 beds is economically a barely viable level at which they can go ahead, and they would plan to review this after two years and seek to increase to a final total of 5-6,000 beds within the designated area.
- Although the National Park and BirdLife International are clearly very concerned at the prospect of development in an area with a globally endangered species, it does present the opportunity to resolve the long-standing threat of a bigger tourism development on the adjacent pristine steppe (SONABA land), ensure better implementation of current regulations within the park and provide compensations measures which the park badly needs due to lack of finance..

- The next stage in the operations will be the preparation of the detail development plan with a full EIA in parallel which will clarify the impact of the development further. Recent pressure and publicity from independent concerned birdwatchers and the Moroccan NGO GOMAC has raised the awareness both within the Moroccan government and at Club Med, of the importance of this site for the Bald ibis and just how careful they need to be with the development of this project. BirdLife is working closely with the Moroccan ministries, and will continue to monitor the situation very closely.

2.Latest Genetic Evidence for Historical Population Structuring among Colonies of Northern Bald Ibis (*Geronticus eremita*) in Morocco

We have recently analysed 882bp of mtDNA control region sequence from 31 northern bald ibis individuals, 19 wild birds from recent mortalities (1996 onwards) in the Souss and 11 founders from Rabat Zoo (wild caught from the Middle Atlas Mountains in 1976-77). Our sequencing revealed 15 closely related haplotypes, 9 from Souss and 8 from Rabat with only two haplotypes shared at low frequency among these two populations. Preliminary analysis indicate that these two populations are significantly differentiated ($F_{st} = 0.1807$, $p < 0.0029$; exact tests $p < 0.0014$) on haplotype frequencies. That is, the Souss colony and the now extinct Middle Atlas colonies were demographically independent exchanging few individuals.

While this is very preliminary data the implications for conservation are beginning to emerge:

- The Middle Atlas colonies are thought to have either gone extinct *in situ* or emigrated *en masse* to the Souss colony. The genetic data is inconsistent with a mass influx of birds into the Souss colonies; if this were the case we would expect to find more haplotypes shared between the two colonies. We cannot however rule out the possibility that *some* individuals may have emigrated from the Middle Atlas colonies.
- The Souss and Middle Atlas colonies are genetically differentiated by shifts in haplotype frequency indicating that they are demographically independent and should therefore be considered as different populations. We therefore recognise that colonies in the Souss, Middle Atlas and Turkey (Pegoraro 2001, this newsletter) belong to genetically distinct populations.
- The bulk of the captive population of northern bald ibis around the world originates from collections made from the Middle Atlas colonies. Thus the genetic resources of this population are well represented in zoological collections but the corollary is that the last

remaining wild colony in the Souss is not well represented among zoological collections around the world.

- Reintroduction efforts in Morocco need to be mindful that they are engaged in the reintroduction of the extirpated Middle Atlas colonies that belong to a different genetic stock to those found in the Souss. Logically then, they should be released in the Middle Atlas Mountains and/or in locations even more distant from the Souss colonies so as to avoid possible introgression via migration.

8 October 2001 Damien Broderick* and Amal Korrida.

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3. Link web sites with more information

www.rspb.org.uk (put Bald Ibis in search on home page)

www.birdlife.org.uk

<http://evolution.humb.univie.ac.at/institutes/grunau.html>

www.univie.ac.at/zoology/nbs/gruenau/

We welcome feedback:

If you have found the content of this newsletter of interest, and would like any future copies or updates, then please contact the secretary, giving us your email address.

Likewise, if you have information that you think would be of interest to IAGNBI or others, we would be delighted to hear from you.