Northern Bald Ibis Conservation and Reintroduction Workshop

IAGNBI Meeting Innsbruck - 2003

IAGNBI

Eds. C.Boehm, C.Bowden & M.Jordan

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Proceedings of the International Advisory Group for the Northern Bald Ibis (IAGNBI) meeting Alpenzoo Innsbruck – Tirol, July 2003.

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Introduction

A total of 1186 bird species (12% of nearly 10.000 bird species of the world) have been identified as threatened (BirdLife International 2000) and 182 (15 %) of these have been categorised "critically endangered". The Northern Bald Ibis *Geronticus eremita,* (NBI) is one of them. During the middle ages the NBI occurred in Central Europe and formerly widespread in North and North-east Africa into the Middle East. Nowadays it is reduced to a small number of about eighty-five pairs in the Souss-Massa National Park and nearby Tamri in Morocco. This last wild population has remained fairly stable over the past ten years or so, mainly owing to improved wardening which involves careful management and monitoring. The population size has actually started to increase slightly over the last two years. The wild eastern population formerly occurring in Turkey however disappeared at the beginning of the 1990s and is reduced to a semi wild breeding colony of about 70 birds. However, the discovery of a small group of seven wild NBI in Syria in 2002 gives hope that there might be more colonies to discover and the eastern NBI might not be lost forever.

Whereas the status of many of the critically endangered bird species can only be improved by stopping the threats in the wild, the NBI also has a big captive population. The story of the NBI in captivity dates back over half a century. Although the first imports into the zoos (in the 1940s) died soon after arrival, the next imports in the late 1950s survived and became the founders of the present large and numerous zoo population. About 150 birds were brought into different zoos, mainly caught as nestling or newly fledged birds. Three different studbooks nowadays manage the captive population: one in North America with 140 birds; one in Japan with 104 birds; and the biggest one in Europe of 850 birds. In addition to these, there are about 500-800 unregistered birds although their exact number is not known. So ironically for the species, there are now more individuals in zoos than in the wild.

Given this background, releasing captive birds would seem to be a potential solution for the NBI problem. There are a number of impressive examples for other species where reintroduction has been a powerful tool in a species conservation plan. Unfortunately though, the biology and behaviour of 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 release, that learning is restricted to only a few early years of the birds' life, and possibly certain sensitive periods within this time.

Largely in response to the concerns that release might not be appropriate or could even present risks to the remaining wild birds, various meetings with the main topic as NBI conservation and reintroduction were held in the 1990s:

- a NBI conservation workshop in Wuppertal Zoo, Germany, 10-12th June 1991
- a conservation viability assessment workshop in Rabat Zoo, Morocco 27-30th April 1992
- a workshop on the strategy of the rehabilitation of the NBI in Agadir, Morocco 8-12th March 1999. (At the end of the meeting in Agadir the International Advisory Group for the Northern Bald Ibis (IAGNBI) was founded.)

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. However, it became clear that the methodology was not yet defined for how this could be achieved.

Since the beginning of the 1990s, more studies and experiments have been carried out on release methodology, and this presents new hope that suitable techniques may well be found. With the complex and strong family bonds between individual NBI in mind, a project based in Grünau, Upper Austria has led for the first time (after early drawbacks) to the establishment of a free flying, non migrant population which is successfully reproducing. Besides this, three further projects have already started or are in the state of planning:

- the waldrappteam.at, in Austria is trying to "teach" the NBI to migrate
- Zoobotanico Jerez, Spain plans to test different releasing methodologies and monitor any effects on native biodiversity
- Munich Zoo, Germany wants to release birds in Morocco from a breeding aviary

Given that several independent groups are working in different countries, using different methods, all addressing one major problem, we felt it was time to bring the various ideas and knowledge together, and increase the level of contact between the people and institutions involved. Hence the idea to have a further meeting. The Alpenzoo in Innsbruck, Austria coordinates the NBI European studbook (EEP), and offered to host the meeting, so we decided it would be appropriate to hold the workshop in the Austrian Alps where the NBI occurred over 500 years ago.

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 gaps and risks of each release project
- review the activities of IAGNBI and discuss its future structure and work
- develop NBI release guidelines and priorities

Twenty-five NBI experts, from a total of eight nations (Austria, Germany, Great Britain, Italy, Morocco, Spain, Switzerland and Turkey) participated in the workshop, and subsequent excursion to visit the Grünau and Scharnstein projects. The fairly small group size allowed fruitful discussions and contributed to the success of the meeting. Its results are represented in this workshop report and will hopefully help to improve our ability to save the NBI in the wild, which is of course still our main task.

Reference

BirdLife International (2000). *Threatened birds of the world.* Lynx Edicions, Bareclona & Cambridge UK.

Participants list and their contact e-mails from the IAGNBI meeting hosted by the Alpenzoo-Tirol held at Innsbruck from the 30/6 – 5/7/2003

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At the beginning of the meeting participants were invited to share their expectations of the forthcoming meeting and also their hopes for Northern Bald Ibis conservation over the next five years.

The expectations and hopes of the participants at the opening of the IAGNBI meeting at Innsbruck 30/6 – 5/7/2003

Name	Organisation/ role	Expectations of the meeting	Hopes for NBI over the next 5 years?
MARIA JIMENEZ-ARMESTO (Pepa)	**SEO** (International Officer)	Setting priorities for work on NBI	Increase of Souss-Massa population and find more in Morocco?
CESARE ZABORRA AVESANI	**PARCO NATURA VIVA**	Have tools for sensitisation and understand the roles of captive population in conservation	Increase sensitivity of public to NBI Establish a new NBI Italian population
CHRISTIANE BOEHM	**ALPENZOO** (EEP NBI + studbook coordinator)	Initiate Turkish Studbook and open discussion on hand-rearing techniques. Produce release guidelines	Sufficient funds to continue work. Sincere interest for NBI future & conservation
CHRIS BOWDEN	**RSPB/Birdlife**	To clarify the role of reintroduction for the conservation of the NBI	Wild population increases and more interest & participation from Syria, Morocco and Turkey
ANDREW CUNNINGHAM	**IOZ/RSPB** (Veterinarian)	International consensus in conservation actions needed for NBI	Improved status for wild NBI
PETER DOLLINGER	**WAZA** (Exec Director)	Criteria for releasing to the wild	Improve wild situation and collaboration between people working in this field
MOHAMMED EL BEKKAY	**SOUSS MASSA NP**	Participate in conservation of NBI	Rise of wild population of NBI
JOHANNES FRITZ	**Waldrappteam.at** (Team leader)	Closer contact with IAGNBI	Success in establishing the way for migratory birds
SAID HAJIB	**EAUX ET FORETS, & REP OF MEZGUITEM PROJECT** (Morocco)	Realistic strategy and means to do it, with instructive critiques of project	Wild population growth & more focus on strategy for those birds
MIKE JORDAN	**IUCN SSC RSG** (Regional chair) **CHESTER ZOO** (Curator)	Hospitality! Resolve some of the conflicts that exist currently in the reintroduction plans for NBI & formulate an effective protocol for release	To see an appropriate and full integration of *in situ* and *ex situ* work to conserve the NBI
MARGIT KIRNBAUER	**KLF**	More information of other projects	Increase number of free-flying NBI in Austria
KURT KOTRSCHAL	**KLF**	Exchange of ideas and information on wild birds	Push reintroduction projects in Europe

Name	Organisation/ role	Expectations of the meeting	Hopes for NBI over the next 5 years?
BERT LENTEN	**AEWA (LINKED UNEP)** (Exec. Secretary)	NBI One of potential species for action plan – information gathering	More help in future? Action Plan for NBI that will be a practical help
JOSE M. LOPEZ	**CON MEDIO AMBIENTE**	Improve Spanish project ideas	Improve wild population & establish new populations of NBI
NURRETTIN OZBAGDATLI	**DD/BIRDLIFE** (NBI Project Turkey)	Understand interrelation of Birecik birds with others	Increase Turkish involvement
KARIN PEGORARO	**BLU**	Establish the best strategies for work on the species	More wild birds and more exciting discoveries like Syria
FABIO PERCO	**PARC NATURA VIVA**	Update on wild populations	Create a new migrating population between Austria and Italy
REGINA PFISTERMÜLLER	**VIENNA ZOO** (Curator Ass.)	Better understanding of why to support reintroduction projects	Increase free-flying pops and of projects in wild
MIGUEL QUEVEDO	**ZOOBOTANICO JEREZ** (Vet & Proyecto eremita)	Share knowledge from past 4 years on vet issues, share ideas on proposed Spanish project	More knowledge from other zoos, and wild. Find reliable release technique for NBI
INIGO SANCHEZ	**ZOOBOTANICO JEREZ** (Director)	Improve knowledge of NBI relevant to proposed Spanish project	Improve public awareness of NBI
KEN SMITH	**RSPB/BIRDLIFE**	Sharing ideas, open discussion, chance to meet.	Secure & increasing pop, with secure funding. An integrated plan for species (Wild & captive)
ROGER WILKINSON	**CHESTER ZOO** (Head of Conservation)	Determine role of zoos, captive population in conservation of NBI. All accept criteria that result	Wild population recovers, and if releases are appropriate, they are successful.

Participants at the workshop, Innsbruck July 2003

Participants at the Alpenzoo Innsbruck – Tirol

IAGNBI its role and committee

IAGNBI 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. 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 Northern Bald Ibis 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

Chris Bowden

- Chair person / Secretary

Mike Jordan

- IUCN / Reintroduction

Christiane Boehm/ Cathy King
- Captive population

Miguel Quevedo/ Andrew Cunningham
- Veterinary

Karin Pegoraro / Kurt Kotrschal
- Research Biology

Mohammed El Bekkay / Said Hajib
- Moroccan population

Taner Hatipoglu / Nurettin Ozbagdatli
- Turkish population

Gianluca Serra
- Syrian population

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.

Contacting the committee: Correspondence should be directed via the Chairman,
Chris Bowden (chris.bowden@rspb.org.uk)

Statement of the conservation priorities for the Northern Bald Ibis as agreed at the committee meeting of the International Advisory Group for Northern Bald Ibis (IAGNBI) held at Innsbruck on 3rd 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 colony of Northern Bald Ibis 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 view of the fact that colonies in Syria have 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 an international 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 Clearly defining the former distribution of 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 site records in determining suitability of potential release sites.

6 The possibility of supplementing the wild population at Souss-Massa was 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 exists for attempting such an exercise.

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

between these, Turkish and Moroccan birds are necessary.

8 The importance of the semi-wild colony in Birecik is recognized. However there is an urgent need to improve standards of hygiene 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 this report.

9 Work at Grünau 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 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 extant wild colonies is paramount.

13 The recent appearance of skin problems in captive Northern Bald Ibis in 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.

Group workshop to discuss and develop guidelines for Northern Bald Ibis (*Geronticus eremita*) release

1. Release methodology

Social bonds within Northern Bald Ibis groups were agreed to be very important, the species has a highly complex social structure with many elements being passed on from generation to generation. Learning and tradition appears to play an important role in their behaviour and only young birds are adaptable to learning whilst older birds accommodate to change very poorly. The release of old birds seems to lead to very high mortality and/or dispersal and the complete loss of all birds. A release of young and guided birds seems to be the only promising method. Release as a group is considered very important.

When hand rearing is considered it is important to keep chicks as groups comprising asynchronous ages and groups of nestlings should mimic that of a "normal" nest (3-4). Hand-rearing appears to be a valuable tool for Northern Bald Ibis release, however it is very costly and highly skilled 'fosters' are required to effectively take on the role of parents to the ibis. Rearing in a group prevents sexual imprinting on humans. Hand reared birds have to be guided to feeding, roosting and breeding sites and should not be abandoned after release!

If hand-rearing with a sedentary species proves to be important, species considered most appropriate are likely to be: sedentary (in areas), similar in foraging strategy, colonial, gregarious and highly terrestrial (e. g. Cattle Egret). Releasing via an aviary (which provides safe roosting sites after release) is essential and confining for a period is considered important. Free flight colonies could be particular important sources for released birds.

Different release options were discussed and reviewed:

Release strategy	Previous experience	General consensus
Hard release[1] of adults	Tested & failed	Technique inappropriate due to high dispersal and mortality, birds lack any experience in site fidelity, feeding on natural food or orientation.
Hard release of juveniles following acclimatisation in cage	Tested & failed	Technique inappropriate due to high dispersal and mortality, birds lack any experience in site fidelity, feeding on natural food or orientation.
Soft release[2] of adults and juveniles together	Tested & failed	Birds apparently lack any experience in site fidelity, feeding on natural food or orientation!!
Cross fostering[3]	Untested	Not considered a priority due to potential behavioural problems normally associated with cross fostering
Colony splitting[4]	***Untested***	***Good potential – requires clarification of techniques and further testing***
Hand rearing isolated chicks	Untested	Technique generally considered inappropriate due to behavioural deprivation of chicks
Hand rearing chicks with no contact with humans	Untested	Technique generally considered inappropriate due to behavioural deprivation of chicks
Hand rearing chicks in groups with contact to human parents	***Tested***	***Very promising with good results already obtained.***
Hand rearing chicks in groups with contact to human parents and a second species.	***Untested***	***Possible potential – requires testing***

2. Managing dispersal / migration behaviour

The Northern Bald Ibis appears to be an optional migratory species. Some populations were migratory whilst others were sedentary. The sedentary nature of the current Souss-Massa population may be untypical of what most populations used to do.

[1] Released straight into the habitat with no enclosure.
[2] Constrained within an enclosure, for a period of some weeks which is then opened to allow bird to escape.
[3] Chicks reared by another surrogate species.
[4] An already released colony is split.

Knowledge on natural movements is very poor and therefore difficult to set targets for managing for dispersal/migration in released populations. More data on wild dispersal would assist this process. Dispersal in wild birds cannot be quantified at present and is in need of investigation.

Dispersal (long distance non-return movements)

Sedentary populations should be managed to limit dispersal, at least initially. Hand rearing birds with a human foster assists in limiting initial dispersal post-release.

Dispersal normally occurs around 1 month after fledging and again at the time of autumn migration. Birds could be contained for 2-3 months about 3 weeks after fledging, and then annually from mid-August – November for at least 3 years. Young hatched at the site may also have to be constrained for the autumn migration period for up of 3 years in order to become sedentary. Limited areas may exist at which it is appropriate to establish sedentary populations.

Dispersal distance may affect release site selection and it may be necessary to retrieve dispersing birds that are likely to contact existing populations therefore satellite tracking would allow this. There was discussion over whether inappropriately dispersing birds should be trapped/shot?? Public awareness and cooperation is also useful for monitoring unexpected movements of birds.

In the long term dispersal from established released populations may well be beneficial to the recovery of the species. Mechanisms for natural establishment of new colonies are not known but must be possible.

Migration (long distance two-way seasonal movements)

It was suggested that perhaps sedentary populations had been coastal whilst inland population were migratory. Some populations will almost certainly have to be migratory.

It is unlikely that birds will discover migration routes and stop over points by themselves and this information will have to be taught to young birds. Hand raised birds with human fosters have the potential to be taught this information. Site selection for over-wintering areas is very difficult, as data does not exist on previously used sites.

It was suggested that perhaps ‘other’ species could be used for teaching migration routes and stop-overs but this is untested and could pose a number of issues, it may be difficult in practice to find suitable species.

The Birecik population should naturally be migratory and a possibility still exists that older birds may still have a knowledge of traditional migration routes that they could teach to younger birds. Satellite tracking of older birds could help gain data on this, or knowledge of the migration routes of Syrian birds may shed light on natural wintering grounds.

3. Post-release monitoring

Possibly different regimes are required for releases of sedentary and migratory populations. It is important to ensure that prior to post-release monitoring that staff training and capacity building occurs in the countries involved in releases. Setting clear aims allow for much better measures of success following releases.

Why monitor?

To monitor success of release
To test methods
To understand problems

What to monitor?

Survival rate / causes of mortality
Habitat use / foraging behaviour
Dispersal
Breeding success / population growth
Health and condition of birds
Threats to ibis
Social behaviour and structure
Impact on sympatric species

Monitoring techniques

- Essential to individually mark birds: metal ring.
- Coloured ring: for visual individual identification from a distance.
- Microchips useful as a permanent identification means, but not an alternative to ringing.
- Radio tracking - terrestrial VHF: important for mortality, finding roosting places, time budget; acceptable frequencies are different in different countries therefore could be problems with migrating birds (international frequencies?).
- Radio tracking – satellite (PTT): long distance information important for establishing migratory population and for recovery of dispersed birds, although the costs involved are large
- Public awareness and reported sightings – good public relations exercise as well.
- DNA sample can allow future reproductive contribution to colony of individuals to be assessed.
- Post-mortems.

Daily monitoring should be carried out for a period possibly as long as 2 years post-release, then the possibility exists to downscale monitoring programme depending upon outcomes. Assessing such aspects as presence, mortality and morbidity, breeding success, impact on sympatric species.

4. Site selection criteria

- Consideration was given to the appropriateness of Reintroduction, Supplementation (reinforcement) and Introduction as strategies for conserving the Northern Bald Ibis. At

the current time there was not considered a role for Supplementation (either Syria or Morocco) or Introduction as a conservation strategy.

The historic range of the Northern Bald Ibis was interpreted in its widest sense to include the limits of former distribution rather than specific sites. This was in light of the large distances moved by birds and the poor quality of information on former sites.

Sedentary reintroduction sites need to comprise:

- Foraging areas: Open steppe or short grassland within 20 km of breeding and roosting sites. Sources of fresh water may well be important and an assessment of the prey base available is important to help determine if the site is large enough to support a viable population.
- Roosting/breeding sites: These are often the same and should afford protected ledges that are inaccessible to people and free from disturbance. Shade, shelter from the wind and the structure of the ledges are all very important.

Consideration should be given to:

- Ability to conduct effective and long-term post-release monitoring of any released population that is essential for reintroduction.
- Protected areas, their legal status and ownership are important for selecting release sites.
- Long term development plans around the release site should be known.
- Potential predators should be surveyed and limited predator control may have to be considered in early on in the release.
- Land use survey of surrounding areas is important particularly with a view to assessing likely risks to the ibis from neighbouring activities, activities such as pesticide use should be clearly addressed, and hunting strictly controlled.
- A risk assessment on the likely impact of released populations on existing biodiversity at the release site.
- Securing long-term management assurances for the breeding, roosting and feeding areas.
- Climatic extremes should be considered on a medium or long-term, these may represent occasional limiting factors to a sedentary population.
- The distance from existing Northern Bald Ibis populations is important, initially a precautionary approach should be adopted until further data may allow distances to be reduced.
- Local support and public awareness should be fostered in advance of any release activities.
- Improving nesting conditions and availability of suitable ledges if required.
- Adherence should be given to all IUCN guidelines for reintroduction.

For establishment of migratory populations then many questions still exist concerning wintering requirements, proximity of wintering localities, stop-overs for migratory populations and the actual methodology for establishing such a population. Until these aspects are resolved the establishment of sedentary populations should take priority.

The pros and cons of currently planned release areas were briefly assessed:

Pros	Cons
European Alps	
Management control easy with skilled staff available locally	Unsuitable winter conditions means that migratory populations are required.
Large fund raising potential	Long absence of the species since extirpation means there may be increased risks to existing biodiversity
Easily accessible resources	Costs are comparatively very high
Good public relations and awareness already exists	NGO support is variable
Large distance from existing extant populations	Human pressure is high with potential sites suffering from disturbance.
	Source of birds for release may be unclear between the western and eastern populations
The European Alps may have promising potential for reintroduction in the future but requires further research into the techniques required for the establishment of migratory populations, the feeding habitat quality of alpine meadows and the potential impact on native biodiversity. There may also be potential problems with traffic or airports (ibises, herons and gulls are known to cause major problems at airports due to their preference for open, short vegetation).	
Turkey	
NGO support in existence	Lack of protection of birds and sites
Good public awareness	Lack of resources and skilled staff
Recently extirpated in region	Uncontrolled development
The Birecik semi-wild colony provides a good model for testing release issues.	Lack of a sufficiently large semi-wild population to begin release yet
The semi-wild population may provide a comparatively low disease risk for release	Close proximity of the Syrian population
	Population would have to be migratory and information does not exist on previous wintering sites
Turkey may have promising potential for reintroduction in the future but prior to release the valuable semi-wild Turkish population needs to be secure in numbers and research into the techniques required for the establishment of migratory population is needed. Further clarification on any potential interaction with the Syrian population is also required. Protection of release sites and the species needs to be secure prior to release.	
Spain	
Good resources available locally	Close proximity of the Moroccan population
Good local support	Risk assessment on possible impact on other biodiversity not yet completed
Suitable sites for release	
Potential to establish sedentary	

populations	
Good public awareness	
Spain may have potential for the reintroduction of sedentary populations if trials to investigate release techniques are successful and the ecological impact of released populations is found to be minimal. Defining the former range is in need of clarification with respect to IUCN guidelines and whether such a release would constitute an introduction or a reintroduction is still controversial.	
Morocco	
Many sites with recently extirpated populations	Close proximity to still extant Moroccan population
Suitable sites for release	No national Species Action Plan exists to integrate 'in situ' and 'ex situ' conservation actions or to secure the local protection of Northern Bald Ibis populations.
Potential to establish sedentary populations	Limited resources
Could decrease fragmentation	Awareness localised to Souss Massa / Mezguitem
Opportunity exists for any partnership to assist local socio-economic development	Reasons for decline and extirpation at many old breeding sites still poorly known.
Reintroduction in Morocco is not appropriate until a national Species Action plan is produced which clearly indicates release as part of a coordinated and integrated conservation strategy for the species. Morocco may have good potential for reintroduction once methodology has been developed for establishing a migratory population or if sites are limited to where a sedentary population could be established. Current available methodology is therefore not advisable at sites where a population would need to migrate and poses a high risk of dispersal and mixing with the wild population which should be avoided .	

5. Demography and genetics

Priorities for genetics work:

- To clarify the relationship between the Turkish, Syrian and Moroccan populations.
- To assess the genetic variability of the captive population.

It was agreed to maintain the Western, Syrian and Turkish stocks separately until further knowledge on genetic differences between them exists.

European zoo stock (EEP) is important for releases in the west of the range and the Birecik population is important as a potential future source for releases in the east of the range. Sources for mid-European releases are less clear as to whether eastern or western stock birds would be more appropriate.

Currently tested and most promising release techniques involve the use of hand-reared socialised juveniles. Release groups should comprise:

- Young birds – similar aged juveniles.
- Establish an out-bred breeding colony (40-60 birds) and then take the nestlings for the release project (this has advantages for veterinary screening, CITES, logistical problems).
- Colony structure should be 2/3 adults 1/3 young, sex ratio 50:50.
- Sexing of the released stock must occur prior to release and can be carried out using DNA samples collected as part of the pre-release health screening process.
- Between 10-20 juveniles should be released a year, for up to 3-4 years. This gives a total release cohort of around 40-80 birds.

Consideration of the management used for the zoo population could be reviewed to see if any of the current colony management computer models are appropriate for Northern Bald Ibis studbook management on a colony basis. Until genetic variability of the captive population is assessed it is unclear as to whether there is a need for the introduction of new genetic stock from the wild to the captive programme.

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The Birecik Northern Bald Ibis population

A recent report (Tavares et al 2003) was submitted to the Turkish National Parks Department, making a number of recommendations following a meeting held at Birecik in October 2002. This report was distributed to the participants at the meeting, and endorsed by the meeting with the following comments and additions:

Points raised in discussion concerning the Birecik colony in Turkey

The wildlife department is known to be keen to cooperate and support actions for the colony management at Birecik. This positive attitude was acknowledged and agreed that more contact between IAGNBI and the wildlife department would be warmly encouraged.

The Ministry of the Environment and Forestry is working with Doga Dernegi to conserve the Northern Bald Ibis colony in Birecik via a protocol (signed in September 2003).

It is considered a high priority to build the Birecik population up to at least 150 birds, hopefully within a target time of 5 years.

The problems of making the cages easier for catching the birds were discussed, and it was agreed that subdividing the proposed new extension from the current back cage may be a good solution.

It would be a good idea to hold a meeting in Turkey with IAGNBI involvement to both increase Turkish interest and appreciation of the international context and importance of the Birecik birds and particularly for empowering local stakeholders to become more directly involved.

The establishment of a new (second) site was discussed in order to split the population and reduce the risks associated with maintaining one single colony. This should be aimed for in the medium term.

The following more specific points were made:

- It would be good to further extend the cage footprint (ground area) to provide larger foraging areas. This would increase the amount of natural foraging behaviour, and give space for the additional birds. The whole aviary floor need not be cemented, but a washable/cleanable feeding site should be provided. The bathing basin should be cleaned at least once a week. The rest of the floor could contain different gravel/sand/earth structures to enrich foraging behaviour.

- Assuming the aviary is enlarged as planned, then the danger of birds flying into the net should be addressed:
    - Detecting holes will become more difficult, but still very important.
    - The cost of regular netting replacement must be planned for, and this will be quite expensive.
    - A smaller wire size would help to reduce the possibility of other bird species (e.g.

sparrows) entering the cage.
  - Problems may occur with snowfall on a larger aviary and should be planned for.

- A clean room/kitchen should be provided for the wardens to prepare food and a dedicated freezer should be available just for storage of the Northern Bald Ibis food.

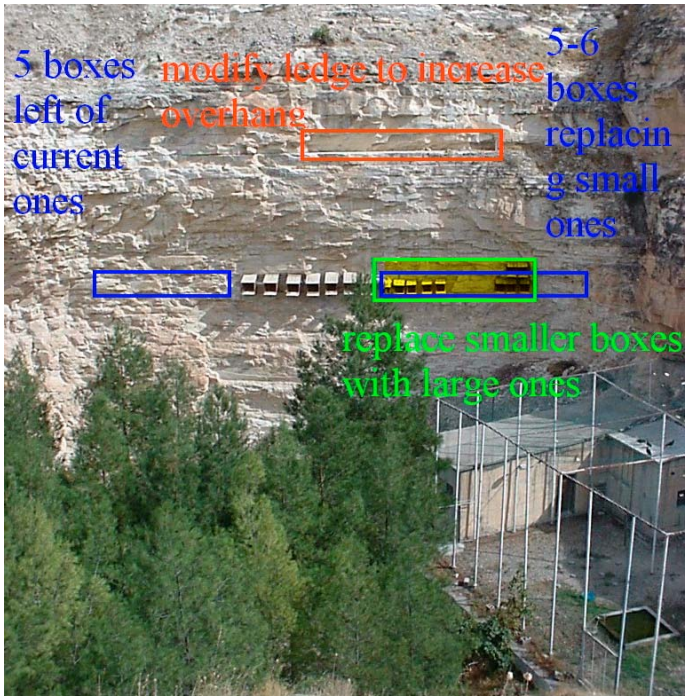
- Catching the birds earlier in the summer is preferable, as this will reduce losses through dispersal in the autumn, thereby building up total numbers more quickly.

- The system of two separate aviaries means that the possibility exists that social structure may be disrupted by shutting birds into different cages, breaking up existing social groups. Ensuring the birds are kept in the same cages each year is strongly recommended.

- Chicks should be ringed earlier, whilst still in the nest. This allows an accurate studbook to be maintained and may be a safer time for the birds.

- More focus on an improvement of the husbandry is recommended, especially on, what, and how to feed in the cages.

- A diagram showing where nest-boxes should be positioned that was left out of the original report to be included (see below)



Reference:

Tavares J, Bowden C, Cunningham A & Taylor B (2003) Conclusions and recommendations of a technical visit to Birecik Kelaynak Breeding Station, 22-23 October 2002. RSPB unpublished report, RSPB, Sandy, UK.

The discovery of a remnant wild population of Northern Bald Ibis in Syria and the efforts and plans so far to conserve them

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There were no published records of northern bald ibis from Syria since 1928, so when a wildlife survey of the Syrian steppe under an Italian-funded, Food and Agriculture Organization (FAO) implemented project (UN-FAO GCP/SYR/009/ITA) discovered a small colony in May 2002, this was greeted with great interest by the bird and conservation communities (e.g. Serra 2003). As well as the obvious importance of such a colony, it is hoped that this may allow us to discover where the birds travel for the non-breeding period, a question which it was feared we might never be able to answer.

Following up reports by local hunters (Adeeb Assaed in particular), in a systematic way, with questionnaires and field visits, seven adult ibis were found in the Palmyra region and better still, these birds had three nests, and successfully fledged three young. The birds then left the area in early July, but six adults returned to breed in the spring of 2003. Furthermore, the results from the questionnaires indicate that far from going extinct after the last published record in 1928, there were very probably multiple colonies until just twenty years ago or less.

Details of the lead up and more background to the discovery are given elsewhere (Serra 2003, Serra et al in press), but the Syrian Steppe project (UN-FAO GCP/SYR/009/ITA) has been following up on the discovery, training wardens, gathering more information on the birds, their feeding areas and the likely threats to the area. BirdLife International has been giving support through RSPB, mainly with technical expertise gained through long involvement with the birds in Morocco. The discovery has now received considerable publicity internationally, but more importantly national media and television coverage has been considerable within Syria. Significantly, the president has expressed some interest in the discovery.

Further searches this spring failed to locate any more birds, so it begins to seem that this colony may really be the very last of the truly wild eastern population, which further increases the importance of protecting them, and learning more about their ecology.

The big question of where they winter?

To try to answer the question of where the birds go, permission was granted in June 2003 to attempt to catch and attach satellite transmitters to two of the birds. A determined effort was made to do this, but the need to leave the breeding site undisturbed meant that options for catching the birds were limited, and the combination of clap-nets and noose-traps were not successful in the very short time available. There was no shortage of suggestions and willing help with how to do it from local hunters, and their participation will ultimately be crucial to the success of any conservation efforts.

The threats and involving local people

The area concerned is sporadically used by Bedouin who have been integrated into the work, five families agreeing to pitch their tents strategically to deter any hunters that might threaten or disturb the birds. Other concerns are increased grazing levels, the cultivation of steppe, and the collection of truffles near to the colony, all of which need to be addressed in future conservation measures as well as awareness raising and compatible rural development initiatives. None of these issues is likely to be simple, especially due to the nomadic lifestyles of the Bedouin, who are most directly concerned. Developing ecotourism locally is likely to be one additional positive measure that will combine awareness raising with local income generation. Two of the staff that have been working with the Talila reserve last year are particularly suited to developing this role. Proposals are currently being developed along these general lines through the BirdLife Middle East office, to follow-up on and expand the work of FAO and the Syrian Government, together with newly formed Syrian NGOs such as SSWG that we hope will develop into a strong conservation body and BirdLife International Partner in future.

Two local Bedouin who are directly involved in protecting the nesting cliff from hunters and disturbance

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Serra G., Abdallah M., Abdallah A., Al Qaim G., Fayed T., Assaed A. and D. Williamson. (*Accepted)*. Discovery of a relict breeding colony of Northern Bald Ibis *Geronticus eremita* in Syria: still in time to save the eastern population? *Oryx*.

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Trapping was attempted at a small reservoir well away from the colony, frequented by the ibis

Northern Bald Ibis conservation project In Souss Massa region

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The Northern Bald Ibis conservation project in the Souss Massa National Park has been running since 1993. Under the auspices of BirdLife International the project is a partnership between The Royal Society for the Protection of Birds (RSPB), the Sociedad Espanola de Ornitologia (SEO) and the Moroccan Department of Eaux et Foret. The authorities of the Souss-Massa National Park (PNSM), with the collaboration of RSPB and SEO, are the responsible for the field activities.

Since 1993, the project has been through several phases:

- 1993 – 1996: a convention was signed between the Eaux et Foret Administration and the Programs Committee for Nature Conservation (CPCN) a Moroccan NGO. A research and monitoring programme for the northern bald ibis was established.

- 1997 – 2000: a convention was signed between the Eaux and Forest Administration and Bird Life International (BLI). Following the first phase of the research and monitoring project an international workshop was convened to review the results and produce a plan of action for the species in the Souss-Massa region.

- From 2000 until now, research and monitoring of the population has continued and many of the other actions in the plan of operation have been completed although many have been delayed because of limited finance.

The plan of action identified a number of broad themes as part of the overall project to rehabilitate the bald ibis population in Souss Massa region:

- To work with the local human population to develop their interest in the northern bald ibis and the find ways for them to benefit from bald ibis conservation.
- To integrate the northern bald ibis in ecotourism activities in the Agadir region in a way which is safe and sustainable for the birds.
- To ensure current and potential breeding sites are retained in suitable condition for the birds.
- To ensure feeding areas are protected and maintained in suitable condition by appropriate management by the local population.

- To ensure key roosting sites are protected and maintained in suitable condition.
- To continue to implement measures to maximise the breeding success.
- To decrease the probability of accidental mortality events.

Bald Ibis population

a) Sedentary population:

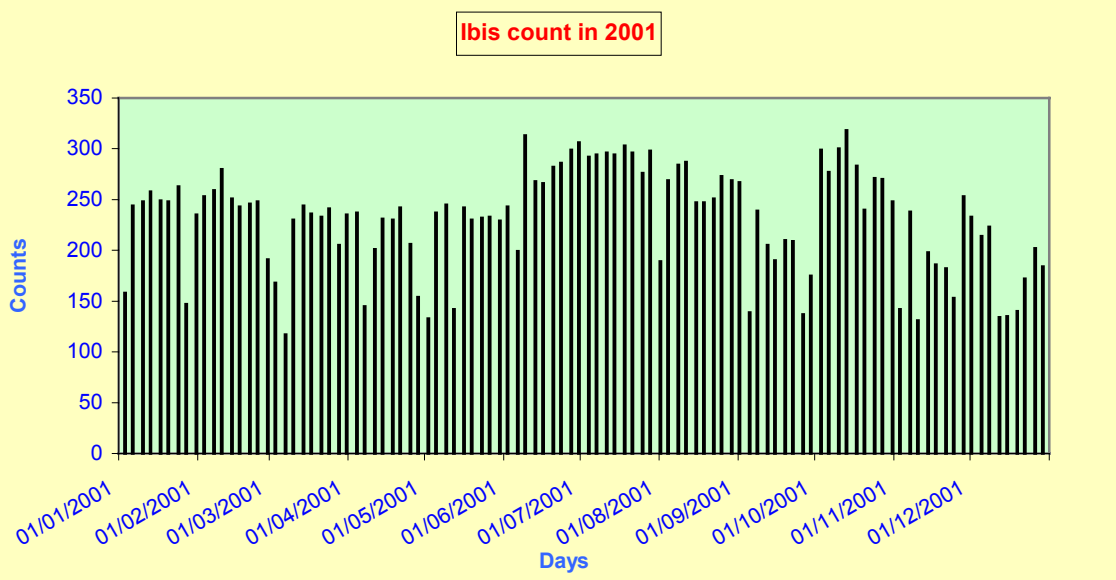

Figure 1. Coordinated roost counts of northern bald ibis in the Agadir region for 2001 showing that birds are present throughout the year.

Northern bald ibis breed in two areas on the coast in the Agadir region. At Tamri to the north of the city there is a single large colony and, to the south, in the Souss-Massa National Park where there are a group of sub colonies.

Unlike many of the former populations of northern bald ibis, those in the Agadir region appear to be more or less sedentary throughout the year. Coordinated counts of the birds at all roosting sites are made twice weekly by the wardens (every Wednesday and Saturday). These show that the overall numbers are more or less stable through the year (Figure 1).

b) Population trends:

The number of the breeding pairs has shown an interesting pattern. Up until 1996 there was an increase but the mortality incident in that year caused the numbers to fall dramatically in 1997 from a total of 77 to 59 pairs. Subsequently there has been a slow increase back to a total 73 pairs in 2002.

Year	Number of nesting pairs		
	PNSM	Tamri	Total
1994	46	19	65
1995	50	24	74
1996	54	23	77
1997	32	27	59
1998	33	29	62
1999	32	28	60
2000	35	30	65
2001	38	28	66
2002	42	31	73

Table 1. The number of nesting pairs in the PNSM and Tamri from 1994-2002.

Year	Productivity	
	PNSM	Tamri
1994	0,92	1,21
1995	1,20	0,54
1996	0,91	0,39
1997	0,69	1,04
1998	1,61	0,86
1999	2,03	0,64
2000	1,77	1,47
2001	0,61	0,65
2002	1,07	0,55

Table 2. Annual productivity (young per nesting pair) for PNSM and Tamri

The data on breeding numbers and nesting success have been analysed and summarized in Bowden et al (2003). In the early years of the project, there were a significant number of nest losses to predation by ravens but limited control and scaring has alleviated this problem. For the

Tamri colony there have been unexplained losses of chicks that apparently occur overnight. As yet the culprit has not been identified but we have deployed an infrared video camera to record events overnight. In due course we will discover the identity of the predator and consider what action is necessary.

c) The impact of the provision of supplementary fresh water on the breeding success of northern bald ibis

The main breeding colonies of northern bald ibis in the PNSM are at least 15 km from any sources of open fresh water and it is not clear how the birds meet their water needs during the breeding season. The observation that they sometimes congregate around wells and livestock watering areas in villages in the park suggests that they may experience water shortages at times. It has long been suggested (H P Muller pers. comm.) that the provision of supplementary fresh water near the breeding colonies could be beneficial. After the mortality incident in 1996, when birds were seen near a polluted water source, it was decided to test experimental water points where clean water could be provided. Initial results showed that not only did the birds readily make use of the water but also there were strong suggestions that those birds with access to water had a higher breeding success than those that did not.

Between 1998 and 2002 we therefore conducted a series of experimental trials with water provided each year at roughly half the sub colonies and not at the others.

Water was provided on an extremely small scale. Within 200m of the focal sub colony a small (0.5 –1.0m diameter) shallow cement bowl was constructed in *situ*. Each 'water point' was normally located someway down the steep sandy slope adjacent to the breeding cliff so that it was inaccessible to domestic stock (mainly goats and sheep but occasionally camels) which would have quickly consumed any available fresh water in more accessible sites. To reduce any possibilities of contamination and disease transmission, the 'water points' were filled with fresh water at the beginning and emptied at the end of each day. Maintenance of the water points was part of the daily routine of the trained colony guardians. The breeding performance of the ibis was monitored by the wardens using standard procedures.

The provision of water points in each colony and year is summarised in Table 3. The birds generally found and used the water points within days of their establishment and were frequently seen bathing and drinking at them.

Although productivity is highly variable from one year to the next, there was a statistically significant effect of water point on productivity. Birds with access to the water points raised on average 1.65 young compared with 1.21 young for those with no access ($F_{114,1}$=4.53, p=0.036). Examination of the data in more detail showed that there were no significant differences between clutch size or the number of young fledged from successful nests. The main effect of the water points appeared to be a reduction in the number of nest failures. Three out of 59 nests with access to waterpoints failed compared with 29/79 of nests with no water points.

There is clearly considerable annual variation in the productivity of northern bald ibis but our experimental approach has demonstrated a positive impact of the provision of water points over

and above this variation. The degree of improvement depends on the year ranging from 0% in 2002 to 166% in 2001.

We have not been able to collect any data on the potential mechanisms involved in the productivity improvement. There are a number of possibilities:

1) The supplemental water allows the adults to forage over a wider area unconstrained by the need to access fresh water during the day and perhaps allows them to exploit areas of high prey availability which would otherwise be unprofitable because of travel times.
2) The water points remove the need for the adults to spend time obtaining water. Qued Massa, the nearest major source of fresh water, is some 17 km from the breeding colonies so a single round trip would take the birds an hour or so.
3) This allows the adults to be more attentive at the nest and so reduces the effects of depredation and intraspecific disputes.
4) The ready supply of water allows the birds to exploit a wider prey base, as they are less concerned about the water content of their prey. This may be a particularly important consideration with respect to food for the young.

The only safe undisturbed nesting sites for northern bald ibis in the PNSM are now a long way from reliable sources of fresh water. Water points have therefore been installed and operated at the main sub-colonies. The provision of safe nesting cliffs nearer to reliable freshwater supplies would be an alternative approach that would be a more sustainable long-term option. Unfortunately there are no obvious sites where this could be implemented.
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Year	With access to water point	Without access to water point
1998	B (8)	E (13), F (2)
1999	B (8), E (10)	F (2)
2000	E (13)	B (9), F (3)
2001	E (14)	B (7), F (6)
2002	B (6)	E (15), F (0)

Table 3. The colonies (and numbers of nests in parenthesis) with and without water points from 1998 to 2002

d) Problems and threats:

There are two major development threats for the northern bald ibis within the Souss-Massa National Park. 'grottes' and tourist development.

- Grottes are small caves or block dwellings built in and against the coastal cliff face in the PNSM. It is illegal to build such structures within the PNSM but the authorities find it extremely difficult to control. The problem for the ibis is the cliff sites suitable for roosting or breeding are now under threat from these developments. The problem is extremely serious. Because of the proximity to Agadir there are many people who wish to spend their holiday near this big town. Year after year, the number of the grottes has

increased despite the inspection efforts.

- Tourism development: the French tourism company 'Club Mediterranean' is interested in building a resort near Tifnit (a very important site as feeding area for Bald Ibis, inside the National Park). The first attempt of tourism development was a 10 000 beds complex covering 200 ha. BirdLife International was very concerned about this, as were other independent organisations and individuals who also voiced their concerns. BirdLife established a dialogue with the Moroccan administration involved, including Ministry of Tourism, and Club Med. BirdLife maintained a strong position, making full use of the invaluable data collected on feeding areas over the course of the research and monitoring project carried out by the Park with BirdLife technical assistance. The negotiation is still ongoing, and some agreements have been reached, such as the SONABA land (not actually under the responsibility of the Park at present, and designated for development, but actually a more important ibis feeding area), given entirely back to the Park, the area to be covered by the hotel complex reduced to 30 ha, and responding to a standard EIA to be done before starting the work. An agreement is expected to be finalised shortly.

e) Summary

Despite the setback of the mortality incident in 1996, the northern bald ibis population in the Agadir region is increasing. An excellent programme of research and monitoring, run by the Park authorities, is in place and yielding good results which are being implemented on the ground. The interest in the bird has been raised and the support of BirdLife International has been crucial in negotiating over development proposals. The basic understanding of the ecology of the bird is good but because of lack of finance only limited progress has been made with projects with the local community. It remains a high priority to raise the resources to take forward these projects with the local people.

Reference

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Kelaynak or Northern Bald Ibis at Birecik

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Birecik is the only place where a semi-wild Bald Ibis (*Geronticus eremita*) population exists since the wild Turkish Bald Ibis (*Geronticus eremita*) population declined to extinction in 1989 (summarised comprehensively by Akçakaya 1990). The Game and Wildlife Department, General Directorate of Nature Conservation and National Parks (MP) in the Ministry of Forestry and Environment has been managing this population. There are 67 individuals in Birecik at the 31st of July 2003.

The captive breeding station (37 409672 E 4100654 N) was established in 1977 by MP when 34 birds returned from wintering grounds. The number of birds returning from wintering grounds declined and in 1990 only one bird returned. Since 1990 no wild birds have returned to Birecik.

A project, lead by DD, together with RSPB and MP was started last year, when it became obvious that there had been a serious and on-going decline in the semi-wild/captive population in the end of the 90s' and something had to be done to change the prevailing situation. By the end of the year 2000 only 42 bald ibis remained in the cages in Birecik, and breeding success in the previous three years had been almost zero. Between 2000 and 2003, a total of 50 juveniles were recruited to the colony.

The project aims to stop and reverse the decline of the bald ibis population in Turkey. Our project objective is to deliver an increase in the Turkish semi-wild Bald Ibis population, and a target has been established that we would like to have over 150 birds by the end of 2004.

Furthermore, this project will also establish the baseline on which to attempt a restoration of a truly wild population in Birecik – maybe we could have a small group of birds (n=50) not captive during the winter and dispersing/migrating by 2008? Bald ibis are long-lived birds, and some of the birds in Birecik have still migrated in the past. It is still conceivable that they may do so in the future (eventually with captive-bred young). But before attempting any such exercise one would have to secure a well managed, enlarged semi-wild population in Birecik.

Our current project is the result of a recognition of the importance of the remaining ibis at Birecik, and a need to better understand and monitor their behaviour and requirements so that future management practices can take these into account, and allow the population to increase.

The main objectives of the current studies can be summarised as below:
1. To decide on the best husbandry protocol for the bald ibis breeding station in Birecik (this includes an evaluation of the cages, food provisioning and semi-captive system).
2. To decide on the visitor protocol system at the bald ibis breeding station in Birecik (this includes the designing of an interpretation centre in the new building, plus the general visitor protocol strategy).
3. To prepare a road map to develop a truly wild Bald Ibis population in Turkey. We will have to discuss seriously at some point how we would eventually attempt to do that (a formal action plan/outline recovery plan for the Bald Ibis in Turkey). This action plan could follow the format of other European species action plans and we could eventually aim for endorsement through the Bern Convention.

The international importance of the Birecik colony can be summarised as below:

- Genetically different from Moroccan birds
- They have never been in contact with any zoo birds.
- Birds fly freely during 5 months and are captive after breeding period
- They are breeding outside the cages
- They feed along The Euphrates river, but have supplementary food provided

International co-ordination and co-operation of Northern Bald Ibis workers is vital not only for Birecik colony but also for the international concept to conserve the wild colonies in the world.

National and International interest on Bald Ibis in Turkey

The Northern Bald Ibis EEP – an overview

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1. The Northern Bald Ibis and its family

The Northern Bald Ibis (NBI) belongs together with the Spoonbills to the family **Threskiornithidae**. Six of the 26 Ibis species are found in the list of threatened birds of the World, four are critically endangered: Giant Ibis *Pseudibis gigantea* (world population < 50); Dwarf Olive Ibis *Bostrychia olivacea* (< 50 birds); NBI *Geronticus eremita* (<250); White-shouldered Ibis *Pseudibis davisoni (*<250,) the Nippon Ibis *Nipponia nippon* is endangered (66) and the Southern Bald Ibis *Geronticus calvus* is vulnerable with a population size of 8-10000. (Birdlife International, 2000):

2. Relationship with Man

All Ibises have been hunted for food, sport or even for their decorative feathers. That endangers especially small local populations. Ten ibis species are included in the European Ciconiiformes Collection plan (Sacred Ibis *Threskiornis aethiopicus*, Oriental White Ibis *Threskiornis molucca*, Straw-necked Ibis *Threskiornis spinicollis*, Northern Bald Ibis, Southern Bald Ibis, Hadada Ibis *Bostrychia hagedash*, Black-faced Ibis *Theristicus melanopsis*, Scarlet Ibis *Eudocimus ruber*, Glossy Ibis *Plegadis falcinellus* and Puna Ibis *Plegadis ridgwayi*). A European Endangered Species Program (EEP) exists for the NBI and one is planed for the Scarlet Ibis, for the Southern Bald Ibis an African Preservation Programme (APP) exists.

3. History of NBI studbooks

The NBI EEP was founded in 1988 and 40 institutions joined the EEP right from the beginning, at present (July 2003) the EEP has 49 members. Over the last 14 years the NBI captive population has more than doubled and the international zoo community now shares an impressive captive population. In 1990 an American NBI studbook was initialised and has now 19 members who keep a population of 140 birds, in 1996 a Japanese studbook was founded.

4. The NBI EEP

4.1. Population size and sex ratio

The EEP population started with 333 birds and has now reached the size of 845 living birds. Together with the North American and the Japanese studbook populations about 1100 living birds are now recorded within studbooks. In addition, there are NBI kept in small non-EAZA institutions as well, so that the whole captive world population can be estimated up to 1600 birds living.

The high breeding success and the low death rate are responsible for the pronounced growth of the EEP population during the last 14 years (Fig.1). About 80 to 100 juveniles hatch every year whereas yearly only 20-30 birds die. Overall the birth rate is 2-4 times higher than the death rate. Only half of the offspring remains within the EEP population and (on the average) 40-50 juveniles leave the EEP every year, i.e. they are transferred to non-EAZA institutions.

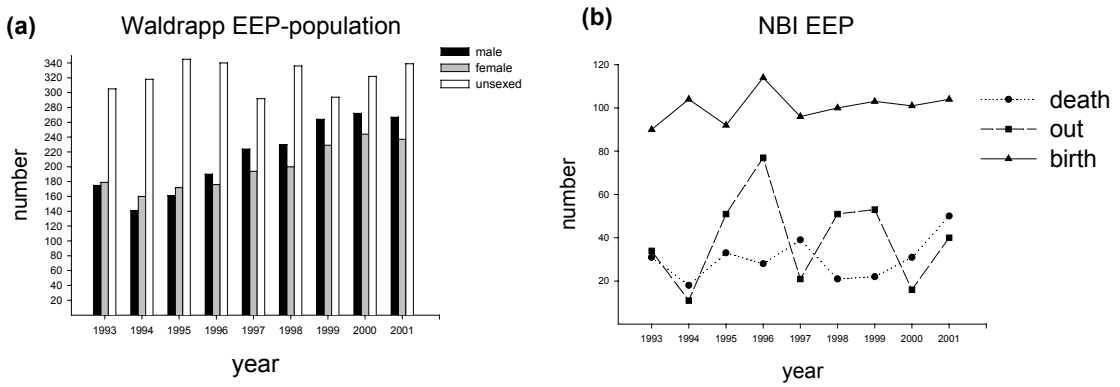

Fig.1: Development of the EEP NBI population between 1993-2001: (a) stock size and (b) numbers of births, deaths and birds that left the EEP.

The sex ratio (number of males/females) is stable (1.0-1.2) throughout the years, with a slight shift towards the males during the last six years. Although an increasing number of EEP participants aims to sex their birds either by behavioural observation or (rarely) by blood sampling, still one third of the NBI EEP population remains unsexed.

4.2. Age distribution

The NBI is a long living bird species. Eighty percent of the EEP birds are younger than 15 years, 54% of the whole population is at the age when reproduction is most likely. Ten percent of the oldest males died at the age of 24-37, the 15 oldest males (out of 250) living are now 26-39 years old. The oldest females died when 21-30 years old and the oldest living females are 25-30 years old, that means on the average females die earlier. Both males and females breed and raise the chicks however probably egg production and reproduction is more exhausting for females.

4.3. Origin and import

All NBI in European Zoos stem from colonies from Morocco. The last import of wild caught birds occurred in the late 1970s. Only nine of these 18 imported birds are still alive and are kept now in seven different institutions. Unfortunately only three of them are individually marked and have reproduced.

According to transfer histories, three main, rather separated bloodlines within the EEP population seem to exist:

(1) **Basle stock**: offspring deriving from this colony have been spread all over the world since 1960.

(2) **Rheine stock:** these birds originate from the last wild import to Rheine (1976-1978)

(3) **Zoo Rabat stock:** this third group includes offspring of wild born birds brought to the Rabat Zoo in the late 1970s.

However, nowadays most other Zoos have at least two of these bloodlines in their colonies.

4.4. Reproduction

The NBI is fully mature when four years old, however with an experienced partner both females and males can reproduce at the age of two. The main reproductive age is between 5-20 years.

It is important to note, that even old birds (with an age of 15-20 years) with no former breeding experience may start to produce first clutches when husbandry is improved or more attractive partners are available.

The breeding season in the captive NBI population starts in April and ends in July, the majority of nestlings hatch during May. Nestling mortality shows no pronounced variation between the months. The quality of husbandry (e.g. frequency of feeding, colony size, behavioural enrichment, winter enclosure) has an important influence on the breeding success.

4.5. Reproductive success

The breeding success differs between the captive colonies, but 50-60% of all colonies reproduce fairly well, with at least one chick every second year. A closer look at the life histories of individually marked birds in well-observed colonies makes evident that also the breeding success between colony members differs severely. The individual life history of each bird (especially if and at which age birds where transferred to which zoos) seems to be highly responsible for differences in the breeding success. Thus, the monitoring of individual life histories will be very important for further husbandry. Important questions, for instance, would be:

(a) At which age and time should birds be transferred
(b) How can birds successfully be integrated ("new blood") into existing colonies, or
(c) What mixture of birds (e.g. experienced breeder vs. young birds with high reproductive potential) has to be used to establish new colonies?

4.6. Inbreeding

The NBI even between separate colonies in the EEP population seem already to be highly related and inbreeding is of course a common phenomenon within single colonies. From the viewpoint of genetic diversity it is disturbing, that a future increase in the relatedness of birds within the EEP is to be expected. However, so far, we seem not to experience any sort of genetically depravation.

5. Conclusions

- The captive NBI population is stable and slowly increasing due to a high birth rate and a low death rate.
- Behavioural enrichment is still not popular for the NBI. As the NBI seems to be able to learn only in his early years, yearlings should get to know as many structures as possible. Thereafter the birds will use these structures for their entire life.
- More and more sophisticated husbandry will be necessary to create not just a numerous but genetically and socially healthy captive population.
- A genetic screening of the EEP population seems to be urgent.

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Release trials of Northern Bald Ibis (*Geronticus eremita*): An overview

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Up to the beginning of the 17th century the Northern Bald Ibis (*Geronticus eremita*) bred in some regions of Central Europe, including Switzerland, Germany and Austria. In the recent past the species has been living in the Middle East and in North Africa, but populations declined rapidly over all those areas. Since the birds breed very well in captivity, reintroduction programs were already considered decades ago.

Turkey

Where? Until the 1950s about 1000 birds nested at the old citadel and in the centre of Bireçik in south-eastern Turkey. A continued loss followed, with a maximum of about 600 birds in 1959/1960 (due to poisoning). By 1973 the colony had shrunk to 26 pairs.
When? Since 1976
Who? WWF, General Directorate of National Parks and Game-Wildlife (Ministry of Forestry), DHKD (Dogal Hayaty Koruma Dernegi); now DD, RSPB, BirdLife
How? A part of the population was caught and transferred to a breeding station 3 km north of the town. The remaining wild birds were attracted by their conspecifics in the aviaries at the station. In the following period immature birds bred in these aviaries were released. All in all, more than 40 individuals were caught between 1977 and 1989, most of them during the first years, but there were further interventions later on. In 1989 the General Directorate of National Parks and Game-Wildlife decided to terminate captive breeding, and since then the birds have been kept semi-wild: they are released in January/February, and most of them recaught in July/August. Breeding occurs, but many of the young disappear. The last years' breeding success was low and declined to zero in 2000. As at the end of 2000 only 42 birds remained in the aviaries at Bireçik, 2001 the new management plan was prepared.
Type of release. Translocation, re-inforcement/supplementation. The birds should be lured from the town centre, where the breeding conditions got very bad due to settlement expansion. The birds should be forced to breed at a lower age in the aviary, as was reported by zoological gardens. Individuals raised in the enclosure should be released to reinforce the stock.
Success: -ve. Since 1984 the last few birds have been living in the area of the breeding station. Nonetheless the wild colony kept shrinking, until the end came in 1990, when the last migrant bird arrived at the station. All in all, 97 individuals were released, but only 12 migrated to the wintering areas with the colony, while most birds died. Reasons for the failure of the project were, among others, malnutrition, overcrowding in the enclosures, bad breeding conditions on the artificial ledge, lacking knowledge of the birds´ behaviour, lacking data on migration.

Israel

Where? Tel Aviv University Research Zoo
When? 1983 – 1987
Who? Tel Aviv University Research Zoo

How? Four different release trials were conducted. (1) In May 1983 an enclosure, with 34 individuals of two years or older and eight breeding pairs with nestlings, were chosen for the trial, because it was assumed that the parents would be strongly attracted by their chicks. In the air the released birds proved completely disorientated, none of them returned to their nests. Only a few birds returned to the zoo by themselves after some days or were picked up near the release area and had lost a lot of weight. (2) In the same year a second trial was made with four newly fledged juveniles, of which only one returned to join the three birds of the first release. (3) 16 young birds were released in autumn of the same year – this time with the primaries of one wing clipped. They accustomed to live on the ground and survived until they moulted in summer of 1984. Two of them joined the remaining birds of the previous trials; only few were picked up weakened in the surroundings; the others disappeared. (4) In 1985 six nestlings were hand-reared and released after fledging. All of them joined the flock of the free-flying Waldrapp Ibises and survived. In October 1986 and March 1987 all but one bird disappeared, separated in two groups.
Type of release. Experimental releases. The aim was to establish a procedure for re-introduction.
Success –ve. Of the four release methods only the one using hand-reared fledglings showed at least a limited success. All but one of the 13 birds free-living at the Zoo disappeared after less than four years at the latest.

Austria I

Where? Thaur near Innsbruck, Tyrol
When? 1991
Who? Alpenzoo Innsbruck/Tyrol
How? A group of chicks was hand-reared by two human foster parents to produce parent imprinting. To simulate a reasonably natural family structure six eggs of the Alpenzoo colony were artificially incubated. The nestlings were brought to the releasing station, a specially adapted farmhouse near Innsbruck. There were a lot of controversial discussions about this project, especially when it was presented at the 23rd International Ethological Conference at Torremolinos, Spain, in 1993. It was so spectacular at that time that it was worth a report in the scientific journal "Nature". At that time hand-rearing had a rather bad reputation. For several reasons it had been severely criticised earlier. A problem of hand-raised birds was that they often showed deviant and deprived behaviour, because the chicks were mostly reared under unnatural conditions (isolated without contact to congeners, sometimes together with young of other species and often without any social contact with their foster parents).
Type of release. Pilot project to develop a new releasing method. The aim of this experiment was not to establish a Waldrapp Ibis colony in the alpine region. We wanted to test a releasing method on the basis of the typical behaviour of this highly social species resulting in minimal loss of individuals. This method should be employed in a following project in Southern Spain.
Success +ve. As we were short of money, time and staff the experiment had to be conceived as a short-term study. Finally we finished the project at the end of November. During violent snowfalls and closed snow cover we lost three of our birds.

Free-flying juveniles near their releasing site, Thaur near Innsbruck.

(Spain I)

Where? Natural Park Cabo de Gata-Nijar near Almeria, Southern Spain
When? The proposal existed from 1991 – 1994
Who? WWF Spain, European Natural Heritage Fund, Alpenzoo Innsbruck/Tyrol, University Innsbruck, Zoo Jerez
How? The Spanish proposal was the adaptation of a small Northern Bald Ibis colony at a similar habitat to Morocco. Extensive studies showed that climate, rainfall and other physical parameters were almost the same. The prey were the same species as, or related to, those found in North Africa. The surrounding areas were subdesertic clay and sand plains, including different protected areas like Sierra Nevada and Sierra de Alhamilla Natural Park, where the birds should have developed a viable population without human threat. To become familiar with the hand-rearing methods the initiator of the project stayed at the releasing station in Austria to follow the experiment.
Type of release. After intensive discussions with members of various organisations the Spanish proposal was treated as a translocation. The aim was to introduce the Northern Bald Ibis in a habitat similar to those in Morocco and to establish a viable colony in a protected area in Spain.
Success –ve. The project was rejected by ICONA (Instituto Nacional para la Conservación de la Naturaleza). This national organization for the conservation of nature did not want the release of a bird species that had not occurred in the region in historical times.

(Italy)

Where? Friuli-Venezia Giulia, north-eastern Italy
When? 1991/1992
Who? WWF Italy, Parco Natura Viva di Bussolengo (a zoo near Verona)
How? The initiator of the Italian proposal followed the experiment at the releasing station in Austria for some days to become familiar with the hand-rearing method. But as it was basically a 'one-woman-show' and hand-rearing is a method that requires more staff, she decided to release a group of immature zoo bred birds from an enclosure at the release site. An aviary was built up at the riverside of the Tagliamento, a river in Fiuli-Venezia Giulia.
Type of release. Re-introduction. The proposal was considered a re-introduction by the initiators, because the Northern Bald Ibis probably occurred in this region in historical time. The aim was to establish a self-sustaining population of Waldrapp Ibis in Northern Italy.
Success –ve. The birds were never released, because of changing authorities and/or loss of birds.

Austria II and III

Where? Konrad-Lorenz-Research Station in Grünau (KLF) and airstrip Scharnstein, Upper Austria
When? Since 1997
Who? Konrad-Lorenz-Research Station in Grünau (KLF), Upper Austria; waldrappteam.at
How? Since 1997 hand rearing has been taking place almost every year: The project started with a group of 12 nestlings from the zoos of Innsbruck and Vienna, followed by 17 in 1998. Hand raising took place at the adapted attic of a building at the Konrad-Lorenz-Research Station. In 2000 for the 22 birds a taller aviary was built in the nearby Cumberland-Game Park. The young birds show a strong tendency towards long-distance excursions beginning in late summer. But these flights head towards Northwest to Northeast – this behaviour points to learning of migration routes in a social context.
Therefore, 2002 a second project began: Human foster parents try to teach the birds migration routes by using ultra light planes. The first flight towards the Italian Tuscany will start in August 2003. For this purpose hand-rearing has been taking place in a specially equipped aviary at the Scharnstein airstrip near the Konrad-Lorenz-Research Station since 2002.
Type of release. Long-term experiments to establish the best-possible release methods and to gain new scientific results. The aim is to establish a stable, free-flying colony of Northern Bald Ibis in the area around Grünau.
Success +ve. The first years delivered promising results. The birds are able to survive on their own. They fly orientated over rather long distances, forage in appropriate habitats and avoid dangerous situations etc. Older birds serve as role models for the newly fledged birds. Problems were the losses of birds during the first years due to long-distance excursions.

Morocco

Where? Ain Tijja-Mezguitem in Northeast Morocco about 60 km northwest of Taza. The small valley is a protected area under the administration of the Ministry of Forestry.

When? Since 1997 first studies had been conducted. In 1999 the project started with a co-operation agreement between the initiators and sponsors. In 2000 the establishment of the Waldrapp station started with the construction of the main parts consisting of two aviaries, and two additional service buildings. At the end of that year 10 birds – an adult couple, 8 juveniles – were transported to their enclosure, one of them died after an injury. In 2001 first breeding took place; one chick came to fledging.
Who? Ministry of Forestry, (at the beginning also GTZ), „Arbeitsgemeinschaft Waldrapp" (a merger of diverse zoological gardens – Rabat, Berlin, Vienna, Nürnberg, Munich Zoo), ATED (conservation society of Tazekka)
How? According to the procedure presented in Agadir in 1999 captive-bred adult and immature birds will be released from their enclosure. The ibises shall be kept in two aviaries – one of them is intended to keep a breeding stock of 10 breeding pairs. The second – with 10 pairs, too – will be the releasing aviary. This year 20 – 30 zoo born birds hatched in 2002 shall increase the actual breeding stock. When the number of birds in the release enclosure will reach 40, the release should be started. The expected period of time seems to be 3 years from the beginning of breeding. During 10 years more than 200 birds shall be released.
Type of release. Re-introduction. The project is handled as re-introduction, because in this region Northern Bald Ibises occurred up to the 20th century.
Success? Until now the considered method is the same as in previous unsuccessful projects. The question if the captive-bred birds can meet the last wild individuals doesn't seem to be resolved.

Spain II

Where? Retin sierra (a navy training ground close to Barbate cliffs and La Janda plains, approximately 60 km southeast of Jerez), Southern Spain
When? The project was started in 2002.
Who? Zoo Jerez, Junta de Andalucia (Consejería de Medio Ambiente), Oficina Parque Natural Breña y Marismas del Barbate
How? The chosen release-site shows ecological and climatic conditions similar to the current Moroccan range. The comparison of four different methods is planned; 36 birds should be released during the first year. (1) Waldrapp Ibises together with cattle egret chicks and (2) another group of ibises without contact to egrets will be hand-raised to the fledgling state and then released. (3) A group of adult individuals shall be released during their second breeding season while rearing young. At the same time their first-year chicks will leave the enclosure. (4) Immature individuals in their second year will be released – this procedure is expected to reduce juvenile dispersal.
Type of release. Temporal limited (2003 – 2007) release experiment with comparison of methods. The main aim of this proposal is to evaluate the effectiveness of different release methods to create a stable and self-sustaining population.
Success? Parts of this project repeat previous failed projects. The question if the captive-bred birds can meet the last wild individuals doesn't seem to be resolved.

Gaps in Knowledge

Releasing methods: The greatest gap is that there are no successfully concluded release experiments until now. One task is to elaborate the best-possible strategy. Many problems occur in this context, one of them the dispersal behaviour, still has to be solved. The situation in Turkey needs long-term monitoring and managing concerning the following questions, too:
Genetic questions: Eastern – western population, Middle Ages – 20th century, degree of relationship within of the captive population
Behavioural studies: Captive vs. wild population. Answers to some questions of behaviour are lacking, or existing information is not available to everybody (e. g. they are often in German).
Requirements of free-flying birds: By studying the needs of the wild and semi-wild birds and quantifying of habitat parameters such as prey abundance, area and structure of feeding habitats, impact of the human land use.
Life history: Documented life histories of the captive birds, data concerning single wild individuals or the Turkish semi-wild ibises.
Veterinary problems: There remain unanswered questions to diseases, pathogens, parasite burdens and sensitivity against pesticides and other agrochemicals either of captive or wild birds and a comparison between both of them.

Adult Northern Bald Ibis sunbathing, at Alpenzoo Innsbruck - Tyrol

Disease Considerations for Northern Bald Ibis Translocations

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Introduction

Disease can cause death, increased susceptibility to predation or further disease, lowered reproductive capacity, or a combination of these. Thus, parasites (the causative organisms of infectious disease) are integrally involved in evolutionary processes and the maintenance of biodiversity, as well as being important components of biodiversity themselves. Changes in host-parasite ecology, therefore, may have broad, long-term and unforeseeable effects, from the individual level to the level of entire ecosystems (Cunningham 1996).

Definitions

Here, the term "parasite" is taken to include metazoan and protozoan parasites, fungi, bacteria, viruses and prions. The term "translocation" is taken to include any human-assisted movement of a living animal from one area to another, regardless of the origin or destination of the animal or the purpose of the movement.

Examples of Disease Risks of Translocations

In Captivity

Here, I present three cases that exemplify the risks of exposure to alien or novel parasites in captive situations. The first two are chosen to show that disease risks are not restricted by taxonomy or by the level of care and attention given to a species. The third case illustrates the unpredictability of the occurrence and outcomes of such risks from alien parasites.

There are many species of Partula snail, all from the French Society Islands in the South Pacific and all endangered with extinction. Many species now exist only in captivity; *Partula turgida* was one such species. In the second half of 1995, however, the captive population of *P. turgida* crashed due to unusually high mortality of all age classes and the species became extinct on 1st January 1996. Following detailed pathological investigations the cause of death of these snails was found to be infection with a previously unknown microsporidian (protozoan) parasite (Cunningham & Daszak 1998). The source of this parasite remains unknown. We now know, however, that some of the other *Partula* spp. and *Samoana* spp. kept in captivity appear to harbour this microsporidian parasite without ill effect. It seems possible therefore, that this parasite was introduced into the *P. turgida* population via another species of snail kept in close proximity to the *P. turgida* – a proximity that would not have occurred in nature.

A novel herpesvirus has recently been described which causes abortion, stillbirth and neonatal death in Asian elephants (Richman *et al.* 1999). The natural host of the virus is the African elephant, in which it appears to be relatively benign, and is transmitted to Asian elephants when these species are held in close proximity to each other in captive situations. Adult Asian elephants may than carry the virus without ill effect, with the disease only striking at the time of reproduction. It appears likely that infection with this virus has played a significant role in

the lack of breeding success of Asian elephants in western zoos.

Bovine spongiform encephalopathy (BSE) was an unforeseeable disease threat to wildlife which was transmitted to zoo animals via contaminated feed (*e.g.* see Kirkwood & Cunningham 1999). Some species have proved to be highly susceptible to the disease, while the effects of infection in others may not become apparent for several more generations. In addition to the threats posed to the livestock industry and to public health, BSE threatens captive breeding and reintroduction programmes for threatened species.

In the Wild

A recent example of a change in host-parasite relationships in wildlife resulting from translocations is the (human-mediated) introduction of the parasite, *Batrachochytrium dendrobatidis* into naïve amphibian host populations. *B. dendrobatidis* is the causative agent of cutaneous chytridiomycosis, an often lethal disease of amphibians. Its introduction almost world-wide has led to it causing global amphibian declines, local population extinctions (and, in some cases, global extinctions) in regions as disparate as Australia, the Americas and Europe (*e.g.* see Daszak *et al.* 1999). This disease has recently been discovered in New Zealand, where it was thought to have been co-introduced with amphibians imported from Australia for the pet trade, and now threatens populations of some of the world's most endangered amphibian species, such as the critically threatened Hamilton's frog (*Leiopelma hamiltoni*).

Another recent example of a change in host-parasite relationship brought about by parasite introduction is that of the introduction of West Nile Virus (WNV) from the Old World to North America (Lanciotti *et al.* 1999). In 1999, WNV was first discovered in Manhattan, but by 2003 it had spread throughout most of the U.S.A., into Canada and Mexico and into at least some of the Caribbean Islands (Dupuis *et al.* 2003). This mosquito-borne disease, the epidemic of which was primarily driven by infection of birds, exhibits differential virulence to avian species, persisting in resistant carrier hosts, which form infectious reservoirs for susceptible species in which it often is lethal.

As stated above, the consequences of such host-parasite changes can be far-reaching and unforeseeable. What the ultimate effect of the loss of multi-species assemblages of amphibians in the tropical and temperate rainforests of Australia and Central America will be consequent to the introduction of chytridiomycosis, for example, can only be guessed at. Who would have predicted, for example, that the introduction of myxomatosis to the rabbit population of Britain would have resulted, 30 years later and via a complex ecological perturbation involving rabbits, grasses, wild thyme and a species of ant, in the extinction of the large blue butterfly (*Maculinea arion*) from this country (Dobson & May 1986)?

In addition to parasites being introduced with translocated animals (parasite co-introductions), there is a risk of host-parasite perturbations occurring when animals are introduced to an area where parasites to which they are naïve are endemic. In such a situation, not only are the translocated animals at risk from succumbing to disease, but they also may provide a new host opportunity for the endemic parasite, increasing the parasite burden in the area and increasing exposure of extant animals to this parasite (Cunningham 1996). Such a situation appears to have

occurred in New Zealand where the introduction of the brush-tailed possum (*Trichosurus vulpecula*) has provided a new "substrate" for the replication and dispersal of tuberculosis (O'Neil & Pharo 1995). Similarly, the introduction of the ring-necked pheasant (*Phasianus colchicus*) to the U.K. for hunting purposes has provided a new (and resistant) host for the caecal nematode parasite, *Heterakis gallinarum*. Large numbers of this parasite are shed by infected pheasants, providing a reservoir of infectivity to the native (and susceptible) grey partridge (*Perdix perdix*), which appears to have declined catastrophically as a result (Tompkins *et al.* 2002).

Specific Considerations for Northern Bald Ibis Translocations

Currently, bald ibis maintained and bred in zoos are the only source of birds for translocation/reintroduction projects. By their very nature, zoos bring together different avian (and other) species from disparate parts of the world, bringing ibis into direct and indirect contact with (alien) parasites that they would not normally experience in the wild. In addition to sympatric zoo species, parasites can be transmitted from wild birds local to the zoo and can be transmitted via feedstuffs and fomites. Feedstuffs are a particular risk when these are raw products of other avian species (*e.g.* poultry eggs, day old chicks), as birds generally pose a bigger disease risk to birds (as people do to people) than do other taxa. Although ibis from zoos are particularly mentioned, the following considerations would apply to ibis regardless of their source, whether this be zoo, semi-wild, reintroduced or totally wild populations.

Alien parasites can cause severe and obvious problems for the ibis, which have not evolved to cope with these pathogens, but in most cases such parasites will not be able to infect bald ibis and will pose no threat to the captive birds or to any translocation programme. In some cases, however, alien parasites will be able to infect bald ibis, with no apparent ill effect or causing only subtle or potentially negative effects, such as decreased reproductive success or illness only when physiologically stressed. In these cases, the ibis may act as undetected carriers of parasites that are alien to the site of release and which might have long-term effects on the outcome of a reintroduction project. It has been shown in some species, for example, that even parasites that cause no obvious health effect can influence mate choice. The co-introduction of parasites completely benign to the ibis but alien to the release site must also be avoided as these parasites might impact negatively on one or more sympatric species at the release site. In general, the same care and considerations should be given to prevent the introduction of parasites to a host or site as would be given to prevent the introduction of an alien vertebrate or plant.

In addition to the potential dangers of co-introducing parasites with the ibis, the introduction of naïve birds to areas with endemic disease or parasites must be considered prior to any translocation being undertaken. This can, for example, significantly impact on the success of the translocation/release programme. Any potential effects on sympatric species must also be considered and investigated.

Although little is known of alien parasites affecting bald ibis, this is probably due to a lack of investigation rather than an absence of such occurrences. Only very recently (following a lead by IAGNBI) have alien parasites and disease risks of translocation been raised specifically as issues for bald ibis conservation programmes. It is important to note, however, that even with

the little amount of work done in this respect so far, some interesting findings are already being made (*e.g.* apparently novel ulcerative skin lesions in captive birds, avian tuberculosis as a threat to captive populations) and more work needs to be done on investigating these issues.

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The diseases and health problems known for the Northern Bald Ibis in captivity

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Information compiled in updating the results of a mortality survey of captive adult Northern Bald Ibis.

Background:

During the last International Workshop – Strategy for the Rehabilitation of the Northern Bald Ibis, Agadir, 8-12 March 1999 a number of gaps in knowledge were identified by the committee (IAGNBI). Some of them were directly related to veterinary aspects of the birds, both in captivity and in the wild.

In Captivity:

- List of diseases (infectious and non-infectious) and medical problems affecting Northern Bald Ibis.
- Determine causes and final diagnoses of death through a detailed post-mortem examination.
- Establish pathogens causing disease-related problems and those persisting infections over long period of time producing no clinical signs (carrier state).

In the wild:

- Natural diseases affecting wild population are not known.
- Potential pathogen agents (bacteria, virus, fungi, parasites) isolated from wild healthy bald ibis has not been sufficiently studied. Identify indigenous infectious agents.
- Establish causes of mortality.
- Knowledge of normal parasites burden.
- Effect of microbial flora of healthy introduced bald ibis to native species.

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.

Methods:

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.

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 prior to death	Date of death	Cause of death	post-mortem findings

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 in the first year.
- The survey was sent again in 2000 to those EEP members that had not responded to the first letter, unfortunately there were only a few responses.
- This survey was sent again in 2002 answering a total of 24 institutions.
- 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 (e.g. hidropericard, hepatitis, gastritis, etc) but the cause of death was not given.
- Thanks to the 24 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, Tierpark Berlin, Stuttgart, Parco Zoo Punta Verde, Mulhouse, Muséum de Besancon, Antwerp and Leipzig. I am very grateful to all of them for their time and consideration

Results:

- From 1999 to 2003, 24 of the 45 EEP Institutions responded (53.3%).
- Only 185 results (65.1 %), out of a total number of 276 analysed specimens, were useable for the purposes of the study.
- The responses were classified according to the cause of death given. The following results were obtained:

Cause of death	n	% of total
Euthanasia	36	19.4 %
Trauma	35	18.9 %
Sepsis	20	10.8 %
Foreign body ingestion	15	8.1 %
Enteritis	14	7.5 %
Renal disorder	11	5.9 %
Cardiac failure	9	4.8 %
Pneumonia	8	4.3 %
Avian tuberculosis	5	2.7 %
Senil degeneration	4	2.1 %
Linfoproliferative process	3	1.6 %
Staphilococcosis	3	1.6 %
Salmonellosis	3	1.6 %
Clostridiois	2	1 %
Erysipela infection	2	1 %
Aspergilosis	2	1 %
Adverse reaction Levamisol	2	1 %
Hepatitis	2	1 %
Starved	2	1 %
Visceral gout	2	1 %
Acute bleeding	1	0.5 %
Ruptured of the aorta	1	0.5 %
Cirrhosis	1	0.5 %
Colibacilosis	1	0.5 %
Fibrosarcoma	1	0.5 %
Reason clear	185	65.1 %
Reasons unclear	99	34.8 %
Total	284	

Discussion:

The cause of death was not always clear, not specific or various causes were diagnosed. In other cases the histopathology was the only response describing the kind of lesion found in the post-mortem report (e.g. enteritis, liquid in lung, degenerative hepatosis, etc) but the cause of death is not given, so only certain and clear causes were taken into consideration.
More detail is given below for some of the more remarkable results obtained:

Euthanasia
It was the most common cause of mortality (19.4 %). The reasons for euthanasia were mainly irreversible disorders such as:

- Chronic skin lesions: 40 % (see report below: Skin problems in Northern bald Ibis). Due to the fact that a great number of birds suffer from skin problems in captivity, it was suggested to investigate this issue into more detail. It is likely that so far the cases have been underestimated since the birds normally do not die of skin problems but of other causes.
- Fracture of mandible or beak: 26.6 %
- Bumblefoot: 13.3 %
- Elderly bird: 3.3 %
- Epidermoid cyst: 3.3 %
- Frostbite: 3.3 %
- Foot problem (undetermined): 3.3 %
- Severe Injury on wing: 3.3 %
- Feather disorder: 3.3 %

Trauma
It was the second highest cause of mortality (18.9 %) 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 (10.8 %). 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 causes of death (8.1 %) 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 7.5 %. 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 but no cause was identified.

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

Cardiac failure
4.8 % 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 (8 %). Adverse effect of levamisol (intoxication) was the cause of death. It is not recommended the use of this drug for parasite treatment in this species.

Conclusions:

During these 4 years I have received valuable information regarding the heath status and pathology of this species (NBI) in captivity. NBI is sensible to those problems seen in other avian species in captivity, especially within the family Threskiornithidae. No relevant disease affecting specially NBI was identified in this survey. There was not any single case of death related to parasitic disease (internal or external).
The results from 276 analysed specimens, although 185 (65.1 %) are useable, provide a good source of information regarding those gasp in knowledge related to veterinary aspects of birds in captivity.

- List of diseases (infectious and non-infectious) and medical problems affecting Northern Bald Ibis. Within the more remarkable infectious diseases are: avian tuberculosis, erysipelas, salmonellosis, staphilococcosis, colibacilosis and clostridiois. Neither Chlamydiosis nor mycoplasmosis were seen in this survey as cause of death. Aspergillosis was the cause of death in 2 cases, but it can be related to secondary problem or immunocompromised birds. Evidence of viral diseases are poorly seen. Avian leucosis due to virus was suspected but not proven. The skin problem remains under investigation, as it may be associated to a certain viral disease. Other avian viral diseases were not detected, such as: paramyxovirus (PMV1, PMV3), avian influenza and avian pox.
- Determine causes and final diagnoses of death through a detailed post-mortem examination. It is recommended especially where infectious and contagious diseases are suspected (avian tuberculosis, skin problems, etc.).
- Establish pathogens causing disease-related problems and those persisting infections over long period of time producing no clinical signs (carrier state), such as avian tuberculosis, erysipelas, salmonellosis or virus disease.

Skin problems in Northern Bald Ibis.

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Definition:

"Skin problems in NBI" appears as a chronic ulcerative dermatitis characterised 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.

Introduction:

In 1999 a mortality survey for adult birds (it was decided not to include mortality of chicks, except where pathological causes were diagnosed) was sent to all EEP members holding this species. Only 18 of the 42 EEP Institutions responded. The information or the cause of death was often uncertain or a detailed port-mortem study 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 (e.g. 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.
Euthanasia was the most common cause of mortality, 21.1% (32 birds out of 151 were euthanased). 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 (including bumblefoot): 3.3 %; severe injury on wing: 3.3 %; feather disorder: 3.3 %

Due to the fact that a great number of birds suffer from skin problems in captivity, it was suggested in the last EEP meeting at Barcelona to investigate this issue into more detail. The first step therefore would be to have a look at the prevalence of skin problems in bald ibises kept under zoological conditions. It is likely that so far the cases have been underestimated since the birds normally do not die of skin problems but of other causes such as hepatitis, sepsis, or other. The next step would be to find out how many birds are still alive suffering from any sort of skin problems. In order to get a more detailed idea of what actually may cause this problem it is suggested to sample these birds in specific regions (for a description see below). Those samples can either be send to Miguel A. Quevedo or should be send to an institution which is able to perform next to histology and bacteriology also a testing for viral infections. In several cases inclusion bodies were found already but it was not possible at that time to associate them to a certain viral disease. Nowadays this can be achieved by PCR and by a dedicated virologist. It would be helpful if each institution would send some sample also to Miguel A. Quevedo for a double check up.

Northern Bald Ibis (*Geronticus eremita*) Necropsy Protocol
in suspect case of skin problem

A thorough necropsy should be performed on Northern Bald Ibis which die at institutions housing this species. In addition to the institution's regular necropsy protocol, the following protocol should be performed.

1. Collect a small section of skin (affected and unaffected) as well as all major tissues (heart, lung, liver, proventriculus, ventriculus, intestine, kidney, spleen, adrenal, muscle and brain) and any tissue with obvious gross lesions in 10% buffered formalin.
2. Include description of the gross findings, body weight in grams of the carcass, important clinical history previous to death.
3. Send it to Miguel A. Quevedo, Zoo Jerez, c/. Taxdirt sn, Jerez 11404, Cádiz, Spain.
4. 2 sections of affected skin, 2 sections of healthy skin, section of liver, spleen and kidney should be frozen at –30 to –70 degrees ºC (if possible) for future viral isolation or another infectious agent.
5. The most important area so far know to look for inclusion bodies (IB) is the area around the feather quill and the adjacent skin. IBs were especially found in feathers which looked thicker and abnormal.

The above protocol is part of a research project. There is no charge for any of the above work, but we really appreciate if the participant institutions could collaborate covering the transport costs for sending the samples.

Conclusions:

- The cause of this "skin problem" is not known yet.

- It is very important to identify captive populations suffering from this problem.

- Birds from affected populations should not be transferred to other institutions.

- Birds showing clinical symptoms should be isolated from the group and if possible put in quarantine to see the evolution of this disease.

- In those cases were there is evidences of skin problem, euthanasia is recommended and a deep post-mortem study performed.

- Due to the fact that a great number of birds suffer from "chronic skin problems" in captivity, it was suggested to investigate this issue into more detail.

World Conservation Union (IUCN) fundamental considerations for release projects applied to the Northern Bald Ibis (*Geronticus eremita*).

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Introduction

The critically endangered Northern Bald Ibis (*Geronticus eremita*) is now restricted to two small adjacent colonies in Morocco and a tiny recently discovered population in Syria. It once however had a widespread distribution around the Mediterranean and up into alpine Europe. The re-establishment of the species across parts of its former range will likely involve '*ex situ*' conservation techniques such as captive breeding and release.

The highly restricted and small existing wild populations mean that translocation is unlikely to be useful as a conservation action for the species in the near future, however reintroduction, restocking (supplementation) and benign introduction have all been mentioned as potential conservation strategies in the past. All three of these strategies will be discussed and the potential pros and cons of each examined. Different circumstances can result in each of these actions being integrated successfully within a conservation strategy, however they are also inappropriate under certain conditions and their implications in the context of Northern Bald Ibis conservation is discussed.

Reintroduction of Northern Bald Ibis

When to consider reintroduction

Reintroduction is the release of a species to a site at which it historically occurred but is now extirpated or extinct. General guidelines for all reintroduction programmes are laid out in the IUCN SSC Guidelines for reintroduction (IUCN 1995) produced by the IUCN SSC Reintroduction Specialist Group. Reintroduction if applied correctly has the potential to be an important part of the conservation strategy for the Northern Bald Ibis. However certain conditions have to be met in order for reintroduction to be appropriate as a conservation action:

- Reasons for extirpation/extinction are known and have been addressed. Prior to any reintroduction programme there should be an appreciation of the reasons leading to the original loss of the species from its range. Only once these have been addressed should it be deemed appropriate to attempt reintroduction in order to re-establish the species.

- Integrated within a whole conservation strategy. Reintroduction alone cannot save a species from extinction or extirpation and it must be considered as one of a number of integrated conservation actions involving both '*in situ*' protection and habitat conservation as well as '*ex situ*' population manipulation and reintroduction. A Species Action Plan (SAP) is a critical step in fully appraising the role of reintroduction as part of the conservation strategy for a species. A feasibility study should be conducted prior

to any project to assess its value as a part of the wider conservation measures for the species.

- Natural recolonisation is unlikely/very slow. Reintroduction should only be considered to sites at which natural recolonisation is considered either unlikely to occur or expected to be extremely slow and precarious. If existing and expanding populations of Northern Bald Ibis are known to occur within the dispersal range of the release site then conservation measures should focus upon habitat improvement and protection measures to enhance the natural spread of adjacent populations.

- Driven by '*in situ*' NOT '*ex situ*' requirements. The motive for reintroduction should be driven by prevailing field conservation needs and the availability of suitable sites at which reintroduction will have a real benefit on the conservation of the species.

- NOT driven by the requirement to dispose of stock. The need to dispose of excess captive stock is not in itself a reason to advocate reintroduction and appropriate population management techniques should be followed to address this situation. The current EEP programme for the Northern Bald Ibis (Böhm, 1999) sets out to manage these issues in a professional manner and institutions with surpluses should work within the recommendations of the EEP. They should not consider inappropriate reintroduction as a solution to this situation.

Reintroduction is sometimes viewed as a controversial strategy with a number of perceived pros and cons:

Pros of reintroduction

- Rapid increase in numbers & range is achieved as a result of released birds.
- Decrease in fragmentation of existing populations by repopulating gaps in current distribution can enhance the viability of existing populations.
- Development of chosen key sites to which animals can be reintroduced.
- Awareness/public relations role of reintroduction can be immense and add value to other habitat conservation and species protection measures.
- Research potential of reintroduction is normally great and can contribute to the wider scientific knowledge of the species and its threats.

Cons of reintroduction

- High cost & complexity of reintroductions.
- Perceived diversion of funds from '*in situ*' conservation can cause controversy.
- Co-ordination of the multidisciplinary teams required for reintroduction can be difficult and time consuming.
- Potential negative ecological impacts as a result of releasing animals.

Reintroduction must not be considered as an alternative to '*in situ*' measures rather it is

complimentary to habitat conservation and species protection as part of a whole strategy for the conservation of the Northern Bald Ibis. Following further research on release techniques it could have a vital role to play in restoring the Northern Bald Ibis to its former range and consolidating its distribution.

The IUCN SSC Guidelines for reintroductions (1995) should be consulted and fully adhered to before planning reintroduction work.

Restocking (supplementation) of Northern Bald Ibis

When to consider restocking

Restocking is the release of a species into an area in which it is already present. It is a practice widely used for game species but as a general principle care should be exercised when considering restocking for conservation purposes. Some of the issues of conducting restocking exercises are discussed in the IUCN position statement on translocation of living organisms (1987). Restocking of Northern Bald Ibis colonies should only be considered for a number of very specific conditions:

- Low genetic variability in a small population. Restocking may be considered to increase genetic variability in small highly inbred populations. However care should be taken to ensure that the genetic situation is actually impacting upon the population and that any declines seen are not actually due to other causal factors.

- Natural rate of population growth is very slow. If very small and highly vulnerable populations are considered to a have a very slow rate of growth then restocking may secure the viability of populations whilst natural growth occurs. This benefit has to be carefully weighed against the potential negative impacts on such a small and vulnerable population.

- Meta-population management of fragments. Limited releases of individuals between small isolated populations may be carried out in an effort to combat the negative impacts of fragmentation. However consideration should initially be given to creating natural dispersal and this strategy is unlikely to play a role in the conservation of a highly mobile species such as the Northern Bald Ibis.

- Integrated within a whole conservation strategy. As with reintroduction it must be indicated as part of a wider conservation strategy.

- Driven by '*in situ*' NOT '*ex situ*' requirements. As with reintroduction, the motive for restocking should be driven by prevailing field conservation needs and likelihood that restocking will have a real positive benefit to the conservation of the species.

- NOT to bolster a declining population without understanding the reasons causing decline. The addition of extra birds to a small and declining population of Northern Bald Ibis is unlikely to have any conservation value whatsoever without first understanding and

correcting the reasons for decline.

- NOT driven by the requirement to dispose of captive stock. As with reintroduction, the need to dispose of excess captive stock is not in itself a reason to advocate restocking.

Restocking suffers from the same perceived cons as reintroduction but has a number of potential problems over and above those and relatively few benefits:

Pros of restocking

- Increased genetic variability of population if appropriate.
- Ease of release site selection on the basis of existing occupancy by the species.
- Secure slow growth rate populations by increasing their viability whilst populations grow naturally.

Cons of restocking

- Negative impact on existing population due to increased density and competition.
- Potential to introduce disease or parasites to existing population.
- Difficulty in post-release monitoring due to problems differentiating existing and released animals.
- Potential for negative impact on already existing but vulnerable populations means that a clear assessment and perceived benefits must exist before conducting restocking.

Due to the potential negative impacts on existing populations restocking should generally be avoided unless the very specific circumstances outlined indicate that it is appropriate and a full assessment of the risks has been conducted. Currently restocking is not advocated for the Northern Bald Ibis.

Benign Introduction of Northern Bald Ibis

When to consider benign introduction

The introduction of a species to an area is a strategy that should only be adopted as a last resort in species conservation. There are many inherent risks in releasing species to areas which are not parts of their native range. The issues involved in benign introduction are discussed in both the IUCN SSC Guidelines for reintroduction (IUCN 1995) and the IUCN position statement on translocation of living organisms (1987). In the case of the Northern Bald Ibis there is considerable confusion over exactly what constituted it's previous natural range. As a migratory species that several centuries ago occupied large parts of the Mediterranean and alpine Europe it is possible that it's native range could be interpreted in a wider sense to include this whole region.

Given the wide scale changes in Europe over the last few centuries it may be much more appropriate to choose sites within the region based upon assessment of current habitat suitability than to try to re-establish to century old colony sites. The benign introduction of Northern Bald

Ibis MUST only be considered as a last resort and then only under very specific circumstances:

- ONLY when there is no remaining area left within the species range. Reintroduction should be considered as a strategy before resorting to benign introduction. Only if no suitable areas for reintroduction exist within the species range should introduction even be considered as a strategy.

- ONLY following a small-scale reversible trial. There is a very high inherent risk of negatively affecting the biodiversity of a region by the introduction of a species. Therefore introduction MUST be conducted as a small-scale reversal trial in the initial instance to assess any impact on the environment and native species.

- Integrated within whole conservation strategy. As with reintroduction it must be indicated as part of a wider conservation strategy.

- Reasons for non-occurrence known and addressed. If introduction is to succeed it is essential to understand the original limiting factors that excluded the species from occupying that area and an understanding of why those factors have now changed.

- Driven by 'in situ' NOT 'ex situ' conditions. As with reintroduction, the motive for restocking should be driven by prevailing field conservation needs and likelihood that restocking will have a real positive benefit to the conservation of the species.

- NOT driven by requirement to dispose of stock. As with reintroduction, the need to dispose of excess captive stock is not in itself a reason to advocate restocking.

As a last resort strategy if introduction is carried out it has a number of potential inherent risks.

Pros of introduction

- Wild population can be established where no other possibilities exist.
- Feasible strategy in cases where threat removal within the natural range is impossible or highly unlikely.

Cons of introduction

- Ecological impact on native biodiversity is largely unknown.
- A small-scale reversible trial is ESSENTIAL.
- Can give a complex and confusing conservation message to the public.
- HIGH RISK OF ALIEN INVASIVENESS EXISTS.
- HIGH POTENTIAL FOR NEGATIVE IMPACT ON EXISTING NATIVE BIODIVERSITY.

In circumstances where no other possibilities for working with '*in situ*' populations exist then benign introduction can play an important role in conservation. However it should be viewed

as a last resort and high-risk strategy.

The value of partnership & collaboration

The release of Northern Bald Ibis is an incredibly complex and difficult process and the management and co-ordination of any planned release activities will be equally challenging. It is highly recommended that release programmes be managed as partnership ventures where full and open collaboration between different organisations with diverse skills bases will bring with it as number of significant advantages. The value of working in such partnerships include:

- Enhanced expertise
- Transfer of skills
- Shared responsibility
- Shared accountability
- Increased funding opportunities
- Enhanced future collaboration
- Increased chance of success!

If integrated appropriately into an overall conservation strategy for the Northern Bald Ibis then well managed co-operative release schemes could contribute significantly to the conservation of the Northern Bald Ibis in the future.

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The history of IAGNBI so far

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One output of the meeting held in Agadir, March 1999 was the creation of the IAGNBI committee. A list of roles was defined, and nominations made and agreed by the delegates present. The committee has communicated primarily by email since its creation, the terms of reference having been defined (see page 8).

The following activities have been undertaken, these and resulting outputs are listed below:

1) A list of Gaps in knowledge in need of attention was produced very shortly after the meeting (listed in 1st edition of IAGNBI newsletter)

2) Two email newsletters have been produced and distributed in 2001 & 2003, which have solicited updates on the main projects, concerning wild and potential reintroduced birds as well as listing recent publications and student projects.

3) A joint round table discussion was held at the International Ornithological Congress in Beijing together with Crested Ibis

4) Links between IAGNBI and the Reintroduction Specialist Group of the IUCN SSC have been developed in order to guide reintroduction plans and facilitate the Innsbruck meeting.

4) Letters have been written by IAGNBI to the Grünau & Spanish projects giving qualified support for developing the projects, and comments given on the proposals submitted to IAGNBI.

5) This meeting in Innsbruck called in July 2003 to review the status of the wild populations, progress in release methodology, go some way to developing reintroduction guidelines for the species, and re-orientate the terms of reference for the committee as necessary.

One change in the committee composition was made in 2001, when Okan Arihan stood down from the committee due to changes in his professional involvement, and Taner Hatipoglu was nominated in his place.

The Grünau project in its 6th year: How to establish a (*Geronticus eremita*) colony from scratch

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Needless to state that the Waldrapp 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 necessary to consider re-establishing colonies in suitable habitats. The question is just how? This was the topic of our 1999 Agadir meeting (ANON. 1999), where it also became clear that all attempts to release a few birds from captivity had failed. However, a pilot project of the Innsbruck Zoo in the early 1980, involving hand raising of nestlings and releasing these socially human-imprinted birds had revealed promising results (THALER ET AL. 1992). In the meantime a reasonably stable, free flying and reproducing group has been established at the Konrad Lorenz Forschungsstelle in Grünau. The knowledge gained is regularly communicated, mainly within the IAGNBI, last time at the Innsbruck meeting and we hope that other projects will be able to benefit from our increasing experience.

We started an experimental project 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 and Common Ravens, a third bird model available for our investigations into the mechanisms of social life and
2. to collect know-how for establishing colonies elsewhere, in climatically more suitable habitats.

Hatchlings from Zoo offspring were carefully hand raised with full social contact. This established close bonds between 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 at adverse conditions). This allowed social traditions to develop which now enable birds to cope with the conditions of our valley. For details of our approach see KOTRSCHAL (1999), TINTNER & KOTRSCHAL (2001), TUCKOVA et al. (1998).

Particularly in the first few years, this developed into an expensive, labour-intense "blood-sweat-and tears" project. Now, six years later, 25 experienced birds are roaming our valley. During summer they forage for themselves at the meadows in Grünau, 6 km North of their night roost in the Cumberland Wildpark and starting in 2002 there is successful reproduction (4 surviving fledglings from 2003, 1 from 2003). For the period of migration the aviary is still closed, but we intend to keep our birds free also in the autumn from next year onwards. From late autumn into late spring, birds have to be fully provisioned with food. Hence, we consider ourselves partially successful. In a spin-off project, J. Fritz and A. Reiter (www.waldrappteam.at) try to migrate with specially raised birds and ultra light planes over the Alps in order to investigate whether suitable migratory routes can be taught to these birds.

Summary of events from 1997-2003

In spring 1997 11 nestlings of 12 from Innsbruck and Vienna Zoo fledged, only 4 of which survived into the next year. Most losses were due to local predators (Eagle Owl) or long-distance dispersal flights in fall. Discouraging as this was, there was also interesting aspects, such as 3 birds returned 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 that they could survive for weeks without supplemental food; actually, 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, once more from Innsbruck and Vienna Zoos fledged, 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 a few of them could be retrieved from Poland and Hungary, 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. 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 to have reached a threshold. So we decided to try a third season and also changed the management of the birds. As before, birds were taken into their "colony site" (the attic) during the night. Also, 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 that we had in the first two years.

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

In spring 2000 only 4 of 6 hatchlings from the Erfurt Zoo fledged (due to some problems with a hand raiser) and joined the group of 18. No birds were lost until spring 2001, so we still have 22 increasingly experienced birds. As the original facilities were insufficient to maintain this colony, we invested lots of time, effort and experience over summer 2000 to build a huge and tall Waldrapp-aviary on a south-facing slope of 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 connection with the aviary which serves the birds to easily exit and enter. The group immediately accepted their new aviary as the colony site and never attempted to return to their previous, smaller night roost at the KLF. No hand raising was done in 2001.

In spring 2002, we first observed courtship behaviour and pair formation in our still young birds. Unexpectedly soon for their age, the 22 birds resulted in 9 pairs building nests and 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 20% of the birds daily needs. The majority of food was obtained via natural foraging around the village of Grünau, some 8 km North of the breeding site. One female breeder disappeared, probably being taken by a bird of prey. Five young fledged, one starved during "weaning" from parental feeding, which happens the first 2 weeks after fledging. This is a relatively low number, but encouraging considering that the pairs were first-time reproducers and hence, inexperienced.

For 2003 we were hopeful of prosperous reproduction. However, there was a total turnover of pairings, we had massive courtship and copulations, but only 2 pairs built nests at the end of May, one month later than usual. Only 1 bird fledged so the group size remains at 25. The total amount of money spent in 5 years in this project is approaching €200 000 (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 fam. 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 revealed knowledge towards 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. In 1997, we investigated the effect of hatching asynchrony on nestling aggression (Klara Tuckova). In 1998, the ontogeny of substrate preferences and social integration were research topics (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 at insufficient food supply) versus group-raised nestlings. 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. We are increasingly sceptical towards "genetic determinism" (the dogmatic focus at the genetic background of the animals used), which may 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, we are interested in whether and what Waldrapp Ibis learn from one another when foraging, how they compete via scramble and interference and how the social relationship between individuals affects the formation of foraging groups. In parallel to our present focus in geese and ravens we also investigate hormonal and early stimulus effects on the development of coping styles (proactive-reactive), etc. Since 2002, a focus is monitoring the feeding behaviour of our free flying birds.

Wild dreams for 2002 and 2003

Former KLF PhD student Dr. Johannes Fritz was training to fly an ultra light plane. Together with a number of courageous co-workers he showed with 11 hand-raised birds in summer 2002, that Waldrapp would follow planes. In spring 2003 he together with Angelika Reiter and co-workers raised another 11 nestlings at the Scharnstein airstrip (near Grünau). From August 18th onwards, two planes and about 20 persons ground crew together with film teams and photographers started to cross the Alps and to migrate via the Northern Adriatic coast to a suitable wintering area in Tuscany. The project is partly successful. Actually, I write this text at a hangar at an airstrip at the Lido de Venetia, where we flew in with the birds yesterday (31st of August). Tomorrow (2nd of Sept.) our trip will continue to the mouth of the river Po and from there cross the Apennine.

We are well aware of the fact that this is an entirely experimental project. Such projects have, however, worked with geese and cranes and we see no reason why it shouldn't work with the Waldrapp. 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 was always living close to man. It was probably only entering the Alpine area together with the first pastoralists.

For a number of reasons, not the least climatic change and educational standards of the human population in mid Europe, and the tendency of these birds to align with human culture, we think it is timely to go towards re-introduction of Northern Bald Ibis into a core area of its former range. As it looks now, chances are at about 70% that Europe will regain a migrating population of Waldrapp Ibis.

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The Scharnstein Project

Establishing a migratory Waldrapp colony by introducing a new migration route with ultra-light planes

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The aim of our project is to establish a self-sustaining 'model-colony' of 30 to 40 Northern Bald Ibis in Scharnstein (Upper Austria), with a migration tradition to a wintering area in Southern Tuscany and to address several of the questions on migration behaviour, habitat use and feeding ecology.

Despite the proximate aim for the reintroduction of the Northern Bald Ibis, flying with human-imprinted birds offers a broad range of options not only for bird conservation but also for behavioural and physiological research in the context of bird flight and migration.

Using the principle of hand-raising, a self-sustaining colony was begun in May 2002 with 11 Northern Bald Ibis from Vienna Zoo, the Alpenzoo, Innsbruck and the Grünau colony itself. The foster parents were with the birds most of the day; contact with other people was largely avoided. This way a close and specific social relationship could be established. Since birds were raised in asynchrony nests of three to four birds, they will not be sexually misprinted. The birds spent the winter at the Alpenzoo with the foster parents in close contact; and were joined in May 2003 by a second group of ten birds from the Zoo Walsrode, Germany, hatched this year.

About 30 days after the first ibis began to fly, the group were introduced to two micro light aircraft. These aircraft will lead the flock on migration. The ibis were taught to follow the micro light aircraft on frequent practice flights to selected meadowland feeding sites where they showed normal behaviour when confronted by dogs or unfamiliar humans, birds of prey or other predators – flying up and perching on the wings of the aircraft, or sheltering close to their foster parents; and they were encouraged to use the ruins of a medieval castle close to Scharnstein where artificial nesting cliffs have been constructed for them, which will be the roosting and breeding site for the colony when it returns in 2004.

In the middle of August 2003 the migration from Upper Austria to Southern Tuscany will start. We plan to leave Scharnstein mid August 2003, depending on the weather. The two micro light aircraft with the birds will cover 40 to 90 kilometres per day at a speed of 50 to 55 kilometres per hour. The course of the route and the daily intervals are based on experiences with the Grünau and Scharnstein birds as well as on data of other bird species. It follows striking landmarks (valleys, rivers, coastlines) and corresponds extensively with frequent migration routes of several species. The journey should take us about 14 days with stopovers at specially created mobile night roosts.

The wintering area is at the World Wide Fund for Nature (WWF) reserve at *Osco did Recon*,

which is part of the Natura 2000 area *Monte Libra - Alta Valle dell'Albegna*. It offers a suitable habitat of cliffs and valleys where the ibis will be able to feed on a variety of invertebrates found in the meadowland.

Basically, it is up to the birds whether they migrate back in spring 2003 or if they stay in Tuscany until sexual maturity (as it is known from the eastern population of the Northern Bald Ibis). If the birds stay in Tuscany, permanent monitoring and care of the birds is guaranteed by our team and the locals. However, we will try to motivate them to migrate back after the first winter, either by disappearing from one day to the next or by flying north together with the birds.

The main focus of our research should be in line with the suggestions by the IAGNBI, focusing on feeding ecology and habitat use, stability of the migration tradition, interaction with other animal species and humans, predator avoidance and parasitic burdens, demography and (more recently) breeding success. Research will be done in close co-operation with the KLF.

If the program develops along the lines, raising of a third group in 2004 is planned, to get a more stable population size (35-40 birds) and to increase the genetic variability. This model-colony should than be monitored for the next few years. If it develops appropriately the project can be turned into a re-introduction program. Further migrating colonies can be established (e.g. Burghausen, Rosegg, Salzburg,) and linked with the Scharnstein colony, all of them migrating southwards along the same route to the South.

We assume that the ability to control autumn migration is of significant relevance for every reintroduction attempt, independent of the origin of the birds and the geographical location. Thus, the chose of the locations during this experimental phase is of secondary relevance. However, due to the experiences of the first year of our project and with the Grünau birds we assume, that a reintroduction of the Northern Bald Ibis in Europe, in particular along our planned migration route from the Alps to the southern Tuscany, will be possible and reasonable, provided that we succeed with our program.

In conclusion both groups of free-flying Northern Bald Ibis, in Scharnstein and Grünau, have not caused conflicts with local groups. On the contrary, the birds are the objects of identification and pride of the local people. Also the media interest for the project is very high and the highlight for this year will be a 50 min documentary of our south migration, co-produced by three European TV-Stations.

Acknowledgements

Waldrappteam.at is an independent team of biologists and pilots. We are self-employed and have to finance ourselves and our project entirely through donations and sponsorship. The team is supported by a broad board of institutions and people, organised in the *Förderverein* ***waldrappteam.at*** (President Prince E. Liechtenstein; Manager K. Kotrschal; Scientific Consultant C. Böhm, D. Schratter, K. Kotrschal, F. Perco). Financial support came from the founding members of the Förderverein Konrad Lorenz Research Station Grünau; Zoo Vienna; Alpenzoo Innsbruck; Wildpark Rosegg; Cumberland Wildpark Grünau as well as from the

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The planned migration route:

0: Breeding area Scharnstein, Alma (airfield and ruin); 1: First stop-over Tribe, Syria (airfield); 2: Second stop-over Mayerhofen; Carinthia (airfield); 3: Third stop-over Rosegg, Carinthia (private meadow); 4: Fourth stop-over Fagagna, Friuli (airfield); 5: Fifth stop-over S. Donà di Piave, Venecia (private meadow); 6: Sixth stop-over Spiaggia Romea, Po-Delta, Emilia Romagna (private meadow); 7: Seventh stop-over Medicina, Emilia Romagna (airfield); 8: Eight airfield Borg San Lorenzo, Tuscany (airfield); 9: Ninth stop-over Cavriglia, Tuscany (airfield); 10: Tenth stop-over Santa Rita, Tuscany (airfield); Wintering areas: 11: Upper Albegna Valley, Natura 2000 Monte Labbro – Alta Valle dell'Albegna; 12:WWF Nature Reserve Laguna di Orbetello; 13:Parco della Maremma.

One of our foster parent, Isabel Meran, at the airfield Scharnstein, Upper Austria, with the juvenile birds and the microlights in the back.

Reintroduction project in the Mezguitem region

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1. Historical overview

Until the beginning of the 20th century, the Northern Bald Ibis (*Geronticus eremita*) was distributed over all Moroccan territory: Oriental, Middle Atlas, Atlantic Cost between El Jadida and Ifni. Before the 1940s the number of breeding pairs was estimated to be more than 1000. The first assessment of the species status was made in 1975 with the sponsorship of the IUCN/WWF, which showed that the Northern Bald Ibis colonies in Morocco did not exceed 250 breeding pairs.

The rapid extinction of the Northern Bald Ibis was due to the combination of several factors: poaching, egg collecting, habitat change, disturbance, pesticides (DDT) and captures of adults for zoos. The later had contributed widely to the extinction of the colonies located in: Foum El Kheng (Anti Atlas), Aoulouz (Haut Atlas) and Tifnit (Atlantic coast).

Currently, the sole wild and viable population that has been survived is living in the Souss Massa national park and Tamri region with some 100 breeding pairs. A rapid assessment of the habitat requirement of the Northern Bald Ibis has shown that the existence of the species is depending on the availability of cliff, poor steppe with short cover and fresh water.

2. Reintroduction project of the Bald Ibis in the Mezguitem region:

2.1 Rationale

In spite of the conservation efforts, the Northern Bald Ibis population has been stable for the last two decades. In 1996, more than forty birds died mysteriously, so far no evidence has been found to explain this tragedy. If such an event occurred again the last viable population of the Northern Bald Ibis would be threatened and brought to the brink of extinction.

For this reason, the implementation of a rescue colony in a former range of the species was thought to be a wise strategy to ensure the survival of the bird. Furthermore, suitable habitat on which it depends is still available all over the country. The reintroduction project has been seen as an opportunity to increase the awareness of the public, decision makers and all stakeholders towards the conservation of the biodiversity. Other reasons that encouraged the project were the availably of sponsorship, government support and the socio-economic benefit that the project may have for the local communities.

2.2 Criteria for site selection

Based on the IUCN guidelines for reintroduction, some criteria were used to select the site for the implementation of the reintroduction project, which were:

- Former range of the species
- Suitable habitat: availability of the necessary conditions required for the survival of the bird; cliffs, steppes, foraging site…

- Undisturbed site
- Social acceptability (no opposition from local community)
- Accessibility
- Distance from the wild population

Based on these criteria, several expeditions had been organised in the oriental region. This constituted a former range of the species and was farthest from the wild population, especially there are many natural obstacles that could constraint the migration of the bird toward the south such as the high Atlas Mountains. The Mezguitem site was selected because it meets most of the criteria already cited.

2.2 The implementation of the project

(This part was extracted from the report of "l'Association de Tazekka pour l'Environnement et le Developpement, 2001 and 2002)

During 2000, a large aviary was constructed near a linear dam. The aviary was composed of two compartments. On 25th November 2000 ten birds were brought from the Munich zoological park and released into one of the compartments of the aviary. One of the birds died during the first week by injuring itself against the wall of the aviary. Some data on the bird's behaviour is summarised below:

- Courtship display started during February and continued during the whole month of March
- One pair started to build its nest at the end of March
- Nesting started in the first week of May.
- The first signs of hatching were observed on June 4th 2001 (two chicks were hatched, one of them died after two weeks.)
- On July 7th 2001 the chick started to fledge. At this time his parents abandoned it.

The following table shows the reproductive behaviour during 2002.

Pair No.	Start of nesting	End of nesting	Number of eggs	Hatching date
1	09 March 2002	01 April 2002	1	4th week of April
2	18 March 2002	06 April 2002	1	2nd week of May
3	02 April 2002	23 April 2002	3	3rd week of May

2.4 The diet

Two types of food are given to the birds: artificial and natural

The artificial diet is composed of: dog food.
The natural diet is composed of: Crickets, worms, snails, snakes, lizards, toads,

3. The social impact of the project

The construction of the aviary required 3000 working days that benefited exclusively local people. Additionally a complex of wells, reservoir and fountains were built to furnish the drinkable water for the local communities. The latter was sponsored by the CIOR (Cimentries de l'Oriental).

In spite of the fact that these actions are not costly, they had a positive impact on the local community, which contributed to the respect and even the patrolling of the aviary. They also anticipate more actions that could help them generate revenue.

4. Perspectives

In response to the recommendation of the Agadir workshop on "Conservation strategy of the Northern Bald Ibis", a study of the surrounding area (within 40 km) is planned in order to access the habitat potential for the ibis before its release. It is decided that a whole social group built up in the aviary will be released. Another group of birds will be brought to intensify the husbandry of the species

More actions toward local community development will be achieved

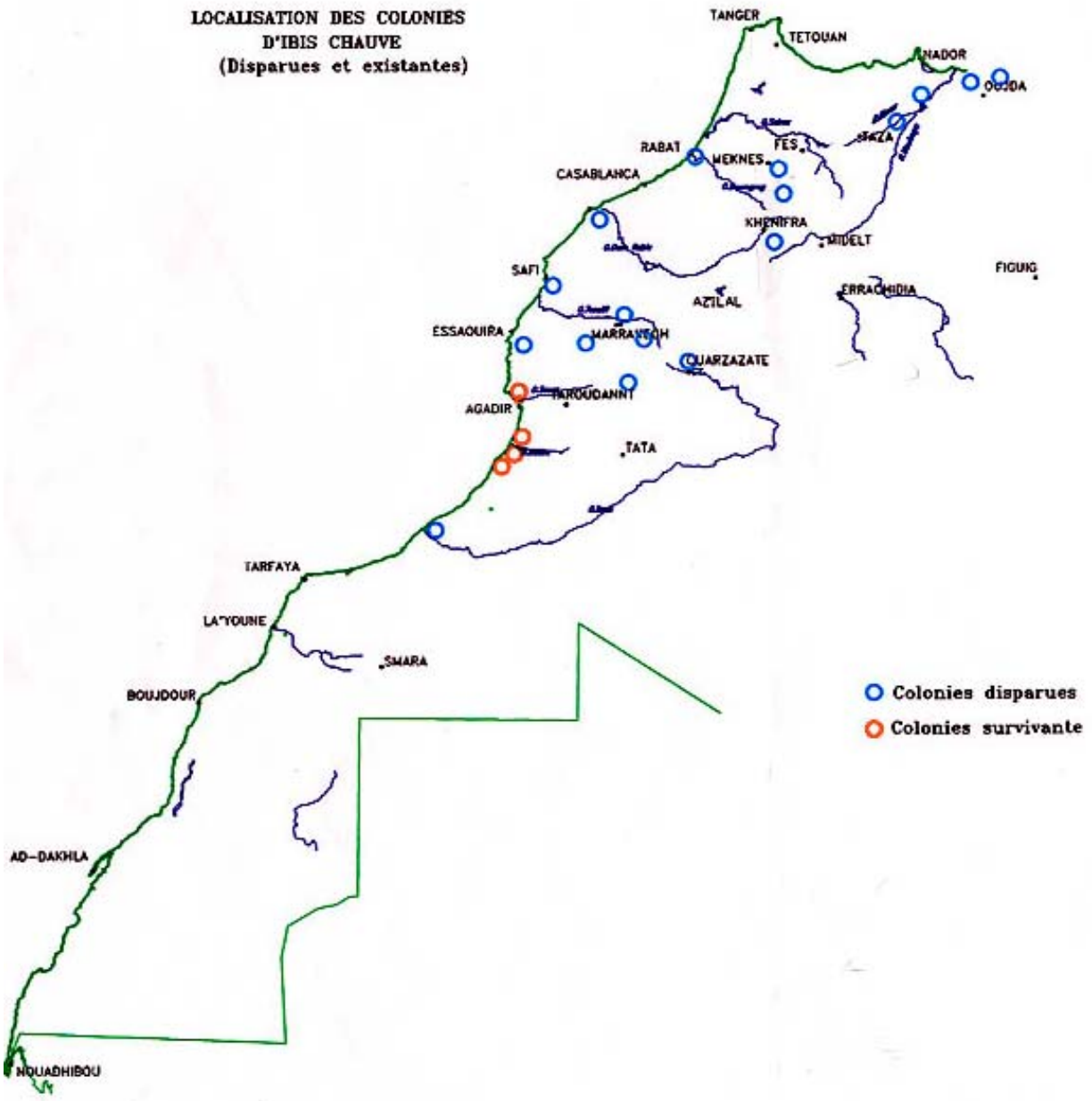
5. Conclusions

The Mezguitem project is promising for the implementation of a rescue population of the Northern Bald Ibis in its former range. Indeed, it has a positive impact on the local community and a contribution to the increase of the awareness on conservation. Also, the project has created a synergy between the state (water and forest department, NGO (national: ATED) and international (AgW) and private (CIOR)).

However, some weaknesses of this project have to be mentioned:

- The financial support of the project is not sustainable and there are no guarantees that the project will continue.
- There is no clear vision (action plan) of the post–releasing phase
- Lack of a scientific follow up
- Insufficient communication and involvement of specialists in the field
- The risk of disturbing the wild population (and no precautions has been taken so far)
- No idea about the genetic and the health of the birds
- No data on the Algerian situation (may be it still there a wild colony)

Compared to other ongoing projects, the Mezguitem project seems to be promising to establish a sedentary population that can replenish the former range of the Northern Bald Ibis in the Oriental region and Algeria. However, a lot of efforts should be done to avoid irreversible ecological mistakes.


LOCALISATION DES COLONIES
D'IBIS CHAUVE
(Disparues et existantes)
TANGER
TETOUAN
NADOR
RABAT
MEKNES
FES
CASABLANCA
KHENIFRA
MIDELT
SAFI
AZILAL
ERRACHIDIA
FIGUIG
ESSAOUIRA
MARRAKECH
OUARZAZATE
AGADIR
TATA
TARFAYA
LA'YOUNE
SMARA
BOUJDOUR
AD-DAKHLA
NOUADHIBOU
Colonies disparues
Colonies survivante

A study of different releasing techniques for a captive population of Northern Bald Ibis *(Geronticus eremita)* in the region of La Janda (Cádiz, southern Spain)

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Background

The Northern Bald Ibis has declined dramatically over the past 50 years and is classified as critically endangered (Collar et al. 1994) the highest threat category according to IUCN criteria (BirdLife 2000). With about 250 birds remaining in the wild (Bowden et al. 2001), the Souss-Massa region near Agadir (SW Morocco) holds the last known breeding population of the Northern Bald Ibis (*Geronticus eremita*). The species has disappeared from the European Alps more than 400 years ago and from Turkey in 1989 (Akçakaya *et al.* 1992), (despite a semi captive population is found nearby Birecik). Occasional records from Yemen and Eritrea suggest that an isolated population might be found in that area but this may be confirmed. In April 2002 a small colony was discovered in Syria (Serra et al. 2002). Hunting, direct persecution by humans, loss of foraging areas and pesticide poisoning (especially in the Turkey population the last decades) are the main reasons for this decline (Cramp & Simmons 1977, Hirsch 1977).

In 1999, an 'International workshop on a strategy for the rehabilitation of the Northern Bald Ibis' hold in Agadir (Morocco, 8-12 March) remarked the necessity of performing studies on releasing techniques to attain a non-migratory and viable population of this species in another area. In cooperation with IUCN/SSC Reintroduction Specialist Group, the workshop developed specific guidelines for release/reintroduction program assuming that reintroduction is perhaps the main strategy to avoid extinction. In order to ensure the international co-operation, it was decided to create the International Advisory Group for Northern Bald Ibis (IAGNBI) that is working since then.

Main Objective

The "Proyecto eremita" aims to evaluate the efficacy of different releasing techniques in *La Janda* area, Southern Spain, a climatically suitable habitat for the species. The success of this study will be assessed by the establishment of a viable, self-sustained population in this area. Previous attempts (Austria, Israel and Turkey) were unsuccessful (Mendelssohn 1994, Thaler et al. 1992) due to a number of reasons (adverse weather, lack of foraging areas, etc). In this project, we will analyse different techniques (with up to 3 groups of animals reared under different conditions) using birds from the captive stock of the European Endangered species Programme (Christiane Boehm EEP co-ordinator) mainly from ZooBotánico Jerez and following

the specific guidelines for release of Northern Bald Ibis based on the IUCN/SSC Reintroduction Specialist Group recommendations. At the end of the project the results will be evaluated before to capture the birds. Regular contact will be maintained with the IAGNBI.

Specific objectives

(1) To perform an area survey. The selected area should have suitable foraging grounds, availability of nesting places (i.e. seashore 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) To implement different methods of releasing Northern Bald Ibis. Some of them using Cattle egrets (*Bubulcus ibis*) as "guide birds". To achieve husbandry and hand-rearing of nestlings under different conditions in captivity (see below).

(3) The monitoring of released bird by observation as well as radio-telemetry using terrestrial and satellite radio-transmitters.

(4) To release approximately 42 (between 30 – 40) birds per year (the exact number has to be discussed yet).

(5) Divulgation campaign with two main components: awareness on the status of the species and activation of ecotourism in the area.

(6) Communications.

(7) To organise an International Workshop (IAGNBI) for the species to be hold in Jerez in 2005.

(8) Trapping and capture of birds.

General methods

Study area.
Sierra El Retin (South-western Cádiz province) is a mountain area used by Spanish Navy as a training camp. This area presents clear benefits for the species: (1) seashore cliffs at "Parque Natural Pinar de la Breña y Acantilados de Barbate" where a large colony of Cattle Egrets (*Bubulcus ibis*) is now breeding; (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) climate is very good 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 that found in the current Moroccan population.

Origin and selection of the specimens.

Animals used in this project will come from the captive stock of the European Endangered Species Program (Christiane Boehm EEP coordinator) although mainly from ZooBotánico Jerez. Our population (N=50 to date February 2003) is operating since 1991. At the enclosure, all the animals are individually marked (metal and plastic rings), the social structure is stable and parental relationship is well established. In addition, it contains 5 out of 7 bloodlines, which are known to have in captivity. If necessary, specimens from other EEP captive populations could be used according to the EEP-coordinator.

Management conditions.
A total of 4 aviaries, each: 6 m (length) x 6 m (wide) x 4 m (high), 5x5 cm mesh, constructed of wire mesh on a metal framework with natural ground and one attached flying cage (18 x 4 m) will be built as enclosures. The back walls being a natural or artificial cliff; preferably oriented to northwest to avoid strong sun and wind exposure. Shelter, nesting ledges and platforms will be provided in the upper part of each aviary. On the ground a pond will be placed in the middle to allow drinking water and bathing. An external fence equipped with an "electric shepherd" will try to keep predators out of the enclosure.

The food, provided twice a day, consists of a mixed diet that included minced chicken with bones, calf heart and commercial food for insectivorous birds with multivitamins added. During the breeding season (February – July), mice, migratory locust (*Locusta migratoria*) and mealworms (*Tenebrio molitor*) will also complete the diet. Prior to the release of the birds, life preys such as crickets, locust, snails and mice will be use to favour foraging learning.

Veterinary procedures.
Those 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 offering appropriate conditions for this project. This captive population have been closely monitored since then and can be consider "in quarantine" over such a long period of time.
The aviaries built will be cleaned and carefully checked for possible foreign material which 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 (necropsy).

Methodology and releasing technique proposal:
The definitive releasing techniques are not established yet. We would like to discuss our proposal during the IAGNBI in Austria. Tentative methods and composition of birds to have in each aviary are as follows:

Aviary 1: A total of 9 Northern Bald Ibis (NBI) and 9 Cattle Egret (CE) chicks will be hand-raised to the fledging state (Thaler et al. 1992; Pegoraro and Thaler 1994; Kotrschal 2001). Later, food will be dropped on the nest and finally, to the aviary floor. Dead (at the beginning) and life preys (later) will be provided. These socially human imprinted birds will be released

together. The idea is that CE (a behaviourally flexible species) act as guiders of NBI on searching for food, roosting places and breeding sites at *La Janda* area.

Also a group of 9 hand-raised NBI will be released (according to the Thaler, Pegoraro and Kotrschal´s experiences) in order to compare these two hand-raised method.

Aviary 2: It will contain 6 NBI pairs. During the reproductive season, while the breeding pair nourishes their offspring, the female and one fledging will be released, leaving the male in the aviary. These birds will be moved to the flying cage two weeks prior releasing.

Aviary 3: A total of 6 NBI pairs. During the reproductive season, while the breeding pair nourishes their offspring, the male and one fledging will be released, leaving the female in the aviary. These birds will be moved to the flying cage two weeks prior releasing.

Aviary 4: A mixed group of 6 NBI pairs and 4 pairs of CE will stay during the whole Project. We hope that this group act as a reference point for released animals to favour site-attachment. Their offspring could be used as released birds if needed.

Previous experience of hand-raising NBI and CE in captivity
An experience on hand-raising a mixed group of 4 NBI and 6 CE was carried out last breeding season (April – July 2002) at ZooBotánico Jerez. These birds were hand-raised in captivity to assess the effects and consequences yielded from this experiment. The result of this experience was promising. There was neither abnormal behaviour nor aggression between species and were successfully integrated into the NBI captive population. At present these birds are kept in the NBI aviary at ZooBotánico Jerez to study relationship and sexual behaviour, especially next breeding season (2004).
It is planned to repeat the experience this year (2003) although with some modification: hand-raising a group of NBI and a group of CE in visual contact but separated groups.

Monitoring.
All the birds will be individually marked using standard aluminium ring plus a plastic colour ring with an alphanumeric code. Both terrestrial and satellite radio-transmitters will be used in some birds. Monitoring will start with the first released birds.

Trapping and capture of birds.
It is planned to capture the birds using different trapping methods once the project has finished: Bireçik´s technique (aviary), capture-cages, gun-nets, etc…

Planning.

1st year: March 2003 to March 2004.

- Habitat survey (field study). It has already started in *La Janda* area.
- Selection of the sites where to locate the aviaries.
- Diffusion and education campaigns, starting autumn 2003.

2nd year: March 2004 to March 2005.

- Diffusion campaigns.
- Building of aviaries and observatory.
- 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.

- Diffusion campaigns
- Release of birds and tracking. Behavioural studies.
- Evaluation of releasing methods.
- International workshop of the Northern Bald Ibis in Jerez (June or July 2005?).

4th year: March 2006 to March 2007.

- Diffusion campaigns
- Release and tracking. Behavioural studies.
- Evaluation of releasing methods.

5th year: March 2007 to March 2008.

- Diffusion campaigns
- Release and tracking. Behavioural studies.
- Evaluation of results. Reports writing.
- Capture of birds.
- Demolition of infrastructures made for the study.

Expected results.

To improve the knowledge of the species and to prepare an effective technique for releasing NBI from captive populations in order to establish a resident, stable, self-sustained and genetically viable population in the wild if it is necessary. We bear in main other indirect benefits such as economical development in the area, an increase of public awareness on endangered species conservation and increase coordination among the different sectors associated to the conservation of this species. Finally, we would like to stress that we are very confident about the results as other related species such as Eurasian spoonbill (*Platalea leucorodia*) and Glossy ibis (*Plegadis falcinellus*) have experienced an increment in southern Spain. Furthermore, other species with a similar foraging behaviour (e.g. White Stork *Ciconia ciconia* and Cattle Egret *Bubulcus ibis*) maintain relative high number of individuals in the area all the year around. In addition, ZooBotánico of Jerez has a broad experience in reproducing and rearing captive Northern Bald Ibis. In fact, our enclosure contains one of the biggest colonies for the species in captivity in with a remarkably sanitary control and high reproductive success every year. Furthermore, our veterinary (Dr. Miguel A. Quevedo) is a member of the IAGNBI. Our ZooBotánico also benefits from a Rehabilitation Centre of Wildlife (CRAS) for the local fauna, which is working since 1981. Finally, we have a great success on recovery and reintroduction

of other colonial species of birds in the wild, e.g. Eurasian spoonbills (*Platalea leucorodia*) EAZA News, 19, 1997 and Avocets (*Recurvirostra avosseta*) EAZA news, 41, 2003.

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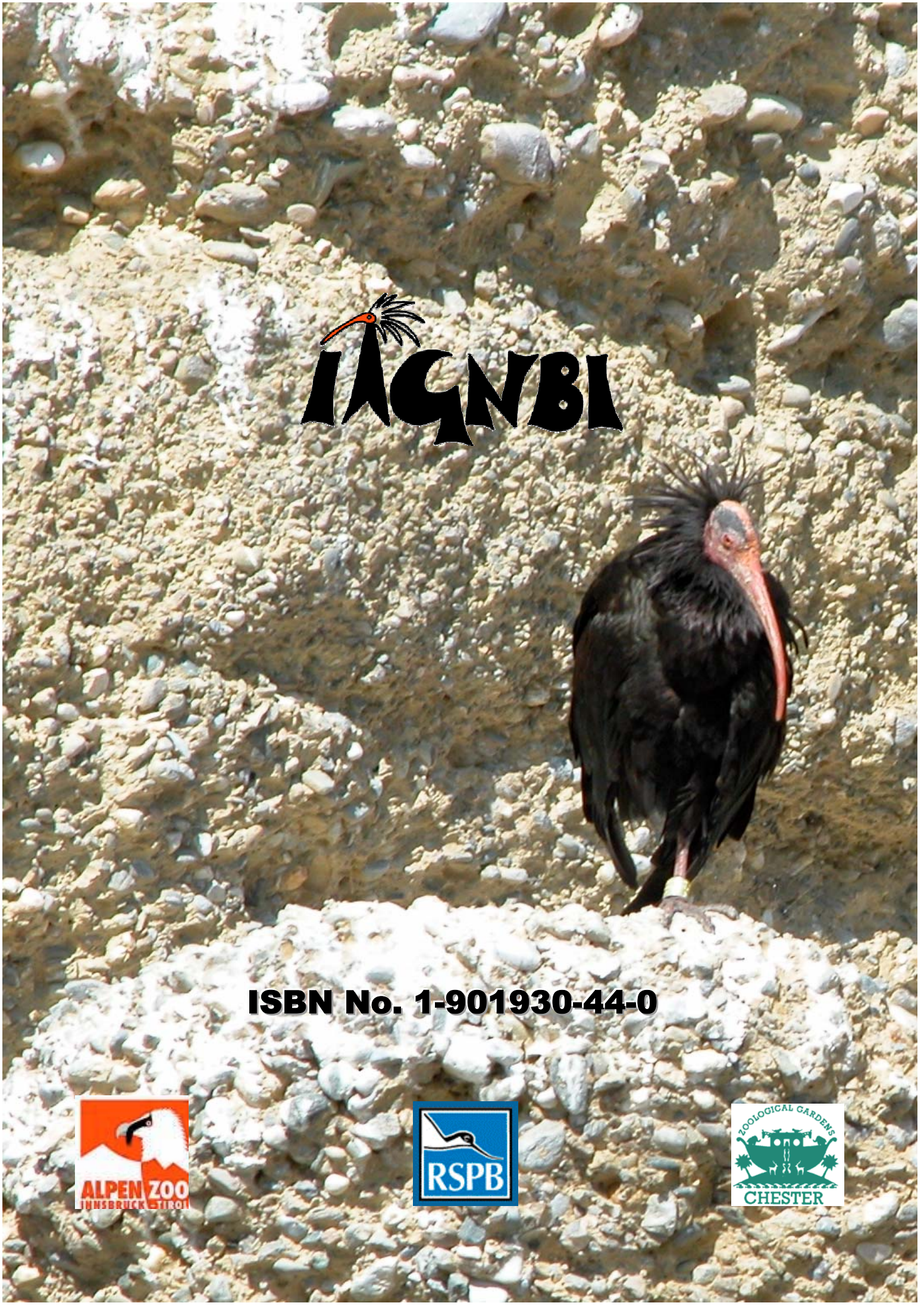

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