Northern Bald Ibis Conservation and Reintroduction workshop

2nd IAGNBI Meeting
Vejer 2006

IAGNBI

Eds. C. Boehm, C.G.R. Bowden, M. Jordan, C. King

Northern Bald Ibis
Conservation and Reintroduction Workshop

Proceedings of the International Advisory Group for the Northern Bald Ibis (IAGNBI) meeting Vejer, Spain September 2006

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Introduction

After the formation of IAGNBI in Agadir in 1999, and our first full meeting in Innsbruck in 2003, there was a clear need to meet again in 2006. The offer from Proyecto Eremita to host the meeting in Spain at Vejer, Andalusia was enthusiastically and gratefully received, and the excellent organisation and hospitality was much appreciated by everyone, making for a very productive few days.

The developments and progress for the species over the past three years has been exceptional. The consolidation of the Moroccan colonies and the Turkish semi-wild population gives a somewhat more secure basis upon which to build. The huge excitement of satellite tagging three Syrian birds this year, discovering the wintering quarters and the migration route is a major step that we feared might never have been fully established, and this brings new range countries into the frame, most notably Yemen and Ethiopia, further extending the challenge of IAGNBI's coordinating role! There has also been important progress with developing a technique to re-establish a migrating population, as well as the consolidation of methodology to establish a sedentary population.

The other key achievement since the Innsbruck meeting was the AEWA* Species Action Plan (SAP) meeting, held in Madrid in 2004, which was published in June 2006. This involved most IAGNBI members, but the major developments outlined above have meant that some of the priority actions outlined in the SAP were already in need of updating. The SAP was not only an important tool for the structuring of the second IAGNBI meeting, but once the project updates had been communicated, the subsequent sessions are reported here in a format that we hope will allow subsequent adoption by AEWA as an update to the SAP itself. We also took the opportunity to briefly review each of the major projects, offering suggestions to collectively coordinate our efforts towards the overall conservation objectives.
The range of interested parties is a diverse one, and it is a great tribute to all concerned that we have been able to pull ideas and expertise together in what we believe is a reasonably coherent way, and with the shared objective of collectively conserving such a distinct and compelling species.

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Reference
JIMINEZ ARMESTO, M.J., BOEHM, C. & C. BOWDEN (Ed.) (2006): International Single Species Action Plan for the Conservation of the Northern Bald Ibis *Geronticus eremita*. AEWA Technical Series No. 10 Bonn Germany. 55pp.

Participants list of the 2nd IAGNBI meeting

27th September – Ist October, 2006
Vejer de la Frontera, Spain

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IAGNBI its role and committee

IAGNBI was created on 12th March 1999 at the "International workshop on a strategy for the rehabilitation of the Northern Bald Ibis" held in Agadir, Morocco. The primary objectives of the committee were to ensure international co-ordination and co-operation on Northern Bald Ibis projects. A Species Action Plan meeting was held in Madrid in January 2004. The Species Action Plan was published in spring 2006.

Mission statement:

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

Terms of Reference for the IAGNBI

- Focusing attention on the priority conservation problems
- 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
- Acting as the implementing partner of the SAP for the NBI for AEWA (subject to AEWA agreement)
- 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
- Liaison with AEWA

Committee composition – 2006

Chris Bowden
Chair person/Research Biology

Christiane Boehm
Secretary / Captive population

Mike Jordan
IUCN / REINTRODUCTION

Cathy King
Captive population

Miguel Quevedo / Andrew Cunningham
Veterinary

Mohammed El Bekkay / Mohamed Ribi
Moroccan population

Taner Hatipoglu / Nurettin Özbağdatli
Turkish population

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Statement of the conservation priorities for the Northern Bald Ibis *Geronticus eremita*

1. An overview of the current status of the critically endangered wild population of Northern Bald Ibis (NBI) clearly shows the overriding importance of maintaining the Souss-Massa wild population (South-west Morocco) which is still subject to numerous threats and pressures. The population has however increased significantly and the chances of natural re-colonisation of former breeding sites in Morocco are increasing.

2. In 2002 a small colony of NBI was discovered in Syria. This population breeds successfully, but is still on the verge of extinction. It is the probably last remnant colony of the eastern population, and is migratory. Efforts to maintain this population and especially its protection from local hunting pressures at the breeding sites and along the migration route are immediate priorities.

3. In view of the fact that colonies in Syria have remained undetected until so recently, the urgent need to survey potential and former sites of the western (Morocco, Algeria) and eastern (Syria, Yemen, Iraq) populations for colonies is clear. Recent tracking results have shown that Yemen and Ethiopia are still important migrations and wintering sites, and it was agreed they should be considered NBI range countries for the purposes of IAGNBI.

4. An international Species Action Plan (SAP) for the NBI was published in May 2006. The implementation in the countries with existing colonies and along the migration route is urgent. The 1997 action plan for the conservation of NBI 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. Similarly, national action plans for Syria and Turkey will also be important to get more national engagement, and further steer actions for those countries.

5. Clearly defining the former distribution of NBI will affect consideration of introduction or reintroduction in the future. It is very likely that the species occurred quite widely around the Mediterranean in the past and historical site records can give us only an incomplete picture. This issue was not discussed further at the meeting, but will need further discussion relative to the IUCN guidelines for reintroduction. It was agreed at the previous meeting that local 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 Palmyra, Syria was reconsidered for the eventuality that there might be a further serious reduction in numbers. A disaster plan for Syria for 2007/2008 was discussed, and is outlined in this report. It is still considered inappropriate for the Souss-Massa and Morocco where the population is far bigger and is slowly increasing.

7. It is 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, is still necessary.

8. The importance of the semi-wild colony in Birecik is recognized. There is still an urgent need to improve standards of hygiene and husbandry in the aviaries. A target of increasing the population to 150 birds was agreed in 2003, before any attempts to use these birds in large scale release should be contemplated. Numbers have increased to 83, and it was agreed that small-scale release of selected tagged birds would be appropriate to discover their fate. Recommendations made at the meeting held in Birecik in November 2002 are still the main guideline for this population, and some updates are given in this report.

9. Work at Gruenau in Austria has shown that techniques are now available for establishing a sedentary free-flying colony. Similar techniques for establish migratory populations are not yet clear, although there is further progress 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 NBI.

10. A healthy, reproducing and well managed captive population of Western origin NBI 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. Reintroduction might be the main opportunity to increase the range of NBI in a significant manner although re-colonisation from the expanding wild population in Morocco is now becoming a very real possibility. Any reintroduction programme should have the goal of creating additional, self-sustaining wild populations of NBI. 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 reason for skin problems in captive NBI in a number of zoos, is still in need of clarification, and should be taken into consideration for any free-flying trials (no such birds should be used). It 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) in 1999 with the Terms of Reference given above.

Proposed review points for the 1st Species Action Plan for the Northern Bald Ibis (AEWA, 2006) – Updates agreed at 2nd IAGNBI meeting, Vejer 2006

The 1st Northern Bald Ibis Species Action Plan (SAP) was published in June 2006, as output from the Madrid meeting, January 2004. Given the significant advances and developments in the two and a half years since that meeting, and the opportunity that the IAGNBI meeting presents, we agreed that proposing SAP updates would be a valuable exercise. The SAP lists the main threats for adult and juvenile birds, breeding success and priority activities needed in the countries where the last wild Northern Bald Ibis occur. Updates to this document are seen to be entirely appropriate for a working document such as an SAP inevitably should be.

During the 2nd IAGNBI meeting held in Vejer de la Frontera during the 27th September – 1st October in 2006 the following comments, additions and revisions were made, and this report will be presented to AEWA for consideration to formalise these updates. We have also taken this opportunity to add some detail to the output from the original meeting, where time simply ran out for some of the later activities. In these cases it is more a case of adding the Agencies etc rather than any fundamental changes. In a limited number of cases, a comment is recorded below the activity, even where the text has otherwise not changed. These are for cases where particular emphasis was agreed upon.

ACTIVITIES (P. 37 in the NBI SAP): Activities which should be taken to conserve the wild Northern Bald Ibis population (**Morocco, Syria, Turkey,** wintering areas**: Yemen, Saudi Arabia Ethiopia,** and potential countries: **Algeria**) – [note the new countries added here]

5. A comprehensive health screening conducted on all birds prior to reintroduction or release (in all countries, even within Europe). ***

Activity	Agencies	Timescale	Cost
5.1 To establish a protocol of health screening for Northern Bald Ibis prior to reintroduction or release			
	IAGNBI, IOZ, Jerez Zoo, Veterinary Institutions.		
***NEW*:** 5.5 Any birds transferred to aviaries at experimental release project sites must also undergo full health screening, even if not destined for release.			
	IAGNBI, IOZ, Jerez Zoo, Veterinary Institutions, all	Ongoing	

	projects.		

7. A captive population maintained with health, inbreeding and age structure managed ***

Activity	Agencies	Timescale	Cost
7.4 Investigate other Northern Bald Ibis holders for the Eastern population and include these and Birecik birds within an organised international breeding programme framework			
	EAZA, IAGNBI, DD, Zoos (Ankara, ...)	2007	

8. The conservation of the Northern Bald Ibis through international coordination and cooperation promoted by the International Advisory Group for the Northern Bald Ibis (IAGNBI)

Activity	Agencies	Timescale	Cost
8.1 To obtain the endorsement of AEWA and other appropriate bodies for IAGNBI as the designated lead coordinating body.			
	IAGNBI, AEWA, IUCN SSC, BirdLife, RSPB	Ongoing	*
Comment – AEWA will forward its terms of reference to IAGNBI in order to confirm whether IAGNBI can work within these as the implementing partner for the SAP. It was noted that currently Syria and Algeria are an AEWA signatory, Morocco is hoping to become so soon, but Turkey, Yemen, and Ethiopia are not.			
8.2 To maintain IAGNBI as both a group of technical experts and governmental representatives from all current and future range states of the Northern Bald Ibis.			
	IAGNBI	Ongoing	*
Comment – IAGNBI was expanded to include the new countries considered to be of relevance in light of new information, Algeria, Yemen, Ethiopia, and appropriate representation will be included on the committee as needed.			
8.3 IAGNBI to promote the development of National Northern Bald Ibis action plans where appropriate			
	IAGNBI	March 2006	**
Comment - National action plans, MOR expected to be first, end of 2006 or soon after.			

10. Risk of infection disease reduced ***

Activity	Agencies	Timescale	Cost
10.1 Veterinary / post-mortem protocol assured for any sick or dead bird.			
Comment – protocols exist but are not always strictly adhered to			
	IAGNBI, IOZ, Jerez Zoo, veterinary institutions		
10.6 Douira poultry unit relocated			
Comment – In light of the recent H5N1 Avian Influenza outbreaks the Poultry farm in SM poses an increased hazard to the future of the NBI.			
	PNSM		
NEW: 10.7 Investigate which zoos have vaccinated their NBI and collate details of vaccines used and data on immunity inferred.			
	IOZ, EEP, vet inst.,		

	Min of Environment & Forestry (T)		

11. Risk of intoxication to be reduced * (Morocco, Syria, Turkey)**

Activity	Agencies	Timescale	Cost
11.1 Local farmers questioned about use of pesticides.			
Comment: Morocco / Algeria / Turkey: local farmers and supplies survey about use of pesticides and a list of products should be compiled (will reduce costs and time needed for testing if incident occurs)			
	PNSM, RSPB MLAE, SSWC, ICARDA Min of Environment & Forestry, IOZ, vet. Inst.	2006 July 2006	* **
11.2 Meetings with farmers, teachers, etc .to raise awareness of risks of pesticides used and demonstrate safe application methods.			
	PNSM, RSPB MLAE, SSWC, Min of Environment & Forestry, IOZ, DD, Min. of Agriculture, MIN, EAV,FOR,DD,AGR	2006 July 2006	**
11. 5 Maintain water-provisioning points near colonies (Morocco **and Syria**). [note inconsistent numbering in original document between countries could cause confusion here]			
	PNSM, MLAE, MAAR, veterinary institutions	March 2006	*
NEW: 11.8. Locust plagues - disaster plan needed (e.g. Control of that area by PNSM itself) – and considered for Syria and Turkey. List which locust control pesticides could be used, which would be most harmful for NBI			
	PNSM, MAAR, DD, Min of Env. (T)		
NEW 11.9. Investigate the use of compensatory payments for reduction of pesticide use in and around NBI foraging sites in Turkey (Turkey)			
	DD, Min of Env. (T)		

15. Buildings on or near to NBI breeding and feeding sites restricted. **

Activity	Agencies	Timescale	Cost
15.1. Stop illegal constructions of grottos at or near breeding and roosting sites			
Comment: - Buildings are effectively prohibited at current colonies in Morocco but further support from the authorities is required to enforce this crucially important protection.			
15.3 Develop a management plan for Tamri and Palmyra including for potential breeding sites in partnership with local communities.			

	MAAR, MLAE, SSCW, BLI / BLME, FIRDOS	2006	**
15.4 Initiate training and provide equipment for staff to implement management plans.			
Comment – community participation is the key to effective protection. Tamri protection status management plan needed—protected area			
	MAAR, MLAE, SSCW, BLI / BLME	2006	***
NEW: 15.5 Manage location of nomadic settlements around the Palmyra colony (Syria)			
	MAAR, MLAE, SSCW, BLI / BLME, FIRDOS	2006	**

17. Agriculture and grazing regimes maintained/altered to provide suitable feeding areas **

Activity	Agencies	Timescale	Cost
NEW: 17.4. Investigate land-use history of favoured feeding sites (All)			
	PNSM, DD, RSPB, SEO, MLAE, MAAR,		
NEW: 17.5. Educate farmers in the land use of the feeding sites, compatible with NBI needs ***Comment:*** Working with communities is key to maintain sustainable land use			
	PNSM, DD, RSPB, SEO, MLAE, MAAR,		
NEW: 17.6. Full support of local authorities needed to control the grazing activities of Western Sahara bussed in animals. (Morocco – Souss Massa)			
	PNSM, SEO		
NEW: 17.7. Encourage active management to improve and expand existing feeding sites			
	PNSM, DD, RSPB, SEO, MLAE, MAAR,		
NEW: 17.8. Document and map feeding areas (all, except Morocco), highlighting those regularly and intensively used.			
	DD, RSPB, SEO, MLAE, MAAR,		
NEW: 17.9. Evaluate the economic output of the areas which are used by the NBI			
	PNSM, DD, RSPB, SEO, MLAE, MAAR,		
NEW: 17.10 Investigate the feasibility of a labelling scheme to highlight produce from NBI friendly land.			
	PNSM, DD, RSPB, SEO, MLAE, MAAR,		

21. Disturbance by military firing range reduced. (suggested for MOR – Souss-Massa*) - not fully discussed at first meeting, **but agreed here and recommended action to move firing range. Propose changing it to 21. Serious disturbance reduced**

Activity	Agencies	Timescale	Cost
NEW: 21.1. Disturbance by firing range within PNSM reduced by relocating firing range			

	PNSM, SEO, RSPB, IAGNBI		
NEW: 21.2. Disturbance by human access and irregular activities to the breeding and feeding sites reduced. Wardens in the feeding/ breeding area for humans (including "birders")			
	PNSM, DD, RSPB, SEO, MLAE, MAAR,		

***NEW*: 22. Develop a contingency plan to prepare for catastrophic events affecting NBI mortality or breeding.**

Activity	Agencies	Timescale	Cost
NEW: 22.1 Syria supplementation (see workshop report chapter 4)			
	IAGNBI, MAAR, DD, RSPB, BLME,		
NEW: 22.1 Avian flu			
	All incl. Vet institutions		
NEW: 22.3. Disaster fund needed, organisations which could help			
	IAGNBI		
NEW: 22.4 Locust plague if current precautions not effective in preventing major ibis mortality			
	PNSM, other?		
NEW: 22.5. Captive population (back up) for Syria and Souss Massa			

NEW: 23: Action plan tables should be produced for Yemen, Ethiopia and Algeria. Potential threats must be identified in the new countries (Yemen, Saudi Arabia, Ethiopia). ***

Note: Breeding information table (SAP NBI p.13) needs to be updated to include Saudi Arabia, Yemen, and Ethiopia as non-breeding visitor countries, with relevant months assigned (July, July-August, August-February respectively). These countries are not an AEWA signatory. Their recruitment should be an activity in the respective action plans.

For the following two results, we wish to put on record that there were lengthy discussions on whether we should increase the priority to ***, and although this was not a clear conclusion, at least some record of this is felt relevant.

4. The level of genetic variation within the captive, semi-wild and wild populations assessed **

9. Techniques for the establishment of new colonies by reintroduction investigated **

Acronyms

AEWA	Agreement on the Conservation of African-Eurasian Migratory Waterbirds
BLI	BirdLife International
BLME	BirdLife Middle EAST
DD	Doğa Derneği Society (BirdLife Turkey)
EAV	

EAZA	European Association for Zoos and Aquaria
EEP	European Endangered Species Program
FIRDOS	Fund for integrated Rural Development of Syria
FOR	
ICARDA	International Center for Agricultural research in the Dry Areas
IAGNBI	International Advisory Group for the Northern Bald Ibis
IOZ	Institute of Zoology (research division of the Zoological Society of London)
IUCN SSC	The World Conservation Union Species Survival Commission
MAAR	Ministry of Agriculture and Agrarian Reform, Syria
MLAE	Ministry of Local Affairs and Environment , Turkey
PNSM	Parc National Souss- Massa, Morocco
RSPB	The Royal Society for the Protection of Birds; United Kingdom
SEO	Sociedad Española de Ornitologia, Spain
SSWC	Syrian Society for Conservation of Wildlife, Syria

Reference

JIMENEZ ARMESTO, M.J., BOEHM, C. & BOWDEN, C. (Compilers, 2006): International Single Species Action Plan for the Conservation of the Northern Bald Ibis Geronticus eremita. AEWA Technical, Series No. 10. Bonn, Germany.

Review on the status of the different Northern Bald Ibis projects: Status, Aims, Feedback and Research needed

Reintroduction of the NBI has been discussed as a tool to establish new Northern Bald Ibis (*Geronticus eremita*, NBI) colonies in the recent breeding range since the breeding success of the captive population started to be well and numerous. Unfortunately a promising method to establish a self-sustaining migrating colony does not yet exist. After first trials (Tel Aviv in 1982: MENDELSSOHN 1994) and disappointing attempts in Birecik (AKÇAKAYA 1992, ARIHAN 1999) a pilot project with hand reared 6 birds in 1991 was started (THALER et al 1992, 1993). Although the socialisation with hand rearing of birds worked well, juvenile dispersal soon after fledging turned out to be a crucial problem. Since then four different projects have started and are working further on developing a technique to successfully release this extremely social and sensitive bird species.

PROJECTS

Konrad Lorenz Forschungsstelle; Austria: project started in 1997; The colony is free flying, tame and started to breed in 2000. Altogether the colony counts now 34 birds in 2006. In 2005 the birds were not fed during spring for 3 month, additional feeding started again in September. Studies are focusing on hormones and behaviour, natural foraging and scrounging. The plan for 2007 is to split the colony and to test how the transferred birds cope with this new situation.

waldrappteam.at, Austria: started in 2002; Guided by motor-trikes, aviated by imprint contact-persons, hand reared birds are guided on a migration route; In 2004 a successful migration was carried out. The birds were guided to a potential wintering area in Grosetto, Italy. They stayed there over winter and were observed throughout the whole winter. In April 2005 the additional feeding was stopped, the birds were left for themselves. In spring 2005 the birds left the Grosetto-area and there were some reports of consecutive sightings at different locations in Northern Italy. The birds flew back to Grosetto in early summer. In spring 2006 again 5 birds left Grosetto and 2 found the way up North to Carinthia. So there are some hopes that the birds will migrate again in spring 2007 when the reach the possible breeding age. The birds of 2003 and 2004 are kept as a sedentary, half-year free flying group in Tierpark Rossegg, Carinthia.

Proyecto eremita, Spain: started in 2003; Birds were hand reared birds (one group together with Cattle egrets *Bubulcus ibis*). They were released in the remote area of El Retin. In 2004 a smaller group of young parent reared birds were incorporated into the group when the birds had to be kept in the aviary during the dispersal period. The birds were released and are free flying in the release area of El Retin. This method was carried on in 2005 and 2006. In 2005 and 2006, respectively, 2 and 14 birds left the area and nothing is known about their whereabouts. One ringed birds was seen in the Middle Atlas, Morocco in 2005.

Bschar el Kh-ir project, Morocco: This project started in 1999/2000. At the beginning 10 birds were brought into the newly erected aviary close to Taza. The birds have bred successfully but the offspring were lost during the following (obviously too severe) winters. In 2004 and 2004 the birds have bred again but all hatchling died within few days. Due to change in diet the birds bred successfully in 2006 and now there are 19 birds (13 adults and 6 juveniles).

Birecik Breeding centre, Turkey: In 2006 there are 83 birds (all ringed since 2002) in the breeding Centre of Birecik. The Birecik birds are released every year in spring to breed outside and are brought back inside the two aviaries of the Breeding Centre in July/August. There are about 20 breeding pairs. As far as the Birecik management reports the main target for future years is to have a breeding group of 150 birds.

STATUS, CLAIMED AIMS, GAPS AND RESEARCH NEEDED OF THE PROJECTS

During the meeting a review on each project was made given. After the projects presentations each project holder outlined their status and the acquired experiences. The next targets for each project were given.
Different options, work and research needed and obvious gaps were discussed. The following points were found as the main gaps with the research needed (the parties which could carry out the work are given in parentheses):

For **sedentary colonies**:

1. a supplementation/Integration into existing colonies (KLF, Proyecto Eremita)
2. to define the number of seasons required to effect (reduce) migration tendency (Proyecto Eremita, KLF, Rosegg colony, Birecik)
3. how to attract a free flying NBI group to natural nests sites/ new breeding sites Proyecto Eremita, waldrappteam.at)
4. to move a well adapted free flying colony to another area (Proyecto Eremita, waldrappteam.at)
5. colony splitting: building up a meta population of linked colonies (KLF)
6. genetic screening for the Eastern and Western population of the NBI (waldrappteam.at, KLF, EEP)

For **migratory and wild colonies**

1. to continue research on the NBI migration behaviour (Syria, Souss Massa waldrappteam.at, Birecik)
2. integration of birds in a migrating group (Syria, KLF, waldrappteam.at)

Within the table the status, aims and gaps are listed for each project:

PROJECT	STATUS	CLAIMED AIMS	Gaps & work/research needed (claimed by IAGNBI)
Konrad Lorenz Forschungsstelle	➢ a free-flying, reproducing sedentary NBI colony which is increasing ➢ birds are tame and can be taken into the aviary when necessary	• To continue a minimal management and to monitor the colony development • To continue basic research on social mechanism, etc. • 1 Experiment / year: supplementation with fledged birds of other zoos • colony splitting (when number of NBI >40)	• better health screening at least basic • Impact of the species in the trial area has to be assessed • not a self sustaining group (has to be fed in winter) • not an introduction at the moment • Number of seasons required to effect (reduce) migration tendency • Colony splitting of meta population of linked colonies
Waldrappteam.at	➢ a free flying group of NBI which learned a migration route ➢ increased knowledge about NBI migration pattern ➢ increased knowledge about NBI hand rearing and social capability	• To continue to establish a migratory population • To continue the research for the movements of the basics of migration behaviour of the NBI based in Italy • Research on the feeding ecology (hopefully published soon) • supplementation once colony established • Genetics of the NBI • Adding birds (f) to the returning (!!) colony	• Are there easier ways than with motor trikes?? • Usable method for the Middle East? • When the NBI returns – would it be an introduction (5 years)? • Adding birds into the group = destabilisation in the first year • How to attract the birds to natural nests sites/ new breeding sites • trials of colony moving • to integrate birds in an already migrating group

Proyecto eremita: Proycto eremita	➢ Partial free- flying NBI group ➢ trials of different methods to create a sedentary (natural moving) colony	• To comparing the release techniques under the view of minimizing the costs • To evaluate the ecological needs in the El Retin area • to establish a method to create a sedentary, natural moving colony • to finish the project in 2008 (unless further agreements) • to take the NBI back into captivity	• Very short time schedule, which might cause pressure • Too many experiments in too short time, results are hard to interpret • More contact with the NBI concerned Moroccan authorities • Concern about the disappeared NBI and there whereabouts (potential disease transfer, behavioural & genetic input to the wild colonies) • Supplementation / Inte-gration into existing colonies • Number of seasons required to effect (reduce) migration tendency • How to attract the birds new breeding sites • trials of colony moving
Bschar el Kh-ir project	➢ Colony of 19 NBI, successful breeding since 2006	• IAGNBI evaluation, visit in November 2006 (not done?) • Re-define objects (?) • emphasis health screening	• Lack of contact • integrate the project into the new plan of the National Action Plan of Morocco for the NBI

Birecik Breeding Centre:	➢ preserving the last big in-situ colony of the eastern NBI population ➢ a breeding, sedentary, half-wild managed NBI colony	• To evaluate and improve husbandry and monitoring issues • To tag birds to follow movements (dispersal) • Note which living birds might have migrated (old pair >24 years and their offspring) in 2007 • To establish a migratory colony • To build up a zoo population (creating an NBI Eastern population studbook)	• To clarify the status of the Birecik colony (wild-or semi wild) • For a release in 2007: 1) Satellite tagging is crucial 2) to limit the number of released birds 3) risk evaluation for the Syrian birds, 4) prevent contact when Syrian colony is breeding • Contact with the Ministry for building up a zoo population • Avian Flu: clarifying what is necessary on the national basis • Number of seasons required to effect (reduce) migration tendency

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Research priorities for the wild colonies

Movement and Migration

Syria:
Continue to monitor existing tagged adult bird(s); to satellite tag a sub-adult or a juvenile, preferably in the wintering grounds (Ethiopia or Yemen?) or near the breeding colony if feasible;

Morocco/ North Africa:
Satellite tagging to monitor juvenile and adult dispersal and possible establishment of new wintering/breeding areas
Consider ringing and VHF radio tagging (much cheaper) of larger sample in Morocco with intensive follow-up to investigate foraging areas/habitats, find new roost sites and, in the long term, determine survival rates.

Turkey:
Satellite tagging of sample of Birecik birds which are allowed to disperse to discover their movements and fate

Notes: Satellite tagging is proving to be an exceptionally good tool to understand movements and migration, and has potential application for Morocco, Syria and Turkey. They cost 3000 € for the tag; plus c.100 € /month for ARGOS satellite use, which work for up to 3 years or until removed. Devices are now reliable. Attachment methods for Northern Bald Ibis have been developed and tested and birds can be safely trapped away from nest sites (but near the breeding colonies).

Foraging habitat use:

Projects on both the wild and experimental release birds to look at landscape/habitat usage, the history and management of favoured feeding areas, diet and available prey base; Build links between all projects to ensure that data are collected in a consistent way to allow comparison of data between wild and release project birds

Genetics - in urgent need of review

Look at genetic variability within captive and wild populations; Examine difference between the eastern and western populations and also look in detail at the Turkish and Syrian populations.

Surveying old /potential breeding / wintering sites

(with some ranking of their priority: (1=highest priority, 7 = lower, but still needed)

Morocco- Atlas & Middle Atlas (1), Coast (2), South (5)
Algeria: Plateau (5), Atlas (3)
Iraq- NW (4),
Yemen (5)
Somalia (5)
Syria (5)
Eritrea (6)
Turkey (7)
Saudi Arabia (7)

Release methodology – Update on the current state of knowledge

Release guidelines for the Northern Bald Ibis were given in the Northern Bald Ibis Conservation and Reintroduction workshop report (BOEHM, BOWDEN & JORDAN 2003). There it was agreed that the Northern Bald Ibis is a species with a highly complex social structure with many elements being passed on from generation to generation. Only young birds have the ability to learn and accommodate to new structures and environment. Older birds cope poorly with transfers and new environments. So the release of young birds seems to be the only promising method and a release of a socially bonded group is considered important.

1 Genetic attributes

The captive population is essentially derived from the western (Moroccan) population of the NBI and is going back to imports of about 150 birds in the early 1960s (see page 75). For a release project, genetically unrelated birds should be selected.

2 Health screening

There already exists a health protocol for the NBI (Kirkwood & Quevedo 1999) and this should be updated each year. Health screening should be obligatory for any bird that is used for a project or any colony moving. The protocol should be used also for the colonies that provide chicks and/or eggs for a project. Health screening is necessary as long as a project is running and samples of birds can be taken. Special care should be taken in nutrition, e.g. the feeding of day-old chicks can cause severe problems (salmonellosis).

3 Identification/marking of project birds

Identification marks for all project birds should be obligatory. Most important is the permanent individual identification mark for each project bird, especially for cases when one gets lost. The different methods are dependent on the questions involved, costs and the risks which free flying birds might present (closeness to wild colonies: Spain, Morocco, Birecik)

Rings: For the visual identification colour rings with colour codes for each bird (Darvic, aluminium) have proved best. They are easy to observe and individual identities can be reported by local birders as well if a bird moves farther away.

Radio transmitters: Radio tracking is the best tool for movements of birds that are part of a sedentary colony. Radio transmitters are much cheaper than satellite tags and can answer important questions of local movements, use of foraging sites, group composition, etc.

Satellite tags: Birds which will potentially leave a project area because there will no enclosing in during the dispersal period or which are part of a release trial should be tagged with satellite tags. Only satellite tags can give reliable information on long distance movements and the bird's whereabouts.

4 Hand rearing method (a key tool for initial establishment of a population)

Releases of adult birds have been unsuccessful, leading to disorientated birds getting lost or dying (MENDELSSOHN 1994)), whereas releases of hand reared, guided young birds (THALER et al. 1992,1993; KOTRSCHAL 1999, 2001, 2004) have led to free flying, however until now only to sedentary colonies. This means that so far only hand reared and guided NBI chicks have successfully formed a free flying NBI colony. There were several fundamental considerations involved in the development of the hand rearing method:

1) **Age:** It is only possible to build up a good and intense contact to a NBI chick, age seems to be crucial. A NBI chicks should not be older the 10days. As rearing of newly hatched chicks is methodologically more difficult the best age is 3-4 days after hatching.
2) **Intense social contact:** The NBI is a highly social species; contact between parent and its chicks is intense and very close. Parents have direct contact with their chicks over 1-2 years, e.g. preening of their offspring even when older than one year. Therefore intense social contact when hand rearing a NBI chick is crucial. No or very poor contact leads to behavioural deprivations of the bird.
3) **Social contact**: Within the *Proyecto Eremita* a time-saving method is being tested: Human foster parents wear black shirts and Ibis shaped helmets to be recognizable for the chicks as "parents". The chicks follow and approach only these "parents" and can be handled and caught. The chicks avoid contact with other humans.
4) **Hand rearing guidelines**: Huge knowledge is available on how to hand rear an NBI chick. There is a short overview of methods and problems of hand rearing (BOEHM 2006) but general guidelines and further details are needed in a published form.

5 Establishing a sedentary colony

A method has been developed to establish a sedentary colony. The experience of the Gruenau project (KLF) has proved to that with hand rearing, close management and enclosing during the dispersal period (July-September) for 3-4 years, the NBI establishes a tradition to stay within a restricted area, using nearby foraging areas. This NBI colony has bred successfully over the past 5 years and the offspring of the colony maintained the tradition of not migrating. (see details below).

Post fledging management

The parent-offspring relation ship in the NBI is very intense. It lasts for more than a year and even after the first year offspring sit close to their parents and are preened by them. Young NBI are guided to foraging sites, roosting sites and probably learn to avoid enemies and dangerous situations. It is fully established but probably the ranking within a group is dependent on the offspring-parent rank as well.

This illustrates why hand reared juveniles have to have such intense contact to their foster human parents, in addition to avoiding social deprivation. The close contact makes it possible to guide the birds to suitable foraging and roost sites and to enclose them when necessary. How long the post-fledging management should last is in need of further testing

Colony size
Hand rearing is an extremely time consuming and expensive method to get a tame and manageable NBI colony. We know that juveniles born within a group easily take over the group traditions. From the experience in Gruenau, hand rearing could be terminated when the group size reaches 20 birds (KOTRSCHAL 2004). A colony with 20-30 birds should therefore be a minimum.

6 Establishing a migratory population

So far, a migrating colony of NBI has not been successfully established. Two "migrations" of the waldrappteam.at with hand reared and high individually managed birds haven been done. It has been shown that the birds follow their foster human parent on motor trikes and that they have survived in the chosen wintering area. The following spring some birds (unguided) migrated north and more or less followed the route which was taken on the way south. The highest deviation of the migration route was 91km, but most of the birds stayed close to the way they had taken the year before.
The targets reached so far are:

- Partial establishing of a migration route , birds followed the trikes
- Distance seems not to be a problem for the birds, it would be more a technical problem for the microlites
- The NBI seems quite adaptable in the wintering area. The birds explored the wintering area and found adequate foraging areas by themselves. However note that the birds have been young.

Establishing a migrating tradition in an NBI group however still faces unsolved problems and challenges:

- The costs and logistics for establishing a migrating colony are very high
- High individual attention and management is necessary for each bird
- Only a small group of 10-12 birds per foster parent is possible
- Breeding sites for when the birds come back have to be found and the birds need to recognise them
- The birds have not yet found their own way back to the start point (but this may take further time?)

7 Supplementation and Integration

Wild colonies
Supplementation is currently regarded as a difficult and/or impossible tool to enlarge an existing wild colony and has not been successfully tested. Experiences in Birecik have shown that birds from a different colony do not integrate with another group, but can cause serious disruption. The situation of the small wild colony in Syria is critical so the idea of supplementation with young birds has been seriously discussed (see p. 22). The main problems and considerations recognised so far are as follows:

1. The NBI is a species having an intense and complex social structure. The challenge is how added birds can be integrated into an established colony. Integration is the key for picking up the group's traditions and patterns in foraging sites or migrating.
2. Supplementation during the breeding period seems to be highly risky for the breeding success of the colony. So supplementation is only advisable after the chicks are fledged. This leaves a very short time span between fledging and the start of migration (3 weeks).

3. Adding birds in the wintering ground would be difficult in Ethiopia but is in any case not advisable. Experiences of the waldrappteam.at have shown that added birds in the wintering area in Grosetto, Italy did not integrate. There is evidence that if the birds have not undergone the outward journey themselves, they will not successfully find their way back, and could even risk disrupting the course of other birds if they did integrate and are dominant.
4. Only young birds seem to have the chance to integrate, therefore only young birds should be added. One untested question is how the young birds which normally have very close contact to their parents during the post-fledgling period would cope with the situation of a transfer, new environment and migrating.
5. A further complication has emerged that there is growing evidence that juveniles probably winter in separate areas from the adults. (This was true for juvenile birds in Morocco in 1989, PEGORARO)
6. Ideas for a supplementation are in the emergency plan for Syria (see p 31).

(A follow-up suggestion by Johannes Fritz and his team may well offer better likelihood of success, and seems worthwhile recording here - although would involve a further delay to set this up: to hand rear a group of Turkish birds, have them highly individually managed. They should be free flying knowing how to find food for themselves. When they have bred, take them and their offspring to Palmyra (probably in June) that they get to know that area. They should be brought to the Syrian colony when the Syrian birds have bred and their chicks have fledged. Then take away the hand-reared parents and leave the young ones close to the Syrian birds. By "losing" their parents they probably would join the Syrian birds.
The advantage would be that they do not face too many new things alone like transfer, new location new birds. They would know the area, be guided by their parents but then just "loose" their parents and the shock would be minimised.
A key disadvantage of this suggestion is that we have to wait longer because first there has to be established a tame, guided group of Turkish birds.)

Project colonies

Juveniles born into a hand-reared group take up the specific traditions of the group, like foraging grounds and roost sites (KLF project, Rosegg free flying group). So this is a natural integration of non tame birds into a group. Supplementation in a project group has been done with older birds in Gruenau, but unfortunately they did not survive the next year. Proyecto Eremita has added one year old and older birds. In the aviary, there was no separation within the groups. After releasing the birds, the added birds followed the group but none of the birds survived more than 6 months. In captivity only young birds seem to integrate well into a new colony.
Juveniles of the Gruenau group however joined for a longer period the hand reared free-flying group of the Waldrappteam.at which were locally close but managed separately from the Gruenau group. A few of the juveniles followed the Waldrappteam.at birds on their migration trip for some days. So it does seem likely that integration of juvenile NBI´s to a colony is possible. Although experience shows that within a juvenile group there is much instability in time pattern and movements, further experiments should be carried out on how, when and how many juveniles or sub adults (hand reared or parent reared) can be integrated into a group.
Questions that need to be answered are:

1) age: at what age can young birds be integrated to a group?
    a. How long do they have to be independent (2-4 weeks)
    b. Are the birds still capable of integrating when 2-3 years old

c. How should the success of integration be measured: surviving longer than one year? Forming a breeding pair with one of the group?

2) number of birds that can potentially be integrated: the number of birds should not out number the size of the colony as their tradition or with young birds their instability in movements could take over. Therefore not more than half or preferably 1/3 of the group number should be added.

8 Moving a colony and colony splitting

The Birecik colony was moved in the early 1970s. The breeding pairs had to be moved due to road and housing construction. This led to a breakdown of the colony, and finally in the collapse of the wild colony in 1992. So a method for how, when and if a NBI colony can be successfully moved is still lacking. It currently seems that a wild colony cannot be moved without destroying it.

Colony moving would be a transfer of a whole colony of NBI (minimum 7-10 birds), whereas colony splitting would be separating a group (of well accustomed free-flying colony) and transferring them to another location. The method for both would be the same. The NBI to be moved would however have to be a well managed, tame and free flying group. This has been partially done with hand-reared birds of the Waldrappteam.at project already. The birds of 2003 and 2004, which were hand-reared, were settled in an aviary in Tierpark Rossegg and were left free flying very soon after. They started to breed in the 2nd year. The birds have been managed and were "guided" by one of the human foster parents. No losses were documented and the birds have coped well with the transfer. Plans exist that part of the free flying sedentary colony of Gruenau, which has birds which are no longer hand reared, will be moved more than 100km from their actual site to see how they cope with such a translocation.

Potential nest sites should be in the area where the birds are settled. Accurate natural sites should be checked and probably adapted for the NBI use.

9 Migration and/or dispersal period

All projects with hand reared NBI chicks have lost significant numbers of birds due to the dispersal behaviour, soon (3 weeks) after fledging. In Gruenau, the birds were taken into an aviary during this post fledgling period to prevent dispersal. After 3-4 years the KLF colony does not have any tendency to migrate any more, and the enclosure is no longer necessary. (Similar is known of White storks, which became sedentary when they are enclosed over a period 3 years). Even the juveniles born into that colony stay with the group, despite the fact that they are not closed in now close after fledging (KLF).

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Emergency plan for SYRIA: What should be done and when?

It was agreed that in the event of a further serious decline, e.g. only one breeding pair returning to the breeding site (but still to be agreed in consultation with IAGNBI when full circumstances arise), we should take the opportunity as a group, to agree on the actions needed - to avoid a panic reaction at the time, and to prompt other related actions to be taken beforehand in preparation for this eventuality.

Supplementation

Objective would be to supplement the wild birds with 1-2 parent-reared Birecik juveniles if agreed that we are in to emergency action. This would definitely not more than two birds, due to serious risk that more birds would be likely to disrupt the movements of the wild birds, and social integration would be less likely. It is possible that just one bird may be added, and this would be decided only at the time.
Plans for this action (e.g. transportation, etc) would be further refined by GS, LP, CGRB, KS in full consultation with IAGNBI, Syrian Ministry, Turkish Ministry etc.

Preparatory actions

Preparatory actions needed in any case to make the above action possible within the time available. Contact with experienced wildlife vet within the region (Immediately)
Contact meetings held with authorities in Turkey beforehand (i.e. by Jan 07?)
Contact meetings held with authorities in Syria beforehand (i.e. by Jan 07?)
CITES permissions prepared beforehand in both Syria and Turkey (i.e. by April 07? But preparations immediately)
Clarify how synchronous the egg-laying is between Birecik & Syria (immediately)
Improved husbandry at Birecik, and particularly close monitoring of appropriate nestlings to be used (should be selected to have a weak social bond between them, so that they will bond with wild birds and not just one another). (agree and plan immediately)

Societies involved

BirdLife Middle East
Ministry Syria
Ministry Turkey
Doga Dernegi (nature conservation)
Syrian **S**ociety for **C**onservation of **W**ildlife (SSCW)
Royal **S**ociety for the **P**rotection of **B**irds (RSBP)
Gianluca Serra, Lubomir Peske
International **A**dvisory **G**roup for the **N**orthern **B**ald **I**bis (IAGNBI)

Northern Bald Ibis Conservation Project in Souss Massa region

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The Northern Bald Ibis conservation project in the Souss Massa region was initialized in 1993. The Royal Society for the Protection of Birds (RSPB) and the Sociedad Espanola de Ornitologia (SEO) are funding the project. The Souss Massa National Park (PNSM), with the collaboration of RSPB and SEO are responsible for the field activities.

The project aim is to rehabilitate the Northern Bald Ibis population in Souss Massa region by the following actions:

- To conserve the breeding sites of the NBI
- To save the feeding areas
- To save the known and potential roosting sites
- To prevent the accidental mortality
- To ameliorate the breeding success
- To convince the local people and farmer of the benefits of the NBI conservation
- To integrate the NBI conservation in an ecotourism conception of Souss Massa NP

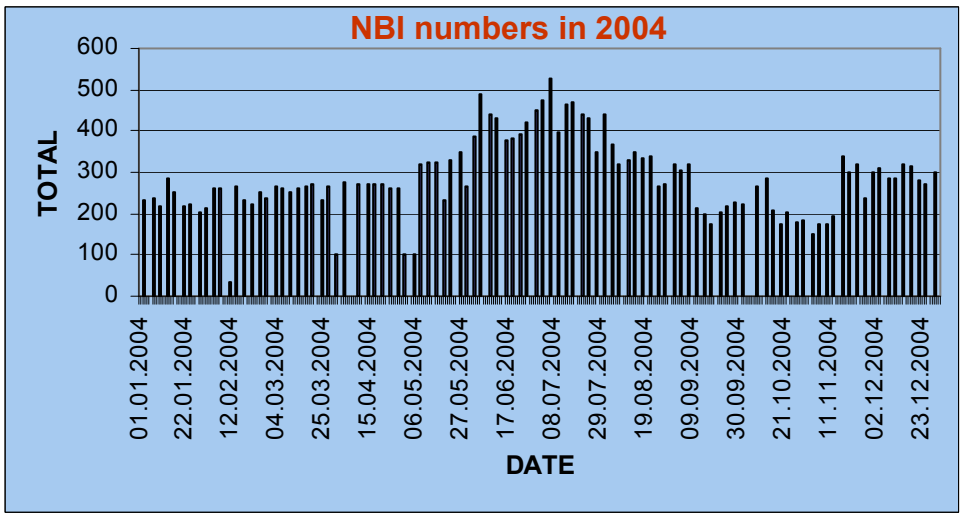
The project had several phases since its beginning:

1. 1993 – 1996: a convention was signed between Eaux and Forest Administration and the program Committee for the Nature Conservation (CPCN);
2. 1997 – 2000: a national action plan was established based on the observations made between 1993-1996, and a convention was signed between Eaux and Forest Administration and BirdLife International
3. 2000 - present: unfortunately many actions of the national action plan are being delayed because of lack of financial support

Northern Bald Ibis Population

Sedentary population

All NBI are counted twice a week, every Wednesday and Saturday, at their well known roosting sites. Most of the NBI seems to be resident around Agadir region the whole year through and is not migratory (Fig.1).



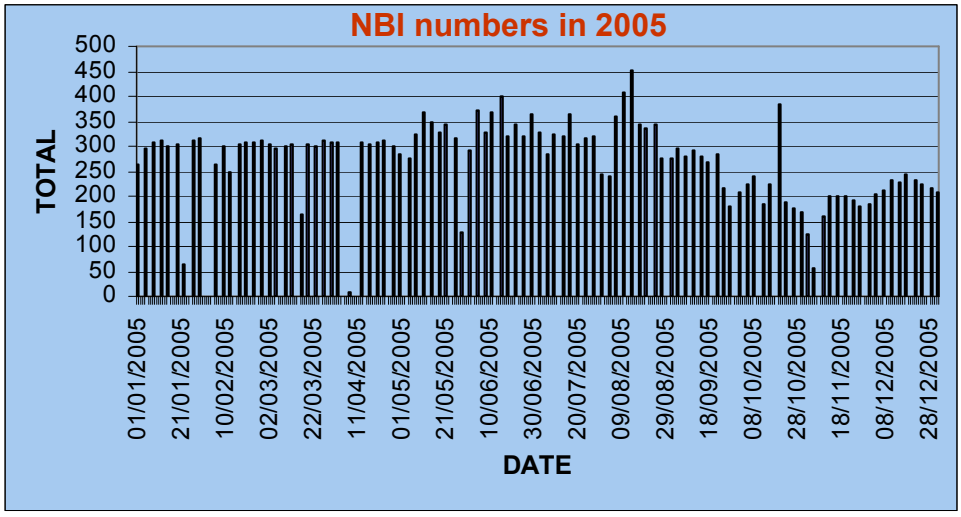


Fig: 1: number of NBI counted twice a week at their roosting sites 2004 and 2005

Population development

The number of breeding pairs has increased steadily since the census began in 1993. The reasons for the increase are:

High Breeding success: The number of fledglings varies a lot between the years. However, more than one chick fledged out of each nest every third year in the colony of Tamri breeding site, and there has been a high breeding success in Souss Massa NP every fifth year (Table 1).

Year	Massa	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 1: number of juveniles fledged per nest from 1994-2002

Predators: In Souss Massa NP no predation (e.g. by ravens) could be observed. In colony of Tamri we observed in 2006 7 cormorants which tried to take over some NBI nests and have bred there.

***Artificial water points*:** Lack of water seems to be a crucial problem for the breeding NBI. Breeding birds searching for water are absent from the nest for long periods, which appears to be lethal for the chicks, especially younger ones. We have provided at least one artificial water point close to each NBI breeding colony since 2003 to decrease the time the parents need to be absent from the nests These water points are small holes which are inaccessible to goats and sheep. The number of breeding pairs and the breeding success has increased remarkably since water provisioning was initiated (Table 2).

Year	Number of breeding pairs	Number of chicks fledged	n chicks per nest
1994	65	67	1,03
1995	74	73	0,98
1996	77	58	0,75
1997	59	50	0,84
1998	62	78	1,25
1999	60	83	1,38
2000	65	106	1,63
2001	66	42	0,63
2002	73	62	0,84
2003	90	110	1,22
2004	94	167	1,77
2005	92	112	1,22
2006	95	105	1,1

Table 2: Breeding performance of the NBI in the Souss Massa region 1994-2006

Post nuptial dispersion survey

The NBI are counted twice each week (see Fig.2). There is distinct difference between the number of the birds counted before and after the breeding season. We think that some Ibises might disperse to other sites in Morocco especially when there has been a sighting of 14 unringed NBI in the Middle Atlas in 2004. Therefore in 2004 the Souss Massa National Park and SEO/BirdLife team decided to catch and satellite tag some birds of the Souss Massa

population. Three NBI were caught and ringed and supplied with a satellite transmitter. Unfortunately, these birds did not leave the National Park and so far we did not learn something about the post nuptial movements. We will however continue to ring and tag birds in the future.

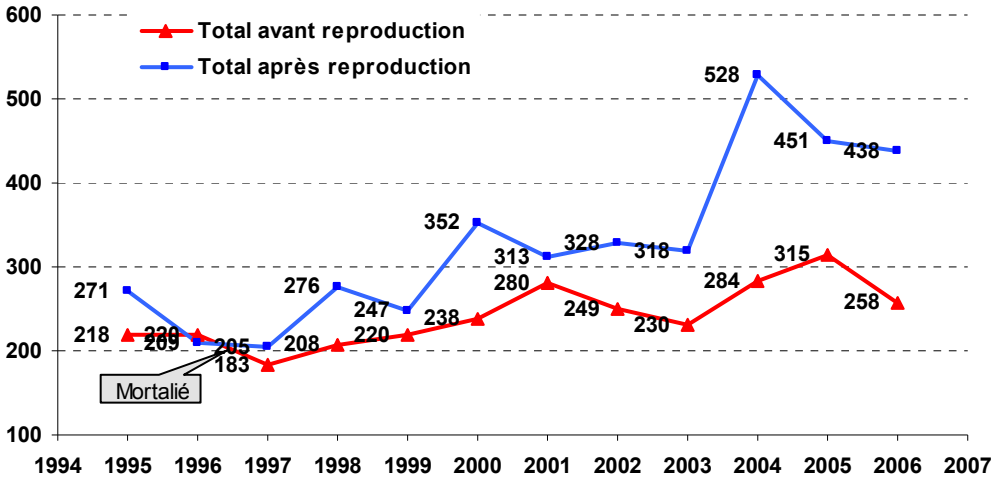


Fig.2: Counts of the NBI in Souss Massa NP before and after the breeding season 1995-2006

Feeding survey

During 1994 - 2006 feeding surveys of the NBI have been made. The data are implemented in the MapInfo data base of the National Park. This allows us to confirm the importance of the PNSM site as feeding grounds for the NBI.

Feeding study

A calibration experiment was performed to learn more about the diet of the NBI. First the faeces of captive birds of Temara Zoo, Morocco were collected to develop a method to identify fragments of common prey items. We can then reconstruct the daily diet when we collect faeces from the field.

Others activities

Many others activities were planed and achieved with the collaboration of our partners (Administrations, local NGOs…etc), for example:

- Ibis presentation at many schools in Souss Massa Region
- Production of a new ibis brochure in 2004
- Two development projects were done with the local people :
  - Sustainable tourism in Massa estuary, 2004
  - Sustainable fishing activities in SMNP, 2005

Northern Bald Ibis conservations efforts in Syria 2002-2006: results and lessons learned

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Protection of the breeding ibises (2002-06)

During the 3 breeding seasons after the discovery (2002-2004) the conservation of Syrian NBI has been focusing mainly on field activities, whilst during the last two breeding seasons the focus has been shifting towards institutional and political issues. The protection of the handful of Syrian NBI since the year of the discovery taken place in 2002 (SERRA *et al.* 2003) to present has been carried out by the Syrian Ministry of Agriculture and Agrarian Reform (MAAR), mainly under two different assistance and cooperation arrangements and thanks to a number of donors - see table below:

Stage	Period	Project	Financial support
I	2002-2004	MAAR/UN-FAO	Italian Coop. Program (DGCS)
II	2005	MAAR – efforts of BirdLife Middle East (BLME) to step in	RSPB/AEWA G. Serra volunteering
III	2006	MAAR/ BLME	RSPB/National Geographic Society's Research and Exploration Committee G. Serra volunteering

It was at the end of the first stage (spring 2004) that an Ibis Reserve was legally established by MAAR. G. SERRA was requested to advise on the boundary of the protected area: the two nesting cliffs and all known feeding areas were included in the reserve, covering a total of about 220 km^2. The reserve does not yet have a management plan, staff nor equipment, but relies for these resources on the adjacent *al Talila* reserve. Moreover, despite fulfilling the criteria as an Important Bird Area (IBA), it has not yet been formally declared as such.

Stage	Breeding season	Adults returned (in Feb)	Nests (n)	Fledglings (n) (migrated with adults)	Breeding performance (n. fledged/nest)
	2002	7	3	3	1
I	2003	6	3	7	2.3
	2004	5	2	4	2
II	2005	5	2	0	0
III	2006	4	2	6	3

Table 1: Breeding success of the NBI in Palmyra, Syria 2002 – 2006.

The table above reports the key data over the 5 breeding seasons following the discovery (SERRA et al., in prep.). These data show that protection programs during stage I and III (breeding seasons 2002 - 2004 and 2006) were quite successful: despite the total number of adults and of nests having steadily declined, the productivity has been high (arguably even increasing) – except for 2005. Overall, this relict colony has shown a remarkable breeding vitality, even compared to the stable Moroccan population which averages barely one chick per nesting pair (BOWDEN et al 2003).

The failure of the breeding season in 2005 (stage II) stands out from breeding seasons of stage I and III. What happened in that year? The variables changed in that year are mainly: lack of co-management of field operations and no external technical assistance, which has probably resulted in reduced and less effective levels of protection efforts. It has been a transitional period from an institutional point of view. From the reports of the local rangers, it seems that human disturbance and raven depredation may have been the proximal causes that induced the death of 5 chicks that year (PESKE 2005).

The typical field arrangement employed during stages I and III were as follow:

3 - 6 guards hired from the community of Bedouin nomads

5 - 2 trained rangers from MAAR coordinated by Abdulkhalek Abdullah ASSAAD (Director of Talila Reserve) and coordinated by Dr KANANI (Deputy Director of Ibis Reserve)

G. SERRA technical assistance/advisory of field operations – backed by RSPB since 2003, with Chris BOWDEN, Ken SMITH and Jeremy LINDSELL.

The typical field activities carried out have been the following:

- monitoring nesting cliff
- collecting data on breeding cycle
- monitoring birds at feeding grounds
- monitoring human activities within breeding area
- raising conservation awareness among nomads and authorities.

Research efforts have been minimal, due to the threats in place and the need to focus on protection. A good amount of information on the ecology, human disturbance and land use has been opportunistically recorded by G. SERRA during the 4 years of field operations. In 2002, some preliminary data on the ibis diet were collected by analysing the pellets and by direct observation (SERRA et al., in prep.).

Important information for NBI conservation in Syria, potentially key for an update of the SAP, is the recent information on how human disturbance may be negatively affecting breeding productivity. This has been recorded especially during the period 2003-2006. Several instances of severe disturbance have been directly observed by G. SERRA during the settlement and incubation stages, especially by Bedouin shepherds and truffle collectors - and possibly also by foreign bird-watching parties.

Also, in the more recent years we have realized how important a safe and stable source of drinking water is for the breeding ibises (the same as it had been realized for the Moroccan ibises in the past). Ibises are generally forced to opportunistically use man-made reservoirs, which are intensively used by pastoralists for their livestock. This costs major losses of time for the birds and also increases risks of being shot – as has apparently happened in July 2003, when one adult was killed by Lebanese hunters at a reservoir.

Recruiters

One of the most important results is certainly the return of recruiters in 2004 (1 bird) and in 2006 (3 birds). The efforts of aging these recruiters from photographs, with the intervention of experienced Kurt KOTRSCHAL, Miguel QUEVEDO, Johannes FRITZ and Karin PEGORARO has resulted in an estimate of returning birds ranging between 3 and 4 year old.

The recruiters of 2006 might well be the survivors of the 7 chicks successfully fledged in 2003 for a number of reasons: the 3 birds seemed to be the same age; their number (3) matches well with a 60-70% of natural mortality; they frequented a specific site (a reservoir) that the colony used in 2003 only etc.

In the past, the apparent lack of recruitment was one of the main sources of concern for the survival of the colony. We can suppose that before the discovery, without any protection in place, most likely the breeding performance of the ibis colony might have been quite low if not zero. This would explain why in 2002 and 2003 we did not record any recruitment event.

Overall, the first significant recruitment event recorded in 2006 is fantastic news and is surely an outcome of the past years of protection efforts. The lesson learned seems to be that protecting the birds at the Syrian breeding grounds is the key for the survival of the colony which really pays off.

And perhaps the threats at wintering grounds are less acute than previously thought. Now we know that birds most likely winter in Ethiopia (see below), where hunting seems to be not so rooted in the culture as it is in Arab countries. We could therefore speculate that the most critical places for the survival of this colony at the moment are mainly around the breeding grounds themselves and potentially some key sites along the migratory route - especially a staging area in western Yemen, a fairly intensive agricultural area.

The saga of the tagging attempts (2003-06)

Since the time of the discovery in 2002 we all knew that it was the key to detect the migratory route and the wintering grounds of the NBI colony in order to ensure its survival. Attempts at trapping and tagging one or more birds started as early as 2003 with the direct involvement of RSPB and BLME. Unfortunately, the first three attempts (2003-05) failed mainly related to causes such as:
- onset of war in Iraq (2003)
- termination of UN-FAO project, followed by a period of transition/instability) (2004 and 2005)
- scarce support from high political circles and full dependence on cooperation of the local authorities (2004 and 2005).

Only in 2006 did we finally manage to trap and tag three adult birds with the key intervention of satellite tagging expert Lubomir PESKE and the engagement of BLME with Syrian authorities (SERRA and PESKE 2006). Benefiting from the lessons learned during 2003-2005, the following key actions were taken as early as autumn 2005:

- a determined advocacy campaign during winter 2005-2006 aimed at top officials in Damascus
- a photo exhibition was organized in early February 2006 by MAAR and BLME with pictures offered by G. SERRA and M. ABDALLAH – the exhibition has been presented by Director of Ibis Reserve and inaugurated by MAAR Minister
- increasing involvement and interest of the Syrian First Lady (culminated in meeting at Presidential Palace in June 2006)
- an action plan was submitted to top MAAR official for endorsement as early as January 2006, envisaging co-management of project and need of external technical assistance/advisory
- a careful preparation of trapping in the field was started as early as February 2006: sound protection & monitoring program of breeding ibises and early establishment of artificial ponds near nesting cliff .

The factors key to the success of 2006 could be summarized as follow:
- superb institutional work done by BLME which secured support from top MAAR officials in Damascus: this enabled us to engage local institutional elements and to successfully channel external field technical assistance
- important support from MAAR and Talila Reserve Director Adulkhalek Abdullah ASSAAD. Also key Also key support from Deputy Director of Ibis Reserve Ahmed KANANI in the fiel (MAAR)
- remarkable motivation and commitment of the two MAAR rangers in particular: Mahmud Scheich ABDALLAH and Ghazy AL QAIM – through the years they have developed a genuine sense of ownership.

Three adult ibises were successfully trapped and tagged during the first 10 days of June by trapping & tagging expert Lubomir PESKE, assisted by a field team composed by Mahmud ABDALLAH, Ghazy al QAIM and Gianluca SERRA (acting as BirdLife Team leader), technically backed by the RSPB (Chris BOWDEN, Ken SMITH, Jeremy LINDSELL). This field team reported both to MAAR (Abdul Khalek ASSAED and Ahmed KANANI) and to BLME (Ibrahim al KHADER

and Sharif JABBUR). The birds were trapped using artificial ponds and clap nets. Each bird was tagged with a satellite tag (PTT) and a VHF tag for detection at short range. The ibis left Palmyra on 18 July and in 10 days reached a site in western Yemen, where they spent about 3 weeks. After that, they crossed the Red Sea and they quickly reached a very restricted area on the highlands of northern Ethiopia, about 100 km NE of Addis Ababa.

Updating SAP with new data collected during 2003-06

In view of the new information gained in the field in recent years, table below shows the recommended updates, relatively to the Syrian NBI, to the International Species Action Plan.

SAP 2006 (data 2002-03)	*Update (data 2003-06)*
Threats to breeding	
Habitat degradation	Institutional issue: lack of a standardized protection program and provision of external specialized assistance by BLI
Drought	Human disturbance (shepherds, truffle collectors and birdwatchers)
	Water availability and hunting
Threats to adult survival	
Hunting	Institutional issue: lack of a standardized protection program and provision of external specialized assistance by BLI
Habitat degradation	Water availability and hunting
Risks of intoxication	
Disease spread	
Pesticides	

Is restoring a viable population of NBI in the Middle East still a dream?

The table below summarises the combination of **S**trengths – **W**eaknesses - **O**pportunities - **T**hreats (SWOT analysis) relative to the estimated chances of survival in the medium and long term of the Syrian NBI colony.

STRENGTHS	OPPORTUNITY	WEAKNESSES	THREATS
Breeding vitality of	Assessing threats at	Lack of funding	Regional political

colony	wintering grounds and along the migratory route		instability / escalating conflicts
Tagging success in 2006 – detection of migratory route and wintering grounds	RSPB project proposal, recently submitted to Darwin Initiative	Temporary position of several key staff – especially Mahmud SCHEICH ABDALLAH, Gianluca SERRA and Lubomir PESKE	Specific threats to ibis breeding and survival (see SAP)
Cumulated knowledge of behaviour and ecology at breeding grounds – human land use and local culture	Photo-exhibition in October 06 in Damascus inaugurated by Syrian First Lady	Support not yet sufficiently established at institutional level	Lack of an action plan endorsed by Minister of Agriculture
Commitment of local trained rangers + Deputy Director	Eco-tourism and bird-watching is growing in Syrian desert	Ibis reserve is still on paper	Human issue (sustainable development) not tackled yet – ibis breeding grounds are traditional grazing areas of a Bedouin tribe (*amur*)
New institutional formula successfully tested in 2006 (MAAR/BLME)	NBI has great potential as a flagship for conservation and awareness movement in Syria		Uncontrolled eco-tourism and bird-watching
Support of top MAAR officials and Syrian First Lady	Syrian Society for Conservation of Wildlife (SSCW) is growing		
Activation of EWNHS – established BLI partner in Ethiopia			

Conclusion

2006 has certainly been an exciting year and it has the potential to become a turning point for the NBI conservation in Syria. In fact, it started quite badly: only 4 birds initially returned (3 adults + 1 young adult), but after that, a succession of positive developments have been taking place such as:

- the four returned adults managed to form exactly two pairs
- they both bred superbly (3 chicks *per* nest), more than the average in Morocco and Turkey (and despite one of the bird seeming to be a young adult)
- three recruiters came back in May
- three breeding adults were successfully satellite-tagged.

Post script:

A key development happened just few days after the end of the IAGNBI meeting in Jerez: the inauguration of a photo-exhibition in Damascus, dedicated to the NBI colony and the Palmyra desert cultural and natural heritage, by Her Excellency Mrs. Asmae AL ASSAD, First Lady of the Syrian Arab Republic. The exhibition, prepared by G. SERRA and Palmyra ranger Mahmud SCHEICH ABDALLAH, was jointly organized by MAAR, the Danish Cultural Centre, Italian Cultural Centre, Finnish Embassy and BLME.

It was an exciting evening, during which we were able to explain to H.E. Mrs. ASMAE, the MAAR Minister, and more than 130 VIPs of Damascus, the story of the Northern Bald Ibis of Palmyra and the recent developments. H.E. Mrs. ASMAE showed great interest in supporting MAAR and BLME in their efforts to save the NBI, as the symbol and flagship of the threatened cultural and natural heritage of the Syrian Desert. The next day the most important Syrian newspapers reported the news on the first page, with images of H.E. Mrs ASMAE watching the images of the exhibition guided by the Palmyra rangers. This event has certainly secured to the Palmyra NBI colony the highest visibility and political support in Syria. During the inauguration we have also presented the international SAP and explained the need to develop and prepare a national action plan specific for Syria.

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Satellite tagging of 3 Northern Bald Ibis (*Geronticus eremita)* in Syria in 2006

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Situation in Syria

Since the discovery of the Syrian NBI colony in 2002 it was unknown where the birds spend the winter and which route they take when migrating. Although the small colony had good breeding productivity, the small number of birds which retuned each February was disappointing. So it became evident that to know where and how the birds spend their time during the non-breeding season had become the highest priority for saving the Syrian population.

In 2004 and 2005 attempts were made to catch young and adult birds to satellite tag them. Unfortunately due to political reasons in 2004 and logistic problems the following year no birds could be caught and satellite tagged.

In 2006 again attempts were made to catch three birds. A trap was installed close to water points. It had to be observed and had to be triggered when the birds was right in the centre of the trap. Finally, 3 birds could be caught at the beginning of June 2006, two males and one female. Only one bird could be tagged with a low weight 12g solar tag, the others were fitted with 'geotrack' tags, about 30g with a battery which should last until August of 2008 (see table 1).

Name	Date fitted	Sex	Weight	Specifications of tag fitted	extra load	
SALAM	1.6.06	☐	1.47 kg	PTT-100 solar 12g; ID 66327, VHF: (R10-LSB) 173.276 MHz, 5,5 g	1.2 %	backpack harnesses
ZENA	4.6.06	☐	1.35 kg	Geotrack 30g, ID	2,5%	rappole

				41881, VHF: (R10-LSB) 151.434 MHz, 3.5g		harnesses
SULTAN	11.6.06	☐	1.54 kg	Geotrack 30g, PTT tag:, ID 41880, VHF: (R10-LSB) 173.434 MHz, 5.5g	2,1%	rappole harnesses

Table1. Syrian birds caught in June 2006

Fig.1: Salam with the satellite tag

The Transmitters

The transmitter is a miniature electronic device designed for locating and tracking wildlife. The transmitter is carried in a harness strapped to the bird's body. Each harness is custom-designed for each species and manually adjusted for each bird or animal for maximum comfort and fit.

The transmitter signal is sent to a satellite, which is called as an uplink. A signal sent down from a satellite to a ground station is a downlink. As the NOAA weather satellite flies along its orbit above the bird's location, the ARGOS section of the satellite receives and stores the up linked data. Later, as the NOAA satellite passes over a ground station, ARGOS downlinks the information to the ground station. The down linked data received by the ground station is sent on to Processing centres. They use the messages to work out the transmitter's location to within a few hundred meters.

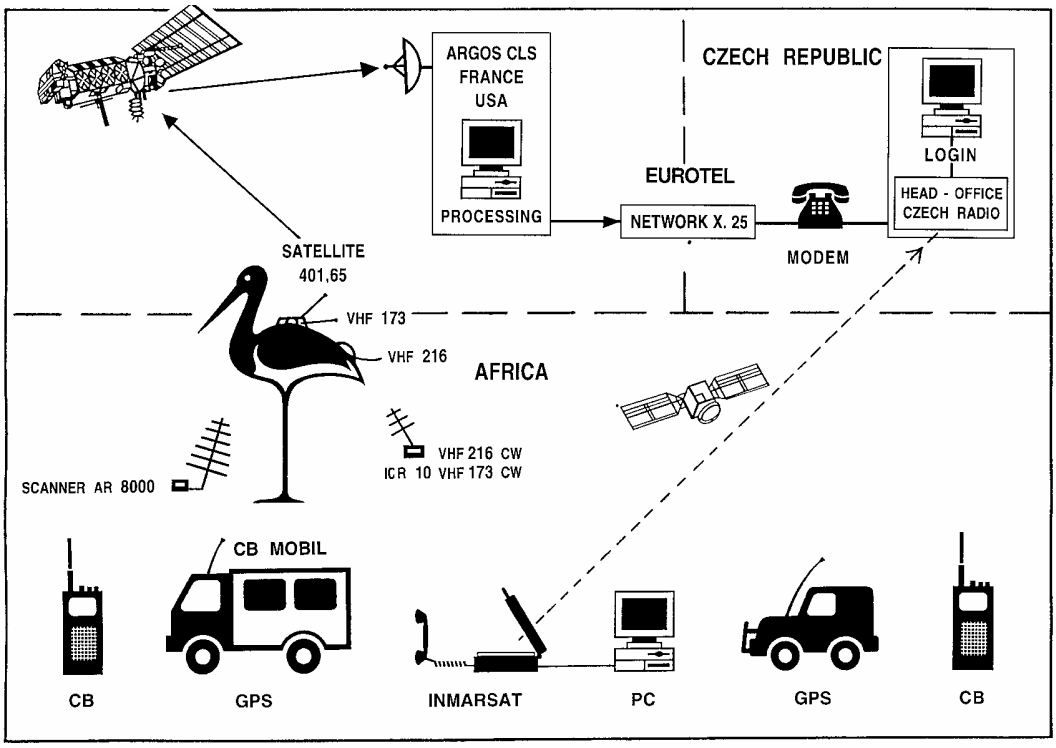

Fig.2: data transfer of the satellite tags to the ground station

Results

The birds stayed in the breeding area and their movements could be followed. All tagged birds then left together at the 18th of July 2006. Very quickly they migrated south and reached Medina the 20th July 2006 and Mecca, Saudi Arabia at the 23rd July 2006.

Fig.3. Movements around the breeding sites Palmyra, Syria Movements in Saudi Arabia and Yemen

Flying south they reached Bajil, Yemen at the 26th July 2006. There they stayed for 3 weeks in an intensively used agricultural area. On the 17th of August 2006 they crossed the Red Sea and arrived the 18th or 19th of August 2006 at a location about 100 km NE from Addis Ababa.

Fig.3: Wintering area in Ethiopia close to Addis Ababa

The birds remained in the same area during autumn 2006 in a very restricted area.

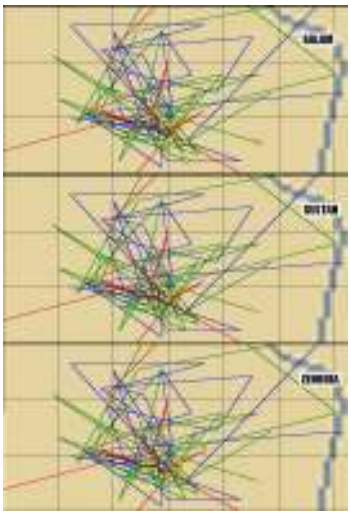

Fig.4. Clusters for individual birds. Yellow squares are night locations. Grid: 1 x 1 km

The three tagged Northern Bald Ibises started migration together and stayed together the whole migration time. The migration route they took is known by migration data of the eastern population of 1967-1998 (Welch 2004). The birds migrated a distance of 3096 km and it took them one month to reach the wintering grounds. They had one long stopover of 3 weeks in Bajil, Yemen.

Northern Bald Ibis Project at the Birecik Breeding Centre

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Population development

In 2006 there are 83 birds in Birecik. Table 1 shows the breeding success from 2000-2006. The population increased from 45 birds to 83 in 2006. However the proportion of the pairs which made breeding attempts decreased over the years (66% to 41%). The proportion of fledglings per nest stayed more or less at the same level. 100 birds fledged in the last 5 years, 21 died and 32 birds disappeared.

Year	n NBI	n breed-ing pairs	% birds reproductive active	n nests with young	% of successful nests	n chicks fledged	Fledglings/ nest	n birds disappeared	n birds died
2000	45	-	-	-	-	-	-	-	3
2001	42	14	66,6	10	71,4	19	1,9	1	-
2002	60	20	66,6	9	45	17	1,8	10	4
2003	63	15	47,6	10	66,6,7	14	1,4	10	2
2004	65	18	55,4	5	27,7	9	1,8	2	2
2005	70	20	57,14	14	70	19	1,4	-	6
2006	83	17	40,9	15	88,3	21	1,4	9	4
∑								32	21

Table 1: Breeding performance of the Northern Bald ibis in the Birecik Breeding Centre

Monitoring

For the Birecik Northern Bald Ibis population the

- Population development
- Breeding parameters
- Feeding and foraging habitats are monitored


Fig.1. Breeding sites close to the Breeding Centre

Husbandry

The husbandry for the NBI colony has been improved by

- The feeding and food provision system researched and developed
- The cages are improved and enlarged
- Interpretation centre is equipped


Fig. 2. Food preparation

Public awareness

Local conscious was raised and integrated to the project

- Local conscious raised to the national level
- People feel proud of Bald Ibis
- Interpretation Centre is running

Future work

- New protocol between Ministry and DD aiming satellite tracking of some free birds at migration period
- Releasing some birds in 2007 migration period
- Improvement husbandry and monitoring works
- Stop pesticide in feeding areas
- Following up SSAP recommendations

Supporters

The Birecik Breeding Centre and its activities are supported by

- TC Birecik Kaymakamligi
- Birecik Belediyesi
- ATLAS
- BidLife International
- Chester zoo
- RSPB
- LPO

Last data on the Northern Bald Ibis (Geronticus eremita) in Algeria

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We initiated investigations of the last breeding site of the Northern Bald Ibis (*Geronticus eremita,* NBI) as part of the activities carried out by the National Agency for Nature Conservation (ANN) to study and monitor threatened species which occur in Algeria.

Data on the NBI in Algeria

The NBI is a critically endangered species. Most reports from breeding sites in Algeria date back to the last decades of the 20th century. However, only very few data are given on the actual status of this species in Algeria (LEDANT & al. 1981, BELLATRECHE 1994, ISENMANN & MOALI 2000, FELLOUS 2004, 2006). Most recently, COMINARDI (1993) reported that seven specimens were seen ten km southwest of Ain Sefra , close to the Moroccan border, in October 1978.

Most of the collected data on the historic distribution of birds or colonies are from semi-arid zones in the 1950s. Approximately a dozen colonies have been mentioned for Algeria. The last colony, which survived until the 1990s, was discovered in 1974 in south-western Algeria in the El Bayadh region.

Fig.1: Historic distribution of the Northern Bald Ibis *Geronticus eremita* in Algeria

Methodology

Our investigation started in 2000 and continued in 2002 and 2004. We focused on the site of the last colony, and tried to establish the main causes of decline. Our survey was carried out among the local people to maximize information collected on this venerated bird species and to also get an idea on prospects for rehabilitation of NBI in that area.

We made a questionnaire with twenty different questions, which we asked older people of the main tribes (the Ouled Aissa, Zwa and Ould Moumen) living close to the former the nesting site in the El Bayadh region. The information was collected by the technical staff of the Unité de Conservation et de Development (UCD) in the EL Bayadh department.

The questions focused on:

- Distribution/sightings of NBI (past and/or recent)
- Biology of NBI (e.g. arrival /departure periods, use of foraging areas)
- Main causes for the decline of NBI (e.g. hunting, predation, drought)

Results

LAST REPORT

The most recent sighting was of two NBI in autumn 2004. They were flying at "Theniet Ould Moumen" two km of north the last known breeding site (A. KAOUI, pers. comm..).


(a)

(b)

Fig 2: Last breeding site in El Bayadh (a) and old nest sites there (b).

Northern Bald Ibises are locally called "Aïcha El Garaa" which means "Aïcha the Bald". Older people spoke of the symbolic value of this bird species and its association with religion, especially because the nesting sites were located in the direction of Mecca. For local people the presence of the NBI symbolized peace, serenity and richness.

SPECIES BIOLOGY

- The birds arrived at the end of winter season (February and beginning of March) and left again at the end of summer.
- Juvenile NBI arrived and left the breeding area together with the adult birds.
- The birds always moved around in groups. The groups became larger during departure and arrival periods.
- The foraging areas, which also had water sources, were always close to the breeding site.
- The people could not give detailed data about the breeding biology of the NBI, e.g. beginning of nesting period, number of eggs)

ESTIMATION OF NUMBERS

The former colonies must have been numerous because people reported sightings of 300 to 400 birds. The first signs of a population decline started in the 1950s.The last birds seen (12-18 birds) were in the late 1980s.

DECLINE CAUSES

- direct hunting of the birds by French soldiers during the French colonization (El Bayadh city was a garrison town)
- a long drought between1970-1980
- a divine cause was always mentioned

OTHER CAUSES WHICH WERE PROPOSED TO THE PEOPLE BUT WERE NOT AGREED UPON:

- Natural predation of the nesting site by raptors or Corvidae
- Diseases infecting the birds
- Disturbance because the cliff was used as a hermitage site
- The loss of the foraging areas because they were used as pastures
- Use of pesticides
- The impact of recent agriculture activities close to the breeding site
- Conservation and rehabilitation of the NBI in Algeria

As the NBI has only been protected since 1983, few data are available up to now. No national action plan for the Nib's conservation exists. However, when the local people were asked what they think about reintroduction of the NBI into the region the attitude was very positive. Many suggested they could be protectors of the "Aïcha the Bald", as their ancestors were in the past. Therefore this bird species could be used as the symbol of peace and prosperity for the region and the entire country.

ACTIONS FOR THE REHABILITATION FOR THE NORTHERN BALD IBIS IN ALGERIA COULD BE:

- To establish a national action plan for rehabilitation of the species based on an objective and scientific evaluation of the actual status of the NBI in Algeria.
- To consider the rehabilitation as a priority research action and to build up a cooperation with local ornithologists
- To collaborate with laboratories, specialized institutions, local administration, local and national NGO's with IAGNBI, IUCN, Birdlife, etc.
- To work on a regional basis with Moroccan collaborators in the context of the CMS convention (AEWA agreement)
- To evaluate a possible reintroduction of NBI following the recommendations of the specialized advisory group (IAGNBI)
- To use the NBI as a local flagship species for ecotourism where the activities in the region are mainly agro – pastoral
- To use the NBI as an attractive tool for young naturalists
- To look for other possible nesting sites

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Update of Proyecto eremita

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BACKGROUND

1991: Jerez Zoo received a proposal to collaborate in a potential release project for Northern Bald Ibis (*Geronticus eremita,* NBI) in south-eastern Spain (Almería). This project was to involve WWF Spain, European Natural Heritage Fund, Alpenzoo and University Innsbruck. The first birds arrived at Jerez Zoo for the "Almería project". These ibises were from a group of Northern Bald Ibis (*Geronticus eremita,* NBI) chicks that had been hand-reared by two human foster parents as part of a pilot release methodology project in Austria (THALER & PEGORARO 1992) The Almeria project did not progress further,
1992: A Conservation Viability Assessment Workshop was held in Rabat Zoo, Morocco.
1997: The release methodology project using the hand-rearing technique started at the Konrad Lorenz Research Station in Gruenau, Austria.
1999: The Workshop on the Strategy of the rehabilitation of NBI was held in Agadir, Morocco. The International Advisory group of the Northern Bald Ibis (IAGNBI) was founded.
Jerez Zoo presented a draft of the project Proyecto Eremita to the regional government (CMA)
2002: The Environmental Council of Andalucia Government (Consejería de Medio Ambiente, CMA) approved the project presented in 1999 by Jerez Zoo.
2003: The 1st IAGNBI meeting, was held in Innsbruck, Austria; and "Proyecto Eremita" started.
2004: A Species Action Plan meeting was held in Madrid.

WHY PROYECTO EREMITA?

- Status of NBI in the wild is critically endangered
- Only two remaining wild populations (Morocco and Syria)

- A captive NBI population with about 800-890 birds is managed as an European Endangered Species Programme (EEP)
- Reintroduction/release of captive-bred birds offer the chance to increase the number and population size in the wild
- An effective release methodology is still not known and needs investigation
- Southern Spain offers excellent environmental conditions for the species, as it shares climate and habitat similarities with Morocco
- The necessary elements were present to attempt such a project: regional government support, advice of scientific institutions, captive stock at Jerez Zoo and social sensitisation to the situation of this critically endangered species released in this ecological very important area.

Fig.1: Hand reared NBI in the release area EL Retin

PROYECTO EREMITA

"Proyecto Eremita" aims to evaluate the efficiency of different releasing techniques in *La Janda* area, Cádiz, Southern Spain. The study will be assessed using degree of success in establishing a sedentary, self-sustained, free-flying colony in this area during the project timeframe (2003 – 2008). References concerning objectives, study area, management conditions, enclosures, methodology and monitoring can be found in IAGNBI Newsletter 3, July 2004

Although the two ongoing release projects, Proyecto Eremita in Spain and Gruenau project in Austria, both employ hand-rearing techniques, they are not similar. Proyecto Eremita also uses other methodology and is oriented towards studying potential establishment of a sedentary population, as the ecological conditions of southern Spain allow this.

A habitat survey (field study) was undertaken in the *La Janda* area in 2003. The main features assessed were: available optimum habitats, feeding areas, potential prey, water sources, potential nesting sites, potential risks and threats including predators (especially Eagle Owl *Bubo bubo*), power lines (electrocution, collision), roads and wind generators. The result of this study was published (Ecologic characterization of the proposed release area in *La Janda,* Cádiz", Manuel A. Dueñas, 2004). The ecological and climatic conditions of this area were found optimal for the species. The selected area has suitable foraging grounds, enough prey all year round, water sources and nesting and roosting places for an estimated population of 1500 birds.

In May 2004 the Retín aviary was constructed at the release site and was ready to receive the birds from Jerez Zoo.

Veterinary protocol in Proyecto Eremita

The release of captive-bred Northern Bald Ibis to the wild could be associated with potential disease risks to the fauna in the ecosystem into which they are released and to the individual birds involved. A veterinary procedure is regularly implemented based on the "Veterinary Protocol in the Reintroduction of Northern Bald Ibis", KIRKWOOD J.K & QUEVEDO M.A. 1999.

Fig.2: taking blood samples of a NBI

a- Selection of birds: Birds used in this project come mainly from ZooBotánico Jerez. Zoo Jerez has held NBI since 1991. Its captive population is closely monitored and can be considered "in quarantine" over such a long period of time (at least 13 years). No infectious or parasitic disease has been recorded. Birds coming from EEP institutions are quarantined before integration.

b- Clinical examinations: Every NBI is examined 3 times a year.
c- Faecal samples (parasites / *Salmonella*): These are done before the releases each November and have been negative so far.
d- Blood samples (haematology / serum): Blood samples are taken
e- Avian influenza (H5N1) analysis: AI analysis was carried out in 2006 with negative result.
f- Radiography: Radiographs were most frequently made in the first year (2004) due to a high incidence of metal foreign body ingestion, i.e. pieces of wire that fell to the ground during aviary construction.
g- Post-mortem studies: Thorough necropsies are carried out in every single bird found dead. No infectious or parasitic disease has been recorded. Death causes have all been associated with natural or related to human activity (see Table 1).
h- Surveillance (long-term): Hand -reared and released birds are monitored for any signs of disease or mortality during the project.

GENERAL PROTOCOL FOR RELEASING METHODOLOGY

(2004, 2005, 2006)

Hand rearing technique: hatching-fledging

The basic method chosen has been the hand-rearing technique using "Characterized foster parents", i.e. foster parents that wear black T-shirts and ibis-hats to minimize the risk of imprinting on human beings.

Phase 1: Hatching occurs in May. The chicks are raised at Jerez Zoo until 30 days of age. During this time they are maintained indoors with heat lamps during the night and outdoors during the day for sunbathing.

Phase 2: The young birds are transferred to the Retín aviary.

Fig.3 a,b: Hand rearing NBI chicks

Twenty-one NBI were hand-reared in 2004, 17 in 2005, and 22 in 2006. All the NBI hand-reared in 2004 and 2005 were from Jerez Zoo. Fourteen of the 22 in 2006 were from Jerez Zoo, 4 came newly hatched from Zoo Doue la Fontaine and 4 6-8 weeks old from Budapest Zoo.

Fledgling learning period with Characterized foster parents: June – August.

The "Learning period" is defined as period of time between fledgling (June) to the beginning of the juvenile dispersion period (August) when the birds are outside the aviary. Volunteer workers (Characterized foster parents) maintain contact with the ibises by feeding them and helping them to find foraging areas and water sources.

Fig.4: Hand reared NBI guided by its human foster parent

Confining the birds to the aviary (2004, 2005, 2006) during juvenile dispersion period, August - November.

It is thought that dispersal normally occurs around 1 month after fledgling. To avoid this phenomenon, juveniles are confined to the aviary for 2 – 3 months (from August to November, the "early" birds fledge at the end of June but the majority in July). Later, the releasing protocol continues.

Fig.5: Release aviary in EL Retin

The dates for confining NBI in previous years were 25.08.04 and 18.08.05. However a group of 17 NBI disappeared on 12.08.06, with only a group of 3 returning. Consequently the rest of juveniles and all the other free-flying birds released in 2004 and 2005 have been kept in a closed aviary since then.

Releases in November (2004, 2005, planned for 2006)

- **2004:** a total of 23 NBI released, including 21 hand-reared and 2 parent-reared at Jerez Zoo.

- **2005:** a total of 22 NBI released, including 16 hand-reared and 6 parent-reared (2 at Innsbruck Zoo, 3 at Amersfoort Zoo and 1 at Chester Zoo). These birds were released together with the 9 still remaining from 2004.

- **2006:** a total of 28 NBI will be released in November. Group composition will include 7 from 2004, 3 from 2005, 11 from 2006 and 7 adult birds (4 - 6 years old) from 2000-2002 that have been maintained previously in the release aviary as breeders for 2 years.

Tracking, monitoring, studies (behavioural, foraging, etc.).

All the birds are individually marked using standard aluminium ring plus two plastic colour rings with an alphanumeric code. Terrestrial radio-transmitters are used on most of them. Satellite radio-transmitters are planned for use in specific cases.

Fig.6: rings and tags on the released NBI

Fig. 7: hand reared NBI in front of the release aviary

Influence of Cattle egrets (Bubulcus ibis) on socialization and learning of NBI
A sub-study was carried out to see whether there would be advantages to rearing NBI with cattle egrets. The cattle egrets could help the young NBI find appropriate roosting and foraging sites.
- **2004**: two hand-reared groups- *group A*: 11 NBI and *group B*: 10 NBI + 8 Cattle egrets (*Bubulcus ibis)*.
- **2005**: two hand-reared groups- *group A*: 10 NBI and *group B*: 7 NBI + 6 Cattle egrets.

Result on the experience of hand-reared NBI & Cattle egrets:

- No negative impact between the two species, no imprinting on each other.
- No significant behaviour differences between the two groups of ibis (i.e. group A reared a pure NBI group, B reared with cattle egrets).
- Both groups acted as a single one when released. It was hard to tell the differences between them.
- A positive observation was that all released NBI identified favourable feeding sites when cattle egrets (as well as cattle) were spotted on the ground.
- Cattle egrets were not used in 2006 due to the fact that no major benefit was observed with this methodology.
- The majority - except 3-4 – of the cattle egrets left the area. The NBI in general is attracted by the cattle egret independent if they are reared together or not.

Adding new birds during the confined period (adding technique):

A number of juvenile parent-reared birds (2 from Jerez Zoo in 2004 and 7 from Innsbruck, Chester and Amersfoort Zoo in 2005) were added to the hand-reared group during the period that they were confined to the aviary. This method allows new birds to integrate and socialize into the core group. As the juvenile mortality is in both groups - parent or hand reared high, we think that the integration has worked well to date and is not linked to the rearing.

Results of the "adding" experience:

- 2004: 2 juvenile parent-reared birds from Jerez Zoo.
  PAA: released 4.12.04. Killed by eagle owl 23.05.05 (5 months)
  PAC: released 4.12.04. Electrocuted 13.12.04 (9 days)

- 2005: 7 juvenile parent-reared birds from (I) Innsbruck, (C) Chester and (A) Amersfoort Zoos.
  P7P: (I) released 10.11.05. Disappeared 17.11.05 (7 days)
  P7R: (I) released 10.11.05. Electrocuted 8.06.06 (7 months)
  P7T: (A) released 10.11.05. Disappeared 27.05.06 (6 months)
  P7U: (A) released 10.11.05. Cable collision 12.06.06 (7 months)
  P7V: (A) released 10.11.05. Hit by car 11.11.05 (1 day)
  PAF: (C) Un-releasable. 13.10.05. broken bill; (kept in captivity)
  PAH: (C) released 10.11.05. Disappeared 17.07.06 (8 months)

Status of NBI released in 2004 and 2005 and disappearances as of September 2006:

Disappeared birds:
A total of 4 birds from 2004, 4 from 2005 and 14 from 2006 have disappeared from the release site to date. We think that the majority of them are dead as no further observations have been reported , other than one observation made of a bird (P9P, missing since 7.08.2005) at lake Affennourir, Morocco on 11.08.2005.

Fig. 8: observations of NBI of Proyecto eremita in Morocco 2005

23 released birds in **2004**:
- Remaining **8** (3 males.5 females)
- Dead **11** (4.7)
- Disappeared **4** (2.2)

22 released birds **2005:**
- Remaining **4** (2.2)
- Dead **14** (6.8)
- Disappeared **4** (2.2)

Total of 45 released birds:
- Remaining **12** (5.7)
- Dead **25** (10.15)
- Disappeared **8** (4.4)

CAUSE	N°	BIRD / DATE
EAGLE OWL (*Bubo bubo*)	5	**P8X** (3.04.05) **P8F** (28.04.05) **PAA** (23.05.05) **P97** (28.12.05) **P8H** (7.07.06)
WIRE INGESTION. PERFORATIVE PERITONITIS	4	**P87** (25.07.04) **P8V** (23.09.04) **P8C** (8.01.05) **P9H** (4.03.06)
ELECTROCUTION	4	**PAC** (13.12.04) **P9R** (24.06.06) **P7R** (8.06.06)

		P9A (12.07.06)
POWER LINE COLLISION	4	**P8L** (10.12.04) **P7U** (12.06.06) **P9N** (7.07.06) **P9T** (10.07.06)
BONELLI´S EAGLE (*Hieraaetus fasciatus*)	2	**P98** (7.12.05) **P9F** (19.05.06)
HIT BY CAR	2	**P8M** (24.02.05) **P7V** (11.11.05)
UNKNOWN CAUSE	2	**P95** (3.11.05) **P9V** (21.04.06)
UNKNOWN TRAUMA	1	**P8N** (30.06.05)
TOTAL	**24**	

Table 1: Mortality causes for released northern bald ibis:

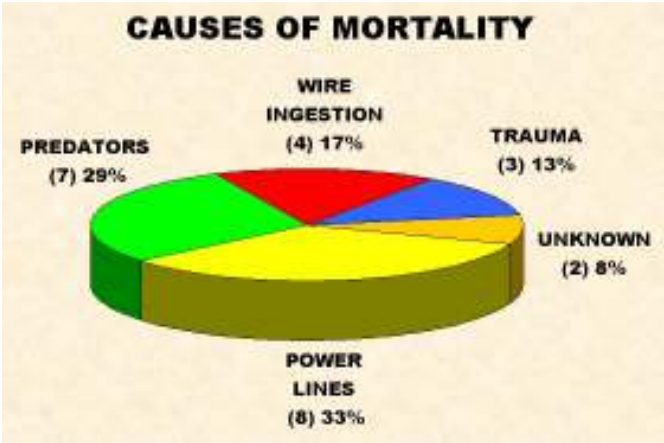

Fig.9: causes of mortality of the released NBI

PRELIMINARY CONCLUSIONS, September 2006:

- Birds from 2004 learned mainly from the human foster parents. Cattle egrets played a minor role in this process. Birds from 2005 learned from the "characterized foster parents" and from the 9 remaining 2004 birds as well. The birds from 2005 integrated perfectly into the 2004 group.
- **This methodology is promising although further research is needed to get reliable and complete data. Birds have been only 2 months fully independent**.
- The hand-rearing technique with "characterized foster parents" ***appears*** to prevent human imprinting which could improve the release success in those countries where human disturbances may occurs.
- Captive NBI retain innate basic survival behaviours such as foraging (including finding water) and identification and avoidance potential predators.
- Adding parent-reared juveniles to hand-reared NBI in the aviary during the confinement period facilitated integration of and socialization of both the hand-reared and parent-reared birds. This method increased the number of released birds and decreased hand-rearing time, cost and effort.

- Released NBI do not seem to have any negative impact on native species.
- There have been two main causes of mortality: (1) predation and (2) causes associated with human activity. Those associated with human activity were corrected when possible (insulating and increasing visibility of power lines).
- There has been no known mortality related to infectious or parasitic disease.
- Acceptance and support of local governments occurred in the region.

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Konrad Lorenz Forschungsstelle: Northern Bald Ibis Project 1997-2006: an Update

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At the Konrad Lorenz Forschungsstelle (KLF (E=13°57´, N=47°49´) a group of free-flying Northern Bald Ibis (*Geronticus eremita* NBI) was established from zoo offspring. Socially involved hand rearing was used from 1997 to 2000. The aims were

1) to establish another model group (besides Greylag Geese *Anser anser* and Raven *Corvus corax*) for basic research on vertebrate social and cognitive mechanisms and
2) to collect a know how for establishing local groups of NBI and in support of protecting wild living birds.

In a joint effort with the local Cumberland Game Park Gruenau, we built an aviary with nesting and roosting sites appropriate for the cliff dwelling NBI in 2000. It serves as a night roost and as a breeding site. In the last years more than 10 offspring per year (Fig. 1) fledged out of more than 8 nests / year. The group size has increased now in 2006 up to 37. Over the years the hands on management of the group could be gradually decreased (Fig: 1) and due to natural reproduction, the proportion of hand raised individuals in the group has decreased to approx. 20 %.

From fall to early spring birds only move within a limited radius of approx. 2 km around their aviary and spend much of the day at the KLF building, where they are also provided with food. From March, upon melting of the snow cover in the surrounding valleys, birds start flying northwards for first foraging excursions, often far beyond the village of Gruenau (Fig 2). Only when the grass on the meadows in and around Gruenau is harvested the first time, mid to end of May, birds can fully subsidize themselves and their offspring by natural foraging. End of September, birds usually stop their foraging excursions to distant meadows and become dependent again on food provisioning. In the first years, many birds were lost due to dispersal. Even though, since 2005 we do not enclose the birds into the aviary during the fall migration period birds stopped flaying away, probably because adequate group traditions have now formed.

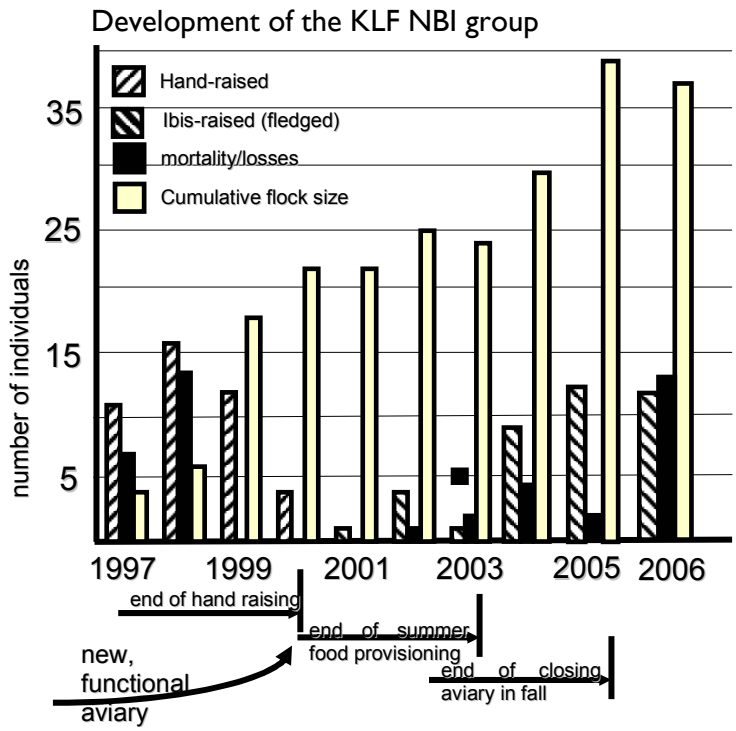

Fig.1: Development and management of the NBI colony in Gruenau, Austria

Research

Since 1997, a number of research projects have been conducted with the KLF NBI, including topics such as social learning, foraging, social development and socialization, cooperation of partners over raising offspring and the functions of sexual ornaments and their tradeoffs with immunity (patches of red skin). In the following, the results of a monitoring project on NBI foraging are summarized as an example and finally, a list of recent publications and masters theses is presented.

Northern Bald Ibis foraging in the Gruenau area

(KIRNBAUER, MARKUT & KOTRSCHAL unpubl.)

The group of free-flying Northern bald ibis (*Geronticus eremita*; NBI) at the Konrad Lorenz Research Station in Gruenau/Austria was used to for monitoring choice of foraging habitat and food items during spring and summer in a cattle farming area north of the Alps. Focal individuals were repeatedly sampled over 5 min observation periods from March to July 2003, when group size was 25 (10 males, 11 females, 4 juveniles). Foraging events, prey type and size and social interactions over foraging (scrounging) were data taken. Upon melting of the snow cover, mid of March, birds first foraged at two meadows within 1 km of their night roost. When the grass was harvested the first time in and around the village of Gruenau, 7 km to the north, on May 20th, birds regularly foraged at these freshly cut meadows till the end of August. In total, only 13 meadows were used, all within the village area, even though many meadows further off would have been available. All the areas utilized by the birds were flat and even, between 2.8 and 16.3 ha in size. Even moderate slopes were avoided. Birds only foraged on meadows until the vegetation had re-grown to approximately 15 cm. Birds foraged in loose groups. The dominating foraging modes were probing the soil with the bill

after touching the soil surface, probably to pick up vibrations from subgenean prey. In fact, more than 55% of prey items (>70% in volume) was detected and retrieved, by probing. Over the season, 50% of items collected were small (<3mm in length) and non-identified, followed by earth worms (34%), subgenean insect larva (11%) and beetles (5%). Earth worms were most important by volume (47%) of total prey, followed by "unidentified" (35%), insect larva (12%) and beetles (6%).

During July birds were present in the Gruenau area for 8 hours and engaged in foraging behaviour 5.6 hours per day on average. Males found 6.5 items per 5 min, equivalent to 4.08g of wet weight. Females retrieved 6.2 items (~3,8g), juveniles 4,8 (~3,1g) per 5 min. Per day, a male retrieved on average 435.5 items (273,4g wet weight), a female 415,4 items (254,6g), a juvenile 321,6 items (207,7g). Over the year, individuals found between 2,5 and 16 items per 5 min on average per day. This variability is due to a number of factors, including seasonally varying motivation, food abundance, feeding area chosen, etc. We conclude that the agricultural landscape north of the Alps provides plenty of forage for NBI to survive and reproduce (unpubl.). Both, epigean and subgenean food are important. As reported from the Middle Ages, Waldrapp Ibis preferred foraging areas close to a human settlement, where low vegetation is created by agricultural activity.

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The Scharnstein Waldrapp Ibis Migration-Project after four years: birds leave the micro lights behind

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The project waldrappteam.at is entering its 6th year. We are working on two major topics: One is the attempt to teach hand-raised Waldrapp Ibis (*Geronticus eremita*; NBI) a migration tradition from the breeding area to an appropriate wintering place and to monitor the spatio-temporal pattern of the birds, when they become independent after arrival in the wintering place.

A second topic is basic research on migration disposition and migration physiology. Physiological data collected during the autumn migration in 2004 presents a characteristic pattern for migratory birds. The physiological data allow evaluating human-led migration as a method for bird conservation and reintroduction.

Human led autumn migration

The first successful human-led autumn migration started on August 17th 2004. It pointed out that the trikes were about 5 km/h faster than the average speed of the birds. Nevertheless, on Sept. 22nd we arrived with 7 birds in the wintering region, the WWF nature reserve Laguna di Orbetello in southern Tuscany (FRITZ 2004A, b)

On August 18th 05 the second migration started. We used another micro light trike with an old fashioned wing and a powerful engine (Fig.1). The speed of that micro light was less than 40 km/h and therefore well-adapted to that of the birds. As a consequence, all birds have kept close contact to the plane and followed it to every flight level needed without problem. This was a methodological break through (FRITZ 2005).

Figure 1: Human-led migration 2005. The speed of that micro light was well-suited to that of the birds. Therefore, the birds followed in a very close distance to the micro light and the pilot.

We followed the same route as last year but we used fewer and partly different stopovers. On September 8th we reached the wintering area. A comparison of different parameters 2004/05 is shown in Table 1.

Year	Mean airspeed (kmh^{-1})	Mean daily distance (km)	Flight days	Total duration
2004	45	62	14	37
2005	38	86	10	22

Table 1: Human-led migrations: comparison of the migration 2004 and 2005. Difference is mainly due to the change to a micro light with lower mean airspeed in 2005 (see text).

Spatio-temporal pattern of juvenile birds

After arrival in the wintering area the spatio-temporal patterns of the sub-adult birds were tracked via sightings and telemetry. For the G04 we have data since autumn 04 and for the G05 since autumn 05. From this preliminary dataset we draw the following conclusions:

(1) The data indicate an annual variation of flight activity in the juvenile birds. During winter the activity and radius is restricted to feeding flights in a range of about 1.2 km around the night roost. During summer, in contrast, the birds increase their feeding range up to 20 km around the night roost and they show a high tendency for long lasting far distant flights (see Fig.2 and Tab.2). Departure for these far distant flights seems to be triggered mainly by decreasing food availability.

Figure 2: Sight reports of the birds from April 2005 till November 2006. Red line: route of the human-led migration 2004 and 2005 (about 900 km); orange stars: sightings 2005; blue stars: sightings 2006; red stars: sightings 2006 'off route' (see text).

Mark	Location	State	Position		Type of sighting	Linear distance from route
			N	E		
	Scharnstein	AUT	47°53	13°56	x	x
	Laguna di Orbetello	IT	42°28'	11°12'	x	x
	Fiesso d'Artico	IT	45°25'	12°02'	flight	18
	Lignano*	IT	45°47'	12°59'	flight	0
	Tomina	IT	44°53'	11°08'	stop-over	85
	Postojna	SLOV	45°45'	14°12'	stop-over	90
	Dandolo*	IT	46°09'	12°43'	stop-over	18
	Osoppo	IT	46°14'	13°04'	stop-over	0
	Kötschach	AUT	46°40'	13°01'	stop-over	47
	Hermagor	AUT	46°37'	13°22'	stop-over	20
	Kühnsdorf	AUT	46°36'	14°37'	stop-over	20,5
	Friesach	AUT	46°57'	14°24'	flight	0
	Neumarkt	AUT	47°05'	14°24'	stop-over	0
	Pula	CR	45°16'	13°35'	stop-over	119
	Cavalese	IT	46°16'	11°27'	stop-over	120
	Saalfelden	AUT	47°26'	12°51'	stop-over	120

* For both Dandolo and Lignano we got two independent sight report. So the total of sigh reports is 14.

Table 2: Data on the locations indicated in Figure 1.

(2) For adult NBI vernal migration is assumed to take place in April. During that period in 2005 no bird from the G04 left for far distant flight. However, in April 2006 all birds from the G04 left for far distance flights, while all birds from G05 remained in the wintering area. That indicates that in juveniles NBI the tendency to leave the wintering area during time of vernal migration increases with increasing age. When birds depart for these flights, food availability in the wintering area reaches an annual maximum. Therefore we assume that, in contrast to the summer flights, the motivation for these flights during vernal migration period is mainly under endogen control.

(3) During 2005 and 2006 we got 16 independent sight reports, mainly from birdwatchers and hunters. At most sites the birds were seen for several days before they continued their journey, why we call them stop-over sites. Due to these reports the birds covered considerable distances up to several hundred kilometres in the direction of their breeding area in the north without reaching it (Fig.2). Birds were repeatedly seen in Austria, what means a flight distance of at least ¾ of the total migration distance. On female bird were seen in Syria, just 100 km south of the breeding area.

(4) Due to the sight reports the birds follow the route of the human-led migration with high reliability. Only during two trips birds were seen 'off route' at three locations (Pula, Cavalese and Saalfelden; red stars in Fig.2). The next section deals with these flights. For the other 13 locations the mean deviation off the route was 24.35 km (± 31.12 km STD) with a maximum deviation of 90 km (Postojna) and a minimum deviation of 0 km (see Fig.2).

(5) Several times birds were seen at stopover up to 90 km off the route (Fig.2). Usually the consecutive sight-report was again along the route or in the wintering area, with two exceptions: In one case a male bird continued from Postojna, Slovenia, to Pula, Croatia. It remained there for 12 days before we decided to catch it. In a second case five birds continued from Tomina to Cavalese, where we caught two birds. On Oct. 25 the remaining three birds continued across the Alps. On Nov. 1 they were seen in Saalfelden, Austria, where we caught them on Nov. 6th.

We don't know about the reason for these two 'off route' trips, particularly because we decided to catch the birds in order to avoid potential losses. However, there is an interesting relationship to individual experiences during the human-led migrations. Not all birds followed the microlight reliable. For several reasons some of the birds had to be carried in boxed for some of the one day trips, particularly during the second half of the human-led migration. We call these birds semi-migrants, compared to full-migrants. Both, the male which flew to Pula as well as the three birds which flew to Saalfelden were semi-migrants. Thus, it may be that deviation from the route, respectively the tendency to lose the way, is related to the individual experiences of the birds during their first autumn-flight. According to that, the individual deviation from route during the independent flights differs in full- and semi-migrants (Fig.3). However, for this analysis we excluded the data of two full-migrants. They joined the group of semi-migrants on the way to Saalfelden, but we caught them already in Cavalese. Therefore it remains open if they would have turn back towards the wintering area or join the group to the north.

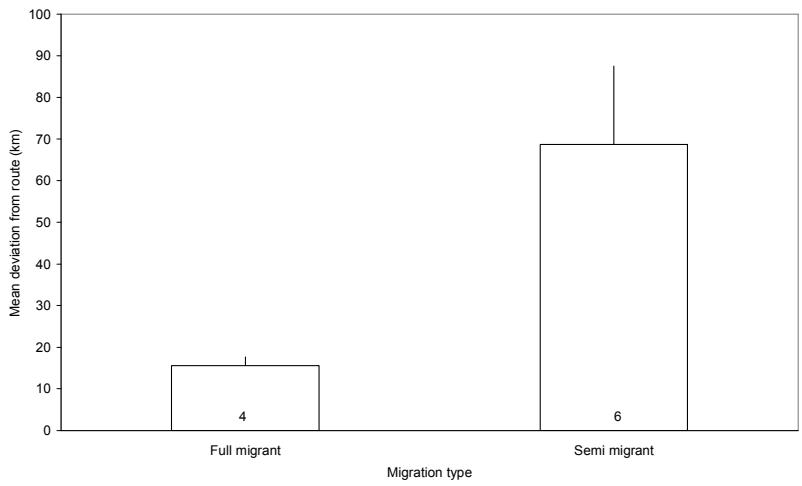

Figure 3: Comparison of the mean deviation from route in 'full-migrants' and 'semi-migrants'. Full-migrants followed the micro light during human-led migration during the whole migration while semi-migrants were carried in boxed for some one day trips, particularly during the latter part of the migration. For the analysis we excluded the data of two semi-migrants, which were caught while joining a group of semi-migrants (see text). The numbers in the bars indicate the number of individuals.

(6) Till spring 2006 we had no losses. In 2006 one bird was injured by a bullet and had to be euthanised. Four further birds disappeared. Three of them left together from the breeding area in July 2006. They were probably seen flying in Northern Italy in August 2006. Thereafter we got no further information. It is unlikely that these three birds just lost their way, first because in this case we would expect to get sight reports and second because they are all full-migrants. It seems also improbable that three experienced birds were all together chased by a predator; rather they were caught or shot by humans.

Sex	date	age	cause of death
male	02.04.2006	24	departure from the wintering area with the other birds, no furthr sighting
male	12.05.2006	25	injured by a bullet of an air-pressure gun, euthanised
male	18.07.2006	27	departure from the wintering area with the other birds, probable sighting at Colli Asolani[1], Northern Italy, no further sighting
male	18.07.2006	15	departure from the wintering area with the other birds, probable sighting at Colli Asolani[1], Northern Italy, no further sighting
male	18.07.2006	15	departure from the wintering area with the other birds, probable sighting at Colli Asolani[1], Northern Italy, no further sighting

[1]A group of three birds flying were seen in Northern Italy, probably the group consisted of the three birds which then got lost.

Table 3: Lost of birds from autumn 2004 till November 2006

(7) During long-distant flights the birds show a stepwise pattern of flight- and stopover-periods. In most cases the sight reports do not allow to track the exact pattern. But some anecdotal dataset indicate considerable flight performance, e.g. 200 km within two days; 570 km within three days; 720 km within two days. Comparison

with the flight performance during the human-led migration (Tab.1) makes clear that NBI cannot cover these flight distances by active flight. It seems probable that they use tailwinds to speed up. That is also indicated by repeated observations that birds at different stopover sites depart at the same day. From our observation we assume that they particularly take advantage of deep-pressure areas.

(8) Birds were repeatedly seen directly along the migration route (Fig.2). However, we have no indication that stopover sites used during the human-led migration were later used as stopover sites by the independent birds. The birds seem to rely on certain type of habitats rather than on particular locations (FRITZ et al. in prep.).

(9) In summer 2006 three birds from the Syrian population were equipped with satellite transmitters. They migrated over more than 3000 km to Ethiopia (see the contributions by G. SERRA and L. PESKE). Overall, the pattern of our birds fit well to the pattern of these birds. For example: The Syrian birds show a stepwise flight pattern similar to that of our birds. The Syrian birds also cover considerable distances during flight periods and they also stay for days and weeks at stopover sites. The Syrian birds seem to rely also on similar types of stopover sites. Finally, the observations of the last years indicate that the Syrian birds do not return to the breeding area before they get sexual mature.

(10) So far no bird returned to the breeding area. However, also none of the birds reached sexual maturity yet. We expect the first birds from G04 to return to the breeding area when they reach sexual maturity in spring 2007. That is indicated by the observation of a strong tendency for far distant flights in the birds after their second winter. Since discovery of the Syrian population no juvenile bird returned (G. SERRA, above). Corresponding to that, SMITH & SMITH (1992) observed straying juvenile NBI during summer in the Arabic region.

Migration physiology

Before and during human-led migration 2004 we collected faecal samples to determine the concentrations of excreted immuno-reactive metabolites of corticosterone (BM). In addition, daily body weight and early morning activity was measured (FRITZ et al., 2006; FRITZ et al., subm.; see also the concerning poster in this newsletter).

(1) We found a parallel increase of corticosterone (BM), body weight and early morning activity at the beginning of August, indicating a physiological and behavioural change of the birds into a migratory state.
(2) On the contrary, BM levels decreased continuously while the birds were actually migrating. This may be due to a down regulation of corticosterone via the hypothalamic-pituitary-adrenal (HPA) stress axis.
(3) BM was low on flight days only, but elevated on intervening non-flight days. This indicates a down- and up-regulation of the BM level in relation to flights and stopovers. That adds relevant aspects to the recent theory about energy management during migration (Migration Modulation Hypothesis).

Feeding ecology of Northern Bald Ibis in winter- and summer habitats: Outdoor study with groups of hand-raised, free-flying individuals

During the last years data collection on feeding ecology took place with groups of hand-raised free-flying individuals in Burghausen, Bavaria and Laguna di Orbetello, southern Tuscany; (FRITZ et al. in prep.; ZOUFAl et al. 2006; ZOUFAL et al. this newsletter; see also the concerning poster in this newsletter).
(1) In all regions the birds' food consists mainly of worms, larva, beetles and snails. Jumping, fast running or flying invertebrates as well as small vertebrates contribute just marginally to the birds' diet. Thus, the preferred prey can be ecologically characterised as slow motion invertebrates.
(2) Feeding efficiency differed significantly according to habitat type. Birds were most efficient on natural, extensively used agricultural sites with low nitric impact, i.e. extensively used meadows and, in particular, pastures. Thus, the Waldrapp Ibis proved to be a Flagship species for natural agricultural sites with a high biodiversity.
(4) Most of the food is taken 2 to 10 cm out of the soil.
(5) Only a few other bird species use the same cultural ecosystems as the bald ibises and most of them have a different hunting technique. This was particularly apparent in the wintering region with a high density of birds of different species. Most of them just used the marshland and the open water for feeding, including species with a similar tactile hunting technique as the Northern Bald Ibis, e.g. Curlew (*Numenius arquata*), and Glossy Ibis (*Plegadis falcinellus*).

Continuation of the project 2006/07

The IAGNBI meeting in Spain, September 2006, has indicated that a methodology to establish migratory colonies will be a relevant technique for future conservation needs in different areas of the former NBI distribution, including Turkey, Syria, Morocco and Europe. Each former and recent NBI free-flight and conservation project faces autumn migration as the major management problem, e.g. the former Birecik project (ARIHAN 1999), the Gruenau project (KOTRSCHAL 1999), the Syrian project (SERRA 2004) and just recently the Spanish project. For the last wild population in Morocco EL BEKKAY & OUBROU (2004) state that: "the NBI dispersal after the breeding season remains a mystery, and it's a real threat for the conservation and the protection of the birds". This "migration" of adults and juveniles, concerns an important proportion of the Moroccan NBI population'.

In 2007 and 2008 we plan two further migrations, based on the experiences during the last years. Basic aim is to continue the feasibility study to re-establish migratory breeding colonies.

In 2006 we tested an alternative type of micro light airplanes, a so called paraplane. (Fig. 4). It allows flying double seated and less than 40 kmh-1. Using double seated microlights gives us a relevant degree of flexibility, because pilot and foster-parent don't have to be one and the same person anymore. In 2007 the migrations will start at the city of Burghausen, Bavaria. This city is located central in the historical breeding area of the European population. In the context of the migration projects we plan to continue and extend our scientific studies.

Figure 4: Test flights with a paraplane. These planes allow flying with very low speeds, even with a passenger behind the pilot. If we succeed with further flights these planes will be used fur further migrations.

Research Project: Physiological and spatio-temporal pattern of juvenile migratory birds: a semi-experimental field study with NBI during human-led migration and the consecutive juvenile phase till sexual maturity.

During two consecutive years 2007 and 2008 we will perform human-led migrations along two different migration routes from a breeding area in Bavaria to a wintering area in the southern Tuscany. After the migration birds will be equipped with a global positioning system (GPS) before they become independent. Every 5 seconds the GPS loggers measure and store the individual's position, altitude, speed and time. A second major dataset on individual physiological parameters will be obtained via faecal samples and blood samples.

The project aims to investigate spatio-temporal pattern and physiological parameters of NBI during three consecutive years from fledging to sexual maturity. It is a semi-experimental approach in the sense that we work with groups of free flying hand-raised birds with known life history, which regularly can be recaptured by the foster-parent for data collections.

PhD Project: Conservation genetics in the Northern Bald Ibis (*Geronticus eremita*): Evaluation of the genetic diversity in the Northern Bald Ibis zoo population

Evaluation of the genetic diversity in the wild, semi-wild and captive population of Northern Bald Ibis is mentioned as a high priority in the NBI species action plan. However, despite several attempts there is no comprehensive study available yet. The project aim to evaluate (in an ascending order)

1. the genetic diversity in selected captive and semi-wild breeding stocks of NBI from Morocco origin;
2. the genetic diversity of the wild Moroccan population and the Syrian birds, as far as feather or tissue samples are available;
3. the genetic diversity from Turkish origin, as far as feather or tissue samples are available
4. to try to get DNA samples out of historical European tissues (bones, feathers).

Our project aims

1. to evaluate and optimise genetic diversity in the captive and semi-wild breeding stock
2. to create a genetically diverse stock of captive breeding birds as a basis for supplementation scenarios and possible reintroduction projects
3. to evaluate the genetic diversity of birds from Moroccan, Turkish and Syrian origin.

PhD Project: On the relationships between genetic determination and social tradition in bird migration: a comparative study in Ciconiiformes

Research on bird migration is traditionally focussed on genetically determined behavioural patterns. Despite numerous data and anecdotes indicating a high relevance of social learning, systematic investigations on the relationship between genetic determination and social tradition in bird migration are rare. White storks (*Ciconia ciconia*), for example, are known to have a genetically determined migration preference (east and west). However, cross fostering experiments indicate a superimposed impact of social information: offspring take over the migration route of their (foster-) parents. In Northern Bald Ibis timing of the migration seems to be genetically determined while the migration route and the wintering destination is a socially learned tradition (FRITZ et al. 2006). Thus, there seems to be a gradual variation in the impact of social information on the determination of an individual's migration behaviour. Clearly, the ability to acquire social information needs an appropriate social context. NBI, for example, is known to have a particularly close and long lasting parent-offspring relationship. This is also being manifested in a particularly long-lasting and close relationship to human foster-parents. Thus, we assume that the relationship between genetic determination and social tradition in birds' migration behaviour is related to the social system.

The project aims to compare the migration behaviour and the social system within the group of Ciconiiformes. In these, social behaviour has developed in many different ways, from loners to highly social group-living species. We discuss how this might affect (traditional) migration behaviour, which parts are genetically fixed and what has to be learned individually from parents or other conspecifics.

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Feeding ecology of the Northern Bald Ibis in different habitat types: an experimental field study with hand-raised individuals

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Introduction

The NBI is a critically endangered species in the wild. Thus for conservation and a possible reintroduction it is necessary to learn more about the ecological needs and requirements of this species. This includes:

- Description of habitat preference
- Intra-specific variation
- Home range size
- Shelter- & food requirements
- Foraging- & feeding behaviour
- Predators & diseases

Therefore, apart of the migration project (FRITZ 2004) we laid our main focus on foraging and feeding behaviour. We wanted to proof the suitability of cultivated areas as feeding habitats for NBI. So we wanted to answer:

- Which food types do NBI feed in different regions?
- Does the foraging efficiency vary in different regions- and habitat types?

However, often it is difficult to investigate on animals in the wild (NOGGE 1993), which is especially true for the rare NBI. The last remaining colony in Morocco seems to live in a rather extreme habitat concerning location and feeding although the NBI is very flexible and able to adapt to different habitat (HANCOCK et al. 1992). Additionally we wanted to investigate new areas with the potential for reintroduction to get more data about "characteristic" breeding and wintering areas.

Method

We decided to work with hand raised individuals. Zoo offspring of NBI were separated from the parents when 5 to 8 days old and then reared by human foster parents. We do this following a strict protocol. The advantages of working with hand raised individuals are clear:
One can

- join them during flying free
- determine where to go, spatial movement is controlled
- observe from a close distance without disturbing the birds

This all together means hand raising is an appropriate tool to study NBI´s in situ.

Sample areas

1) One north of the Alps in Germany, in Burghausen. Burghausen is a city which lies central in the historical breeding area. The investigated areas there are agricultural and managed in an ecological way. Burghausen represents a potential summer- respectively breeding region (SR).

2) The second area is in Italy in southern Tuscany, called Laguna di Orbitello. This region is protected and managed by the WWF and is a potential wintering region (WR). In fact it is a relevant wintering area for many other bird species. The investigated areas are natural areas. In the agricultural areas in Germany we distinguished between different habitat types:

- pasture: these habitat type is grazed by cattle and there is no additional fertilization
- grassland: it is cut three times a year and fertilized with cow dung
- poor grassland: cut twice a year and no fertilization at all.

Sample Area (State)	N° of Individuals	Age (month)	Season	Periods
Burghausen (GER) agricultural areas	8 (2004)	13-15	Spring / Summer	May 20th 05 - Jul. 28th 05
Laguna di Orbetello (IT) natural areas	11 (2002) 10 (2003)	18-22 (2004) 06-10 (2005)	Winter	Oct. 19th 03 - Feb. 15th 04

Table 1: sample areas

Data sampling:

Data collection was done with 29 birds in total, 19 were older than one year at the time of data collection. So these birds had enough experience in finding food of their own. We took data in the years 2003, 2004 and 2005 at the different areas and in different seasons.

Data collection was done by focal sampling within a standardized protocol (taken with a dictaphone). A foster parent went out with the birds and joined them during free flying. The foster parents decided were to go. The birds are well accustomed to the human foster parents and normally they stay close to this person. So we could easily observe from a short distance on what the birds were feeding and their feeding frequency. The focal individual was chosen by chance and observed for 5 minutes. If this bird stopped feeding data collection stopped as well. We didn't use these short protocols for interpreting our results. For taxonomic determination we used only food bits we collected by hand during the observations. Following parameters were taken:

Type-	Size-	Origin of the food bits
Annelidae	Small (< 1 cm)	In the soil
Larvae	Medium (1 – 5 cm)	On the soil
Beetles	Large (> 5 cm)	Out of dung
Gastropoda		
Others		

Table 2: Observed parameters

Additional parameters

Additionally we made food samples. We also analysed the soil fauna with Barber traps and earth samples to get an idea what kind of food was available for the birds. (Barber traps are representative for moving jumping and also flying invertebrates. Earth samples are representative for slow motion, cryptic species in the soil.) All the food samples were classified taxonomically (determination by T. MARKUT) and dry weight was determined.
In both investigating areas we measured temperature, humidity and the amount of rainfall at the aviary.

Results

Food origin, size and foraging habitat

In Germany the birds found annelids equally in and on the soil, insect larvae were significantly more often detected in the soil and adult beetles only on the soil. The result is not really surprising. In Italy annelids and larvae were found significantly more often in the soil, beetles in and on the soil in equal shares. At pastures a marginal proportion of food was found in dung, i.e. dung beetles and annelids, but just a small amount (Table 4).

	Food-Type	Food Origin	
		In the soil (%)	On the the surface (%)
GER	Annelides	45.13	54.87
	Larves	92.70	7.30
	Beetles	0	100

IT	Annelides	94.80	5.20
	Larves	90.67	9.33
	Beetles	56.17	43.83

Table 4: Origin of food bits.

	Food-Type	Food Size		
		L	M	S
GER	Annelides	48.70 %	43.14 %	8.16 %
	Larves	6.85 %	86.66 %	6.48 %
	Beetles	14.91 %	85.09 %	0 %
IT	Annelides	29.43 %	51.14 %	19.43 %
	Larves	2.11 %	62.35 %	35.54 %
	Beetles	33.94 %	66.06 %	0 %

Table 5: Size of food bits

Most food bits were allocated size class M in Germany and Italy as well. There was only one exception in Germany with annelids when bigger earthworms (class L) were found in higher amounts (48%).

	Mean Temperature (°C)		rainfall mm/month
Time	09:30	13:30	
October 2003	14		
November 2003	16	17	122
December 2003		14	63
January 2004	6	11	56
February 2004	9	13	40
March 2004	12	13	55

Figure 6: Meteorological data for the winter region Orbitello, Italy in October 2003 to March 2004; Data were taken near the birds' aviary (N 42°28.608', EO 11°12.507').

Food types

The type of food used by the NBI in Burghausen, Germany and in Orbitello, Italy varied significantly. Whereas in Burghausen annelids played the most important role with 61,2 % of all food items taken, they made just 22,9 % of the diet in Orbitello. In Italy adult beetles played with 22% an important role. Larvae of insects (beetles, flies and butterflies) were with 30% an important part of the daily diet in both regions.

Food-Type	taxonomic groups1	Proportion of the diet (%)	
		IT	GER
Annelids	Earthworms (Lumbricidae)	22,9	61,23
Larva	Larvae from beetles (e.g. Tenebrionidae, Staphylinidae), flies (e.g. Syrphidae) and butterflies	36,8	31,4

Beetles	Staphylinidae, Carabidae, Scarabeidae, Tenebrionidae	22,25	4,17
Gastropodes	Helicidae (Cantareus sp.), Hygromidae (Cochlicella sp.)	14,45	4,5
Others	Inorganic and vegetable pieces, snail eggs, pieces of snail shells, Arthropoda (Myriapoda, Saltatoria, Arachnida, Isopoda)	3,6	0,05

Table 3: Food composition

Annelids consisted mainly of earthworms. Within in the group Larva larvae of beetles and flies were most abundant. Within the Gastropodes the birds liked specimen of *Cantareus sp*. most. However, as this species is foaming when disturbed, the NBI learned to avoid it and later preferred *Cochlicella sp*.
Although the food types varied between the different regions but in general NBI´s were foraging on invertebrates with a cryptic lifestyle and slow motion. During the data collection the birds never caught insects in the air or collected animals from higher vegetation.

Foraging efficiency

Energetic needs can be expressed by food dry weight (DW) and dry weight of food is a function of body mass in birds (M1987). To get an idea of the energy requirements of a NBI it is necessary to know its bodyweight. : Mean body weight of our birds was 1284 ± 112 g which results in a mean energetic need of 68,7 g dry weight per day. This calculation is related to field metabolic rate (FMR) in birds. To explain foraging efficiency we wanted to know more about energy requirements in our birds.
And FMR is defined as the energy needs respectively energy alteration in the wild (HELDMAYER 2004). FMR includes BMR (basic metabolic rate), Thermoregulation, motion, feeding behaviour, predator avoidance, alertness, posture, digestion, reproduction and growing.

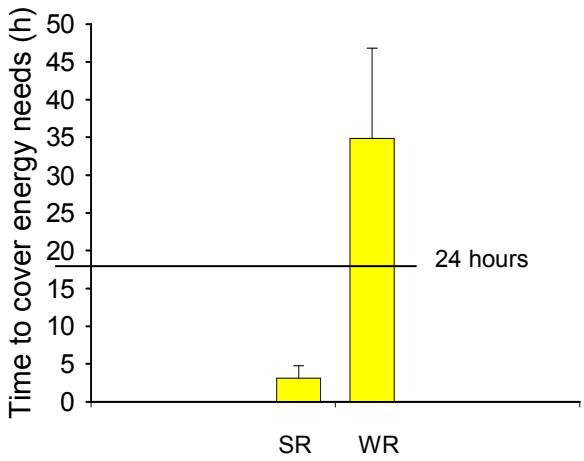

Figure 1: Calculated time spent on foraging in agricultural (SR) and natural regions (WR). (Mann-Whitney-test p = 0,000).

The calculated time that the NBI needed to cover their energy needs for one day or 24 hours in the agricultural region (SR) and the natural region (WR) varies significantly (Mann-Whitney-test p = 0,000). The foraging efficiency and the time spent to cover the energy needs in the three defined habitat types (pasture, grassland and poor grassland) vary considerably (Fig.2).

Figure 2: Calculated time spent on foraging in three different habitat types.
(Friedmann-test: p = 0,000).

Discussion

Food types

Three main food types contributed to the food of our birds: annelids, larvae and beetles. Although the food composition varies in the different sample areas there are obvious common characteristics of the preferred food types like cryptic lifestyle and slow motion.

Foraging efficiency

In Germany with the organically managed agricultural habitats it is easy for them to cover their energetic demands in a short time (Fig. 1). But in Italy on the natural habitats it is impossible for the birds. They would need longer than 24 hours for doing so. One explanation for this high value in Italy is the calculated energy needs as FMR. FMR includes not only energy costs for daily survival in the wild but also energy for reproduction and growing. This energy calculation fits for birds in their breeding area, were reproduction happens. But probably in the wintering area the energy demands are not as high and we possibly have overestimated what the birds really need. So this could explain this extreme high value.

However our birds showed us something interesting: When independent of their foster parents in Italy they went for areas which are similar to the habitat in Germany. The birds preferred to forage on agricultural areas. These observations are similar to the experiences in Austria, Gruenau, were the free flying colony forages exclusively on agricultural areas. But at the moment we have no data from these preferred feeding places in Italy.

Organically managed grassland was the most efficient feeding habitat. For this habitat type we calculated 1,5 hours to cover one birds daily energy demand. On pastures birds were more efficient than on poor grassland. According to the definition of the three habitat types it seems that not only short vegetation plays an important role in feeding efficiency but also fertilization has an impact.

Our data show that agricultural habitats particularly organically respectively extensively managed areas, offer appropriate feeding habitats for NBI. This corresponds with historical records, which indicate that the main breeding areas of NBI were in such regions close to human settlements (SCHENKER 1977).
Data collection will go on in European and when possible also other regions with historical NBI records. We aim to form a database for conservation the last remaining wild colonies and to evaluate possible regions for reintroduction.

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First survey of Eastern Northern Bald Ibis Geronticus eremita wintering on the Ethiopian highlands: field mission report 14th November -1st December 2006

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1. Background

A relict breeding colony of the eastern population of Northern Bald Ibis (*Geronticus eremita,* NBI) was unexpectedly discovered in 2002 in the central Syrian desert (SERRA et al. 2003). Until then, the eastern NBI population was thought to have become

extinct from the whole Eurasia by 1989, with the extinction of the colony of Birecik, Turkey. As the Syrian colony showed to be migratory and to spend about 7 months outside the breeding grounds (typical feature of the NBI eastern population versus the western one which is more or less resident), it was soon realized that sound protection at breeding grounds was not sufficient to ensure its survival.

After three failed attempts (2003-05), successful tagging of 3 breeding adult NBI took place in Syria in 2006 (SERRA & PESKE, 2006), with the aim of getting key information about the rest of the NBI distribution range. Subsequent satellite tracking enabled to unveil the migratory route and the wintering grounds of the NBI relict colony. After a stop-over of about 18-19 days in coastal western Yemen, the tagged birds quickly reached on 19th August a location on the Ethiopian highlands, about 75 Km NE of Addis Ababa.

During 2-4 October 2006, EWNHS organized a preliminary survey to detect the birds on the ground: four adult birds were detected and photographed by a pond (locally known as Tigri pond, a roosting site for about 200 Common Cranes *Grus grus*). A second unauthorized visit was undertaken by Dr. RAF Aerts at the end of October (either on 27th or 28th): no details are available about this second survey except that Dr. Raf mentioned he saw the birds at the same pond. Preliminary analysis of Argos satellite locations during the period of mid August till the end of October 2006 showed that the home range of the four birds was remarkably restricted (< 30 km²), in an area lacking of any kind of human infrastructure.

2. Purpose

A preliminary survey of tagged NBI at their wintering grounds with the aim of acquiring as much information as possible in order to enhance their future chances of survival.

3. Study area and method

G. SERRA arrived on 10th November 2006 in Addis Ababa while Lubomir PESKE on 12th November. Despite email communication sent well in advance, any attempt to meet Dr RAF Aerts in Addis Ababa in those days failed. We met with Mr. Kinfe ABEBE, Executive Director of EWNHS, on 13th November 2006 at the office of Addis Ababa. On 14th November 2006, we met with Mr. Mengistu WONDAFRASH (EWNHS Biodiversity Conservation Team Leader and Program Director). The day was spent in preparing needed materials and equipment, organizing logistics, purchasing food supplies etc. As agreed in advance, Mr. WONDAFRASH had purchased the relevant topographic maps of the study area (1:50.000): although the accuracy of co-ordinates grid was not very precise, these maps proved to be very useful for locating drainages but not useful to reveal the contour of villages and of wetlands.

Next day, 15th Nov 2006, early morning, the party departed from Addis Ababa with a 4x4 vehicle provided by EWNHS, driven by Mr. Tewabe ASHENAFI. We arrived at destination at sunset of same day, after 185 km of driving. Mr. Getiye GIRMA, a young staff member from the local Agricultural District joined the field team. A total of 15

days of field work were carried out from 16th – 30th November (study period, hereinafter). The study period was a dry one, following the long rainy season (mid June-mid September). This dry season is a cold one, ranging from mid October until mid January, characterized by a sharp temperature difference between day and night (average temperature: 12.6 °C; min: –6 °C & max: 24 °C – see Fig. 1). The average altitude of study area is about 2750 m.

After we had found the tagged birds at feeding grounds and their roost on the first day (16th November 2006), the roost was monitored thoroughly during roosting time (17:30/18:00) and during predawn (6.00/6.15) at least across 3 different days. On 2 different days (18th and 20th November 2006) the four birds were followed continuously from the very moment they left the roost until they returned (always between 17:45 and 17:50), recording their behaviour and any other significant observation each 10 minutes. On the other four days, while conducting reconnaissance and mapping of feeding habitats, GPS recording etc., birds were observed more loosely and opportunistically. But due to the restricted home range used by the birds and the crucial help of VHF tag's signal we were most of the time aware of the bird's whereabouts.

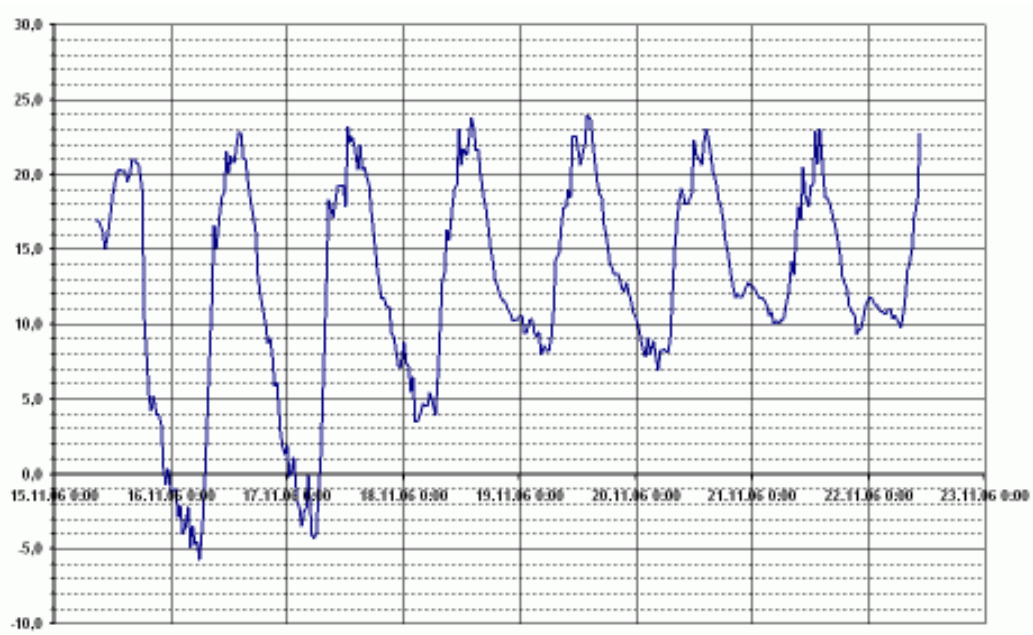

Figure 1: daily variation of temperatures in the study area during study period

An analysis of the movements of the NBI during the whole wintering period (18th August 2006 till 10th February 2007) was carried out a posterior, using the LC3 and LC2 satellite diurnal locations provided by Argos. In order to avoid those LC3/LC2 locations with large errors (in theory about 33% likelihood), only those spatially and temporally clustered were considered: in these cases, the average error was assessed by using a reference GPS point recorded directly in the field (the roost), and resulted < 300 m. "Feeding area" was identified and defined as the largest surface polygon including all the NBI locations reached by the birds either by walking or by short-range flights (i.e. < 100-200 m), detected during the daily observations in the field, adjusted as much as feasible to the topography.

Feeding habitat selectivity of the NBI was assessed by comparing the time spent by birds in each feeding habitat against the relative surface of the feeding habitats. Surfaces were estimated a posteriori using GPS records and program Ozi Explorer. The use of each feeding habitat was assessed by recording the time spent by the birds at each habitat, in slots of 10 minutes, across two days (18th and 20th November 2006). An area of the Ethiopian highlands with an extension of about 95x35 km = 3,325 km² of apparently uniform landscape, surrounding the actual NBI home range, had been previously identified from the satellite imagery analysis: the search for possible additional NBI was focused on this area, during the 24th– 30th November 2006.

The search was planned and carried out using an opportunistic approach, by: a) focusing on the scant but crucial information we had: the description of the location where John Ash's saw 5 NBI on 22nd January 1977 (about 35 km E-SE of the NBI actual home range, in the surroundings of the village of Cha-cha), the location of another possible recent record provided by EWNHS, and the database of WELCH & WELCH (2004); b) making good use of all limited possible accesses, either by hiking and/or driving (most of the central highland plateau is accessible only by walking and horse riding). Due to conservation concerns (as explained in details in Potential threats, see 4.9), information on the socio-economics of the local community was indirectly drawn from the local Agriculture Office – rather than questioning directly the local community.

4. Outputs

4.1 Roost and search for additional birds

The flock of four adult NBI (three of them sat tagged) was found on the morning of the very first day (16th Nov), following the signal of VHF tags, about one hundred meters away from the so called "core area": this was the area from were most of the nocturnal satellite locations of the period before the start of survey were coming from, i.e. an area of 1x1.5 = 1.5 Km². The roost was detected the evening of same day (Photo 1), and appeared to coincide with the so called "core area"itself - with an error of about 50m. The roost is a 20m tall *Eucalyptus grandis* tree, towering a two family tiny village, sitting on a low hill (2670 m), overlooking Basin 1 and one of the two main feeding areas (FA-A, see Map 1).

Photo 1: The 4 NBI flying over their roost at sunset

Because all villages are located on slow rolling ridges and top of low hills, bordering the main drainages, the NBI roost represented one of the highest points of the whole home range, and surely the highest point of Basin 1 (see Map 1). The roost has a dominant position over the basin, and it probably ensures a good safety to the NBI: it is supposed that shorter trees would not ensure same degree of safeness to roosting birds. In fact, on the same Eucalyptus tree, few Pied Crows were observed roosting, while some 30-50 Wattled Ibises (*Bostrychia carunculata*) roost on another high *Eucalyptus grandis* tree few tens of meters away.

On their return at sunset, birds were observed flying around the roost several times, some more than the others, before landing on the upper third of the height of the tree (see Photo 1). The Eucalyptus tree used as a roost was reported by the owner being about 50 year old. Eucalyptus trees are reported to be logged in the area, typically during the month of April at age of 7-12 years. Eucalyptus trees are common around villages, and they are used mainly as building material – and in a lesser amount as firewood. Some trees are kept close to the huts as a shade. The roosting tree appeared to be just beside huts - possibly used as a shade.

Map 1: The wintering home range of the 4 NBI, with indication of the two main basins (in blue, streams), the roost and the two main feeding areas (FA-A and FA-B)

There are several tall trees, probably all in cutting age, all around the NBI roost. Birds were monitored closely during the 7 field days, also due to the very restricted home range, and roost was also monitored thoroughly several times, during predawn and at sunset. The four NBI individuals have almost never separated during the whole study period. None additional NBI individual was detected neither at feeding grounds nor at the roost.

4.2 Home range

The actual NBI home range is located in the central Ethiopian highland plateau, a relatively flat and undulating landscape with an altitude ranging between 2600 - 3100m.

The altitude of the NBI actual home range (average 2750m, lowest 2630m) appears remarkably lower than the average altitude of the plateau. The home range remotely revealed by the LC3/LC2 satellite diurnal locations of the three tagged birds, from period 18th August – 14th November 2006 (n=48), is an area < 4.56 x 6.85 km= 31.24 km²: this home range was confirmed during the survey, except from the Tigri pond. From the satellite locations it is evident that birds quit the use of this pond by early November, possibly due to its reduction in size following the progressing dry season.

The home range used by the four NBI during the study period, due to the restricted size, has been fully identified and recognized. Two parallel shallow valleys or basins form the NBI home range: they are indicated as Basin 1 and Basin 2 in Map 1, both with a stream, running (S-N) along their central sector. The two basins are separated between each other and bordered by slow rolling ridges scattered with Eucalyptus and Acacia trees and regularly-spaced villages.

The two basins suffer a heavy human impact and are used for agro-pastoral purposes by the local community. No native vegetation cover appears to be present anymore (except from scattered and isolated Acacia trees). The slopes adjacent to villages are mostly used for cultivations (mainly wheat, tef (an endemic sort of grain used on the Ethiopian highlands), barley, oath/rye) or kept as (overgrazed) pastureland. The wetter sectors of the basins, along the streams, are used as hay fields. During study period farmers were intensely engaged in cutting the hay fields, in harvesting tef and also, in a lesser extent, in ploughing the fields.
We were told that hay cutting is an activity typically carried out from mid October to mid November, annually. LC3/LC2 Argos diurnal locations showed that the home range used by NBI after the survey (December 2006 – February 2007) is a bit larger than that used up to November: the estimated size is < 7.55x4.84 km= 36.54 km². This home range is actually much larger if a location of Zenobia detected by satellites at 27.5 km E from the roost, dated 13 January 2007, is included (see feeding habitats, below).

4.3 Feeding habitats

According to our definition of feeding area, mainly two distinct feeding areas have been used daily by the 4 NBI during the study period, located about 3 km apart from each other: Feeding Area A (FA-A: an estimated area of 309,142 m²) and Feeding Area B (FA-B: an estimated area of 2,467,515 m²) (see Map 1), within Basin 1 and 2, respectively. Feeding habitats within FA-A and FA-B were duly identified and photographed.
The only habitat used at FA-A was the recently cut hay fields (Photo 2). This specific habitat appeared to be used by birds only as long as the cut hay remained green or greenish. Birds appeared to quit using it once the hay turned dry and yellowish. Actually, during the study period we could witness the usage of a recently cut hay field, within FA-A, and the subsequent abandonment of it within the following days, as more freshly cut hay fields were becoming available. During the study period the birds have been seen using 3-4 different recently cut hay field within FA-A (within an area of about 0.53 x 0.82 km= 0.43 km²). During the study period an intense hay cutting was taking place within FA-A, with many farmers deployed in the hay fields the whole day. Apparently, the hay cutting this year was a bit delayed than usual.

Photo 2: Two NBI (left) and 1 Wattled Ibis (foreground, to the right) feeding on a recently cut hay field at Feeding Area A (FA-A).

Within FA-B, birds used dry and overgrazed pastureland as feeding habitat instead of freshly cut hay fields. They used 4-5 different pasturelands within a radius of 1.5 km. Moreover, the birds were seen at least in two instances feeding outside FA-A and FA-B, on some hay fields adjacent to a stream of Basin 1. As already reported above, during the study period they were never seen using the Tigri pond where they had been seen and photographed during the first EWNHS survey. Habitat preference by NBI could be assessed for each feeding area separately, by comparing usage versus availability (Fig. 2a and 2b): a preference seems evident for either recently cut hay fields, when in FA-A (Fig 2a) and for dry pastureland, when in FA-B (Fig 2b).

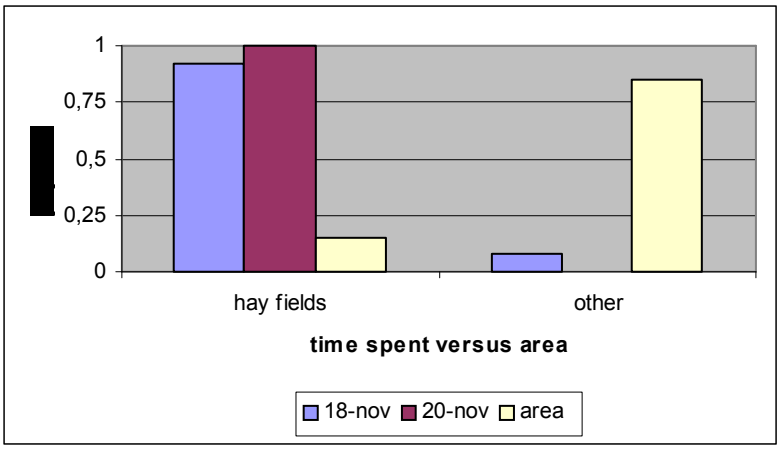

Figure 2a: Habitat selection at Feeding Area A (FA-A)

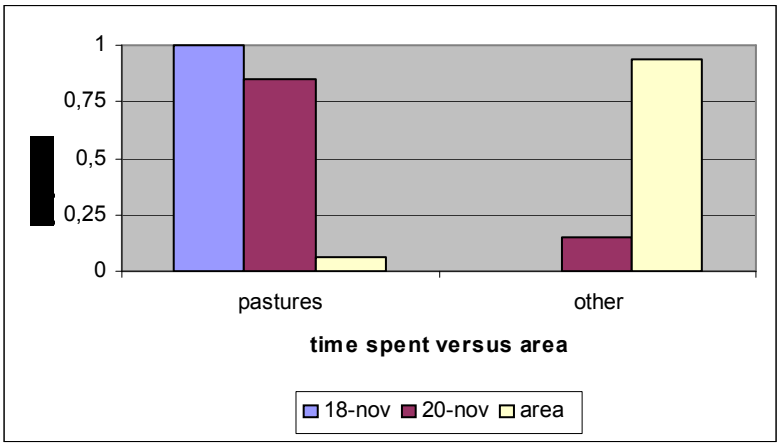

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Figure 2b: Habitat selection at Feeding Area B (FA-B)

Diurnal satellite locations (LC3/LC2) during period 18th August – 14th November 2006 (n=48) show the positions of the three NBI as being clustered mainly in two areas: one located 780 m NE of the roost and one 2.93 km N of the roost. The former area actually coincides with FA-A while the latter with the Tigri pond where the birds have been seen during the previous two visits. During the same period there are only 2 locations coming from the area defined as FA-B. There are only 2 good-quality satellite locations relatively to the days of the actual survey and match to what was seen on the ground: two afternoon locations of tagged birds at FA-B on the 21st November. When considering the diurnal locations relatively to the period 1st December 2006 till 10th February 2007 (n=49), 4 clusters are recognizable:

- one is 610 m E of the roost, used until the 17th January 2007 – this is actually FA-A
- one is 3.05 km W-SW of the roost, used until 9th February 2007 – this is actually FA-B
- one is 3.2 km E-SE of the roost, used during period 18th -21st December 2006, and another is 3.87 NW of the roost (only 3 locations during days 7th-10th January 2007) – both seem new feeding areas.

Interestingly, on the afternoon of 13th January 2007 Zenobia was detected by satellites as far as 27.5 km E from the roost, and only 6.26 km apart from the actual site where John ASH had recorded 6 NBI in January 1977. This is surely the furthest location from the roost of the whole period [1]. In conclusion, the key facts about the use of feeding areas seem the following:

- all birds seem to have used the Tigri pond during October only
- FA-A has been used from August throughout mid January
- FA-B has been used from about mid November throughout the last day before the return migration
- other 3 new feeding areas have been used after the survey.

[1] This long-range excursion was confirmed by consistent locations (LC1 and LC3). As the other birds did not transmit in that period and as we observed the 4 birds all together at all times during study period, it is reasonable to presume that actually the whole flock had made this long-range excursion. Zenobia's locations are from the afternoon (about 13:30 – 17:00 local time), thus we cannot rule out a direct visit to the John Ash site itself. Sultan was transmitting from the usual roost that same night, therefore it was most likely a return trip.

4.4. Behaviour

The daily temporal pattern of usage of the two feeding areas (FA-A and B) appeared to be very conservative during the whole study period: the birds typically spent the early morning on pasturelands of FA-B (from about 6:15 until 8:30-9:30), the late morning and early afternoon in FA-A (from 8:30-9:30 until 14:30-15:30), and late afternoon until sunset at FA-B again.

In both feeding areas, but especially in FA-A, the NBI tended to group, while feeding, with Wattled Ibises – when on hay fields close to streams also with Cattle Egrets (*Bubulcus ibis*) and Sacred Ibises (*Threskiornis aethiopicus*). In certain instances, NBI was seen mixed with as many as 20 Wattled Ibises. More commonly, on average, they were seen together with 0-10 Wattled Ibises. Feeding grounds of NBI and Wattled Ibises overlap only partly, mainly on hay fields, as the latter uses also high meadows and true wetlands. The NBI was also seen relaxing sometimes together with Wattled and Sacred Ibises by a pond or a stream (Photo 3).
When feeding at FA-B the four birds were more often observed as a sole group (or together with few crows). Even when mixed with Wattled Ibises, the 4 NBI showed to be constantly quite close in contact between each other. They always flew from one feeding ground to the other alone, and they also roosted by themselves, despite the roost of Wattled Ibises was on another Eucalyptus tree only 20-40 m apart from their own.

Photo 3: The 4 NBI relaxing together with Sacred Ibises at a pond.

The continuous observation of the NBI during two distinct days (a holiday, 18th November, with few people working in the fields and a working day, 20th November) showed that birds spent most of their time feeding (on average 78-80% over the two days), while a small percentage of time was allocated for preening and relaxing (Fig. 3). Typically, sustained and long range flying (i.e. more than few minutes and > 2 km) has been observed usually only 4 times daily: from roost to FA-B, from FA-B to FA-A, from FA-A to FA-B again and finally from FA-B to roost. The amount of time allocated by the NBI for feeding at wintering grounds during the study period, seemed quite

larger than that observed at breeding grounds, suggesting a lower productivity of the wintering versus the breeding grounds.

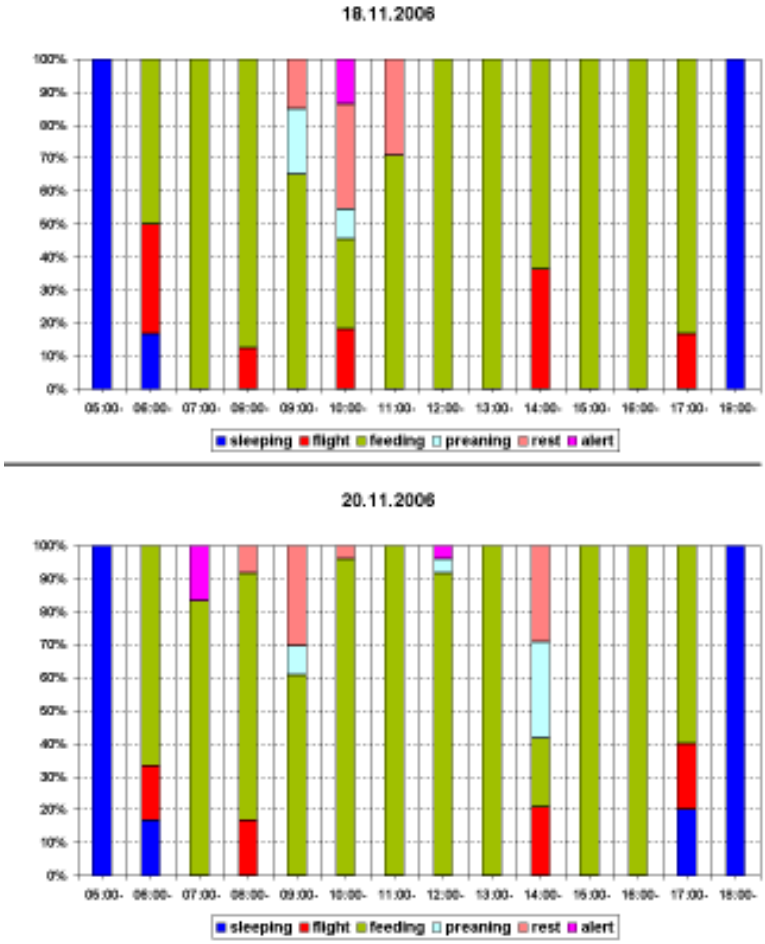

Figure 3: Behaviour temporal budget of the NBI during the 18th and 20th November 2006

Observations of feeding around the Tigri pond made during first EWNHS visit indicated that the NBI may have temporarily different food resources available. At that time birds seemed to use even more time for resting, suggesting that while winter progresses the birds might become more dependent on cut hay fields and their daily activities become fully concentrated on food collection. In one instance, the alert reaction behaviour of the four NBI triggered by the passage of a Tawny Eagle (*Aquila rapax*), quite high in the sky, could be observed in detail: birds, while continuing to feed, were regularly (every 5-15 sec) turning the head toward the sky, clearly gaping at the soaring raptor. This observation seems to suggest that the NBI can be preyed upon by large raptors, such as eagles.

4.5 Indication on diet

Despite we had agreed to avoid close behavioural observations due to conservation concerns (see Potential threats, see 4.9), the feeding behaviour of Wattled Ibises and the NBI at FA-A was recorded from close range in at least one occasion: Wattled Ibises appeared to probe with the tip of the bill the ground surface and, once found a hole, sticking the bill few cm underground to extract what most likely seemed insect larvae (length ≤ 1 cm).

NBI seemed often to behave likely, although not so intensely like Wattled Ibises: they seemed most frequently to pick up items from the ground surface. Inspection of cut hay fields (FA-A), used as a feeding area by the NBI only half an hour before, revealed the presence of:

- Coleoptera: at least 3 different small-sized species (length ≤ 1 cm), one of them a Carabidae
- Orthoptera: at least 2 species (a small one with length ≤ 1 cm, and a medium sized one ≤ 3 cm)
- Formicidae
- Amphibia: 1 small frog and one small toad (length ≤ 2 cm), found hidden under stones.

All these potential prey found at FA-A was duly photographed. Observation of feeding behaviour of NBI at dry and overgrazed pastureland (FA-B), coupled with inspection of the pastureland surface, suggested that birds were mainly feeding on ants in that specific habitat.

4.6 Mapping and GPS recording

The following key topographic features of the NBI actual home range were duly GPS recorded:

- roost location
- contour of all recorded ibis feeding habitats (i.e., cut hay fields and pastureland in FA-A and FA-B, respectively)
- villages
- streams
- trails

The following topographic features of NBI home range were regarded as most probably recognizable from a medium-quality resolution satellite image:

- ploughed fields: very dark and regularly shaped surfaces (squared or rectangular)
- uncut hay fields and pasturelands: light yellowish surfaces
- villages surrounded by trees: dark irregular surfaces.
- The contour of several samples of these three key topographic features was duly GPS recorded with the aim of carrying out ground truthing on satellite images at a later stage.

4.7 Bird community

We recorded the occurrence of a total of 100 bird species within the NBI home range. Beside wetland birds the area seems an important feeding/wintering site for birds of prey (vultures, eagles, harriers). The number of bird species raises up to 127 when including the surveyed areas surrounding the home range.

4.8 Local community

The local community living within the NBI wintering grounds belong to the ethnic group known as Oromo, which is the largest one in the country - although not the politically dominant one. They speak their own idiom (Oromifa), different from the official national language (Amharic). Majority are Christians, with a little Muslim

minority. In the study area the people typically make a living out of an agro-pastoral subsistence economy. Rain-fed agriculture and livestock husbandry is carried out probably according to same fashion since centuries (if not millennia) ago. In general, land is owned by the State in Ethiopia and people have use rights either by way of leasing or against payment of land revenue taxes.
Mr. Guutaa ALIIKOO, a top official in the local Agricultural Office reported to us that about 18% of the people of the study area are listed as food insecure and thus need some assistance under the framework of 'Safety net' in the form of food-for-work. In certain years these people are subjected to food limitations - but apparently not real disastrous famines. Most (extended) families (averaging 5-6 individuals) live in small villages, with typical straw-roof huts. The density of households in the study area, as reported by Mr.. ALIIKOO, is about 6.3/ha. They have their cultivated fields and pastures adjacent to the villages and usually own cattle (an average of 10-15 per family), and in lesser amount also sheep, donkeys and horses.

They use water from streams for drinking, cooking and washing themselves and their clothes. According to Mr. ALIIKOO the productivity of the land has been increasingly deteriorating during the recent past, due to over-exploitation, all this likely fueled by a rampant demographic rate. For this reason an increasing amount of youth emigrate to the urban centers. Importantly, according to Mr. Aliikoo, these people do not usually hunt, following their culture and traditional beliefs. Reportedly, in some areas they can trap francolins.

There are no electricity or road networks in the area: people move on foot and by horse. In particular, the NBI home range does not have even any driving dirty track: the last 15-20 Km needed to reach the area require a difficult off road driving, which can become really challenging during and soon after the wet season (in fact the first EWNHS expedition experienced significant difficulties in early October). The environment appears very clean, as plastic is not used yet too much by the local community. The "ecological footprint" of this people is therefore almost zero - if land intense usage is not taken into account. There is one elementary school within the study area, and many children are able to speak some English. The previously planned informal questioning of local people about their socio-economics was discarded due to conservation concerns (see Potential threats, see 4.9).

According to the Agriculture Office, there had been some use of fertilizers especially in the recent past, but nowadays this practice is decreasing due to increasing costs. The District Agriculture Office is working nowadays to promote the use of organic compost as fertilizer opposed to inorganic synthetic fertilizers. Mr. ALIIKOO reported that there has never been a significant use of pesticides in the District and this has been confirmed by some information obtained in the field. However, at times the information we obtained about the use of fertilizers and pesticides in the study area seemed a bit contradictory or unclear.

4.9 Potential threats

The NBI appeared to live in relatively close contact with the local community during the study period, and their survival was fully dependent on human-created habitats; they roost on a tall tree in the middle of a village, and feed on cut hay fields, with people working at close range. The same applies for the pastureland habitat.

On people approaching, recorded flight distance seemed quite shorter (i.e. around 30 m) than that recorded at Syrian breeding grounds (i.e., 50-100 m). Most of times, when disturbed by approaching humans, birds just walked away or at times made short flights to land at close range. People do not seem to pay too much attention to the several bird species feeding on the hay fields and pastureland, i.e. Wattled and Northern Bald Ibis, Sacred Ibis or Cattle Egret. Moreover, being non hunters, the locals do not seem capable of telling the Wattled Ibis and the NBI apart: this observation and the recorded mixing and grouping of NBI with Wattled Ibis are surely a very effective protection measure in itself.

Importantly, we recorded no significant difference in NBI behaviour and in their selection of feeding habitats/areas when comparing usage information collected during a holiday (18 Nov) versus a working day (20 Nov), suggesting that human disturbance is not a critical factor and that farmers' activities have a negligible impact on the NBI behaviour.

It was early realized that the main short-term direct threat to the four NBI was actually our very presence, as it could draw the attention of the locals specifically to the 3 tagged ibises. Due to the remoteness of the area, it was quite clear that the locals had never seen non Ethiopian people before. It was then decided to keep a very low profile and to explain the local people - all the time enquiring about the reasons we were there - that we were undertaking a general bird survey aimed at producing a bird book about Ethiopia.

Nevertheless, being our survey already the third visit of non Ethiopians during the course of one month, and considering that the second visit had been totally out of control, we heard rumours that some (specific) birds were on search (by us) because escaped from a zoo or a park. Some of them even wondered what the value of these birds was and there were even whispers that they carried "gold rings" on their legs (!). We judged this situation as highly dangerous for the survival of the four NBI, Therefore we tried to deny and dismiss these rumours as much as feasible by diverting the attention of people to other birds occurring in the area. We agreed to avoid focal observation on NBI and to take close-range photos and videos at them.

Due to the constant association of farmers with birds in the fields, it is just possible that anyone from the locals could/can spot the coloured leg rings or even the tag on the back of the birds, which could trigger the idea of catching or killing them for the sake of curiosity or profit. Surely, at a distance of 20-30 m the coloured leg rings can be sometimes visible with naked eyes, as well as antennas. At the time of the survey, the only safe protection of the NBI was to divert attention of the people away from the birds. For this reason, after thoroughly discussed the issue, we decided not to implement the previously planned informal questioning of local community about their socio-economics and to reduce the duration of the survey at the NBI wintering site from the previously planned 2-3 weeks to just 1 week.

On our return we paid a visit to the District Agriculture Office. The NBI protection strategy was explained well to Mr. GETIYE and Mr. ALIIKOO, in order to secure their key cooperation at present and in the future. In conclusion, threats to the NBI at recently-discovered wintering grounds can be summarized and listed as follows:

Short term threats

- non Ethiopian visitors and/or informed local authorities raising the attention of locals toward the four birds and the equipment they carry (coloured rings and satellite tags with antennas)
- unauthorized visits by bird enthusiasts and photographers, which can have the same negative consequence as described above (note: the option of promoting and developing controlled eco-tourism should be carefully discussed and planned at a later stage, in the framework of a comprehensive protection and management strategy).

Short to medium term threats

- unexpected change of agro-pastoral practices, e.g. conversion of hay fields and pastureland in cultivations or other
- rainfall shortages and subsequent food limitations
- possible use of fertilizers or pesticides by farmers
- logging of roosting tree

4.10 Searching additional birds outside home range

Despite we did not have a precise location and description at hand we tried hard to find the area where John ASH had seen the NBI in 1977. Following the indications of Gary ALLPORT we searched an area that did not seem to match ecologically with the study area: it was in fact a quite wide and wet valley with streams in the middle, partly covered by high grass and the rest converted in agricultural fields during recent decades. In fact, the land use pattern might well have changed during the past 30 years. This environment was dominated by big numbers of wintering ruffs and lapwings, species not found in the actual NBI home range. Only the upstream sectors of the mentioned valley seemed more suitable ecologically for the NBI. Interestingly, we received the actual precise description of the location directly from John ASH himself once the search was already over: the site he described corresponded to one of these upstream sectors mentioned above. Fortunately, we can say that the specific area indicated by John ASH had been fully searched – without success.

Although the search was unsuccessful in detecting additional NBI, it was very useful to better define and put on focus the key ecological features of the specific habitats used at present by the four NBI – through the comparison with landscapes and habitats we encountered during the search. The key features of the actual present NBI home range can be summarized as follow:

- slow rolling hilly environment
- restricted and shallow basins with streams, enclosed by hills
- abundance of hay fields (along streams) interspersed with cultivated fields (typically located on the upper belt of the basins)
- relative lower altitude than rest of the highlands

The presence of Wattled and Sacred Ibis, and that of Cattle Egret, can be certainly used as a reliable indicator of NBI habitat suitability. In facts, in most of the areas searched we did not find the density of Wattled Ibis found in the NBI home range. Most of the landscape surveyed during the search was more cultivated and more uniformly open and flat than the NBI home ranger - a characteristic, the latter, that could have a significant effect in terms of local temperature and consequently on invertebrates occurrence. The enclosed and relatively lower basin of the NBI home

range may create a more favourable micro-climate different from surrounding open plains.

5. Recommendations

Based on the observations and information gathered during the above described field survey, we recommend the following actions to be taken:

Short term

- keeping the location of NBI wintering home range secret
- actively preventing the visit of birdwatchers and unauthorized people to the area
- coordinating and ensuring frequent contact with the District Agriculture Office in order to make sure that they cooperate in not disclosing to the local community the occurrence of tagged NBI
- discussing, planning and implementing a detailed socio-economic survey for the area, taking into account the above described conservation constraints and concerns (perhaps better to plan this survey outside NBI wintering period)
- discussing removal of inactive satellite tags and coloured rings from the 3 NBI
- identifying an individual identification method different than coloured leg rings
- discussing, planning and implementing a winter time field survey aimed at:
    - assessing potential threats during other periods of the wintering time, for instance September-October and/or December-January, taking into account the above described conservation constraints and concerns;
    - by use of detailed satellite imagery [2], the ground-truthing information and search experience gained in the field this year, and the historical database of WELCH & WELCH (2004), planning and implementing a more focused search of potential additional NBI within the whole central Ethiopian plateau.

Short to medium term

- discussing and planning possible future NBI protection and management measures aimed at eliminating any or most identified threats, to be ideally integrated with promotion of sustainable development in the benefit of the local community (i.e. discussing and planning a project proposal combining conservation and sustainable development)
- securing the funding to achieve the objectives agreed and to implement needed activities.

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[2] e.g. high-quality resolution satellite maps on sale.

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Travel report November 2006 Station Bechar el Kheir; Morocco

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From Nov. 11th to Nov. 16th we visited the Station Bechar el Kheir in Morocco. The tour was organised by Zoo Vienna, which is one of four European Zoos belonging to the Arbeitsgemeinschaft Waldrapp (AgW: Zoo Munich, Zoo Vienna, Zoo Berlin, Zoo Nürnberg). The AgW gives financial and organisational support to the project Bechar el Kheir. The project is managed by the Association Tazekka for Environment and Development (ATED).

In summer 2006 Zoo Vienna invited two people from the project Bechar el Kheir to visit the Austrian NBI projects. Our visit was a further initiative to get concrete information about the state of the project, to establish personal contacts and to support further development of the project.

History and Location

Fig: 1: Entrance of the project station

The project Bechar el Kheir (the name means 'the bearer of the good message') was founded due to intention of the forest ministry (Haut Commissariat aux Eaux et Forets et a la Lutte Contre la desertification) to reintroduce NBI in their former range the Atlas region of Morocco, accompanied by socio economic and educational activities. Task force from the beginning was Mr. Hans-Peter Müller and Mr. Nachid Naim from the forest ministry. Mr. Naim is also president of ATED (Association Tazekka for Environment and Development) which manages the project.

Picture 2: Left picture from left: F. Amar, T. El Houcine, H. Nour Eddine, R. Pfistermüller, J. Fritz; middle picture: H.-P. Müller; right picture from left: R. Pfistermüller, J. Fritz, N. Naim;

A first task was to search for an appropriate location within the former range of the birds. A hunter informed that he saw two NBI drinking at the water reservoir Ain Tijja near Mezguitem at the beginning of the 90's.

It was emphasized that the region was formerly well known for their NBI populations. We could see numerous cliffs along (at time almost dry) riverbeds in the region, which – from distance – seem suitable for NBI. However, no one could show us a particular breeding location.

The station is located in a small valley with a (at time dry) riverbed. Some water was in and below a little reservoir just below the station. Water for the station comes from a well, which furnish also the local people with water. The surrounding consists of natural areas and agricultural areas. At time of the visit the ground was dry and compact. During a rough survey we could hardly find any invertebrates. In 2005 a shrub planting project for (*Atriplex halimus*) founded by the European Community, started near the station.

Picture 3: Surrounding of the station. Wide angle view (about 200°) towards the station in the south (white arrow).

Station Bechar el Kheir

Picture 4: Station Bechar el Kheir; left: aviaries with the visitor centre in the front; mid: left aviary with the artificial rock face; right: water bond with spring;

The station (N34°28,036' W003°38,466'; sea level of 855 m,) was built in 2000. It consisted of two big aviaries (each about 140 m² and 8 m height), which are connected by a sluice. In the back is a further adjacent aviary (about 20 m²) which can be opened for free flight.

The equipment of both main aviaries is similar (Fig.3). The back and one side wall consist of a massive artificial rock face with breeding platforms of different size. The ground is natural rock and earth. The former blue net was replaced by a solid green net. It seems that the number of collisions with the net decreased since this change (probably the blue net was more difficult to be detected by the birds) against the sky.

In 2005 a water basin was built above the aviaries (about 15 m³). It can be filled from the well by a pump. This basin provides small shallow ponds in both aviaries with fresh water (Fig. 3).

The station further consists of a building for the keeper and a visitor centre with one room for education and exhibition as well as three guestrooms for visitors. This centre is at time without furniture, except of one table for some information material (general NBI information and information on other project, not on the Bechar el Kheir project).

Both buildings are equipped with cables. However, there is no electricity available yet. The next power line is some hundred meters away. Due to information by Mr. NOUR EDDINE, who is responsible for the smooth run of the station, they will get an offer for connecting the station to this power line soon after our visit.

One keeper, Mr. El HOUCINE, a biologist with a BA degree has a permanent position and lives in the station. He is employed by ATED. Mr. El HOUCINE is supported by the second keeper, Mr. AMAR. Both seem motivated and interested.

Northern Bald Ibis at the station

At time the population consist of 19 birds, 13 adults and 6 juveniles. All adult birds came from different European zoos. This year Bechar el Kheir had the first fledging offspring since beginning of the project. Six couples bred, six birds from 5 nests fledged

(fledging rate 1.0). During the last years some birds hatched but always died after a few days.

We assume that the breeding success 2006 was mainly due to a change in the food diet. Till 2005 the birds were fed almost exclusively by soaked pellet dog food. During and after the feeding season 2006 the birds got in addition a mixture of 2/3 ricotta (cottage cheese) and 1/3 minced beef heart as well as vitamins and crushed snails. Other factors like the supply of fresh water, may also have contributed to the increase in the breeding success.

At time the birds get food twice a day, in total about 3.5 kg (what is less than the usual quantity of 250 gram per birds per day; empirical mean value Gruenau, Rosegg, Waldrappteam.at). Invertebrates, except snails, are rarely fed at time.

Nevertheless, the birds seem to be in a good condition. From distance the plumage seems shiny and undamaged. The head coloration is not pale. Lost feathers show no signs of ectoparasites. When entering the aviary the birds are relatively calm and trusting.

General conclusions

- Bechar el Kheir makes the impression of a well managed project.
- Size and equipment of the aviaries is impressive, particularly the supply of fresh water ponds improved the conditions.
- Fledging rate of 1.0 in 2006 is a positive and relevant reference for the project, but consistency and increase of the breeding rate should still be a major objective (we assume that the fledging rate can easily be further increased via improvement of both the food-quality and -quantity).
- The food quality and quantity has improved but is still not optimal, particularly because the birds get almost no invertebrate food and the quantity is below the customary amount.
- Knowledge about historical occurrence of NBI in the region seems to be rather general; we could not visit any concrete breeding location.
- The recent suitability of the range as a habitat for NBI is an open question. Even though people report that NBI occurred in the region year round, it seems particularly questionable to us if the area is suitable as a wintering habitat for NBI.

Suggestions

In June 2006 the International Single Species Action Plan (SSAP) for the Conservation of the Northern Bald Ibis was completed by AEWA (Agreement on the Conservation of African-Eurasian Migratory Waterbirds). It requires implementation in Morocco, Syria, and Turkey. We assume that Bechar el Kheir can become a major institution for research and implementation due to several medium and high priority SSAP topics.

We suggest preparing a research and management plan for Bechar el Kheir for the next years in agreement with the priorities mentioned in the international SSAP and, in

particular, in the context of a national management plan for the wild Moroccan NBI population.
Based on the outcome of the IAGNBI meeting in Spain, September 2006, we discussed already some potential research topics for Bechar el Kheir during our stay in Morocco:

(1) Building up of a backup population for the wild Moroccan birds (replacing the birds from zoo origin by birds from the recent wild Moroccan population);
(2) Genetic and parasitological investigations with the backup population (comparison with the zoo population as well as with the eastern population);
(3) Physiological and behavioural investigating during the migration season with the backup population (Do they indicate migratory readiness as a prerequisite to re-establish migratory colonies in the Atlas?);
(4) Investigating the suitability of the region Mezguitem as a breeding and wintering habitat for NBI (data collection on feeding ecology with hand-raised NBI);
(5) Evaluating the suitability of historical breeding locations in the Atlas region (about 35 to 40 locations are known) for a potential re-colonization.

Evidence of the historic presence of the Northern Bald Ibis (*Geronticus eremita*) in Spain

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The distribution of Northern Bald Ibis (*Geronticus eremita*, NBI) until the end of the 17th century in central Europe (Austria, Switzerland and Germany) has been reported by GESNER (1555), ROTHSCHILD et al. (1897) and other references compiled by PEGORARO & FÖGER (1999). Recently, other authors have suggested a wider distribution of the species during the Early Modern age: Greece (DESFAYES 1987), Upper Adriatic Region (PERCO 2001) and France (PASCAL et al 2003). Furthermore ALDROVANDI illustrated a specimen captured in Illyria (present day Croatia) in *Ornithologia* (1559-1603). This evidence and the recent findings of fossils in the Mediterranean basin (SÁNCHEZ MARCO 1996; BOEV 1998; MC DONALD 1998; MONTOYA 1999; PAVIA 1999, 2000; BEDETTI 2003; MOURER-CHAUVIRÉ et al. 2006) clearly show a wider Mediterranean distribution of NBI in the past. In this note, I provide evidence suggesting the historic presence of the species in the Iberian Peninsula and its extinction in recent historical times.

Firstly, there are no bio-geographical reasons to expect a non-homogeneous distribution of NBI that would account for its absence in the Iberian Peninsula in historic times. Perusal of the distribution maps of the 600 birds in Europe (ULLMAN in JONSSON 1992) indicates that there are no birds now living in both continental Europe and Northern Africa that are absent in the Iberian Peninsula, with the exception of the Demoiselle Crane (*Antropoides virgo*). Still found in Eastern Europe and with remnant populations in Morocco and Turkey, this species became extinct from Spain at the beginning of the 20th century (HERNÁNDEZ & TYRBERG 1999).

Secondly, the lack of historical references in the Iberian Peninsula could have been simply due to the lack of scientific tradition in our country. Whereas central Europe could built up a long scientific tradition there were few noticeable naturalists in Spain during the Early Modern Age. The best ones travelled to the recently discovered New World, attracted by its exotic nature. In fact our rich avifauna stayed remarkably unknown until the end of 19th century when a number of British birdwatchers and naturalists explored the wilds of Spain. Thanks to their efforts, the historic presence of some birds that became extinct in Spain the early 1900's, e.g. the Marsh Owl (*Asio*

capensis), the Lanner Falcon (*Falco biarmicus*), the Demoiselle Crane (*Antropoides virgo*) and the White-tailed Eagle (*Haliaetus albicilla*), is documented. It is quite likely that NBI was probably extinct much earlier with few references in the Spanish scientific literature.

Fossils of NBI have been found at two different areas of Eastern Spain (SÁNCHEZ MARCO, op. cit; MONTOYA, op. cit). Remarkably, new remains have been recently reported at Gibraltar (FINLAYSSON et al. 2006) extending the ancient distribution of the species in Spain. As far as we know there are no records during the historic era in Spain, apart from an isolated female captured in Doñana in 1958 (DE JUANA 2001) and two birds recently spotted in central Spain (one in Piedrahita and the other one in Toledo, reported at www.rarebirdspain.net). Both animals had perfect health and feather, proper natural behaviour and they did not carry any ring or other identification marks so we cannot discard the possibility that they were migrant birds from Morocco population.

Figure 1. NBI Fossils records (red dots), present populations (green) and circum Mediterranean countries in which historic NBI presence has been suggested (grey).

On the other hand, the rock paintings located at the "El Tajo de las Figuras" cave (Benalup, Cádiz) dated from Neolithic and Chalcolithic periods, represent the rich avifauna of the area at that time (BREUIL & BURKITT 1929). Despite these paintings belong to the style known as "arte sureño" (southern art) characterised by schematic shapes, some bird figures with curved bill and bulky heads resemble that of a NBI representation (see Fig. 2).

Figure 2: Schematic figure of a bird in "El Tajo de las Figuras" cave (Benalup, Cádiz). taken from a trace by BREUIL & BURKITT (1929)

Furthermore, we found a clear representation on that bird in a Roman mosaic found in Italica (Seville) dated from the 1st century AD. (see Fig. 3).

Figure 3: A representation of a NBI at a Roman mosaic at Italica (Seville, S Spain)

Plinio the Elder, in his famous *Naturalis Historia* (AD 77) mentioned a bird named by the Greeks as *Phalakrokorax* (literally *bald raven*) present in the Alps and characteristic from the Balearic islands ("*...et per Alpes etiam, ubi et phalacrocoraces, aves Balearium insularum peculiares*."). The fact that this is the present scientific name of the cormorants has lead to confusion among some modern translators. In Plinio's XI book he clearly stands that this bird is bald ("*...quibus apud Graecos nomen est inde.*"). On the other hand he refers to the cormorant in other passages of the book with the Latin name of *Mergus*, also used by other classical authors. ROTHSCHILD et al. in 1897 are the first authors who mention that the Plinio's *Phalacrocorax* is in fact the Northern Bald Ibis. After him another experts on Plinio´s work like THOMSON (1936), ANDRÉ (1967), LEITNER (1972) or CAPONNI (1979) reached the same conclusion.

The misunderstanding between Cormorants and NBI dates back a long time ago. The reason is probably that both birds were wrongly considered to be related to the ravens at least until the 16th century. In fact, both species have been named as *koras, corvus, corvi, corbeau, cuervo, rapp* in different European languages. This confusion could have led BRISSON to establish the Linnaean genus *Phalacrocorax* for the Cormorants, despite the evidence that they are not bald at all.
Another proof of the identity of this bird is the pictures from the *Ornithologiae* by ALDROVANDI (1559-1603), clearly showing a NBI below the title: *Phalacrocorax ex Illyriomillus* (Phalacrocorax from Illyria) (Fig.4).

Figure 4: Illustration on the *Phalacrocorax* in the *Ornithologiae* by ALDROVANDI (1559-1603)

Returning to Spain, in the first Spanish translation of the Plinio's *Naturalis Historia* by the renowned naturalist Francisco HERNÁNDEZ in the 16th century, the author added interesting comments to the original text. Regarding this bird species he refers: "*cuervos calvos, en griego phalacrocoraces, y son conocidos aunque raros en España*"(" bald ravens, called phalacrocoraces in Greek and they are known although they rare in Spain"). Later he mentions "*a Belonio le parece que sea ibis negra la que Gesnero nombra cuervo selvático, que dezimos en Hespaña cuervo calvo*" ("it seems to be a Black Ibis for Belonio, the same that GESNER named Selvatic Raven and that we call Bald Raven in Spain".
I found many references of *cuervo calvo* (Bald Raven) at Spanish falconry treatises. These books offer valuable information of birds species present during the medieval and renaissance in Spain. Pero LÓPEZ DE AYALA (c. XIV), Juan DE SAHAGÚN (c. XV), Juan VALLÉS (c. XVI), Luis DE ZAPATA (c. XVI) and Diogo FERNÁNDEZ FERREIA (c. XVII), all of them refer the Bald Raven as a typical prey captured by the falcons. Unfortunately we found no geographical references where to locate the place in most of these books. However there are no doubts that this was indeed a well-know species. Luis ZAPATA, a noble of Felipe II' s court who lived in Extremadura region, mentioned *cuervo calvo* at a number of localities from Badajoz province (Llerena, Villagarcía de la Torre or Medellín). In the following paragraph we can also notice that he used the NBI as a meal, like it has been proved in Central Europe (PEGORARO & FÖGER1999):

"Fue este un dia excellente, vna hora buena

Matar junto a Llerena en pocos ratos
dos garças, siete patos, tres milanos
y cinco (canquivanos) alcarauanes,
vna grua y dos galanes cueruos caluos
los que saluos a Dios ruego que sean, pues ya a su fuego se han subido".

"It was an excellent day, a good hour
to kill near Llerena within a short time
two Herons, seven ducks, three Kites
and five Stone Curlews,
one Crane and two gallant Bald Ravens
which I beg of God that they are healthy
because they have raised to its fire already"

Even though in those books there are no descriptions of the birds there is no doubt that they refer to NBI with this name. Together with the *Cuervo calvo* the authors also mention the Common Raven as *Cuervo* and the Cormorant as *Cuervo marino.* They mention that the *Cuervo calvo* is captured by the method *a brazo tornado* reserved for big preys. Juan Vallés (c XVI) mention in his *El Libro de acetrería y montería*: *"y las otras presiones, así como grúa, garza, ave ramia, martinete, cuervo calvo y cuervo marino, alcabarán, ...*" (and the other preys like the Crane, Heron, Spoonbill, Night-Heron, Bald Raven and Cormorant, Stone Curlew,…") so we can discard the smaller corvids present in Spain that are also mentioned with other vernaculars.

To finalise Antonio DE NEBRIJA (1495) the most famous Spanish humanist and grammatologist in this period in his *Vocabulario español-latino* (the first Spanish grammar) also distinguish between: "Cuervo = corvus; Cuervo calvo = Calvus corvus ; Cuervo marino = mergus".

There are a number of possible reasons for the extinction of the species in Spain. Direct human persecution by hunting (remember that it was considered as a meal) and changes in land use and then in habitat structure are argued as possible explanations. Several authors have proposed climatic changes, specifically the so-called "Little Ice Age" as a cause of the extinction of the species in central Europe. This period of cooling, that lasted from the 16th to the mid 19th centuries, was characterised by the advance of the glaciers, long winter with long lasting snow cover in the Alps (PFISTER 1992) whereas its effect was quite different in Southern Spain. RODRIGO et al. (2000) demonstrate that its main effect was an increase of the rains that led to higher and denser vegetation structure in a traditionally semi arid area. This change could certainly have contributed very much to the extinction of the species in Spain because the NBI needs arid and semi arid steppes and plains with sparse vegetation not over 15-20 cm high (BOEHM et al 2005).

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Contribution of the captive populations of the Northern Bald Ibis *Geronticus eremita*

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Background

Origin of the NBI EEP population

The first reported imports of Northern Bald Ibis (*Geronticus eremita,* NBI) of Morocco into Europe date back to 1949-1954. The birds were brought to Basel Zoo. For the Northern Bald Ibis Endangered species program (NBI EEP) population 71 imports are recorded. 15 of these birds are reported as males, 13 as females, 43 with unknown sex. The majority of theses birds has been imported before 1960 (42 birds: 2 females, 5 males and 35 of unknown sex), the last imports occurred in the 70s (29 birds: 10 males, 11 females, 8 unsexed). 49 of the imported birds got older than 2 years and might have bred. However only of 6 birds breeding records are definitely given.

In 1934 birds from Palestine with unknown number were brought to Berlin Zoo and one from Birecik 1973 to Basel Zoo. The fate of the former is unknown but probably they did not survive to breed. The bird of Birecik died within few days. Therefore no bird of the eastern population survived in an European zoo.

Other Northern Bald Ibis studbooks

Birds have been exported also to non European zoos as to North America and Japan. The birds have bred there and two studbooks have been initialised.

The American NBI studbook was established in 1990. First imports date back to 1951. Imports from Europe lasted till the early 1980s (1984). Birds came from Basel Zoo (1951, 1963, 1966, 1972, 1975) Berlin Tierpark (1987), Innsbruck (1977), Jersey (1972, 1975, 1976), Rheine Zoo (1984), Tel Aviv (1974, 1986) and Wuppertal (1986). The studbook keeper is Mark Hofling, Bronx Zoo.
In 1992 a Japanese studbook was founded in 1992. Birds were coming from Europe (Basel Zoo (1954, 1969, 1970, 1973), Innsbruck (1983), Tel Aviv (1984) Zurich Zoo (1976, 1980).

The studbook keeper has been Kumiko HARA until 2003 and now Ogata Mitsuaki, Yokohama Zoo took over. Problems are the lack of space and breeding facilities, inbreeding and skin problems.

Population size

NBI EEP Population size

The EEP population started in 1988 with 333 birds in 40 institutions. Due to the high breeding success and the low death rate it has steadily increased up to 800-890 living birds which are living in 62 different colonies (Fig.1)

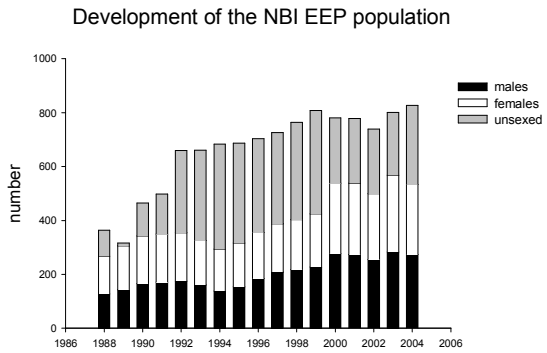

Fig.1: NBI EEP population development 1988-2006

NBI North American population

At the beginning the North American studbook had 6 members and 94 birds (24.25.45). The population has grown in 1999 up to 146 birds in 15 institutions. Due to lack of space the population size target had to be reduced to 135 birds. In December 2005 there are 127 birds (61.53.13) in 20 North American institutions.

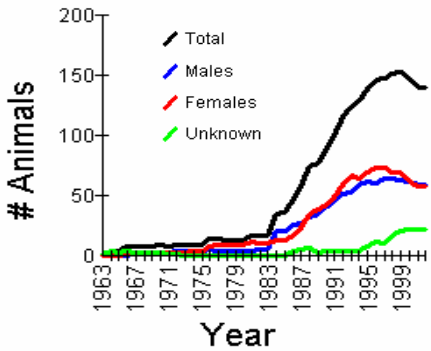

Fig. 2: Census of North American Waldrapp NBI population from 1963- 2002.

NBI Japanese Studbook

The Japanese studbook started with 39 birds in 5 different zoos. It increased up to 12 members and the population counts now of 105 birds (Fig.3).

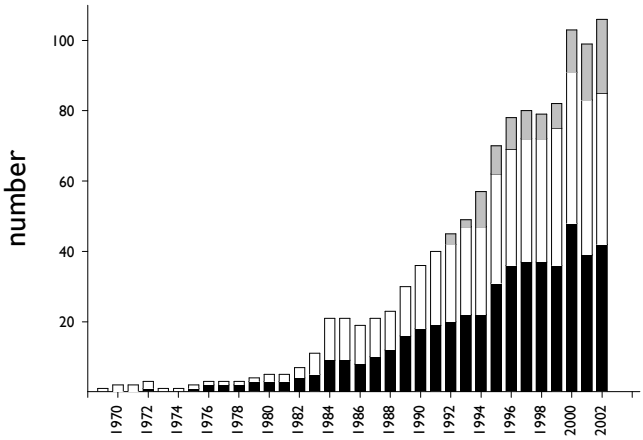

Fig. 3: Japanese NBI population development 1970-2002

Age of the captive NBI populations

NBI EEP

The age pyramid is triangle shaped (Fig. 4). There is a broad basis of young birds (under 5 yrs old) but most of them are still unsexed (< 50%). Mature birds in the best reproductive age (age class 5 -15 years) account for nearly the half of the EEP population. But as younger birds under 5 years make up 41% of the whole population there will be a good number of birds which may reproductive in the next 5-8 years. This means that the NBI population is a rather young and vivid population with good chances of future reproduction and growth.

One third (34%) of all NBI in the EEP population is older than 10 years and at least half of these birds are 10-15years old and can be regarded as possible breeders. There is no distinct difference in the age classes for males and females (Fig. 4a) which indicates that an appropriate number of potential breeding partners are available for birds in different age classes.

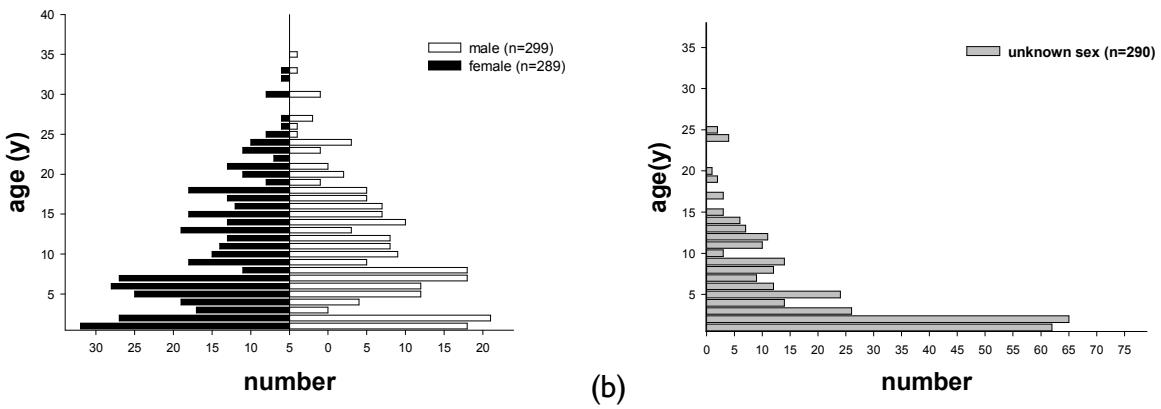

Fig.4: age pyramid for males and females (a) and unsexed birds (b) in the NBI EEP

NBI in North America

In the North American population the older age classes are fuller than younger age classes. This creates a population with an insufficient base of young animals to offset future mortality (Fig.5). It would be necessary to increase in the number of hatches to compensate for mortality and create a more stable age distribution. The lack of space and the target of a population size of 140 birds do make this task difficult.

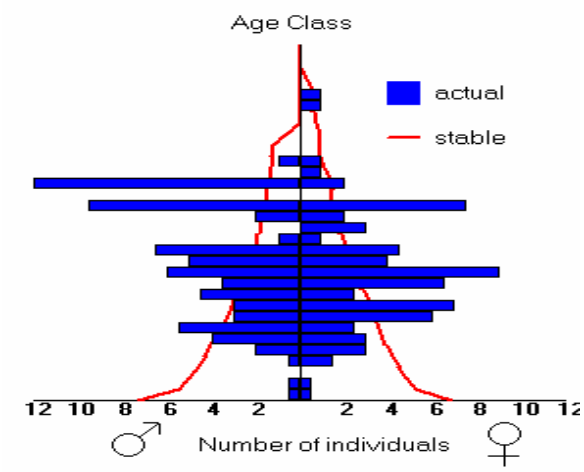

Fig. 5: Age structure of the living North American NBI population (2005)

NBI in Japan

The Japanese captive NBI population has a more balanced age structure. More than 60% are younger than 15 years which means still in a high reproductive age.

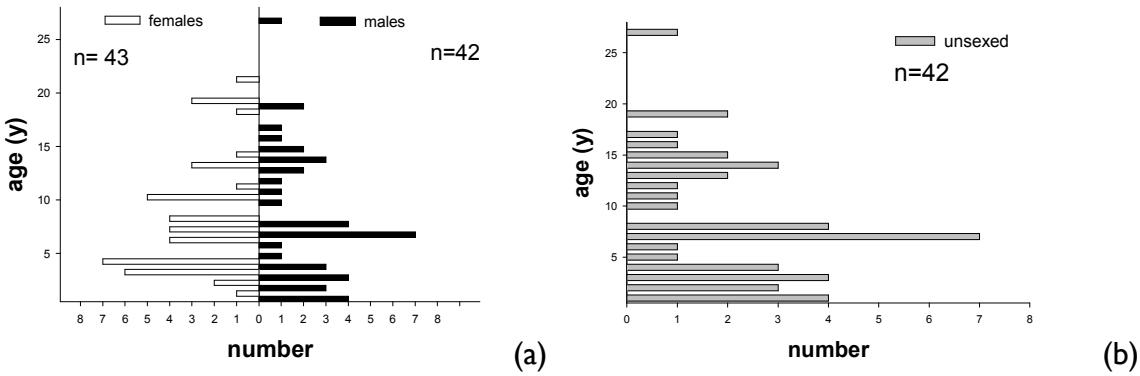

Fig.6: age pyramid for males and females (a) and unsexed birds (b) of the Japanese captive NBI population (2002)

Reproductive success

NBI EEP

The NBI EEP population has been very productive over the last 18 years. Each year about 100-150 nestlings hatched. A closer look at the breeding performance however shows an uneven distribution in the breeding success. 20% off the colonies have never bred, 20% do

not breed each year but 60% breed on a regular basis. The number of offspring per colony differs as well. One third of the colonies have more than the average numbers of offspring/year (2, 3) and 20 % (19) of all colonies have produced more than 80% of all chicks of the EEP population.
The reasons for these obvious differences in the breeding success between the EEP colonies are not always clear but keeping conditions (e.g. frequency of feeding, colony size, behavioural enrichment, type and structure of winter enclosures) have an important influence on the breeding success. These data also make evident that birds which could and should have bred still had not the chance to do so. As a consequence the breeding success within the NBI EEP should be become more equally distributed and to improve husbandry is still important.

NBI in North America and Japan

According to the data of the last NAM NBI studbook the number of birds of a colony in the North American institutions is very small. In a bigger group breeding normally is more likely and more potential partners are available. In the NBI EEP colonies which were smaller than 6 birds never started to breed. Only three colonies in North America have more than 10 birds, 7 colonies have 6-10 birds and 9 colonies are smaller than 5 birds. Recommendations are already made and transfers took place.
Breeding performance of the NBI colonies in Japan seems to be well. Especially the colony in Tokyotama Zoo produces well and has been the source of many new colonies in Japan.

Inbreeding

Many NBI EEP colonies are 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.
For the NAM and Japanese populations inbreeding is also a problem which can hardly be solved especially when space is lacking. The lack of breeding records of founders or the first imports of Europe in the 1960s-1980s make, like in the EEP population, any genetic analyses very difficult.

Skin disease

Some birds show a distinctive "skin problem". It 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. Although some birds have died quickly other birds have lived quite long with those bare skin parts and some individuals even recovered and feathers were growing again. The cause of this disease is not known. However some there is an indication that stress (transfers, low ranking in the hierarchy, overcrowded aviaries, etc.) may be the trigger of that disease.
In all studbook populations the "skin problem" has been observed and documented.

Conclusions: strength and weakness

There exists a numerous captive NBI population which is managed in three different studbooks (North America, Japan, Europe). The European studbook is the most numerous

one with the biggest imports of founders. The age structure in the NBI EEP and Japanese colonies is promising and reproduction is likely for the next 5-10 years.

Wild birds were imported in the late 19650s and 1960s. The last imports occurred in the 1970s in the NBI EEP. Unfortunately the breeding success of the founders is very bad reported. In the EEP 49 wild birds got older than 2 years and might have bred. However actual breeding success is reported only of 6 birds.

Proyecto Eremita

DIET COMPOSITION OF THE NORTHERN BALD IBISES (*Geronticus eremita*) RELEASED IN LA JANDA (CADIZ, SW SPAIN)

INTRODUCTION

The Northern bald ibis is a Critically Endangered species (IUCN 2006). Its global population in 2006 was reduced to 92 breeding pairs in Morocco and 2 pairs in Syria. In contrast, more than 1500 individuals are kept in captivity (about 600 in EEP institutions). As part of a research project focused on the efficacy of different releasing techniques for the reintroduction of the species, 21 and 23 yearling birds, born in captivity in 2004 and 2005 respectively, were released in La Janda (SW Spain). Here we describe diet composition of those free-flying birds in 2005 and 2006.

Photo I: NBI looking for preys in a cow dung

Photo II: NBI catching a scoptera (*Phortus ranrouni*)

METHODS

Diet was assessed using two different techniques: regurgitated indigestible material in pellets and food items directly observed while birds were foraging. Pellets were collected under a roosting site and examined in the laboratory under binocular magnifying glass. Food items were sorted and identified in as much detail as possible with the aid of a reference collection of invertebrates collected in the area. In addition, we recorded by observing through a telescope the size and identity to the lowest possible taxon of prey captured by birds during 5 min focal observations.

2005

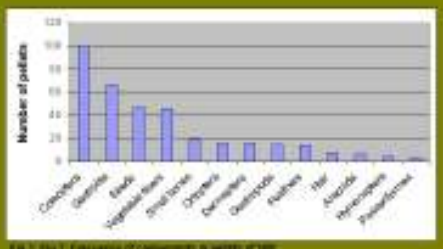

Fig 1: Frequency of components in pellets of NBI

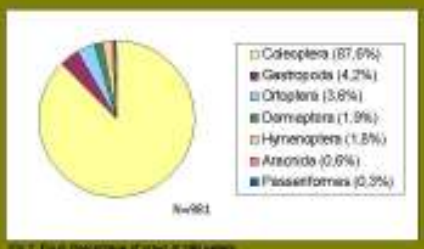

Fig 2: Percentage of prey in NBI pellets

Fig 3: Prey occasionally taken by NBI foraging in 2004

2006

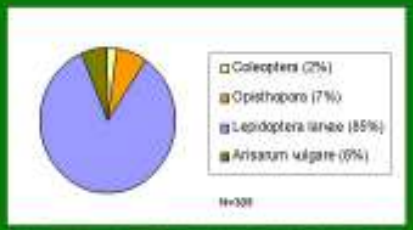

Fig 4: Prey occasionally taken by NBI foraging in 2005 and 2006

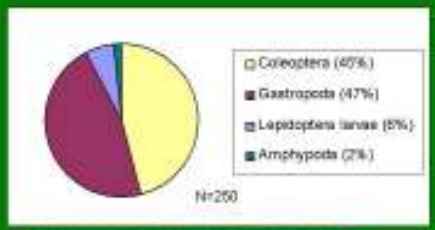

Fig 5: Prey occasionally taken by NBI foraging in 2005 and 2006

Photo III: NBI in a pastureland on shelf.

RESULTS

Diet composition of NBI in La Janda varied according to sampling technique, year and season.

•During the winter of 2005, food items mainly consisted of beetles (88%) according to the pellets analysis, but of earthworms (46%) and caterpillars (25%) according to direct observation.

•During 2006, the winter diet of NBI, as assessed by direct observations, consisted of about 85% caterpillars, 7% earthworms and 6% plant material; whereas in spring-summer birds mainly feed on beetles (49%) and snails (47%).

Photo VI: NBI group feeding in a pastureland close the beach

Photos IV and V: NBI group drinking in a watering place for cows

Photo VII: NBI ingesting *Arisarum vulgare*

CONCLUSIONS

•Northern Bald Ibises released in La Janda mainly fed on ground invertebrates which captured by both tactile and visual techniques. Vegetal items (leafs and flowers of *Arisarum vulgare*) were also important during winter and spring.

•The estimates of diet derived from each technique in a single season yield inconsistent results, food assessed by pellets may over-estimate prey with hard-parts such as beetles, whereas direct observation may over-estimated conspicuous an large prey. This should be carefully considered before results can be interpreted.

•Annual and seasonal changes in the diet could indicate that birds are able to feed opportunistically on plague species (i.e. caterpillars and snails) and thus be beneficial for agriculture.

•Nones of the preys items captured by NBI are cataloged as endangered or endemic species.

Proyecto Eremita

SIGHTING OF NORTHERN BALD IBIS (*Geronticus eremita*) BELONGING TO THE EREMITA PROJECT DURING 2005 AND 2006

RESULTS

Home range and sighting areas have increased in 2006. Maximum distance recorded between foraging area and the aviary was 60 km.

Between January and July 2006, a total of 3 new foraging areas have been recorded. Remarkably all these areas present extensive cattle. In two of them, artificial watering system was available allowing the pasture areas to keep green throughout the summer.

According to our data, released NBI were independent and self-sufficient for at least, 50 d (between 29 May – 17 July). Due to the risk of electrocution, NBI were trapped and kept at the aviary. The electricity power lines are being corrected.

The farest distance registered for a tagged NBI was 350 km (Afannouir lake, Morocco). This is the only reported case of a NBI at our Project that have crossed the Gibraltar Strait.

Feeding ecology of the Northern Bald Ibis in its European winter and summer habitat: An experimental field study with hand- raised individuals

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Introduction

The Northern Bald Ibis (NBI; Geronticus eremita) is a critically endangered species with only one remaining colony on the Atlantic coast in Morocco and some individuals in Syria. 350 years ago this bird was native to Europe. For conservation aspects, as well as for a possible reintroduction it is necessary to learn about the ecological needs of this species.

Question 1: On which food types do NBI feed in different regions (agricultural & natural)?
Question 2: Do the foraging efficiency vary in different regions and habitat types?

Method

Feeding ecology was evaluated in a region with agricultural habitats (Burghausen, Germany) and one with natural habitats (no cultivation, partly grazed by sheep) in Southern Tuscany (WWF nature reserve, Laguna di Orbetello, Italy). In the agricultural region we investigated three different types of habitats: pasture (grazed by cattle, no additional fertilization), grassland (cutted three times a year, fertilized with cow dung) and poor grassland. Data collection was done in situ with two groups of NBI (Germany: 6 birds, Italy: 21 birds). All birds were offspring from zoo individuals, raised by human foster parents. An observer joined the birds during free flight and determined on which feeding area to go. Food types and feeding frequency were observed by focal sampling. We estimated dry weight of the birds food and compared it with the birds daily energy needs (field metabolic rate, FMR: 66.71 g dry weight/day).

Results & Discussion

1) Annelids and larvae constituted the main food type available for NBIs in agricultural regions (∑ 94 %), whereas in the nature reserve there were two further relevant food types: beetles and gastropods (∑ 87 %) (figure 1, figure2).

The food types varied between the different regions but in general NBIs were foraging on slow-motion invertebrates. They exploit a special ecological niche by rumbling with their long curved bill up to 10 cm in the soil.

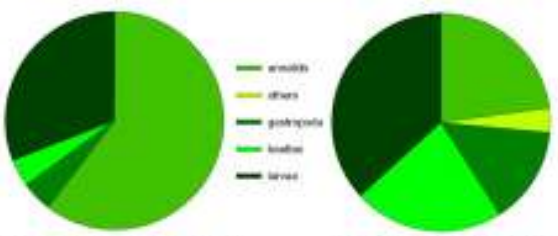

Figure 1: Food composition in agricultural regions.

Figure 2: Food composition in natural regions.

2) Agricultural regions easily covered NBIs energy requirements, while natural reserves did not (figure 3). In the agricultural region grassland pointed out to be the best feeding habitat. For this habitat type we calculated 1,5 hours to cover one birds daily energy demand. Pastures were more efficient than poor grassland (figure 4).

The observation of freeflying zoo-colonies in Central Europe confirm our results. They preferably forage on agricultural areas, similar to the ones investigated in Germany.

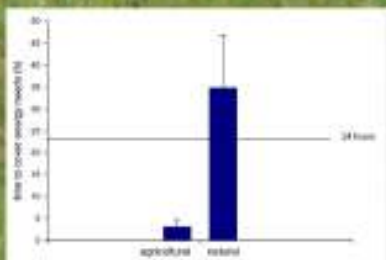

Figure 3: Calculated time spent on foraging in agricultural and natural region (Mann-Whitney-test: p = 0,008).

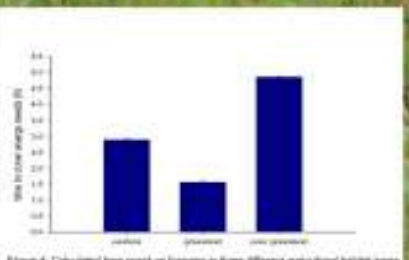

Figure 4: Calculated time spent on foraging in three different agricultural habitat types (Friedman-test: p = 0,000).

The data show that there are agricultural areas in Europe which offer adequate feeding opportunities for NBIs. Data collection is going on, presently in Europe and other regions of historical appearance (Morocco, Atlas Mountains, Birecik in Turkey).

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Human-led migration and the use of GPS data loggers offers new opportunities to study bird migration: Tracking the flight pattern of sub-adult migratory birds

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Background

In many migratory bird species juveniles do not return to the breeding place until sexual maturation. It is assumed that they stay in their wintering region all year round, or that they disperse along their migration route.
This study focuses on spatio-temporal patterns of juvenile Northern Bald Ibises (NBI; *Geronticus eremita*) during the first two years of independence.

Birds were raised by human foster parents and trained to follow micro-light aircrafts. In 2004 and 2005 two groups of seven NBI followed their foster parent from the area they were raised in Upper Austria over 900 km (airline distance ~635 km) to wintering grounds in southern Tuscany, Italy (WWF Nature reserve Laguna di Orbetello). There the birds were released into independence. The movement of the birds has been tracked via radio transmitters and sightings and, since May 2006, additionally via GPS data loggers.

Fig.1: Seasonal flight pattern
- Artificial sleeping place
- Foraging radius at winter, Laguna di Orbetello
- Foraging radius at summer, Laguna di Orbetello

Seasonal flight pattern

NBI show a seasonally changing pattern of flight activity (Fig.1). During winter the birds have a consistent spatio-temporal pattern within a radius of about 1.2 km surrounding their sleeping place. During the summer, however, the birds extend their foraging radius up to 4 km around the nature reserve. They are also repeatedly seen outside the telemetry-radius. People have observed them up to 388 km north of the Lagoon.

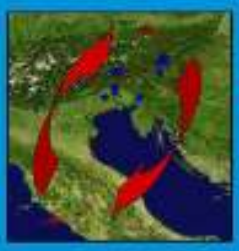

Fig.2: Age-dependent flight pattern
- Human led Migration route
- Breeding area, Austria
- Wintering area, Italy
- Sightings Summer 2005
- Sightings Spring 2006

Age-dependent flight pattern

Adult NBI are assumed to migrate during April. Juvenile showed no significant changes in their spatio-temporal patterns at that time after the first winter. However, after a second winter all birds left the nature reserve during April. Numerous sightings indicate that they followed the migration route to the North, even coming close to the breeding place (birds' most northern sightings range from 442 km up to 572 km airline distance). Finally the birds turned back to the wintering grounds.

Fig.3: GPS tracks of summer-flights at Laguna di Orbetello
Laura: June 5th – June 7th
Sacha: May 24th – May 26th
June 5th – June 7th

GPS tracks of summer-flights

Fig. 3 shows flight patterns of three sub-adult NBI equipped with GPS data loggers. Data was recorded and computed at intervals of 1 to 10 sec. Each point provides information about position (accuracy ~5 m), sea level and speed. The flight patterns of the birds overlap to a great extend. Three main activities were considered on the basis of the actual speed: resting (0-1 km/h), feeding (1-5 km/h) and flying (5-80 km/h). Most of the time the birds spent roosting (52.3 ± 8.1 %), followed by feeding (38.5 ± 6.9 %), and flying (7.6 ± 2.4 %) at an average speed of 35 to 40 km/h.

Discussion

- ★ Juvenile NBI show seasonally changing spatio-temporal pattern. During winter they are permanently within a small radius around their roosting place. During summer they extend their range and repeatedly leave the region for several weeks.
- ★ During spring the spatio-temporal pattern is age-dependent. After the first winter all birds remain in the region. After the second winter the birds leave for long distant flights northwards. They come close to the breeding area, but turn back before reaching it.
- ★ Long distant flights during the summer seem to be triggered mainly by food shortage. Departure in spring occurs at a time of high food availability. We assume that these flights are triggered by endogenous mechanisms, which cause vernal migration.
- ★ Juvenile birds, which leave the winter region, follow the originally learned migration route northwards with high accuracy. The maximum deviation from the route is 90 km, the mean deviation is 30.5 km (± 5.97 km, SE).
- ★ During these flights the birds may acquire a magnetic and/or optical map along the migration route, which allows them to fly individual routes based on their own experience. Therefore, we assume that the deviation from the originally learned migration route increases with increasing experience. This hypothesis will be tested in future with GPS data loggers.
- ★ We also collected faecal samples to analyse levels of steroid hormone metabolites. However, these data are not available yet.

The project was financed by the following institutions and persons:

Zoo Vienna; Alpenzoo Innsbruck; Gamspark Rosegg; Cumberland Gamspark Grünau; Konrad Lorenz Research Station Grünau; Frau Maria Schram; Verein für Tier- und Naturschutz; Lebensministerium Österreich; Oberösterreichische Landesregierung; Deutscher Wildgehegeverband e.V.; Österreichischer Wildgehegeverband; Verband der Deutschen Zoodirektoren (VDZ); Grüner Kreuz Österreich; City Travel; Österreichische Zoologenstation (ÖZO); World Association of Zoos and Aquariums (WAZA); City Burghausen; Region Alto Chiangiu im Salzach; Bund Naturschutz Bayern e.V.; WWF Italia; Provincia di Grosseto; Ai field Schermsen; Village Schermsen; Village Grünau

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New opportunities for investigating bird migration: Tracking flight patterns in sub-adult migratory birds with GPS data loggers

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1. Background

Northern Bold Ibises (NBI; *Geronticus eremita*) are highly endangered in the wild with a single colony in Morocco and some further birds in Syria. In Europe the species became extinct during the middle age. NBI are migratory birds. Experiences with juvenile zoo offspring indicate that the information about the migration route is mainly a socially passed tradition.

The project Waldrappteam.at tries to teach a new migration tradition to groups of human-raised zoo offspring. Human foster parents guide young NBI to the wintering area once with the use of microlight aircrafts. At the wintering grounds the birds are released into independence. The return migration is expected with sexual maturation, which is attained at the 3rd year.

The spatio-temporal patterns of sub-adult birds were tracked via sightings since their independence in 2004 and via GPS data loggers since spring 2006. To give an impression of these flight patterns, data of one sub-adult female NBI, Aurelia, will be shown in this poster.

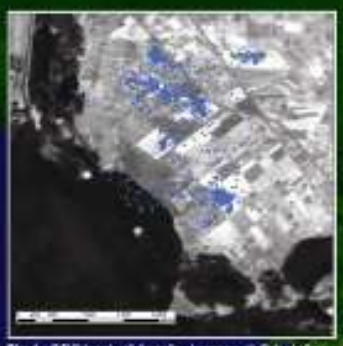

Fig.1: GPS track of Aurelia, Laguna di Orbetello, Tuscany, June 5th – June 7th 2006

2. Human-led Migration Autumn 2004

Mid August Aurelia and 6 conspecifics migrated with their foster parent. The migration, with an airline distance of 638 km, started at the breeding area in Scharnstein, Upper Austria, and ended at one of the major Italian wintering grounds, the WWF Nature reserve Laguna di Orbetello, Southern Tuscany (—).

Human-led Migration Autumn 2004
Sightings Summer 2005
Sightings Spring 2006

3. Exploratory Flights Summer 2005

In May 2005 the whole group flew up to 388 km airline distance to the north, and back to the winter-habitat. The timing of departure was later than expected for a regular vernal migration (Tab.1). At that time food availability for NBI in the Tuscany decreased. Therefore these flights are considered as explorative, triggered by the exogenous factor of food shortage. Nevertheless, all NBI oriented well along the route they had learned during the autumn migration half a year ago (★).

4. Graded Return Migration Spring 2006

At the beginning of April 2006 the NBI left the wintering area. This is the expected time for starting the vernal migration (Tab.1). The food availability at the time of departure reached an annual maximum. Thus, food shortage as an exogenous trigger for the departure, as in 2005, can be excluded. Even though no NBI reached the breeding area north of the alps, the birds covered considerable flight distances. Aurelia flew up to 572 km north with a mean distance of 13.19 km (SD= 9.06) deviation from the human-led migration route 2004 (★).

Laguna di Orbetello

5. GPS tracks Summer 2006

In June 2006 we started to investigate spatio-temporal patterns with GPS data loggers. They provide data recorded and computed at intervals of 1 to 10 sec. Fig. 1 shows as an example a 2 day data collection of Aurelia. Each data point provides information about position, sea level and speed.

Tab.1: Period of flight activity, flight direction and maximum airline distance from origin for Aurelia.

		Period of flying activity (month)												Direction	Airline distance
		1	2	3	4	5	6	7	8	9	10	11	12	from origin	from origin (km)
Human-led Migration	2004													south	638
Exploratory Flights	2005													north & south	388
Graded Return Migration	2006													north &south	572
Expected Vernal Migration	2007													north	638

6. Discussion

Flight patterns in the sub-adult NBI were found to be age-dependent.
After their first winter in the Tuscany the birds showed no migration tendency. They left the winter region after the migration period. Data indicate that these flights were triggered exogenous by food shortage. After their second winter the NBI left at the expected time for vernal migration. They flew several hundred kilometres to the north but turned back before reaching the breeding area. We assume that this flight activity was already triggered by endogenous factors, which control the vernal migration behaviour.
In spring 2007 the birds reach sexual maturity. Then we expect them to migrate straight to the breeding area.

The behaviour of a further NBI group, which migrated to the Tuscany in autumn 2005, corresponds with these patterns.
All birds oriented well along the route they had experienced once in autumn 2004. The sightings indicate that they easily and very precisely follow the track.
In the future we will equip the migrating birds with GPS data loggers. This allows us to track the flights with a solution of a few second and an accuracy of a few meters. Information about orientation, flight intervals, stop-over sites, ground speed, social coordination and the influence of environmental factors will be available.

The project was financed by the following institutions and persons:

Zoo Vienna; Alpenzoo Innsbruck; Gamspark Rosegg; Cumberland Gamepark Grünau; Konrad Lorenz Research Station Grünau; Frau Maria Schrem; Verein für Tier- und Naturschutz in Österreich; Deutscher Wildgehegeverband e.V.; Österreichischer Wildgehegeverband; Verband der Deutschen Zoodirektoren (VDZ); Grünes Kreuz Österreich; City Traun; Österreichische Zoorganisation (ÖZO); World Association of Zoos and Aquariums (WAZA); City Burghausen; Region Altötting Chiemgau-Inn-Salzach; Bund Naturschutz Bayern e.V.; Lebensministerium Österreich; Oberösterreichische Landesregierung; WWF Italia; Provincia di Grosseto; Air-field Scharnstein; Village Scharnstein; Village Grünau

waldrappteam.at

Corticosterone patterns in Northern Bald Ibises on experimental autumn migration

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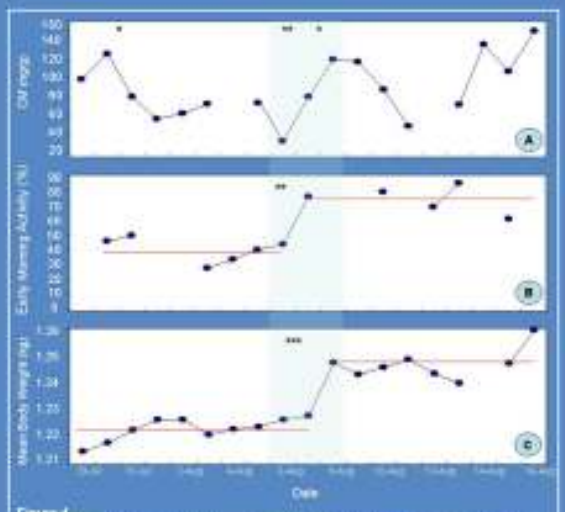

Figure 1
Pre-migration: (A) Faecal corticosterone metabolites (CM), (B) Early morning activity, (C) Mean Body weight; the blue coloured area marks the period with significant changes in all three parameters.
Statistics: * marks P<0.05; (A) Day for day comparison (Wilcoxon test); (B) Comparison of the period 18 Aug.6 and after Aug.6 (Mann-Whitney test); (C) Comparison of the period 18 Aug.7 and after Aug.7 (Mann-Whitney test).

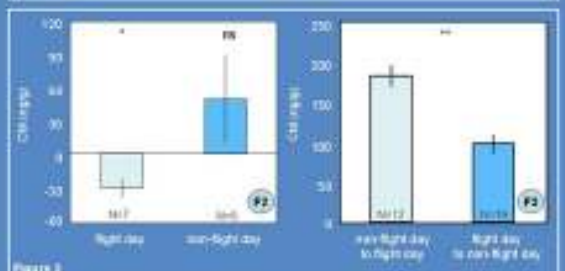

Figure 2
Faecal corticosterone metabolites (CM) on flight days and non-flight days; period Aug. 9 to Sep. 21
Statistics: Mean ± SE; ** marks P<0.01; Mann-Whitney test.

Figure 3
Change of faecal corticosterone metabolites (CM) from non-flight days to consecutive flight days (■) and from flight days to consecutive non-flight days (□); period Aug. 9 to Sep. 21
Statistics: Mean ± SE; * marks P<0.05; Wilcoxon test.

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Zoo Vienna; Alpenzoo Innsbruck; Gamepark Rosegg; Cumberland Gamepark Grünau; Konrad-Lorenz-Research Station Grünau; Frau Maria Schram; Verein für Tier- und Naturschutz in Österreich; Deutscher Wildgehegeverband e.V.; Österreichischer Wildgehegeverband; Verband der Deutschen Zooldirektoren (VDZ); Grünes Kreuz Österreich; City Traun; Österreichische Zooorganisation (ÖZO); World Association of Zoos and Aquariums (WAZA); City Burghausen; Region Altes Chiemgau-Inn-Salzach; Bund Naturschutz in Bayern e.V.; Lebensministerium Österreich; Oberösterreichische Landesregierung; WWF Italia; Provincia di Grosseto; Anfield Schermsen; Village Schermsen; Village Grünau

Introduction

A group of seven Northern Bald Ibises (NBI, Geronticus eremita) was raised by human foster-parents and conditioned to follow an ultra-light aircraft. Human-led migration was conducted to teach the birds a migration route between Austria and Italy.
Before and during the autumn-migration we investigated the following questions:

Question 1
At which time of the year and how do NBI enter into a migratory state? Can physiological and behavioural changes be measured?
Question 2
Do NBI systematically change their Corticosterone level during human-led migration?

Method

Data were collected before migration (July 29 to August 16) and throughout the 860 km human-led migration (17 August to 22 September). We measured the following parameters: (1) Concentration of excreted immuno-reactive metabolites of corticosterone (CM), determined from faecal samples; (2) Daily body weight; (3) Early morning activity during the period before migration, determined acoustically on the group level.

Results & Discussion

Question 1

We found parallel physiological and behavioural changes at the beginning of August. Within three days CM, body weight and early morning activity increased significantly (Fig. 1).

The parallel increase of CM, body weight and early morning activity from 6 August to 8 August may be the effect of an intrinsic physiological change towards a state of migratory readiness.
Corresponding to that, free-flying juvenile NBI are known to leave for long-distant flights around mid of August. According to the fining we started the human-led migrations about mid of August.

Question 2

During migration we had 14 flight-days (flight distance between 40 and 87 km) and 23 non-flight days. When including all flight days and non-flight days CM decreased significantly (r_s=-0.596, N=28, P=0.001). At the start of migration CM was six times higher compared to the end of migration.
CM during non-flight days was significantly higher compared to flight days (Fig.2). CM generally decreased from non-flight days to consecutive flight day (Fig.3).

On a first view the CM decrease seem to contradict the migration modulation hypothesis (MMH), which assumes that the corticosterone level is rather elevated during migration to facilitate lipogenesis and hyperphagia. However, field data supporting the MMH were generally from birds caught at stopovers. If we consider only CM at non-flight days we also find a rather elevated CM level compared to the CM level one month before start of the migration. In fact, our data indicate a down- and up-regulation of the CM level in relation to flight days and non flight days respectively. The elevated CM level at non-flight days may be functionally related to lipogenesis and hyperphagia, corresponding to the MMH. On the other hand, the low CM level during flight may be functionally related to flight exertion and stress management. For example, low level of CM may protect the pectoral muscle from catabolism and enhances memory formation.

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TRACKING FLIGHT PATTERNS BY THE USE OF GPS DATA LOGGER

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Three Northern Bald Ibises (NBI; *Geronticus eremita*) were tracked with GPS datalogger during their free fligths in the wintering region WWF Oasis Laguna di Orbetello. GPS were attached using a velcro strip on the back of the birds (Fig.1).

Data were recorded for two to three days. Then the GPS was removed from the birds.

Positions (with an accuracy of +4 m) were recorded at 10 sec interval for a 48-60 h period for each bird. For the analysis of the time budget we excluded the GPS points recorded during the roosting (sleeping?) phase, i.e. between 21:00 and 5:00. For each animal we analysed two days of tracking (Fig.2).

Three main activities were considered on the basis of the actual speed recorded by the GPS:
-flying: speed between 5 and 80 km/h
-feeding on the ground: speed between 1 and 5 km/h
-resting: speed between 0 and 1 km/h

On average the birds were flying only for 7,6+2,4 % (mean + SE) of the time at an average speed of about 35-40 km/h. Most of the time was spent roosting 52,3 +8,1 % (mean + SE), while feeding activity – mainly walking and searching for insects in the surrounding agricultural landscape—kept them busy for 38,5 +6,9 % (mean + SE) of the time (Fig.3).

Figure 1
Male Northern Bald ibis with a GPS data logger on the back

Figure 2
Three flight patterns of Northern Bald ibises in the wintering area Laguna di Orbetello, Tuscany.

Figure 3
Time budget of the three birds during two days of data collection.

Data collection continues with new version of the GPS logger, which allows data storage for up to 15 days before the battery has to be reloaded. Research will manly focus on the migration periods.

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