

# Northern Bald Ibis

The Most Threatened Bird  
of the Middle East

## THE LAST FLIGHT OF THE ANCIENT GUIDE OF HAJJ

2002 - 2011

NINE YEARS OF CONSERVATION EFFORTS BETWEEN ARABIA AND EAST AFRICA

Each species is a small universe in its own, different from all the others due to its genes, anatomy, behaviour, vital cycle, role in the ecosystem; a self-sustaining system, created in the course of an evolutionary history, complex beyond our imagination. Each species deserves that researchers devote their careers on it, and poets and historians celebrate it. Nothing even closely similar can be said about a proton or an hydrogen atom. In few words, Reverend, this is the strongest and most transcendent moral argument, provided by science in view of supporting the urgent need to save the Creation.

*E.O. WILSON (The Creation, 2006)*

# Northern Bald Ibis

The Most Threatened Bird  
of the Middle East

## THE LAST FLIGHT OF THE ANCIENT GUIDE OF HAJJ

2002 - 2011

NINE YEARS OF CONSERVATION EFFORTS BETWEEN ARABIA AND EAST AFRICA



NATIONAL  
GEOGRAPHIC

Committee for Research  
and Exploration



Syrian General Commission  
for Badia Management and Development



Saudi Wildlife Authority



The Mohamed bin Zayed  
Foundation for Animal Conservation

# CONTENTS

## ACKNOWLEDGEMENTS

This publication was made possible by a grant from the Mohamed Bin Zayed Foundation. Cooperation and support from the Syrian Desert Commission, the Ethiopian Wildlife Society and the Saudi Wildlife Authority were instrumental to run this long-term conservation project. It was made possible by multi-year funds made available by the Italian Development Cooperation (DGCS) and by several grants from RSPB, Embassies of Finland and Netherlands in Damascus, Monaco Foundation, National Geographic Society and Mohamad Bin Zayed Foundation. The passion and dedication of Mahmud S. Abdallah, Ahmed K. Abdallah and Ghazy Al Qaim have been of paramount importance. Lubomir Peske made available his long-term experience in satellite tagging and telemetry with passion and very often as a volunteer. Gianluca Serra served this project as a volunteer for several years.

## CITATION

Serra G. 2017. The Last Flight of the Ancient Guide of *Hajj*. Self published. Apia, Samoa. 74 pp.

## ONLINE AVAILABILITY

[www.thelastflight.org](http://www.thelastflight.org)

## COPYRIGHT

© G. Serra

## DESIGN & LAYOUT

Sebastiano Ranchetti ([popdesign.it](http://popdesign.it))

## DISCLAIMER

The contents of this publication do not necessarily reflect the views or policies of the Mohamad Bin Zayed Foundation, the Syrian Desert Commission, the Saudi Wildlife Authority, the Ethiopian Wildlife Society, the National Geographic Society and the Italian Development Cooperation (DGCS). It is a contribution from the author, as champion and expert of the oriental Northern Bald Ibis, aimed at providing an independent perspective and insight about the 9 years ibis conservation work.

Cover photo © Gianluca Serra

	SUMMARY	PAG 7
	1. BACKGROUND	PAG 11
	2. THE DISCOVERY IN SYRIA	PAG 17
	3. THE ORIENTAL NORTHERN BALD IBIS	PAG 21
	4. BREEDING PROTECTION AND CAPACITY BUILDING	PAG 25
	5. AWARENESS AND EDUCATION	PAG 29
	6. THE DISCOVERY OF THE MIGRATORY ROUTE	PAG 33
	7. IBIS PROTECTED AREA IN SYRIA	PAG 37
	8. THE WINTERING SITE IN ETHIOPIA	PAG 43
	9. THE MYSTERY ABOUT THE IMMATURE BIRDS	PAG 49
	10. THE FLYWAY ALONG WESTERN SAUDI ARABIA	PAG 53
	11. SUPPLEMENTATION TRIAL	PAG 59
	12. RECOMMENDATIONS	PAG 63
	13. REFERENCES	PAG 67





## SUMMARY

**T**his is a case study about the 9-year conservation efforts that were put in place between the Middle East and East Africa with the aim of preventing the extinction of the last known colony of oriental Northern Bald Ibis *Geronticus eremita*.

The conservation saga spans from the time of the discovery of an unreported relict colony of this species in early 2002 in the Palmyra desert (Syria) until the political unrest erupted in early 2011.

Certainly the rarest in the Middle East, the bird in question is also one of the rarest in the world, listed as Critically Endangered by the IUCN Red List since 1994. It used to have significant symbolic and cultural values attached in the region. The bald ibises still breeding in Syria, discovered during an extensive biodiversity survey carried out as part of a FAO aid project, were the last living descendants of those depicted in Egyptian hieroglyphs from 4500 years ago.

The decline of this bird species from its original breeding range in the Middle East is part of a large wave of biodiversity loss that has occurred in the region during the past 30-40 years – and that has caused the extinction of several other species of iconic animals and plants.

Following the discovery in Syria, a community-based ibis breeding intensive protection program was established in Palmyra during years 2002-2004, in parallel with an extensive capacity building program in the benefit of the local community and



Above. One of the three breeding pairs of N. Bald Ibis discovered in 2002 in the Palmyra desert, engaged in a courtship display at the nest, beside their chick and an unpaired adult (© G. Serra, 2002).

Aside. View of the breeding grounds of the N. Bald Ibis in the Palmyra desert (© G. Serra, 2009).

staff from the Syrian Desert Commission. Fourteen chicks successfully fledged during this period.

Beside protection and training operations, data on threats and on feeding and breeding ecology were collected in the field. An Ibis Protected Area was recommended and established. An awareness and education program was also launched and implemented - reaching the highest political spheres in Damascus.

Two breeding failures occurred in 2005 and 2008 following a change of project management and of ibis protection strategy, that took place between 2004 and 2005. Three birds were tagged with satellite transmitters and the migratory route and wintering site of the colony were discovered in 2006. Three surveys were undertaken at the wintering site on the Ethiopian highlands between 2006 and 2009, establishing that no immediate threats were present at the site.

Thanks to an IUCN project the Ibis Protected Area in Palmyra desert was further developed in 2008-2009 just in time to curb the threats of infrastructure uncontrolled proliferation and heavy oil prospection schemes.

Meanwhile it became apparent that only adults were reaching the wintering site in Ethiopia and that it was the low survival rate of immature birds outside the breeding range - and thus an insufficient recruitment at the breeding colony in Palmyra - that had been causing the slow and steady decline of the colony from 3 breeding pairs in 2002 to just 1 in 2010.

Satellite tracking and surveys conducted in western Saudi Arabia during 2009-2010, with key cooperation of the Saudi Wildlife Authority, suggested that a combination of hunting and electrocution were causing a high mortality rate of dispersing immature ibises. This mortality is regarded as the main cause of the low recruitment occurred at the Palmyra colony during the years following the high breeding performance of period 2002-2004 (only 3 recruitment events out of 14 chicks fledged).

A supplementation trial could be eventually conducted in 2010 by introducing captive-born chicks into the wild colony in Palmyra. An ibis captive breeding center was established in Palmyra. Three chicks introduced at the wild colony in Palmyra followed a migrating wild adult for more than 1000 km from Palmyra well into south-west Saudi Arabia.

This trial reinvigorated the hopes that the colony could be still saved. Conservation efforts were interrupted in March 2011 due to the worsening of the political situation in Syria. Palmyra trained rangers have continued to protect the breeding birds until 2014-2015.

Recommendations for the years to come are provided along. The current status of the rarest bird in the Middle East is highly critical. If action is not taken urgently and effectively, the Middle East will lose this species forever in a few years.

Few focused and urgent interventions along the western Saudi Arabia flyway could alone still prevent the extinction in the wild of this iconic bird. Because the migratory route used by the N. Bald

Ibis along western Saudi Arabia is a well known international migratory flyway used by at least 6 other globally threatened and 4 declining species of soaring and water-birds, the mentioned interventions would serve a much broader conservation scope.

Aside. *N. Bald Ibis* adults and juveniles feeding at their breeding grounds in the Palmyra desert in spring 2003 (© G. Serra).

Below. *View of the ancient ruins of the Temple of Baal seen from within the oasis of Palmyra* (© G. Serra, 2009).





## 1 BACKGROUND

An international development aid project, based in the millenary oasis of Tadmur (Palmyra), central Syrian steppeland (often also referred as “desert”), was in operation during the period 1996-2004<sup>1</sup>. The goal of this project was to assist the Syrian Government in testing ways to halt the desertification of the steppeland through the improved management of the rangelands (mostly used as pastures for livestock) and the protection of the remnant and threatened biodiversity heritage.

The project’s second component envisaged the establishment and development of the first protected area in the country, Al Talila Reserve. For the purpose a long-term survey reconnaissance program of fauna and flora was carried out during the period 2000-2003. Objective of this program was to detect, list and document the key naturalistic and biodiversity assets of the central Syrian desert (where Al Talila was the core of the survey area). A team of locals and government staff was in-service trained during the extensive surveying work by an international wildlife expert (G. Serra). The fauna surveys produced interesting findings such as:

- 1 beetle species new to science (Coleoptera, Aphodidae)<sup>2</sup>
- 1 butterfly species new record for Syria (Lime Swallowtail *Papilio demoleus*)<sup>3</sup>
- 1 snake species new record for Syria (Black Cobra *Walterinnesia aegyptia*)
- 21 bird species new records for Syria (see References)
- 9 bird species globally threatened (see References)
- 2 mammal species new records for Syria (Sand cat *Felis margarita* and Ruppell’s fox *Vulpes ruppellii*).

Together with these findings came the awareness that several key species had vanished from the Syrian desert ecosystem across varying ranges of time. Charismatic mega-fauna like the Asiatic lion *Panthera leo persica*, the Caspian tiger *Panthera tigris virgata* and the Arabian oryx *Oryx leucoryx* had disappeared centuries ago, while the Arabian leopard *Panthera pardus nimr*, the Brown bear *Ursus arctos syriacus*, the Golden hamster *Mesocricetus auratus*, the Northern Bald Ibis *Geronticus eremita* and most likely the Sand gazelle *Gazella subgutturosa marica* vanished more recently during the course of the past century - some of them just during the last few decades of that century.

In fact it was realized that most of the biodiversity’s losses had taken place in the Syrian desert especially during the past 40 years as part of an intense desertification process fuelled by the over-exploitation of the steppe natural resources. This has been a dramatic process - still an on-going one - affecting the overall steppe ecosystem functionality and progressively impoverishing



the people who make a living out of it, the Bedouin nomads. The livelihood of this indigenous people being extensively based on the natural resources and services of the steppe ecosystem.

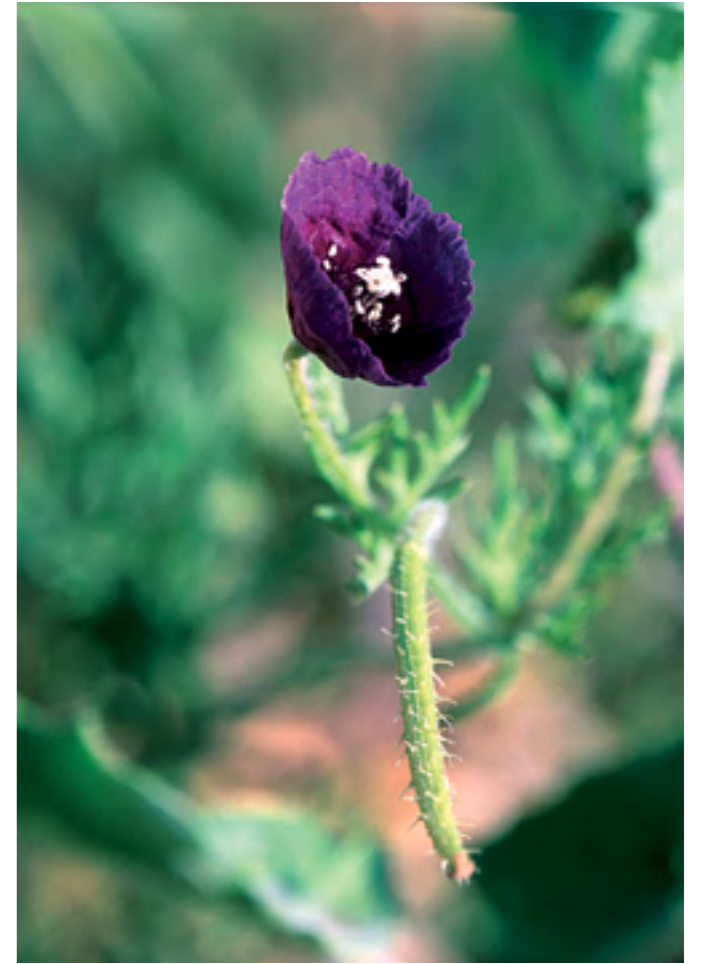
Overall, the intensive fauna and flora survey program put on focus and raised the awareness on the fact that both the cultural and the biodiversity heritages of the Syrian desert had become rapidly critically endangered due to a complex cocktail of underlying problems whose ultimate outcomes are the over-grazing of pastures, the uncontrolled and extensive uprooting of vegetation cover as firewood, the uncontrolled hunting and usage of underground water and, more recently, the unplanned infrastructure development.

1. DGCS-funded UN-FAO project (GCP/SYR/009/ITA) / DGCS: Italian Development Cooperation/Aid Program
2. named *Aphodaulacus talilensis* (Della Casa, in prepar.)
3. an alien species, potentially invasive

Above. Young Bedouin shepherd from the Sba’a tribe in Al Talila Reserve (© unknown).

Aside (top left). Sand cat (*Felis margarita*) still surviving in Al Talila Reserve; the FAO project revealed for the first time the occurrence of this species in Syria (© G. Neumann-Denzau/naturepl.com).

Aside (left). Insect collection from Al Talila Reserve displayed at the eco-museum; one beetle species found within the reserve resulted new to science and a butterfly species is a first record for Syria (© G. Serra, 2001).



Aside (far left). *One of the trainees as ranger of the Syrian Desert Commission during the fauna survey and photo-documentation program (© G. Serra, 2001).*

Aside (top left). *A chick of Houbara Bustard (Chlamydotis undulata), a very rare bird still occurring seasonally in Al Talila Reserve (the photo was taken in Saudi Arabia in 2000, © G. Serra).*

Aside (left). *A gecko (Ptyodactylus puiseuxi) on a wall of the ancient ruins of Palmyra (© G. Serra, 2000).*

Aside (bottom). *Wolf spider (Licosidae) occurring in Al Talila Reserve (© G. Serra, 2000).*

Aside (right). *Little purple poppy (Roemeria hybrida) sporadically blossoming in the Palmyra desert during the wetter years (© G. Serra, 2003).*

Below. *Ad-dud ar-rabie, the "spring's worm" as it is called by Bedouins. It is a moth caterpillar occurring within the Palmyra desert. It takes a circling posture when threatened (© G. Serra, 2000).*





Above. View of the ancient ruins of Palmyra surrounded by the oasis and the seasonal salt lake Sabkhat al Moh (© G. Serra, 2002).

Aside (left). Camel snake (*Spalerosophis diadema cliffordii*) occurs in Al Talila Reserve (© G. Serra, 2000).

Aside (top right). Chamaleon (*Chamaleo chamaleo*) a locally endangered species of the Syrian desert (© G. Serra, 2000).

Aside (far top right). Common Cranes (*Grus grus*) photographed in Al Talila Reserve (© G. Serra, 2000).

Aside (right). Monitor lizard (*Varanus griseus*) still surviving in Al Talila Reserve (© G. Serra, 2002).







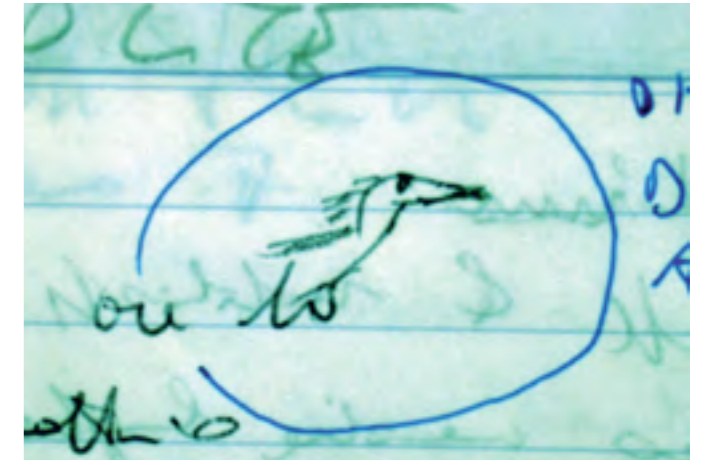
## 2 THE DISCOVERY IN SYRIA

The reconnaissance survey program of the steppe fauna culminated with the discovery in April 2002 of a surviving relict colony of Northern Bald Ibis, still breeding within a mountain range not far from Palmyra. At the time it was quoted by authoritative sources as “the most significant ornithological discovery in the last 50 years anywhere in the Middle East”.

The news was reported widely internationally across the conservation community and the media network. The N. Bald Ibis had suddenly “reappeared” in the Middle East, “like the Phoenix regenerated from its own ashes”.

First hints of a possible unreported occurrence of this rare bird in Syria were collected by the team from a local hunter during the project fauna survey program. Following the positive verification of this anecdotal information, a systematic search was designed, organized and implemented across the whole Palmyra desert and more than 100 Bedouin families across an area of ca. 20,000 Km<sup>2</sup> were interviewed in a standardized fashion.

N. Bald Ibis, one of the rarest bird globally, had been listed as “Critically Endangered” (the highest threat level before extinction) as early as 1994 by the IUCN’s Red List of Threatened Animals and Plants. Before the discovery in Syria, it was known



to survive in the wild only in a few scattered colonies in Morocco, for a total of ca. 90 breeding pairs (the so called western population).

The eastern population of N. Bald Ibis, that used to breed between Turkey and Syria, had separated from the western one centuries ago. The last record of bald ibises in the Syrian desert





was from the early Thirties, and since then, according to the specific literature, the species had become extinct in this country. The whole eastern ibis population was declared extinct in 1989 in coincidence with the demise of the last known colony of Birecik in Turkey.

Post-1989 occasional N. Bald Ibis sightings in western and south-western Arabia had led some to believe that an ibis “lost colony” was possibly still breeding somewhere in Arabia or Eastern Africa. This mysterious and possibly yet unnoticed breeding colony had been emphatically defined as the “Tutankhamen’s tomb” of Arabian ornithology.

On 19 April 2002 the knowledge about the conservation sta-

tus of the ibis eastern population, up to then based on wrong assumptions, suddenly changed. A relict colony of 7 breeding individuals of this species was found in the Syrian central desert, evidencing that the specific literature was incorrect in reporting that this species had vanished from the Syrian desert more than 70 years ago.

The importance of the discovery was that the eastern population of N. Bald Ibis is behaviorally, ecologically and genetically distinct from the western one: the former is in fact a long-range migratory population while the latter is a sedentary one. The discovery was especially significant from a conservation point of view, as it revived the hopes to save this iconic population in its native habitats in the Middle East.

The key to the discovery of the tiny ibis colony across a vast territory was the successful decoding of the traditional naturalistic knowledge retained by the Bedouin nomads. The so called “anecdotal information”, so often neglected and downplayed by academia and experts, was carefully and rigorously assessed, filtered, interpreted and used at its best potential.

Information gathered during the extensive surveying evidenced that this bird was most likely, far from being vanished, a common and awe-inspiring sight of the Syrian steppe landscape until only 20-30 years earlier. An early funeral had been devised for the bird through incomplete surveys done in that period and the subsequent drawing of wrong conclusions. Declaring the extinction in the wild of an animal species is often not an easy matter.



#### Previous pages

Pag. 16. *Two views of the landscapes of the breeding grounds of N. Bald Ibis in the Palmyra desert* (© G. Serra, 2001 and 2008).

Pag. 17 (top). *A sketch drawn by a young shepherd in March 2002 that resulted crucial for the discovery of the N. Bald Ibis relict colony* (© G. Serra, 2002).

Pag. 17 (bottom). *A trained ranger from the FAO wildlife team during the N. Bald Ibis search in March 2002* (© G. Serra).

#### These pages

Above. *One of the three breeding pairs of N. Bald Ibis discovered in 2002, at the nest together with their chick and an unpaired adult* (© G. Serra, 2002).

Aside (left). *Two views of niches and ledges of limestone cliffs used as nests by the N. Bald Ibis colony discovered in 2002* (© G. Serra, 2002).

Aside (right). *A large cliff in the vicinity of Palmyra reportedly hosting hundreds of breeding pairs of N. Bald Ibis until the Seventies-Eighties* (© G. Serra, 2003).



The tiny ibis colony of Palmyra, together with the last 90 pairs still surviving in Morocco, made up the whole global population of the species. In 2002 therefore N. Bald Ibis suddenly became the rarest and most threatened bird of the Middle East. If the N. Bald Ibis as a species was already listed as Critically Endangered before the discovery in Syria, the handful of ibises still breeding in the middle of the Syrian desert could have been well defined as “hyper-critically endangered”. Indeed a big responsibility on the shoulders of the FAO project wildlife team. As early as 2002 a call for cooperation was made to international conservation organizations as the future of the FAO project was becoming uncertain.



### 3 THE ORIENTAL NORTHERN BALD IBIS

**T**he oriental N. Bald Ibis is a unique and charismatic animal that has had symbolic and cultural values attached in the Middle East region since time immemorial. Its punk weird appearance, its iridescent plumage, the echoes of its guttural reptilian calls resounding from the desert pink cliffs and its awe-inspiring black flocks, in formation over the desert horizon, were contemplated with wonder by the successions of amazing civilizations that have risen and fallen in this region across the millennia.

The ibis in general (as a zoological family, the Threskiornithidae) was a symbol of wisdom according to the ancient Egyptians. Hence the ibis-headed god of wisdom and knowledge Toth. N. Bald Ibis in particular was known to the ancient Egyptians as shown by its unmistakable graphic representation in 4500-year-old hieroglyph finely carved on the walls of the temple of Horus, along the Nile valley, south to Luxor.

The N. Bald Ibis was actually believed to be the incarnation of the spirit Akh who was responsible for escorting the soul of the departed to the Afterlife. It is fascinating to reflect on the fact that the ibises discovered in Palmyra are the last living descendants of those revered by the Egyptian pharaohs.

In fact, these ancient myths about the ibis are still alive in the region in different variants and forms. For instance, an elder Bedouin from the Syrian desert reported to the survey team in



Above. 4500 year old hieroglyph from the Temple of Horus at Edfu, south of Luxor (Egypt), unmistakably representing a N. Bald Ibis (© A. Vándor, 2007).

Aside. Portrait of a captive N. Bald Ibis showing the iridescent plumage (© J. Crisalli, 2009).

Bottom. Three adult N. Bald Ibises at an artificial pond within the breeding grounds of the Palmyra desert in 2003 (© G. Serra).

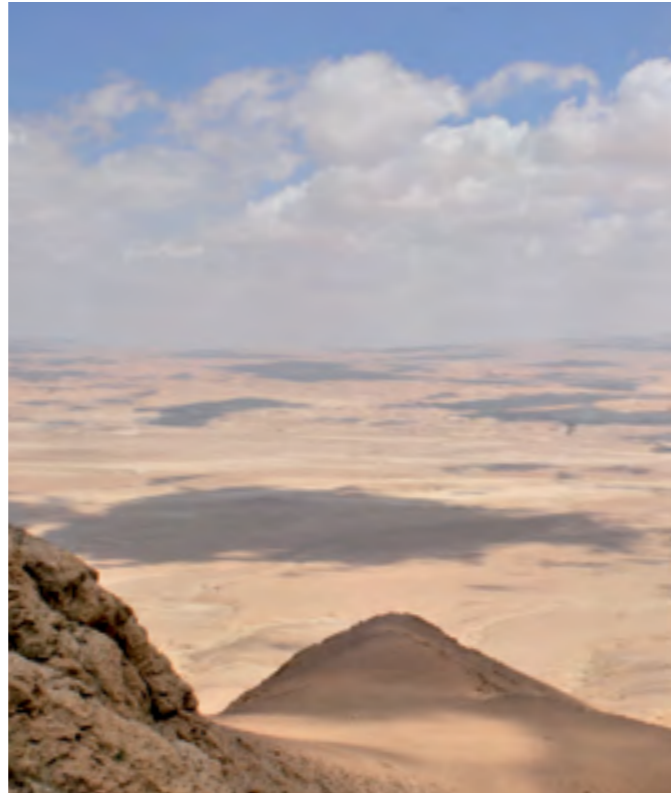




2003 that its tribe used to hold the N. Bald Ibis as a symbol of wisdom. N. Bald Ibis seems even cited in the Old Testament of Christianity as the legendary messenger of fertility released by *Noah* from the ark.

Until the 1980s, the most famous stronghold of this species in the Middle East was certainly the large colony returning every year to breed on the sandstone cliffs, on which the ancient fortress of the southern Anatolian village of Birecik is perched, along the Euphrates River in Turkey. The local Muslim community believed that the bald ibises, through their summertime southward migration, used to guide the pilgrims during their *haji* towards the Holy Makkha. Until recent times they used to celebrate their migratory return every year in February, heralding the beginning of the spring, with a traditional festival. This iconic colony was still counting more than 1000 birds around the 1950s, as reported by several fascinated travelers and ornithologists.

These birds have co-existed in harmony with the herds of the Bedouin nomads in the Syrian desert for centuries: in fact not



only the elderly of these people still use a specific name of their idiom for the bird - An-nug - but they also currently use this same name to identify specific desert locations and sites (for example: the cliff of the ibis, the cave of the ibis etc.). An-nug is actually the Bedouin dialect denomination for the dromedary's female: apparently this name was given to the N. Bald Ibis due to the way it moves its head back and forth while walking on the ground searching for food, the same way the dromedary female does.

N. Bald Ibis must have been a key species of the Syrian steppe in a long time, not only culturally but also ecologically. In the past this bird, occurring in large numbers, likely played an important ecological role within the Syrian steppe ecosystem: being a relentless insectivore, it was probably key in controlling the insect populations of the steppe, and in so doing maintaining the ecological health and productivity of the pastures on which the nomads rely for their livelihoods. Interestingly, the Syrian Government recognized the beneficial ecological role played by the ibises for the agriculture at national level through Decree n. 28 issued in 1967.

Above (left). *The ancient ruins of Palmyra enlightened by the dawn* (© G. Serra, 2002).

Above (right). *View of the ibis breeding grounds within the Palmyra desert* (© G. Serra, 2008).

Aside (left). *A Turkish traditional calligraphy representation of N. Bald Ibis* (© G. Serra, 2008).

Aside (right). *Two views of N. Bald Ibises in flight at the Syrian breeding grounds in June 2003 (top) and in May 2008 (bottom)* (© G. Serra).





## 4 BREEDING PROTECTION AND CAPACITY BUILDING

The key threats to the survival and the breeding performance of bald ibises were identified by the field team during the weeks and months soon after the discovery: human disturbance during incubation, raven depredation of chicks during the first 2-3 weeks following the hatching and illegal hunting.

Two types of N. Bald Ibis breeding protection programs, in assistance of the local competent authority (the Syrian Desert Commission), were run following the colony discovery in April 2002. An intensive protection program involving both in-service capacity building and external expertise support made available on the ground for the whole duration of the breeding (February-July). A light protection program involving direct provision of financial support to the local authority and technical advice made available mainly remotely (see table below).

The intensive protection program was established the same year of the discovery of the ibis colony. Led by an international ornithologist and conservationist (G. Serra), it was characterized by round-the-clock scientific advice and on-the-ground coordination of the team of trained local rangers and guards provided through the long-term field presence of the expert. A genuine community-based protection program, it was run for three consecutive breeding seasons (2002-2004) achieving a remarkably high breeding success - higher than the average breeding performance recorded in Morocco during the best years.

A total of 14 chicks successfully fledged during 2002-2004 and another 10 fledged during 2006-2007. Starting from 2004 a total of 5 sub-adults returned to the colony (2004-2007). Three of them successfully recruited into the colony, partially com-




pensating the annual mortality of adults.


From the observation of null recruitment recorded during years 2002-2004, it was concluded that the breeding performance of the ibis colony must have been very low or zero during the years

Above. Daily life in the tent of the FAO ibis team (© G. Serra, 2004).

Aside. The tent of the FAO ibis team used for the intensive ibis protection program during period 2002-2004 (© G. Serra, 2003).

Breeding seasons	Chicks successfully fledged	Average breeding performance	Management/funds
2002-2003- 2004	14	1.75 chick per nest	FAO/DGCS <sup>4</sup>
2005	0	0	BirdLife/RSPB <sup>5</sup>
2006-2007	10	1.67 chick per nest	BirdLife/RSPB
2008	0	0	BirdLife/RSPB
2009	0	0	BirdLife/RSPB and IUCN/DGCS
2010-2011	0	0	BirdLife/RSPB

 Intensive protection program

 Light protection program

4. Italian Development Cooperation

5. Royal Society for the Protection of Birds

before the discovery. Evidently, the intensive protection program had been successful in addressing and curbing the existing threats present at the breeding grounds. The breeding of the ibis colony therefore, due to its limited size (3-2 pairs) and the consequent high vulnerability to disturbance, seemed totally dependent on high levels of protection. Based on the experience of the intensive protection program, a Standard Ibis Protection Protocol was developed and recommended to authorities.

The sharp difference in performance of the two types of protection programs during the years when the colony was still sizable and vital (2002-2008, see table at the bottom of previous page) is an evidence of the strategic importance of running an intensive protection program versus a light one. Clear recommendations about this critical issue were provided and passed on by the FAO project to the international conservation organizations that took over the management of the ibis project after 2004.

The main reason of the importance of the external expertise available on the ground for the whole duration of the ibis breeding season is that a capacity building program had been successfully carried out during the FAO project resulting in the formation of a well trained national wildlife team (rangers, guards, eco-guides). Unfortunately this program was never coupled and completed with a training program aimed at building the capacity of a local or national biologist who may have been able one day to take over the duties of scientific advising and field team coordination. This was due to the scarcity of candidates with suitable qualifications and interest available nationally and also due to time and fund constraints.

Field experience showed how easily human disturbance could produce disastrous consequences during the 20-day ibis incubation time. For example a Bedouin shepherd passing with the herds too close to the nesting cliff or an inexperienced guard or an unaware and unaccompanied eco-tourist getting too close to nests, as it was witnessed, can produce easily a breeding failure.



It was also noted that the small and decreasing size of the ibis colony made them progressively more exposed and vulnerable to the depredation of nestlings by ravens.

In 2008 the colony failed the breeding due to insufficient protection and consequent raven depredation of all chicks from two nests. The same most probably happened in 2005 - no data from that year was ever made available nor disclosed. During years 2006 and 2007 the breeding performance of ibises returned to the initial levels due to the resuming of the intensive protection program - the key expert and ibis champion was allowed again to work in the field making the experience gained during the years of successful protection 2002-2004 fully available.

Two consecutive breeding failures were recorded in Palmyra in 2009 and 2010 due to unknown causes: it is hypothesized that inbreeding and social disruption were the main causes of failure. In fact, for the first time only 1 pair attempted breeding in 2010. Being a social and gregarious species, at this stage the colony seemed to have reached the point of no-return. Not even an intensive protection program could help the colony much at that point.

The naturalistic, ecological and conservation capacity of few selected local people (4 Government staff, 2 Palmyra hunters and 10 indigenous pastoralists) was built through in-service training during the course of 3 years in the field (FAO project). Their passion and awareness was promoted and stimulated. At same time their sense of conservation commitment and responsibility grew enormously during this period making these people the first genuine conservationists in the country.

This program was also aimed at training some of those same locals as bird-watching and eco-guides and at teaching them the English language. Gradually, they have become highly motivated and skilled in bird field identification and able to speak English. One of them, among the most respected and renowned hunters of Palmyra, turned into a passionate bird-watching guide and a fervent anti-poaching campaigner nationally.



This page. *Five daily scenes of the ibis intensive protection program during period 2002-2004* (© G. Serra, 2002-2004).

Page aside (bottom left). *Adult N. Bald Ibis at nest with a chick in 2002* (© M.S. Abdallah).

Page aside (bottom right). *Interiors of the tent of the FAO ibis team and a local Bedouin guard* (© G. Serra, 2004).



Further assistance was provided in setting up and creating a dedicated web page on bird-watching in Syria and also by directly and continuously putting them in contact with foreign eco-tourists and birdwatchers who were flocking to Palmyra following the ibis discovery. Starting from 2005 two of these trainees (an ex Bedouin pastoralist and the ex Palmyra hunter) finally began to earn a living out of guiding eco-tourists and birdwatchers in the desert. While in parallel another two trainees, staff from the Desert Commission, became the first certified protected area rangers in Syria.

This work experience with local community was defined as “an example of good practice in conservation” by the Dana Declaration Standing Committee and the World Alliance of Mobile

Indigenous Peoples (WAMIP) at the IUCN World Conservation Congress in 2004.

These pioneer conservationists from Palmyra were most probably the first people in Syria who started making a living out of nature conservation. Through their enthusiasm and commitment they have shown to others that not only hunting wildlife is profitable but protecting and appreciating it can be profitable as well. An innovative concept locally and nationally, integrating and promoting the notion of caring and feeling sympathy for the aspirations of the future generations.



## 5 AWARENESS AND EDUCATION

**A**n eco-museum, set up at the entrance of Al Talila Reserve under the FAO project, was inaugurated by the First Lady in 2003. This museum contains a unique collection of locally taken high-quality images of fauna and flora of the Palmyra desert, highlighting the most peculiar, the rarer and more endangered species. A section of the exhibition is focused on the cultural heritage of the desert. This museum, a unique awareness and educational resource regionally, was conceived for school children and eco-tourists.

A program of informal meetings with local hunters was also undertaken under the same project. An educational booklet about the N. Bald Ibis was produced by a local NGO and the Ministry of Education and distributed to schools locally and also nationally.

The awareness on the global/national importance of the last N. Bald Ibises surviving in the Middle East steadily raised in the country from the year of the discovery. The inauguration of a dedicated photo-exhibition by the First Lady in the old city of Damascus in October 2006 ("Syrian al Badia: a cultural and natural heritage under threat") clearly indicated that the issue had become of national relevance in the country.

Following this particular event the next day, probably for the first time in Syria, all the major newspapers were reporting and discussing in their front pages about the ecological crisis of the Syrian steppe and the uncertain destiny of the N. Bald Ibis colony. This bird finally appeared as the flagship of a new conservation awareness rising in the country.



These pages

Aside (left). *Four daily scenes of the ibis awareness program during period 2002-2004* (© G. Serra, 2002-2004).

Aside (right). *Two scenes of the photographic awareness campaign in Damascus in 2006* (© unknown and G. Serra, 2006).

Following pages

Pag. 30 (top). *A limited series stamp featuring the N. Bald Ibis was issued in Syria soon after the discovery in 2003* (© G. Serra, 2003).

Pag. 30 (mid). *Daily life at a Bedouin encampment in the Palmyra desert* (© G. Serra, 2003).

Pag. 30 (bottom). *The interiors of the eco-museum established at the entrance of Al Talila Reserve in 2003* (© G. Serra, 2004).

Pag. 31. *Portrait of a teenager with the interiors of a Bedouin tent as a background during a wedding celebration: the traditional mansaf is ready to be served (in the bottom left corner of the image)* (© G. Serra, 2004).







## 6 THE DISCOVERY OF THE MIGRATORY ROUTE

Since the year of the discovery field research was prompted and undertaken in parallel to the protection efforts. Data about the breeding and feeding ecology of this unique bird colony were collected, both systematically and opportunistically, keeping the maximum care in preventing any disturbance to the rare animals.

The breeding habitat used by the birds is a rugged rocky desert characterized by plateau and sheer cliffs, intersected by few large *wadis* (drainages) and small lateral *wadis*, holding very sparse scrubby vegetation. According to the year, ibises nested in niches and ledges of 2 different sheer limestone cliffs, located 20 Km apart, well protected from the predominant wind (that can be at times fierce).

Their main feeding habitat was a stone and sparsely vegetated open and gently undulating steppe. This feeding habitat is heavily over-grazed by the sheep herds of the Bedouin nomads and the native shrub coverage is almost completely disappeared due to uprooting for firewood. Another key feeding habitat are the man-made reservoirs, where ibises fed on young toads.

The bulk of the diet of Syrian breeding ibises was estimated to be a mix of beetles (mainly ground beetles Tenebrionidae), grasshoppers (Acrididae) and young toads. Possibly a ground mantis and an isopod species, as well as small reptiles, might be important components of the diet as well. A daily need for drinking water was evidenced. Ibises seemed to hunt their prey both by sight and by probing with the tip of the bill into holes and cracks of the soil and under the stones.

The foraging behaviour of ibises was highly gregarious and quite conservative during each breeding season and across years: they tended to use the same feeding areas across the years with similar temporal sequence. Ibises fed on increasingly higher altitude feeding areas throughout each breeding season, starting from about 400 m asl in February and reaching about 950 m asl in June-July. Interestingly, also the Bedouin nomads followed in parallel the same pattern in search of green pastures suitable for their livestock.

Despite the protection program at the breeding grounds in Syria, the number of adult breeding pairs returning to Syria at the onset of the springtime gradually and steadily decreased from 3 in 2002 to 2 in 2004, and finally 1 in 2010.

Overall the adult annual mortality rate appeared quite comparable to that of similar species (ca. 20%) but instead the estimated mortality rate of immature birds resulted very high. Only an estimated 20% of chicks fledged successfully from Palmyra breeding grounds managed to come back after 2-3 years of dispersal outside Syria. This low return rate was clearly incompatible to



compensate the natural adult mortality rate.

The N. Bald Ibises discovered in Syria were clearly migratory and spending half of the year, from July to February, outside Syria. Since the beginning it was feared that the key trait of this oriental ibis, its likely long-range migratory habit, was also the reason making the challenge to save it hardest. Obviously, it is far much simpler to establish a conservation project aimed at rescuing a bird species/population, starting from few survived individuals, when the species/population is resident.

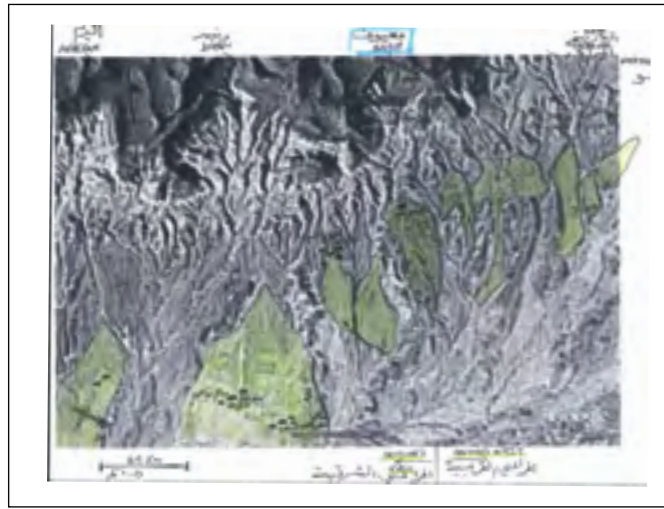
Like it was done successfully for their “cousins” in Morocco or for the “photographic negative” of the bald ibis, the Crested Ibis (*Nipponia nippon*), in China (an ibis with almost the same appearance as the N. Bald Ibis, except for the white plumage).

Above. Head of rangers from the Syrian Desert Commission holding the first bird trapped in June 2006 (© G. Serra).

Aside (top left). The ibis team on daily duty radio-tracking ibises soon after tagging in June 2006 (© Sultan).

Aside (top right). Stomach content obtained from a dead N. Bald Ibis chick in 2009 revealing its diet mainly made of ground beetles (Tenebrionidae) and solifuges (Arachnida) (© G. Serra, 2004).

Aside (other images). Scenes captured during the ibis trapping and tagging in spring 2006 (© G. Serra).



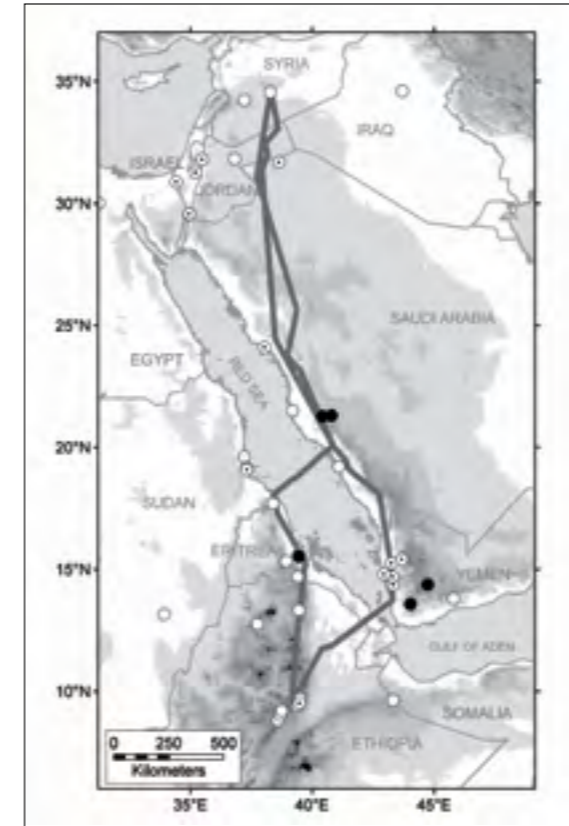
Only in the US so far, a long-range migratory bird species was successfully rescued starting from few individuals - the Whooping Crane (*Grus americana*), during the 1950-1970s - by establishing a solid partnership between Government agencies and the civil society and thanks to investing sound funding.

The protection program of ibises at the Syrian breeding grounds, even when intensive and successful, appeared to be not sufficient: the fact is that the creature was to be protected also in the

rest of its unknown range. The only way to discover the rest of the distribution range of this species was to trap and tag with a satellite transmitter one or more birds. Three long years had to be waited (2003-2006) before trapping and satellite tagging was authorized in Palmyra.

Following a determined advocacy campaign in Damascus during the winter 2005-2006, which even prompted the direct interest and support from the Presidency<sup>6</sup>, field operations in Palmyra were eventually resumed in spring 2006. Three adult ibises were successfully trapped and tagged thanks to mobilization of international top expertise (L. Peske). Conservationists and bird enthusiasts could follow online the progress of the migration of the 3 tagged adults during July-August 2006 until they reached their wintering site.

The birds, departed from Palmyra in mid July, flew southward for several days along western Saudi Arabia, only stopping to rest at night. The average flying distance covered during daytime was 200-300 Km. Amazingly, technology and science enabled to confirm the ancient belief of southern Anatolia Muslims: astonished bird enthusiasts from all over the world followed online, through Google Earth, the three adult tagged ibises flying over the Holy Makkah during their summertime migration.



They came to an halt in south-west Saudi Arabia, where they stopped over for almost a week. They then moved to another stopover site further south, in the western plains of Yemen where they spent another 20 days. Following this second stopover, they continued their flight south and reached Bab al Mandab, from where they crossed into Ethiopia and in a few more days they reached a remote site in the middle of the Ethiopian highlands at almost 3000 m asl. During the following few weeks, it became gradually clear that this was their final destination. The total distance travelled from Palmyra was ca. 3200 Km.

Six months later, on their spring migration northward, they did not pass through Bab al Mandab, but instead flew northward across Eritrea and then into the south coast of Sudan. At that point, surprisingly, they crossed the Red Sea at its widest point<sup>7</sup>. Their challenge involved a 300 km open-sea flight crossing, taking a whole day, and reaching the coast of west Saudi Arabia, near the town of Al Lith. After a stopover of several days in the area, likely spent recovering the energy used for the open-sea crossing, through a few additional days of northward flight they reached Palmyra.

Spring northward migration proved to be quicker than the autumn migration southward: birds appeared to be more hurried during the northward migration, as they were probably motivated to start as soon as possible the nesting and the breeding.

These migratory routes, southward and northward, proved to be conservative through the years. The same route and same key stopover sites in western Saudi Arabia and Yemen were re-used during all the following migration seasons when satellite tracking was made it possible (at least another five migrations).

Above. Release of one of the three tagged adults in June 2006 (© G. Serra).

Above left. Migratory route (late summer southward and early spring northward) as it was reconstructed through satellite telemetry between July-August 2006 and February 2007 (© J. Lindsell, 2007).

Aside (top left). Feeding grounds of the N. Bald Ibis colony marked on a topographic map for research purposes (© G. Serra, 2006).

Aside (bottom). Portrait of female Zenobia, one of the three adults successfully trapped and satellite tagged in June 2006 (© G. Serra).

6. The *leit motiv* being an exhibition of photos taken by G. Serra and the FAO project wildlife team during the fauna survey program and N. Bald Ibis protection programs (2002-2004).

7. It is assumed that usually terrestrial birds avoid crossing open sea expanses by undertaking detours and making good use of land straits: but recent satellite tracking work, not only that on N. Bald Ibises, is revealing that this is not always the case.



## 7 IBIS PROTECTED AREA IN SYRIA

Following the ibis colony discovery and the early years' conservation efforts, a 300-Km<sup>2</sup> Ibis Protected Area (IPA) was established by the Syrian Government in spring 2004 - without indication of any specific border. The known threats at the breeding grounds in Syria were reduced and minimized with alternate fortunes according to the year and the type of protection program established. The reality was that these threats continued to be still present dangerously at the Syrian ibis breeding grounds during the years following the discovery and unfortunately birds heavily depended on intensive and specialized protection in order to breed well.

To the direct threats affecting the breeding performance of ibises, recognized at an early time, other ones, more subtle but not less lethal, emerged gradually within time. Like the severe on-going degradation of natural habitats and ecosystems, the uncontrolled development of infrastructures and, more recently, oil prospection schemes operated by international corporations. Even the inexperience of local authorities on the investments and preconditions needed before planning and developing ecotourism (for instance, sound protection and management of key assets) put the future of that internationally important area at odds.

A range of urgent recommendations were proposed with the aim of scientifically informing decision makers and conservationists and helping them in mitigating the mentioned threats. Certainly among the key recommendations were those of expanding IPA according to new data on ibis use of the area and the one of turning the IPA from paper into an operative one according to international standards, as a matter of urgency.

An IUCN DGCS-funded project was run during 2008-2009 with the specific aim of expanding and developing the IPA. A detailed socio-economic and cultural survey was carried out at the beginning of this project. Based on ibis satellite data and GIS spatial analysis, advises and recommendations were provided to stakeholders so that IPA would cover all the habitats crucial for the breeding of the bald ibises.

The range used by these birds for breeding was quantitatively estimated by using satellite and visual locations collected during period 2006-2009. The total range used by the ibis colony amounts to ca. 1500 Km<sup>2</sup> of surface mostly encompassing a mountainous area north of Palmyra, ranging from 400 to 1000 m asl. The core breeding range was found to be 224-253 Km<sup>2</sup>.

It was recognized that the scenic landscape of the IPA is enriched by interesting flora – especially after wet winters – and additionally by very rare fauna such as what is most likely the last known wild herd of Sand gazelle in Syria (a threatened species



globally) and one of the 2 last known colonies of Griffon Vulture in the country (a species rapidly declining regionally and globally).

Above. A herd of captive Sand gazelle (*Gazella subgutturosa marica*) reintroduced in Al Talila Reserve by the FAO project during the late 1990s (© G. Serra, 2001).

Aside. Two views of the N. Bald Ibis breeding grounds in the Palmyra desert (© G. Serra, 2003-2008).

Next pages

Pag. 38 (bottom). Two N. Bald Ibises feeding on the ground in the Palmyra desert (© M.S. Abdallah, 2007).

Pag. 38-39. Two landscapes at the N. Bald Ibis breeding grounds in the Palmyra desert (© G. Serra, 2002-2003).

The area in question is inhabited mainly by the Amur tribe. These people are Bedouin pastoralists who raise sheep and goats and claim the traditional right of use of pastures in the area. This nomadic and semi-nomadic low-density population was assessed to be quite poor, mostly living at a subsistence level, with scarce support of social services.

The ecological services offered by this area include water recharge of mountain aquifer serving Palmyra oasis, provision of pastures and of energy through firewood, soil formation and nutrient cycling, provision of salt and of medicinal plants, truffles and wild flowers, recreation. Overall, the national and international ecotourism potential of this area was assessed as very remarkable - the Syrian Government had recently set ecotourism as a strategic objective for the development of Palmyra region during period 2010-2020.

Based on this data and subsequent consultations, an IPA Assessment was produced laying the ground for the expansion and sound management of the IPA in the future. This important document, presented and delivered to the Presidency in May 2010, provided the management objectives of the IPA, subdivided according to different zones that had been discussed and agreed with the local stakeholders and authorities.

Thanks to the quantitative assessment of the borders and the sound zonation of IPA it was possible to curb timely the threat of oil prospection within the ibis core breeding area in 2007-2009.

A DGCS-funded multi-year project aimed at further developing the IPA, through a sustainable development framework, that was due to start in March 2011 was put on hold and funds were frozen due to the onset of the revolt in Syria.





Above (right and left). Kids of the Bedouin nomads (Amur tribe) seasonally living within the area where the N. Bald Ibis breed (© G. Serra, 2003-2004).

Aside. Landscape at the N. Bald Ibis breeding grounds in the Palmyra desert (© G. Serra, 2003).

Aside (top left). Three bald ibises returning to the nests at dusk in the Palmyra desert (© G. Serra, 2009).



## 8 THE WINTERING SITE IN ETHIOPIA

The ibis wintering site discovered in August 2006 was only 30 km from the last observation of N. Bald Ibises on Ethiopian highlands recorded in 1977. A first survey of the ibis wintering site was carried out in November 2006. The site, in the middle of nowhere on the plateau, was reached by good use of satellite locations, GPS and a 4x4 vehicle.

In total three field surveys were carried out between November 2006 and January 2009. The observations from these surveys combined with 1067 satellite locations, collected over a 5-year period, gave a good picture of the behavioral ecology of these birds at their wintering site. Adult ibises spent the winter at the same site on the central Ethiopian highland plateau, from the end of August until the beginning of February, during 5 consecutive winters (2006-2011).

The wintering site is an agro-pastoral landscape where the ibises live in an apparent harmony with the local community and unthreatened for almost 6 months every year. The site is a road-free and car-free landscape, without electricity, telephones, plastic and cement. It is inhabited by a gentle settled people living on rain-fed agriculture and livestock raising, the same way for centuries if not millennia. Unfortunately they currently live in relatively poor and isolated conditions.

Ibis preferred as feeding habitats pastures and recently cut hay fields, where the potential preys available belong to the same taxa already included in the estimated diet at breeding grounds in Syria. Conversely, they avoided tall grasses and uncut hay fields and cultivations.

Satellite locations analysis showed that the bald ibises used a core and an extended range area c. 20 and 60 times smaller, respectively, than those calculated for the breeding site in Syria. Eighty-one percent of the core area in Ethiopia was used in all five years confirming the birds' fidelity to this wintering site.

They showed a high fidelity to a specific *Eucalyptus* tree, located in a village, for roosting. It was then realized that, basically, these birds "commute" twice a year between a niche of a sheer cliff in the Syrian desert and a tree on the Ethiopian highlands.

Despite the ibis dependence on human-created habitats, disturbance observed in the field was minimal. The main short-term threat for the ibises was judged to be the potential raising of attention on part of the local community specifically towards these few individual ibises. In the medium term, the main threat comes from the conversion of pastures into crop cultivations and the potential use of fertilizers and pesticides.

Sightings of N. Bald Ibises on the Ethiopian highlands were not uncommon until 40-50 years ago. For this reason, searches for ibises on the highlands and on the Djibouti coast (where a



juvenile was spotted in January 2008) were carried out along - with no success.

That same first winter 2006-2007 it was realized that only the adult breeders had reached the Ethiopian wintering site. Juvenile and sub-adult birds that flew together with the adults

Above. Tagging and telemetry expert Lubomir Peske scans with the binoculars the ibis wintering grounds in Ethiopia; in the background the local intermediate school (© G. Serra, 2006).

Aside (top). Two last pairs of oriental N. Bald Ibis wintering on the Ethiopian highlands, photographed in November 2009 (© G. Serra).

Aside (bottom). Two of the four birds mentioned in the previous caption: Zenobia (left, with a yellow ring on her leg) and Sultan (right, with a green ring on his leg) (© G. Serra, 2009).



along the western Saudi Arabia and Yemen during July-August 2006 were in fact absent at the Ethiopian site - but they returned to the breeding site in Palmyra the following spring. This same observation was confirmed during the successive winters.

Above. Children at the ibis wintering grounds on the Ethiopian highlands (© G. Serra, 2009).

Aside (top). The expedition vehicle gets stuck few hundred meters away from the final destination in November 2009 (© G. Serra).

Aside. Women at the ibis wintering grounds in Ethiopia washing clothes along a stream, and drying them on the ground (© G. Serra, 2009).

Next pages

Pag. 46 and 47. Landscapes and people at the N. Bald Ibis wintering grounds on the Ethiopian central plateau (© G. Serra, 2006).







## 9 THE MYSTERY ABOUT THE IMMATURE BIRDS

The discovery of the wintering site in Ethiopia and the chance to observe the adult birds there was a huge breakthrough. But only to realize that from a conservation point of view the other half of the story, the one concerning the immature ibises, was even more important: what are young ibises doing and where do they go during the period between the time they abandon the colony breeding grounds in the Palmyra desert (where they are born) and the time they return to the same natal site 2-3 years later upon reaching sexual maturity, and ready to attempt breeding?

This was the ethological and conservation conundrum already arisen as early as 2007. Of course, they would return to Palmyra only if they survive. And this was the grim point: during period 2002-2010 only 20% of immature birds managed to return safely to Palmyra, few years after their birth. A figure much lower than that observed in the closely related White Stork *Ciconia ciconia*, for instance.

It was therefore realized that the high mortality of young ibises before returning to Palmyra might well be at the origin of the inexorable decline of the relict colony discovered in 2002. This recruitment rate, insufficient to compensate the natural mortality of adults, made apparent the intensive protection efforts at the Palmyra breeding grounds insufficient for the sake of preventing the extinction of this unique bird colony.

It was July 2009 when eventually the “smoking evidence” of what may drive the truly last surviving oriental ibis colony into extinction was found: hunting along the migratory route. In fact, a young female that was tagged a couple of weeks earlier in Palmyra, named Julia<sup>8</sup>, was shot on her very first day of migration, as soon as she reached by evening time the village of Tabarjal in northern Saudi Arabia (some 300 Km south of Palmyra). The readiness and cooperation of the Saudi Wildlife Authority (SWA) was crucial in shedding light on this very important event. The SWA, through direct commitment of its director general Prince Bandar Al Saud, has since then targeted the village with an awareness program.

Unveiling the second half of the mystery, the wintering strategy of the young ibises, was going to be a huge accomplishment that could have enabled to plan appropriate conservation measures. A key step in that direction was to understand the orientation mechanism of fledged juveniles at their first migration southward. Due to drawing of quick conclusions from past ibis release trials, it was long assumed that juveniles at first migration would follow their parents and learn the migration route from them - the same as it had been found for cranes.

But satellite tracking of juvenile and young ibises both from



Syria (wild birds) and from Birecik (semi-captive birds) have shown during recent years that juveniles upon their first migration have an “inner” knowledge of the correct migratory flying direction - with no need of learning it from their parents (the so called “genetic vector”).

On the other hand, one of these trials showed that juveniles are also keen to follow adults - not necessarily their parents - for a stretch of the migration. Then they are abandoned to their destiny - usually around the plains of south-western Saudi Arabia or coastal Yemen at about half migratory way. This complex pattern of migratory orientation, combining innate knowledge with learning, known as “social learning”, was described for the first time in white storks migrating from Russia to Eastern Africa only a few years ago.

At this point, it was realized it would be useful to carefully analyze the opportunistic observations of bald ibises recorded in the region during the past 130 years. Italian and British military personnel, and their associates (explorers, geologists and naturalists), recorded most “bird-watching observations” between

Above. *Fatally injured subadult female Julia photographed by the hunter who shot at her shortly earlier, on her very first day of migration southward, in the evening of 19 July 2009, Tabarjal, north-western Saudi Arabia (© unknown).*

Aside (top and bottom). *Two same pairs of N. Bald Ibis (three sat-tagged individuals) photographed the same year (2006) at the breeding grounds in the Palmyra desert in May (bottom, © M.S. Abdallah) and at the wintering grounds on the Ethiopian highlands in November (top, © G. Serra).*

<sup>8</sup>) Ironically the female ibis was given this name after the Director General of IUCN Julia L. Marton who had visited the ibis colony that year.



en the 1880s and the WWII. Despite the gaps and ID mistakes typical of the so-called “grey literature”, this database contained nonetheless precious information waiting to be patiently extracted, decoded and evaluated. Like the description by Captain Flower from the British Navy who saw “hundreds of bald ibises”, in migratory flying formation, following the course of the Blue Nile in February 1922.

Taken all together, historical records clearly show that in the past, the bulk of the oriental bald Ibis population was wintering on the Ethiopian highlands (like nowadays). Young ibises were



observed both during wintertime and during breeding time mostly in western Arabia. But some observations of young individuals were also recorded on the Ethiopian plateau, as opposed to nowadays - thus raising the question: why would young ibises reach the Ethiopian plateau in the past and not today? It was then realized that all the scattered observations on young ibises made during recent years could be combined like puzzle pieces with the scattered historical observations, in order to answer this intriguing question.

Until the 1970s, the oriental population of the N. Bald Ibis, composed by the large Birecik colony and the relatively smaller, but numerous, colonies scattered within the Syrian desert, migrated southward during summertime using the route discovered in 2006, in discrete flocks - creating a “migratory flow” that was even used as an orientation clue by both Muslim pilgrims and by juvenile ibises at their first migration. Young N. Bald Ibis could either fly on their own, relying on their innate knowledge of migratory direction, or follow adults for limited stretches of the migratory route.

Through these means they were able to confirm the correct direction from the adult migratory “stream” southward - by simply waiting for the next flock of adults, and counting on the traditional use of stop-overing sites.

Young ibises have actually no other choice, being weaker fliers than adults: so they would follow adults, than stop and rest. And wait, like at a bus stop, to “intercept” the following flock of adults passing by, days or weeks later. It is easy to imagine that some of them, the strongest and more motivated, would be able to reach the Ethiopian highlands and join the masses of adults congregated on the plateau.



Starting from the 1970s the whole oriental ibis population experienced a very rapid decline, becoming increasingly fragmented. Until reaching the sad situation of today where only a handful of adults who still fully knows the migratory route - a culturally transmitted knowledge - have survived. The spectacular ibis migratory flow over western Arabia of the past, even witnessed by T.E. Lawrence during his desert adventures, have long vanished. And Muslim pilgrims are nowadays, prosaically, using charters and cars equipped with GPS in order to reach Holy Makkah.

As a consequence, the few juveniles lucky enough to fledge from Palmyra nowadays are unable to reach the Ethiopian plateau through social learning anymore as they used to do in the past- not even if they are strong nor motivated. They instead spend their first 2-3 years of life mostly in western Arabia (Saudi Arabia and Yemen) - possibly reaching Eastern Africa on their own in mid winter. Consistently, a juvenile born in Palmyra the previous spring was spotted alone by a group of Swedish birdwatchers - to their delight - on the Djibouti coast in January 2008.

The interesting observation made in 2011 of two un-ringed young ibises on the Ethiopian plateau may still fit well in the puzzle: they could have been subadult ibises, not sexually mature and therefore having not returned to Palmyra yet. They might have “intercepted” and picked by luck the last two adult females in the Middle East at their traditional stop-overing site in coastal Yemen in August 2010 - while *en route* to Ethiopia. And then they have just followed them. (Unfortunately they did not follow them to Palmyra next spring: did they perish during migration or weren’t they sexually mature yet and therefore not motivated to

return to Palmyra?)

Overall, due to the dramatic population decline and lack of social learning during migration, today young ibises have no other choice than spending most of their time in western Saudi Arabia. An area with non irrelevant risks to their survival (see Chapter 10). Immature birds are certainly more vulnerable to threats than adults, due to their lack of experience, possibly explaining the differing mortality rates between young and adult specimens recorded during recent years and the young ibis low return rate to Palmyra.

The extinction of the Birecik colony in 1989 followed a steady decline in the number of birds returning from spring migration during the previous decade. Recent observations of Syrian birds, belonging to the same eastern population, demonstrate that 20–30 years later the poor survival of N. Bald Ibises during migration remains the greatest threat to the survival of this population. The clue to the demise of this species in the Middle East clearly rests in the fact that these birds cross some 7 countries twice a year for a total of ca. 6400 Km.

Above. A pair of N. Bald Ibis at the breeding grounds in the Palmyra desert (©M.S. Abdallah, 2006).

Aside (top). Five chicks at the fledging stage photographed at the end of May 2003 in the Palmyra desert (©G. Serra).

Aside (bottom). A freshly fledged chick at the Palmyra breeding grounds (©M.S. Abdallah, 2007).



## 10 THE FLYWAY ALONG WESTERN SAUDI ARABIA

**D**uring a meeting of the International Advisory Group for Northern Bald Ibis (IAGNBI), held in Palmyra in November 2009, a desperate call for emergency action was made. A 12-month Emergency Action Plan was then agreed, envisaging three key objectives for 2010 and subsequent years:

- 1. intensive protection program at the Syrian breeding grounds during spring making use of the Standard Ibis Protection Protocol
- 2. satellite tracking and awareness raising in western Saudi Arabia during migration time
- 3. supplementation at the wild colony in Palmyra by use of Turkish captive-born chicks.

Meanwhile, another adult, Sultan, the pillar of the colony - a large and strong male - did not return to Palmyra in spring 2010. The colony was then reduced to 3 adult individuals, for a total of only one breeding pair.

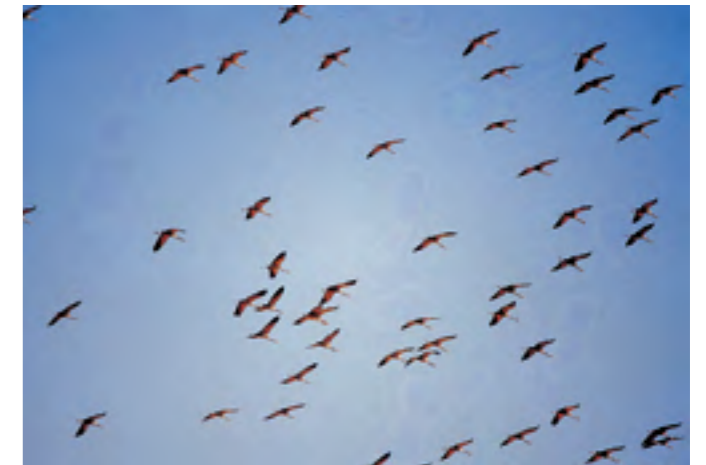
Two expeditions were eventually authorized and carried out along the ibis migratory route in western Saudi Arabia, with key cooperation and involvement of the SWA, in March and in July-August 2010. In-service training of two young staff from SWA was performed by an international experienced ornithologist in March 2010 and by the trained Syrian rangers in August 2010. Amazingly, this latter expedition was able to follow directly on the ground four tagged ibises during their migration.

These expeditions in Saudi Arabia confirmed that hunting and electric cables across western Saudi Arabia may be the main causes for the high mortality of immature ibises - while pesticides could be an additional deleterious reason for which no sufficient evidence could be gained.

At this point it was clear that in order to attempt reducing the mortality rate of immature birds and thus to halt the inexorable decline of the last Middle Eastern colony of N. Bald Ibis, conservation efforts should be focused along the migratory route in western Saudi Arabia and Yemen.

More importantly, mitigating the mentioned threats holds the potential to broaden the conservation focus by directly benefiting also several other threatened and declining species of migrating birds that use the same flyway.

In fact the adult N. Bald Ibis migratory flyway across western Saudi Arabia and Yemen - the current most likely over-wintering range of N. Bald Ibis immatures - is a known international flyway for a number of other globally threatened waterbirds and soaring birds, including Sociable Lapwing *Vanellus gregarius*, Slender-billed Curlew *Numenius tenuirostris*, Greater Spotted Eagle *Aquila clanga*, Eastern Imperial Eagle *Aquila heliaca*, Lesser Kestrel *Falco naumanni* and Pallid Harrier *Circus macro-*



*urus*; and by several declining soaring birds, including Demoiselle Crane *Grus virgo*, Common Crane *Grus grus*, Steppe Eagle *Aquila nipalensis* and White Stork.

Above. Two bird species whose migratory route overlap with the one of the N. Bald Ibis along western Saudi Arabia: Common Crane (*Grus grus*, top) and Sociable Lapwing (*Vanellus gregarius*, bottom) (© G. Serra, 2003 and M.S. Abdallah, 2007, respectively).

Aside. Hejaz mountain range, north-western Saudi Arabia (© G. Serra, 2010).



Above. Power lines running across the Tahama plains in south-western Saudi Arabia (© G. Serra 2010).

Above (top). N. Bald Ibis chick born in Palmyra roosting on a power line in western Saudi Arabia in August 2010 (© M.S. Abdallah).

Aside. Camel herd in the Tahama plains, western Saudi Arabia (© G. Serra, 2010).

Aside (top left). Bedouin traditional coffee pots with the engraved symbol of the Kingdom of Saudi Arabia, photographed in the Syria desert (© G. Serra, 2003).

Aside (top right). Staff from the Syrian Desert Commission and the Saudi Wildlife Authority jointly surveying the western Saudi Arabia migratory route of N. Bald Ibis in August 2010 (© M.S. Abdallah).

Next pages

Pag. 56 (top and bottom). Landscapes of the north-western Saudi Arabia (© G. Serra, 2010).

Pag 57 (top). Two N. Bald Ibises flying over their breeding grounds in the Palmyra desert (© G. Serra, 2009).





## 11 SUPPLEMENTATION TRIAL

**T**he realization that immature ibises can migrate independently from adults holds an important conservation implication: captive-born juveniles of Turkish origin could be released at the Syrian wild colony in Palmyra for the sake of supplementing and reinforcing it. (Genetic tests confirmed that the Turkish and the Syrian birds belong to the same wild population and genetic pool.)

Following lengthy (multi-year) discussions by experts and a complicated bureaucratic process, it was only in June 2010 that, thanks to the direct intervention of the Syrian and the Turkish First Ladies, 2 pairs and 2 chicks of bald ibises were finally transferred overland from Birecik in Turkey to a purposely built aviary in Palmyra. This was an important achievement as it was set to become a N. Bald Ibis captive breeding center in Syria. Ultimately a supplementation test, the first of this kind, was successfully undertaken in 2010 in Palmyra, thanks to an extraordinary diverse international partnership.

With key technical input from Waldrappteam and Alpenzoo, the two Turkish juveniles and a Syrian wild juvenile abandoned by its parents, were released beside the last wild Syrian adult still occurring at the breeding grounds in the early days of July. Two days later the adult departed for migration and the 3 chicks followed her for more than 1000 Km into south-western Saudi Arabia. This trial clearly showed that supplementing the Syrian wild colony with captive-born chicks is a feasible and effective conservation option. Indeed a big injection of renewed hopes.

The onset of the revolt in Syria in 2011 created suddenly a major constraint for the intensive protection program at the



breeding grounds. Reportedly, trained rangers from the Syrian Desert Commission have nonetheless struggled to continue on their own the ibis protection program in 2011 and 2012, even when the revolt turned gradually into a civil war.



Above. A chick, born few weeks earlier in Palmyra, is ready for migration (© M.S. Abdallah, 2010).

Aside. Six ibises transported in boxes at the border between Turkey and Syria during the transfer from Birecik to Palmyra in June 2010 (© G. Serra).

Page aside. N. Bald Ibises at their feeding grounds in the Palmyra desert (© M.S. Abdallah, 2007).

Next pages

Top: the aviary built in 2009 at Al Talila Reserve to host the ibises transferred from Birecik (© G. Serra).

Bottom: landscape of the N. Bald Ibis migratory route in western Saudi Arabia, at the edge between the Hejaz mountain range and the Taha-plains (© G. Serra, 2010).





## 12 RECOMMENDATIONS

**T**his unique relict colony of N. Bald Ibis - the most threatened bird in the Middle East - seems to have reached a critical point. Further serious and determined action is urgently needed if the extinction is to be prevented. If efforts were resumed quickly, bearing in mind the lessons learnt and the below listed recommendations, still there would be some chances to rescue the colony. Key short-term recommendations, based on 9 years of conservation experience, are the following:

- 1. SAUDI ARABIA: further surveying and assessment of threats along the migratory flyway, within the western sector of the country; awareness and education initiatives, protection measures and mitigation of threats are discussed with authorities and implemented at the recently discovered key stopover sites along the migratory route.



- 2. ETHIOPIA: low-profile and careful monitoring of the ibis colony at the known wintering site every 2-3 years.







Above. Bedouin people from the Amur tribe seasonally living within the N. Bald Ibis breeding range (© G. Serra, 2002).

Above (top). Mountain range north of Palmyra where the breeding grounds of the last N. Bald Ibises are located (© G. Serra, 2002).

Aside. Landscape of the breeding grounds of N. Bald Ibis in the Palmyra desert (© G. Serra, 2009).

Previous pages

Pag. 62. Bedouin kids from the Amur tribe seasonally living within the N. Bald Ibis breeding range (© G. Serra, 2004).

Pag. 63 (mid). N. Bald Ibises feeding on the ground at their Palmyra desert breeding quarters (© G. Serra, 2002).

Pag 63 (bottom). Mamluk castle overlooking Palmyra (© G. Serra, 2008).

Aside. Interiors of a Bedouin tent during a wedding celebration with the traditional mansaf at the bottom-center of the image (© G. Serra, 2004).

Below (mid). Landscape of the migratory route of N. Bald Ibis in north-western Saud Arabia (© G. Serra, 2010).

Below (bottom). Ancient ruins of Palmyra under a sand storm photographed in June 2000 (© G. Serra).



## 13 REFERENCES

### CHAPTER 1 | BACKGROUND

- Benyamini, D., Bruschini, C., Serra, G., John, E. 2007. First confirmed records of *Papilio demoleus* (Linnaeus 1758) in Syria, with comments on the species' appearance in Turkey and the Dominican Republic. *News of the Is. Lepidopterists Society* 24(2): 4-10.
- Murdoch, D.A. and G. Serra. 2006. The status of Sociable Plover *Vanellus gregarius* in Syria. *Sandgrouse* 28(1): 57-61.
- Safriel, U.N. 1980. Notes on the extinct population of the northern bald ibis *Geronticus eremita* in the Syrian desert. *Ibis* 122: 82-88.
- Serra, G. 2002. Proposal for an action plan to protect wildlife of Palmyrean desertic steppe. FAO report project GCP/SYR/009/ITA, prepared upon request of Syrian Ministry of Environment, available at FAO Representation in Damascus Syria. 28 pp.
- Serra, G., Abdallah, M.S., Assaed, A., Al Qaim, G., Abdallah, A. 2005a. A long-term bird survey of central Syrian desert (2000-2003) – Part 1. *Sandgrouse* 27(1): 9-23.
- Serra, G., Al Qaim, G., Abdallah, M.S., Kanani, A., Assaed, A.K. 2005b. A long-term bird survey of central Syrian desert (2000-2003) – Part 2. *Sandgrouse* 27(2): 104-125.
- Serra, G., Abdallah, M.S., Al Qaim, G. 2007. Occurrence of Rüppell's Fox, *Vulpes rueppelli*, and Sand Cat, *Felis margarita*, in Syria. *Zoology in the Middle East* 42: 99-101.
- Serra, G., Mirreh, M., Kaddour, H., Razzouk, T., Al Jundi, A., Kanani, A., Batello, C., Williamson, D. 2009. Assessment and characterization of *Al Talila* Reserve and surrounding Palmyrean desert. IUCN West Asia/DGCS Trust Fund project (76812-040). 134 pp.
- Sindaco, R., Serra, G., Menegon, M. 2006. New data on the Syrian herpetofauna, with a newly-recorded species of snake (Amphibia, Reptilia). *Zoology in the Middle East* 37: 29-38.

### CHAPTER 2 | THE DISCOVERY IN SYRIA

- Aharoni, J. 1928. Der Waldtrapp – *Comatibus eremita* (L.). *Der Ornithologische Beobachter* 26: 58-60.
- Aharoni, J. 1929. Zurbrutbiologie von *Comatibus comate* Bp. (*Geronticus eremita* L.). *Beitrag zur Fortpflanzungsbiologie der Vogel* 5: 17-19.
- BirdLife International 2004. *Geronticus eremita*. In: IUCN 2006. IUCN Red List of Threatened Species. <www.iucnredlist.org>. Downloaded on 09 June 2007.
- Blair, M. 2005. Editorial. *Sandgrouse* 27(1): 2.
- Collar, N.J. and S.N. Stuart. 1985. Northern Bald Ibis *Geronticus eremita*. In: Collar N.J. (ed.) Threatened birds of Africa and related islands. The ICBP/IUCN Red Data Book, Part 1, International Council for Bird Preservation, Cambridge, pp 74-108.
- Martins, R. 1993. An Inventory in Arabia Felix. The highlands of southwestern Arabia surprise most Westerners. *Saudi Aramco World* 44(5): 2-11.
- Safriel, U.N. 1980. Notes on the extinct population of the Northern Bald Ibis *Geronticus eremita* in the Syrian desert. *Ibis* 122: 82-88.
- Serra, G. 2003. Discovery of Northern Bald Ibises in Syria. *World Birdwatch* (BirdLife International magazine) 25(1): 10-13.
- Serra, G., Abdallah, M.S., Abdallah, A., Al Qaim, G., Fayed, T., Assaed, A., Williamson, D. 2004. Discovery of a relict breeding colony of Northern Bald Ibis *Geronticus eremita* in Syria: still in time to save the eastern population? *Oryx* 38 (1): 1-7.

*Sheep milking by Bedouin nomads in the Hamad desert, south of Palmyra (© G. Serra, 2001).*



**CHAPTER 3 | THE ORIENTAL NORTHERN BALD IBIS**

- Akcakaya, H.R. 1990. Bald Ibis *Geronticus eremita* population in Turkey: an evaluation of the captive breeding project for reintroduction. *Biological Conservation* 51: 225-237.
- Hirsch, U. 1978. Artificial nest ledges for Northern Bald Ibises. In: Temple S.A. (ed.) *Endangered birds: management techniques for preserving threatened species*. University of Wisconsin Press and London, pp 61-69.
- Hirsch, U. 1979. Northern Bald Ibis. *Studies of west Palearctic birds* 72(7): 313-325.
- Kumerloeve, H. 1967. Nouvelles donnees sur la situation de la colonie d'ibis chevelus *Geronticus eremita* (L.) 1758 a Birecik sur l'Euphrate (Turquie). *Alauda* 35: 194-202.
- Kumerloeve, H. 1984. The Waldrapp, *Geronticus eremita* (Linnaeus, 1758): historical review, taxonomic history, and present status. *Biological Conservation* 30: 363-373.
- Safriel, U.N. 1980. Notes on the extinct population of the Northern Bald Ibis *Geronticus eremita* in the Syrian desert. *Ibis* 122: 82-88.

**CHAPTER 4 | BREEDING PROTECTION AND CAPACITY BUILDING**

- Boehm, C., Bowden, C., El Bekkay, M., Evans, S., Hatypoglu, T., Jiménez, A.M., Jordan, M., Kotschal, K., Lenten, B., López, V., José, M., Madroño, A., Nagy, S., Pegoraro, K., Quevedo, M., Rivera, E., Serra, G., Tavares, J. 2005. International Northern Bald Ibis *Geronticus eremita* Action Plan. UNEP-AEWA, BirdLife International. 89 pp.
- Bowden, C.G.R., Smith, K.W., El Bekkay, M., Oubrou, W., Aghnaj, A., Jimenez-Armesto, M. 2008. Contribution of research to conservation action for the Northern Bald Ibis *Geronticus eremita* in Morocco. *Bird Conservation International* 18: 74-90.
- Boehm, C., Bowden, C., El Bekkay, M., Evans, S., Hatypoglu, T.,

- Jiménez, A.M., Jordan, M., Kotschal, K., Lenten, B., López, V., José, M., Madroño, A., Nagy, S., Pegoraro, K., Quevedo, M., Rivera, E., Serra, G., Tavares, J. 2005. International Northern Bald Ibis *Geronticus eremita* Action Plan. UNEP-AEWA, BirdLife International. 89 pp.
- Bowden, C.G.R., Smith, K.W., El Bekkay, M., Oubrou, W., Aghnaj, A., Jimenez-Armesto, M. 2008. Contribution of research to conservation action for the Northern Bald Ibis *Geronticus eremita* in Morocco. *Bird Conservation International* 18: 74-90.
- IAGNBI 2004. Statement for conservation priorities for the Northern Bald Ibis. IUCN's International Advisory Group for Northern Bald Ibis (IAGNBI) Newsletter n. 3: 5-6.
- Jimenez Armesto, M.J., Boehm, C., Bowden, C. 2006. International Single Species Action Plan for the Conservation of the Northern Bald Ibis *Geronticus eremita*. AEWA Technical Series No. 10. Bonn, Germany. 53 pp.
- Serra, G. 2002. Proposal for an action plan to protect wildlife of Palmyrean desertic steppe. FAO report project GCP/SYR/009/ITA, prepared upon request of Syrian Ministry of Environment, available at FAO Representation in Damascus Syria. 28 pp.
- Serra, G. 2005. Time running out for Syrian ibises. *World Birdwatch* (BirdLife International magazine) 27(4): 9.
- Serra, G. 2010. Standard Ibis Protection Program. Report with recommendations to Syrian Government (Desert Commission), IUCN West Asia/DGCS Trust Fund project (76812-040). 4 pp.
- Serra, G. and L. Peske. 2006. Northern Bald Ibis conservations efforts in Syria 2002-06: results and lessons learned. Proceedings of a workshop organized by International Advisory Group on Northern Bald Ibis (IAGNBI), held in Andalusia in September 2006. 36-42.
- Serra, G., Peske, L., Abdallah, M.S., Al Qaim, G., Kanani, A. 2009. Breeding ecology of the last oriental N. Bald Ibises in the Syria desert. *Journal of Ornithology* 150: 769-782.

**CHAPTER 5 | AWARENESS AND EDUCATION**

- IAGNBI 2004. Statement for conservation priorities for the Northern Bald Ibis. IUCN's International Advisory Group for Northern Bald Ibis (IAGNBI) Newsletter n. 3: 5-6.
- Jimenez Armesto, M.J., Boehm, C., Bowden, C.. 2006. International Single Species Action Plan for the Conservation of the Northern Bald Ibis *Geronticus eremita*. AEWA Technical Series No. 10. Bonn, Germany. 53 pp.
- Serra, G. 2002. Proposal for an action plan to protect wildlife of Palmyrean desertic steppe. FAO report project GCP/SYR/009/ITA, prepared upon request of Syrian Ministry of Environment, available at FAO Representation in Damascus Syria. 28 pp.
- Serra, G. 2008a. Preliminary report on natural heritage sites in eastern Syria. Municipality Administration Modernization (MAM) project MED/2004/6264. EUROPE AID/119822/SV/SY. 25 pp.
- Serra, G. 2008b. Preliminary report on natural heritage sites in western Syria. Municipality Administration Modernization (MAM) project MED/2004/6264. EUROPE AID/119822/SV/SY. 22 pp.
- Serra, G. 2010. Standard Ibis Protection Program. Report with recommendations to Syrian Government (Desert Commission), IUCN West Asia/DGCS Trust Fund project (76812-040). 4 pp.
- Serra, G. and L. Peske. 2006a. Coordinating protection efforts of breeding N. Bald Ibises *Geronticus eremita* in Palmyra (Syria) and trapping/satellite tagging 3 individuals. Internal Report. BirdLife International / Royal Society for the Protection of Birds. 8 pp.
- Serra, G. and L. Peske. 2006b. Northern Bald Ibis conservations efforts in Syria 2002-06: results and lessons learned. Proceedings of a workshop organized by International Advisory Group on Northern Bald Ibis (IAGNBI), held in Andalusia in September 2006: 36-42.
- Serra, G., Batello, C., Williamson, D. 2003. From Indifference to Awareness. FAO report project GCP/SYR/009/ITA. Available at FAO Hqs, Rome, Italy. 47 pp.
- Serra, G., Mirreh, M., Kaddour, H., Razzouk, T., Al Jundi, A., Kanani, A., Batello, C., Williamson, D. 2009. Assessment and characterization of Al Talila Reserve and surrounding Palmyrean desert. IUCN West Asia/DGCS Trust Fund project (76812-040). 134 pp.
- Serra, G., Nahaz, M.M., Idan, M., Peske, L., Savioli, A., Bruschini, C., Alomari, K. 2009. Assessment and characterization of the Ibis Protected Area in the Palmyra Desert - a proposed 5-year management and development framework. IUCN West Asia/DGCS Trust Fund project (76812-040). 156 pp.
- Serra, G., Bruschini, C., Lindsell, J., Peske, L., Kanani A. 2011. Breeding range of the last eastern colony of critically endangered Northern Bald Ibises *Geronticus eremita* in the Syria steppe: a threatened area. *Bird Conservation International* 21(3): 285-295.

Aside. Camel herd belonging to a family of the Sba'a tribe, Al Talila Reserve, Syria (© G. Serra, 2001).

**CHAPTER 6 | THE DISCOVERY OF THE MIGRATORY ROUTE**

- Lindsell, J., Serra, G., Abdallah, M.S., Al Qaim, G., Peske, L. 2009. Satellite tracking reveals the migration route and wintering area of the middle-eastern population of Northern Bald Ibis. *Oryx* 43 (3): 329-335.
- Lindsell, J.A., Shehab, A., Anderson, G. 2011. Patchiness in prey levels increases vulnerability of critically endangered Northern Bald Ibises *Geronticus eremita* on their Syrian breeding grounds. *Bird Conservation International* 21: 274-283.
- Serra, G. and L. Peske. 2006. Coordinating protection efforts of breeding N. Bald Ibises *Geronticus eremita* in Palmyra (Syria) and trapping/satellite tagging 3 individuals. Internal Report. BirdLife International / Royal Society for the Protection of Birds. 8 pp.
- Serra, G., Abdallah M.S., Al Qaim G. 2008. Feeding ecology and behaviour of the last known surviving oriental Northern Bald Ibises *Geronticus eremita* (Linnaeus 1758) at their breeding quarters in Syria. *Zoology in the Middle East* 43: 55-68.
- Serra, G., Peske, L., Abdallah, M.S., Al Qaim, G., Kanani, A. 2009. Breeding ecology of the last oriental N. Bald Ibises in the Syria desert. *Journal of Ornithology* 150: 769-782.

**CHAPTER 7 | IBIS PROTECTED AREA IN SYRIA**

- IAGNBI 2004. Statement for conservation priorities for the Northern Bald Ibis. IUCN's International Advisory Group for Northern Bald Ibis (IAGNBI) Newsletter n. 3: 5-6.
- Jimenez Armesto, M.J., Boehm, C., Bowden, C.. 2006. International Single Species Action Plan for the Conservation of the Northern Bald Ibis *Geronticus eremita*. AEWA Technical Series No. 10. Bonn, Germany. 53 pp.
- Serra, G. 2006. Improving the living conditions of mobile indigenous people of Syrian arid steppe land through sustainable development and nature conservation. Project proposal and feasibility analysis commissioned by Fund for Integrated Rural Development Of Syria (FIRDOS), 27 + 23 pp.
- Serra, G. 2007. Ecotourism in the Palmyra desert, Syria. A feasibility study. BirdLife International, 88 pp.
- Serra, G. 2008a. Ecotourism and nature tourism in Palmyra. In: Palmyra Region Strategic Action Plan: a Strategy for Sustainable Development. Municipality Administration Modernization (MAM) project MED/2004/6264: EUROPE AID/119822/SV/SY. 49 pp.
- Serra, G. 2008b. Preliminary report on natural heritage sites in eastern Syria. Municipality Administration Modernization (MAM) project MED/2004/6264. EUROPE AID/119822/SV/SY. 25 pp.
- Serra, G. and L. Peske. 2006a. Coordinating protection efforts of breeding N. Bald Ibises *Geronticus eremita* in Palmyra (Syria) and trapping / satellite tagging 3 individuals. Internal Report. BirdLife International / Royal Society for the Protection of Birds. 8 pp.
- Serra, G. and L. Peske. 2006b. Northern Bald Ibis conservations

efforts in Syria 2002-06: results and lessons learned. Proceedings of a workshop organized by International Advisory Group on Northern Bald Ibis (IAGNBI), held in Andalusia in September 2006. 36-42.

- Serra, G., Abdallah M.S., Al Qaim G. 2008. Feeding ecology and behaviour of the last known surviving oriental Northern Bald Ibises *Geronticus eremita* (Linnaeus 1758) at their breeding quarters in Syria. *Zoology in the Middle East* 43: 55-68.
- Serra, G., Peske, L., Abdallah, M.S., Al Qaim, G., Kanani, A. 2009a. Breeding ecology of the last oriental N. Bald Ibises in the Syria desert. *Journal of Ornithology* 150: 769-782.
- Serra, G., Nahaz, M.M., Idan, M., Peske, L., Savioli, A., Bruschini, C., Alomari, K. 2009b. Assessment and characterization of the Ibis Protected Area in the Palmyra Desert - a proposed 5-year management and development framework. IUCN West Asia/DGCS Trust Fund project (76812-040). 156 pp.
- Serra, G., Bruschini, C., Lindsell, J., Peske, L., Kanani A. 2011. Breeding range of the last eastern colony of critically endangered N. Bald Ibises *Geronticus eremita* in the Syria steppe: a threatened area. *Bird Conservation International* 21(3): 285-295.

## CHAPTER 8 | THE WINTERING SITE IN ETHIOPIA

- Lindsell, J., Serra, G., Abdallah, M.S., Al Qaim, G., Peske, L. 2009. Satellite tracking reveals the migration route and wintering area of the middle-eastern population of Northern Bald Ibis. *Oryx* 43 (3): 329-335.
- Serra, G., Peske, L., Wondafrash, M. 2007. Preliminary survey of Middle Eastern N. Bald Ibises at their recently discovered wintering grounds in Ethiopian highlands. Internal Report. BirdLife International and Royal Society for the Protection of Birds. 21 pp.
- Serra, G. and M. Wondafrash. 2009. Eco-ethological and conservation survey of N. Bald Ibises wintering in the Northern Shawa (Ethiopia) during 2008-09. IUCN West Asia/DGCS Trust Fund project (76812-040). 22 pp.
- Serra, G., Bruschini, C., Peske, L., Kubsu, A., Wondafrash, M., Lindsell, J.A. 2013. An assessment of ecological conditions and threats at the Ethiopian wintering site of the last known eastern colony of critically endangered Northern Bald Ibis *Geronticus eremita*. *Bird Conservation International* 23: 399-413.

## CHAPTER 9 | THE MYSTERY ABOUT THE IMMATURE BIRDS

- Akcakaya, H.R. 1990. Bald Ibis *Geronticus eremita* population in Turkey: an evaluation of the captive breeding project for reintroduction. *Biological Conservation* 51: 225-237.
- Fritz, J. 2004. The Scharnstein Project: Establishing a migration tradition with handraised Waldrapp Ibises. *WAZA (World Association of Zoos and Aquariums) Magazine* 5: 16-19.
- Hirsch, U. 1978. Artificial nest ledges for Northern Bald Ibises. In: Temple S.A. (ed.) *Endangered birds: management techniques for preserving threatened species*. University of Wisconsin Press and London, pp 61-69.
- Hirsch, U. 1979. Northern Bald Ibis. *Studies of west Palearctic birds* 72(7): 313-325.
- IAGNBI 2004. Statement for conservation priorities for the Northern Bald Ibis. IUCN's International Advisory Group for Northern Bald Ibis (IAGNBI) Newsletter n. 3: 5-6.
- Jimenez Armesto, M.J., Boehm, C., Bowden, C. 2006. International Single Species Action Plan for the Conservation of the Northern Bald Ibis *Geronticus eremita*. AEWA Technical Series No. 10. Bonn, Germany. 53 pp.
- Kumerloeve, H. 1967. Nouvelles donnees sur la situation de la colonie d'ibis chevelus *Geronticus eremita* (L.) 1758 a Birecik sur l'Euphrate (Turquie). *Alauda* 35: 194-202.
- Kumerloeve, H. 1984. The Waldrapp, *Geronticus eremita* (Linnaeus, 1758): historical review, taxonomic history, and present status. *Biological Conservation* 30: 363-373.
- Lindsell, J., Serra, G., Abdallah, M.S., Al Qaim, G., Peske, L. 2009. Satellite tracking reveals the migration route and wintering area of the middle-eastern population of Northern Bald Ibis. *Oryx* 43 (3): 329-335.
- Serra, G. and M. Wondafrash. 2009. Eco-ethological and conservation survey of Northern Bald Ibises wintering in the Northern Shawa (Ethiopia) during 2008-09. IUCN West Asia/DGCS Trust Fund project (76812-040). 22 pp.
- Serra, G., Peske, L., Wondafrash, M. 2007. Preliminary survey of Middle Eastern Northern Bald Ibises at their recently discovered wintering grounds in Ethiopian highlands. Internal Report. BirdLife International / Royal Society for the Protection of Birds. 21 pp.
- Serra, G., Peske, L., Abdallah, M.S., Al Qaim, G., Kanani, A. 2009. Breeding ecology of the last oriental N. Bald Ibises in the Syria desert. *Journal of Ornithology* 150: 769-782.
- Serra, G., Lindsell, J.A., Peske, L., Fritz, J., Bowden, C.G.R., Bruschini, C., Welch, G., Tavares, J., Wondafrash, M. 2014. Accounting for very low survival of a Critically Endangered bird on a major migratory flyway. *Oryx*. DOI: 10.1017/S0030605313000665.
- Welch, G. and H. Welch. 2004. Movements of the eastern population of Northern Bald Ibis *Geronticus eremita* in the Middle East. IAGNBI newsletter, 3: 66-72.

## CHAPTER 10 | THE FLYWAY OF WESTERN SAUDI ARABIA

- Lindsell, J., Serra, G., Abdallah, M.S., Al Qaim, G., Peske, L. 2009. Satellite tracking reveals the migration route and wintering area of the middle-eastern population of Northern Bald Ibis. *Oryx* 43 (3): 329-335.
- Serra, G. 2009. Twelve-month emergency action plan to avoid extinction of the wild NBI colony from eastern range: November 2009-October 2010. In: Proceedings of the International Advisory Group for Northern Bald Ibis (IAGNBI) meeting Palmyra, Syria November 2009. 23-24.
- Serra, G. 2010a. Standard Ibis Protection Program. Report with recommendations to Syrian Government (Desert Commission), IUCN West Asia/DGCS Trust Fund project (76812-040). 4 pp.
- Serra, G. 2010b. Surveying Northern Bald Ibis migratory route along western Saudi Arabia, in March and August 2010. Research report, National Geographic Society, Committee for Research and Exploration, Grant # 8479-08. 44 pp.
- Serra, G. 2010c. Key nodal sites along the migratory route of the eastern Northern Bald Ibises in western Arabia. Report IUCN West Asia/DGCS Trust Fund project (76812-040). 8 pp.
- Serra, G., Lindsell, J.A., Peske, L., Fritz, J., Bowden, C.G.R., Bruschini, C., Welch, G., Tavares, J., Wondafrash, M. 2014. Accounting for very low survival of a Critically Endangered bird on a major migratory flyway. *Oryx*. DOI: 10.1017/S0030605313000665.



Ancient ruins of Palmyra under a sand storm photographed in June 2000 (© G. Serra).



A pair of N. Bald Ibis adults at nest with two chicks and an unpaired adult in May 2003 (© M.S. Abdallah).

## CHAPTER 11 | SUPPLEMENTATION TRIAL

- Akcakaya, H.R. 1990. Bald Ibis *Geronticus eremita* population in Turkey: an evaluation of the captive breeding project for reintroduction. *Biological Conservation* 51: 225-237.
- Boehm, C., Bowden, C., El Bekkay, M., Evans, S., Hatypoglu, T., Jiménez, A.M., Jordan, M., Kotrschal, K., Lenten, B., López, V., José, M., Madroño, A., Nagy, S., Pegoraro, K., Quevedo, M., Rivera, E., Serra, G., Tavares, J. 2005. International Northern Bald Ibis *Geronticus eremita* Action Plan. UNEP-AEWA, BirdLife International. 89 pp.
- Broderick, D., Korrida, A., Idaghdour, Y. 2001. Genetic diversity in the last remaining wild population of Northern Bald Ibis (*Geronticus eremita*); preliminary results inferred from mtDNA sequence data. *Newsletter of the International Advisory Group for Northern Bald Ibis* 1: 25-26.
- Fritz, J. 2004. The Scharnstein Project: Establishing a migration tradition with handraised Waldrapp Ibises. *WAZA (World Association of Zoos and Aquariums) Magazine* 5: 16-19.
- Hirsch, U. 1979. Northern Bald Ibis. *Studies of west Palearctic birds* 72(7): 313-325.
- IAGNBI 2004. Statement for conservation priorities for the Northern Bald Ibis. IUCN's International Advisory Group for Northern Bald Ibis (IAGNBI) Newsletter n. 3: 5-6.
- Jimenez Armesto, M.J., Boehm, C., Bowden, C. 2006. International Single Species Action Plan for the Conservation of the Northern Bald Ibis *Geronticus eremita*. AEWA Technical Series No. 10. Bonn, Germany. 53 pp.
- Kumerloeve, H. 1984. The Waldrapp, *Geronticus eremita* (Linnaeus, 1758): historical review, taxonomic history, and present status. *Biological Conservation* 30: 363-373.
- Pegoraro, K., Föger, M., Parson, W. 2001. First evidence of mtDNA sequence differences between Northern Bald Ibises (*G. eremita*) of Moroccan and Turkish origin. *Journal of Ornithology* 142: 425-428.
- Serra, G. 2009. Twelve-month emergency action plan to avoid extinction of the wild NBI colony from eastern range: November



2009-October 2010. In: Proceedings of the International Advisory Group for Northern Bald Ibis (IAGNBI) meeting Palmyra, Syria November 2009. 23-24.

- Serra, G. 2010. Surveying Northern Bald Ibis Migratory Route Along Western Saudi Arabia, in March and August 2010. Research Report, National Geographic Society, Committee for Research and Exploration, Grant # 8479-08. 44pp.
- Serra, G., Lindsell, J.A., Peske, L., Fritz, J., Bowden, C.G.R., Bruschni, C., Welch, G., Tavares, J., Wondafrash, M. 2014. Accounting for very low survival of a Critically Endangered bird on a major migratory flyway. *Oryx*. DOI: 10.1017/S0030605313000665.

Above (top). Landscape of the breeding grounds of N. Bald Ibis in the Palmyra desert (© G. Serra, 2009).

Below. Girls from the Amur tribe seasonally living within the N. Bald Ibis breeding range (© G. Serra, 2001).

Aside (top). Camel herd belonging to a family of the Sba'a tribe, Al Talila Reserve, Syria (© M.S. Abdallah, 2007).


Aside (bottom). Kids peeking inside the tent at the N. Bald Ibis wintering grounds on the Ethiopian highlands (© G. Serra, 2009).





Dr Gianluca Serra is a conservation biologist, practitioner and activist. He loves nature in all its forms. He spent 10 years in Syria assisting the Government in prompting nature biodiversity conservation and establishing protected areas in the country. Following the discovery of the Northern Bald Ibis colony in the Palmyra desert he embarked, together with his Syrian colleagues and trainees, in the mission to try to prevent the extinction of this threatened bird from the Middle East. He kept striving relentlessly in this mission, against all odds, until the war erupted in 2011.





In the Name of Allah, the Most Compassionate, the Most Merciful:  
there is not a moving (living) creature on Earth,  
nor a bird that flies with its two wings,  
but are communities like you.

Qur'an 6:38