Flamingo

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FLAMINGO SPECIALIST GROUP

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ABOUT THE GROUP

The Flamingo Specialist Group (FSG) was established in 1978 at Tour du Valat in France, under the leadership of Dr. Alan Johnson, who coordinated the group until 2004. Currently, the group is coordinated from the Wildfowl & Wetlands Trust at Slimbridge, UK, as part of the IUCN-SSC/Wetlands International Waterbird Network.

The FSG is a global network of flamingo specialists (both scientists and non-scientists) involved in the study, monitoring, management and conservation of the world's six flamingo species populations. Its role is to actively promote flamingo research and conservation worldwide by encouraging information exchange and cooperation among these specialists, and with other relevant organisations, particularly IUCN - SSC, Wetlands International, Ramsar, Convention on the Conservation of Migratory Species, African Eurasian Migratory Waterbird Agreement, and BirdLife International.

FSG members include experts in both *in-situ* (wild) and *ex-situ* (captive) flamingo conservation, as well as in fields ranging from field surveys to breeding biology, infectious diseases, toxicology, movement tracking and data management. There are currently 208 members around the world, from India to Chile, and from Finland to South Africa. Further information about the FSG, its membership, the membership list serve, or this bulletin can be obtained from Brooks Childress at the address below.

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2006-07 FLAMINGO SPECIALIST GROUP ANNUAL REPORT

Aim of the Group

The aim of the Flamingo Specialist Group (FSG) is to actively promote study, monitoring, management and conservation of the world's six flamingo taxa by:

- Developing and maintaining an active and comprehensive international network of *in situ* and *ex situ* flamingo conservation specialists (both scientists and non-scientists)
- Stimulating and supporting information exchange among flamingo conservation specialists
- Encouraging development and implementation of conservation action plans for the three taxa of greatest conservation concern: *P. andinus*, *P. jamesi* and *P. minor*.
- Promoting innovative conservation approaches, such as coordinated management of wetland networks to secure flamingo population processes (e.g. dispersal and seasonal movements) and reconciliation of water conservation for people and for flamingos in the context of climate change and predicted water shortage
- Providing information and technical advice in support of the programmes of Wetlands International, IUCN - SSC, BirdLife International, Ramsar and others that promote the conservation of flamingos and their habitats

Significant short and long term programmes

To accomplish its strategic objectives, the FSG has organised its 2004-08 work plan into four programme areas corresponding to the objectives:

Programme 1: Developing and maintaining an active and comprehensive international network of *in situ* and *ex situ* flamingo conservation specialists

Four-year objective: To develop an international FSG membership that includes the flamingo specialists in each flamingo range state, those working on flamingo conservation at zoological societies and scientific institutions, and others interested in flamingo conservation, wherever located.

We propose to achieve this objective by:

1. Updating the FSG membership list extant at the end of 2004, including contacts, focal species and expertise or special interests
2. Conducting an active membership drive early in 2005, with the goal of increasing the geographical coverage and expertise of the membership
3. Actively recruiting new members and updating the membership list continuously during the four-year period

Progress during 2006-07: In 2006-07, membership grew by 36 (+19%). There are now 226 members from 57 countries.

226 members from 57 countries
161 involved primarily with "in-situ" conservation
65 involved primarily with "ex-situ" conservation

Country	No. Members	Country	No. Members
Algeria	6	Madagascar	2
Argentina	7	Mauritania	1
Bahamas	2	Mexico	11
Belgium	4	Morocco	1
Bolivia	1	Namibia	2
Botswana	3	Netherlands Antilles	2
Canada	1	Paraguay	1
Chile	8	Peru	3
Colombia	2	Poland	1
Cuba	2	Portugal	1
Cyprus	3	Saudi Arabia	1
Czech Republic	2	Senegal	3
Denmark	1	South Africa	8
Djibouti	1	Spain	6
Dominican Rep.	1	Suriname	1
Egypt	1	Switzerland	2
Equador	2	Tanzania	4
Eritrea	1	The Netherlands	9
Ethiopia	3	Tunisia	2
Finland	1	Turkey	1
France	8	Turkmenistan	1
Germany	5	Uganda	1
Guinea-Bissau	1	United Arab Emirates	5
India	9	United Kingdom	31
Iran	2	Uruguay	1
Italy	5	United States	34
Kazakhstan	1	Venezuela	1
Kenya	5	West Indes	1
Libya	1		

Programme 2: Stimulating and supporting information exchange among flamingo conservation specialists

Four-year objective: Develop and maintain convenient facilities and opportunities for FSG members to exchange information and ideas

We propose to achieve this objective by:

1. Developing and promoting an FSG e-mail list-serve for use by members
2. Developing a new tri-lingual (English, French and Spanish) FSG web site
3. Developing and publishing an up-graded bulletin annually
4. Organising international workshops

Progress during 2006-07: A new network of individuals and organisations concerned with the *in-situ* and *ex-situ* conservation of the Caribbean Flamingo was launched at a workshop held at the Ria Lagartos Biosphere Reserve, in Yucatan, Mexico in November 2007. This new initiative (Red del Flamenco del Caribe) is being led initially by FSG member Dr Nancy Clum of the Wildlife Conservation Society, with the assistance of Dr Felicity Arengo of the American Museum of Natural History, the Western Hemisphere Chair of the FSG. The purpose of this new group will be to coordinate research efforts and funding for the Caribbean Flamingo.

The international list serve continued to provide an active channel of communication for members, with over 75 messages posted during the year concerning subjects as varied as the potential causes of the Lesser Flamingo die-offs in East Africa, the effects on flamingos of baiting wildfowl by hunters in Europe, breeding and ringing reports from around the world,

announcements of important conferences and workshops, distribution of the SSC, Wetlands International and AEWA newsletters, and many other subjects of concern *to in-situ* and *ex-situ* flamingo conservationists.

- **Programme 3:** Encouraging development and implementation of conservation action plans for the taxa of greatest conservation concern: Phoenicoparrus andinus, Phoenicoparrus jamesi and Phoenicopterus minor.

***Four-year objective**:* Develop a single-species action plan for the Lesser Flamingo for submission to the Technical and Standing Committees of the African-Eurasian Migratory Waterbird Agreement (AEWA) and the Convention on Migratory Species (CMS) in 2007. Develop a similar action plan for Andean and James's Flamingos for presentation to the ninth Congress of Parties (COP 9) of the Convention on Migratory Species (CMS) in 2008.

We propose to achieve this objective by:

1. Compiling a biological assessment report for each species containing current data on population size and trends, breeding biology, feeding ecology, habitat requirements, conservation status, threats and priorities for future conservation action from information supplied by FSG members and specialists in each of each of the species' range states
2. Organising and supporting action planning workshops to finalise the conservation priorities for each species
3. Drafting, reviewing and editing a Lesser Flamingo action plan for submission to the AEWA Technical and Standing Committees in 2007, and to MOP 4 in late 2008.
4. Drafting, reviewing and editing of the action plans for the Andean and James's flamingos for submission to the CMS Technical Committee and to COP 9 in late 2008.

Progress during 2006:

Lesser Flamingo: Based on the range state data and other information provided by Lesser Flamingo specialists at the AEWA/CMS Lesser Flamingo action planning workshop held in Nairobi, Kenya 25-29 September 2006, the international conservation action plan was drafted and presented to the CMS Scientific Council on 13 March 2007, and AEWA Technical Committee members shortly thereafter. Comments and suggestions from these two groups were incorporated and a new draft was submitted to the AEWA range state focal points for review and comment. A final draft will be submitted to AEWA Standing Committee members for at their 2007 meeting. Pending endorsement by this committee, implementation will begin in 2008.

Andean and James' Flamingos: An action planning workshop for these two species was held in conjunction with the annual meeting of the Grupo para la Conservación de Flamencos Altoandinos in Firmat Argentina, 11-12 June 2007. The workshop was facilitated by Dr. Felicity Arengo, Western Hemisphere Chair of the Flamingo Specialist Group.

Programme 4: Provide information and advice in support of the programmes and publications of Wetlands International, IUCN-SSC and others that promote the conservation of flamingos and their habitats

Four-year objective: Provide information on the plans and activities of the FSG, including a new quadrennial work plan and annual updates, liaise closely with Wetlands International and the IUCN-SSC, as requested, to provide the most recent research information and advice in support of their programmes and publications, as well as the programmes of other organisations (e.g. BirdLife International, AEWA, CMS) concerned with the conservation of flamingos and their habitats.

We propose to achieve this by:

1. Producing a quadrennial work plan for 2005-2008, with annual updates

2. Liaising closely with relevant staff at Wetlands International and IUCN-SSC
3. Providing input for updates of Wetlands International's *Waterbird Population Estimates*, *No. 4* and the IUCN *Red List of Threatened Species*
4. Participating in conferences, TAG meetings and conservation workshops

Progress during 2006-07: During 2006-07, FSG coordinators participated in the following conferences, meetings and workshops:

Meeting: Annual meeting of Grupo para la Concervación Flamencos de Altoandinos, 7-10 June: annual planning meeting and open meeting with Aves Argentinas, mining companies and other stakeholders for strategic planning of the Network for Conservation of Priority Areas for Flamingo Conservation.
Venue: Hotel Majestic, Rosario, Argentina
Number of participants: 30
Key outputs: a) During this meeting, 8 of the 14 priority sites formally declared support for the Wetland Network Project (signed a joint agreement) b) Evaluation of degree of implementation of priority sites (see Research Reports) c) Identification and planning of pilot activities for cross-border integrated conservation in Atacama, Avaroa and Vilama priority sites.

Meeting: CMS Andean and James's Flamingo Action Plan Workshop, 11-12 June:
Venue: Hotel Majestic, Rosario, Argentina
Number of participants: 17
Key outputs: Data on Andean and James's Flamingo distribution and status in four range states were presented and a threats analysis was conducted. The participants agreed the three most important threats to the survival of the species were habitat degradation at key breeding and feeding sites, and disruption of breeding colonies. An action plan will be produced, with the first draft being available for review and comment by the range states early in 2008.

Meeting: Mediterranean and West African Greater Flamingo Network Workshop, 5-6 November:
Venue: Hotel Las Villas, Antequera, Spain
Number of participants: 25
Key outputs: Reports were presented on the status of the Greater Flamingo metapopulation in the Mediterranean and northwest African regions, and a new joint research programme was approved.

Meeting: Caribbean Flamingo Network launch workshop, 26-27 November
Venue: Ria Lagartos Field Research Station, Yucatan, Mexico
Number of participants: 30
Key outputs: The new research network was launched; regional priorities for conservation action in the Caribbean were set and the workshop created a plan for funding and implementation of the first year's projects.

2006-07 Publications (FSG coordinators as first or contributing authors)

Béchet, A. & Johnson, A. R. 2007. Anthropogenic and environmental determinants of Greater Flamingo *Phoenicopterus roseus* breeding numbers and productivity in the Camargue (Rhone delta, southern France). Ibis. http://www.doi.org/ doi: 10.1111/j.1474-919x.2007.00740.xbis

Childress, B., Arengo, F. Béchet, A., and Jarrett, N. (eds.) 2007. *Flamingo*, Bulletin of the IUCN-SSC/Wetlands International Flamingo Specialist Group, No. 15, December 2007. Wildfowl & Wetlands Trust, Slimbridge, UK.

Childress, B., Hughes, B., Harper, D., Van den Bossche, W., Berthold, P. & Querner, U. 2006. Satellite tracking documents the East African flyway and key site network of the Lesser Flamingo *Phoenicopterus minor*. *Waterbirds around the world.* Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. pp. 234-238.

Childress, B., Hughes, B., Harper, D. & van den Bossche, W. 2007. East African flyway and key site network of the Lesser Flamingo (*Phoenicopterus minor*) documented through satellite tracking. Ostrich 78(2): 463–468.

Diawara, Y., Arnaud, A., Araujo, A. & Bechet, A. 2007. Nouvelles données sur la reproduction et l'hivernage des Flamants rose *Phoenicopterus roseus* en Mauritanie et confirmation d'echanges avec les colonies méditerranéennes. Malimbus 29: 31-41. (French)

Johnson, A. & Béchet, A. 2007. The third international workshop on Greater Flamingos in the Mediterranean region and North-west Africa: summary of main outputs. Ostrich 78(2): xxv-xxvi.

Samraoui, B., Ouldjaoui, A., Boulkhssaïm, M., Houhamdi, M., Saheb, M. & Béchet, A. 2006. The first recorded reproduction of the Greater Flamingo *Phoenicopterus roseus* in Algeria: behavioural and ecological aspects. Ostrich 77(3&4): 153–159.

Collaborators (partner networks and institutions)

Grupo para la Concervación Flamencos Altoandinos
Mediterranean and West African Greater Flamingo Network
Caribbean Flamingo Network
Flamingo Conservation Network
American Zoological Association
European Association of Zoos and Aquaria
International Flamingo Foundation

Resources and Funding of FSG activities

The Flamingo Specialist Group is a voluntary organisation open to all flamingo specialists without charge. Its activities are coordinated by the global and regional chairs who serve without compensation, and whose time is donated by themselves and their respective employers. The funding required for its activities are raised through donations and grants secured by the coordinators from various funding sources. The FSG receives important on-going support from the International Flamingo Foundation, and from Wildfowl & Wetlands Trust (WWT) who operates the FSG list serve and funds the production and mailing of the annual bulletin, with a contribution from Wetlands International.

In addition, we have received major contributions toward the costs of specific projects from the following organisations:

Project	Amount raised	Major Donors
Lesser Flamingo action plan workshop	US$37,000	- Wildfowl & Wetlands Trust, UK - Swedish Env. Protection Agency - Intl. Flamingo Foundation, USA - Disney Animal Kingdom, USA - Taiwan Council of Agriculture - Pensthorpe Cons. Trust, UK - Hillside Bird Oasis, UK - Friends of Banham Zoo, UK - Flamingo Land, UK
Andean & James' Action Plan workshop	None req.	
Caribbean Flamingo Network workshop	US$13,000	- International Flamingo Foundation - Wildlife Conservation Society - AZA Ciconiiformes TAG, USA - Dallas Zoo, USA - SeaWorld Orlando, FL, USA - National Aviary, USA - The Nature Conservancy, USA

IN SITU BREEDING SUMMARY

South America

Argentina

Breeding period: December-February

There are 11 known breeding sites, 2 for *Phoenicoparrus andinus*, 5 for *P. jamesi* and 5 for *Phoenicopterus chilensis*. During 2006-2007, 8 of the sites were surveyed.

Laguna Pozuelos (P. chilensis): No breeding
Laguna Vilama (P. jamesi): No breeding
Laguna Honda (P. jamesi): At least 132 active nests, 18 chicks.
Laguna Pabellón (P. jamesi): No survey
Laguna Grande (P. jamesi): No breeding
Laguna Aparejos (P. jamesi): No breeding
Laguna Brava (P. andinus): 600 unidentified nests, nesting colony decimated by foxes
Salinas Grandes (P. chilensis): No survey
Mar Chiquita (P. andinus & P. chilensis): No breeding
Laguna Melincué (P. chilensis): No breeding
Laguna Llancanelo (P. chilensis): No survey

Bolivia

Breeding period: December-February

There are 11 known flamingo breeding sites in Bolivia (see *Flamingo* 13). During 2006-07, breeding was documented at the following four sites.

Laguna Calina (P.jamesi & P. andinus): 2,966 chicks (90% P. jamesi; 10% P. andinus)
Laguna Colorada (three species): 14,966 chicks (85% jamesi, 10% andinus, 5% chilensis)
Laguna Cachi (P. jamesi): 575 chicks
Laguna Guayaques (P. Jamesi): 220 chicks

Chile

Breeding period: December-February

There are 15 known flamingo breeding sites in Chile (see *Flamingo* 13). During the 2006-07 breeding season, breeding was monitored at four lakes within Salar de Atacama, Bajo Reserva Nacional Los Flamencos, where approximately 2,900 *P. Andinus* pairs produced 538 surviving chicks. (E. Rodriguez and N. Amado, CONAF).

Bajo Reserva Nacional Los Flamencos - Salar de Atacama (P. Andinus & P. jamesi)
Barros Negros: 656 *P. andinus* eggs laid; none survived
Puilar: ~1,900 *P. andinus* eggs laid; ~ 400 survived
Salada: 123 *P. andinus* eggs laid; 18 survived
Saladita: 233 *P. andinus* eggs laid; 120 survived

A first nesting record for *P. jamesi* was recorded at Laguna Negro Francisco, a site at the southern end of their distribution in Chile.

Peru

Breeding period: December-February

There were no reports of breeding in Peru during 2007. (F. Arengo, *in litt.*)

Bahamas & Caribbean

Bahamas (*P. ruber*)

Breeding period: March-August

Lake Rosa, Great Inagua: The birds bred successfully this year, but heavy rains later in the season flooded the nesting site preventing a count of the nests. (Nancy Clum, nclum@wcs.org)

Bonaire (*P. ruber*)

Breeding period: October-March

Pekelmeer: Counts of breeding pairs, chicks hatched and fledged are not available for 2007. (Peter.Montanus@bonairegov.com)

Cuba (*P. ruber*)

Breeding period: April-June

There are 13 known breeding sites in Cuba. The four used most regularly are El Refugo de Fauna Rio Maximo, Desembacadura del Canto, Las Picuas-Cayo Cristo and Caibarien. El Refugo de Fauna Rio Maximo is the single most important breeding site for the Caribbean Flamingo, having produced between 17,000 and 42,000 chicks annually between 1998 and 2004 (*Flamingo* 13). There was no breeding in 2005 due to severe drought. However, during 2006 and 2007, this site produced an estimated 50,000 and 55,000 chicks respectively. (José Morales Leal, fefoflamenco@yahoo.es)

During 2007, Desembacadura del Canto produced approximately 10,000 chicks, while Las Picuas-Cayo Cristo produces approximately 4,000-8,000 chicks per year. (Juan Castillo Pérez, ffaunach@enet.cu)

Mexico (*P. ruber*)

Breeding period: April-September

The Punta Mecoh breeding island was restored between March-April with financial assistance from the Federal Ministry of the Environment, the Yucatan Secretariat for Social Development, the Yucatan Tourism Foundation, the International Flamingo Foundation and the Yucatan Salt Company. A small colony of 2,800 pairs settled at Punta Manolo, but was disrupted by a pack of feral dogs. Some flamingos moved to a mudflat adjacent to Punta Mecoh where 120 chicks were hatched. Another small colony nested on the Salt Company salt pans, hatching 80 nestlings, for a total of 200 chicks hatched at the Ría Lagartos Biosphere Reserve.

Unsuccessful breeding efforts in 2006 and 2007, as well as having only few band readings (of young flamingos), and a lower number of individuals surveyed in July both years make us believe the adult portion of the Yucatan breeding population attempted nesting elsewhere, perhaps in Cuba. These facts make international cooperation a more critical necessity. (rodrigomigoya@prodigy.net.mx)

Venezuela (*P. ruber*)

Breeding period: Irregular: breed in both dry (October-March) and wet (April-September)

Refugio de Fauna Silvestre y Reserva de Pesca "Ciénaga de Los Olivitos": No breeding report for 2007.

Mediterranean & West Africa

Breeding by *P. roseus* in Mediterranean and West African countries during 2007 has been reported at 10 sites. More than 46,000 (unknown total number) pairs attempted to breed and an estimated 34.365 chicks were produced. The only remarkable event of this breeding season was an unusually late breeding attempt by apparently immature birds in the northern Po delta, a new breeding site. The following reports were provided by Arnaud Béchet and members of the Mediterranean and West African Greater Flamingo Network.

Mauritania (*P. roseus*)

Breeding period: March-July

Banc d'Arguin National Park (Grande Kiaone Island): 11,500 pairs attempted to breed; ~9,400 chicks were produced

Algeria (*P. roseus*)

Breeding period: April-June

Garaet Ezzemoul: No pairs attempted to breed in 2007

Tunisia (*P. roseus*)

Breeding period: April-June

Thyna Salinas: 140 pair attempted to breed; 17 chicks were produced

Spain (*P. roseus*)

Breeding period: April-June

Ebro Delta: 1,800-2,000 pairs attempted to breed; 891 chicks were produced

Fuente de Piedra: 15,076 pairs attempted to breed; 2,658 chicks were produced

Doñana: ~ 2,000 pairs attempted to breed; 56 chicks were produced

France (*P. roseus*)

Breeding period: April-June

Camargue (Etang du Fangassier): For the first time in 38 years, Greater Flamingos have not bred in the Camargue in 2007. This resulted from the absence of flooding of the breeding saltpan due to the decision by the salt company to drastically reduce salt production. During winter, the breeding salt pan is allowed to dry out. The spring flooding of this lagoon by the salt company therefore conditions the establishment of flamingos and determines the date of egg-laying which occurs on average 20 days afterwards.

At the beginning of 2007, the salt company decided to reduce production from an average 900,000 down to 340,000 metric tons annually. This was accompanied by the announcement of the dismissal of half of the personnel. There were negotiations between the workers and the management of Salins but the crisis persisted and as a result no water was pumped into the Fangassier in spring. Flamingos attempted to settle in the nearby Salins d'Aigues-Mortes but heavy rainfall flooded the island they had chosen.

The situation should improve in 2008 as the breeding salt pan should be sold to the Conservatoire du Littoral, a French governmental agency dedicated to purchasing coastal lands in order to protect them from urban and industrial sprawl.

Italy (*P. roseus*)
Breeding period: April-June

Comacchio saltpans: 1,246 pairs attempted to breed and ~ 700 chicks were produced

Margherita di Savoia: Unknown number of pairs attempted to breed and ~ 410 were produced

Molentargius, Sardinia: No breeding attempts during 2007

Saline di Macchiareddu (Santa Gilla, Sardinia): ~ 14,250 pairs attempted to breed and ~ 12,500 chicks were produced

Turkey (*P. roseus*)
Breeding period: April-June

Camalti Tuzlasi saltpans (Izmir): Unknown number of pairs attempted to breed; ~3,500 chicks produced

Tuz Gölü: Unknown number of pairs attempted to breed; 4,382 chicks produced

Southwest Asia & South Asia

Iran (*P. roseus*)
Breeding period: May-June

Uromiyeh Lake: No report for 2007

India (*P. minor* & *P. roseus*)
Breeding period: Erratic, depending on the rains, but mainly September-November

Zinzuwada Salt Pan (P. minor): No report for 2007.

Purabcheria Salt Pan (P. minor): No report for 2007.

Great Rann of Kachchh (P. roseus): No report for 2007.

"Flamingo City", Great Rann of Kachchh: No report for 2007.

East Africa & southern Africa

Tanzania (*P. minor & P. roseus*)
Breeding period: Erratic, depending on the rains, but mainly November-February

Lake Natron: In late January, we received a report (M. Baker and M. Aeberhard *in litt.*) that the December-January 2006-07 breeding attempt on Lake Natron had been flooded out by heavy rains. The rains disrupted breeding and seemed to be the cause of heavy chick mortality. There also appeared to have been substantial adult mortality, with the cause unknown.

In May, the birds began to build nests again as the water receded (M. Baker *in litt.*), and by mid-July were breeding in their hundreds of thousands. Unfortunately, a small number of Marabou Storks created havoc amongst the colonies by chasing adults of their nests, killing chicks and destroying eggs.

Botswana (*P. minor & P. roseus*)
Breeding period: Erratic, depending on the rains, but mainly November-February

Sua Pan: In contrast to the bumper breeding season in 2005-06 (see *Flamingo* 14), both species experienced very poor breeding results at Sua Pan in 2006-07 due to severe drought conditons. In early March, Graham McCulloch wrote "I recently conducted an aerial survey of the flamingo colony on Sua Pan to assess the breeding progress. With the lack of rain and intense heat we experianced during late January and February, things have taken an unfortunate turn for the worst. It's not looking good at all for the chicks. A mere one to two thousand chicks remain huddled around an already abandoned nesting colony, and they have two months to go yet before they fledge, so the odds are stacked against them lasting until then. I must say, I was surprised to see no adults on nests, but that may be due to the long hot and dry February. Once again Mother Nature has proven impossible to predict. (G. McCulloch, *in litt.*).

Namibia (*P. minor & P. roseus*)
Breeding period: Erratic, depending on the rains, but mainly November-February

Etosha Pan: No breeding occurred on Etosha Pan for the second year in a row. In 2005-06, there was too much rain and the main breeding island was flodded during the breeding period. In 2006-07, there was too little rain. The pan was completely dry during an overflight on 24th May and only about 600 flamingos, mainly Greaters, were seen in the Ekuma River tributary and the Lake Oponono wetlands to the north of Etosha Pan. (W. Versfeld, *in litt.*)

South Africa (*P. minor*)

Kamfers Dam: During the austral summer of 2006-07 the Lesser Flamingos constructed ~ 160 nests and laid two eggs on the new Lesser Flamingo breeding island on Kamfers Dam (Kimberley, South Africa), but no chicks were fledged. (M. Anderson, *in litt.*)

EX-SITU BREEDING SUMMARY

Three flamingo species (Chilean *P. chilensis,* Caribbean *P. ruber* and Greater *P. roseus*) breed regularly in zoos and other captive facilities. The following table summarises captive flamingo populations and breeding success during 2007. (Rebecca.Lee@wwt.org.uk)

Species	No. of zoos	No. of individuals	No. hatched
Chilean Flamingo (*Phoenicopterus chilensis*)	167	4656	109
Caribbean Flamingo (*Phoenicopterus ruber*)	154	4396	118
Greater Flamingo (*Phoenicopterus roseus*)	113	3446	132
Lesser Flamingo (*Phoenicopterus minor*)	56	1096	8
Andean Flamingo (*Phoenicoparrus andinus*)	3	34	0
James's Flamingo (*Phoenicoparrus jamesi*)	2	4	0

Source: International Species Information System + Wildfowl & Wetlands Trust

IN SITU RINGING SUMMARY

Bolivia

Flamingo chick banding was carried out 29 March, 2007, in Laguna Colorada, Bolivia. This activity was coordinated by Centro de Estudios en Biología Teórica y Aplicada (BIOTA) with collaboration from the Wildlife Conservation Society, American Museum of Natural History and the park guards of the Reserva Nacional de Fauna Andina Eduardo Avaroa. A total of 414 chicks were banded. We obtained 50 blood samples for health evaluations. This is the fifth year this activity has been carried out and each year we improve procedures. We met our target number of chicks banded. Team leaders conducted a training workshop for park guards and volunteers about Andean Flamingo ecology and health prior to the banding. (*Omar Rocha*, BIOTA, orocha@entelnet.bo)

Chile

Given low reproductive success for Andean Flamingo colonies in Atacama Site - the largest number of surviving chicks was below 500 in any of the 4 colonies, CONAF authorities decided to cancel 2007 banding activity to avoid human disturbance and associated risks for chick survival. (E. Rodriguez erodrigu@conaf.cl) and N. Amado namado@conaf.cl, CONAF).

Bahamas & Caribbean

Mexico (*P. ruber*)

One hundred and one flamingos were banded in Mexico during 2007 (R. Migoya, rmigoya@ninosycrias.org.mx).

Venezuela (*P. ruber*)

No report for 2007

Mediterranean & West Africa

Algeria (*P. roseus*)

No chicks were ringed in Algeria in 2007 (B. Samraoui)

France (*P. roseus*)

No chicks were ringed in France in 2007 (A. Béchet)

Italy (*P. roseus*)

501*P. roseus* chicks were ringed at the Comacchio salt pans in July 2007. (N. Baccetti)

Sardinia (*P. roseus*)

On 4th August, 419 *P. roseus* chicks were ringed at Saline di Macchiareddu (N. Baccetti)

Spain (*P. roseus*)

400 chicks were ringed on 1st July 2007 at Ebro Delta; 56 were ringed on 4th July 2007 at Donana and 616 were ringed at Fuente de Piedra on 14th July 2007 (M. Rendón-Martos, J.M. Ramírez, A.Garrido , C.M.A. Andalucia)

Turkey

On 29 July, 216 chicks were ringed at Camalti Saltpans (Ö. Balkiz)

RESEARCH PAPERS AND REPORTS

Breeding of the Greater Flamingo *Phoenicopterus roseus* in Salines de Thyna, Tunisia

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Introduction

The Greater Flamingo occurs in most Tunisian wetlands, its distribution depending on water level, salinity, and food abundance. The number of wintering birds regularly reaches 40,000. Many juvenile birds come to Tunisia from their breeding colonies around the Mediterranean, often remaining for 3-4 years.

Almost every year, Greater Flamingos attempt to breed in Tunisian wetlands such as Sebkhet Ariana, Sebkhet Sejoumi and the Thyna salt pans. They rarely succeed, either because they are young inexperienced birds, or because of disturbances. The last successful breeding in Tunisia was in 1991 when a colony of 4,000 pairs hatched 600-700 chicks at Garaet Sidi Mansour near Gafsa in southern Tunisia (Isenmann *et al.* 2005).

Site description

The Thyna salt pans (34° 38' N 10°43' E), occupy >13 km along the Tunisian coast near Sfax. The site covers approximately 1,500 ha and is one of 46 Important Bird Areas (IBAs) in Tunisia (Amari & Azafzaf 2001). Its designation as a Ramsar site is under way.

Due to their natural physical characteristics, the Thyna salt pans are an important feeding and roosting site for a multitude of different species, in particular the Greater Flamingo, which is recorded with important concentrations in winter (BirdLife International 2007).

Table 1: Numbers of wintering Greater Flamingos (*P. roseus*) in Thyna saltpans, 1994 to 2007.

Year	Number
1994	4252
1996	2800
1998	6080
2000	3840
2001	5850
2002	4683
2003	8070
2004	6270
2005	7950
2006	8013
2007	2840

Breeding in 2007

For several years small colonies of flamingos regularly attempted to breed in the salt lakes of Thyna, but without success. In 2007, the colony consisted of approximately 140 nests, and for the first time 17 pairs raised chicks. The chicks were first recorded by Mr. Mohamed Ali Chokri on 8 August 2007, when they were estimated to be 2-11 weeks old. Later, they were observed on 26 August and on 23 September 2007 by Groupe Tunisien d'Ornithologie (GTO).

The breeding of the Greater Flamingo in the salt lakes of Thyna this year is probably related to two major factors: the absence of breeding conditions in the pond of Fangassier in the Camargue (France), one of the principal breeding sites in the Mediterranean (Johnson 1992),

and the efforts made by Tunisian authorities, NGOs and other organizations to conserve the Tunisian avifauna. For many years, the Directorate-General of Forests within the Ministry for Agriculture and Water Resources, and Association Les Amis des Oiseaux (AAO) have monitored and guarded the avifauna in the salt lakes of Thyna. AAO also participates in the ongoing Mediterranean Greater Flamingo research program by the reading coloured rings on juvenile birds from colonies in France, Spain, Italy, Turkey and Algeria.

Figure 1. Juvenile Greater Flamingos bred at Thyna saltpans, July 2007

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Greater Flamingo migration from UAE to Turkmenistan documented by satellite tagging

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A Greater Flamingo *Phoenicopterus roseus* tagged with a 70g solar-powered GPS satellite transmitter at Al Wathba Wetland Reserve in Abu Dhabi in 2005 by the Environment Agency - Abu Dhabi (EAD), and named Sinbad by the Agency, continued to chart new frontiers. During its second spring migration from the UAE, this bird covered 4,269 km, first crossing into Iran on 9th March, and then continuing northward to Azerbaijan, before moving into Kazakhstan, on the north-eastern shore of the Caspian Sea. By early October, the bird had moved into coastal Turkmenistan. Sinbad was the first of the four tagged birds to migrate across The Gulf, and has provided the first confirmed documentation of movement and migration patterns of flamingos wintering in the UAE.

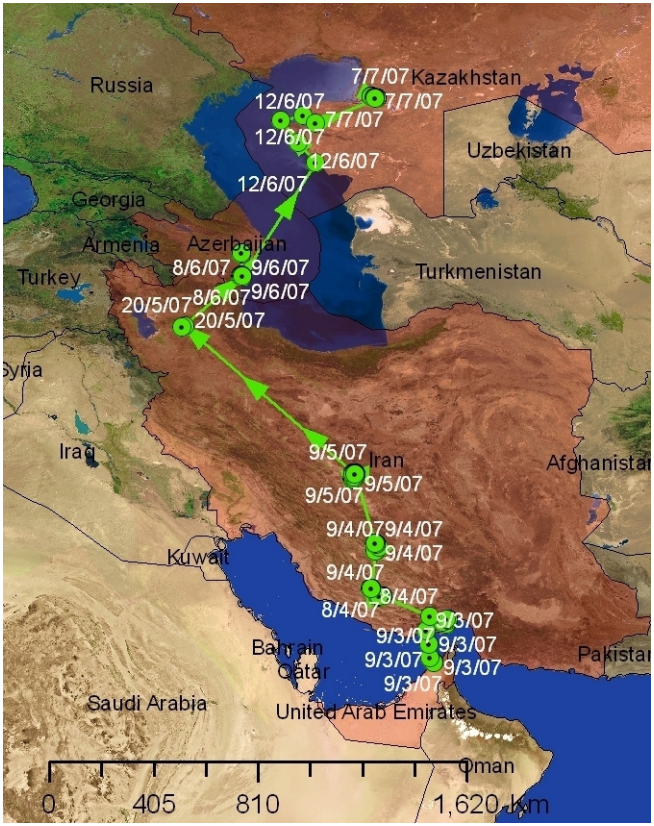
Sinbad began its second spring migration across The Gulf from Khor Al Beidah in Umm Al Qaiwain on 9th March 2007 to reach near Qushm Island in Iran. The bird then moved to Nariz Lake on 9th April, a site where three other flamingos, satellite tagged by the Agency, have spent much of the 2007 summer. It continued its northward journey as in 2006, but instead of going northeast, it moved northwest near the Iran-Azerbaijan border on 20th May 2007 and reached Azerbaijan on 21st May 2007. After a 23-day stopover in a bay south of the capital Baku, it continued its journey across the Caspian Sea into Kazakhstan. Prior to its spring migration in March 2007, Sinbad spent 92 days wintering in the UAE, using only two sites since its arrival at Ras Al Khor in Dubaion 7th December 2006.

Sinbad has exhibited true nomadic behaviour and in the process has provided valuable new information on migration patterns, stopovers and staging sites used by Greater Flamingos in the Middle East. Since its tagging on 26th November, 2005, the bird has logged more than 15,000 km and the transmitter has provided more than 5,000 high accuracy locations. The bird's flight speed has averaged >50 km/hour.

Environment Agency – Abu Dhabi Continues to Track Flamingos

The programme to satellite track Greater flamingos (*Phoenicopterus roseus*), begun in 2005, is successfully continuing and currently six birds are being tracked. Satellite locations of flamingos marked in 2005 and 2007 have provided new and interesting information on local movement and wetland use patterns. It has also clearly documented the origin and range of birds wintering in the UAE. Movement of Sinbad alone, ranging over five countries, shows extensive movement and the potential for the inter-mixing of flamingos breeding in colonies in Kazakhstan, Azerbaijan, Iran and potentially other neighbouring countries.

As Iran, Azerbaijan and Kazakhstan have reported incidences of Highly Pathogenic Avian Influenza (HPAI) in the past, it would be interesting to monitor the movement patterns of Sinbad and other tagged flamingos as routes and stopover sites used by flamingos are generally shared by other water birds. EAD will continue to monitor movement patterns of the tagged flamingos and also monitor key sites of wintering waterbirds throughout the UAE, as birds start arriving during autumn migration.



Salim Javed, Environment Agency

Figure 1. Greater Flamingo migration route, March-July 2007

H6N2 avian influenza virus detected in wild greater flamingos from Italian breeding colonies

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Viral diseases monitoring in greater flamingos (*Phoenicopterus roseus*) was continued during recent ringing operations in Italy, despite negative results on three previous breeding seasons (Guberti *et al.* 2005). In July 2006, 75 blood samples and cloacal swabs were collected from 4 moulting adults and 71 fledgelings aged two months belonging to the Comacchio nursery (645 birds fledged in that year). In July 2007, 495 cloacal swabs were obtained at Comacchio (sample including also 2 adults), where the productivity was of 700 juveniles; 60 additional cloacal swabs were taken in August 2007 from the Macchiareddu nursery, Sardinia, thanks to the courtesy of Paolo Briguglio.

Out of the 75 Comacchio swabs of 2006, 19 (25.3%) resulted positive for avian flu type "A" after being screened by real-time reverse transcriptase-polymerase chain reaction (RT-PCR) (Terregino *et al.* 2007). One virus, of the H6N2 subtype, could be isolated from these positive

samples. One Wigeon (*Anas penelope*) sampled 4 months later in the Po river delta, 46 km north of Comacchio, was found positive for the same virus subtype (H6N2); this area temporarily hosted a large fraction of Comacchio flamingos in the post-breeding season, as shown by records in August to December of 446 marked individuals, out of 1156 ringed or observed at Comacchio saltpans in 2006, January to July inclusive (39%). The study of the genetic homology between the two viruses has been planned. All samples collected in 2007 were negative.

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Network of important wetlands for flamingo conservation: Preliminary results from 2007 monitoring at priority sites

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The James' (*Phoenicoparrus jamesi*) and Andean Flamingos (*P. andinus*) are mostly restricted to the altiplano, although they can be found in lowland wetlands of central Argentina, particularly in winter. Using concepts adapted from Roshier 2003 and Caziani et al. 2007 for site-based conservation strategies, we selected fourteen priority wetland sites to integrate the first stage of a project during which we will develop a wetland network for the conservation of high-Andes flamingos (Marconi 2007). Priority site-selection criteria are based on Andean or James' Flamingo abundances (1% of the global population) or occurrence of breeding colonies. We adopted an operative definition of key site: wetland or wetland complex that are in close proximity and constitute a survey unit or a management unit if it is a formally protected area. Priority sites identified were: Melincué, Dulce-Mar Chiquita, Brava, Parinas, Vilama and Pozuelos in Argentina; Avaroa, Lípez and Poopó in Bolivia; Negro Francisco, Punta Negra, Atacama, and Surire in Chile; and Salinas in Perú.

The Wetland Network project consists of four main programmatic components (1) Research and Monitoring, (2) Conservation and Management, (3) Institutional Strengthening and Interinstitutional Coordination, (4) Training and Outreach, with objectives that are in line with those of the Regional Strategy for Conservation and Sustainable Use of High Andes Wetlands developed among Ramsar, the GCFA, and Grupo Páramo.

We identified annual flamingo and waterbird population monitoring and habitat characterization at key sites as main activities within the Research and Monitoring program.

From mid-summer (early February) to early fall (late March) 2007, the GCFA and local institutions conducted systematic flamingo and other waterbird counts at 12 priority sites applying a standardized monitoring protocol (Valqui et al. 2000, Caziani et al. 2006, Caziani *et al.* 2007). Results of 11 key sites were available for this analysis (Punta Negra absent).

We surveyed 78 wetlands within priority sites where we had previously recorded flamingos and recorded high-Andes Flamingos in 83% of them during this study. We also surveyed an additional 7 wetlands (not within our priority sites) that have also historically had significant flamingo numbers. Total counts were 70,333 James' Flamingos, 25,471 Andean Flamingos, 53,199 Chilean Flamingos and 20,649 unidentified flamingos (mostly chicks and juveniles). Only five wetlands: Grande (Parinas), Colorada (Avaroa), Khara (Lípez), Vilama and Blanca (Vilama) had 57% of the James' Flamingos recorded; and only four wetlands: Negro Francisco (N. Francisco), Colorada (Avaroa), Surire (Surire), and Salar de Huasco had 63% of the Andean Flamingos recorded.

The two species showed distribution patterns similar to those observed in previous summer censuses (Figure 1) (Caziani *et al.* 2006, Caziani *et al.* 2007).

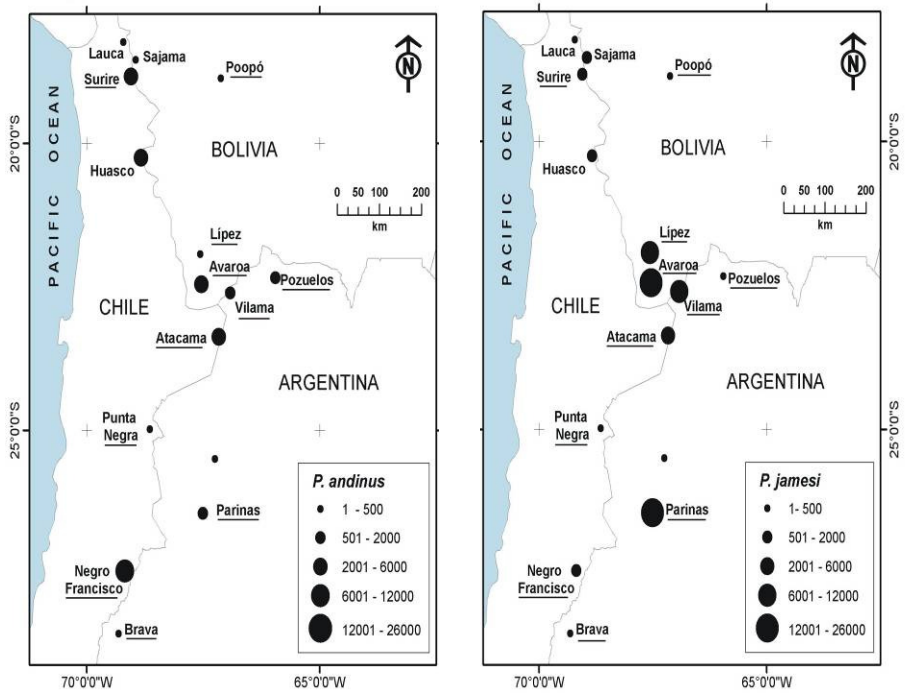


Figure 1. Total abundances of Andean Flamingos and James' Flamingos at sites surveyed in summer-early fall 2007 (early February and late March). Wetland network priority sites are underlined.

The summer 2007 monitoring was not conducted simultaneously for all 12 sites: 8 were surveyed in early February (wetlands in Argentina and Chile), and 4 at the end of March (wetlands in Bolivia and Brava in Argentina).

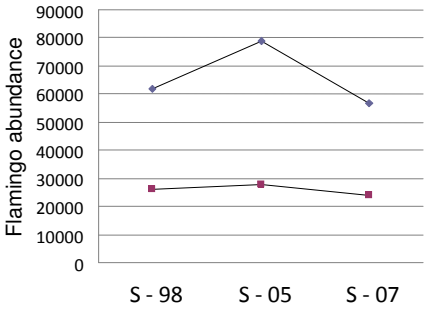
We compared results from the same sites surveyed during simultaneous summer censuses conducted in 1998 and 2005 (Fig. 2). If we include 2007 results from wetlands surveyed in late March (n=66), a drop in James' Flamingo abundances can be observed (a), but considering only wetlands surveyed simultaneously (n=40), James' abundance remains fairly constant (b).

Andean Flamingos abundances were similar in both cases (with and without Bolivian wetlands) among these years.

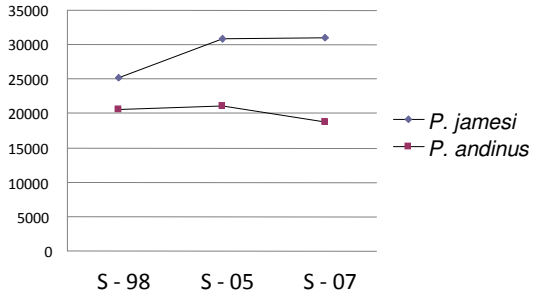
Breeding activity was recorded in Avaroa: Laguna Colorada (14,966 Andean and James' Flamingo chicks), Kalina (2,966 unidentified chicks), Guayaques (220 unidentified chicks); Lipez: Cachi (270 unidentified chicks); Vilama: Honda (18 James' Flamingo chicks).

We can draw two preliminary conclusions regarding summer monitoring of key sites in the wetland network:

1. These sites are a representative sample of summer congregation sites for both Andean and James' Flamingos, thus counts at the priority sites can be used for reasonable extrapolations of total population estimates, with considerable less fieldwork effort and lower costs than required for coverage of the entire summer distribution. However, if we were to notice flamingo declines at these sites this would warrant examination of other sites to determine if flamingo habitat use has shifted or if population numbers as a whole have declined.



(a)



(b)

Figure 2. Summer abundance estimations at a) 66 wetlands and b) 40 wetlands within the network for flamingo conservation.

2. To obtain reliable population estimates or trends, summer monitoring should be simultaneous, with a maximum delay of two weeks from beginning to end. In this case, the 2-month interval between counts in Argentina and Chile vs. the counts in Bolivia

introduced inaccuracies due to individual movement between wetlands, and also encompassed a seasonal change that results in significant drops in numbers at summer congregation areas. At a site above 4,300 m a.s.l., i.e. Laguna Colorada (Avaroa), flamingo numbers can be markedly seasonal, especially for James' Flamingos, and late March fall conditions result in movement of a large portion of both species' populations to wetlands at lower altitudes. This could explain the apparent drop in James' Flamingo numbers at Laguna Colorada (late March: 9,337 individuals) compared to the 2005 simultaneous census (late January: 18,412 individuals).

We strongly recommend continuity of a summer annual census of key sites in the network for the monitoring of Hhigh-Andean flamingo populations, and that these be done simultaneously. A special effort should be placed on improving species identification of groups of chicks numbering over 100.

Of note were the results from Salar de Huasco (currently not on our priority list) that had more than 1% of the global estimated population of both species, which confirms the site for future inclusion in the wetland network for flamingo conservation.

Acknowledgements

We would like to thank the generous collaboration of biologists, students and park rangers that participated in the field work, especially to Ricardo Clark, Pablo Perovic, Flavio Moschione, Guillermo Nicolossi, Kantuta Palenque, Magali Vargas, Rodrigo Araya, Alejandra Castro, Marcos Cortés, Nelson Galleguillos, José Luis Jara, and Carlos Ochoa. The summer monitoring was supported by the Wildlife Conservation Society (WCS). Local institutions that supported this study were, in Argentina: Fundación YUCHAN, Alianza Gato Andino, ECOSUR, Administración de Parques Nacionales, Gobierno de la Provincia de La Rioja; in Bolivia: BIOTA, the personnel of Reserva Nacional de Fauna Eduardo Avaroa, WCS-Bolivia, Dirección General de Biodiversidad (DGB); in Chile: CONAF, Quiborax Ltda., Cerro Colorado, Doña Inés de Collahuasi, Quebrada Blanca, El Abra, SQM Ltda. Sociedad Chilena de Litio Ltda., Escondida Ltda., Mantos de Oro and Maricunga.

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Nidificatión de flamencos en la region de Antofagasta, Chile; Temporada reproductiva 2006-07

Flamingo Nesting in the Antofagasta Region, Chile; 2006-2007 Breeding Season

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Abstract
The Corporación Nacional Forestal (CONAF) in Chile has been monitoring flamingo breeding sites in the Regions of Tarapacá, Antofagasta and Atacama in northern Chile since 1986. This report presents results for the 2006-2007 breeding season for the Atacama and Salar de Tara sites in the Antofagasta Region. The field team consisting of technicians and park guards surveyed 4 wetlands in Atacama (one in January and 3 in March) and one in Salar de Tara (in March). A total of 2,912 Andean Flamingo eggs were counted in Atacama from which 908 chicks hatched and of these 59.3% fledged. The Barros Negros wetland had 100% mortality. At Salar de Tara we found 1,800 James' Flamingo chicks, 60 Chilean Flamingo chicks and 500 abandoned eggs. We examined breeding records for Atacama for the past 10 years and find marked fluctuations in nesting activity and survivorship with a maximum of 11,000 chicks in 1997, a period of 6 years with no chicks fledged between 1989 and 1995, and fluctuations between 100 to 5,000 fledged since 1998. The 2006-2007 breeding period was characterized by unusual behavior such as premature courtship, use of alternative breeding sites that has not been used in 10 years, decrease in use of sites more commonly used in more recent years, and the first-time nesting of James' Flamingos in Laguna Negro Francisco, for example. Though the causes of these changes in behavior are probably complex, the occurence of La Niña during the breeding period could explain some of these observed peculiarities.

Introducción
La Corporación Nacional Forestal ejecuta desde el año 1986 un programa de seguimiento de la dinámica espacio-temporal y reproductiva de flamencos sudamericanos, que comprende el área andina de las Regiones de Tarapacá, Antofagasta y Atacama en el norte de Chile. El presente documento comunica los resultados finales de la evaluación de la nidificación correspondiente a la temporada reproductiva 2006 – 2007, de flamenco andino (*Phoenicoparrus andinus*) en el Salar de Atacama, y de flamenco de James (*Phoenicoparrus jamesi*) en el Salar de Tara. Junto con lo anterior, se comunica el número de pollos nacidos en el Salar de Punta Negra, todos estos sitios localizados en la Región de Antofagasta.

Metodologia

Área de estudio
El Salar de Atacama se ubica a una altura de 2300 metros sobre el nivel del mar, posee una superficie aproximada de 3000 Km^2, las precipitaciones son principalmente estivales y bordean los 25 mm/año, en tanto que la evaporación potencial alcanza los 2000 mm/año y la temperatura media es de 14º C. Insertos en él se encuentran al menos dos sistemas hidrológicos principales, conformados por una serie de lagunas interconectadas en superficie a través de canales, y de cuerpos lacustres aislados e independientes entre sí: El Sistema Soncor, donde se encuentran las lagunas Burro Muerto, Chaxas, Barros Negros y Puilar; y el S. H. Peine, donde se ubican las lagunas Salada, Saladita e Interna.

El Salar de Tara por su parte, se ubica a una altura de 4.400 msnm, posee una superficie aproximada de 48 Km^2, las precipitaciones son principalmente estivales y bordean los 150 mm/año, en tanto que la evaporación potencial alcanza los 1500 mm/año y la temperatura media es de 0º C. La superficie de la laguna principal oscila entre los 3 y 25 Km^2.

Toma de datos
Las actividades de terreno fueron efectuadas por personal de CONAF, tanto técnicos como Guardaparques. La evaluación efectuada en el Salar de Atacama se llevó a efecto el 11 de

enero en la laguna Barros Negros y el 6 y 7 de marzo en las lagunas Puilar, Salada y Saladita; en tanto que la evaluación en el Salar de Tara se realizó el 24 de marzo de 2007.

Para el caso de la colonia de flamenco de James del Salar de Tara, la evaluación consistió solamente en un muestreo azaroso de huevos, que tuvo por finalidad determinar el grado de desarrollo embrionario y posibles causas de mortalidad.

La evaluación de las colonias de flamenco andino nacidos en el Salar de Atacama, consistió en determinar algunos aspectos de su biología reproductiva, y que en síntesis se refieren a los siguientes:

1.- Tamaño total de la postura
2.- Número total de pollos nacidos
3.- Número total de huevos y pollos muertos
4.- Número de pollos sobrevivientes

La información sobre los pollos nacidos en Salar de Punta Negra sobrevivientes hasta los 3 meses, fue obtenida del informe técnico emitido por el Centro de Ecología Aplicada (CEA), entidad de Investigación y Monitoreo Ambiental asociada a las actividades productivas de la Empresa Minera Escondida Limitada.

Resultados

Salar de Atacama

Tamaño total de la postura
El recuento total de huevos y pollos realizado en las lagunas Barros Negros, Puilar, Salada y Saladita al término de la nidificación, permite establecer para la temporada reproductiva 2006 – 2007, un tamaño total de la postura en el Salar de Atacama de 2912 huevos.

La distribución de la postura total en cada laguna y el aporte porcentual correspondiente a cada una de ellas, fue la siguiente: 1900 huevos (65%) en Puilar, 656 huevos (22%) en Barros Negros, 233 (8.0%) en Saladita y 123 (4.2%) en Salada.

Número total de pollos nacidos
Considerando el total de pollos vivos y muertos encontrados en toda el área de nidificación, se obtuvo un total de 908 pollos nacidos, los que se distribuyeron en las distintas lagunas de la siguiente manera: Puilar 704 (77.5%), Saladita 183 (20.2%), Salada 21 (2.3%) y en Barros Negros 0 (0%).

Número total de huevos y pollos muertos
Se alcanzó una mortalidad total de 2374 huevos y pollos. La distribución porcentual de huevos y/o pollos muertos por laguna, fue la siguiente: Barros Negros (100%), Salada (85.4%), Puilar (78.9%) y Saladita (48.5%).

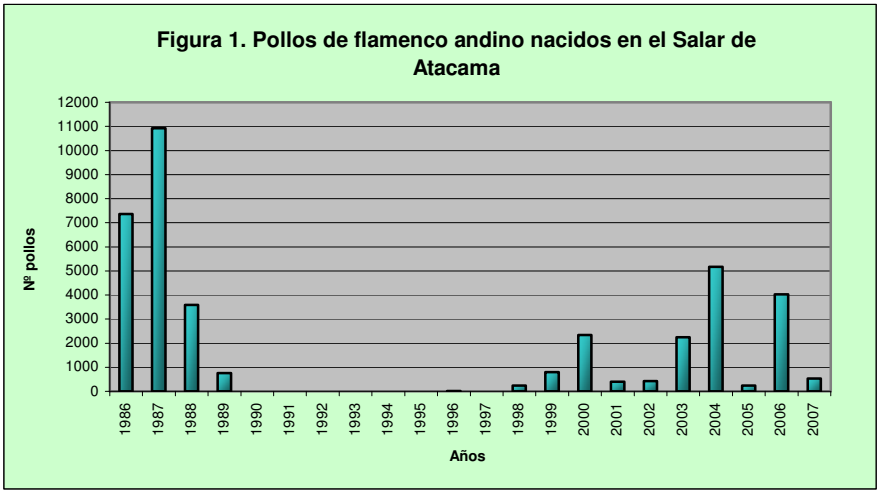
Número de pollos sobrevivientes
Del total de pollos nacidos se obtuvo una sobrevivencia total de 59,3%. La sobrevivencia en cada laguna fue la siguiente: Barros Negros (0%), Puilar (56,8%), Salada (85,7%) y Saladita (65,6%).

La Tabla 1 muestra el resumen de los resultados de la evaluación de la nidificación de flamencos en el Salar de Atacama. La Figura 1 muestra la producción histórica de pollos de flamenco andino en el Salar de Atacama.

Salar de Tara
La evaluación efectuada en marzo de 2007, permitió constatar el nacimiento y sobrevivencia de 1800 polluelos de flamenco de James y alrededor de 60 polluelos de flamenco chileno. En esa ocasión se contabilizó además un total aproximado de 500 huevos abandonados en una agrupación de nidos de mediano tamaño.

Tabla 1. Resumen general de la nidificación de flamencos en el Salar de Atacama: Temporada 2006-2007

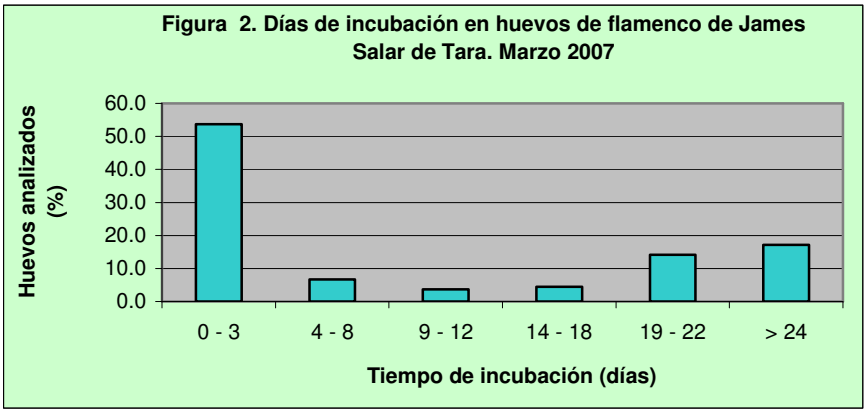
Categorías	Barros Negros	Puilar	Salada	Saladita	Totales
Pollos vivos	0	400	18	120	538
Pollos muertos	0	304	3	63	370
Huevos perdidos	656	1196	102	50	2004
Postura total	**656**	**1900**	**123**	**233**	**2912**
Sobrevivencia absoluta (%)	0	21,1	14,6	51,5	18,5
Mortalidad absoluta (%)	100	78,9	85,4	48,5	81,5
Número de pollos nacidos	0	704	21	183	908
Sobrevivencia de pollos nacidos (%)	0	56,8	85,7	65,6	59,3
Mortalidad de pollos nacidos (%)	0	43,2	14,3	34,4	40,7



La Tabla 2 muestra los resultados del examen visual efectuado a una muestra de 134 huevos para determinar el estado embrionario. La Figura 2 muestra la distribución de huevos en los distintos días de desarrollo embrionario.

Tabla 2. Resultado del examen visual para determinar el estado embrionario en 134 huevos abandonados.

Fase	Días de incubación	% de huevos
1	0 – 3	53,7
2	4 – 8	6,7
3	9 – 12	3,7
4	14 – 18	4,5
5	19 – 22	14,2
6	> 24	17,2



La Tabla 3, muestra el resultado final del número de pollos de las tres especies de flamencos en los distintos sitios de nidificación de la Región de Antofagasta.

Tabla 3. Producción de pollos de flamencos nacidos en la región de Antofagasta.

Sitio	Flamenco andino	Flamenco de James	Flamenco chileno
Salar de Atacama	538	0	0
Salar de Tara	0	1800	60
Salar de Punta Negra	276	0	0
TOTAL	814	1812	60

Discusión

De los resultados del seguimiento de la dinámica reproductiva de flamenco andino en el Salar de Atacama desde el año 1986, se desprende la irregularidad espacio-temporal histórica asociada a cada una de las fases de desarrollo de estos procesos, desde la temprana fase de cortejo hasta la más tardía de dispersión de los pollos al final de la temporada reproductiva, pasando por el establecimiento definitivo de las colonias de nidificación, la confección y reparación de nidos, la postura e incubación de huevos y la eclosión de los mismos con la consiguiente producción de pollos, entre las más importantes.

Parte de lo anterior se constata al observar la Figura 1, la cual muestra un periodo con grandes números de pollos nacidos en el que destaca claramente el año 1987 con una producción estimada en 11.000 pollos; luego en el año siguiente se contabilizó sólo un tercio de este monto, para finalmente no detectarse nacimiento alguno durante los siguientes 6 años. En 1996 comienza nuevamente un ciclo productivo con apenas 15 ejemplares, para continuar en los años siguientes y hasta la fecha, con sensibles fluctuaciones en los montos de producción. El hecho que al término del periodo de seguimiento comprendido entre 1986 y 2007 se obtenga un total de 39075 pollos nacidos, con un promedio de 1776 y una desviación estándar de 2865.67, confirma lo previamente señalado.

La temporada reproductiva 2006 – 2007 se caracterizó por una inestabilidad particularmente inusual de la dinámica reproductiva cuyas causas no resultan fáciles de precisar. De acuerdo a los antecedentes recabados por CONAF Antofagasta, durante las visitas de seguimiento del evento, de CONAF Atacama y de información obtenida del personal técnico del Centro de Ecología Aplicada (CEA) de la Estación de Investigación Tambo Solor en Punta Negra, tal conducta de los flamencos adoptó entre otras, las siguientes formas de expresión:

1.- Inicio levemente prematuro de la nidificación de flamenco andino en el Salar de Atacama.
2.- Abandono de la nidificación, incluso después de la postura de huevos (Barros Negros, Pujsa).
3.- Desplazamiento errático de fracciones del contingente reproductivo entre los distintos sitios de nidificación.
4.- Primer registro de nidificación de Flamenco de James en Laguna Negro Francisco, Región de Atacama.
5.- Conducta de cortejo de flamenco andino fuera de temporada, observada en los salares de Punta Negra y Salar de Atacama en marzo de 2007.
6.- Nidificación de flamenco andino en laguna Saladita después de unos 10 años en que no la hubo, y reducción del número de posturas en laguna Salada respecto de lo observado en los últimos 8 años. Ambas lagunas ubicadas en el Sistema Hidrológico Peine del Salar de Atacama.

La causa más probable del comportamiento un tanto caótica observada en la presente temporada reproductiva de flamencos, pudo haber estado asociado a La Niña que afectó a la región en esas fechas, eventos cuyas interacciones océano-atmósfera pueden generar alteraciones a macro y mesoescala capaces de promover cambios conductuales en los organismos biológicos, y muy especialmente en vertebrados superiores altamente sensibles como los flamencos, a los que se les reconoce como buenos indicadores del estado de sus hábitats.

Por otro lado, el caso de abandono de la postura observada en Barros Negros no debe ser considerado un hecho accidental, sino más bien una conducta frecuentemente observada que ha sido interpretada como intento de nidificación, dado que del análisis efectuado a los huevos abandonados se desprende que la mayoría de éstos no estaba fecundados, o en el mejor de los casos con un embrión en una fase temprana de desarrollo.

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Resultados preliminares sobre comportamiento y abundancia de flamencos altoandinos en dos humedales de Argentina

Preliminary results on behavior and abundance of High Andes flamingo in two wetlands of Argentina

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Abstract
The Andean (*Phoenicoparrus andinus*) and James' (*P. jamesi*) Flamingos use wetlands in the high Andes of Argentina, Bolivia, Chile and Peru, and in the lowlands of Argentina during their annual cycle. We are conducting a study to examine differences in behavior and habitat use in two of these contrasting habitats: Vilama in the Andes, and Melincué in the lowlands (both in Argentina). Preliminary results show more Andean Flamingos using the lowland site (3,254 vs. 1,022) while James' Flamingos were the dominant species in the Andean site (5,750 individuals) but was absent from the lowland site. Andean Flamingos spent most of their time engaged in courtship in the lowland site, while foraging was the dominant behavior for both species in the Andean wetland. The observed behavioral differences can be due to different priority activities during the life cycle: courtship in preparation for breeding in the winter and foraging for chick feeding in the summer. Our results suggest that conditions and resources for courtship in lowland sites will affect breeding colony establishment while resources in the Andes will affect production of eggs and fledging of chicks.

Los flamencos altoandinos utilizan de forma alternativa y durante su ciclo anual, humedales en los Andes centrales y en las tierras bajas de Argentina, Bolivia, Chile y Perú (Caziani et al. 2007). En función de esta situación, el Grupo de Conservación de Flamencos Altoandinos, con apoyo de Ramsar y Birdlife Internacional, planteó una estrategia de conservación a escala regional, a través de la implementación de una Red de Humedales Altoandinos y Ecosistemas Asociados (Marconi 2005). Dentro de este marco, desarrollamos el proyecto "Conservation of high Andes flamingo species (*Phoenicoparrus andinus* and *P. jamesi*): habitat use and activity patterns in two contrasting wetland systems of Argentina"*, en donde el objetivo central es analizar la distribución, las abundancias, el uso de hábitat y los patrones de actividad de las especies de flamencos altoandinos en dos humedales ubicados en los extremos geográficos de su distribución, en el noroeste y centro-este de Argentina.

Para ello se seleccionaron dos sitios: Vilama como sitio andino (4 500 m s n m) en el noroeste argentino y Melincué como sitio de tierras bajas (84 m s n m) en centro-este de Argentina. En una primera fase de este proyecto realizamos dos campañas de muestreo, en donde censamos números totales de flamencos, y registramos patrones de actividad y variables físico-químicas en los microhábitats utilizados por los flamencos.

Nuestros resultados preliminares mostraron que las abundancias totales de *P. andinus* fueron mayores en el sitio invernal (Vilama 1 022, Melincué 3 254). *P. jamesi* estuvo ausente en el sitio de tierras bajas, pero en Vilama fue la especie dominante (5 750 individuos). Estos valores fueron menores a los registrados en los censos anteriores en los mismos sitios (Caziani y Derlindati 2000, Romano et al. 2006, Caziani et al. 2006 y 2007).

Los patrones de comportamiento difirieron marcadamente al menos a nivel de sitio. El sitio de tierras bajas (Melincué) mostró mayores proporciones de tiempo utilizado por *P. andinus* en despliegues de cortejo, específicamente marchas de entre 32 y 225 individuos. En el sitio

andino (Vilama), la mayor proporción de tiempo fue utilizada en alimentación por ambas especies.

Los valores promedios de las diferentes variables Físico-químicas fueron: Vilama, Temperatura del agua (ºC) 17.60 ± 4.00, pH 8.62 ± 0.91, [O_2] mg/l 20.12 ± 6.75 y Conductividad (mS) 86.73 ± 54.83; Melincué, TºC 19.41 ± 4.36, pH 9.33 ± 0.51, [O_2] mg/l 6.21 ± 0.97 y conductividad (mS) 5.47 ± 1.37.

El mayor porcentaje de tiempo dedicado a alimentación en ambientes andinos, podría estar asociado a las colonias de nidificación cercanas (Bolivia y Chile) (Caziani et al. 2005 y 2007). En tierras bajas la energía estaría dirigida a comportamientos prenupciales.

Estos resultados sugieren que la instalación de colonias podría estar regulada por las condiciones y recursos en las áreas de invernada, en tanto que la eclosión de huevos y producción de pollos estarían asociados a las condiciones y los recursos en los humedales de los Andes Centrales. Para comprobar si este patrón es consistente, sería necesario realizar estudios similares ampliando el número de humedales e incluyendo áreas de nidificación.

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Current status of Greater Flamingo *Phoenicopterus roseus* at major coastal wetlands along the east coast of India with special emphasis on population decline

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Introduction

The Greater Flamingo *Phoenicopterus roseus* is a seasonal migrant in South Asia. It breeds at both coastal (Rann of Kachchh) and inland (Sambar Lake in Rajasthan) sites in India, as well as on Lake Uromiyeh in Iran and Lake Tengiz in Kazakhstan [Ali & Ripley (1983), Directory of Indian Wetlands (1993), Kumar (1996), Kumar & Bhargava (1996) and BNHS ringing-recovery data]. Many of these birds spend winters at four major wetlands along the east coast of India: Great Vedaranyam Swamp (Point Calimere), Pulicat Lake, Dhanushkodi Lagoon in

Rameswaram Island (Gulf of Mannar) and Chilika Lake. The status of the Greater Flamingo at these four wetlands has been well-documented through long-term waterbird population studies since the 1980s. Flamingo numbers in all four major wetlands have been in decline for the last three decades. This paper documents the declines and discusses the possible causes.

Materials and methods

This paper is based on data generated through recent (after 2000) BNHS waterbird population monitoring/ringing projects executed under my supervision on year round basis with the duration of two to six consecutive years in three (Point Calimere, Chilika and Dhanushkodi) of the four major wetlands. As peak numbers in all these wetlands were mostly recorded during December to January, the current status of Greater Flamingo in these wetlands is based on the maximum counts recorded during these months. Among all the wetlands Point Calimere has been consistently and well monitored for waterbirds for nearly the last three decades since 1980. From 1980 to 1992 a team of researchers (sometimes up to 12) were involved in bird ringing and population monitoring project. Till 1986, before the introduction of Asian Waterbird Census in India, censuses were conducted only as transect counts in different habitats, as it was not possible to undertake the total count considering the huge and dense flocks of all water bird groups (duks, terns, gulls, ducks, waders and other wading birds including flamingos). Hence, Greater Flamingos numbers were mostly guessed based on the huge flocks on a long line stretching for several Kilometers distance, almost resembling the congregations of Lake Nakuru in Kenya. Currently it is possible to do the total count as they are in scattered flocks, and number has never exceed 6,000 in any of these four wetlands during the last 10 years (1998- 2007). The details of the monitoring are given in Table 1.

Study sites

Point Calimere (Great Vedaranyam Swamp)

The Great Vedaranyam Swamp (c.349 sq. km area) of the Point Calimere Wildlife and Bird Sanctuary (10° 18'N, 79° 38'E) stretches along the Palk Strait for about 48 km. Two private chemical firms extract salt in leased swamp areas. Their evaporation ponds have relatively high salinity and temperatures which create an ecological barrier for most marine organisms from April to October. Only the monsoon makes this environment temporarily habitable for marine organisms. It was designated a Ramsar site on 19 August 2002.

Pulicat Lake

Pulicat Lake is situated on the south coast of Andhra Pradesh (13 ° 25'-13 ° 55'N, 80 ° 03'- 80 ° 19'E), on the eastern seaboard of India (Fig. 1). It covers an area of about 450 sq.km, The entire area is a vast, brackish to saline lagoon with extensive mud and sandflats. Mudflats attract huge congregation of waders and flamingos depending on water level fluctuations. This is a declared bird sanctuary.

Dhanushkodi Lagoon of Rameswaram Island

Dhanushkodi Lagoon of Rameswaram Island in the Gulf of Mannar is approximately 14 km in length with width ranging from 0.7 to 1 km; the total area of the lagoon is 11 sq km. The middle portion of the lagoon with its admixture of sand and clay is the most favoured habitat of Greater Flamingo. This lagoon supported overall 50,000 coastal birds (waders, terns and other wading birds) including 13,000 flamingos during mid 1980s (Balachandran, 1995). The lagoon forms part of the area declared as a Marine National Park.

Chilika Lake

Chilika Lake, designated a Ramsar site in October 1981, is the world's second largest brackish-water lagoon. It is located between 19º28' and 19º54' N and between 85º05' and 85º38'E. The various habitats include marshes, mudflats, freshwater pools and areas of open water with varying depths and salinity. A submergible island (Nalabana Island) with extensive mudflats (c. 19 sq km), exposed only during the dry season (December to May), attracts over 300,000 waterbirds. The island supports the largest concentrations of waders in the lake, and a few thousands of flamingos.

Table 1. Details of bird monitoring by BNHS researchers

Site	Year	Monitoring period	Duration/ Frequency	Activities
Point Calimere	1980-1992	Continuous		
	1998-2004	Nov - Feb	3-4 weeks/ season	
	2005 to date	Continuous		
Dhanushkodi	1985-1988	Continuous		Count and Ringing
	1989-1992	Dec - Feb	1 week/month	Count and Ringing
	2004-2006	Continuous		Bird count
Chilika Lake	1983-1984	Dec - Feb		Count and Ringing
	1997	Jan - Feb	3 days/month	Bird count
	1996-1998	Continuous	Fortnightly	Bird count
	2002-to date	Continuous	Weekly	Count and Ringing
Pulicat	1989	Jan - Mar	15 days/month	Count and Ringing
	1990-1992	Continuous	Fortnightly	Count and Ringing
	1998	October	20 days	Count and Ringing
	2002-to date	Continuous	Fortnightly	Bird Count

Results

Point Calimere

Though there was no documentation of the total numbers of any species occurring at this swamp, it was estimated at 1,000,000 plus including ducks, waders, terns, gulls and flamingos. However, the Greater Flamingos number estimated during the 1986 mid winter waterfowl count was 28,000 (Manakadan 1992). This count was partial, because, some remote flamingo habitats (accessible only by boat) were not covered. As I have been working on the waterbirds of this sanctuary and ringing birds since 1981, I believe that the count of 28,000 was an underestimate. Ornithologists who worked in the 1980s believed that the population was not less than 40,000.

The decline in numbers was well pronounced since 1990s, as the numbers between 2000 and 2007 never exceeded 5500. However the peak numbers are seen only for a short duration of two months (January – February). It is interesting to note that in the 1980s and early 1990s two to three thousand Greater Flamingos were regularly observed during the summer also. For last three years, during summer the number is less than 50.

Table-2. Population trend of Greater Flamingo

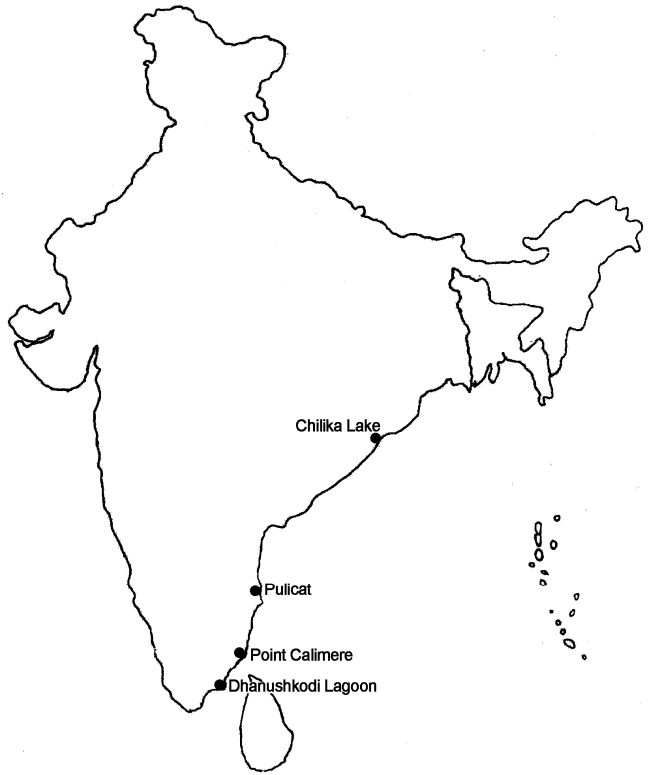
Species Name	1980s	1990s	2000-05
Point Calimere	> 40,000	> 10,000	1,500 - 5,500
Pulicat	> 30,000	> 8,000	3,000 -15,000
Dhanushkodi Lagoon	>14,000	> 7,000	3000 - 5,500
Chilika Lake	7,000	6,500	142 - 5000

Pulicat Lake

Over 200,000 waterbirds were recorded at Pulicat Lake in January 1989, including about 30,000 Greater Flamingos. This census was conducted along with a group of bird watchers from the two

NGOs Birdwatchers Society of Andhra Pradesh and Madras Natural History Society. A total of 15,000 Greater Flamingo were recorded during December 2005 (Kannan *pers. comm.*)

Map. 1: Flamingo habitats along the east coast



Dhanushkodi Lagoon

The maximum number of Greater Flamingo recorded during the three-year study undertaken between 1985 and 1988 at Gulf of Mannar was 14,000, 5,000 and 7,000 respectively (Balachandran, 1995333333).

The regular fortnightly bird population monitoring carried out between August 2005 and April 2006 has recorded the maximum of 5,500 during January and February 2006 at Dhanushkodi Lagoon. When the Dhanushkodi Lagoon was dry during October 2005, 1,500 individuals of this species was seen in the nearby inland wetlands Sakkarakottai and Big tanks in Ramanathapuram town which is about 60 km from the lagoon.

Chilika

The Greater Flamingo was an abundant winter visitor to Nalabana Island, arriving in August and departing in July. A dramatic decline (from 5,000 to 150) during 2003-2004 was observed in the Greater Flamingo numbers from the stable peak numbers of the previous two years (Table 2). In 2004-2005, though an increase in numbers was noticed, the peak never matched that of the first two years.

Discussion

The decline in Greater Flamingo population is so evident from the population count made during the last five years except the estimate of 15,000 in December 2005 by Mr Kannan, Research Scholar of the BNHS. Shifting of population from the traditional sites to neighbouring area is also possible, but even then the numbers from all the east coast wetlands is less than 40,000 equivalent to the numbers recorded from Point Calimere during the 1980s. Though Flamingo occurrence was recorded at a few more new sites for the last several years other than from the regular sites, there is no increase in numbers at other minor sites.

The seasonal shifting of Greater Flamingo from Dhauskodi to Big Tank (Peria Kanmai) and Sakkarakotai Kanmai (an IBA), and Valinokkam saltpans, located respectively 60 km northwest and southwest of Dhanusodi is possible, subject to the water level in the tanks and Lagoon. As numbers in these sites never exceeded 2000, the decline is evident.

Being a migratory species to the Indian east coast, the causes for the decline may be due to factors either at the breeding ground, the wintering ground or both.

Point Calimere

At Point Calimere, the major reasons for the declines appear to have been degradation of the flamingos' habitat due to increasing salinity and the closure of lagoon mouths due to siltation, and a change in the salt works' schedule of operation.

Increasing ground water extraction by the salt works, accompanied by inadequate ground water recharge due to the consistently diminishing rainfall over the last two decades has caused hyper saline conditions. The higher salinity altered the texture of the mudflats, which resulted in the decline of Chironomuslarvae, the major food source for the flamingos during the 1980s.

The closure of lagoon mouths due to siltation at Point Calimere may be one of the possible reasons for the decline in Greater Flamingo numbers during the last two decades, as the natural lagoon systems exist only during peak rainy season.

The shortening of the rainy season from the 1990s resulted in the salt works advancing the commencement of their activities from late February to early January. This in turn resulted in the loss of feeding habitats not only for flamingos, but also for migrant shorebirds for which the decline during the last two decades was over 70% (Balachandran 2006).

Dhanushkodi Lagoon

As at Point Calimere, the closure of lagoon mouths due to siltation may be one of the possible reasons for the decline in Greater Flamingo numbers during the last two decades, as the natural lagoon systems exist only during peak rainy season.

Recommendations

One of the major reasons for the waterbird decline at the coastal wetlands of India is the sharp decline of Chironomus larvae, the major food component of the waders and flamingos. Restoration measures should be aimed at restoring the population of major benthic organisms especially the Chironomus larvae. Otherwise alternate food organisms to substitute for Chironomus should be identified. The waders caught for ringing in some experimental salt pans selected for brine shrimp *Artemia* spp. culture near Kanyakumari (southern tip of India), weighed 30-40% higher to the same species at Point Climere during the similar period. As saltpans with *Artemia* spp. are being frequented by Greater Flamingos regularly till summer, it is suggested that the introduction of brine shrimp into saltpans may help to maintain both the flamingo and wader populations.

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Guidance for collection of samples for assessment of Lesser Flamingo *Phoenicopterus minor* exposure to cyanotoxins

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Summary
This paper gives practical information concerning the collection and storage of samples, both for cyanobacterial material and tissues from living and deceased Lesser Flamingos (*Phoenicopterus minor*). The methods will favour the best possible chance of preserving cyanobacteria and their toxins (cyanotoxins) when subsequently analysed. This will permit accurate assessment of toxin concentrations to understand the contribution and role of cyanotoxins with respect to Lesser Flamingo health.

Introduction
Periodic mass mortalities of Lesser Flamingos are a feature of African Rift Valley lakes. A number of explanations for these events have been proposed including a *Mycobacterium avium*-related epizootic, pesticides, heavy metals and organic pollutants (e.g. Kock *et al.,* 1999; Nelson *et al.,* 1998; Greichus *et al.,* 1978). Recently, the possibility that cyanotoxins may contribute to such deaths has been investigated. This has been necessary as the Lesser Flamingo is known to feed almost exclusively on *Arthrospira* blooms present in these lakes, in addition to ingesting fragments of cyanobacterial mats present at freshwater hot springs where the birds drink. These sources contain a number of potentially toxic cyanobacterial genera. Examples of cyanobacterial genera present and respective concentrations of cyanotoxins are given by Krienitz *et al.* (2003) and Ballot *et al.* (2004).

Analysis of post mortem Lesser Flamingo tissues has shown the presence of a number of cyanotoxins at concentrations deemed to be significant contributors to the mass mortalities of Lesser Flamingo (Krienitz *et al.,* 2003). Here we discuss cyanotoxins potentially present and give practical guidance for the collection and storage of cyanobacterial and animal samples for microscopic examination and cyanotoxin analysis.

Site and exposure assessment
Before sampling, site assessment should be performed to determine the most appropriate location(s) for sampling. Of particular importance are sampling in areas close to sites of sick or dead birds and observation of prevailing weather conditions, as cyanobacterial scums may accumulate in bays or on shores as a direct result of wind action on buoyant cyanobacteria. Other areas of consideration may be lake areas where Lesser Flamingos congregate.

Cyanobacteria
As the principal diet of the Lesser Flamingo on East African alkaline saline lakes is cyanobacteria, mainly *Arthrospira* species, the potential for intoxication due to cyanotoxins exists, dependent on the genera which make up the cyanobacterial population of the lakes. Research has shown that *Arthrospira* strains isolated from the East African alkaline saline lakes where the Lesser Flamingo feeds are capable of producing two classes of cyanotoxin indicated as potentially contributing to mass mortalities, namely hepatotoxic cyclic heptapeptides (microcystins) and the neurotoxic alkaloid anatoxin-a (Ballot *et al.,* 2004). In East African Rift Valley lakes a number of other potentially toxic cyanobacterial genera have also been described, including *Phormidium*, *Anabaena*, *Oscillatoria* and *Anabaenopsis* and the dominance of these may change affecting cyanotoxin concentrations.

To determine the potential contribution of cyanobacteria, much can be done: from simple microscopy to mass spectrometric identification of the toxins present, depending on the information required by users. Methods for the preservation of small volumes of cyanobacteria for later identification under the microscope exist including the use of Lugols Iodine or 1% (v/v) formaldehyde (Meriluoto and Codd, 2005). Although these reagents denature cyanotoxins and other metabolites, they preserve cyanobacterial cell morphology for later identification. However, if potential or actual cyanotoxin production is to be determined, temporary storage of the cyanobacteria is necessary. Although cyanobacteria are generally blue-green or green in colour, some genera such as *Phormidium* are often dark brown and macro-structures containing this cyanobacterial genus often resemble mud. This filamentous cyanobacterium can be observed under the microscope and examples of photomicrographs are given by Krienitz *et al.* (2003).

The techniques used to collect cyanobacterial samples often vary with respect to the collection of scums and mats and cyanobacteria-containing water samples. As research into the analysis of cyanotoxins and the potential for cyanotoxin production increases, it should be expected that reduced volumes of cyanobacterial samples can be taken. Examples of the appropriate volumes for various cyanobacterial sample scenarios are given below.

Lesser Flamingo samples
Cyanotoxins have tissue, organ and biochemical targets. Only a limited number of different tissue types need be taken to assess whether cyanotoxins have been ingested or metabolised by the flamingos. In assessing exposure to cyanotoxins, the digestive tract will most likely contain ingested cyanobacterial filaments and/or colonies which can be analysed for the toxins. The liver is a major target organ for microcystins. Some cyanotoxins are more stable than others and efforts should be made to minimise potential degradation after taking environmental and tissue samples. Most likely, samples stored in dark and cold conditions will be better preserved when subsequently analysed. If cold and dark conditions cannot be achieved, then storage under methanol or ethanol can be used to preserve tissues and minimise toxin degradation and/or transformation before tissues are analysed. In terms of the quantities required, 1-2 ml of bloom, scum or mat material can be used for the identification of cyanobacterial genera and for genetic analysis. For cyanotoxin analysis, as much material as possible is usually better and often this should be of the order of a few grams wet weight.

Safety considerations
As there is potential for the presence of cyanotoxins in addition to other microbiological and toxicological hazards in cyanobacterial water and Lesser Flamingo tissue samples, precautions should be taken to prevent potential intoxication by cyanotoxins. Normal care and common sense will help to ensure safe cyanobacterial sampling along with practices including washing hands after sampling and before eating and drinking. The use of safety equipment including

rubber gloves and face masks will also help to minimise health risks during environmental sampling and to scientists actively engaged in such research (see Meriluoto and Codd, 2005).

Sample collection and treatment

1. Cyanobacterial scum and mat samples : if available at least 100 ml from the waterbody or shoreline, divided into:

    i. 2-3 ml, cooled (e.g. in a domestic cool box, with chiller pacs but not frozen) if possible for microscopy, genetic analysis and laboratory culture.
    ii. 1-2 ml plus formaldehyde to a final concentration of about 1% (v/v) or a few drops of Lugol's Iodine, for cyanobacterial identification.
    iii. at least 100 ml to be either frozen or freeze-dried for toxicity assessment and analysis. If freezing or freeze-drying is not possible, preservation of scum with methanol (about four volumes of methanol to one of scum) will minimise cyanotoxin degradation.

2. Water or bloom samples: 2-3 L of water or bloom , divided into:

    i. 2-3 ml cooled (to domestic refrigerator temperature e.g. about 4ºC) if possible for microscopy, genetic analysis and laboratory culture.
    ii. 1-2 ml plus two or three drops of formaldehyde or Lugol's Iodine (Meriluoto and Codd, 2005) for species identification.
    iii. about 2.5 L, cooled if possible as in 2 (i) for cyanotoxin analysis.

3. Cell-bound cyanotoxins can also be analysed from dried filter discs (Meriluoto and codd, 2005). This is sometimes more convenient when facilities are limited and known volumes of water or bloom samples can be filtered through glass fibre filters. These filters should be protected from strong sunlight (to avoid cyanotoxin photodegradation), and air-dried or freeze-dried for extraction or transportation and stored in a deep freeze (at about -20ºC) whenever possible, although air dried filter discs of cyanobacteria have successfully been used for the analysis of microcystins and may be more amenable to studies of East African Rift Valley lakes.

Non-invasive methods: analysis of feathers

Much of the research on the role of cyanotoxins in Lesser Flamingo mass mortalities has involved post-mortem tissues. The cyanotoxin concentrations subsequently determined in tissues from natural poisonings are usually compared to results of quantitative animal toxicity studies with cyanotoxins to determine their significance. In the case of the Lesser Flamingo, which consumes cyanobacteria as the major part of the diet (potentially including toxic genera), non-invasive and humane methods to determine the concentration of cyanotoxins present and to monitor live populations are now possible.

Recent research has shown that cyanotoxins accumulate in Lesser Flamingo feathers (Metcalf *et al.,* 2006a). Of the feathers analysed from the head, breast and wing, the latter were found to contain the highest concentrations of microcystins and anatoxin-a (up to 30µg g^{-1} feather). Furthermore, as the cyanotoxin concentrations in feathers is derived from that in the blood (Metcalf *et al.,* 2006a) it is possible that analysis of blood may also be useful to determine cyanotoxin exposure and concentrations. However, at present this remains untested.

A further means of obtaining information about the exposure of Lesser Flamingos to cyanotoxins is via the removal of cyanobacterial material adhering to the skin and bills of the birds, in addition to feathers. This has proved useful in investigations concerning dog deaths and cyanobacterial toxins, with dogs consuming toxic cyanobacteria adhering to the fur through self-cleaning. If necessary, dried cyanobacteria could be removed from the Lesser Flamingo's body for preservation and analysis. However at present, feather analysis seems to be a useful tool to monitor Lesser Flamingo populations with respect to the risks posed by cyanotoxins. Cyanotoxin analysis with single feathers has been successful although multiple feathers would increase analytical sensitivity and feathers should primarily be taken from the wing or breast (Metcalf *et al.,* 2006a).

Communication and transportation

It is important when investigating mass mortalities of Lesser Flamingos, and trying to examine proximal causes, that good communication between interested parties and the efficient transportation and analysis of samples occurs. Apart from communication between scientists, veterinarians, wildlife and government officials, and rapid and informed responses to potential mass mortalities involving cyanobacterial toxins, the main problem in terms of cyanobacteria, water and tissue animal samples is the preservation of the cyanotoxins for transportation and storage before they can be analysed. This arises from a need to preserve cyanotoxins for analysis and minimising risks presented by pathogens, including bacteria and viruses, which may also cause delays in the transportation of samples. Other requirements, including appropriate licenses, e.g. CITES, will require due attention. These important needs may prohibit or delay transportation of certain samples, in addition to the possible restrictions with respect to toxicity (Metcalf *et al.,* 2006b).

Future needs

Further research is required to investigate the role of cyanotoxins in the mass mortalities of Lesser Flamingos and the interaction of these toxins with other possible causes or contributors to the mass mortalities. In addition, information is needed regarding cyanotoxins in apparently healthy bird populations and on environmental cyanotoxin concentrations to help elucidate the role of these toxicants in the ecology of the Lesser Flamingo and other flamingo species.

Acknowledgements

We thank all relevant Government and funding agencies, persons and parties which have supported research concerning cyanotoxins. In addition, we expressly thank Drs. Lothar Krienitz, Stephan Pflugmacher and Claudia Wiegand for their advice, support and assistance.

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OTHER NEWS

New Ramsar sites in Tunisia: recognition of prime flamingo habitats

Tunisia is a country of major importance for the Mediterranean meta-population of Greater Flamingo. Following (increasingly infrequent) wet winters in the south of the country (*e.g.* 1969/70, 1973/74, 1989/90), large breeding colonies occur on the natural salt lakes on the steppe-desert edge. 25-40k Greater Flamingos from the breeding colonies in southern Europe (Spain, France, Italy and Turkey) winter annually in wetlands throughout the country and juveniles born in the European colonies often spend their first three-four years there, making Tunisia the kindergarten for Mediterranean flamingos.

In 1980, Tunisia was one of the very first African countries to join the Ramsar Convention, with the designation of Lake Ichkeul as a Ramsar "Wetlands of International Importance". Lake Ichkeul lies within a large freshwater ecosystem that is important for the flamingos, especially in late summer when hatching *Artemia* provide ideal feeding conditions. In the 1990s, this ecosystem was severely affected by construction of dams on inflow rivers and by a series of winters of poor rainfall, leading to increased evaporation, massive increases in salinity and consequent die-off of vegetation. Fortunately, a series of wet winters and imaginative conservation measures have greatly improved the situation at Lake Ichkeul.

Recently, the Tunisian authorities decided to nominate an additional 19 sites that represent the wealth and variety of Tunisian wetlands and are spread throughout the country. They include peat bogs in the northern forested areas, the delta of the Medjerda River, (the country's largest), a number of Mediterranean coastal lagoons, a series of "sebkhas" (large salt basins where water collects in winter and which are probably the most characteristic North African wetland type), large areas of the tidal coastline in the Gulf of Gabes (the *only* tidal area in the Mediterranean apart from the northern Adriatic where there are substantial tidal movements), artificial wetlands like reservoirs and salt pans, and a group of small wetlands around the desert edge oases. The 19 new sites include a number of major flamingo sites: Sebkhet Sejoumi, very close to the capital, which is a major site for up to 10,000 older birds throughout the year, especially in summer when other sites dry out; the Korba Lagoons which regularly hold up to two thousand immature flamingos in summer; the salt pans at Thyna where concentrations of several thousand occur throughout the year (and where there was a small breeding colony which produced 17 young in summer 2007); the Kneiss islands, the central point of the tidal Gulf of Gabes, which regularly holds several thousand flamingos; and three tidal sites round the island of Djerba which are particularly important for young birds in winter.

The 19 new sites which will bring the number of Tunisian Ramsar site to 20, were formally declared on 7th November 2007, the twentieth anniversary of the accession of President Ben Ali, and thus contribute to a major national celebration. Now that the new sites have been formally declared, there are major challenges at national level to carry out conservation measures to ensure that the ecological character of these sites is maintained, as required by the Ramsar Convention. Mike Smart (smartmike@btinternet.com)

High-Andes Flamingo Species Action Plan Workshop

The GCFA is working with the IUCN-SSC/Wetlands International Flamingo Specialist Group (FSG) to produce Single Species Action Plans for the Andean and James' Flamingos using the CMS format. These two species are sympatric in the saline wetlands of the high Andes of Argentina, Bolivia, Chile and Peru, thus a single plan will combine activities for both species. The first workshop was held in Rosario, Argentina on 11-12 June 2007, moderated by FSG Western Hemisphere Coordinator Felicity Arengo. Specialist participants from the four range states were asked to fill out worksheets and summarize biological and population data prior to the workshop.

During the workshop these were compiled and reviewed. A thorough threats assessment using the CMS guidelines was conducted as well, and plan activities were defined by the group. Sufficient information was gathered during the workshop to produce a draft of the plan in the next few months. Felicity Arengo (farengo@amnh.org)

Network of Important Wetlands for Flamingo Conservation in South America

The GCFA and Aves Argentinas partnered with the Rio Tinto-BirdLife International Partnership Action Fund and Ramsar in 2007 to initiate project activities in relation to the definition and implementation of a Network of Priority Areas for Flamingo Conservation (see *BirdLife International - Rio Tinto partnership to focus on flamingo conservation in the high Andes*, Flamingo14: 33). The American Museum of Natural History and Wildlife Conservation Society of the US also provided support for this project. The goal of the project is to achieve sustainable and integrated conservation of wetlands of importance for Andean and James' Flamingos through the establishment of a regional network of priority sites, focusing on the high Andean wetlands, but also including key lowland sites. The long-term project will include sites in Argentina, Bolivia, Peru and Chile. During the first three years of the project we envision the development of a basic network of priority wetlands in each country where we will carry out coordinated pilot projects and activities of regional reach. Research activities scheduled for the first year include population monitoring through focused censuses at key sites, satellite tracking of individual Andean Flamingos, and banding of Andean and James' Flamingo chicks. We have contributed directly to flamingo protection on the ground through thorough monitoring of nesting colonies and also provided invaluable data on health status of flamingos.

Within the context of this project, the GCFA convened the First Wetland Network Meeting in Rosario, Argentina in June to bring together representatives and researchers from each of the priority sites to share information and begin to coalesce support and integration of this initiative. In attendance were Aves Argentinas (AvA) and GCFA members from the following institutions: Corporación Nacional Forestal-CONAF (National Forestry Corporation), Chile; Fundación Yuchán, Argentina; Centro de Investigaciones en Biodiversidad y Ambiente-ECOSUR (Center for Research in Biodiversity and Environment), Argentina; Administración de Parques Nacionales-APN (National Park Administration), Argentina; Universidad Nacional de Salta – UNSa (Salta National University), Argentina, Universidad Nacional de Córdoba (Córdoba National University), Argentina; Centro de Estudios en Biología Teórica y Aplicada-BIOTA (Center for Studies in Theoretical and Applied Biology), Bolivia; Dirección General de Biodiversidad-DGB (General Directorate for Biodiversity), Bolivia; The American Museum of Natural History (AMNH), USA and governmental authorities from the following priority sites: Poopó, Surire, Atacama, Negro Francisco, Pozuelos, Parinas, Melincué and the representative from Minera Escondida (Punta Negra Site).

Main activities developed during this workshop were: a) Evaluation of degree of implementation of priority sites (see Research Papers and Reports, this volume); b) Identification of conservation alternatives for priority sites that lack legal protection: Las Parinas and Bañados de Rio Dulce, Argentina; Punta Negra, Chile; c) identification and planning of pilot activities for cross-border integrated conservation in Atacama, Avaroa and Vilama priority sites. During this meeting, 8 of the 14 priority sites formally declared support for the Wetland Network Project. The workshop was facilitated by Patricia Marconi of Fundación Yuchán, Argentina.
(fund_yuchan@ciudad.com.ar)

New Caribbean Flamingo conservation network launched

With encouragement from the Flamingo Specialist Group, a new organisation, the Caribbean Flamingo Network, is being formed to enhance the conservation of the Caribbean Flamingo. The objective of this alliance, which will be similar to the Greater Flamingo Network in the Mediterranean and Western Africa, is to unite the investigators working with the Caribbean Flamingo (*Phoenicopterus ruber*), to identify research priorities and to work towards their implementation. The objective would be to have a research program that approaches the problems on a regional scale.

Dr. Nancy Clum, Assistant Curator of Ornithology in the Wildlife Conservation Society (and flamingo researcher in the Bahamas) has agreed to lead the initiative, with Dr. Felicity Arengo, FSG Western Hemisphere Chair acting as advisor. Although the emphasis of the group will be *in situ* work, we recognize the value of being able to study the animals in captivity, and we will invite the participation of people working with *ex-situ* populations.

The first annual meeting of the Caribbean flamingo Network will be held on 26-27 November 2007, at Ria Lagartos Bioshphere Center in Yucatan, Mexico. The goal of this meeting will be to gather researchers and other interested parties to identify and implement regional research priorities for *in situ* work on this species. Nancy Clum (nclum@wcs.org)

Con el estímulo del Grupo del Especialistas del Flamenco, una nueva organización, la Red del Flamenco del Caribe, se está formando para realzar la conservación del Flamenco del Caribe. El propósito de esta alianza, parecido al de las redes del Mediterráneo y de África Occidental para el flamenco mayor, es de reunir a los investigadores trabajando con el flamenco del Caribe (*Phoenicopterus ruber*) para identificar prioridades de investigación y trabajar hacia su implemetación. El objetivo sería de tener un programa de investigación que aborde la problemática a escala regional.

Dra. Nancy Clum, Assistant Curator of Ornithology en la Wildlife Conservation Society (e investigadora de flamencos de las Bahamas) ha convenido lidere la iniciativa, con Dra. Felicity Arengo, Coordinadora de las Americas del Grupo de Especialistas como asesora. Si bien el énfasis del grupo sería de trabajo *in situ* (en el terreno), reconocemos el valor de poder estudiar a los animales en cautiverio, por lo invitamos la participación de personas trabajando con poblaciones *ex situ*.

La primera reunión de la red de flamenco del Caribe se llevará a cabo del 27-29 de noviembre del 2007 en Yucatán, México. El objetivo de la reunión es trabajar con investigadores de la región para identificar e implementar prioridades regionales de investigación en el campo para la especie. N. Clum (nclum@wcs.org)

Advocating best-practice husbandry for flamingos

Worldwide, over 300 zoos and countless private collectors manage *ex situ* populations of flamingos. The Flamingo Specialist Group (FSG) advocates the use of best-practice techniques in caring for these captive birds and some of its UK members, in cooperation with the Wildlife Information Network (WIN) and Wildfowl & Wetlands Trust (WWT), are developing a Wildpro health and management volume for flamingos.

This volume will follow the same format as WIN's Wildpro volumes "Waterfowl: Health and Management" and "Cranes: Health and Management" (in development), with fully referenced, peer reviewed information on captive management, diseases and treatment as well as an overview of natural history. It is intended that the volume will be highly illustrated and enhanced by video clips showing bird catching and handling techniques, nest-site preparation, egg manipulation and hand-rearing methods.

Wildpro (http://www.wildlifeinformation.org/) is now “Open Access” in all Low Currency (developing) Countries. In developed countries, access is available by Institutional Subscription, or individual volumes can be purchased on CD-ROM. (Nigel.Jarrett@wwt.org.uk)

Caribbean and Chilean Flamingo breeding success at Chester Zoo, UK

Chester Zoo (North of England Zoological Society) keeps large flocks of Caribbean and Chilean Flamingos, both of which breed almost every year. During 2007, the zoo had its best ever breeding success with these two species. The Caribbean flock (77 birds) laid 23 eggs, 14 (61%) of which were fertile, whilst the Chilean flock (74 birds) laid 69 eggs, 27 (39%) of which were fertile.

The numbers of eggs laid this year were significantly greater than during any previous year in the zoo's history. For example, the previous five-year mean for the Caribbean Flamingo flock was 8.0 eggs (57.5% fertility), and for the Chilean Flamingo flock was 15.8 eggs (58.2% fertility). In 2007, there was no significant difference in fertility rate vs. the previous five-year mean for the Caribbean Flamingo eggs, but the fertility rate for the Chilean Flamingo was significantly below the previous five-year mean. Nevertheless, there were still more fertile eggs laid in 2007 than in the preceding three years combined.

Each year eggs, and the nests on which they are laid, are routinely numbered. The eggs are then removed for artificial incubation, being replaced by dummy eggs. Soon after removal from their nests, the eggs are candled to determine their fertility. The dummy eggs are then removed from nests that contained infertile eggs, to encourage re-usage of nests by other pairs. Fertile eggs are returned to their incubating parents at internal pipping so hatching and rearing occurs with the natural parents.

During 2007, determination of fertility and removal of dummy eggs from nests with infertile eggs occurred earlier than ever before; by day 4-5 of incubation. We believe it was this early recycling of nests that resulted in the improved breeding success experienced this year.

Mike Jordan (m.jordan@chesterzoo.org)

Mike Jordan

Figure 1. Caribbean Flamingo *Phoenicopterus ruber* chick on nest at Chester Zoo

Greater Flamingos *Phoenicopterus roseus* bred successfully on man-made lake in the Abu Dhabi Emirate, UAE

In April-May 2007, an apparently wild flock of approximately 250 Greater Flamingos confiscated a man-made shelter intended to provide shade for a private duck and goose collection on a private man-made lake in Abu Dhabi Emirate, and produced a crèche of ~ 100 chicks.

During a site visit on 10th May, it appeared that breeding had been asynchronous over a period of at least two months. There were chicks ranging widely in age, from newly-hatched to almost-fledged. One substantial crèche consisted of approximately 40 well-developed chicks, and a second large group of older, near-fledged chicks was also seen. Many birds were still sitting and were presumed to be incubating, although they were screened from observation by the main colony of adults. Eggs and newly hatched chicks could also be clearly seen.

The site, N 24 48 441 E 54 66 763, is on a private man-made lake of brackish water. At the end of the lake nearest the colony, salinity was 26 ppt (measured with a refractometer), and 32 ppt at the end opposite to the flamingo colony. A cursory examination of the water revealed what seemed to be the presence of low numbers of artemia, but none were caught for positive identification. The lake end nearest the colony was sampled and no artemia were seen. Observation, coupled with a conversation with one of the farm labourers suggested that no fish were present. Midges and biting insects were present in profusion, suggesting sampling of the lake bed may be useful to determine insect larvae present. Apparently, the flamingos are now fed directly in addition to whatever food they get from the duck spill-over.

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Kevin Hyland

Figure 1. Breeding site

Kevin Hyland

Figure 2. Nests, egg, newly-hatched chick and Egyptian Goose

Eagerly-awaited book on Greater Flamingos by Alan Johnson and Frank Cézilly to be published in December

The eagerly-awaited new book *The Greater Flamingo* by Alan Johnson and Frank Cézilly of Tour du Valat is expected to be available from the publisher, T. & A. D. Poyser (London) in December. *Greater Flamingo* summarises our current understanding of flamingo biology, with detailed discussions of population dynamics, evolution and systematics, migration and movements, feeding, reproductive biology and conservation, with emphasis placed on the authors' work on the famous flamingo population in the Camargue region of southern France. There is also a detailed inventory of breeding areas throughout the range, and an outline of future challenges for research.

RECENT SCIENTIFIC ARTICLES AND REPORTS

Contact corresponding authors or publishers for copies of articles and reports

Angehr, G., Schmidt, B., Njie, F., Christy, P., Gebhard, C., Tchignoumba, L. & Ombenotori, M. A. E. 2006. Bird surveys in the Gamba Complex of Protected Areas, Gabon. Bulletin of the Biological Society of Washington 12: 327-351.

Amat, J. A., Hortas, F., Arroyo, G. M., Rendón, M. A, Ramírez, J. M., Rendón-Martos, M., Pérez-Hurtado, A., & Garrido, A. 2007. Interannual variations in feeding frequencies and

food quality of greater flamingo chicks (*Phoenicopterus roseus*): Evidence from plasma chemistry and effects on body condition. Comparative Biochemistry and Physiology, Part A 147 (2007) 569–576.

Greater flamingos in southern Spain foraged in areas distant from a breeding site, spending 4–6 days in foraging areas between successive visits to the colony to feed their chicks. During four years, we took blood samples from chicks to ascertain whether there were interannual variations in several blood parameters, indicative of food quality and feeding frequencies. When the chicks were captured, 20–31% of them had their crops empty, indicating that not all chicks were fed daily. Additional evidence of variations in feeding frequencies was obtained from a principal component analysis (PCA) on plasma chemistry values, which also indicated that there were annual variations in the quality of food received by chicks. The association of cholesterol and glucose with some PC axes indicated that some chicks were experiencing fasting periods. Of all plasma metabolites considered, cholesterol was the best one to predict body condition. Greater flamingo chicks experiencing longer fasting intervals, as suggested by higher plasma levels of cholesterol, were in lower body condition. amat@ebd.csic.es

Ayache, F., Gammar, A. M. & Chaouach, M.. 2006. Environmental dynamics and conservation of the flamingo in the vicinity of Greater Tunis, Tunisia: the case study of Sebkha Essijoumi. Earth Surface Processes and Landforms 31: 1674-1684.

The flamingo *Phoenicopterus roseus* frequents Mediterranean wetlands. In recent decades, the population of this species has increased significantly in the Mediterranean region, despite the reclamation of many wetlands. The increase is thought to reflect the opportunistic behaviour of flamingos. They visit some sites more frequently than others in response to human activities such as organic pollution, conservation measures and better management of breeding areas on the northern side of the Mediterranean. Tunisian wetlands are major wintering and nursery habitats for the flamingo that in very wet years can also become important breeding areas. These areas can support up to half the population of the western Mediterranean, which is estimated at around 80 000 to 90 000 birds. To demonstrate the changes in the wintering population in Tunisia, the key site of Essijoumi, which has up to 25 000 wintering flamingos, was selected as a case study area. It has been shown that Essijoumi, an urban wetland in Tunis, has changed from a hypersaline to a brackish waterlogged site for most of the year. The change can be traced to the recent urban extension of Tunis which led to a water balance surplus due to increased runoff and decreased agricultural land in the catchment area. Organic pollution is playing a major role in the nutrification of water resources leading to better feeding habitats. This, in turn, has influenced the distribution of flamingos and the carrying capacity of the wetland. Increased water depth to about 3 m has made the northern part of Essijoumi inaccessible. However, the southern and eastern parts of this wetland have become more attractive to flamingos and to a diversity of waterfowl. Fayaches@yahoo.fr

Baitchman, E. J., Tlusty, M. F. & Murphy, H. W. 2007. Passive transfer of maternal antibodies to West Nile virus in flamingo chicks (*Phoenicopterus chilensis* and *Phoenicopterus ruber*). Journal of Zoo and Wildlife Medicine 38:337-340.

Passive transfer of maternal antibodies against West Nile virus (WNV) was studied in a captive population of Chilean (*Phoenicopterus chilensis*) and Caribbean flamingos (*Phoenicopterus ruber*). Transfer of WNV antibodies from hens to chicks was documented and measured by plaque-reduction neutralization test. Hen titers were significantly correlated to chick titers. Mean half-life of maternal WNV antibodies was 13.4 days in chicks for which half-life was measurable. ebaitchman@ZOONEWENGLAND.com

Baker, N. E., Baker, E. M., Van den Bossche, W. & Biebach, H. 2006. Movements of three Greater Flamingos *Phoenicopterus roseus* fitted with satellite transmitters in Tanzania. *Waterbirds around the world.* Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. pp. 239-244.

In April 2002, backpack PTTs were fitted to three Greater Flamingos *Phoenicopterus roseus* at two sites in northern Tanzania. To maximise battery life, the transmitters were programmed to send signals for 12 hours at intervals of 192 hours. All three batteries lasted into 2004, having provided more than 24 months of data. This paper maps the recorded movements of the three birds, comments on each individual and raises issues related
to the conservation of the species within Tanzania and Kenya. © Scottish Natural Heritage 2006. tzbirdatlas@yahoo.co.uk

Balkiz, Ö, Dano, S., Barbaud, C., Tekin, S., Özesmi U.., Dundar, M. And Béchet, A. 2007. Sexing Greater Flamingo Chicks from Feather Bulb DNA. Waterbirds 30(3): 450-453.

Adult Greater Flamingos (Phoenicopterus roseus) are sexually dimorphic, with males being on average larger and heavier than females. However, there is no practical way to sex the chicks by their morphology. Here we describe a method relying on quick and easy DNA extraction from feathers. A PCR test employing primers to amplify introns whose lengths usually differ between the CHD-W and the CHD-Z genes allow sex discrimination. This method is thus a fast, accurate and inexpensive protocol to sex flamingo chicks from feathers bulbs sampled in the field. ozge.balkiz@dogadernegi.org

Balkız Ö., Özesmi U., Pradel R., Germain C., Sıkı M., Amat J. A., Rendón-Martos M., Baccetti N., & Béchet A., 2007. Range of the Greater Flamingo, *Phoenicopterus roseus,* metapopulation in the Mediterranean: new insights from Turkey. Journal of Ornithology 148 (3): 347-355.

Metapopulation conservation should rely on a flyway approach aiming at assessing the spatial range of metapopulations by estimating the level of exchanges among local populations. In the western Mediterranean, Greater Flamingos have been shown to constitute a metapopulation with natal and breeding dispersal among colonies. In this paper, we examine whether this metapopulation reaches Turkey using a band-resighting study. Our results are the first evidence of natal and breeding dispersal from the western Mediterranean to Turkey, and suggest that the Gediz Delta, one of the two Turkish breeding colonies, can play a significant role in the recruitment of flamingos from the western Mediterranean. In 2003 and 2004, breeders of western Mediterranean origin accounted for more than 1.2 and 1.9% of the estimated breeding population of the Gediz Delta, respectively. Our observations also indicate that the western Mediterranean and Southwest Asia may constitute two sets of populations, which overlap in Turkey. Finally, the resightings of flamingos banded in Turkey show that post-fledging dispersal from Turkey reaches both the eastern and western Mediterranean wetlands. Future data on the natal and breeding dispersal of flamingos born in Turkey could clarify further the connection between Turkey and the western Mediterranean metapopulation. © Dt. Ornithologen-Gesellschaft e.V. 2007. ozge.balkiz@dogadernegi.org

Batty, M., Jarrett, N. S., Forbes, N., Brown, M. J., Standley, S., Richardson, T., Oliver, S., Ireland, B., Chalmers, K. P. & Fraser, I. 2006. Hand-rearing greater flamingos *Phoenicopterus roseus* for translocation from WWT Slimbridge to Auckland Zoo. International Zoo Yearbook 40: 261-270.

Twenty Greater flamingo *Phoenicopterus roseus* eggs, originating from a flock held at the Wildfowl & Wetlands Trust, Slimbridge, UK, were hatched in incubators. The chicks were hand-reared in a pre-export isolation facility before being successfully translocated to Auckland Zoo, New Zealand, at 33-71 days of age. At Auckland Zoo the flamingos were

held in a quarantine facility for 30 days prior to being introduced to an enclosure on view to the public. © International Zoo Yearbook. Nigel.Jarrett@wwt.org.uk

Beauchamp, G. 2006. Non-random patterns of vigilance in flocks of the greater (Caribbean) flamingo, *Phoenicopterus ruber*. Animal Behaviour 71: 593-598.

Models of vigilance in groups usually assume instantaneous randomness in scan initiation and sequential randomness in the duration of successive interscans, thus predicting a negative exponential distribution of interscan durations and no predictability in the duration of successive interscans. However, recent models suggest that scanning should instead occur regularly rather than randomly when foragers are threatened by non-observant predators, thus predicting interscans of constant duration and predictable interscan sequences. I examined whether vigilance patterns departed from instantaneous and sequential randomness in greater (Caribbean) flamingos wintering in a tropical lagoon complex in Venezuela. Predation risk in this large species is almost nonexistent, and it is argued that disturbance by people, the most probable threat, should best be detected using a regular pattern of scanning. As predicted, the distribution of interscan durations showed a strong central tendency and differed significantly from the expected negative exponential distribution. Interscan intervals of similar duration occurred in succession more often than predicted by chance. Despite obvious departures from instantaneous and sequential randomness, substantial variability remained in the distribution of interscan durations, and several interscan sequences were quite unpredictable. I relate these findings to potential variation in food supply within the confine of a flock and preemptive scans to detect potential threats. (c) 2005 The Association for the Study of Animal Behaviour. Published by Elsevier Ltd. All tights reserved. guy.beauchamp@umontreal.ca

Béchet, A. & Johnson, A. R. 2007. Anthropogenic and environmental determinants of Greater Flamingo *Phoenicopterus roseus* breeding numbers and productivity in the Camargue (Rhone delta, southern France). Ibis. http://www.doi.org/ doi: 10.1111/j.1474-919x.2007.00740.xbis

Predicting how bird populations may respond to climate change is a major challenge which could be addressed by understanding how past environmental processes have driven the variations of breeding population size and productivity. In inhabited regions, this issue may be complicated by the interference associated with heterogeneous levels of habitat management. Here, we have explored how several hydrological variables influenced the breeding of the Greater Flamingo *Phoenicopterus roseus* in the Camargue (Rhone delta, southern France) over a 28-year period (1974–2001). In this region, Flamingos breed in a commercial salt pan. They forage in both salt pans and adjacent brackish lagoons. We hypothesized that breeding numbers, productivity and body condition of chicks at fledging were influenced positively by water levels of the Vaccares, the main lagoon of the delta, in spring (water and food availability) and the Rhone discharge in winter (nutrient availability in the salt pans). We controlled for variations of the flooding date of the breeding salt pan by the salt company and the size of the breeding island. We first found the Vaccares water levels and Rhone discharge to be negatively correlated with the North Atlantic Oscillation (NAO). Secondly, the number of Flamingo breeding pairs (range 3560–22 200) increased by 1767 ± 1418 (95% CI) with a 10-day advance of the flooding date of the breeding salt pan and by 1146 ± 1081 per 10-cm water level rise in the Vaccares. Productivity was 0.46 ± 0.41 chicks per pair and could not be explained by any of the variables considered. Finally, chick body condition decreased with the number of breeding pairs and Rhone discharge. Our results show that (1) this intensely managed system remains sensitive to large-scale climate variations, (2) the breeding of the Greater Flamingo is affected by both climate variations and management of the salt pan, and (3) the expected enhancement of delta productivity by high river discharge was absent, probably prevented by dykes and embankments along the river. The response of bird populations to climate variations can thus be complex in intensely managed biological systems as found in the Mediterranean. We encourage pursuing such analyses incorporating anthropogenic variables explicitly in

order to expand our capacity to make inference on the future of these systems.© The authors 2007. bechet@tourduvalat.org

Bertelsen, M. F., Klausen, J., Holm, E., Grondahl, C. & Jorgensen, P. H. 2007. Serological response to vaccination against avian influenza in zoo-birds using an inactivated H5N9 vaccine. Vaccine 25: 4345-4349.

Five hundred and forty birds in three zoos were vaccinated twice against avian influenza with a 6-week interval using an inactivated H5N9 vaccine. Serological response was evaluated by hemagglutination inhibition test 4-6 weeks following the second vaccine administration. 84% of the birds seroconverted, and 76% developed a titre >= 32. The geometric mean titre after vaccination was 137. A significant species variation in response was noted; penguins, pelicans, ducks, geese, herons, Guinea fowl, cranes, cockatiels, lovebirds, and barbets showed very poor response to vaccination, while very high titres and seroconversion rates were seen in flamingos, ibis, rheas, Congo peafowl, black-winged stilts, amazon parrots, and kookaburras. (C) 2007 Elsevier Ltd. All rights reserved.

Boukhriss, J., Selmi, S., Bechet, A. & Nouira, S. 2007. Vigilance in greater flamingos wintering in southern Tunisia: Age-dependent flock size effect. Ethology 113: 377-385.

Decrease in individual vigilance with flock size is a widely recognized pattern in group-living species. However such a relationship may be affected by other factors, such as age and flock composition. For instance, because young animals generally lack experience and have higher nutritional needs than adults, they can be expected not only to be less vigilant than adults but also to decrease their vigilance level by a greater extent when flock size increases than adults do. We investigated this issue using data on greater flamingos wintering in the Gulf of Gabes, in southern Tunisia. Flamingos tended to congregate in small single-age flocks for feeding, but as flock size increased, flocks became mixed. We found that when flock size increased, young flamingos significantly decreased their vigilance time, while adult did not, suggesting an age-dependent flock size effect on vigilance. However, when flock composition (single-age vs. mixed) was taken into account, a more complex pattern was found. Within single-age and small flocks, no difference was found between young flamingos and adult ones regarding their vigilance level and their response to increasing flock size. However, within mixed and large flocks, adult flamingos were more vigilant than young ones, while variation in flock size did not result in a significant change in vigilance. These results suggest that young birds relied on the presence of adults, and hence more experienced individuals in detecting dangers, to reduce their vigilance and to increase their foraging time in order to satisfy their higher nutritional requirements. They could also be interpreted as a possible consequence of increasing competition with flock size which constrained more nutritionally stressed young flamingos to increase their foraging time to the detriment of vigilance. slah_selmi@yahoo.fr

Caziani, S. M., Rocha Olivio, O., Rodri´guez Rami´rez, E., Romano, M., Derlindati, E. J., Ta´lamo, A., Ricalde, D., Quiroga, C., Contreras, J. P. Valqui, M. & Sosa, H. 2007. Seasonal distribution, abundance and nesting of Puna, Andean and Chilean Flamingos. The Condor 109: 276–287.

Of the world's six flamingo species, the rarest and least known are the Puna Flamingo (*Phoenicoparrus jamesi*) and the Andean Flamingo (*P. andinus*). These two species coexist with the more common Chilean Flamingo (*Phoenicopterus chilensis*) throughout much of their range. We conducted four simultaneous surveys from 1997 to 2001 (two in summer and two in winter) to estimate the distribution and abundance of all three species in Argentina, Bolivia, Chile, and Peru, at a regional scale. Of 224 wetlands surveyed, 179 had flamingos; 63% of these were in the high Andes (above 4000 m), 25% were in the puna (3000 to 4000 m), and the remainder were in lowlands (below 3000 m). Maximum counts were 64 000 Puna Flamingos (summer 1998), 34 000 Andean Flamingos (summer

1997), and 83 000 Chilean Flamingos (winter 1998). In summer, Puna Flamingos congregated at wetlands in the high Andes, with 50% of the population in just three lakes: Colorada, Grande, and Vilama. Andean Flamingos were more uniformly distributed across a broader elevational range (2500 m), and Chilean Flamingos showed a heterogeneous distribution pattern. In winter, all species moved to lower latitudes within the high Andes and to lower altitudes on the central plains of Argentina. The most important nesting wetlands were Colorada, in Bolivia, for the Puna Flamingo, Surire and Atacama, in Chile, for the Andean Flamingo, and Surire for the Chilean Flamingo. We recommend continued monitoring through simultaneous summer surveys, and a conservation strategy that considers the large spatial and temporal scales at which these species operate, including their seasonal migrations. dvazquez@unsa.edu.ar

Childress, B., Hughes, B., Harper, D., Van den Bossche, W., Berthold, P. & Querner, U. 2006. Satellite tracking documents the East African flyway and key site network of the Lesser Flamingo *Phoenicopterus minor*. *Waterbirds around the world.* Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. pp. 234-238.

The itinerant Lesser Flamingo *Phoenicopterus minor* is dependent on a network of specialized sites for its survival. To study the movements of individual birds and define this network in East Africa, four adult male Lesser Flamingos were tagged with satellite transmitters (PTTs) at Lake Bogoria, Kenya, in October 2002. During the first 15 months, there was no significant difference in the length of their inter-lake flights. However, there were significant differences in the number of flights and the number of days spent at each stopover. One bird flew 2 964 km, making 20 visits to eight different lakes (mean stay 21.8 days), while another made 18 visits to six different lakes (mean stay 24.1 days), flying 3 012 km. A third bird moved among lakes 70 times, visiting 11 different lakes (mean stay 6.4 days) and flew 7 870 km. The fourth bird's PTT stopped transmitting after 38 days. There were no flights outside East Africa. The flyway for the Lesser Flamingo in East Africa consisted of a 940 km north-south range between Lake Logipi, Kenya, and Lake Bahi, Tanzania. The network of sites used by the study birds consisted of nine alkaline lakes in Kenya and Tanzania. The conservation status of these nine sites varies from well-protected to completely unprotected. Brooks.Childress@wwt.org.uk

Childress, B., Hughes, B., Harper, D. & van den Bossche, W. 2007. East African flyway and key site network of the Lesser Flamingo (*Phoenicopterus minor*) documented through satellite tracking. Ostrich 78(2): 463–468.

In October 2002, four adult Lesser Flamingos were tagged at Lake Bogoria, Kenya: two with solar-powered platform transmitter terminals (PTTs) and two with battery-powered PTTs, one of which stopped transmitting after 38d. In July 2003, an additional four birds were tagged with solar-powered PTTs. During the first two years (November 2003–October 2004), flight patterns of the tagged birds were independent. Interlake flight distances ranged from 16–441km (mean: 111.5km, n = 243), 68.3% being less than 100km and 96% less than 300km. There was no significant difference among the birds in the median length of their interlake flights. The number of days spent at each stopover ranged from 0 (less than 1d) to 153d (mean: 14.4d, n = 250). There was a significant difference among the birds in the number of days spent at each stopover. This difference was due to one very active bird that made 133 interlake flights during the period, visiting 12 different sites, spending a mean 5.2d at each site and travelling 12 600km. There was no significant difference among the other six birds. The seven birds' flights were confined to a 940km north-south range within the Great Rift Valley between Lake Logipi in northern Kenya and Bahi Swamp in central Tanzania. Their key site network consisted of eight alkaline lakes (Logipi, Bogoria, Elmenteita, Nakuru, Natron, Empakai Crater Lake, Manyara and Eyasi), and Lake Bahi, a seasonal lake in central Tanzania. The conservation status of these nine sites varies from well-protected to completely

unprotected. None of the birds appears to have bred during either the 2002–2003 or the 2003–2004 breeding seasons (October–January), although other Lesser Flamingos bred at Lake Natron during both seasons, Lake Natron being the only East African site where the Lesser Flamingo has bred successfully during the past 45 years. Copyright © NISC Pty Ltd., all rights reserved. Brooks.Childress@wwt.org.uk

Childress, B., Nagy, S. and Hughes, B. (Compilers). 2007. International Single Species Action Plan for the Conservation of the Lesser Flamingo (*Phoenicopterus minor*). AEWA Technical Series No. --. Bonn, Germany.

Although the most numerous of the world's flamingos, the Lesser Flamingo is classified "Near Threatened" in the 2006 IUCN Red List of Threatened Species, indicating that it is considered likely to qualify for a threatened category in the near future. The species is also listed in Columns A and B of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) Action Plan, Appendix II of the Bonn Convention (CMS) and Appendix II of the CITES convention. The species occurs regularly in 29 countries from West Africa, across sub-Saharan Africa and along the SW Asian coast to South Asia, and occurs as a vagrant in 25 additional countries. However, its global population is concentrated in 10 primary range states and confirmed regular breeding is confined to just five sites in four of these countries: Makgadikgadi Pans in Botswana, Etosha Pan in Namibia, Lake Natron in Tanzania, and Zinzuwadia and Purabcheria salt pans in India. The major threats to the survival of the Lesser Flamingo are the loss and/or the degradation of its specialised habitat at these key sites through altered hydrology and water quality, wetland pollution, extraction of salt and soda ash, and the disruption of its few breeding colonies by human activities. The activities identified in this plan focus on measures to address these threats and fill current knowledge gaps. © AEWA. Brooks.Childress@wwt.org.uk

Diawara, Y., Arnaud, A., Araujo, A. & Bechet, A. 2007. Nouvelles données sur la reproduction et l'hivernage des Flamants rose *Phoenicopterus roseus* en Mauritanie et confirmation d'echanges avec les colonies méditerranéennes. Malimbus 29: 31-41. (French)

New data on the breeding and wintering of Greater Flamingos *Phoenicopterus roseus* in Mauritania and confirmation of exchanges with Mediterranean colonies. The Greater Flamingo *Phoenicopterus roseus* breeds in the Mediterranean and in the coastal wetlands of Mauritania, where it is often abundant. However, the link between the birds breeding in these two areas remained unclear. We monitored Greater Flamingos in the coastal wetlands of Mauritania in 2003-4, using flight surveys and sightings of PVC-banded birds, with a mobile hide. We put the first results of this study in the perspective of the 48 years' data on this species in Mauritania. The observation of two birds which were hatched and ringed in the Mediterranean feeding chicks on the Banc d'Arguin, proves exchange between the Mediterranean and Mauritanian colonies. We discuss the implications of these results for the limits of the metapopulation of this species. Ydiawara00@yahoo.fr

Ferrell, S. T., Snowden, K., Marlar, A. B., Garner, M. & Lung, N. P. 2007. Fatal hemoprotozoal infections in multiple avian species in a Zoological Park. Journal of Zoo and Wildlife Medicine 38: 309-316.

Over a 3-yr span, two juvenile lesser flamingos (*Phoenicocopterus minor*), two green jays (*Cyanocoraxyncas glaucescens*), and two Montezuma oropendolas (*Psarocolius montezuma*) died peracutely with no premonitory signs at a zoological park in the southern United States. At necropsy, the birds were in excellent body condition. Except for one green jay, the coelomic cavities were filled with a dark serosanguineous fluid. Splenomegaly and hepatomegaly were present. The livers were tan to purple with numerous, randomly distributed red-to-black foci, ranging in size from 1 to 4 mm. The predominant histopathologic finding, except in one green jay, was large protozoal cysts in the hepatic parenchyma. Histologically, the protozoal cysts were restricted to the liver, and none were identified in the skeletal muscle, spleen, or other tissues. Frozen tissue

samples harvested at necropsy had a nested polymerase chain reaction assay performed to amplify the mitochondrial cytochrome B gene of the protozoa. The amplified gene sequences were compared with reference cytochrome B gene sequences for avian Plasmodium spp., Haemoproteus spp., and Leucocytozoon spp. The protozoal parasite within the hepatic parenchyma from the Montezuma oropendolas and the lesser flamingos was identified as Haemoproteus spp. Both green jays had Plasmodium spp. isolated from the submitted tissue samples. The peracute nature of the infections precluded any successful medical intervention, making prevention by exclusion the principal means to control hemoprotozoal transmission. There are no reports in the literature documenting identified fatal hemoprotozoal infections in oropendolas, green jays, or lesser flamingos.

Figuerola, J., Jime´nez-Clavero, M. A., Rojo, G., Go´mez-Tejedor, C. & Soriguer, R. 2007. Prevalence of West Nile virus neutralizing antibodies in colonial aquatic birds in southern Spain', Avian Pathology, 36:3, 209 – 212.

The rapid expansion of West Nile virus (WNV) throughout the New World has raised interest in understanding the population dynamics and patterns of dispersal of emerging infectious diseases by wildlife. WNV affects humans, although its main reservoirs are various species of birds. Here we analyse the prevalence of WNV-neutralizing antibodies in nearly full-grown chicks belonging to seven different species of colonial waterbirds at three localities in southern Spain. Chicks with neutralizing antibodies against WNV were detected in three species and at all three localities. However, the low antibody titres suggest the presence of antibodies is probably due to maternal transfer of antibody, presumably from exposure of the adult birds to WNV or a similar flavivirus at some stage of their lives. The analyses of the movements of tagged birds confirmed that all species with antibody visit regions that have had reports of WNV infection over the past decade. © Taylor and Francis 2007. jordi@ebd.csic.es

Guilherme, E., Aleixo, A., Guimares, J de O., Dias, P. R da F., do Amaral, P. P., Zamora, L. M. & de Souza, M. S. 2005. First record of *Phoenicoparrus jamesi* (Aves, Phoenicopteriformes) for Brazil. Ararajuba 13: 212-214.

On 28 April 2005, a small group of flamingos landed next to the runway of Rio Branco International Airport, Rio Branco, capital city of the state of Acre, Brazil. One injured individual of this group was captured, and died in captivity two days later. This individual was prepared as a study skin (MPEG 58,950) and later identified as a juvenile Puna Flamingo *Phoenicoparrus jamesi*, therefore representing the first record of this species for Brazil. Apparently, the small group of flamingos recorded at Rio Branco was deviated from its normal course by strong winds of a cold front that swept through the central Andes and western Amazonian lowlands in late April 2005.

Harebottle, D. M., Williams, T., Weiss, Y. & Tong, G. 2006. Ten years of waterbird counts on an urban wetland: Paarl Sewage Works, South Africa, 1994-2004. Journal of Ornithology 147: 179. doug@adu.uct.ac.za

Holliday, C. M., Ridgely, R. C., Balanoff, A. M. & Witmer, L. M. 2006. Cephalic vascular anatomy in flamingos (*Phoenicopterus ruber*) based on novel vascular injection and computed tomographic imaging analyses. The Anatomical Record Part A: 288A: 1031-1041.

Head vascular anatomy of the Caribbean Flamingo (*Phoenicopterus ruber*) is investigated and illustrated through the use of a differential contrast, dual vascular injection technique, and high-resolution X-ray computed tomography (CT), allowing arteries and veins to be differentiated radiographically. Vessels were digitally isolated with segmentation.

Johnson, A. & Béchet, A. 2007. The third international workshop on Greater Flamingos in the Mediterranean region and North-west Africa: summary of main outputs. Ostrich 78(2): xxv-xxvi.

The third international workshop on Greater Flamingos in the Mediterranean region and North-west Africa was held in Djerba, Tunisia, on 26 November 2004, coinciding with the 11th Pan African Ornithological Congress held the previous days. The workshop was organised by Arnaud Béchet of the Tour du Valat (Camargue, S. France) and attended by 33 participants from 10 countries. Twelve talks were given on a variety of aspects relating to conservation, monitoring and research on flamingos. The aim of the meeting was, however, above all to maintain and develop the capture-resighting programmes of chicks, banded in France, Spain, Italy including Sardinia, and Turkey, begun in 1977, for which a strong network of governmental and non-governmental organizations in these countries is now well established. The Greater Flamingo is one of the 15 species of conservation concern to the Protocol concerning Specially Protected Area (Barcelona Convention, 1976) because of the limited number of breeding places. In spite of this, the numbers of breeding pairs and of sites occupied in the Mediterranean region have both increased in recent years. bechet@tourduvalat.org

Johnson, A. & Cézilly, F. 2007. *The Greater Flamingo*. T & AD Poyser, London.

The Greater Flamingo summarises our current understanding of flamingo biology, with detailed discussions of population dynamics, evolution and systematics, migration and movements, feeding, reproductive biology and conservation, with emphasis placed on the authors' work on the famous flamingo population in the Camargue region of southern France. There is also a detailed inventory of breeding areas throughout the range, and an outline of future challenges for research.

Johnson, K. P., Kennedy, M.& McCracken, K. G. 2006. Reinterpreting the origins of flamingo lice: cospeciation or host-switching? Biology Letters 2: 275-278.

The similarity of the louse faunas of flamingos and ducks has been used as evidence that these two groups of birds are closely related. However, the realization that ducks actually are more closely related to Galliformes caused many workers to reinterpret this similarity in parasite faunas as host switching from ducks to flamingos. Recent unexpected phylogenetic results on the relationships of waterbirds and their lice call for a reinterpretation of the origins of the lice of the enigmatic flamingos. Here, we bring together new evidence on the phylogenetic relationships of flamingos and their lice and show that the lice of flamingos and grebes are closely related because their hosts share a common ancestor (cospeciation). We also demonstrate that the similarity of the louse faunas of flamingos and ducks is a result of host switching from flamingos to ducks, rather than from ducks to flamingos.

Kolodny, E. H., Zeng, B. J., Viner, T., Torres, P. A., Wang, Z. H. & Raghavan, S. S. 2006. Spontaneous appearance of Tay-Sachs disease in American (Caribbean) Flamingos. Neurology 66: 274.

Kumar, A. B. 2006. A checklist of avifauna of the Bharathapuzha river basin, Kerala, India. Zoos Print Journal 21: 2350-2355.

The Bharathapuzha river basin of Kerala state was surveyed from Parali to Purathoor estuary region during January 1998 to December 2004 period. A total of 140 species of birds in 49 families were recorded. Sixty-five per cent of the bird species recorded was resident forms and 35% migrants. In Kerala the Greater Flamingo (*Phoenicopterus roseus*) and Brahminy Shelduck (*Tadoma ferruginea*) were recorded only from the Bharathapuzha river basin. Among the bird species recorded from the Bharathapuzha basin, the Darter (*Anhinga melanogaster*), the Painted Stork (*Mycteria leucocephala*), the Oriental White

Ibis (*Threskiornis melanocephalus*) and the Black-bellied Tern (*Sterna acuticauda*) are Near Threatened. The river basin has been identified as a preferred breeding site of the Black-bellied Tern.

Martin, G. R. 2006. Visual fields and their functions in birds. Journal of Ornithology 147: 59. g.r.martin@bham.ac.uk

Mateo, R., Green, A. J., Lefranc, H., Baos, R. & Figuerola, J. 2007. Lead poisoning in wild birds from southern Spain: A comparative study of wetland areas and species affected, and trends over time. Ecotoxicology and Environmental Safety 66: 119-126.

We studied lead (Pb) shot contamination in sediments from the Guadalquivir marshes and six other closed-basin lagoons in Southern Spain that are of major importance for threatened species of waterbirds. Shot densities were relatively low in Donana, ranging from 0 to 25 shot/m(2) in the top 10 cm of, sediments. The density at Medina lagoon (Ramsar site) was 148 shot/m(2), making it the most contaminated wetland known in Europe. Densities in the other five lagoons ranged from 9 to 59 shot/m2. We studied the prevalence of ingested Pb shot in waterbirds from Donana and found a lower prevalence in ducks than previously recorded in other Spanish wetlands. Lead shot were also found embedded in tissues of some waterbirds, proving that protected species such as the greater flamingo (*Phoenicopterus roseus*) and the glossy ibis (*Plegadis falcinellus*) are subjected to illegal hunting. The prevalence of embedded shot for geese was especially high (44% for trapped birds). Lead shot were detected in 2.8% of the pellets of the Spanish imperial eagle (*Aquila adalberti*) which usually preys on geese. We found that the prevalence of ingested Pb shot in geese and in Spanish imperial eagles has significantly decreased in recent years, possibly due to restrictions on hunting activity, efforts to remove shot from a sand dune used by geese to obtain grit, and to the high rainfall in Donana during the last years that permitted waterfowl to stay more within the protected areas. (c) 2006 Elsevier Inc. All rights reserved. Rafael.Mateo@uab.es

Mlingwa, C. & Baker, N. 2006. Lesser Flamingo *Phoenicopterus minor* counts in Tanzanian soda lakes: implications for conservation. *Waterbirds around the world.* Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. pp. 230-233.

Counts of the Lesser Flamingo *Phoenicopterus minor* in Tanzanian soda lakes have been carried out since the 1960s. We present here data on population estimates for this species in Tanzania. Despite the sporadic nature of the counts, the available data indicate the nomadic nature of this species within the soda lakes in northern Tanzania. The lowest number of birds recorded was 68 163 in 1969, and the highest, 2 759 026 in 1995. The total population of the Lesser Flamingo in East Africa may be at least four million birds, if data from Kenya are included. It is evident from the data currently available that a full set of soda lakes, regardless of size, is necessary in order to secure the conservation of the Lesser Flamingo in East Africa. © Scottish Natural Heritage 2006. neilandliz@ntlword.com

Okeson, D. M., Llizo, S. Y., Miller, C. L. & Glaser, A. L. 2007. Antibody response of five bird species after vaccination with a killed West Nile virus vaccine. Journal of Zoo and Wildlife Medicine 38: 240-244.

West Nile virus has been associated with numerous bird mortalities in the United States since 1999. Five avian species at three zoological parks were selected to assess the antibody response to vaccination for West Nile virus: black-footed penguins (*Spheniscus demersus*), little blue penguins (*Eudyptula minor*), American (Caribbean) Flamingos (*Phoenicopterus ruber*), Chilean Flamingos (*Phoenicopterus chilensis*), and Attwater's prairie chickens (*Tympanuchus cupido attwateri*). All birds were vaccinated intramuscularly at least twice with a commercially available inactivated whole virus vaccine (Innovator). Significant differences in antibody titer over time were detected for black-footed penguins and both flamingo species. dokeson@cmzoo.org

Ortiz-Milan, S. M. 2006. Contribution of Industria Salinera de Yucatan (ISYSA) to the protection of the environment in the Reserve of the Biosphere Rio Lagartos, Yucatan, Mexico. In: Lekkas, T. D. & Korovessis, N. A. (eds) Proceedings of the 1st International Conference on the Ecological Importance of Solar Saltworks, October 20-22, 2006, Santorini Island, Greece. pp 141-147. Global Nest, Secretariat. Athens, Greece.

With more than 60 years of production of sea salt, the Industria Salinera de Yucatan S.A. de C.V. (ISYSA) is one of the most important Mexican companies in this heading. During these years, the production area has comprised of one of the coastal ecosystems of significant environmental characteristics. At the moment the production system is within the Ria Lagartos Reserve of the Biosphere, an area of federal protection, which counts on classification RAMSAR being a coastal wetland of international importance because it supports to a great amount of species of plants and vulnerable animals and in danger of extinction.

In this zone a great amount of migratory and resident birds comes together emphasizing by their ecological importance in the region the Caribbean Flamingo (Phoenicopterus ruber), that it has a located site of preponderant nesting area in the neighbourhood of the Las Coloradas Saltworks facilities. On the other hand, the coast that delimits the ocean with the production ponds, they are of vital importance for the nesting area of two of the most important species of marine turtles: hawksbill turtle (*Eretmochelys imbricada*) and black turtle (*Chelonia mydas*).

ISYSA comprises one of the components of users of the Reserve of the Biosphere, and like so, it must accept the fulfillment of the effective environmental laws being one of the few companies that by their dimension are located within a protected natural area. Therefore, ISYSA during many years has been it compromise with the care of the environment, recognizing that exists one narrow relation between the salt production system and its natural surroundings.

Sakellarides, T. M., Konstantinou, I. K., Hela, D. G., Lambropoulou, D., Dimou, A. & Albanis, T. A. 2006. Accumulation profiles of persistent organochlorines in liver and fat tissues of various waterbird species from Greece. Chemosphere 63: 1392-1409.

Waterbirds are particularly subject to accumulation of persistent organic pollutants (POPs) that have been shown to constitute a major hazard for this group of birds. Liver and fat tissue from ten species belonging to the orders Ciconiformes (Ardeidae, Oconfidae, Phoenicopteridae) and Pelicaniformes (Pelecanidae, Phalacrocoracidae) were used as bioindicators in order to assess environmental pollution by POPs (HCHs, DDTs, cyclodienes, PCBs) in Greek wetlands. To our knowledge, this is the first study on POPs in livers of water birds in Greece and Eastern Mediterranean area. The DDTs consisted mainly of p,p'-DDE with percentages over 60% in the great majority of the samples. The highest Sigma DDT concentrations were measured in the liver and subcutaneous fat of *Phoenicopterus ruber* and in *Ardea Purpurea* liver (15 565, 24 706 and 10 406 ng g(-1) wet weight, respectively). Low concentrations of cyclodienes (Cycls) and HCHs were detected occasionally and the contamination pattern of OCPs in most species of waterbirds followed the order Sigma DDTs > Sigma Cycls > Sigma HCHs. Individual values of total PCBs reached the levels of 4468 and 3252 ng g(-1) wet weight, for *Nycticorax nycticorax* and *Egretta garzetta* samples respectively. Some of the recorded differences in organochlorine concentrations could be due to different causes of death, with a subsequent effect on body lipid levels. Organochlorine pesticides and PCBs residues were lower than those commonly associated with mortality and reduced reproductive success in most species. However, low level exposure to these contaminants may constitute one of the many stressors that in combination could adversely affect bird populations.

Samraoui, B., Ouldjaoui, A., Boulkhssaïm, M., Houhamdi, M., Saheb, M. & Béchet, A. 2006. The first recorded reproduction of the Greater Flamingo *Phoenicopterus roseus* in Algeria: behavioural and ecological aspects. Ostrich 77(3&4): 153–159.

Following several decades of unsuccessful attempts at locating breeding colonies of the Greater Flamingo *Phoenicopterus roseus* in Algeria, breeding was recorded on a natural islet of Garaet Ezzemoul, a seasonal salt lake near the town of Aïn M'lila in the Hauts Plateaux. This successful mass breeding event by at least 5 379 breeding pairs followed two failed attempts due to human disturbance at the same site during preceding years. Egg-laying started relatively late (mid-May) with precocious pairs nesting in the middle of the islet and at a higher nest density. Estimated breeding success was notably high (~5 000 chicks) with apparent good hatching rate and chick survival. Ring sightings indicated that the breeding population was made up in part of adults born in Spain, France and Sardinia, supporting evidence of a metapopulation of nomadic birds breeding and wintering across the Mediterranean Basin. Garaet Ezzemoul does not benefit from any conservation status and is not labelled as a Ramsar site in contrast to some of the neighbouring wetlands. In the light of the key role played by this site, at the regional scale, its status should be reassessed and in view of the threats facing it, urgent conservation measures should be initiated. Local authorities have reacted swiftly in response to the discovery of the breeding colony of the Greater Flamingo, and administrative steps are being taken to formally protect Garaet Ezzemoul. Bsamraoui@yahoo.fr

Sanchez, M. I., Georgiev, B. B. & Green, A. J. 2007. Avian cestodes affect the behaviour of their intermediate host *Artemia parthenogenetica*: An experimental study. Behavioural Processes 74: 293-299.

The brine shrimp *Artemia parthenogenetica* (Crustacea, Branchiopoda) is intermediate host for several cestode species whose final hosts are waterbirds. Previous field studies have shown that brine shrimps infected with cestodes have a bright red colour and are spatially segregated in the water column. However, the ethological mechanisms explaining such field observations are unknown. Changes in appearance and behaviour induced by trophically transmitted parasites have been shown to increase the risk of predation by the final host. In this experimental study, we compared the behaviour of uninfected Artemia and those infected by avian cestodes. We found that parasitised individuals behave differently from unparasitised ones in several ways. In contrast to uninfected individuals, infected brine shrimps were photophilous and showed increased surface-swimming behaviour. These observations suggest that the modified behaviour (in addition to the bright red colour of the majority of the infected individuals) results in infected brine shrimps becoming more vulnerable to avian final hosts, which facilitates parasite transmission. We discuss our results in terms of the adaptive nature of behavioural changes and their potential implications for the hypersaline ecosystem.

Shieh, B-S., Lin, Y-H., Lee, T-W., Chang, C-C. & Cheng, K-T. 2006. Pet trade as sources of introduced bird species in Taiwan. Taiwania 51: 81-86.

Pet trade has dominated in contributing to exotic bird introductions into Taiwan. At least 290 exotic species of pet birds have been imported to Taiwan since 1994, of which 93 species have escaped from captivity and become introduced species, and 28 species have been found to breed in the wild. An estimated 32.1% of overall escaping rate was significantly higher than that suggested by Tens rule. Among 11 bird families which have at least one species breeding in the wild, the escaping rate was significantly higher for four families: Sturnidae, Timaliidae, Cacatuidae, and Pycnonotidae; and the breeding rate was significantly higher for only one family - Estrildidae. We suggest that these five families should be focused on, in future monitoring programs for risk assessment of invasive species.

Siegal-Willott, J. L., Carpenter, J. W. & Glaser, A. L. 2006. Lack of detectable antibody response in greater flamingos (*Phoenicopterus ruber*) after vaccination against West Nile virus with a killed equine vaccine. Journal of Avian Medicine and Surgery 20: 89-93.

Greater (Caribbean) flamingos (*Phoenicopterus ruber*), an endangered and popular zoo bird species, are susceptible to West Nile virus (WNV) infection, often with a fatal outcome. To determine whether vaccination of Caribbean Flamingos produced an immunologic response with measurable antibody titers and to monitor for adverse effects of vaccination on health status, a vaccine trial against WNV infection, using a killed vaccine licensed for use in horses, was performed in 1-month-old flamingo chicks. Fifteen chicks determined to be seronegative for WNV were divided into 2 groups: Group A (n = 8) received 2, 1-ml IM doses of vaccine 3 weeks apart; and Group B (n = 7) received 1, 0.5-ml IM dose, followed by 2, 1-ml IM doses, all given 3 weeks apart. A booster vaccination of 1 ml was administered to all birds 280 days after the initial vaccination series. Antibody titers were measured after the initial immunization and before and 3 weeks after the booster vaccination by plaque-reduction neutralization testing (PRNT). A positive titer at the 90% plaque-reduction cut-off was not detected after initial vaccination or booster vaccination in any of the birds studied, but serum neutralizing activity was detected in 60% of the samples after the booster at 50%-82% plaque reduction at a 1:20 dilution. No adverse effects of vaccination were observed. The lack of a demonstrable antibody response to WNV vaccination in the flamingos may be attributable to the lack of species specificity of the vaccine, poorly developed immune system in 1-month-old flamingo chicks, poor sample handling or storage, or inadequate vaccine dose volume or frequency of administration.

Smart, M., Essghaier, M. F., Etayeb, K., Hamza, A., Azafzaf, H., Baccetti, N., Du Rau, P. D. & Dlensi, H. 2006. Wetlands and wintering waterbirds in Libya, January 2005 and 2006. Wildfowl 56: 172-191.

Systematic surveys of mainly coastal wetlands in Libya were carried out for the first time in January 2005 and 2006, to identify sites of major importance for waterbirds in winter. In 2005, nearly 30,000 waterbirds were found, and in 2006 over 52,000, with large numbers of gulls recorded in both years. The surveys showed that Libyan wetlands are used by a range of species, notably the near-threatened Mediterranean endemic Audouin's Gull *Larus audouinii*, several other gull species, wildfowl and waders. Eurasian Cranes *Grus grus* were found well into the desert. Overall, Libyan wetlands are internationally important for waterbirds of Mediterranean lagoon ecosystems, including Greater Flamingo *Phoenicopterus roseus*, Kentish Plover *Charadrius alexandrinus* and Slender-billed Gull *Larus genei*. They also provide different types of typical Mediterranean wetland habitat. A number of species rarely recorded were observed, including birds new to Libya, but the Critically Endangered Slender-billed Curlew *Numenius tenuirostris* was not found. Waterbirds previously considered to winter exclusively south of the Sahara, such as Purple Heron *Ardea purpurea*, Squacco Heron *Ardeola ralloides* and Little Bittern *Ixobrgchus minutus* were also observed. Sightings of colour-ringed birds indicated that waterbirds wintering in Libya had migrated there from eastern, northern and western Eurasia. © Wildfowl & Wetlands Trust. smartmike@btinternet.com

Storer, R. W. 2006. The grebe–flamingo connection: A rebuttal. *The Auk* 123(4):1183–1184.

To a large extent, however, cladistic analyses of phylogeny overlook biology and paleontology and focus, instead, on the analysis of large numbers of characters, which are employed without regard to possible convergences. The presumption, evidently, is that if enough characters are used, any complications resulting from convergent evolution will be swamped out and thus not be significant. However, because the fewer convergent characters that are included, the more accurate the analysis will be, it follows that characters suspected of convergence should be omitted. The results of pruning may be surprising and may show why some phylogenies are far off the mark.

A recent cladistic analysis proposing a sister-group relationship between the grebes (Podicipedidae) and the flamingos (Phoenicopteridae) (Mayr 2004) exemplifies this problem. Mayr used characters described in two of my papers (Storer 1982, 2000). In the first (Storer 1982), I pointed out that in both groups (and also the tinamous, gallinaceous birds, pigeons, sandgrouse, ibises, spoonbills, some cormorants, some falcons, and four of the nine suborders of the complex order Gruiformes), variable numbers of the thoracic vertebrae are fused into a notarium. According to my understanding, this structure has arisen independently in at least 10 phylogenetic lines of birds, presumably to strengthen sections of the vertebral column. In falcons, a notarium might prevent damage from the hard jolt in striking prey on the ground. In heavy-bodied but poorly maneuverable flyers (e.g., tinamous and Galliformes—an accepted convergence—and grebes), a stronger vertebral column could be advantageous in hard landings. In flamingos, it could mitigate the tendency of the downward pull of their long legs and neck to stretch gaps between the vertebrae during flight. Whatever the selective advantage might be, the presence of a notarium is not evidence for a relationship between flamingos and grebes.

Young, H. G. & Razafindrajao, F. 2006. Lake Bedo—a little-known wetland hotspot in Madagascar. Bulletin of the African Birding Club 13 (1): 91-95.

Lake Bedo (19°55' S 44°32' E), located at mid-west of Madagascar, enters Belo-on-Tsiribihina and Morondava, is known little by foreign ornithologists visiting the country. This lake, which extends on approximately 400 ha, is however one important site for water birds, such as storks, ibis, spatulas, flamingos, will hérons, ducks (the Teal of Bernier *Anas bernieri* y is often present) and limicolous. The authors hope that the ornithological interest and the easy access to the site will attract visitors, who are invited to contribute with a better knowledge of the avifauna by sending their observations to Madagascar. Madagascar@durrell.org

Zeno, C. 2006. The ecological importance of the Margherita di Savoia Saltworks, Italy. In: Lekkas, T. D. & Korovessis, N. A. (eds) Proceedings of the 1st International Conference on the Ecological Importance of Solar Saltworks, October 20-22, 2006, Santorini Island, Greece. pp 15-24. Global Nest, Secretariat. Athens, Greece.

The Margherita di Savoia Saltworks, located in Apulia (South Italy), are the largest productive saltworks in Italy. They are connected with the Apulian wetlands, an important network thanks to its central geographic position between the east and west of the Mediterranean basin. Several species and habitats of European and international interest (Natura 2000 network, Ramsar list) are present in them. It plays a significant role as an area of stopover, wintering and breeding along the migratory routes of birds that cross the Mediterranean. The most interesting migratory and wintering species is the *Numenius tenuirostris* (slender-billed curlew), which is the bird most at risk of extinction in Europe. Moreover in the early 1990s The *Phoenicopterus roseus* (greater flamingo) has colonised the reserve in great numbers, around 6,000 today, making it the largest concentration of the species in mainland Italy. The Margherita di Savoia saltworks are entirely a man-made area, the characteristics of which (water levels, salinity) are preserved entirely due to sea salt production, which guarantees all the chemical and physical factors necessary for the survival of these habitats. It is also worth noting the type of production adopted in the saltworks, which makes it possible to recover the processing brine, thus eliminating one of the critical factors in the symbiotic relationship between salt production and environmental protection.

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