Management options for the improvement of flamingo breeding at Al Wathba Wetland Reserve

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Introduction

"The prime role of Al Wathba Wetland Reserve is to provide breeding habitat for the Greater Flamingo (Phoenicopterus ruber) as well as to conserve biodiversity in all its forms" (Perry and Kiwan 2000).

The Greater Flamingo is a common visitor in the United Arab Emirates and can be observed all year round in lagoons and mudflats of the coast (Richardson 1990). After a first breeding attempt in 1993, the Al Wathba Wetland Reserve (hereafter "Al Wathba") hosted in 1999 the first recorded breeding of the Greater Flamingo in the Arabian Peninsula since the last report from Kuwait in 1922 (Aspinall and Heyer 1999). The unsuccessful breeding attempts observed in March 2002 and November 2003 (Javed and Khan 2003) showed however that Al Wathba is a potential breeding site attracting flamingos. Flooding of the nesting island due to the accidental or natural rise of waterlevels was identified as the main reason for breeding failure in Al Wathba (Javed and Khan 2003). However, there might be other reasons that I review below with some proposals to tackle the issues on either a short-term or a long-term basis.

In flamingos, as in other colonial waterbird species, the colony dynamics, in particular the selection of the breeding site, is driven by multiple factors depending both on habitat quality and on the species (Kharitonov and Siegel-Causey 1988, Fasola and Alieri 1992, Boulinier and Lemel 1996, Erwin et al. 1998).

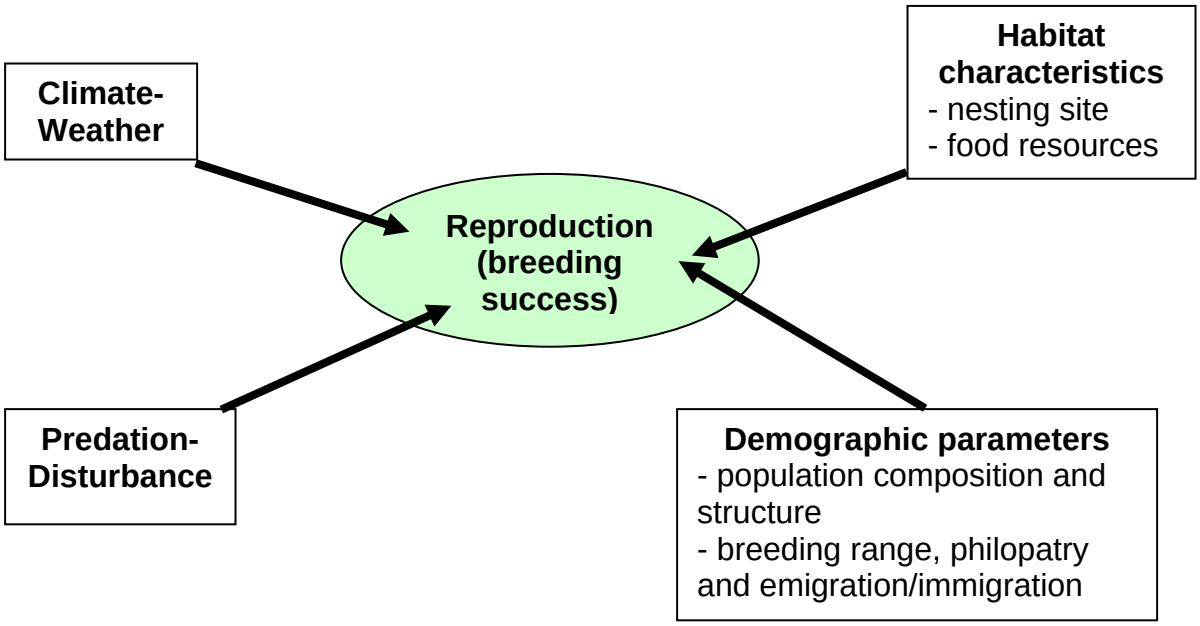

Figure 1. Parameters driving reproduction in colonial waterbirds

The **availability of food resources**, the **nesting site quality** (*e.g.* suitable island, sufficient water levels for protection against predators, etc) and the **demographic components** [*e.g.* survival rates, dispersal, philopatry, proportion of mature males and females, etc…] will directly affect colony location, colony size and reproductive parameters, *i.e.* the production of offspring (Cezilly et al. 1995, Nager et al. 1996, Hafner et al. 1998, Reed et al. 1999, Bennets et al. 2000, Kushlan and Hafner 2000, Hafner et al. 2001, Rendon et al. 2001, Fasola et al. 2002).

One of main the objectives of the Al Wathba Wetland Reserve management plan is to create and manage a suitable breeding site for flamingos (Perry and Kiwan 2000, Javed and Khan 2003). **However, before predicting any regular breeding or launching any costly management actions, it is necessary to investigate first the following questions:**

1) Is Al Wathba a suitable site for flamingo breeding?

2) Is the current Al Wathba flamingo population ready to breed?

1. Is Al Wathba a suitable site for flamingo breeding?

Habitat quality issues have been identified below.

1.1. Breeding site quality

- **Landscape characteristics of the breeding site:** Flamingos are birds from "open-landscapes": they breed in open lakes, lagoons, artificial salt pans, seashores and even freshwater marshes (Johnson 1983) and avoid closed habitats (i.e. with higher vegetation, trees, hedges, bushes) that prevent them from seeing predators and from taking-of easily (Tourenq *et al.* 2001). Successful breeding in 1998 and recent attempts in Al Wathba showed that ***the landscape characteristics of the site were not a limiting factor for the breeding of flamingos***.

- **Substrate quality of the nesting site:** Flamingos nest on low islands of mud or sand, surrounded by water, and construct a nest-mound of the material surrounding the nest. If the surface of the island is hard or dry, there will be no mound, or either no nest at all as in Mauritania and Kenya (Rendon Martos and Johnson 1996). Previous breeding attempts have shown that the soil substrate in Al Wathba is suitable to build nests. ***Nesting failure or success in Al Wathba is not linked to the substrate.*** However, experience in the Camargue, France, and Fuente de Piedra, Spain, showed that the nest building and therefore the reproduction of flamingos could be initiated and accelerated by creating artificial nests on the breeding site (Rendon Martos and Johnson 1996; pers. obs. Figure 2 & 3).

Proposed actions:

1. Creation of **artificial nests** on the previous breeding sites before flamingo breeding season

Figures 2 and 3. Creation of artificial nests on the flamingo breeding island of the Fangassier in the Camargue, France

- **Water levels around the nesting site:** Water levels around the breeding island must be sufficient to prevent any terrestrial predator intrusion but also not so high to nests flooding. Humans, foxes, dogs, wild boars, badgers, jackals, hyenas, racoons, jaguars or wild cats, are known as terrestrial predators of flamingo eggs and chicks

(Johnson 1983, Rendon Martos and Johnson 1996, Baldassarre and Arengo 2000, Nasirwa 2000). Among these, only dogs, red foxes and cats are present in Al Wathba. Dogs are the most serious threat for adult flamingos, eggs and chicks during the first weeks of nesting; once the chicks are mobile and form the crèche (age: ca 10 days), the predation impact is low. ***Previous breeding attempts by flamingos may have failed in part because of changing water levels that either flooded the nesting site, or when reduced made a link with the main land and thus, accessible to terrestrial predators (Javed and Khan 2003).*** In 2002, flamingos bred in "a peninsula" in the west part of the lake. This peninsula could be isolated from the main land by a trench (Figure 4). The method of transforming abandoned dikes into breeding island has been proven to be efficient to improve the establishment and the breeding success of waterbird colonies that were subject to predation by foxes and dogs in Mediterranean industrial salt pans (Sadoul et al. 1998).

Proposed actions:

1. **Control of water levels** during the critical phase of the breeding season (nest building to chick crèche formation)
2. **Identification of threats and control, if necessary, of potential terrestrial predators**

a) Record of signs that could help to identify the predator (tracks, faeces, etc…) in the vicinity of the breeding island and in case of predation: shape of broken shells, hairs. Some camera-traps could be installed to gain further insights on the predator identity revealed by other marks.

b) Trapping of identified predator, fencing with electric wire the area close to the breeding island

and/or

3. **Creation of an artificial island** in a safer place, *i.e.* with sufficiently high, and controlled, water belt around.

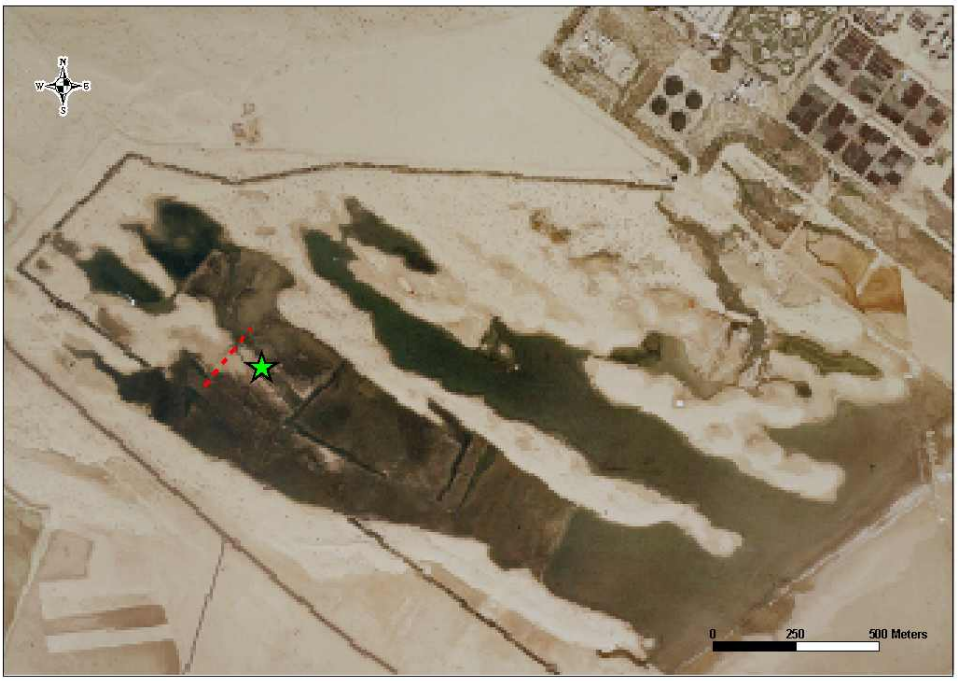

Figure 4. Historic breeding site (star) in Al Wathba. The proposed trench to isolate the breeding site from the main land is shown in red dash.

1.2. Foraging resources

Brine shrimps (Artemia spp.), one of the main food of flamingos in salt waters, is present in Al Wathba lake. Following a drastic decline of Artemia population and an algae bloom in Al Wathba in 2002, an Artemia recovery strategy and guidelines were developed through an "Artemia research project". The population of Artemia recovered, and

supposedly linked with it, the number of flamingos visiting Al Wathba increased (Drew 2003).

However, in response to the variability and unpredictability of food resources, especially in shallow waters of coastal wetlands, flamingos concentrate where food is abundant and are able to deplete their own food resources quickly and therefore, obliged to disperse. Flamingos continuously sample food patches within wetland complexes. (Baldassarre and Arengo 2000). A landscape-level approach is thus necessary when studying their foraging behaviour (Baldassarre and Arengo 2000, Tourenq et al. 2001). Flamingos in Europe are known to travel daily up to 200 km from colonies sites to find suitable foraging grounds (Johnson 1997, Rendon-Martos et al. 2000). Moreover, they are not exclusive "Artemia feeders" and feed on other preys of salt- and freshwater both, between 0.1-10 mm width, such as invertebrates (i.e. chironomidae and ephidrae larvae, oligochetes, gastropods, copepods, crustaceans, etc…), vegetable matter (seeds of aquatic plants, algae) or even small fishes (Johnson 1983, Baldassarre and Arengo 2000). Thus, the breeding success in Al Wathba may not be only linked with brine shrimp density on the site itself. Despite its Artemia resources, Al Wathba may not be sufficient to support the breeding population of flamingos and a potential breeding population in Al Wathba would be dependent on the entire coastal wetlands complex of Abu Dhabi and Dubai emirates.

Therefore, we should ask the following questions: Are the food resources in Al Wathba sufficient for the entire flamingo "population" of Al Wathba? Where do the Al Wathba flamingos forage? Are they focused on Al Wathba site, or do they expand their foraging on the coastal and estuarine inter-tidal mudflats, lagoons, lakes, etc…? Flamingos are seen foraging on lagoons and mud tidal flats along the UAE north coast shore from Sila to Ras al Khaimah (Richardson 1990, Javed pers. com., pers obs.). This habitat is currently under threat because of urbanisation and industrial development. Therefore,

the identification of key coastal foraging grounds for Al Wathba breeding flamingos might be a “plus” for the Abu Dhabi Coastal Protected Areas project by TERC in preparation (Kiwan et al. 2003).

Proposed actions:

1. **Monitoring of the foraging resources in Al Wathba (*i.e*. Artemia).** This is currently done by TERC’s ADBS team.
2. **Identification of potential foraging grounds for flamingos around Al Wathba** by:
   - **a) Mapping** (with satellite images, maps and ArcGIS)
   - **b) Regular visits or aerial surveys** of these sites (flamingo counts)
3. **Individualisation of potential breeders** by:

a) Ringing/tagging with engraved DARVIC (plastic) rings for reading by telescope or binoculars. Adult flamingos may be captured with leg snares, which differs from the ringing of chicks: chicks are captured before fledging at the age of ca 2 months by leading the whole crèche towards a corral established on dry land (Johnson 1983).

and/or

b) Harmless coloration using, for example, picric acid (easy spotting by binoculars or by plane). This has been successfully used in the Camargue to asses the distribution of breeders around the colony. No need to capture birds that can be sprayed from a floating hide used to approach birds without scaring them.

and/or

c) Satellite tracking that has been successfully experimented in Spain. Adult flamingos may be captured with leg snares.

1.3. Predation/disturbance

Despite the fact that flamingos are commonly observed to forage close to human settlements or activities, (near highways, suburbs, industrial areas, in sewage basins or salt pans, etc…), **they are very sensitive to disturbance and predation when breeding**. Terrestrial predator pressure was evoked in 1.1. Large seabirds, gulls, marabou storks, eagles have been reported to be active predators of flamingos nests worldwide (Johnson 1983, Baldassarre and Arengo 2000, Nasirwa 2000). Moreover, disturbance by terrestrial (including man for photography or egg collecting) predators can lead to the temporary desertion of the nesting site (Johnson 1983, pers. obs.), which is thereafter accessible to scavengers such as crows, gulls or even Egyptian vultures in Africa (*Nephron percnopterus)*. According to field observations by TERC staff, Lesser Black-backed Gulls (*Larus fuscus*) present in Al Wathba did not show interest in flamingos breeding (S. Javed, pers. com.), and Al Wathba is theoretically safe from any human disturbance.

Proposed actions:

1. **Prevention of any human disturbance** by creation of a security perimeter around the nesting spot, **forbidden to any public** (photographer, scholars, etc…) during the early stage of reproduction **(from nest building to chicks crèche formation)**

1.4. Weather and Climate

Rain, cold, and drought have an impact on flamingo reproduction directly on the potential breeders or their offspring, or indirectly, on the access to food resources (Johnson 1983,

Cezilly et al. 1996). Heavy and continuous rain during the first stage of reproduction (nest building to egg laying) can directly lead to asphyxia of eggs, eggs and adults gluing to nest mud and therefore nesting failure (pers. obs.) or indirectly to the flooding of the nesting island by a rise of water levels (Rendon Martos and Johnson 1996). The probability of such a climatic event in Al Wathba is very low but nevertheless uncontrollable; however previous observations showed that Arabian Gulf storms could suddenly raise the water table in Al Wathba (Javed and Khan 2003). On the other hand, pronounced and early drought could decrease the water levels and make the breeding island accessible to terrestrial predators. Suitable and vital foraging grounds for flamingos could also dry up quickly due to drought.

Proposed actions:

1. **Control of water levels** during the critical phase of the breeding season (nest building to chick crèche formation)

or

2. **Creation of an artificial island in a safer place**
3. **Monitoring of foraging grounds of Al Wathba's flamingos** around the colony: record/mapping of flooded areas, counts of flamingos.

2. Is the Al Wathba flamingo population ready to breed?

Despite flamingos attempts to breed in the past, nothing is known about the composition and structure of the groups of individuals at Al Wathba. **Are the birds mature to assure**

a successful breeding? Where do Al Wathba flamingos come from? Are they the same individuals year after year?

Demographic parameters issues are identified below:

2.1. Population composition, structure and density

Flamingos are strongly gregarious birds: they breed in dense colonies and usually make communal displays in large flocks in the vicinity of their breeding site. Thereafter, once they are paired, the pair isolates and copulation occurs (Johnson 1983, Rendon Martos and Johnson 1996, Studer-Thiersch 2000). Therefore, there might be a minimal density and group composition to ensure the start of breeding. Moreover, since the Greater Flamingo is a long-living species (> 60 years in captivity, 40 years in the wild), the age of first breeding is high: it may be 3 years but this is exceptional and the majority of first attempt occurs generally between 5 and 10 years of age (Johnson 2000). Rendon et al. (2001) showed that younger individuals were displaced from good to lower-quality breeding sites. The presence of juveniles in their first year (up to 60% of the flocks; pers. obs.) and previous rings recoveries (Jennings pers. com.) shows that there is an influx of migrants from Iran, Turkey or ex-USSR (closest breeding sites). But there might be also a continuous mix and turn-over of these migrants with nomadic birds from other GCC countries (Oman, Yemen, Saudi Arabia, Kuwait) that are either not mature or fit for reproduction on northern colony sites (Johnson 2000, Rendon et al. 2001). It is thus important to know the composition and the structure of the flamingo groups in Al Wathba.

Therefore, we may ask **whether flamingos are observed displaying and copulating in Al Wathba or nearby? Is the density of birds, the proportion of males and**

females and the proportion of adults in Al Wathba sufficient to establish a breeding population?

Proposed actions:

1. **Analysis of data** recorded by TERC staff
2. **Flamingo counts**
3. **Age structure assessment of groups** by plumage description according to Johnson et al. (1993)
4. **Sex-ratio assessment of groups by size differences** (females and males are easily distinguished by their size: males are taller than females, Johnson 1983).
5. **Monitoring of location and date of displays, pair formations and copulations**

2.2. Breeding range of the species, philopatry and emigration/immigration processes

Flamingos show a strong fidelity to their breeding and wintering grounds (philopatry; Nager et al. 1996, Johnson 2000). However, studies on the west-Mediterranean metapopulation showed that exchanges occurred between different colonies (Johnson 2000). UAE is at the limit of the breeding range of the species in Central Asia with established population in Iran, Turkey or ex-USSR countries. Previous surveys of Al Wathba showed that the number of flamingos fluctuated according to the season (Javed and Khan 2003). As evoked above (2.1.), the flamingo population of Al Wathba may be a mixture of adult and juvenile migrants and/or GCC resident nomads. Some immatures may be also chicks born in Al Wathba in 1999. Iran scientists ringed flamingos in the past but mostly with metal rings (except in 1999 where 400 chicks were ringed in

Uromiyeh Lake) and a darvic (plastic) ringing operation was done last year (2003) on chicks in a colony of Turkey (Johnson and Bechet, pers. com.). Eighteen metal ring recoveries suggest movements from Kazakhstan and Iran (Jennings, pers. com.). However, virtually nothing is known about the movements of flamingos in Central Asia and the Gulf region in particular. To understand the breeding of flamingos in Al Wathba, it is necessary to know **the origin and movements of Al Wathba flamingos.**

Proposed actions:

1. **Individualisation of Al Wathba flamingos** by:

   a) Marking scheme with rings (spotting by telescope) or harmless colorant such as picric acid (easily spotting by binoculars or by plane)

   and/or

   b) Satellite tracking

2. **Continuous checking of rings on the tibia of (juveniles) flamingos in Al Wathba**

Summary of proposed actions

OBJECTIVE: Management of breeding of flamingos in Al Wathba

PROPOSED ACTIONS:

1) Short-term basis (for the 2004-2005 breeding season)

a) <u>Before flamingo breeding season</u>:

⇒ **enhancement of nesting** by:

- creation of artificial nests on the previous breeding sites

and/or

- creation of artificial island with safer conditions

b) <u>During breeding season</u> (from nest building to chick crèche formation):

⇒ **secure the nesting site** by:

- control of water levels

- control of predation and disturbance (including human)

2) Long-term basis (> 1 year)

a) <u>Monitoring of population structure and dynamics</u>:

- counts, age structure and sex-ratio assessment of groups

- monitoring of displays and mating behaviours

b) <u>Monitoring of flamingo movements</u>[1]:

- marking schemes and/or satellite tagging,

- mapping and monitoring of coastal foraging grounds

[1] If breeding is successful and a flamingo breeding population is established, chick ringing operations might be scheduled on an annual basis, as in the Mediterranean, to study the movements and survival rate of UAE born flamingos.

References cited

Aspinall, S. and Heyer, P. 1999. The history and development of Al Wathba lake, Abu Dhabi, Tribulus, 9: 22-25.

Baldassarre , G. A. and Arengo, F. 2000. A review of the ecology and conservation of Caribbean flamingos in Yucatan, Mexico. Waterbirds, 23: 70-79.

Bennetts, R. E., Fasola, M., Hafner, H. and Kayser, Y. 2000. Influence of environmental and density-dependent factors on reproduction of Little egrets. Auk, 117: 637-639.

Boulinier, T. and Lemel, J.-Y. 1996. Spatial and temporal variations of factors affecting breeding habitat quality in colonial birds: some consequences for dispersal and habitat selection. Acta Oecologica, 17: 531-552.

Cezilly F., Boy V., Green R.E., Hirons G.J.M. and Johnson A.R. 1995. Interannual variation in Greater Flamingo breeding success in relation to water levels. Ecology, 76: 20-26

Cezilly F., Viallefont A., Boy V., and Johnson A. 1996. Annual variation in survival and breeding probability in Greater Flamingos. Ecology, 77: 1143-1150

Drew, C. 2003. Water quality and Artemia monitoring in Al Wathba. TERC-ERWDA Internal Report, Abu Dhabi, UAE.

Erwin, R.M., Nichols, J.D., Eyler, T.B., Stotts, D.B. and Truitt, B.R. 1998. Modelling colony-site dynamics: a case study of Gull-billed terns (*Sterna nilotica*) in coastal Virginia. Auk, 115: 970-978.

Fasola, M. and Alieri, R. 1992. Conservation of heronry Ardeidae sites in North Italian agricultural landscapes. Biological Conservation, 62: 219-228.

Fasola, M., Hafner, H., Kayser, Y., Bennetts, R.E. and Cézilly, F. 2002. Individual dispersal among colonies of little egrets Egretta garzetta. Ibis, 144: 192-199

Hafner, H., Bennetts, R.E. and Kayser, Y. 2001. Changes in clutch size, brood size and number of nesting Squacco Herons (*Ardeola ralloides*) over a 32-year period in the Camargue, southern France. Ibis, 143: 11-16.

Hafner, H. and M. Fasola. 1992. The relationship between feeding habitat and colonial nesting Ardeidae. Pages 194-201 in Managing Mediterranean wetlands and their birds (C.M. Finlayson, G.E. Hollis, and

T.J. Davis Eds.). Proceedings of the Symposium of Grado, Italy, IWRB Special Publication 20, Slimbridge, U.K

Hafner, H., Kayser, Y., Boy, V., Fasola, M., Julliard, A.C., Pradel, R. and Cézilly, F. 1998. Local survival, natal dispersal and recruitment in Little Egrets *Egretta garzetta*. Journal of Avian Biology, 29: 216-227.

Javed, S. and Khan, S. 2003. Monitoring bird populations at Al Wathba Wetland Reserve. TERC-ERWDA Internal Report, Abu Dhabi, UAE.

Johnson A.R. 1983. Eco-ethologie du Flamant rose *Phoenicopterus ruber roseus* Pallas de Camargue et du Palearctique occidental. PhD, University Paul Sabatier of Toulouse, France.

Johnson, A.R. 1997. Long-term studies and conservation of Greater Flamingos in the Camargue and Mediterranean. Colonial Waterbirds, 20: 306-315.

Johnson, A.R. 2000. An overview of the greater flamingo ringing program in the Camargue (Southern France) and some aspects of the species' breeding biology studied using marked individuals. Waterbirds 23: 2-8.

Johnson A.R., Cezilly F., and Boy V. 1993. Plumage development and maturation in the Greater Flamingo *Phoenicopterus ruber roseus*. Ardea, 81: 25-33.

Kiwan, K., Brown, G., Javed, S. and Drew, C. 2003. Abu Dhabi Coastal Protected Areas. Abu Dhabi Coastline Rapid Assessment. TERC-ERWDA Internal Report, Abu Dhabi, UAE.

Kharitonov, S.P. and Siegel-Causey, D. 1988. Colony formation in seabirds. Current Ornithology, 5: 223-272.

Kushlan, J.A. and Hafner, H. (Eds.). 2000. Heron Conservation. Academic Press, London.

Nager, R., Johnson, A.R., Boy, V., Rendon-Martos, M., Calderon, J. and Cezilly, F. 1996. Temporal and spatial variation in dispersal in the greater flamingo (*Phoenicopterus ruber roseus*). Oecologia 107: 204-211.

Nasirwa, O. 2000. Conservation status of flamingos in Kenya. Waterbirds, 23: 47-51.

Perry, R. and Kiwan, K. 2000. Al Wathba Wetland Reserve Management Plan. ERWDA, Abu Dhabi.

Reed, M., Boulinier, T., Danchin, E. and Oring, L.W. 1999. Informed dispersal: prospecting by birds for breeding sites. Current Ornithology, 15: 189-259.

Rendon Martos, M. and Johnson, A.R. 1996. Management of nesting sites for greater flamingos. Colonial Waterbirds, 19: 167-183.

Rendon, M.A., Garrido, A., Ramirez, J.M., Rendon-Martos, M, and Amat, J.A. 2001. Despotic establishment of breeding colonies of greater flamingos, *Phoenicopterus ruber*, in southern Spain. Behavioral Ecology and Sociobiology, 50: 55-60.

Rendón-Martos, M., Vargas, J.M., Rendón, M., Garrido, A., Ramírez, J.M. 2000. Nocturnal movements of breeding greater flamingos in southern Spain. Waterbirds 23: 9-19.

Richardson, C. 1990. The birds of the United Arab Emirates. Hobby Publications, UK.

Sadoul, N., Walmsley, J. G. and Charpentier, B. 1998. Salinas and nature conservation. Conservation of Mediterranean Wetlands. MedWet/Tour du Valat, Arles, France.

Studer-Thiersch, A. 2000. What 19 years of observation on captive greater flamingos suggests about adaptations to breeding under irregular conditions. Waterbirds, 23: 150-159.

Tourenq, C., Aulagnier, S., Durieux, L., Lek, S. Mesleard, F., Johnson, A., and Martin, J.L. 2001. Identifying rice fields at risk from damage by the greater flamingo. Journal of Applied Ecology, 38: 170-179.