Flamingo Husbandry Guidelines

A Joint Effort of the AZA and EAZA
in Cooperation With WWT

Editors: Chris Brown, AZA Ciconiiformes TAG, Dallas Zoo
Catherine King, EAZA Ciconiiformes/Phoenicopteriformes EEP, Rotterdam Zoo
Copy Editors: Sherry Mossbarger, Avian Research Technician, Dallas Zoo
Janelle Barron, Management Assistant, Dallas Zoo

(This page intentionally left blank.)

Table of Contents

Preface

Due to the unreliable reproduction of flamingos in captivity, aging population, and responsibility of captive managers to no longer depend on collecting wild birds; members of the AZA Ciconiiformes TAG, EAZA Ciconiiformes/Phoenicopteriformes EEP, and Joint Management of Species (JMS) collectively agreed on the need for a guide to assist captive managers and keepers with a collaborative approach to methods for managing flamingos in captivity. The Flamingo Husbandry Guidelines represents a global collaboration with many meetings, planning, and searching for information in order to provide the most comprehensive husbandry guide for flamingo managers.

In October 1998, Wetlands International/IUCN-SSC Flamingo Specialist Group met in conjunction with the annual Waterbirds Society meeting (Miami, Florida) to develop conservation recommendations, interface with field and captive flamingo biologists, and explore opportunities for captive managers to aid in situ flamingo conservation. It was at this meeting the idea of husbandry guidelines began to take on major importance. The AZA Ciconiiformes TAG facilitated the beginning of a workshop that would include zoo and aquarium professionals from North America and Europe to come together to produce husbandry guidelines for flamingos in captivity. Christopher Brown, AZA Ciconiiformes TAG chair (Dallas Zoo, U.S.A.), Catherine E. King, EAZA Ciconiiformes/Phoenicopteriformes EEP chair (Rotterdam Zoo, The Netherlands), and Tony Richardson, then of the Wildfowl and Wetlands Trust (Slimbridge, U.K), worked cooperatively to prepare for the process. To help facilitate information gathering, chapter coordinators were identified in 1999. The coordinators built teams of interested professionals who collaborated to collect pertinent information about the art and science of flamingo management. In June 2000, a workshop was facilitated by Christopher Brown and hosted by Disney's Animal Kingdom (Orlando, Florida); with AZA Ciconiiformes TAG vice-chair, Sue Maher, acting as coordinator. Along with the chapter coordinators, zoo and aquarium flamingo managers, nutritionists, veterinarians, and keepers from all regions were invited. Catherine King represented EAZA and Tony Richardson represented JMS. Unfortunately, Mr. Richardson was unable to attend, but provided valuable information from his region.

During the meeting at Disney's Animal Kingdom, those assembled focused on the most numerous of the flamingos in captivity. The four primary flamingos in captivity, Caribbean *Phoenicopterus ruber ruber*, greater *Phoenicopterus ruber roseus*, Chilean *Phoenicopterus chilensis*, and lesser *Phoeniconaias minor* are discussed in detail. Life histories and distributions of the remaining two flamingos, the Andean *Phoenicoparrus andinus* and Puna (James) *Phoenicoparrus jamesi*, are referred to, but as their captive populations are minimal they are discussed primarily in the Introduction chapter where their conservation, and special management concerns relative to small populations are noted.

While much data have been compiled for these guidelines, there is still much to be learned about the husbandry of flamingos. It is our intention that these guidelines be the catalyst for scientific inquiry into the management of flamingos in captivity. The guidelines represents recommendations of husbandry techniques for the successful maintenance of flamingos in captivity given the scientific data currently available and the successful experiences of our colleagues. With respect to exhibit design, guidelines are given for the renovation of existing facilities or the construction of new exhibits.

Additional information concerning these recommendations may be gathered by contacting the respective Population Management Plan coordinators and/or studbook keepers. It should be emphasized that these recommendations are guidelines, and in all cases, common sense concerning enclosure design and routine captive animal management should be used. Parameters exclusive to an individual institutions and regions also need to be considered.

Our goal then was to initiate a collaborative effort by numerous zoo and aquarium professionals to compile and present the most up-to-date information possible on the art and science of captive flamingo management. We hope that this goal was met. Any comments are welcome and encouraged as this document is meant to be fluid and is intended to be updated periodically.

Acknowledgments

The editors would like to acknowledge the following people and organizations for their contributions to these guidelines:

Felicity Arengo, PhD, New World Chair for the Flamingo Specialists Group, Museum of Natural History, New York, N.Y.

Elizabeth Stevens, PhD, Vice-president Disney's Animal Kingdom, for providing the facilities, equipment, and personnel in order to make the husbandry workshop possible.

Special recognition goes to:

Yvonne Clippinger and the Columbus Zoo for providing the resources for Catherine King to travel from The Netherlands to participate in the workshop at Disney's Animal Kingdom.

Adelheid Studer-Thiersch, Basle Zoo, for her significant contributions to flamingo behavior, management, and exhibit design.

Nigel Jerrett, Wildfowl and Wetlands Trust, for providing numerous photographs in order to demonstrate management techniques and his experiences and knowledge of captive flamingo husbandry.

Kim Smith, Milwaukee County Zoo, for providing funding and dedicating staff time for the production of the guidelines.

Every one of the chapter coordinators, contributors, and husbandry workshop participants for their time, expertise and knowledge.

Fort Worth Zoo for recognizing the importance of the husbandry guidelines and providing the support to begin the process.

Dallas Zoo and Dallas Aquarium at Fair Park for dedicating staff time and resources to this important project. Especially Sherry Mossbarger, Avian Research Technician, who dedicated her spare time compiling information, proofreading, and contacting contributors.

Chapter 1

Natural History

Facilitators: Tony Richardson and Simon Pickering, Wildfowl and Wetlands Trust; Peter Shannon, San Francisco Zoo

The flamingos are a particularly distinctive group. There are many close similarities between the six forms, some of which have been studied much more extensively than others. Therefore, in many sections of these guidelines the species are treated together as this seems to be the most effective way of drawing attention to known similarities and differences between them, as well as assisting the reader in extrapolating where necessary from one species to another without excessive cross-referencing.

Taxonomy

Flamingos are among the most ancient of bird taxa. The fossil record shows the earliest forms of modern flamingos appearing 40 million years ago during an era of rapid evolution for birds as a whole. Despite the antiquity of the group, their evolutionary origins remain unclear. Sibley and Ahlquist (1990) provide an excellent summary of the attempts to classify the flamingos from the mid eighteenth century to the present. In their words “One of the most controversial and long-standing problems in avian systematics has been the relationships of the flamingos.”

Beginning with Linnaeus, morphology has always played a key role in categorizing flamingos. He placed them in the order Grallae which included spoonbills, storks, cranes, herons, and ibises -- birds with long necks and legs. In the nineteenth century, close relationships were suggested between flamingos and storks (Ciconiiformes), wildfowl (Anseriformes) and waders (Charadriformes). Evidence for one of these links is not conclusive enough to dismiss the others. Flamingos have also been considered as a sub-order of Ciconiiformes, on the basis of anatomical similarities to storks (Ciconiidae) and ibises (Threskiornithidae), though egg-white proteins suggest a link elsewhere in the Ciconiiformes with herons (Ardeidae). The wildfowl link is suggested by behavior and feather-lice, while a comparative study with the Australian Banded Stilt (*Cladorhynchus leucocephalus*) led to the suggestion that flamingos be included within Charadriformes (Olson & Feduccia, 1980). Each author had his own theories based on a few selected traits. These same affinities, however, were often used by others to argue for a different classification. For instance, webbed feet and feeding apparatus have been used to place flamingos with either Anseriformes or Charadriiformes. Internal vs. external parasites have them categorized with either Anseriformes or Ciconiiformes. Flamingo skeletal characteristics, internal organs, and feather details have similarities to the Ciconiiformes. Downy young, vocalizations, swimming behavior, and nest building techniques are similar to those found in Anseriformes. One author makes an argument for grouping flamingos with seriemas, secretary birds, and thickknees based on similarities in pelvic musculature, carotid arteries, and caeca. Even same taxonomists changed views over time and moved flamingos between groups depending on what characteristic were deemed most important at the time.

As time passed, the minutiae used to validate classifications became more detailed and included feather structure, details of musculature, presence or absence of skeletal details, arrangement of feather tracts, downy young that can swim shortly after hatch, intestinal characteristics, blood vessel arrangements, etc. Several authors have suggested that some of these shared characteristics could be attributable to evolutionary convergence rather than speciation.

In recent years, two major conflicting taxonomies focus on paleontological vs. DNA evidence for their proposed phylogeny. Olsen and Feduccia (1980) use the traditional fossil, morphologic and behavioral characteristics to argue that flamingos are derived from a flamingo-like ancestor within the charadriiformes. Sibley and Ahlquist reject this in favor of DNA analysis of related groups that place the flamingos within the Ciconiiformes.

In general, most taxonomists seem to agree that the flamingos belong somewhere between the ciconiiformes and the anseriformes with affinities to the Charadriiformes. Some place them in their own order as a compromise. However, the notion of phylogeny requires that taxa emerge from some older form and thus be the result of a splitting and subsequent divergence. Therefore, the issue of relationships to other taxa and lines of descendency remains unclear.

Despite taxonomic issues, it remains obvious that there are six different types of modern flamingo. Whereas Sibley and Ahlquist consider them closely related and place all six into a single genus *Phoenicopterus*, others continue to recognize the three traditional genera (*Phoenicopterus, Phoeniconaias*, and *Phoenicoparrus*). Some authors consider the Caribbean, greater, and Chilean to be subspecies of *Phoenicopterus*. Variations include the inclusion of the Chilean flamingo in *Phoenicopterus ruber*, and the inclusion of the lesser flamingo in *Phoenicopterus*. The greater flamingo has occasionally even been considered a separate species (*Phoenicopterus roseus*) (Walters, 1980).

Hybridization in captivity blurs the taxonomic distinctions even further. Hybrids have been produced in captive collections between Caribbean/greater, Caribbean/Chilean, Caribbean/Andean, greater/Chilean, and greater/James'. Caribbean/Chilean and greater/Chilean offspring are known to be fertile with other *Phoenicopterus* (Shannon studbooks, pers. com. Adelheid Studer-Thiersch, Philipp Kessler). At the 1973 Slimbridge meeting, participants agreed (with the exception of Jean Delacour who preferred the single genera model) to the following nomenclature (Kear 1975):

- Caribbean (*Phoenicopterus ruber ruber*) -- also known as American, Cuban, Rosy, West Indian
- Greater (*Phoenicopterus ruber roseus*) -- also known as European, *antiquorum*
- Chilean (*Phoenicopterus chilensis*)
- Lesser (*Phoeniconaias minor*)
- Andean (*Phoenicoparrus andinus*)
- James' (*Phoenicoparrus jamesi*) -- also known as Puna

Morphology

CARIBBEAN (or American or Rosy) FLAMINGO, *Phoenicopterus ruber ruber*

Coloration: Plumage is deep red-pink throughout, with the exception of the primary and most secondary flight feathers which are black (as in all species); darker and more orange than other flamingos; red deepest on wing coverts, palest on lower breast and belly. Long scapulars hang over folded wings onto flanks and tail. The bill is orange-pink with black tip. The eyes are straw colored. Legs are grayish pink with joints and feet are brighter pink.

Description: Only slightly smaller than the greater flamingo, with the largest males standing approximately 1.6m high. As with all flamingos, males are larger than females, though there is some overlap in measurements and weight. The legs and neck are very long, the feet are webbed on three toes and the hind toe is reduced. The bill is deep and de-curved. Birds from the Galapagos are said to be slightly smaller and paler and have occasionally been considered as a separate race but this distinction is not generally recognized.

GREATER FLAMINGO, *Phoenicopterus ruber roseus*

Coloration: The palest of the flamingos, the head, neck and body are white or pink; wing-coverts are red; primaries and secondaries are black. Legs are pink; bills are deep pink with black tip; and eyes are yellow.

Description: Similar in proportions to *P.r. ruber*. The largest individuals are slightly larger than P*.r. ruber*, but on average there is little difference in size between the two races. There may be more size overlap between the sexes in *P.r. roseus*.

CHILEAN FLAMINGO, *Phoenicopterus chilensis*

Coloration: Plumage of head, neck and body is pale salmon pink, deeper on lower neck and upper breast. Scapulars and long back feathers are red, also the upper and lower wing coverts. Legs are gray with contrasting red-pink feet and joints. Bills have a more extensive black tip than *P.r. ruber* or *P.r. roseus*. The base of the bill is paler, almost white and the eyes are yellow.

Description: Shorter in neck and legs than *P.r. ruber* though otherwise only slightly smaller.

ANDEAN FLAMINGO, *Phoenicoparrus andinus*

Coloration: Head, neck and upper breast are a deep mauve-pink, lower breast and back are paler pink mottled with red; wing-coverts are more heavily marked red. Remiges are black, more obviously so at rest than in other species, as not covered by back plumes. Legs are yellow; bill is black, pale yellow at base sometimes with pink flush on culmen; eyes are red-brown, with a small area of red skin on the lores.

Description: Similar in size to *P. chilensis*. No hind toe. The bill is more deeply keeled with a much finer filtering structure.

JAMES' (or Puna) FLAMINGO *Phoenicoparrus jamesi*

Coloration: Head and body are pale pink, neck often deeper pink. Upper breast is heavily spotted with red. Scapulars and wing-coverts are long, red-tipped, hanging over folded wings. Remiges, including inner secondaries, are black. Legs are orange; bill is yellow, tipped black, with red sub-terminal band on upper mandible; eyes are red-brown; lores are red and not feathered.

Description: Smaller than the preceding species but a little larger and stockier than the lesser flamingo. No hind toe.

LESSER FLAMINGO, *Phoeniconaias minor*

Coloration: Plumage is generally deep pink; wing-coverts are heavily mottled with crimson (feathers tipped crimson), crimson scapulars, black remiges. Bill is purplish, with black tip and red sub-terminal patch on lower mandible; eyes are bright orange-red; lores are purplish and not feathered; legs are dark red.

Description: The smallest flamingo.

It is generally agreed that the Caribbean flamingo is the nominate *Phoenicopterus* species. In historical zoo records, there is frequently confusion as to whether "greater flamingo" referred to Caribbean, greater, or both, especially in facilities which may have held both sub-species at some point in their history. It remains problematic that authors within the zoo community continue to incompletely identify the species with which they work. Even in the abstracts from the 1998 Flamingo Specialist Group Miami meeting, Caribbean is also called American and referred to as *P. ruber*, instead of the complete *P. ruber ruber*. In one paper, lesser flamingos are referred to as *Phoenicopterus minor*, presumably following the Sibley/Ahlquist model. The International Species Information System (ISIS) has long been a source of confusion for many species. The system is not intended to be an arbitrator of taxonomic issues but is frequently used by the zoo community as the final authority. The database merely attempts to reflect the taxonomy in use by the zoo community.

Voice

Flamingos, particularly *Phoenicopterus* species, have loud, honking, goose-like voices and are extremely vocal. The calls of the lesser flamingo are much deeper and less strident.

Longevity

Flamingos appear to be among the longest-lived birds. Many captive birds are of unknown age but Studer-Thiersch (1998) records a female greater flamingo as not only alive but breeding successfully at 53, and eight birds in the same flock have lived to at least 44 (Johnson & de Boer 1984). In another instance, a Caribbean flamingo at Philadelphia Zoo died at 44 (Duplaix-Hall & Kear 1975). There are individuals of all species at Slimbridge which are at least 20 and probably 30 years old.

Longevity records for wild birds are held by greater flamingos ringed as chicks in the Camargue. One female was resighted feeding a chick 33 years and 10 months after being ringed at a few weeks old (Johnson & de Boer 1989), and birds at least 23 years old are not uncommon (Johnson & de Boer 1984). In January 1985, almost 3000 greater flamingos were collected dead following extreme weather. Of these, 155 were ringed, including seven birds over 27 years old. The two oldest were 28 years 5 months and 30 years 4 months (Johnson & de Boer 1986).

Field Data

Zoogeography/Ecology

Ecology/Biology

Despite their fragile, exotic appearance, flamingos forage and breed in generally inhospitable habitats. They exploit habitats ranging from tropical coastal lagoons to high altitude lakes, with occurrence tied directly to food resources. They occupy large shallow lakes or lagoons, which may be alkaline, with ph value of as much as 10.5, or saline, sometimes with more than twice the salinity of seawater (del Hoyo 1992). It is in these alkaline/saline waters that each species finds its preferred food resources; however, they also require fresh water sources for drinking. Frequently, fresh water is found at inlets to salt/soda lakes or in coastal estuaries.

Flamingos are probably best known for their colonial habits both while foraging and nesting. The spectacle of hundreds of thousands of birds congregating on the African Rift Valley lakes is one of the truly spectacular sights of the natural world.

As a group, flamingos are widespread. In the Old World, they range from India, across southern Europe and down to southern Africa. In the western hemisphere, flamingos cover the Caribbean and the southern half of South America. The James' and Andean have the most restricted ranges with greaters being the most widespread.

Distribution (Ogilvie & Ogilvie 1986)

CARIBBEAN FLAMINGO, *Phoenicopterus ruber ruber*

- Bahamas, Cuba, Yucatan, Bonaire, Venezuela, Colombia. Feral in Florida. Apparently isolated population on Galapagos Islands.
- Breeds at four main sites: Greater Inagua, Bahamas; Rio Lagartos, Yucatan Peninsula, Mexico; Bonaire, Netherlands, Antilles; James Island, Galapagos, and sometimes other Galapagos islands. Birds from the Bahamas population also breed less regularly at Archipelago de Camaguey, Cuba; Acklins Island, Bahamas and in the Dominican Republic. There are regular and irregular seasonal movements from these breeding sites, with wintering flocks in the Bahamas, Cuba, Dominica and Haiti, around the coasts of the Yucatan Peninsula, and in Venezuela, Colombia and Surinam where birds from Bonaire spend the winter. Most breeding sites have some non-breeding birds present at all times of the year.

GREATER FLAMINGO, *Phoenicopterus ruber roseus*

- The most widely distributed flamingo, ranging from the western Mediterranean, where it occurs in Spain and southern France as well as in North Africa (principally Tunisia, Algeria and Morocco), into West Africa, and in the eastern Mediterranean and eastward to Iran and the former USSR, India and Sri Lanka, and also in East and Southern Africa.
- The main concentrations are in the Camargue, Provence, France; Fuente de Piedra and Coto Donana, Andalucia, Spain; Chott Djerid, Tunisia; Banc d'Arguin, Mauritania; Djoujd, Senegal; Cyprus; Tuz Golu, Turkey; Lake Rezaiyeh, Iran; Lake Tengiz, Kazakhstan;

Rann of Kutch, Bombay, India; Lakes Elmenteita and Nakuru, Rift Valley, Kenya; Lakes Natron and Magadi, Rift Valley, Tanzania and Kenya; Makgadikgadi Pan, Botswana; Etosha Pan, Namibia; Lake St. Lucia, Natal, South Africa. Most of these are breeding sites though the list also includes some major wintering sites, and there are many more sites which are used by smaller numbers of birds, or which are used less regularly.

- Most breeding sites hold some birds throughout the year, but most populations are at least partially migratory, with some of the movement patterns being more or less regular. It is obvious from ring recoveries, however, that other movements also occur involving interchange between distant populations and more irregular patterns of movement. In the Camargue, for instance, up to 25,000 birds are present in the summer but birds start to leave in September and by December only a few hundred, or at most 2000-3000 are present for the winter. First-year birds ringed as chicks in the Camargue have been recovered in Spain, Portugal, Morocco, Algeria, Tunisia, Libya, Sardinia and Italy, and older birds have also been found in Mauritania, Senegal and Turkey. Young birds assumed to be from North Africa also frequently turn up in the Camargue before the Camargue (or Spanish) young have fledged. Chicks ringed in Iran have been recovered in India, Libya and Ethiopia in their first winter.

CHILEAN FLAMINGO, *Phoenicopterus chilensis*

- The most widespread of the three South American flamingos, ranging from the highlands of central Peru to Tierra del Fuego. Breeding occurs mainly on the Andean altiplano of northern Chile and western Bolivia, also southern Peru and northwest Argentina. Major sites include Lake Junin, Peru; Salar de Uyuni and Lakes Poopo, Loromayu, Colorada and Chalviri, Bolivia; Lake Pozeulos, Argentina and Salar de Surire, Chile. There are also at least two breeding sites at lower altitudes in Argentina. Non-breeding birds may be found at other, including coastal, sites. In some areas, regular seasonal movements occur; in others, the pattern is less clear and at least some birds may be resident.

ANDEAN FLAMINGO, *Phoenicoparrus andinus*

- The Altiplano of southern Peru, northern Chile, western Bolivia and north-west Argentina, using sites in the northern part of the range of the Chilean flamingo. One regular breeding site is known, at Salar de Atacama in Chile, with breeding also recorded at other lakes in Chile, Bolivia and Argentina, usually with Chilean and/or James' flamingos. Large-scale movements occur frequently, but no regular patterns have been documented.

JAMES' FLAMINGO, *Phoenicoparrus jamesi*

- Also restricted to altiplano salt-lakes, in southern Peru, western Bolivia and the north of Chile and Argentina. Previously thought to have a much more restricted distribution than andinus, but several range extensions have been recorded more recently. J. & C. Munoz (1975) observed and photographed two birds in Chubut Province, Argentina (with Chilean flamingos) but this is well outside the normal range. No breeding site was known to ornithologists until Laguna Colorada in Bolivia was visited in 1957 (Johnson et al 1958). Other breeding sites now known include Lakes Poopo and Chalviri, and Salar de Uyuni, also in Bolivia, Lake Vilama in Argentina, and in Chile at Salar de Surire, Salar de Tara (Conway in litt.), Aguas Calientes and Lagunas Brava. Hurlbert (1982) found that this species occurred on average at higher elevations than *P. andinus*, though with considerable overlap.

LESSER FLAMINGO, *Phoeniconaias minor*

- Sub-Saharan Africa and India, often with greater flamingos. The largest flocks are found in the East African Rift Valley, particularly in the central section at Lakes Bogoria (formerly Hannington), Elmenteita, Nakuru and Magadi in Kenya, and Natron and Manyara in Tanzania, but also at Lake Rudolf in northern Kenya and Lake Abiata in Ethiopia, and farther south at Lake Rukwa in southern Tanzania and Lake Mweru in Zambia. Breeding takes place most regularly at Lake Natron, but has occurred at all these sites.
- In Southern Africa there are sizable concentrations, and breeding, at Etosha Pan in Namibia and Makarikari Pan in Botswana, and at other sites in South Africa, are also used regularly. There is one West African colony in Mauritania and one in the Rann of Kutch in north-west India. This is a regular breeding site for greater flamingos, but though lesser flamingos have been seen there with recently fledged young, nesting sites have yet to be found and may be in Pakistan (Palmes 19??). Birds are frequently recorded at the southern ends of both the Red Sea and Arabian Gulf, suggesting possible movements between the African and Asian ranges. Brown (1975) considered movements between the East and South African populations to be extremely unlikely, but Tuite (1979) believed that increased numbers at Etosha and Makarikari in the mid 1970's arose through migration from East Africa.

Migration

All flamingo species are highly nomadic with their movements apparently driven by food availability as opposed to the traditional notions of migration based on climatic changes. The greater flamingos in the Camargue region of southern France are one of the best studied populations with 15,000+ birds having been banded over the last 21 years. Along with banding projects in Spain, Iran, and Kazakhstan, 240,000+ resightings have expanded the knowledge of how far individual birds actually wander during their lifetimes (Johnson 1998). Since they are capable of such long distance movements (especially in their first five years of life), it has been proposed that greater flamingos be considered one large meta-population.

There is much less known about the movements of lesser flamingos. This is due in large part to the general inaccessibility of the breeding sites and the lack of long-term banding studies. Because of periodic rapid increases or decreases in some populations (especially the appearance of large numbers of young when no breeding was evident in the traditional nesting locations), it is suspected that the entire African continental population may be interconnected. The migratory routes are unclear but could include both direct north/south routes along the rift valley and a less direct west/south route which might explain the occasional disappearance of large numbers of birds. Since large migrations are seldom seen in daylight, it could be that they travel great distances at night to avoid daytime heat or to make use of celestial cues. Movements for African species appear to be a product of rainfall patterns that drive the prey production (and they somehow know how to follow the rains over great distances), dispersal of young, aggregation at breeding sites, and disturbance at feeding grounds. It was proposed at the 1998 Flamingo Symposium that a Pan-African survey be conducted in the year 2000 to help answer questions of population size and migration patterns

As with the lessers in Africa, it is unclear how the various major population centers of the Caribbean flamingo might be connected. Despite previous banding projects in the Bahamas, it is not known how much, if any, movement there is between this population and those in Cuba, the Yucatan, and the southern Caribbean. The Galapagos group is quite likely an isolated population without contact with the Caribbean flocks. As with other species, movement of Caribbeans is tied to food resources.

In the Andes, movement of the James' and Andean flamingos are restricted to high altitude lakes whereas Chileans seem to range much further and move from high altitude to lower altitude in search of food. Recent multi-country efforts to identify feeding and nesting sites for each species are beginning to shed light on the population numbers and movements of these species.

Habitat

Flamingos are "confined to shallow soda lakes and salt lagoons with a high pH (up to 10.5), usually barren of vegetation and surrounded by almost desert-like wastes" (Kear 1985).

The Caribbean flamingo is found on coastal mudflats and saltpans, including man-made salt works, while the greater flamingo occupies similar habitats but is also found at inland salt or alkaline lakes, some at quite high altitudes, e.g. lakes at apex. 2000m in Kenya and Lake Dasht-e-Nawar at 3100m in Afghanistan (Koning & Rooth 1975). In East Africa, the greater flamingo frequents less alkaline areas than the lesser flamingo, probably because of differences in diet, but both species regularly fly to fresh water if available to drink.

The Chilean flamingo is principally a bird of salt lakes, mainly at altitudes of 3500-4500m, but also frequents highland peat bogs and coastal mudflats. The Andean flamingo is found in the same highland habitats, while James' flamingo is confined to altiplano salt-lakes, not moving out to feed in freshwater lakes and bogs as do the other two species (McFarlane 1975).

The lesser flamingo is found in similar habitats to the greater and is possibly even more tolerant of alkaline conditions. Lake Nakuru, the main display site for lesser flamingos, has a pH of 10.5 (Hopcraft 1975), whereas pH readings of 8.6 - 8.8 have been obtained at Lake Elmenteita, the main East African breeding site for greater flamingos (Brown 1958). Berry (1975) recorded pH at 9.2 while lesser flamingos bred at Etosha - greater flamingos having bred earlier when water levels were higher- however, both species are often found together, and Brown (1958) points out that pH varies widely both spatially and temporally within a single lake.

Diet and Feeding Behavior

All flamingos have feeding structures design to filter food from the mud and water. The larger species will also choose larger food items which are selected and swallowed, bypassing the filtering mechanism. Prey availability seems to be the main factor affecting occurrence of flamingos within a habitat.

Vilina and Martinez (1998) found that the presence of James', Chilean, and Andean flamingos was correlated to food abundance within the wetland under study. Where the high Andes birds co-exist, they seem to exploit different food resources and thus do not compete. James' were the most selective in terms of habitat and were associated with shallow highly saline lakes which are rich in diatoms and cyanophytes but poor in zooplankton. Chileans are found in deep lakes with macrophytes and dense zooplankton with more diverse waterfowl communities present than at the shallow lakes. Andean flamingo populations were generally less dense than the others but typically found in lakes with intermediate characteristics (Caziani and Derlindati 1998).

Differential exploitation of food resources also holds true for the old world species. Greaters can feed throughout the water strata eating a variety of items including aquatic invertebrates, mollusks, insects, algae, and diatoms. Lesser flamingos, on the other hand, are largely dependent on blue-green algae (such as *Spirulina*) and diatoms and thus do not generally compete with greaters within the same habitat.

As in the high Andes, the concentration of birds in East Africa can be correlated with prey availability. Densities of blue-green algae, *Spirulina*, and benthic diatoms correlate to the density of lesser flamingos. The productivity and density of benthic diatoms is one to two orders of magnitude less than *Spirulina* and explains the much lower flock densities and more dispersed pattern at times when the population is dependent on benthic diatoms as its primary food resource (Tuite 1998).

Food Preference

Flamingos can be divided into two groups according to their diets: the *Phoenicopterus* species feed primarily on arthropods and mollusks, while the other species take algae and diatoms.

Important foods of the Caribbean flamingo include brine fly (*Ephydra pupae*, *Ephydra gracilis* at Bonaire), shrimps (*Artemia sp.*) and mollusks (*Cerithium lutosum*, *Gemma purpurea* and *Cerithidea costata* at Bonaire)(de Boer 1979). When these foods are not available at sufficiently high densities it will also feed on seeds of wigeon grass (*Ruppia maritima*) and tubercles of musk grass (*Chara* sp.) (Schmitz & Baldassarre 1992b) and will take amphipods and mollusks from *Ruppia* beds, and even fish when these are concentrated or disabled by falling water levels (de Boer 1979, Bildstein et al 1991). All species also obtain food by ingesting mud with a high organic content.

Artemia is also an important food for the greater flamingo in Europe (Britton et al 1986). In East Africa the copepod lovelula and chironomid larvae are the major foods. The chilean flamingo probably feeds on *Artemia*, chironomid larvae, amphipods and corixids (Hurlbert 1982).

The Andean flamingo takes diatoms and algae, particularly the large diatoms of the genus *Surirella* (Hurlbert & Chang 1983), while James' flamingo takes smaller diatoms and algae.

The lesser flamingo feeds primarily on blue-green algae, particularly *Spirulina platensis* in East Africa. At Etosha the dominant blue-green alga is *Anabaena sp.* (Berry 1975), with *Nodularia* and *Oscillatoria*, which is also present in some East African lakes. Diatoms are also taken, particularly *Navicula* in East Africa (Ridley et al 1955), which was also found at Etosha. Diatoms are thought to be a particularly important food in East Africa when *Spirulina* densities are unusually low (Tuite 1980).

Feeding Behavior

All flamingos feed mainly by filtering large numbers of their small food organisms from water or mud using their bills which are highly adapted for filter feeding. The *Phoenicopterus* species have "shallow-keeled" bills with which they take their animal prey from at or just above or below the surface of the substrate, either below water or in soft exposed mud. Of the "deep-keeled" species, *Phoenicoparrus* also feed largely at or near the mud surface, while *Phoeniconaias* feeds primarily near the water surface.

The bills of all species are held upside-down when feeding, and have "the lower jaw large and trough-like and the upper small and lid-like" (Jenkin 1957). All species also have spined or ridged tongues which act as pistons to pump food-rich mud or water through the bill and over the internal lamellae which trap food. In the shallow-keeled forms this filter network is relatively coarse, but deep-keeled species have the inner surfaces of the bill finely laminated, and lamellae at the edges to exclude large particles. In these species, the mandible is markedly keeled to fit into a "V" inside the maxilla, with the tongue running in a groove at the base of this "V".

Phoenicopterus "walk-feed", moving forward with the bill in the substrate, or "stamp-feed", treading on the spot to disturb food, and may also feed by upending while swimming. Walk-feeding is usually the most common technique (Hurlbert 1982, Bildstein et al 1991). Schmitz and Baldassarre (1992b) suggest that walk-feeding is more common where invertebrate food is plentiful, and stamp-feeding more common where food is in short supply and secondary food sources such as seeds and tubers must be exploited. This study was carried out following a hurricane which was thought to have made the (Caribbean) flamingos' usual food unobtainable. McFarlane (1975) observed Chilean flamingos at a salt lake walk-feeding in belly-deep water and stamp-feeding in shallow water.

Greater and Caribbean flamingos feed mainly at night (Rooth 1965, Studer-Thiersch 1972, Britton et al 1986). This last study, of greater flamingos feeding on *Artemia* in the Camargue, found that the prey was actually easier to collect in quantity during the day, and suggested that nocturnal feeding helped either with thermoregulation or the avoidance of human disturbance. Brown (1975) found greater flamingos to be less nocturnal than lesser flamingos in East Africa, which may suggest that disturbance is more important than thermoregulation.

The two *Phoenicoparrus* species often feed at the same lakes and with Chilean flamingos. Competition is avoided through differences in food preference, bill adaptation and feeding behavior. *P. andinus* takes diatoms over 0.8 mm in length, while *P. jamesi*, with more closely-spaced lamellae, takes items under 0.6 mm (Hurlbert 1982). Hurlbert found upending to be a common technique only in the Andean flamingo; walk-feeding was the principal method with all three species, the Chilean at 40-60 steps/minute, Andean 20-30 and James' 10-15. McFarlane also found both *Phoenicoparrus* walk-feeding with Chilean flamingos in deep and shallow water and on exposed mud.

The lesser flamingo feeds by holding its bill at the surface of the water with the mandibles partially submerged to a depth of about 3 cm. The bulbous and cellular lower mandible may act as a float to help maintain a constant feeding depth in turbulent water (Ogilvie & Ogilvie 1986). Spaces between the excluder lamellae are 1.0 x 0.4 mm and between the finest inner lamellae are only 0.01 x 0.05 mm. In East Africa feeding takes place mainly at night, probably because water conditions are usually calmer then (Brown 1975). Birds regularly swim while feeding and are thus able to use the whole area of the lakes, while greater flamingos at the same lakes feed only around the edges (Brown 1975). Brown (1958) observes that both greater, and particularly lesser flamingos, regularly go to sources of fresh water to drink and bathe, but Berry (1975) found both species, and particularly lessers, breeding successfully without access to fresh water.

Reproduction

The flamingo breeding cycle is well known and is dependent on appropriate available nesting site, temperature, and rainfall. The typical breeding cycle consists of group display, nest building, egg laying, and hatching. Since initiation of breeding seems to be dependent on these sometimes unpredictable environmental conditions, the group display presumably serves to quickly synchronize reproductive condition so that a large number of birds are in the right physiological state to nest together at the same time.

Flamingos living in areas with clearly defined seasons usually breed in spring (France, Spain) or during or after the rainy season (e.g. Etosha pan Namibia, Simmons 1996, Sambhar Lake India, Johnson 1998). High Andes species breed in January and February when temperatures are the highest. Species living in areas with constant weather can initiate breeding attempts throughout the year. Flamingos may become reproductively active as a result of an increase in rainfall which changes food quality or abundance and induces or increases flooding of the areas around breeding islands.

Traditional breeding sites are well known for some species, probably due to their consistently appropriate conditions (e.g. Lake Natron, Sua Pan, Etosha Pan in Africa, Camargue in southern France, etc.). In many other areas, breeding sites develop randomly when the conditions are suddenly appropriate.

Seasonality

The timing of breeding may depend on a number of factors, some of which are poorly understood. The greater flamingo, in the northern parts of its range, would find it impossible to breed through the winter; but in other places, and for some other species, breeding may depend on less seasonal variations in water level and chemistry which affect food supply and the availability and suitability of nest sites and material. The number of birds present may also be important, and even when all known factors appear to be favorable breeding may not take place.

In the Caribbean flamingo breeding is erratic and only loosely seasonal at some sites; on Bonaire breeding often begins in December or January, but in some years also commences in March, April, May or July, or may not occur at all (Rooth 1975, de Boer 1979).

Egg-laying in the greater flamingo has occurred in mid-February in Tunisia, early May in the Camargue, and late May in Iran and Mauritania. In East Africa it is less seasonal, at Lake Natron egg-laying usually occurs in October and November, but also in February; and at Lake Elmenteita, laying has been recorded in every month but September, December and January, with primary laying occurring in April, June and July (Brown 1975). In southern Africa, breeding is linked to seasonal rains and has occurred from February through May at Etosha (Berry 1975) and between October and April in South Africa (Broekhuysen 1975).

For the Chilean flamingo Munoz & Munoz (1975) report regular seasonal breeding in Argentinean Patagonia with laying in mid-November. Egg-laying has occurred between March and June in northern Chile (McFarlane 1975), where Conway (in litt.) found James' flamingo breeding in January. In Bolivia, Johnson et al (1958) also found *P. jamesi* breeding in January and Hurlbert (1982) found birds incubating in mid-December.

In the lesser flamingo in East Africa seasonality is not marked; eggs have been laid at Lake Natron in January, February, March, June, July, August, October, November and December (Brown & Root 1971), but breeding peaks in October and November (Brown 1975). In Mauritania, breeding has been recorded in July (Trotignon 1975) and at Etosha starting in May, with laying continuing until July (Berry 1975).

Nest

The nest is similar in all flamingo species. It consists of a mud mound with a cupped top. The next is built by both sexes, although building is often initiated by the male. Most building is performed by a bird sitting or standing on the nest drawing up material with its bill, though its mate may add material while standing beside the nest. Building may start several weeks before laying. Studer-Thiersch (1975a) examines the roles of male and female in nest-building and related behavior in a captive colony of greater flamingos.

In suitable conditions the nest may be over 30 cm high, though it is usually much lower at laying, with building continuing into and sometimes throughout incubation if suitable material is available. In some situations the mound may be important in providing protection from flooding; in others, it provides shelter from the very high temperatures sometimes experienced at the surface of the surrounding mud. Nest-building is not always followed by breeding.

Brown & Root (1971) found that lesser flamingo nest mounds varied from six to 40 cm high with basal diameter apex. 40 cm and the depression on top seven to nine inches across. The smaller nests were built from soda crystals, while the larger ones were built where mud was available. Temperature was found to be significantly lower at the top of the nests than on the surface of the surrounding mud or soda, where conditions were far too hot for successful incubation. Broekhuysen (1975) found that two samples of greater flamingo nests averaged 10.3 and 7.6 cm high, with the mean cup diameter 33.5 cm in both cases. Mean basal diameter of the lower nests was 44.4 cm.

In the greater flamingo at least breeding may occur where mud is not available, in which case the nest may be a low rim of stones and any other available debris around a shallow scrape or eggs may even be laid in natural depressions on bare rock (Scott 1975).

Flamingos are highly colonial when nesting. In South Africa several very small colonies of greater flamingos have been reported (Broekhuysen 1975), and even a successful single nest (Middlemiss 1961). Caribbean flamingo colonies on the Galapagos Islands may also consist of as few as five pairs, but colonies consisting of thousands, or in the case of the lesser flamingo sometimes hundreds of thousands, of nesting pairs are more usual. These colonies may include virtually all the birds in the area, but often the breeding birds form only a small proportion of a much larger concentration. In all species nest densities within colonies may be very high. Brown & Root (1971) noted two types of nest grouping, dictated by ground conditions. Where the mud was suitable nests would be built in clusters with five nests/m2, but where the mud was covered with a hard coat of soda nests would be arranged linearly along cracks in this coating. The breeding area was large but consisted of numbers of smaller colonies with spaces between.

Eggs

The egg in all species is a rather elongated and symmetrical oval, white or pale blue with a white chalky coating. On mud nests the egg quickly becomes heavily soiled. The yolk is deep red or orange in color. Egg dimensions are given in Reproduction, Chapter 4, Table 5.

Laying

Generally closely synchronized within a colony of several thousand birds, with late eggs often being deserted when the bulk of the birds leave the nesting area with their chicks. The dropping of eggs onto the mud around colonies is not unusual (Brown & Root 1971). The female leans forward on the nest to avoid depositing the egg over the rim (Studer-Thiersch 1975a).

Clutch Size

The normal clutch is one in all species. In studies of a number of species frequencies of two-egg clutches have been found to be 0.2-2.0%, but in no case is it known whether these clutches result from one female laying two eggs, or from two females laying in the same nest. In captivity, at least some two-egg clutches are known to originate from two females (Studer-Thiersch 1975a).

Incubation

In the lesser flamingo the incubation period is 28 days (Brown & Root 1971), 28-30 days for all other species. Incubation is shared by both sexes. Incubation shifts are variable in length, in some cases linked to the distance which the "off-duty" bird needs to fly to find food. Most authors report peaks of shift-change in the morning and late afternoon, but Brown (1958) notes decreasing regularity as incubation advances in the greater flamingo. There is no elaborate behavior at changeover. Birds arriving at the nest shake mud and water from their feet before commencing incubation.

Hatching

Flamingo chicks may call loudly, often some time before the egg is pipped externally. Hatching usually takes 24-36 hours from external pip.

Brown & Root (1971) estimated hatching success at two lesser flamingo colonies to be 85-90% and 70-80%, with failure being caused by desertion of late eggs, laying of eggs out of nests, eggs falling from nests or being lost in cracks through the collapse of nests, as well as predation.

Development

Chicks of all species hatch with pink or red legs and bills and white or pale gray down, and with eyes open. The chick stays on the nest for approximately five to eight days and is fed on crop milk by both parents, and brooded by either parent for most of this time. Chicks often eat large quantities of eggshell in the first two days if this remains in the nest.

Crop milk is a glandular secretion which is passed from the bill tip of either parent into that of the chick. In a captive greater flamingo it contained 15% fat, 8-9% protein and 0.1-0.2% carbohydrate (Studer-Thiersch 1975a). It is initially dark red and later pink.

On leaving the nest chicks can walk and swim, and are initially attended by one or both parents and may return to the nest (if accessible) to be brooded, but later form large groups attended by small numbers of adults, though parent birds arrive regularly to feed their own chicks. Chicks may begin to exhibit feeding behavior at two weeks, and may be able to feed themselves effectively from about a month old (Sprunt & Crego-Bourne, 1975), but are usually fed at least partly by their parents until fledging at 75 days. The bill is straight and shallow on hatching, gradually acquiring the typical deep, down-curved shape up to fledging.

The first, pale gray down is replaced by a darker gray down at about two weeks. Legs and bill turn black within the first week. The juvenile plumage is gray marked with darker brown, and is developing noticeably by 30 days, with the body feathering complete at 50 days. There is some pink suffusion in the juvenile plumage, particularly in those areas which are brightest in adults.

The lesser flamingo chick is unable to stand for 24 hours. On the second day it can stand but remains on the nest. From the third day it will leave the nest if disturbed, but will otherwise not do so until the fifth or sixth day, as it cannot climb back onto the nest before this. Chicks leaving the nest early may come to no harm if the substrate at the base of the nest is reasonably solid, but they cannot cope with thick slushy mud. Large groups of chicks begin to form from about eight days. These may number hundreds of thousands, but break up into smaller groups at regular times of the day, probably returning to the vicinity of their hatch sites to meet their parents for food. Fledging takes 65-90 days, in good conditions usually 65-75 days. The natal down is on average darker than in the greater flamingo, and the bill is black-tipped. The legs turn black at about six days, and the bill, which begins to curve quite early, also becomes black. The bill has a pronounced curve by 20 days. The darker second down appears at about two weeks, to be followed by a juvenile plumage which is darker than that of the greater flamingo (Brown & Root 1971).

Greater flamingo chicks observed by Brown (1958) could move out of the nest at two to three days (but the nests were low at the colonies studied). Unwilling to take to water until 12 days, they formed large groups from 14 days. Legs were dark pinkish brown by five days and black or dark brown by seven days. Groups of chicks revisiting nesting areas ate eggshell and shell membrane and were seen stamp-feeding. Wing-flapping was frequent from 60-70 days with fledging at 75-78 days. Feeds increased in length and decreased in frequency as chicks grew. Feeds on the nest lasted 5-15 seconds, just before fledging feeds lasted 11-18 minutes.

Adults may fly daily to feeding sites up to 90 km away from the breeding sites, and chicks are often fed early in the morning and again in the evening (Brown 1958, Munoz & Munoz 1975, de Boer 1979).

Chicks may also move long distances. Berry (1975) describes an 80 km trek by a large group of lesser flamingo chicks following receding water at Etosha.

Sexual Maturity

Full adult coloration is usually attained at three years in all species, but this can be variable, and sexual maturity and the age of first breeding are not necessarily closely linked to plumage and leg color. In captivity Caribbean flamingos have been recorded breeding at two years (Duplaix-Hall & Kear 1975) and Berry (1975) records lesser flamingos breeding in immature plumage in Namibia. Nest-building by immature birds is commonly seen in captivity and has been recorded in the wild (Broekhuysen 1975). Captive-bred Chilean flamingos at Slimbridge first breed between two and 10 years of age (mean = 4.8 years, S.D.= 2.8 n= 15, Pickering 1992).

Behavior

Activity

In most species there seems to be a reduction in feeding and a corresponding increase in resting and comfort behaviors during the middle of the day (Brown 1971, Britton et al 1986, Bildstein et al 1991), though this is also the time of peak display activity (Brown 1971).

Locomotion

Flamingos are strong flyers. As well as long-distance migrations, birds at some colonies make long flights daily from breeding to feeding sites. They fly with their necks and legs extended. Take-off is achieved by running on land or on the bottom in shallow water. Take-off from or landing onto deeper water is uncommon. Flamingos walk on land or in shallow water, and can swim very well in deeper water. The lesser flamingo swims more regularly than other species.

Predation

In the larger species predation of healthy adults is probably rare, and predation of eggs and chicks is largely by avian predators, as the environment at breeding sites is usually inhospitable or inaccessible to mammals.

In greater flamingo colonies in East Africa, marabou storks (*Leptoptilos crumeniferus*) cause major losses of eggs and chicks. In some cases flamingos react aggressively to marabou storks and are successful in defending eggs or chicks, but in others the presence of small numbers of storks can cause mass desertion of breeding colonies. Great white pelicans (*Pelecanus onocrotalus*) also affect breeding by competing successfully for nesting islands, but are not direct predators. The African fish eagle (*Cuncuma vocifer*) takes chicks and tawny (*Aquila rapax*) and steppe eagles (*Aquila nipalensis*) take eggs, but principally following disturbance by other predators. The eagles also take chicks but mainly as carrion (Brown 1958). In South Africa, the water mongoose (*Atilax paludinosus*) took 50% of the chicks at one colony (Broekhuysen 1975).

Herring gulls (*Larus argentatus*) are major predators of eggs and chicks at the Camargue colonies, where they will work on the ground, sometimes in pairs, pecking at the leg joints of incubating birds from behind to make them stand so that nests can be robbed, and will even hover over nests inciting sitting birds to make threat displays and then lift them off nests by the bill. If wind conditions are not right for hovering they may use a similar technique on the ground at the edges of a colony. As many as half the eggs laid in the Camargue may be predated by gulls.

Little is known about predation in South America. McFarlane (1975) lists potential predators at a site in Chile but found no evidence of predation.

Adult lesser flamingos are regularly taken by African fish eagles and possibly other eagles in East Africa, and by marabou storks, while mammalian predators include lions (*Panthera leo*), leopards (*Panthera pardis*), cheetahs (*Acinonyx jubatus*), jackals (*Canis sp.*), ratels (*Mellivora capensis*) and particularly spotted hyenas (*Canis crocuta*). The level of predation however is not thought to be high, though disturbance by mammals such as hyenas can cause large-scale panic and desertion of nests.

Breeding sites are usually inaccessible to mammals but eagles and vultures are also predators of chicks and eggs. In East Africa vultures may also take adults. The Egyptian vulture (*Neophron percnopterus*) is the most serious egg predator, but lappet-faced vultures (*Torgos tracheliotus*) and white-headed vultures (*Trigonoceps occipitalis*) more frequently take chicks and adults. Lesser flamingos are more persistent in defense of their eggs or chicks than are greater flamingos, and are sometimes capable of driving away Egyptian vultures, but may be killed by the larger vultures if they take persistence too far; however, the soft substrate around many of the breeding colonies makes them inaccessible to the larger vultures (Brown & Root 1971).

Social Behavior

Flamingos are highly gregarious at all times of the year. Territoriality when breeding is confined to the immediate area of the nest. Antagonistic behavior consists of raising the scapulae and back-feathers in an imposing chrysanthemum-like effect, accompanied by HOOKING, in which the neck is stretched forward but the bill held down so that it points backwards; or in higher-intensity threats, by NECK-SWAYING where the head is waved at an opponent with bill gaping. A recent study of non-breeding Caribbeans found that adult males initiated and won more aggressive encounters than females and juveniles flamingos (Schmitz and Baldassarre 1992a).

Sexual Behavior

Sexual and social behavior are closely associated in flamingos as the displays which precede breeding are performed in large groups. This helps with the synchronization of breeding, ensuring that all birds breed when environmental conditions are most favorable, probably in relation to food supply, but with the additional benefit that predation of eggs and chicks is almost certainly lower that it might be if breeding was spread over a longer period.

Displays are performed by both sexes, but are usually initiated by males. Male and female displays are similar, but display by males is often more intense and protracted than that by females. Ritualized behavior is "contagious", with a particular display by one bird being followed by similar displays from others. Display may precede breeding by months (or may occur after breeding) and may occur at sites where breeding does not take place. In lesser flamingos at least, the number of birds present may be significant in triggering display (Brown & Root 1971), but display may not involve all birds in a large concentration, and only some of the birds that do display may go on to breed.

Population

Population Trends in the Wild

Estimating population numbers for wild flamingos has always been problematic because their generally remote and inaccessible haunts are frequently spread over vast geographic areas. The difficulty of counting is compounded by the bird's ability to travel great distances in short periods of time. The general consensus is that, in many parts of the world, flamingos are at risk due to loss of feeding and breeding sites and, as it becomes more difficult for them to breed successfully, populations are destined to decline.

At the time of the Slimbridge Symposium in 1973, the best population estimates for all species were compiled by Kahl (Kear 1975). At that time, the numbers were:

Caribbean	60,500
Greater	790,000
Chilean	500,000
Lesser	6,000,000
Andean	150,000
James'	50,000

The best current population numbers for any species come from a comprehensive multi-country survey of flamingo sites in 1997 and 1998 in Bolivia, Argentina, Chile and Peru. In this study, the authors came up with high counts of 63,143 for James' and 33,927 for Andean (Valqui, M. 1998). This would be a significant contrast to Kahl's estimates of 150,000 for Andean and 50,000 for James'.

Recent estimates of five million for lesser flamingos in east and southern Africa (Arinaitwe 1998) seem to be consistent with historical numbers. So, considering the extent of the species' range through the middle east and southern Asia, it is likely that Kahl's estimate of 6,000,000 is probably still accurate.

Allen chose 95,000 for Caribbean historically with a reduction to 21,500 by 1955. Kahl's estimate of 60,500 may be low considering the recent estimated counts of 25,000 in the Yucatan and 37,000 on the Venezuelan coast (Arengo et al 1998, Espinoza 1998) in addition to the estimate of 60,000 birds on Inagua in the Bahamas. Lacking data from Cuba, it still seems plausible that the species may well exceed Allen's historic estimate.

Current estimates for Chilean flamingo populations are also problematic due to the extent of their range and difficulty of access to many areas. Recent estimates of 200,000 are more likely than Kahl's estimates of 500,000 but it remains difficult to verify numbers.

Because of their wide distribution across three continents and numerous political boundaries, the size of greater flamingo populations are also difficult to estimate. Specific populations are very well known and numbers seem to be consistent from year to year as long as conditions are appropriate. Overall, 750,000 to 790,000 (Kahl's number) are probably realistic.

Current Captive Populations

It is a bit easier to judge population numbers of captive flamingos than it is their wild counterparts. The numbers for North America are probably the most accurate due to the extent to which membership in ISIS has saturated the region along with the presence of studbooks for all species. Nearly all significant collections are accounted for via those two repositories of data. The populations in Europe are most certainly under reported in ISIS but over time, as more facilities participate, better estimates will be available. A recent survey of European collections indicates that the region holds at least a third more birds than North American facilities (King, pers. comm.) Data from Africa and South America is sketchy at best, and there are large groups of flamingos in Asia which are not represented in the ISIS database.

The worldwide captive populations documented in either the North American Regional Studbooks or the ISIS database for each species through the end of the 20th Century are:

Caribbean	2898
Greater	1504
Chilean	3432
Lesser	834
Andean	48
James'	8
Total	8724

Approximate North American Regional numbers

Caribbean	~1800
Greater	~ 200
Chilean	1800 +
Lesser	~600
Andean	
James'	

Approximate European Regional numbers

Caribbean	~1500
Greater	1400 +
Chilean	~3000
Lesser	~430
Andean	~90
James'	~25
Unk	~500

Total regional numbers in the databases (for Europe, total is from the survey and does not represent ISIS data):

US	4400
Europe	6869
Africa	413
Asia/Aust	761
South America	87
Total	12,530

It is likely that undocumented birds would bring the worldwide captive population to an estimated 13,000 to 13,500 individuals.

The existence of studbooks makes the North American population the easiest about which to make broad statements. Flamingos have been found in North American collections since at least 1899. Until the mid 1960's, none were held in significant numbers and many collections held a few specimens of several species. The first captive reproduction occurred at the Hialeah Race Track in 1937 but it was not until 1953 that a second facility hatched a chick. It took an additional twenty years before a significant number of collections began successfully raising offspring.

Rapid expansion of the North American populations thirty years ago represented significant importation of birds over a period of a few years as opposed to improved reproduction. The development of animal oriented theme parks beginning in the mid 1960's through the early 1970's accounts for the increase in Caribbean flamingo numbers. When U.S. legislation afforded Caribbeans more protection, Chilean flamingos became the most readily available alternative for filling exhibits. The government of Argentina put restrictions on Chilean flamingo exports in the mid 1980's and lesser flamingos then became and remain the most easily acquired species for importation. Greaters have never been common in U.S. collections. Their increase in the mid 1980's was due largely to confiscation of birds being illegally imported. At this point in time, Chileans (1800+) are the most numerous species in our collections followed by Caribbeans (~1800), lessers (~600), and greaters (~200).

In Europe, Chileans (~3000) are also the most common species, followed by Caribbean (~1500), greater (1400+), lessers (~430), Andean (~90), and James' (~25). These numbers are approximate to account for the non-responding facilities to the King survey.

Despite recent increases in reproduction for all species, only Caribbeans are approaching self-sustaining status in North American collections. Facilities holding Chileans are seeing increased success. Lessers are only just beginning to be bred. Greaters occur in such small numbers that they are unlikely to ever be sustainable. Although birds are probably capable of reproducing at three years of age, stimulating reproduction of captive flocks remains problematic and frequently birds do not begin to breed until they are much older. The same problems with reproduction occur in the European collections. As the populations age, without greater breeding success, there is likely to be a significant decline in all species in the next 10-15 years since importation of wild birds in both regions have been largely reduced and are having a minimal impact. A majority of captive birds worldwide have not been sexed.

Population estimates vary widely for most species. In some cases, this difference is because of counting problems caused by the mixing of two or three species at the same site. In others, it is because of the combination of irregular large-scale movements with the lack of coordinated counts at known sites and the likely existence of unknown sites. The variation between estimates makes the identification of trends very difficult, but the Caribbean flamingo is the only species thought to be increasing (in relation to population levels 30 years ago, but still lower than those 200-300 years ago (Allen 1956)).

Earlier estimates of Chilean flamingo populations have been higher, even as high as 1,000,000 (Cordier 1968), but it is not certain whether current figures represent a decline or inaccuracies in past or present estimates. The Andean flamingo has almost certainly declined markedly in recent decades for reasons which are unclear. Lower recent estimates are unlikely to be due to undercounting as the known range and population estimates for James' flamingo, which occurs at many of the same sites, have increased during the same period.

Conservation Status

The available breeding and feeding sites for flamingos around the world are decreasing in size and quality due to many factors. As ecological specialists, flamingos are very vulnerable to even subtle changes in the environment, but they are also very quick to adapt when new appropriate conditions appear where they did not occur previously.

Fluctuation in water levels from both natural patterns of weather instability and man-made alterations can have a variety of effects on nesting sites and food resources. Changes in the hydrology of wetland areas are often a by-product of dams and reservoirs. Rising water levels can either flood existing nest sites or create new ones. Falling water levels frequently degrade existing nest areas or expose the sites to increased predator access (including natural predators, dogs, cats, and humans). Reclamation of wetlands for agriculture by expanding human populations reduces feeding and drinking sites. Although salt/soda production plants may become useful feeding sites for birds, the associated intrusion from roads, fences, power lines, human population growth, etc. can negate any positive impact from the industrial activities. Complete loss of water resources via desertification is sometimes a result of removal of forest for firewood and cattle grazing.

In addition to alterations to the physical environment, changes in water level and quality also affect salinity and thus prey production. The more specialized flamingo species are most at risk from changes in food resources resulting from changes in water quality. This, in addition to drain off of pesticides, heavy metals, mining activities, and industrial chemicals from increased human activity can significantly alter the ecology of feeding/nesting sites. Pollution in and of itself may be more significant in terms of its affect on food resources than a direct impact on the birds -- if the food is not there, the birds won't be either. It is also unclear how the flamingos themselves affect the ecology of the water resources on which they depend. Due to the enormous biomass that flamingos represent in their environment, it has been suggested that a reduction of flamingos in Botswana and Mauritania could impact the blue-green algae bloom and possibly disrupt the health of the entire ecosystem of these areas.

Hunting and egg collecting has a significant effect on nesting colonies in the New World but does not generally seem to be a factor in the Old World except in parts of eastern range where nest areas are more accessible or areas on the African continent embroiled in civil unrest. Ingested lead shot was identified as a major factor in a die off in the Yucatan following Hurricane Gilbert in 1989 but use of lead was subsequently banned (Arengo 1998). Disease does not seem to be a significant factor in flamingo populations.

Despite the negative impacts on flamingo populations from resource exploitation for human use, there are management techniques that can be employed which seem to facilitate co-existence. In several parts of the world, salt production has been managed to the benefit of flamingos, but even when the salt pans are managed for flamingos, they leave when the food is depleted. Modification of water control projects could be beneficial for both people and birds. The Ramsar Convention, Convention on Biological Diversity, and Convention on Wetlands of International Importance attempt to protect wetlands of global importance benefiting flamingos along with the many other species that are dependent on these sites. Work in the Camargue has shown that by artificially managing water levels and restoring/maintaining nest sites, birds can be encouraged to recolonize previously abandoned sites.

The recent cooperation between agencies across country borders in South America has resulted in tremendous increases in the knowledge of population numbers and ecology of the high Andes flamingo species. The proposed Pan-African survey will help address issues of migration and population numbers on that continent. Lack of information on greater and lesser flamingos in the eastern part of their range might be due to a lack of personnel, interest, or money. Development of contacts in those regions could facilitate the sharing of information and/or deployment of resources for both basic data collection and education.

Tourism in all areas can help local economies but can easily disrupt flamingo populations when appropriate controls on access are lacking. Lake Nakuru in East Africa has long been a regular stop for tourists on safari but pollution from agricultural activities around the park may be affecting the water quality and thus food production for the birds. At Laguna Pozuelos in Argentina, a survey over a five year period indicated that 98% of the visitors came to the lake exclusively to see the three flamingo species, with 70 % of foreign origin. There are concerns that growing tourism is beginning to degrade the local natural resources and education is necessary, not only for visitors, but for locals who depend on the visitation in order to maintain sustainable use (Clark et al 1998). In the Yucatan, an increase in boat tours to view flamingos over the past ten years decreased flamingo feeding time by 60%; however, by educating the tour operators and with some modification to the way in which boats approach the birds, the disturbance has been all but eliminated, thereby improving the experience for the visitors with seemingly little impact on the birds (Arengo et al 1998). Low flying aircraft providing a spectacle by scaring birds into flight has been a problem historically in some locations (Bonaire, Camargue, East Africa), but this practice appears to be less prevalent now.

A global action plan for flamingos is being developed following the 2nd International Flamingo Symposium held in October 1998. Zoo based Taxon Advisory Groups (TAGs) in both North America and Europe are developing regional collection plans to improve management of captive populations. Facilities holding flamingos have the opportunity to help flamingo conservation through public education, basic research on biology, and raising funds to support conservation efforts in countries where flamingos occur. For current and proposed research, see the Research Chapter.

None of the flamingos are seriously threatened, but all are essentially vulnerable because of the kinds of ecosystems they inhabit. These are characterized by high productivity and low biodiversity, and are thus very susceptible to damage through environmental change. Flamingos are highly adapted to these ecosystems and are poorly equipped to survive in other environments. The irregularity of breeding and occasional mass mortality in many flamingo populations is an indication of the already marginal suitability of their usual habitats and their narrow tolerance of change in these habitats. The greater flamingo, for instance, is numerous and has a large range, but few of the sites at which it occurs regularly provide suitable conditions for breeding.

Habitat loss through human activity does threaten flamingos in a number of areas. The number of breeding sites for Caribbean flamingos has declined from possibly 35 to around five, though on Bonaire the development of a salt works at one of these five has not been the disaster that it might have been through enlightened cooperation between commercial interests and conservationists (Rooth 1965, 1975), though de Boer (1979) sounds a note of caution regarding the need for monitoring and management of environmental change in the future. Caribbean flamingos in Inagua and Yucatan, and greater flamingos in the Camargue, have also been affected by, and now depend on favorable management by, the salt extraction industry (Sprunt 1975, Johnson 1975).

For all flamingos the presence of a good food supply and the occurrence of suitable conditions for nesting often depend on the maintenance of water levels and salinity or alkalinity within narrow limits. The occurrence of favorable conditions is often naturally cyclic or sporadic and dependent on levels of rainfall, which of course affect not only water levels but also salinity and alkalinity. Flamingo sites around the world are threatened by or vulnerable to human management of water levels for agricultural, industrial or domestic water supply, and are also at risk from pollution (Hopcraft 1975).

Hunting may also still be a potential threat to some populations. Several species have been harvested for food as eggs or adults over a long period (Ogilvie & Ogilvie 1986) and at a few locations these practices continue, in some cases in breach of legal protection. In general, this is not at a level which threatens populations, but in Bolivia special measures were introduced in 1987 to stop the taking of eggs of James' flamingo at Laguna Colorada (Johnson & de Boer 1988). The increased demand for food arising from the development of mining settlements in the Andes poses similar threats at other sites.

The taking of flamingos from the wild for zoos and other collections has greatly reduced in recent years, but the two African species at least are still regularly collected in Tanzania, and young birds of both species said to originate from chick rescue operations on drying salt pans have been offered for export from Botswana.

Disturbance has been a major problem at a number of sites (Brown 1958, Brown & Root 1971, de Boer 1979, Hopcraft 1975), particularly disturbance by aircraft. Light aircraft carrying tourists eager to see flamingos are sometimes flushing birds deliberately to improve the spectacle have repeatedly caused breeding failures by disturbing nesting birds. At a number of locations, including Bonaire, the Camargue and East Africa, restrictions have been introduced to control the use of airspace over colonies, though enforcement can be a problem (de Boer 1979). Susceptibility to disturbance varies between species and locations and also with the activity patterns of the birds. Greater flamingos in some East African Lakes are used to regular high-altitude traffic but may be disturbed by low-level flights. When breeding, their reaction to disturbance, whether by aircraft, humans on foot or in boats, or avian predators, varies according to the stage of incubation or age of chicks (Brown 1958). Lesser flamingos breeding at Lake Natron were not unduly disturbed by a light aircraft circling at apex. 150m, but non-breeding birds on the same lake would take flight when flown over at 300 or, in one case, 600m (Brown & Root 1971). Caribbean flamingos on Bonaire may desert sites before or during breeding in response to quite a low level of disturbance by humans on foot, but birds from the same population may tolerate much greater disturbance at feeding sites in Venezuela. Flamingos can be an important resource for eco-tourism, but can also be very difficult to exploit (de Boer 1976).

References

Allen, Robert Porter. The flamingos: Their life history and survival. Research Report No. 5. 1956. National Audubon Society. 285 pages.

Arengo, F., G.A. Baldesarre, E. Galicia. Ecology and conservation of American flamingos in Yucatan, Mexico. Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.

Arinaitwe, J. Current status and distribution of lesser flamingos in East Africa, especially in Uganda. Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.

Beer, V.J. & Kear, J. (1975) Fungal infections of the plumage In: Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead. pp 203-206.

Berry, H.H. (1975) Hand-rearing Lesser Flamingos In: Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead. pp 109-117.
Berry, H.H. (1975) South West Africa. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 53-60.
Bildstein, K.L., Frederick, P.C. & Spalding, M.G. (1991) Feeding Patterns and Aggressive Behavior in Juvenile and Adult American Flamingos. Condor 93(4): 916-925.
Britton, R.H., de Groot, E.R. & Johnson, A.R. (1986) The daily cycle of feeding activity of the greater flamingo in relation to the dispersal of the prey Artemia. Wildfowl 37: 151-155.
Brock, H. & Hass, G. (1974) Estmalige kunstliche Aufuzucht eines Flamingos im Zoo Wuppertal. Zoo Garten N.F24., 44 1/2, pp. 80-86.
Broekhuysen, G.J. (1975) South Africa. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 61-64.
Brown, L.H. & Root, A. (1971). The breeding behaviour of the Lesser Flamingo *Phoeniconais minor*. Ibis, 113, 147-172.
Brown, L.H. (1958) The breeding of the Greater Flamingo *Phoenicopterus ruber* at Lake Elmenteita, Kenya Colony. Ibis 100: 388-420.
Brown, L.H. (1975) East Africa. InKear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 38-48.
Brown, L.H. & Root, A. (1971) The breeding behaviour of the Lesser Flamingo *Phoeniconaias minor*. Ibis 113: 147-172.
Brown, M.J. & Pickering, S.P.C. (1992) Health and mortality in captive flamingos at Wildfowl & Wetlands Trust Slimbridge Centre 1973-1989. Wildfowl 43 pp 185-193.
Brunning, D. F. & Dolensek, E. P. (1986) Ratites (Struthioniformes, Casuraiiformes, Rheiformes, Tinamiformes & Apterygiformes). In Fowler, M.E. (Ed.) Zoo and Wild Animal Medicine, 2nd Edition. W.B Saunders Co., Philadephia, London: 277-291.
Brunning, D. (1973) Breeding and rearing rheas in captivity. Int. Zoo. Yb. 13:163-172.
Brunning, D. (1981) Hand-rearing flamingo chicks. Am. Pheasant Waterfowl Soc. Mag. 81-9; 14-18.
Burn, J. & Pickering, S.P.C. Temporal and Spatial effects on the Behaviour of Caribbean Flamingos in prep.
Caziani, S. and E. Derlindati. 1998. Flamingo abundance patterns and habitat relationships in the Andean Salt-lakes of Vilama, northwestern Argentina. . Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.
Clark, R.R. and M. E. Mosqueira 1998 . The value of flamingos as a tourism resource in Laguna Pozuelos Natural Monument. . Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.
Cooper, J.E., Karstad, L. & Boughton, E. (1975) Tuberculosis in lesser flamingos in Kenya. J.Wildl. Dis. 11:32-36.
Cordier, C. (1968) Flamingos in Bolivien. Freunde des Kolner Zoo 11: 13-16.
Coughlan, A. (1989) All about Eric. Widfowl & Wetlands 1989
Creighton, E. & Stevens-Wood, B. (1990) A census of captive flamingos in Great Britain. Unpublished Report. Manchester Polytechnic.
Cromie, R.L. (1991) Development of a vaccine for avian tuberculosis. Unpublished PhD thesis, University of London.
Cromie, R.H., Stanford, M.J., Brown, M.J. & Price, D.J. (1990) Epiootiology of Avian Tuberculosis at The Wildfowl & Wetlands Centre at Slimbridge, In: Proceedings of the Zoological Society of London, British Veterinary Autumn Meeting 1990.
de Boer, B.A. (1979) Flamingos on Bonaire and in Venezuela. STINAPA documentation series No.3. 59 pp.
del Hoyo, J., A. Elliot, J. Sargatal, eds. 1992. Handbook of the Birds of the World. Vol. 1, Lynx Edicions, Barcelona.

Duplaix-Hall, N. & Kear, J. (1975) Breeding requirements in captivity: In: Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead. pp 131-142.
Espinoza, F.E. Population status of the Caribbean flamingo in Venezuela. Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.
Fowler, J.D., Bauck, I., Cribb, P.H. & Presnell, K.R. (1987) Surgical correction of tibiotarsal rotation in an emu. Companion Anim. Pract. 1(5):26-30.
Griswold, J.A. (1975) Pigment feeding: In: Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead. pp 193-196.
Hopcraft, J. (1975) Conservation Problems at Lake Nakuru. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 49-52.
Humphreys, P.N. (1975) Pathological conditions. In: Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead. pp 199-203.
Hurlbert, S.H. (1982) Limnological Studies of Flamingo Diets and Distributions. National Geographic Society Research Report 14: 351-355.
Hurlbert, S.H. & Chang, C.C.Y. (1983) Ornitholimnology: Effects of grazing by the Andean Flamingo *Phoenicoparrus andinus*. Proc. Natl. Acad. Sci. USA 80: 4766-4769.
IATA (1989). Live animal regulations. International Air Transport Association. Montreal. pp 129-130.
Jenkin, P.M. (1957) The filter-feeding and food of flamingoes (Phoenicopteri). Phil. Trans. Roy. Soc. London B, 240: 401-493.
Johnson, A.R. (1975) Camargue flamingos. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 17-25.
Johnson, A.R. & de Boer, B.A. (Eds.) (1984) ICBP-IWRB Flamingo Research Group Newsletter No.2.
Johnson, A.R. & de Boer, B.A. (Eds.) (1986) ICBP-IWRB Flamingo Research Group Newsletter No.3.
Johnson, A.R. & de Boer, B.A. (Eds.) (1988) ICBP-IWRB Flamingo Research Group Newsletter No.4.
Johnson, A.R. & de Boer, B.A. (Eds.) (1989) ICBP-IWRB Flamingo Research Group Newsletter No.5.
Johnson, A.W., Behn, F. & Millie, W.R. (1958) The South American Flamingos. Condor 60: 289-299.
Johnson, A. 1998. Flamingo Specialist Group Newsletter No. 8. Annual reports 1995-1996. 41 p.
Johnson, A.R. 1998. The greater flamingo ringing program and results. . Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press
Kahl, P. (1975) Ritualised displays. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. &A.D. Poyser, Berkhamsted: 142-149.
Kear, Janet, Nicole Duplaix-Hall. Flamingos. Poyser. 1975. Berkhamsted. 246 pages.
Kear, J. & Duplaix-Hall, N. (1975) Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead.
Kear, J. (1985) Flamingo. In Campbell, B. & Lack, E. (Eds.) A Dictionary of Birds. T. & A.D. Poyser, Calton: 217-218.
Koning, F.J. & Rooth, J. (1975) Greater Flamingos in Asia. In press.
Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. &A.D. Poyser, Berkhamsted: 33-34.
Kunnemen, F. & Perry, J. (1990) Hand-rearing the Caribbean flamingo *Phoenicopterus ruber ruber*. Int. Zoo. Yb. 29:95-99.
Liggett, C. (1989) Breeding season of the Chilean Flamingos at Martin Mere in 1988. In: Wooldridge A. (Ed) Martin Mere Avicultural Report 1988.
Lindgren, C.J. & Pickering, S.P.C. ???? Behaviour of Captive Andean Flamingos *Phoenicoparrus andinus* at the Wildfowl Trust, Slimbridge. Unpublished report. ???

McFarlane, R.W. (1975) Northern Chile. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 84-90.
Munoz, J, & Munoz, C. (1975) Chubut Province, Argentina. In
Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 91-92.
Ogilvie, M.A. & Ogilvie, C. (1986) Flamingos. Alan Sutton, Gloucester.
Olson, S.L., A. Feduccia. 1980. Relationships and evolution of flamingos (Aves:Phoenicopteridae). Smithsonian Contributions to Zoology. 316:1-73.
Ounsted, M. (1989) Flamingos: A Zoo's most valuable exhibit. 4th International Symposium of Zoo Design and Construction, Paignton Zoo.
Palmes, P. (1981) The riddle of the fickle flamingo. Wildfowl World 85: 16-18.
Phalen, D. N., Ambrus, S. & Graham, D. L. (1990) The avian urinary system: Form, function & diseases. Proceedings Association of Avian Veterinarians.
Pickering, S.P.C. (1992) Flamingo project 1990-91. Unpublished Wildfowl and Wetland Trust Report.
Pickering, S.P.C. (1992) Comparative breeding biology of flamingos at The Wildfowl & Wetlands Trust Centre, Slimbridge, Gloucester, England. Int. Zoo Year Book.
Pickering, S.P.C, Creighton, E. & Stevens-Wood, B. (1992) Flock size and breeding success in flamingos. Zoo Biology Vol 11 No 4 pp 229-234.
Pickering, S.P.C. & Duverge, L. (1992) The influence of visual stimuli provided by mirrors on the marching displays of lesser flamingos Phoeniconais minor. Anim. Behav. 43, 1048, 1050.
Pickering, S.P.C. (1989) Flamingo Project report to Wessex Water. Unpublished Wildfowl and Wetlands Report.
Richter, N.A. & Bourne, G.R. (1990) Sexing Greater Flamingos by Weight and Linear Measurements. Zoo Biology. 9:317-323.
Ridley, M.W., Moss, B.L. & Percy, R.C. (1955) The food of flamingoes in Kenya Colony. Jour. E. Afr. Nat. Hist. Soc. 22: 147-158.
Rooth, J. (1965) The Flamingos on Bonaire (Netherlands Antilles): habitat, diet and reproduction of *Phoenicopterus ruber ruber*. Uitgaven "Natuurwetensch. Stud. Suriname en de Ned. Ant.", Utrecht, No.41, 151 pp.
Rooth, J. (1975) Caribbean Flamingos in a man-made habitat. In
Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 75-79.
Schafer, W.B., Beer, J.V. Wood, N.A. Boughton, E. Jenkins, P.A. & Marks, J. (1973) A bacteriological study of endemic tuberculosis in birds. J. Hygiene 71: 549.
Schmitz, R.A. & Baldassarre, G.A. (1992a) Contest Asymmetry and Multiple Bird Conflicts During Foraging Among Nonbreeding American Flamingos in Yucatan, Mexico. Condor 94(1): 254-259.
Schmitz, R.A. & Baldassarre, G.A. (1992b) Correlates of Flock Size and Behavior of Foraging American Flamingos Following Hurricane Gilbert in Yucatan, Mexico. Condor 94(1): 260-264.
Scott, D.A. (1975) Iran. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 28-32.
Shannon, P. (1985) Flamingo management at Audubon Park Zoo and the benefits of long term research. AAPA Regional proceedings: 226-236.
Shannon, Peter W. 1996. N. Am. Regional Caribbean flamingo studbook.
Shannon, Peter W. 1996. N. Am. Regional Greater flamingo studbook.
Sibley, Charles G. and Jon E. Ahlquist. Phylogeny and Classification of Birds. Yale University Press. New Haven. 1990. 976 pages.
Sileo, L.,Grootenhuis, J.G., Tuite, C.H. & Hopcraft, J.B.D. (1979) Mycobacteriosis in the lesser flamingo of Lake Nakuru, Kenya. J.Wildl. Dis. 15:387-389.

Simmons, R.E. 1996. Population declines, viable breeding areas, and management options for flamingos in Southern Africa. Cons. Biology Vol 10, No 2: 504-514
Sivelle, C. (1984) Management and propagation of Chilean Flamingos in a private collections. Am Pheasant Waterfowl Soc. Mag. 10: 1-3.
Sprunt, A. (1975) The Caribbean. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 65-74.
Sprunt, A. & Crego-Bourne, A. (1975) Capture and trannsport of young Caribbean Flamingos. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 103-105.
Stevens, E. F. (1991) Flamingo breeding: the role of group displays. Zoo Biology,
Studer-Thiersch, A. (1974) Die Bal der Flamingo gattung *Phoenicopterus* unter besonderer Bercksichtigung von *Ph. ruber roseus*. Z. Tierpsych 36: 212-266.
Studer-Thiersch, A. (1972) Beobachtungen an freilebenden Flamingos in Sudspanien. Ornith. Beob. 69: 237-252.
Studer-Thiersch, A. (1975) Flamingos in captivity: Basle Zoo. 121-130. In: Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamstead.
Studer-Thiersch, A. (1975a) Basle Zoo. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 121-130.
Studer-Thiersch, A. (1975b) Group display in *Phoenicopterus*. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 150-158.
Trotignon, J. (1975) Mauritania. In Kear, J. & Duplaix-Hall, N. (Eds.) Flamingos. T. & A.D. Poyser, Berkhamsted: 35-37.
Tuite, C.H. (1979) Population Size, Distribution and Biomass Density of the Lesser Flamingo in the Eastern Rift Valley, 1974-76. J. Appl. Ecol. 16: 765-775.
Tuite, C.H. (1980) Lesser Flamingos in East Africa: a review 1969-1976. In Johnson, A.R. (Ed) ICBP- IWRB Flamingo Working Group (Old World) Newsletter No.1: 8-10.
Tuite, Chris. 1998. The distribution and density of lesser flamingos in relation to food availability and productivity. Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.
Valqui, M., S. Caziani, O. Rocha, E. Rodreiguez. 1998. Results of simultaneous censuses of JamesÌ and Andean flamingos in Boliva, Argentina, Chile, and Peru. Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press
Vilina, Y., and G. Martinez. Habitat association of three species of flamingo in Salar de Ascotan, Chile. . Proceedings of the 2nd International flamingo symposium. Miami. 1998. In press.
Walters, M. (1980) The Complete Birds of the World. David & Charles, London.
Management of Flamingos in Captivity
Watkins, J. (1989) Flamingo Project: Unpublished B.S.c Applied Biology Placement report. Trent Polytechnic 1989.
Wilkinson, R. 1989. Breeding and Management of Flamingos at Chester Zoo. Avic. Mag. 95, No. 2: 51-61.
Yoshitake, M. Suuki, T., Yasufuku, M. & Murata, K. 1988. Breeding flamingos during the last five years (1983 - 1987) at Kobi Oji Zoo. Wetlands Research 29 (4). In Japanese with English summary.

Chapter 2

Housing and Enclosure Requirements

Facilitator: Kim Smith, Milwaukee County Zoo

Introduction

Unfortunately, most current exhibits are open-air enclosures creating the need for the birds to be rendered flightless to prevent escape. Most common methods for restricting flight are pinioning and wing feather clipping. It has been shown that reproduction is severely hindered by pinioning, due to the male's difficulty in balancing himself during copulation. The recommendation is to keep flamingos full-winged and design new exhibits to accommodate a full-winged flock. Sadly, there are very few exhibits that are designed for full-winged flocks. There are advantages to keeping full winged or pinioned birds in an aviary. These include minimal threat of predation, reduced food stealing by gulls and mallards (Crieighton & Stevens-Woods 1990) and increased fertility (Yoshitake, M. Suuki, T., Yasufuku, M. & Murata, K. 1988). The same basic principles of exhibit construction apply to aviaries. Special care is needed to reduce the risk of injury to flamingos attempting to fly in large aviaries. An exhibit of this type would be very educational, have considerable public appeal, and would increase the likelihood of reproduction within a flock. The zoos that are successfully exhibiting full-winged birds are Sacramento (U.S.), San Antonio (U.S.), Basel (Switzerland), Kobe (Japan) and Xcaret (Mexico). Flamingos are colonial and are best kept in large flocks of at least 20 birds. Reliable breeding occurs with flocks of 40+ birds. A facility should be designed to hold the future desired number of birds and be able to accommodate potential offspring. "Display only" birds are not recommended, but some facilities will only house birds for exhibit purposes. Consideration should be made to ensure that these birds are housed in small flocks and not kept alone or in pairs. Most flamingo exhibits are large outdoor enclosures with some sort of pool or pond. In cold weather areas an indoor facility will need to be built to house the flock on cold days.

Enclosure Requirements

In creating an enclosure for flamingos, the prime consideration must be to ensure the best possible conditions for the birds while taking into account the impact of the exhibit on the viewing public. The nesting area should be visible to the public and where possible designed in such a way that the public feels they are not just viewing a stage set but approaching a flamingo colony (Ounsted 1990).

Outdoor Exhibits

Acceptable Minimal and Optimal Enclosure Sizes

Outdoor exhibits should be built with the maximum desired flock size in mind vs. the current flock size. There should be enough land space to allow a flamingo flock to engage in courtship displays and breeding activities. Areas for sunning and nesting should be taken into account. The recommended size for an outdoor enclosure is 1.4 m^2 or 15 ft^2 per bird, and hard abrasive substrates should be avoided. The pool should be large enough for the entire flock to occupy the area at the same time. Water should be able to flow freely in all areas to avoid any possible buildups of botulism. Also, this area should be large enough to allow the flock to engage in any courtship displays. A nesting area should be large enough to accommodate the entire flock, with room to allow for potential aggression. A recommended size for a nesting area is $.9m^2$ or 10 ft^2 per bird. Always allow enough space to accommodate offspring and any future acquisitions. Additionally, where prevailing winds are common, windbreaks should be added to prevent even the pinioned birds from taking short flights. Enclosure orientation should also be looked at in these cases to eliminate long runs into the wind. If possible, also include a built-in catching and holding area.

Aesthetics

Outdoor exhibits usually have natural plantings to help enhance the aesthetics of the enclosure. The plant density should be kept to a minimum to allow the birds to move unobstructed through the area. Flamingos are very prone to injuring themselves on bushes and trees. Several bird safety issues should be considered when placing plants inside an exhibit:

a) Does the location of the vegetation pose a hazard for the birds?

b) Low bushes should be avoided due to trip hazards, and the potential for a bird to get caught up in the vegetation.

c) Plantings should be placed in areas that do not hinder flock movements. Flamingos have very long legs and can easily fracture a leg by tripping over low-lying plants.

d) A large area should be free of plants to allow normal movement of the flock to occur.

e) Large boulders and rocks are not advisable due to the trip hazard

f) Problem plants: There are several species of plants that have proven to be problematic in flamingo exhibits. These plants are: Flax - birds can become trapped; Palms - potential eye injury; Coral trees and roses - can cause foot problems; Osier willows – cause sooty mold on feathers (see Health and Medicine Chapter).

g) Tall grasses have worked well and do not pose any hazards.

In addition to enhancing an exhibit's visitor appeal, plants can also provide necessary shade and relief from the hot summer sun in warmer climates. Public barriers can be created through the use of vegetation to add a buffer zone between the birds and zoo visitors.

Mixed Species

Many outdoor exhibits in zoos are mixed species, combining bird and mammal species to show the diversity in a specific habitat. Unfortunately, this theme is not a good idea for flamingos. It is not recommended to mix flamingos with any mammal species, especially hoof stock. These types of mixed species exhibits have the potential for injury to the flamingo flock, and the birds are more likely to be disturbed during their breeding cycle. Some flamingo exhibits do, however, mix other species of birds with their flamingos. There are some bird species that should be avoided, such as swans and geese. These types of birds have a tendency to be aggressive and can cause injury to the flock and interfere with breeding activity. Some suitable species of birds to mix with flamingos are non-aggressive waterfowl species and ibis. There have been varied degrees of success using tree ducks in flamingo exhibits. Some institutions report aggression problems by tree ducks, and other zoos say that they mix well with flamingos. When considering a mixed avian species exhibit, special consideration should be made to separate feeding areas for species other than flamingos. There have been several incidences of Lesser flamingos becoming impacted on the sand and grit used in various waterfowl diets.

Exhibit Maintenance

The maintenance of the exhibit should always be considered when designing a facility. Several zoos have reported a cessation in breeding activity with their flamingos during routine pool cleaning. The exhibit should be designed with potential nesting behavior and courtship displays in mind. Potential exhibit repairs and gardening should be taken into account. Many exhibits have substrates of grass that will need to be frequently mowed.

Nesting Area

The future desired flock size should be considered when constructing a nesting area. It is better to err on the side of more space than less. A recommended size for a nesting area is .9 m^2 or 10 ft^2 per bird. Some institutions have nesting areas that are smaller than this and still get breeding from their flocks. Many species prefer to nest near shrubs and trees as well as areas that are in full sun. The nesting areas should be located in such a manner to offer the flock a choice and be located out of the general traffic pattern for the enclosure. The choice of substrate in a nesting area can be a very important decision. Some zoos have used clay, a clay/sand mixture, leaf mulch, and native soil from surrounding areas with success. The nesting area should be located in a secluded portion of the exhibit as far away from the general public as possible. Visitors should not be able to access the nest area. Several institutions have nesting areas located on islands, pool edges and on dry land in close proximity to the pool. The location of the nesting area in relation to daily exhibit servicing should be taken into account. Enough space should be provided for the keepers to do their daily work without disturbing nesting birds. Plants should not obstruct access to the area. A water source close to the nest site is vital to allow birds to construct their nest mounds. The nest area should always be located in close proximity to the pool, and there should be some ability to soak the area with water. This can be done through the use of soaker hoses, sprinklers, and by adjusting the level of a pool or lake to flood the area. Please refer to Chapter 4 - Reproduction for more information.

Containment Barriers

A variety of containment barriers have been used in outdoor exhibits and are outlined below. Depending on the style of the exhibit, any of these barriers will work. Any fences should be constructed with the posts on the outside of the enclosure. Once settled in an enclosure pinioned flamingos will not normally cross fences one meter high although they are quite capable of jumping over such fences. Prevailing winds should be taken into account when designing new enclosures. In strong winds even pinioned flamingos may be able to fly/jump considerable distances. Banks, fences or trees can be used to form wind breaks and enclosures should not be oriented to allow long run ups into the wind.

a) Chain link: This type of barrier is inexpensive and available in a variety of heights and diameters. There is a considerable amount of flexibility with installation, but in all cases, posts should be placed on the outside of the enclosure. However, chain link is not naturalistic and can require a considerable amount of maintenance and upkeep over time. Birds can get feet and wings stuck in this type of fencing during captures.

b) Pipe fence: Although inexpensive and durable, this type of barrier is also not naturalistic and requires considerable upkeep such as yearly painting.

c) Split rail wooden fence: A fence of this nature can often be manufactured and installed in-house which can be inexpensive. It is an attractive alternative but will need periodic maintenance for repair/replacement of damaged rails. Split rail fencing can be an ineffective barrier against predators and the public. It can also pose a safety hazard to zoo visitors due to the fact that it will be used as a bench, and children find it irresistible to play on.

d) Brick: This type of barrier is durable with very little maintenance and is an effective barrier. However, brick can be expensive to install, is prone to graffiti, and can provide reduced visibility for smaller zoo patrons

e) Gunite: An attractive, naturalistic alternative, gunite can be utilized as an effective barrier. It requires expert installation and can be quite expensive. Depending on the surface applied, gunite can also be very abrasive to bird wings. This type of fence is hard to remove once installed.

f) Foliage: Natural planting can be a very attractive and naturalistic barrier for an outdoor exhibit. It is very high maintenance and requires frequent trimming, watering, and replacement of damaged plants. This does not provide an effective barrier against zoo patrons and predators.

g) Water: Some facilities use large bodies of water as a public barrier. This type can occur in the form of a lake or moat. It can effectively deter some predators.

A factor that should be considered when choosing an effective outdoor containment barrier is predator control. Several institutions have experienced losses within their flocks due to predation by feral dogs and, in Europe, foxes. Some alternatives that have been used in some zoos are electric fences, routine trapping of predators, and enclosed areas that have roofs or meshed ceilings that the flamingos are shifted into at night. Typically, flamingos are housed in open-air exhibits, which lend themselves to potential predator problems. Several zoos have minimal public barriers and keep their flocks contained without incident.

Water Source

The water source for a flamingo exhibit typically occurs in the form of a pool. The pool is probably the most important feature of the exhibit and should be designed carefully. Construction should allow water to flow freely through every part of the pool with no dead ends where sediments or concentrations of botulism can build up. Flamingos rely heavily on the use of bodies of water for various activities, such as courting, copulating and sleeping. The depth of the pool should be anywhere from 1.5 –2.75 ft (46-70 cm). Some facilities provide deeper pools that allow birds to swim. Flamingo pools can be a natural stream/lake or a man-made pool. Natural streams or lakes should be tested periodically for contaminants. The pool should allow the birds to easily access the water. Special attention should be paid to the slope, which should be gentle. A steep slope will pose a trip and slip hazard for the birds. A water flow adjustment should be built into a pool whenever possible. The ability to raise and lower the water level around the nest site would assist with the management of a breeding flock and diminish the amount of keeper intrusions.

There are several different types of man-made pools that can be utilized, such as dump and fill and recirculating/skimming. The dump and fill pool is probably the most common and is less expensive to install than recirculating/skimming pools. Dump and fill pools require weekly cleaning and can be a disruption factor with breeding birds.

Regardless of the type of pool installed, a substrate must be adhered to the surface of the pool. Several different types of pool substrates that have been used in zoos are outlined below:

a) Natural bottom: A pool that contains a natural bottom typically has clay, sand, or mud. Sand is not recommended for lesser flamingos due to risk of ingestion and impaction. Pools with this type of substrate allow natural behaviors and are easy on bird feet. Clay, mud, or sand substrates do, however, pose a potential disease problem, and some species may ingest the substrate. If a natural substrate is installed in a man-made pool, it may need to be changed periodically. Again, testing for contaminants would be advisable with any type of organic substrate. A natural bottom pool is recommended only if there is good water flow.

b) Concrete: This type of substrate can be inexpensive to install and is easy to clean. It can, however, be abrasive to bird feet and slippery if not textured.

c) Fiberglass

d) Combination of rock and concrete: This substrate can be attractive and naturalistic. Depending on the texture, it can be abrasive to bird feet.

e) Gunite formed concrete: This type of surface can also be made to look naturalistic. It also can be abrasive to bird feet and is expensive to install.

f) Plastic liner: A substrate of this nature often occurs in recirculating pools and is designed to operate without routine cleaning. It can also be easy on bird feet. The surface can become slick and could pose a potential fall hazard for keepers and birds alike.

Another water source is salt water. This has not been widely used in zoological institutions but is an interesting concept. A source for fresh drinking water should be available for the birds, if a saltwater pool is installed. This type of water source should be checked periodically for contaminants.

Anti-erosion devices are often used around pools. These devices should not be jagged, and the use of netting is not advisable due to the potential for birds to get caught in it. Wooden piling is also advised against, as birds may catch or break their legs in it (Pickering, 2000). Enkamat, which is an anti-erosion product that is currently used by zoos for flooring, can be a safe alternative.

Feeding Areas

It is recommended that when designing a new exhibit separate feeding areas should be set aside within the enclosure. These areas should be separate from the pool or main water source, with their own drainage system and water source. There should be access from all sides of the feeding area or pool to prevent aggression. A round design is recommended for pools and tubs, and all of the birds should appear to be comfortable approaching the feed station. A diameter of 3.8-5.9 ft (1-1.5 m) and a maximum depth of six inches (15.2 cm) work well. Placement at the front of the enclosure will draw the birds closer to the public during feeding. If using a container instead of a feeding pool, the container needs to be thoroughly cleaned on a daily basis with a disinfectant.

Water Quality and Filtration

Water quality and filtration can be important issues when managing a flock of flamingos. There have been reported die-offs due to contaminants in the birds' water source. Some facilities use water filtration systems and skimmers in artificial pools to maintain water quality. If using a natural lake or stream, the water quality should be tested for coliform levels and contaminants. A separate water source and drain is recommended for feeding areas. There have been cases of birds becoming ill due to contaminants in the pool in exhibits that did not have separate feeding areas. Water for an exhibit can come from a variety of sources, such as: city water, well water, or natural pond or stream.

Substrate/Topography

In an outdoor area the following substrates have been utilized:

a) Grass: This substrate has been used the most in outdoor exhibits and is very good for flamingo feet. It does require frequent maintenance, such as watering and mowing. This substrate is recommended for use in outdoor enclosures.

b) Soil/clay: Although this substrate does not require much maintenance, it has been attributed to numerous foot problems, and lesser flamingos are prone to ingesting it.

c) Mulch: This substrate requires frequent replacement and can be quite expensive. It has also been attributed to numerous foot and leg problems.

d) Sand and decomposed granite: These two substrates are often attractive and easy to maintain but ingestion has caused impaction. Lesser flamingos appear to be especially prone to ingesting sand (see Health and Medicine, Chapter 6). Numerous foot problems have been attributed to sand and decomposed granite substrates.

The topography of the exhibit should be as flat as possible. Steep hills and slopes should be avoided. A greater proportion of water to land should be part of the overall design whenever possible. The variety of different activity areas, such as feeding stations, loafing, and nest sites should be kept separate.

Indoor Facilities

Two factors usually determine when flamingos need to be brought indoors. They are predators and weather. Northern zoos are faced with cold weather during the winter months that necessitate the birds coming indoors for a portion of the year. These indoor facilities should be built adjacent to the exhibit to allow the birds to move into winter holding without capture. It is not recommended to capture birds and move them to a winter holding area that is away from the exhibit. This building does not need to be as large as the outdoor exhibit space but should be large enough to allow the birds to move freely and separate from aggressive members of the flock. If the birds need to be kept indoors during part of their breeding season, larger quarters should be considered to allow display behavior (Heldstab and Studer-Thiersch, 2001, unpublished paper). A recommended size (land and pool space combined) is 1.4 m^2 or $15ft^2$ per bird. The depth of the pool should be at least 30-60cm or 1-2 ft. with gently sloping sides. It is also recommended that the keeper service area be kept separate from the bird areas and that all floors be sloped to the drains. Built-in footbaths allow easy treatments of foot problems as well. Ideally, a public viewing area should be designed into any new winter holding structure, with viewing limited to one side. This arrangement has been very successful at The Wildfowl & Wetlands Trust in Slimbridge, United Kingdom (Pickering, 2000).

Note: Since most indoor holding facilities' floors can remain damp for long periods of time and are usually constructed of concrete it is essential that rubber, vinyl, or other easy-to-clean fast-drying matting material be used to separate the birds' feet from the caustic and abrasive properties of concrete. Long term exposure to damp concrete causes the birds' feet to become receptive to abrasions thus opening up the opportunities for infection and the debilitating condition known as bumblefoot.

Containment Barriers

Some of the types of barriers that have been used in winter holding facilities are:

> a) Chain link/ expanded wire: This type of mesh is versatile, easy to install, inexpensive, and provides increased airflow. However, wings and legs can get caught within the mesh, and it can be abrasive to bird wings. Debris and feathers can be difficult to clean off of the surface of the wire.
>
> b) Concrete or CMU block: This material provides a solid barrier, can be glazed to aid in cleaning efforts, provides durability, and requires little maintenance. It can be expensive to install, and if it is painted instead of glazed, it will require periodic repainting.
>
> c) Metal walls: Metal provides a solid barrier and is easy to clean. This material can be expensive to install and does not have any insulation properties.

The placement of barriers within the facility is important. Several institutions have built shift stalls to allow the flock to be shifted during routine cleaning. Shift stalls also provide areas to separate birds if aggression occurs. Typically an indoor facility will house more than just flamingos, and the interior walls should act as a separation between species that cannot be housed together. Solid interior walls up to six feet with mesh extending from the top of the wall to the ceiling are recommended. The mesh will allow for good air circulation within the building.

Sometimes it is necessary to catch up birds while they are in their holding area. If the walls are concrete or metal, the following method, used at the Los Angeles Zoo in California, can help prevent any injuries:

> "Metal lag screws/ bolts are put into the wall at about two foot intervals around the room, about five feet up from the floor. The bolts stick out from the wall approximately eight to

nine inches. A piece of PVC pipe is put on the bolt as a spacer to keep a curtain out from the wall. The curtain itself can be made of indoor/outdoor carpeting, shade cloth, canvas or anything with enough body to give a little resistance when the birds hit it. This has greatly cut down on the incidence of scraped and bloody wings, hocks, etc."

Outdoor Access

Access to the outdoors during the winter months is essential for birds that are housed in winter holding facilities. This practice allows the birds to go outside on nice days and keeps the flock acclimated to outdoor temperatures. An acclimated flock will be able go outside sooner in the spring. Many northern zoos have courtyards that connect to the building to allow the birds limited access to the outside. Snow on the ground can cause foot dryness and cracks. Some institutions shovel the excess snow out of the area and put down a bed of straw to prevent these foot problems. Doors to the outside should be as wide as possible to prevent injuries from crowding. If possible, a built-in footbath should be placed in front of the door. Among other things, this makes it easier to treat foot disorders with saltwater or other solutions.

Predator Control

Predators can be a problem in such a small, enclosed area and it is recommended that this be taken into consideration. Some methods of preventing depredation include the use of electric wire on the top of the fence and a mesh ceiling to prevent predator access to the area.

Air Quality

Air quality within the building is always a concern during long winter months. The building should have adequate ventilation, and there should be at least ten air changes per hour.

Substrate/Topography

The substrate/topography of indoor enclosures should be carefully considered. Flamingos are especially prone to foot problems, and there are some materials that the birds will actually ingest. There are several substrates that have been used in indoor facilities. These substrates are outlined below:

a) Concrete: This substrate can be extremely caustic and abrasive to feet and legs without protective matting between the birds' feet and the surface. It is the easiest to clean and disinfect on a daily basis. Concrete should be brushed at pouring to give a just a little texture. (This has worked well for Chilean flamingos at the Wildlife Conservation Society/Bronx Zoo; Caribbean flamingos needed mats.) However, a floor covering for all species of flamingos is recommended to prevent foot and leg injuries. Rubber, vinyl, or other soft synthetic matting have been used successfully and are easy to disinfect. Some institutions use wood shavings and straw. Although these two substrates are inexpensive, they must be kept dry at all times and pose an aspergillosis (mold, fungus) risk to the birds. Straw and wood shavings must be cleaned regularly to reduce health risks to the birds. Lincoln Park Zoo uses sphagnum moss over sand. The moss is replaced once a week, and it is hosed everyday to keep it moist. Rubber flooring can also be affixed permanently to the concrete. This can be very expensive and difficult to repair. Also, several institutions have had difficulty with the slick surfaces that these types of floors often have. A list of flooring vendors can be found at the end of this chapter under product information.

b) Soil/clay: This soft surface can be effective in preventing foot and leg problems. Using this type of substrate poses several problems. A soil floor poses an aspergillosis (mold, fungus) risk to the birds and can be difficult to clean and disinfect. This type of substrate also needs to be removed regularly and replaced which is the most labor intensive of all.

Generally speaking, concrete floors with a washable soft surface to keep the birds' feet from coming in direct contact with concrete is recommended. Since most indoor holding facilities' floors can remain damp for long periods of time and are usually constructed of concrete it is essential that rubber, vinyl, or other easy-to-clean fast-drying matting material be used to separate the birds' feet from the caustic and abrasive properties of concrete. Long term exposure to damp concrete causes the birds' feet to become receptive to abrasions thus opening up the opportunities for infection and the debilitating condition known as bumblefoot.

Temperature/Humidity

We think of flamingos as tropical birds and sensitive to cold. The three species most often managed in zoo and aquarium collections are surprisingly hardy and can benefit from some limited exposure to mild low temperatures. Temperature and humidity should be taken into consideration when housing flamingos. A suggested general minimum ambient cold temperature for the birds to remain outside is -6°C (24°F). However, wind chill will more often be the determining factor. Once the outside temperature has fallen to this level, the birds should be brought into a heated facility and definitely if snow or ice are present. In some areas summer temperatures can be extremely hot. Misters and sprinklers are used to provide relief for the birds. Shade from natural vegetation can also provide relief from the sun. Flamingos can suffer from dry skin on their feet and legs. Providing at least 40-50% humidity may provide relief for flocks that reside in dry, heated buildings during winter months. A recommended indoor temperature is 10°C (50°F). Appendix 1 lists the results of a survey of winter lock-in parameters and holding shelters of U.S. Zoos that can be used as a guide. Contributions from the European community are invited and will be added to the survey.

Utilities

In areas that have short day lengths, supplemental lighting might be interesting to try and simulate the even day/night hours of the natural range. Supplemental lighting can be provided in a number of ways. Skylights are an option and provide the ability to use natural day length, although it may not correspond to the species' native photoperiod. This type of lighting is also able to provide a larger quantity of light. The installation of skylights can be expensive, and they have a tendency to leak. Several different types of windows can be installed in a building to provide light. Two types that have been used in various facilities are glass block and regular windows. Artificial lights can be installed in indoor facilities to provide lighting. It is advisable to place the lights on timers to allow for the setting of photoperiods. Two types of artificial lights are that are utilized in zoos are fluorescent and UV spectrum.

Short-term holding

Short-term holding is defined as one week or less. Many southern zoos are faced with severe weather that necessitates bringing the flock inside a shelter. Some of the reasons for bringing a flock of flamingos into a short-term holding are: 1) brief cold snaps 2) severe thunderstorms and hail 3) hurricanes 4) tornadoes, etc. The Fort Worth Zoo has a 12' x 16' (3.6m x 4.9 m) shelter for a flock of 20-30 birds. This shelter appears to be adequate to house a flock of this size without problems for approximately one week. Moving a large flock into a shelter can be quite stressful. The stress on the birds should be weighed carefully against the severity of the storm and the potential loss of life. There have been several reports of flamingos surviving hurricanes by immersing themselves in deep water for the duration of the storm. In this circumstance it may be better to leave the birds with access to their pool, if it is deep enough, vs. putting into a shelter that may be blown away by hurricane force winds. These types of decisions must be made on a case-by-case basis, with the needs of the birds kept in mind.

Utilization Of Space / Indoor And Outdoor

There are several considerations for utilization of space that need to be taken into account regarding both outdoor and indoor space. For both outdoor and indoor space, courtship and aggression should be considered. The nest site location in an outdoor area should be located some distance from the public. The keeper activities should be kept in mind when placing a nesting area. Some keeper activities to consider are pool cleaning, feeding, exhibit servicing, and gardening activities (i.e. lawn mowing, pruning etc). An indoor facility puts the birds in close proximity to the keeper staff, and room should be given for the birds to be able to move away from the keeper during stall servicing.

Public viewing can be a factor for both indoor and outdoor facilities. Some institutions have indoor facilities that can be viewed by the public year round. It is ideal to allow only two to three sides of an exhibit for public viewing. There are exhibits that have public viewing from four sides, and they still get breeding. The location of nesting areas should be considered when designing public space. The birds should have some distance between their nesting area and the zoo visitors.

Capture And Handling Facilities

Many exhibits have attached holding areas that the birds can be herded into. This type of area can be very useful when dealing with medical procedures, exhibit maintenance, and flock management activities, such as ringing/banding. The area should be large enough to hold the flock comfortably for an extended period of time and be predator proof. A mesh roof is highly recommended for a capture stall, but not required.

Isolation From Similar Or Same Species

A quarantine area can be a separate facility or a modified stall within an existing hospital/quarantine space. Flamingos are very prone to foot problems, such as bumblefoot. The floor should be covered with some sort of substrate to prevent potential foot problems. Please see the section on substrate/topography for a discussion on floor substrates for an indoor facility. There is also a list of products at the end of this chapter. The same type of caging that is used in a winter holding facility should be utilized here. The air quality should be monitored, and adequate ventilation should be available. The space should allow for more than one bird to be housed at a time, as flamingos typically do better when housed with one or more birds. A shallow pool should be provided for birds in quarantine. It may be permanent or removable, as space permits.

There should be some plan for medically treating flamingos. The same considerations outlined above for a quarantine facility should be taken into account for medical holding areas. Existing caging can be modified for use as medical holding areas. See Management, Chapter 3 for further details.

Special Features

Fountains have been placed in several outdoor exhibits. Although this can be a very attractive addition to an exhibit, it should be designed with the birds in mind. In zoos that have fountains, the birds really enjoy bathing in them, but some designs pose potential trip hazards for the birds.

Enrichment has been provided to several flamingo flocks, mostly to stimulate breeding in small or inactive flocks. Audiotapes of flamingo vocalizations have been used to stimulate breeding as well as to encourage new or sick birds to eat. Mirrors have been used in some institutions to stimulate small flocks to breed. The mirrors are supposed to fool the birds into thinking that the flock is much larger than it actually is.

Severe Weather

All zoos that receive severe weather should have an emergency preparedness plan for their flamingos. The potential for severe weather includes hurricanes, tornadoes, severe thunderstorms, hail, flooding, extreme temperatures (hot or cold), ice storms and blizzards. Some southern zoos have used public bathrooms as safe areas for their birds during severe weather. Other zoos have set contingency plans and designated holding areas. Appendix 1 lists the results of a winter holding criteria survey.

Appendix 1

Cold weather lock-in parameters for zoos in North America. All temperatures are in degrees Fahrenheit.

Zoo/Institution	Tulsa Zoo	Pittsburgh Zoo	Tracy Aviary	Cleveland Metroparks Zoo
Determining Factor for bringing Flamingos Inside	predators, low temps.	in every night, regardless	low temps.	experience
Determining date or temp.			<20	consistently in 30's
Judgment call factors	wind, precip, sun			cold rain
When outside, is there access to shelter or heat?	yes	no	yes	no (lessers only)
Is the shelter or heat over water or land?	both		both	
Do the birds use the shelter by choice?	no, trained to come in		no, door too small	no, walked in
Factors to keep birds locked in the shelter	ice on ground or pool	temps. below 40°, precip.		
Temps. when birds are allowed to go outside (degrees F)	over 25 if clear or over 30 if precip.		over 20° heat lamp if <10°	
Notes				

Zoo/Institution	Denver Zoo	Roosevelt Park Zoo	Dallas Zoo	Columbus Zoo and Aquarium
Determining Factor for bringing Flamingos Inside	(into winter holding) – 5-7 days	low temps., violent rains	low temps., precip.	temps. and weather
Determining date or temp.	consec, of <20 night low temp.	<32 at night	<32 at night	<25
Judgment call factors	or 3-5 days consec. of <5 real temp/wind chill or 12-18+ inches snow accum. in 24 hrs with no 40+ temps in the next week		wind, precip.	wind chill
When outside, is there access to shelter or heat?	no	shelter only	yes	yes
Is the shelter or heat over water or land?		land	yes	yes
Do the birds use the shelter by choice?		no	yes, on rare occasions	yes
Factors to keep birds locked in the shelter			ice, wind chill, <40	low temps. and precip.
Temps. when birds are allowed to go outside (degrees F)			32, no wind	mid 20's with no wind
Notes	winter facility separate from exhibit. Birds let out in mid to late April, depending on weather.	winter facility separate from exhibit	often kept themselves in once herded in	

Zoo/Institution	Topeka Zoo	John Ball Zoological Gardens	Detroit Zoo	Akron Zoo
Determining Factor for bringing Flamingos Inside	n/a	temps.	low temps.	ice or snow on ground
Determining date or temp.		<32 for several nights	20's at night	
Judgment call factors		ice on their pond		
When outside, is there access to shelter or heat?		no, vegetation only	yes	no, vegetation only
Is the shelter or heat over water or land?			yes	both
Do the birds use the shelter by choice?			no, walked in	no, walked in
Factors to keep birds locked in the shelter			<10 or snowing heavily	
Temps. when birds are allowed to go outside (degrees F)		when stays at 40 at night		
Notes	only 2 birds, never been outside	birds are put inside for the winter		

Zoo/Institution	Tautphaus Park Zoo
Determining Factor for bringing Flamingos Inside	temps
Determining date or temp.	<32
Judgment call factors	
When outside, is there access to shelter or heat?	yes
Is the shelter or heat over water or land?	land
Do the birds use the shelter by choice?	no, walked in
Factors to keep birds locked in the shelter	temps.
Temps. when birds are allowed to go outside (degrees F)	over 20
Notes	

References

Pickering, Simon. 2000. Flamingo Husbandry draft document produced through the Wildfowl and Wetlands Trust Slimbridge, England.

List of Products

Enkamat 7010
American Excelsior Co.
P.O. Box 249
Sheboygan, WI 53082-0249
Phone: (414) 458-4333

Dri-Deck Tiles
R.C. Steele
1989 Transitway
Box 910
Brockport, NY 14420-0910
Phone: 1-800-872-3773

Turtle Tiles
Turtle Plastics, The Recycled Products Co.
7450 A Industrial Park
Lorain, Ohio 44053
Phone: (440) 282-8008   FAX: (440) 282-8822.

Bandettes used by Disney's Animal Kingdom
Any poultry supply company or

National Band and Tag Company
721 York St. P.O. Box 72430
Newport, Kentucky 41072-0430
tags@nationalband.com

For Europe please contact the EAZA Office

Acknowledgments

The following individuals provided their expertise for this chapter:

Peter Shannon, San Francisco Zoo

Tom Schneider, Detroit Zoo

Linda Henry, Sea World Adventure Park San Diego

Susan Healy, Sacramento Zoo

Jeff Perry, San Antonio Zoo

Lynda Paul and Cathy Christel, Los Angeles Zoo

Nigel Jarrett, Wildfowl & Wetlands Trust, Slimbridge, England

Chris Sheppard, Wildlife Conservation Society/Bronx Zoo

Megan Ross, Lincoln Park Zoo

Chapter 3

Management

Facilitators: Stephanie Costelow, Sea World Adventure Park, San Diego; Nigel Jarrett, The Wildfowl and Wetlands Trust

Identification

It is now vital to ensure all captive flamingos are marked so that they can be individually identified. There are two main types of ring or band available. These are metal rings/bands (either models made from an alloy of nickel and copper or aluminum) or large Darvic plastic rings/bands. Metal rings/bands probably last longer but it is necessary to catch birds to identify individuals. Engraved plastic rings/bands have the advantage that they can be read easily without the need to catch birds to identify them.

Metal rings/bands should only be applied by an experienced ringer/bander using a pair of ringing/banding pliers.

Engraved plastic rings/bands are made out of two or three sheets of different colored plastic laminated together. The letters or numbers are engraved exposing the second color which contrasts against the outer layer. These can be made in various sizes and length to fit each species of flamingo.

Plastic rings/bands can either be bought ready made and engraved or, with the correct equipment rings/bands can be cut, engraved and molded on site. This is only practical if thousands of rings are to be made on site.

All rings/bands need to be fitted properly to avoid any damage to the birds' legs. Because flamingos spend a large proportion of their time standing in water, it is advisable to apply the ring/band on the upper leg above the tarsi-tibia joint.

Ring/band wear and ring/band loss appear to be greater in breeding birds compared to non-breeders (Pickering 1992). This may mean that some birds may require regular re-ringing/banding. Permanent transponder tags may soon be required for C.I.T.E.S. species and may prove valuable in the long term. The bill patterns of flamingos are highly variable and individually distinct. A photographic record of each individual in a flock should ideally be made when they are first ringed.

All flamingos are sexually dimorphic and most individuals can be sexed using one or two standard measurements (Studer-Thiersch 1986, Richter and Bourne 1990). Standard measurements are tarsus, bill length or bill and head, wing length and body weight. This can be checked by laparoscopy.

Rings/Bands

Plastic rings/bands are the recommended form of physical identification. They are easy to order and relatively inexpensive, providing numerous color variations, numbers, lettering and stripes. It is important to note that the color of the plastic may affect the durability of the band, with different colors having different strength characteristics, i.e., white core appears to last longer (P. Shannon, personal communication). Additionally, color may be important to overall readability of the band, e.g., WWT recommendations state that yellow with black lettering or green with black lettering may be the easiest to read. Conversely, dark backgrounds with white lettering may become difficult to read if mud fills the light lettering. Simplicity of lettering or numbering is recommended, using not more than a two-digit system but with the numbers repeated two to three times around the circumference of the ring/band (vertical versus horizontal orientation). Please consult the Bibliography for detailed articles about ring/band design. Please see Product Information below if you do not have a supplier for plastic rings/bands.

It is recommended that the ring/band be placed above the tarsal joint on the leg. Size of the ring/band should be suited to the species and to size variations within the species. Please consult any of the ring/band suppliers in the Product Information section for appropriate size. Some institutions place ring/bands above the foot, but this may adversely affect readability and increase the risk of injury if the ring/band slips over the toes. The plastic ring/band has the potential to migrate on the leg causing constriction or abrasion. It is recommended to consult your TAG if you have concerns about this. Ring/band suppliers recommended in this publication have experience with the appropriate material to minimize abrasion. Occasionally rings/bands crack, break or fade over time. Therefore, it is recommended to have a secondary or back-up means of identification.

Also, after the band has been placed on the leg, the overlapping edges can be, if desired, bonded with a high-quality adhesive. After application, the surfaces can be held together with clear adhesive tape, which will wear off with time. Band wear and band loss appear to be greater in breeding birds compared to non-breeders (Pickering, 1992).

Secondary Identification

a) Plastic or metal ring/band

b) Transponders: The use of a transponder is optional. Transponder failure and migration have been reported. The bird must be in hand or adjacent to scanner to read the transponder. The IUCN/SSC Captive Breeding Specialist Group's recommendations (CBSG, 1991) concerning transponder site and use should be followed when using a transponder system. The transponder should be placed dorsally at the juncture of the neck and the body on the left side.

c) Plastic cable ties, such as are used by electricians to bind a group of cables or electric wires together, are not recommended except as a temporary form of identification. The cable tie has a mechanism intended to synch the tie around the object(s) and the only way to loosen the tie is to cut it. The ties can constrict the bird's leg causing compromised circulation, swelling or abrasion. Instances of birds' bills becoming entangled in the cable ties have been reported. In addition, birds can manipulate the ties in such a manner as to further tighten them around the leg.

d) Wing Web Clip/Patagial Flags are not recommended.

e) Tattoo/dyes are not recommended.

f) Physical characteristics that are specific to some birds (e.g., old fracture, bill and facial markings, size, eye injuries, etc.) may allow some secondary identification to be possible, especially in a small flock. This method is not reliable and highly subjective, but it is always useful to note these special individual characteristics.

Record Keeping

It is particularly important to keep accurate records on long lived birds such as flamingos. During a flamingo's life, (50+ years) even if it stays in the same collection, it is likely to be looked after and be the responsibility of a large number of people. It is essential that each flamingo should be individually marked and records kept of any movements between collections, mates, breeding, offspring and health. It is particularly important for the future genetic management of captive flamingos that accurate records of breeding and parentage are kept.

Each season a map of the nest site should be drawn with the location of each nest marked prior to the first egg being laid. If the flock goes on to breed the flock should be checked daily to record the location of each egg, lay date and identity of the parents. Care should be taken to check each nest every day as birds are frequently displaced from their nest by incoming pairs.

The absolute minimum for a system of records should be a card index with one card for each bird. More convenient, but more expensive is a computer data base. The Animal Records Keeping System (ARKS), developed and supported by International Species Information System (ISIS), has now become the world standard. Standard For Data Entry by Joanne Earnhardt (AZA publication) offers guidelines that might be a starting point for standardized record management.

Capture, Handling and Restraint

Flamingos are captured, handled and restrained for a variety of purposes. Some of the more common reasons are for weight measurements, placement of identification, pinioning and seasonal flock movement. On occasion it may be necessary to intervene for a particular event or circumstance such as for shipments, removal of sick or injured birds, individual or flock movements, construction or severe natural events. It is not recommended to handle or move birds often, or during the breeding cycle (see Reproduction, Chapter 4). When considering flamingo colony intervention, it is prudent to weigh the benefits of the procedure against the stress and possible physical harm that may be incurred. Catching and moving flamingos can result in severe injury or death. It is recommended to seek advice from your TAG prior to undertaking a move or capture if not familiar with the process.

There are several basic guidelines that should be observed when working with flamingos. It is important to be aware of the flocks' position at all times, while in or around the exhibit. Awareness will facilitate in responding to the flamingos' behaviors or reactions to external stimuli. Avoid sudden movements and loud unexpected noises that could frighten the flock. Do not leave objects (e.g., hoses, shovels, rakes) unattended in the exhibit. These could be potential sources of injury from tripping. Training should be provided for all bird and non-bird personnel who may have reason to work with or around flamingos.

Methods used for capture and handling are influenced by exhibit design, flock size and birds' behavior. It is important to observe and interpret individual bird or flock behavior to aid in capture. Flamingos can be conditioned over time to recognize particular keeper behaviors or movements eliciting a particular response from the bird (i.e., hands in the air to prevent birds' approach, back turned to allow birds' passage). Again, care should be taken to protect birds from potential hazards in the exhibit such as rocks, branches, pipes, slopes, holes, etc. Once captured, extra persons may be required to hold birds. Planning and discussion of capture and handling procedures should be undertaken prior to the event.

Capture

In planning a capture sequence, managers should consider the following important factors:

a) Species
b) Number of birds
c) Reason for capture
d) Location of capture - indoor vs. outdoors; water and land details (i.e., topography, depth, etc.)
e) Acclimation level of the flock
f) Previous capture experience for both flock and staff
g) How many staff available/needed for event
h) Location of release
i) Procedures planned while birds are in hand - time in hand
j) Ambient temperature (it is not a good idea to plan a catch in hot weather)

It is imperative to understand that all these factors are co-dependent. Circumstances are variable as are each of these factors. After evaluating the above factors, managers can then decide on the type of corralling necessary and the appropriate barrier materials.

Corrals

Flamingos can be herded into primary and even secondary corral systems, when it is necessary to catch them up. In smaller flocks, birds can be conditioned to enter a corral, if used routinely (e.g. winter holding), or a "follow-the-leader" type behavior may be encouraged to move the flock to a desired area. In larger flocks, selectively separating out smaller numbers from the flock into corrals may work as well. By letting a few birds out at a time they can be caught up without causing undue stress to the flock as a whole.

Corrals may be permanent or temporary and the barriers made from a variety of materials. In designing new exhibits, managers should take into consideration the necessity of catch and release for flock management (see Housing, Chapter 2 for further details.)

Barriers

Barriers can be modified to fit the corral size needed. Some commonly used barriers include fencing, plywood, burlap, regular or closed-cell foam, and black or clear plastic sheeting. Mesh barriers are not recommended due to the high risk of injury due to entanglement. Care must be taken when using fencing to ensure the holes are small enough so wings or feet do not penetrate. Fencing not greater than 1" X 1" is recommended. Some abrasions have been noted from birds rubbing against wire when closely confined. Burlap and plastic sheeting work best as hand-held barriers. Given adequate numbers of staff, a line of people arms length apart can function as a barrier.

Barriers can be designed as a corral, as a corridor to direct the route the birds are to follow, or to block visual access to unfamiliar or frightening objects. In other cases, materials can be used to reduce the impact on objects with which birds might collide. Hand-held barriers can be used to separate small groups from the colony or move the entire colony in one direction.

Water versus Land Capture

The advantage of arranging water capture is that the birds' movements are inhibited, making them easier to catch by hand. In addition, deeper water can reduce the impact if a bird were to trip or fall. Some disadvantages include potential medical complications from birds getting wet, hypothermic or aspirating water. Other hidden dangers might include submerged rocks, wood snags, plants or pipes.

Advantages of land capture are the ability to visually read leg rings/bands for easier identification and targeting of selected birds. The propensity for birds to collide with barriers and fall has greater probability for injury.

Hand Capture

It is recommended that flamingos be caught by hand. It is not recommended to use hand-held or mist nets. Flocks may become sensitized to long-handled tools if hand-held nets are used. One way to catch a bird is to take hold of the upper part of their wing (T. Richardson, pers. comm.)

Escapes

Flamingos can and will escape from outdoor exhibits, even if flight ability has been restricted. Methods for capture are similar to in-exhibit capture with added hazard considerations such as public access, vehicular traffic and buildings.

Handling and Restraint

Techniques

Whenever possible, birds' legs should remain unfolded. Folding can increase the risk of capture myopathy and leg paralysis or injury. A very large or unruly bird may require folding the legs for ease of handling or safety. Other circumstances might dictate the need for folding. If folding of the legs is to be undertaken, it must be done with caution. To fold, grasp the legs below the ankle joint and apply gentle pressure until the bird relaxes. Legs should never be forced into a folded position. Additional care should be taken to avoid crossing the legs at the ankle.

a) Hand-held restraint:
    i. Body close to holder, head facing backward; legs may be down or folded.

ii. Body close to holder, head facing forward; legs may be down or folded.

iii. Wing hold at shoulders with one hand, grasping neck gently with the other, legs down allowing bird to be guided along in a semi-walking fashion It is recommended that only handlers with experience use this method.

b) Mechanical restraint:

i. On occasion it may be necessary to restrain a bird in a sling. Slings are made from fabric, foam and/or plastic. Flamingos can be secured in the sling by using cloth, vet wrap, tape or netting. When positioning the bird, one should take into account the bird's comfort level and the injury necessitating the use of a sling (See Health and Medicine, Chapter 6).

ii. Towels can be used as a temporary form of restraint for weighing. The flamingo is wrapped snugly with legs folded. Another towel can be draped over the head (as it lays on the back) to reduce external stimuli. Some facilities place the bird in a clean trashcan with a lid for weighing. Subtract the weight of the trashcan.

Special Considerations

a) Time in hand: Every effort should be made to reduce the overall time birds are handled from capture to release. Advance preparation can greatly reduce the amount of time birds are in-hand by insuring proper training and adequate supplies.

b) Concerns: Medical problems associated with capture and handling include overheating, myopathy, leg paralysis, and trauma-related injuries such as dislocations, fractures, tendon/ligament damage, eye injuries, broken blood feathers, lacerations and abrasions. A period of flock over-excitability and in appetence is likely to follow any capture event (Ref. Health and Medicine, Chapter 6).

c) Safety: The wearing of goggles and hooded sweatshirts to prevent bite injuries is used by some institutions as a safety precaution. Do not wear jewelry, as birds may bite off or become entangled in the articles. Some facilities have used hoods or socks to quiet the bird by covering the head.

Moving Between Exhibits

When moving birds from summer to winter holding or between exhibits flamingos may be walked, guiding with hand-held barriers, or hand-carried. All the same handling and restraint considerations apply.

Release

When releasing flamingos, managers must take into consideration all the same factors as listed for capture with special attention to the following points:

a) The time from capture to release should be as short as possible. Pre-planning is vital to this aspect of capture, handling and restraint.
b) Release is a critical stage in the capture sequence; it is advised that an experienced person undertake the releasing of birds following capture.
c) Managers must examine exhibits for release locations that have an even topography for a land release or moderately deep water (two to three feet) for a water release.
d) A variety of techniques may be used to release flamingos. Flamingos may be unsteady on their legs by the time of release, especially when folded. Furthermore, they are often panicky and eager to escape being held. If the bird has been folded, it is important to unfold the legs and ensure the legs are steady and the bird is able to stand before release. Blood flow may have been compromised and simple massage of the legs and thighs with fingers can assist with improving the blood flow. Extra caution should be used when dealing with a struggling bird, as these birds may bolt away and fall. Having a quiet area within the exhibit where birds can reside immediately following release without undue disturbance or keeper activity is beneficial.
e) Managers should make provisions for a reduction of disturbance in and around the flock. This should include keeper activities, landscaping or other activities in proximity to the exhibit.
f) Flocks should be monitored closely following release for signs of capture myopathy. Medical problems resulting from a capture event may be seen from the time of release to two weeks thereafter. Common symptoms might include leg shaking, shivering, droopy wings, generalized weakness, lethargy, in appetence, and individual isolating from the main flock.

Crating and Transport

Crating and transport are areas of flamingo management that require further examination. Previous transport experience is often vital to a successful shipment. Even experienced managers have had serious adverse consequences resulting from the shipping process. However, successful movement of flamingos is crucial to the future management of self-sustaining captive populations.

It is recommended that flamingos be shipped individually crated and free standing when possible. This method eliminates folding and may reduce the incidence of capture myopathy, leg paralysis and overheating. It is not recommended to ship freestanding birds grouped together due to reported wing and leg injuries. International Air Transportation Association (IATA) regulations require the following container dimensions; 50cm (19.5in) long, 90 cm (35.5in), tall and 35cm (14in) wide per container, or compartment of a container. Padding, made from a soft non-destructible material, is required under the top of the roof. The two cm (3/4 in) wood frame is covered with lightweight plywood or similar. The floor must be covered with a solid non-slip, leak proof absorbent material (non-agricultural) and securely attached to the floor to give bird a solid foothold. The container must have an entry and exit means, the front or rear may slide or be hinged with a secure means of fastening, or the roof can act as a lid. Adequate ventilation must be provided in at least three sides of the container. Flamingos must be packed individually in compartments of a container, or in an individual container. No more than four flamingo compartments must be in a single container. Separate food and water containers must be provided, they must be accessible for refilling, and the sides of the water container must be flanged to prevent spillage. (For additional information and specifications see IATA CONTAINER REQUIREMENT 17).

A note about slinging individual birds inside shipping compartments.:

Although IATA includes slings within the shipping specifications as optional, flamingo managers should consider the hazards associated with slinging birds unmonitored during shipping.

The height of the sling must be properly adjusted to fit each individual bird so that it is in contact with the keel, without supporting the bird. That is, each bird's feet should be allowed to touch the floor of the shipping container compartment. This means each sling must be custom fitted to each individual flamingo. Severe leg and foot injuries have frequently occurred when using slings often leading to death. Flamingos struggle while in transit and a sling makes this worse as the bird can not reason why it is unable to move unrestricted and so it continually fights trying to free itself from the sling. If slings are used they should only be installed by an experienced, proficient handler. In the past, some airlines have refused shipments without slinging birds. If you experience this tell your airline cargo manager that IATA now allows slings to be optional. The AZA Ciconiiformes Taxon Advisory Group does not recommend the use of slings during shipping.

Preparations

Key considerations in preparing for crating and transportation are:

a) Species, age and physical condition
    i. It is not recommended to transfer flamingos two years of age or younger.
    ii. Do not ship during wing molt due to increased risk of blood feathers breaking.
    iii. Caribbeans may be more high-strung than other species.
b) Time of day and year
    i. breeding cycles
    ii. air temperatures
c) Total flight/confinement time
    i. from capture to release
    ii. folded no longer than eight hours
d) Temperature
    i. above 0° C (32ºF) but below 21° C (70º F)
e) Conditions under which birds are caught and crated
f) Expense

Methods of Shipment

A variety of methods have been used to ship flamingos. Among them are the following:

a) Freestanding, individually crated. Construct a crate large enough to allow the bird to stand at normal height but narrow enough to prevent extension of the wings. Be sure the dimensions of the box are long enough to accommodate the legs of a bird if it were to sit down. The best substrate is indoor/outdoor carpet secured to the floor. One disadvantage of this method is that the crate may be difficult to maneuver within the air cargo hold during loading and unloading. In addition, the size of the crate may preclude airline shipments.
b) Standing, crate height to back (keeps bird's head down). Construct a crate of a height no higher than the back of the bird. This allows the bird to stand but unable to raise the

head above shoulder level. The bird is then in position to steady itself with its bill, if necessary, for balance. Again, the crate must be of a dimension to accommodate the legs should the bird sit down and/or flex its wings. The advantage of this method over the full freestanding method is that the crate is smaller and the bird may have better balance inside the crate.

c) Folded, wrapped, and crated. Crates are constructed individually or larger with individual compartments. Again, size will depend on the mode of transportation; airlines have size restrictions. Each bird is wrapped and secured from rolling after placement in its crate or compartment. The disadvantage of this method is that birds are folded. However, if the crate meets airline specifications, birds can be shipped over longer distances than by truck. The risk of myopathy is greater.
d) Folded, wrapped, in back of truck. Flamingos have been transported as a group in the back of a truck lined with clean hay. Each bird is individually wrapped in a pillowcase then nestled in the hay, which prevents the birds from rolling around. An alternative method to prevent rolling would be to use pipe insulation tubes, cut to length, on each side of each bird. Since the birds' heads are free, it is advised to alternate the position of each bird, i.e., head, tail, head, tail, to prevent aggression. A refrigerated truck is recommended to help regulate temperature. The disadvantage of this method is that birds are folded, and it is only recommended for shipping distances of less than eight hours.
e) Freestanding in back of truck/van. This method involves putting freestanding birds together in the back of a truck, commercial van or trailer. The vehicle should be padded and air ventilation assured. The substrate should be non-slip and securely affixed to the floor. Birds are then added one-by-one to the holding space until all birds are loaded. The disadvantages of this method include the high propensity for a bird to be injured from falling and being trampled. Driving must be slow with careful starts, stops and turns.

Shipment Procedures

Preparing the Flock for Shipment

Refer to Health and Medicine (Chapter 6) of this manual (Noninfectious Diseases – Capture or External Myopathy) for recommendations on the supplementation of Vitamin E/selenium prior to and at transport.

Crating

Flamingos have been transported in sky kennels, cardboard boxes and wooden crates. A crate can be designed to hold more than one bird and compartmentalized to eliminate direct physical contact between birds. Crate dimensions vary depending on the species to be shipped. The bird's position in the crate (standing or folded) will determine the length, width and height. It may be necessary to have several crate sizes available. There should be one bird to each compartment, although they may be built in blocks of up to five compartments. Internal walls may be made of a thick sacking material (T. Richardson, pers. comm.)

Crates can be constructed using plastic, wood, cardboard or pegboard. Metal containers are not recommended. Evaluate the interior for potential scrape hazards and cushion as necessary. Proper air ventilation and circulation is imperative, and ventilation holes are suggested on at least three sides. A secured indoor/outdoor carpeting or a similar non-slip surface is recommended for the bottom of the container. Other substrates that have been used are shavings and clean hay.

Wrapping

A pillowcase of 100% cotton or gauze-like material is used to enclose and immobilize folded birds for transport. Nylon or body stockings are not recommended. The pillowcase is affixed with masking or duct tape to secure the legs and body. Caution must be taken to ensure the legs are not crossed inside the case. It is critical that this material allow heat exchange to prevent overheating. It has been reported that a cotton tubular fabric (similar to material used to cover casts in hospitals) has been used with some success.

Transport

Airplanes have the advantage of covering a greater distance in a shorter period of time. Advance communication with the airline is necessary to ensure the crate size will fit in the cargo hold. It is recommended that an attendant accompany the shipment to facilitate in container placement, monitoring and later release.

Release following shipment

Birds should be removed from the container as soon as possible. It may be necessary to assist the bird in standing. This may simply involve supporting the bird until it can stand, massaging the legs or walking the bird to increase circulation. Weaker birds may need to be slung for a few hours prior to release. Some birds may get too wet when released in water, exacerbating weakness. It is recommended that birds be monitored closely up to 24 hours after release. Managers should be aware that problems associated with transport may occur up to one week following release.

Shipping and Transport - Examples of What Has Worked

Modified Sling For Shipping Flamingos

Steffan Patzwahl, Parc Paradisio (Belgium)

This shipping crate design was used by Ralph Boussfield of “Birds and Game” in Botswana. Mr. Boussfield shipped 70 adult-sized Greater flamingos (Phoenicopterus ruber roseus), rehabilitated birds found as chicks in an abandoned colony, from Botswana to Belgium. The duration of the trip was more than 24 hours, and only one of the 70 birds was lost in transit.

Each crate contained four adjacent compartments. Cotton cloth walls divided the compartments. Cotton cloth wrapped around the body of each flamingo (with wings closed) was stitched closed down the middle of the flamingo’s back. Openings were made for the neck, cloaca and legs. A piece of cotton attached (sewn) along both sides of the top of the compartment was slung under the flamingo. Food containers were attached along the front wall of the crate.

Shipment of 20 Greater Flamingos from Slimbridge Wildfowl & Wetlands Centre to the Auckland Zoo

Nigel Jarrett, Avicultural Manager, The Wildfowl and Wetlands Trust (England)

Sixty-day-old Greater flamingo chicks (Phoenicopterus ruber roseus), hand-reared in isolation under strict quarantine conditions, were flown in special crates over 11,000 miles to New Zealand. They were reared and attended by Michael Batty, a senior keeper at the Auckland Zoo. They went first to quarantine and then on to a purpose-built African Exhibit at the Auckland Zoo.

Shipping Chilean and Caribbean Flamingos from Discovery Island to San Francisco

Scott Barton, Disney's Animal Kingdom (U.S.)

In the fall of 1999, Discovery Island (Orlando, Florida) shipped 32 Chilean flamingos (Phoenicopterus chilensis) and 65 Caribbean flamingos (Phoenicopterus ruber ruber) in three separate shipments. Two shipments were by ground vehicle, and one shipment of 32 Chileans flamingos was shipped by air to San Francisco (California). For these shipments, birds were in the crates from eight to 14 hours.

All flamingos were shipped in crates that allowed the birds to stand but did not have any sling device. Each crate had four compartments. The overall crate dimensions were: 56 inches long x 30 inches wide x 32 inches high. When putting the birds into the crates, we make sure that the birds are standing comfortably in the crate before securing the compartment. With this method, we had 100% success with each of our flamingo shipments. In one shipment, a single bird was sitting down on arrival and had difficulty standing after being released. With assistance and veterinary care, this individual recovered completely. The only other injuries were slight abrasions to the wings in the alula region on some birds. For future shipments I would consider adding padding to help with this. Narrowing the crate to 12 inches might also reduce the movement of the flamingo in the compartment and reduce these abrasions. Shade cloth denser than 0% should also be used. In all cases, these were minor injuries and resulted in no more serious complications.

Disney's Animal Kingdom also received 10 Greater flamingos (Phoenicopterus ruber roseus) from Pretoria, South Africa. They were shipped in a crate measuring approximately 1.1 meters tall, two meters wide and 2.5 meters long. This crate was divided into two sections, with five birds in each section. The flight from Pretoria to New York was over 16 hours. All the birds arrived well. The zoo in Pretoria reported that they have used this technique for other flamingo shipments as well.

In conversations on this subject with Dr. Mark Penning, a veterinarian and Director of Umgeni River Bird Part in Durban, South Africa, he related that they have shipped over 100 birds using the IATA designed crates with slings, and they see between four to six percent of the birds develop injuries or myopathy, often associated with the slings. He said that he has seen birds get their heads stuck in the leg holes in the slings, leading to serious injury or death.

Dimensions of Crates used by the Caldwell Zoo (Texas)

A shipment of Chilean flamingos (Phoenicopterus chilensis) was sent to the Wildlife Conservation Society, Bronx Zoo by the Caldwell Zoo in Tyler, Texas. The crates were 10 inches wide by 28 inches long by 29 inches tall.

Notes on American Flamingo Transport from Discovery Island to Audubon Park
Published in The Quill in 2000

Crate Details

Two types of crates were utilized for transporting flamingos. Thirty crates originally designed for Mississippi sandhill cranes measured 21 inches wide X 20 inches deep X 33 inches in height. Full-length slide doors were located in the front of each crate. An additional 15 crates were constructed specifically for this transfer and measured 18 inches wide X 24 inches deep X 36 inches in height. Full-length, side-hinged doors were located on the front of each crate. See Figure 1 for diagrams of crates.

All of the crates were padded in some manner. Pieces of carpet remnants were stapled on the ceiling and upper half of the sides in 39 crates. The inside of the doors of the larger crates were padded; the slide doors of the smaller crates could not be padded. Four of the larger crates were padded with two layers of burlap, which were stapled to the ceiling, sides and door. All crates were bedded down with one to two inches of shredded paper.

During the crating process, it was decided that larger, taller birds would be placed in the taller crates whenever possible.

Vehicle/Loading Details

Two trucks with 8'X16" refrigerated cargo holds were rented for the transfer. Temperature was controlled by digital thermostats, adjustable up to 80 degrees. As per discussion with Mary Healy, it was agreed that maintaining a temperature of 60 degrees would be desirable. In actuality, the thermostats cycled between 59 and 66 degrees with a 60-degree setting. Since the birds were enclosed in padded crates and under stressful conditions (i.e. generating more heat), a lower temp setting probably could have been used. There were no examples of extremely overheated birds when they were uncrated.

Crates were loaded in the cargo areas from front to back. Spacing between crates averaged approximately four inches on the sides, and between approximately two to three inches on the front and backs. All crates were distributed more or less equally between the two trucks. After loading the full complement of crates in each truck, they were tied together as a unit to prevent sliding or tipping. No tie-downs were available within the cargo area.

The trucks departed Discovery Island at 1300 EST (1200 CST) on 10 November and arrived in New Orleans at approximately 0200 CST on 11 November. Travel time including several refueling/rest stops totaled 14 hours. Birds spent between 15 and 18 hours crated during the trip.

Quarantine Facility

For the first 24 hours, birds were allowed access to only the indoor portion of the quarantine area. This consisted of three indoor holding rooms measuring 12 foot square, with two similarly sized adjoining outdoor areas (see Figure 2 for schematics). The concrete floors of the inner rooms were bedded down with straw, while several rubber mats padded the floor of the outer areas. Two wading pools were placed in the outdoor area along with feeding tubs. Inner rooms were artificially lighted.

On Friday, 12 November, the group was allowed access to the large, outdoor courtyard measuring 48 feet X 40 feet with grass substrate. A small portion of the yard was partially flooded to allow the birds to dabble in mud pools. Four wading pools were placed throughout the yard in addition to four feeding tubs. One pool has a continuously running hose to provide a source of fresh water, however, the birds preferred pools that became muddy. Once the birds had been given access to the outdoor courtyard, they would not utilize indoor holding areas.

Unloading Details

Upon their early morning arrival in New Orleans, the decision was made to uncrate the birds. Since some birds had been crated for over 15 hours, it was felt that it would not be in the birds' best interest to keep them crated until first light. Within 20 minutes of arriving, staff began unloading birds one at a time. A veterinarian was present with one additional staff member when unloading birds. As each crate was opened, birds were carefully assisted in exiting the crate and were then examined by the vet. Heads, wings and legs were examined for abrasions or other injuries. Each bird was physically supported until it was confirmed that it was coordinated and capable of walking, after which it was released. Only three to four birds were found in the sitting position as the crates were opened. Only one of these birds was one from a large crate.

Virtually all of the birds were a bit shaky after uncrating, but all but one bird was able to quickly walk away with minimal assistance. The one exception was a large bird (yellow #52 R) that had been crated in a small crate. The bird was found in a sitting position, and upon its removal from the crate was alert but very uncoordinated with poor balance and leg extension. The bird's hocks were slightly abraded due to contact with the unpadded portion of the crate's sides. After physically supporting the bird for up to five minutes, it was able to stand and, with difficulty, take short steps. Its condition continued to improve over the next 20 minutes, and the decision was made to let it remain with the group without further intervention.

Post Arrival Details

Throughout their day of arrival, the flock was very nervous and flighty. Food was offered in the morning. However, there was no evidence that the group ate (most likely stress-induced loss of appetite), but introduction of a new diet was probably also a factor. By Friday, 12 November, the group was allowed access to the outdoor courtyard. Food was offered in both dry form and with water mixed in to form a slurry. By Saturday, the group's appetite began to improve, and by Sunday, 14 November, it had recovered completely. By this time, the group was displaying normal behaviors and showed little to no sign of stress. Windows overlooking the courtyard proved to be the most effective way to observe the group at close quarters.

Weighing

It is recommended to weigh birds opportunistically, if circumstances allow, when birds are in-hand. Several techniques have been used to weigh flamingos as follows

a) Folded and restrained (towel) without a container.
b) Restrained in a container (e.g., trash can)
c) Keeper holding bird with a walk-on scale.

Other measurements, such as bill and tarsus length, can also be taken at this time. The addendum at the end of this chapter outlines the various measurements that can be taken and the methods and materials to accomplish the task

Flight Options

It is recommend that flamingos be full-winged in appropriate exhibits (ref. Housing, Chapter 2). It is currently hypothesized that full-wing flamingos have better balance for copulation than their flightless counterparts, which may improve overall fertility. However, many exhibits are not designed to house full-wing birds. The three most common ways to render a bird flightless are pinioning, feather clipping and tendonectomy.

a) Pinioning is the surgical removal of the metacarpals, which permanently inhibits flight. Some managers prefer a long pinion, where four to five primaries are left intact. It is believed that fertility may be enhanced in long-pinioned birds. It is still unclear if a long pinion adequately inhibits or prevents flight.
b) Feather clipping involves cutting the primaries along the wing coverts on one wing. This method is not recommended due to the irregularity and frequency of wing molt in flamingos. It is temporary and may need to be repeated every six to eight months.
c) A tendonectomy is a surgical procedure that abrades the carpo-metacarpal joint to ankylose or freeze the joint. This procedure is not recommended. There has been low success in preventing flight, and it is highly invasive with a long post-operative recovery period. Tendonectomies can only be done on adults; birds under two years of age are at increased surgical risk and, therefore, poor candidates for this method.

Sex Determination

It is recommended that all birds be sexed. The most commonly used sexing techniques are DNA analysis (blood, feather pulp), surgical laparoscopy, body measurements and behavioral observations.

a) DNA analysis and laparoscopy are the most reliable methods but may not be practicable. (Reference Health and Medicine, Chapter 6)
b) The tarsus, bill length or bill and head, wing length and body weight are anatomical features used for measurement (Studer-Thiersch 1986, Richter and Bourne 1990). Caribbean flamingo juveniles can have measurements taken as early as 2-2.5 months of age. Kevin Drees of Blank Park Zoo in Des Moines, Iowa reported that the tarsal lengths of 12.12 Chilean flamingos were measured. Male tarsal lengths were between 28.57 and 29.53 cm. Female tarsal lengths were between 25.01 and 26.07 cm (95%

confidence intervals). For more information on measuring flamingos, see the addendum to this chapter, Measuring Flamingos, by Nigel Jarrett.

c) Behavioral observations, such as pairing or copulations, as a sole source for gender determination are not recommended. However, behavior can be used as a temporary method for sexing until other procedures can be performed.

Pests/Predators

Predators and pests can be a problem for any flamingo exhibit. Depending on geographical location, predators may include foxes, raccoons, dogs, coyotes, bobcats, rats, humans, owls, eagles, hawks, herons, white ibis, gulls and snakes. Pest species include Canada geese, flies, mosquitoes, fire ants and lice. Managers should be aware of standing water as an environment for vector species (e.g., mosquitoes), which carry avian malaria, the West Nile Virus, and pox. New World flamingo species are especially vulnerable to West Nile Virus.

Protection from predators might include aviary housing, electrical fencing, Havaheart© traps, motion sensor lighting or barriers (above and below ground). Some managers have had to move their flocks on and off exhibit nightly. Alternating feeding stations and times might break up the routine, reducing gull/heron/white ibis numbers in the exhibit.

For mixed species exhibits see Housing, Chapter 2 for incompatible species.

Product Information

Havahart Traps- Valentine Inc. 4259 S. Western Blvd. Chicago, IL. 60609
phone: 1-800-438-7883 and fax (312) 650-9099

Sources for plastic rings/bands:

Catherine King – EAZA Ciconiiformes/Phoenicopteriformes EEP Chair

European Association of Zoos and Aquariums

Peter Shannon- (phoenicops@aol.com)

Haggie Engraving –Avian Color Bands for Marking and Research (haggie@intercom.net)

Transponder- See your professional organizations recommendations

Tubular fabric - 50% cotton and 50% polyester –
Kimberly Clark, O.R. Specialty Products, phone: 1-800-524-3577

Acknowledgments

The following individuals contributed their expertise to this chapter:

Linda Henry, Sea World Adventure Park San Diego
Peter Shannon, San Francisco Zoo
Stacey Johnson, Dreher Park Zoo
Laura Wittish, Sea World Adventure Park San Antonio
Susan Healy, Sacramento Zoo
Veronica Hawk, Yerkes Regional Primate Research Center
Sara Hallager, National Zoo
Tony Richardson, Wildfowl and Wetlands Trust

Other contributors include:
Wendy Turner, Sea World Adventure Park San Diego
Sherry Branch, Sea World Adventure Park Orlando
Michael Mace, San Diego Wild Animal Park
Peter Andrews, Zoological Society of San Diego
Laurie Burch (Conrad), Sea World Adventure Park San Diego
Lauren DuBois, Sea World Adventure Park San Diego
Nigel Jarrett, Wildfowl and Wetlands Trust, U.K.
Adelheid Studer-Thiersch, Basel Zoo
Steffan Patzwahl, Parc Paradiso (Belgium)

References

CBSG. 1991. Recommendations for Standardized Transponder Implantation Sites. CBSG News 2 (3): 6.

CBSG. 1991. Final report on transponder system testing and product choice as a global standard for zoological specimens. CBSG News 2 (1): 3-4.

Standards for Data Entry and Maintenance of North American Zoo and Aquarium Animal Records Databases©. Lincoln Park Zoo, Department of Conservation and Science.

World Wildfowl Trust. Plastic Leg Rings, Materials and Application Information; Making 'Darvic' Rings.

Addendum to Chapter 3

Measuring Flamingos

Compiled by Nigel Jarrett, The Wildfowl and Wetlands Trust (WWT)

Introduction

Morphological measurements of flamingos are used by WWT to ascertain differences in body size that can be related to differences in mating and reproductive success, and in condition and survival.

WWT has developed a guide to describe and standardize the terminology and methodology for various external linear measurements that may be taken from live flamingos under field conditions. The guide seeks to reduce the variation and the detail with which measurements are reported.

The WWT guide defines and illustrates those measurements, which have proven useful and practical for flamingos in captivity. With practice, all of the measurements can be taken from live birds quickly and humanely. The guide is largely based on that for measuring geese, developed by Duzbin and Cooch (1992).

What Measurements to Take?

The measurements that are useful for a study aimed at differentiating populations may be different from those needed to characterize the condition of the individual birds. Therefore, a researcher must decide how the morphometric data is to be used before deciding which measurements to record. In general, the researcher should aim to take a sufficient number of different measurements from each individual bird to characterize its overall structural size.

As a minimum, three hard measurements (see below) should be taken, since three dimensions are the minimum needed to define a 'geometric space'. Hard measurements are those of variables/characters, which do not change in magnitude within individuals as a function of age, length of time a bird is held, or when during the annual cycle the bird is measured. Typically, skeletal bones, such as tarsus are hard characters. In contrast, soft variables/characters can change significantly due to a variety of factors. For example, the body mass of the bird is significantly affected by the stage in the annual cycle at which it is measured: a bird weighed immediately after breeding may be significantly lighter than one caught immediately prior to spring migration.

Nevertheless, body mass is a soft character that is regularly recorded since it is easily measured and provides useful information on the condition of a bird. However, body mass alone cannot not be used as a measure of body size, as body mass will, in part, be a function of structural size. Additionally, body mass is more susceptible to short-term variations than other soft or hard characters, with, for example, variation attributable to handling time before weighing or time of last feeding.

For birds measured during their first year, all characters are soft because in flamingos there is significant growth of all characters during this time. Thus, comparisons of measurements are meaningful only if the age of the bird is known.

The WWT guide recommends that researchers attempt to measure at least the following characters:

Hard measurements
- head length
- total tarsus length
- sternum length

Soft measurements
- flat wing (a.k.a. wing chord) length
- ninth primary length
- body mass

This set of measurements can be taken from a bird in under three minutes.

This minimum set of measurements should be supplemented with as many other measurements as possible. The minimum set contains both hard and soft measurements. If time does not allow for the minimum set of measurements to be recorded, then only the hard characters should be taken. In general, the hard characters are more repeatable than the soft characters (with the exception of body mass, which is highly repeatable). This is because not only are soft characters more variable over time, but they are also more ‘malleable’ in hand - subtle variations in caliper pressure may cause considerable variation in the measurement. Despite the problems associated with measuring soft characters, there is considerable value in taking such measurements. Soft characters are often the most sensitive indicators of variation in the condition of a bird.

Basic equipment

Equipment needs include a set of digital or Vernier calipers, a steel rule for the linear measurements (long enough to at least measure the length of the ninth primary), and a scale (Pesola™, Salter™ or electronic) for body mass. The measurement board is useful for measurement of total length and flat wing (see the wing chord photographs for an example of an easily constructed measurement board). All equipment should be checked and calibrated against known standards prior to use in the field.

Definitions and Techniques

culmen: The chord of the upper mandible length, measured medially from the lowest point of the forehead at the midpoint of the upper bill, where the integument meets the horny portion of the mandible, to the distal tip of the bill.

bill-nares 1: Diagonal length of the upper bill measured from the anterior edge of the nostrils to the distal tip of the upper mandible.

bill-nares 2: Diagonal length of the upper bill measured from the posterior edge of the nostrils to the distal tip of the upper mandible.

bill depth: Diagonal depth of the mandibles from the lowest point of the forehead at the midpoint of the upper bill, where the integument meets the horny portion of the upper mandible, to the lower edge of the bottom mandible.

gape: The length of the upper mandible from the posterior end of the gape to the distal tip of the nail along the mouth line.

total tarsus: The diagonal distance from the posterior junction of the tibiotarsus and tarsometatarsus to the distal junction of the tarsometatarsus at the base of the middle toe.

tarsus bone: The diagonal length of the tarsometatarsus bone only, along the outside edge.

mid-toe: The length of the middle phalanx along its dorsal surface from the proximal articular surface at the juncture of the tarsometatarsus to the distal end of the toe at the base of the claw.

nail: Also known as claw. The length of the chord of the claw from its base to its tip. Fig. 11.

wing chord: The maximum measurement from the bend of the closed wing to the end of the longest primary, with the wing flattened and the longest primary straightened against a vertical border attached to the edge of the measuring surface. Fig. 12.

ninth primary: The total length of the outermost primary feather from the insertion of the remige calamus at the skin surface to the distal end of the feather (with the ruler placed between the 8th and 9th primaries). Fig. 13.

sternum: The length of the sternal ridge nearest the skin, including the skin and feather from the distal to proximal end of the sternum. Fig. 14.

tail length: The maximum length of the entire tail fan from the point of insertion of the calamus on the skin of the center rectrix to the tip of the longest rectrix (usually the third or fourth inward from the most lateral rectrix). Fig. 15.

head length: The length of the skull from the external occipital ridge (at the back of the head) to the distal tip of the bill nail (including skin and feathers). Fig. 16.

total length: The length of the bird from the tip of the bill to the distal end of the longest tail feather - usually the 3rd or 4th from the most lateral feather. This is measured with bird laid on its back on a flat surface. Fig. 17.

body mass: Mass in grams of the entire bird measured with spring balance or electronic scales. Figs. 18 and 19.

References

Dubin, A. and E.G. Cooch. 1992. Measurements of Geese: General Field Methods. California Waterfowl Association, Sacramento, CA. 20pp

Chapter 4

Reproduction

Facilitator: Jeff Perry, San Antonio Zoo

Introduction

Flamingos are exhibited in nearly all zoos, generally as one of the first or featured exhibits. However, the captive populations are aging, and reproductive levels are insufficient and not reliable enough to support the movement of genetic material from zoo to zoo or maintain population levels and achieve captive self-sustaining populations (Shannon, 1996a, 1996b; Hawk, 1999a, 1999b). The development of successful reproductive programs in captive populations of flamingos is possible for all taxa, and important. Due to the uniqueness of the reproductive biology of flamingo species in the wild, all the species are vulnerable to the disturbance and encroachment by man's activities. Two species, Andean and James', are now found in only low numbers and in extremely remote areas, a fraction of their historical range. Already efforts are under way to re-introduce them to lakes and areas that have been abandoned, using techniques that have much to gain from captive reproductive programs. Zoos can no longer freely remove flamingos from the wild to provide interesting exhibits. Zoo and aquarium bird collection managers need to seriously concentrate our efforts toward learning more about flamingo biology, in particular reproductive biology. Current collection populations are not self sustaining and so we must work in collaboration with each other, field naturalists, researchers and conservationists sharing our knowledge.

The following chapter is intended to provide information on the little we know about captive breeding biology of flamingos and help flamingo managers develop protocols conducive to successful breeding programs.

Breeding Season

Why flamingos nest in colonies of many thousands of pairs is not known. There are probably significant selective advantages in nesting in large colonies in terms of avoiding avian predation, although limited suitable nesting habitats may also encourage large concentrations of breeding birds particularly in unpredictable environments. It has been suggested that a minimum flock size is required to achieve the level of display activity needed to stimulate breeding behavior. There is some evidence that larger flocks display more frequently (Brown & Root 1958, Studer-Thiersch, 1974; Stevens, 1991; Pickering & Duverge, 1992). In captivity flock size seems to be an important factor in ensuring a group of flamingos will breed. Pickering et al (in press) showed that in Britain and Northern Ireland breeding Caribbean and Chilean flamingo flocks are significantly larger than non-breeding flocks. Also larger flocks breed more frequently than smaller flocks (Pickering et al, 1992). All Chilean flocks containing more than 40 birds have bred successfully at least once, but one flock of only 4 Chilean Flamingos has reared a chick. In contrast all Caribbean flocks in Britain and Northern Ireland with more than 20 birds have successfully reared chicks yet the smallest Caribbean flock to rear a chick was one of 14 birds, although one flock with only four birds has laid eggs.

Flamingos in the wild are opportunistic breeders, taking advantage of conditions that are favorable for building nests and raising chicks. Whenever weather conditions (generally rainfall) are correct, large numbers of colonial flamingos can quickly bring themselves into reproductive condition.

Colonial flamingos achieve synchronous breeding through the use of ritualized displays: head-flagging, wing salute, twist-preen, inverted wing-salute, wing-leg stretch, marching, false feeding, broken-neck, marching (Kahl, 1975; Studer-Thiersch, 1975; Ogilvie, 1986). These displays precede breeding by months. They can also occur during breeding and may occur when no breeding takes place. However, the displays are good indices of impending breeding. The San Antonio Zoo's Caribbean flamingos begin displaying in October and peak in display intensity and duration in February. Copulations begin in March, early April (Perry, unpublished data). Observing copulations indicates the birds are ready to begin nest building.

In the temperate parts of their range, the seasonal window of opportunity is restricted compared to the tropical areas. Flamingos can be easily put off breeding by changes in weather conditions, loss of food supply, or disturbance by man or storms. In captivity, this can make flamingos fickle breeders. Changes in weather, hotter or colder than normal, too wet or too dry, can result in an earlier or later than normal season, or preclude it altogether. When flamingos are housed indoors, permanently or temporarily for the cold months of the year, breeding can occur at unusual times, even during the winter months. However, because more control over these variables can be achieved in captivity, relatively predictable breeding seasons can be established (Tables 1 and 2).

Mating

Flocks should ideally have equal sex ratios although female-female pairs appear to be able to rear chicks. Unpaired male greater flamingos may cause considerable disturbance to a breeding flock by persistently attempting to rape incubating birds. Unpaired male and female Chilean flamingos have been observed smashing and eating unguarded eggs at The Wildfowl & Wetlands Trust, Slimbridge.

Unlike wild greater flamingos (1995), captive flamingos tend to breed with the same partner each season (Studer Thiersch 1975, Shannon 1985, Wilkinson 1989, Pickering 1992) although the degree of fidelity appears to decrease as flock size increases (Pickering 1992). While paired birds are often seen associating in the non-breeding season (Studer-Thiersch 1975) pairs can form very rapidly during the breeding season (Wilkinson 1985) and birds losing their first egg may re-pair with a different bird in the same season (Pickering 1989).

Factors regarded as important in breeding flamingos in captivity are flock size, sex ratio and age structure , the design of the enclosure and nest site, manipulations of water levels and diet (Duplaix-Hall and Kear 1975).

The first documented breeding of a flamingo in captivity was when the semi-feral flock of Caribbean flamingos at Hialeah racetrack, Florida USA laid eggs in 1937. The first chick was successfully reared there in 1942. The first zoo bred flamingo was reared at San Antonio Zoo in 1952. Since then the number of collections breeding flamingos has increased (Kear & Duplaix-Hall 1975); in Britain there are at least 30 flocks of flamingos that have bred once or more in the last five years (Creighton and Stevens-Wood 1990).

TABLE 1

SPECIES	DATE OF FIRST LAYING PER SEASON			DURATION OF LAYING (DAYS)		
	Mean	Standard Deviation	Range	Mean	Standard Deviation	Range
Caribbean	16-May	13	21 Mar - 8 Jun	50	11	35 - 74
Greater	1-May	24.5	26 Mar - 18 Jun	46.2	21	24 - 71
Chilean	7-Jun	12.3	13 May - 2 Jul	69	26	17 - 112
Lesser	15-Jun					
Andean	7-Jun	18.5	17 Apr - 2 Jul	38.8	21	13 - 70
James	13-Jun	25	30 May - 8 Jul			

Table 1. Mean date of first egg laid in a season and duration of laying season in flamingos at Slimbridge. (Pickering, 1992).

TABLE 2
CARIBBEAN FLAMINGOS

Copenhagen Zoo, Denmark

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1999	24-May	21-Jun	2-Jul	11-Jul	11
2000	28 Jun	28-Jun	None	None	1
2001	28-May	28-Jun	20-Jul	20-Jul	9

National Zoo, Washington D.C.

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH *	TOTAL # OF EGGS
1992	25-Apr	5-Jun	8-Jun	8-Jun	7
1993	11-Jun	19-Jun	13-Jul	15-Jul	8
1994	12-May	28-Jun	20-Jun	30-Jun	16
1995	10-May	16-Jun	15-Jun	13-Jul	16
1996	23-Apr	19-Jun	28-May	18-Jun	22
1997	17-May	29-May	19-Jun	27-Jun	14
1998	10-May	17-Jun	8-Jun	15-Jul	18
1999	10-Apr	20-Jun	7-May	23-Jun	32
2000	15-May	11-Jun	13-Jun	21-Jun	26
2001	25-Apr	5-Jun	24-May	11-Jun	28

*Last hatch dates for 2000 and 2001 were of eggs kept at the National Zoo. Some of the last eggs laid for those two years were sent to the Baltimore Zoo.

Rotterdam Zoo, The Netherlands

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1992	6-May	14-May	5-Jun	-------	3
1993	12-May	8-Jun	26-Jun	7-Jul	3
1994	17-May	19-Jun	-------	-------	12
1995	5-Jun	11-Jul	6-Jul	9-Aug	10
1996	23-May	4-Jul	22-Jun	3-Jul	12
1997	3-May	3-Aug	1-Jun	-------	10
1998	5-May	20-Jun	3-Jun	26-Jun	17
1999	5-May	9-Jul	3-Jun	18-Jun	13
2000	30-Apr	14-Jun	23-Jun	26-Jun	14
2001	13-May	23-Jun	11-Jun	26-Jun	13

San Antonio Zoo, Texas

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1981	21-May	---	22-Jun	15-Aug	---
1982	25-May	---	29-Jun	28-Jul	---
1983	5-May	22-Jul	3-Jun	8-Aug	29
1984	5-May	25-Jul	11-Jul	1-Aug	35
1985	24-Apr	6-Jul	3-Jun	21-Jul	43
1986	24-Apr	11-Jul	27-May	11-Aug	45
1987	19-Apr	11-Jul	30-May	7-Aug	43
1988	No Breeding				
1989	2-Jun	4-Jul	4-Jul	20-Jul	12
1990	26-Jun	16-Jul	24-Jul	12-Aug	13
1991	No Breeding				
1992	16-Jul	27-Jul	14-Aug	14-Aug	5
1993	No Breeding				
1994	2-May	11-Jul	14-Jun	9-Aug	14
1995	4-May	11-Jul	6-Jun	12-Jul	16
1996	12-Apr	18-Jul	20-May	10-Jul	40
1997	No Breeding				
1998	29-Apr	17-Jun	27-May	15-Jul	22
1999	5-Jun	20-Jul	8-Jul	16-Aug	13
2000	16-May	26-Jun	18-Jun	23-Jul	37

Sea World Orlando, Florida

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1987	15-Jun	19-Sep	5-Sep	5-Sep	11
1988	No Breeding	No Breeding	None	None	0
1989	12-May	4-Jul	12-Jun	26-Jun	17
1990	13-May	15-Jul	20-May	30-Jul	42
1991	11-May	8-Jul	20-Jun	9-Jul	32
1992	No Breeding				0
1993	No Breeding				0
1994	No Breeding				0
1995	No Breeding				0
1996	~29 May	~29 May	25-Jun	25-Jun	3
1997	n/a	n/a	n/a	n/a	1
1998	No Breeding				0
1999	No Breeding				0
2000	No Breeding				0
2001	No Breeding				0

n/a = not available

Zoological Garden Dvur Kralove nad Labem, Czech Republic

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1988			17-Jun	27-Jun	
1992	16-May	27-May	13-Jun	18-Jun	14
1993	17-May	6-Jun	22-Jun	7-Jul	13
1994			15-Jun	23-Jun	
1995			21-Jun	12-Jul	
1996			7-Jul	9-Jul	
1997	11-Jun	18-Jun	8-Jul	16-Jul	9
1998	25-May	8-Jun	24-Jun	6-Jul	12
1999	1-Jun	7-Jun	30-Jun	30-Jun	9
2000	16-May	4-Jun	13-Jun	30-Jun	14
2001	22-May	2-Jun	20-Jun	29-Jun	14

GREATER FLAMINGOS

Disney's Animal Kingdom (Tree of Life) Orlando, Florida

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1998	12-May		9-Jun		6
1999	13-Apr		8-Jun		9
2000a	4-Mar		9-Apr		14
2000b	15-Nov		6-Jan		8
2001	2-May		3-Jun		10

Los Angeles Zoo, California

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1989	22-Apr	3-Jun	7-Jun	7-Jun	11
1990	23-Mar	5-Jun	21-Jun	21-Jun	13
1991	16-Mar	27-Apr	8-May	31-May	6+*
1992	20-Mar	2-May	12-May	29-May	8
1993	3-Mar	8-May	30-May	20-Jun	12
1994	5-Mar	11-Mar	17-Apr	20-Apr	4
1995	No Breeding	No Breeding	None	None	0
1996	8-May	21-May	7-Jun	7-Jun	5
1997	27-Mar	21-Apr	27-Apr	22-May	8
1998	18-Apr	3-May	None	None	7
1999	22-Apr	16-Jun	23-May	22-Jun	23
2000	22-May	30-May	21-Jun	24-Jun	6
2001	29-Apr	22-May	30-May	4-Jun	12

Note - These are the eggs we can account for. The nesting areas do not allow us to see all parts of the enclosure without disturbing the birds, therefore it is possible that some eggs may be broken without the keepers seeing and recording them.
*There was not a good record taken that year.

Rotterdam Zoo, The Netherlands

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1992	26-Apr	18-Jun	4-Jun	5-Jun	13
1993	30-Apr	10-Aug	10-Jun	1-Jul	19
1994	12-May	4-Jul	19-Jun	31-Jul	14
1995	10-Jun	12-Jul	24-Jul	9-Aug	9
1996	12-May	11-Jun	11-Jun	10-Jul	12
1997	1-May	26-Jul	1-Jun	13-Aug	17
1998	4-May	21-Jun	3-Jun	20-Jul	21
1999	6-May	13-Jun	6-Jun	7-Jul	17
2000	25-May	14-Jun	30-May	3-Jul	21
2001	7-May	1-Jul	13-Jun	28-Jun	26

Sea World San Diego, California

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1992	27-May	15-Jul	23-Jun	28-Jul	49
1993	7-Jun	20-Jul	13-Jul	17-Aug	27
1994	14-Jun	25-Jul	15-Jul	31-Jul	27
1995	10-May	6-Jul	11-Jun	31-Jul	46
1996	15-May	2-Jul	12-Jun	17-Aug	55
1997	23-May	21-Jul	25-Jun	3-Aug	52

1998	20-Jun	18-Jul	18-Jul	10-Aug	47
1999	3-Jun	7-Aug	1-Jul	3-Sep	87

Zoological Garden Dvur Kralove nad Labem, Czech Republic

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1988			1-Jul	1-Jul	1
1992	12-May		10-Jun	10-Jun	1
1993	17-May		14-Jun	14-Jun	1
1994			14-Jun	14-Jun	1
1995	21-May				1
1996	3-Jun		2-Jul	2-Jul	1
1997	13-Jun		11-Jul	11-Jul	1
1998	28-May		25-Jun	25-Jun	1
1999	1-Jun		30-Jun	30-Jun	1
2000	17-May		14-Jun	14-Jun	1
2001	23-May	24-May	20-Jun	20-Jun	2

CHILEAN FLAMINGOS

Caldwell Zoo Tyler, Texas

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1989			4-Sep	8-Oct	
1990-1993	No Records				
1994			6-Aug	24-Oct	
1995			9-Jul	30-Aug	
1996			13-Jun	11-Aug	
1997			13-Jun	1-Aug	
1998	6-Jun	20-Jul	7-Jul	16-Aug	27
1999	27-May	15-Jul	24-Jun	10-Aug	49
2000	18-May	20-Jul	19-Jun	4-Aug	39
2001	21-Jul	21-Aug	22-Aug	16-Sep	33

Los Angeles Zoo, California

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1999	3-Jul	19-Jul	15 Aug*	15 Aug*	4
2000	5-May	26-Jul	3-Jun	5-Aug	24
2001	22-May	19-Aug	8-Jul	14-Aug	32

*The chick that hatched this year is of unknown species. The Chilean and American flocks had not been separated when this egg was found and put into the incubator. It may be a hybrid. There is a DNA test pending to try to determine his species. At this time the chick has the appearance of a Chilean.

Re´Serve Africaine de Sigean, France

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1991	26-Jun	18 Sep?	20 Jul	17-Oct	30 (chicks)
1992	29-May	7-Sep	28 Jun	10-Sep	26 (chicks)
1993	11-Jun	24-Sep	13 Jul	26-Sep	24 (chicks)
1994	15-May	-------	10-Jun	3-Sep	30 (chicks)
1995	End of Apr	-------	16 Jun	22-Aug	27 (chicks)
1996	End of Jun	Beg. Of Sep	11 Jul	11-Aug	26 (chicks)
1997	Beg. Of Jun				flood in Jun
1998	End of May	?	30 Jun	13 Sep (art. inc.)	26
1999	Beg. Of Jun	?	5 Jul	4-Sep	54 (chicks)
2000	4-Jun	?	5 Jul	26-Aug	52 (chicks)

Note: The nesting area is an island on a 10 hectare lake. Observations are difficult, even with binoculars.

Rheine Zoo, Germany

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1987	22-May	25-Jun			17
1988	6-May	30-Jun			20
1989	30-Apr	6-Jul			19
1990	15-May	7Jun, 5 Jul			16
1991	15-May	8-Jul			21
1992	31-May	23-Jul			17
1993	12-Jun	26-Jul			27
1994	6-Jun	5-Aug			20
1995	17-Jul	20-Aug			10
1996	16-Jun	14-Aug			30
1997	18-Jun	11-Aug			34
1998	31-May	1-Aug			38

San Antonio Zoo, Texas

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1997	1-Jul	1-Nov	29-Jul	30-Nov	13
1998	No Breeding				
1999	2-Aug	6-Nov	31-Aug	23-Dec	11
2000	25-Jul	1-Aug	18-Aug	18-Aug	3

Sea World Orlando, Florida

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1977 or 1978	n/a	n/a	n/a	n/a	33
1979	n/a	n/a	n/a	n/a	30
1980	?7 Jun (one collected)	n/a	n/a	n/a	20
1981	n/a	n/a	n/a	n/a	13
1982	30-Jun	30-Jun	~27 Jul	~27 Jul	1
1983	No Breeding				0
1984	24-Jun	1-Aug	~6 Aug	~29 Aug	24
1985	n/a	n/a	n/a	n/a	32
1986	9-Jun	1-Aug	n/a	n/a	23
1987	2-Jun	13-Sep	12-Jul	8-Oct	63
1988	3-Jun	7-Sep	16-Jul	21-Sep	66
1989	10-Jun	11-Sep	10-Jul	9-Oct	55
1990	8-Jun	26-Sep	7-Jul	15-Oct	81
1991	11-Sep	19-Dec	16-Oct	10-Jan-92	56
1992	27-Jun	25-Sep	25-Jul	25-Oct	134
1993	24-Jun	n/a	n/a	n/a	114
1994	23-Aug	n/a	n/a	n/a	81
1995	28-Jul	31-Oct	7-Sep	30-Oct	134
1996	17-Sep	9-Dec	16-Oct	4-Jan-97	99
1997	No Breeding				0
1998	No Breeding				0
1999	No Breeding				0
2000	No Breeding				0
2001	3-Aug	15-Aug	2-Sep	11-Sep	6

Zoological Garden Dvur Kralove nad Labem, Czech Republic

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1992	23-May		22-Jun	22-Jun	1
1993	20-May		22-Jun	22-Jun	1
1994			21-Jun	21-Jun	1
1995			27-Jun	27-Jun	1
1996	7-Jun		7-Jul	7-Jul	1

LESSER FLAMINGOS

Sea World San Diego, California

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1989	25-Jun	31-Jul	26-Jul	26-Jul	3
1990	21-May	1-Jul	7-Jul	7-Jul	7
1991	18-Apr	21-Jul	24-May	15-Aug	18
1993	17-May	17-May	0-Jan	0	1
1995	9-Jul	9-Jul	0-Jan	0	1
1997	5-Jun	30-Jun	6-Jun	30-Jun	6
1999	25-Jun	18-Jul	12-Jul	12-Jul	8
2000	30-May	15-Jul	5-Jun	5-Jun	8
2001	27-May	30-Jun	27-May	27-May	8

Sea World Orlando, Florida

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1988	26-Apr	26-Apr	None	None	1

HYBRID - AMERICAN X GREATER FLAMINGO

Rotterdam Zoo, The Netherlands

SEASON	FIRST EGG	LAST EGG	FIRST HATCH	LAST HATCH	TOTAL # OF EGGS
1992	22-Apr	27-May			5
1993	5-May	18-Jun			10
1994	20-May	4-Jun	20 Jun		3
1995	5-Jun	28-Jun	-------		3
1996	1-Jun	4-Jul	8 Jul		7
1997	26-Jun	14-Jul	-------		4
1998	10-May	1-Jul	10 Jun		4
1999	4-May	26-May			9
2000	25-Apr	14-Jun			21
2001	16-May	23-Jun			9

Table 2. Laying and hatching data from American, greater, Chilean, lesser and hybrid flamingos from several zoos

Egg Laying and Incubation

Timing of egg laying appears to be dependent on latitude and local weather conditions (Duplaix-Hall & Kear 1975). Onset of egg laying is approximately a month later for every 10 degrees north; the egg laying season extends for approximately half a year at any latitude. It has been suggested that flamingos are inhibited from breeding when there is less than 12 hours daylight (Duplaix-Hall & Kear 1975). At any given latitude each species tends to lay at different times during the summer . Clutch size of one is normal but birds will re-lay after losing an egg. A maximum of five eggs laid by one female Chilean flamingo has been recorded (Liggett 1989). The period between egg loss and relaying is highly variable, 6-90 days, but is typically between 10 and 15 days (Pickering 1992).

At the beginning of the egg laying period, particularly in large flocks, there is often considerable fighting over nest sites even when there is an excess of nesting space and nest bases. Egg loss due to fighting can be very high (Pickering 1990). Vulnerable eggs can be removed to an incubator (see 2.4.3) and replaced with dummy wooden or clay eggs. Flamingos appear to be unable to recognize their own egg and will incubate any object roughly the correct size and shape.

Although they have relatively thick shells and often become covered in mud, eggs can be easily candled at approximately 10 days. Infertile eggs (or the dummy eggs on the parents' nest) can then be removed to encourage birds to relay. Pairs producing infertile first eggs will often produce fertile second eggs (Pickering 1992). An alternative strategy is to give fertile eggs to infertile pairs and encourage proven fertile pairs to relay.

Fertility of captive flamingos varies between different flocks, species and seasons (Duplaix-Hall & Kear 1975, Yoshitake, M. Suuki, T., Yasufuku, M. & Murata, K. 1988, Pickering 1992). It has suggested that pinioned males may find difficulty balancing when mating. Captive pinioned male greater flamingos certainly fall off when mating more frequently than full winged wild greater flamingos (Pickering 1992), although there is considerable variation between individual males (Pickering 1990). Also there was an increase in hatching success in greater, Chilean and Caribbean flamingos at Kobe Oji Zoo after the practice of feather cutting stopped when the birds were placed in an aviary.

The share of incubation is almost equal between male and female parents. In trios one bird often takes a greater share of incubation than the other two. Incubation period is 28-30 days. Incubating Flamingos stand and turn eggs 3-8 times during daylight hours.

Nests

Nesting Area Sites

It is essential that all routine maintenance work is carried out to a regular pattern in tune with the flock's breeding cycle. All concrete edges to ponds and nest islands should be checked and repaired annually to avoid sharp edges where birds may damage their legs. Silting up of ponds is an inevitable problem with large numbers of birds in large enclosures and sludge should be pumped out when necessary. Generally horticultural work is disruptive but with care and consideration disturbance can be minimized and flocks can become accustomed to regular work programs.

Greater flamingos seem to prefer open, sunny areas for nesting and resting (Studer-Thiersch, 2000). Caribbean and Chilean flamingos seem to prefer shaded areas. The nest site should also be separated from the resting and feeding areas. The same should apply to separation from the public, either by space or visual barriers. Ideally, the nest site should have minimal disturbance from the keeper while performing daily routines. Many times this can be accomplished by having the nest site on an island, surrounded by water. This would also serve as a protection from predators. It can also be accomplished by using vegetation as a visual barrier, exhibit design or distance.

Flocks of flamingos will sometimes select their own nest site. It is important to observe the flock during the spring and summer and if birds are seen attempting to nest build in an area other than the carefully designed nest site it is probably wise to let them get on with it and only provide extra mud if necessary. Careful observations may help to decide how best to develop this area for the following season. Small modifications rather than wholesale redesigning of enclosures tend to bring the best results; however, it has proved possible to persuade colonies to breed on the keeper's preferred site by denying access to the site they had chosen the previous season.

Once an established flock has begun breeding, indicating their choice of nest site, they will remain faithful to that site from season to season. A new flock, or one that hasn't nested yet, may choose sites that are inappropriate or difficult to manage. However, they may need to be encouraged at those sites to get them started. Careful observations may indicate the reasons for choosing those sites, such as the need for privacy and lack of disturbance (very important for novice flocks and/or new imports), and the suitability of the nesting substrate (its moisture level and manipulative qualities). As an example, when the San Antonio Zoo's flock of breeding American flamingos was moved to their new exhibit in 1988, they made initial attempts at nest building on the pool edges and along the rear walls where the pool and watering of the plants kept the substrate wet. Next season they moved over to a more suitable and manageable nest area set up for them.

Nest Site Preparations

The important criteria for flamingos to build nests are a suitable substrate and an appropriate moisture level. Where there are no suitable natural nesting sites concrete lined pits filled with mud and clay can be created as nest islands. The concrete lip of each nest site should be lower than the edges of ponds. This allows the nest sites to be regularly flooded by raising and lowering the water level in the pond; however, this may also bring risks in sites susceptible to Botulism. An alternative method is to have a separate clean water supply to the nest so it can be flooded without the need to change the level of the water in the pond. Experiments have shown that rising water levels result in greater nest building activity than simple wetting of the nest site (Pickering 1989).

The best substrate should be easily manipulated by the flamingos to build and maintain a nest mound. The flamingos will stand or sit and pull nesting material to their feet and body using the bill like a backhoe. Eventually a mound is built, surrounded by a trench. At the San Antonio Zoo a sand/clay mix is used. This is the material used for baseball/softball diamonds, a 50% sand 50% clay mix. When this material is brought into the nest area, it is worked into the existing soil and any old, remaining nest material along with some timothy hay, by digging and turning over with shovels. Then it is thoroughly wetted with water. We find this mix, when formed into mounds, holds its structure well, even with heavy rains. Other institutions use the existing soils, adding potting soils or fine bark mulch as necessary but also turning over the soil, mixing in the mulch and wetting the area.

The nature of the substrate and the moisture level go hand in hand. The nesting material must be kept wet enough to enable the flamingos to dig with their bills. This can be accomplished in several ways. One is to raise the water level and flood the area. If one has a nesting island, especially one designed for this purpose, this can be very effective. Secondly, one can have a hose(s) set up to allow the area to be flooded on a controlled basis. The control (on/off and volume) of the hose needs to be somewhat remote from the nest area to prevent disturbance. A disadvantage of this method is that once the flamingos start digging and mound building, dams, dikes and low spots may be created generating problems in getting even coverage of water. Thirdly, sprinklers can be used. With proper placement on the ground or overhead, the coverage can be effective, even and controllable. At the San Antonio Zoo, two flamingo exhibits use the flooding technique, and the main flock uses a combination of a hose and sprinklers.

Providing Nest Starts

Most managers will provide “starter” nest mounds to help stimulate the birds. Providing a nest start may be more important for young or newly formed flocks. It appears to act as a stimulus to entice first-time breeders into nest building. This has also been tried with free-ranging birds in the Camargue, increasing numbers of breeding pairs and establishing a regular nest site (A. Johnson, pers. comm.) In captivity, established breeding flocks may not require “starter” nests. At the San Antonio Zoo in 1995, no nest starts were given to the well-established breeding flock of Caribbean flamingos. The birds built good nest mounds entirely on their own and had an excellent breeding year. However, providing nest starts is an effective stimulatory tool and ideally providing nest material to the nest site should be done just prior to the nesting period or even the week the first sign of nest building activity is observed. Using about a half or more of a wheelbarrow load of material, suitably wetted, one can form a mound measuring about 0.6 meters (2’) in diameter at the base, 0.45 meters (1 ½’) in diameter at the top, and 0.38 meters (1 ½’) tall. The mound should be packed together to insure its survival, even during rains. A shallow depression should be formed on the top. A 18.9 liter (5-gallon) bucket can be packed with the nest material and inverted over to aid in the formation of a nest start. Flamingos tend to build their nest mounds as close together as possible. Therefore, the bases of any nest starts can be as close as 0.45 meters (1 ½’) to each other. An excess of nest starts should be provided to allow the flamingos to select their own nests. Spare nest sites are often occupied by young birds practicing nest building. The nest site should be kept damp. If the flock does not lay within three to four weeks of the extra mud being added the nest site should be reworked to ensure there is sufficient freshly turned mud for nest building. This practice should be continued at intervals throughout the summer until the flock breeds or autumn arrives.

Permanent nests built out of fiberglass or concrete are not recommended. The hard surface can result in broken eggs and broken legs. Nests left intact throughout the year lose their stimulatory effect. If any birds are reproductively active, and they like the location, they may choose to adopt a pre-made mound or nest start, add to it and finish it off.

Nest Building Behavior

Paired flamingos start nest building by standing at the site and begin pulling material to that site using their bills and reaching out with their long necks to extend the range of nest material gathering. The mated pairs work together. As the materials start to accumulate and pile up, the birds will alternately adopt a standing and a sternal-recumbancy position on top of the pile and continue pulling materials to them. With their breasts on the middle of the top, a shallow depression is formed with a lip. The mound will grow in diameter and height until the egg is laid. Nest building will continue after the egg is laid. The mound is constantly maintained by pulling wet material to it and dribbling it down the sides. Sometimes the nest mounds can reach a remarkable height of 2 3/4 feet (0.76 meter) tall.

Space Requirements for Nest Area

The recommended space for each individual nest site is 12.25 square feet, or 3.5 x 3.5 feet (1.15 square meter, or 1.07 x 1.07 meter). The size of the nesting area will be determined by the size of your flock. The main breeding flock of Caribbean flamingos at the San Antonio Zoo numbers approximately 60 birds. In our experience, about one-half of the flock will be taking part in nesting activity at any one time. This gives us 15 pairs, or 183 square feet (16.8 square meters) of nest area used. Approximately 500 square feet (46 square meters) is set-aside as a nesting area. This seems to adequately accommodate the amount of area used by the nesting birds. This also seems to correlate with other institutions published figures (Johann 1998; Studer-Thiersch 2000).

Post Hatching Nest Maintenance

Once chicks start hatching and leaving the nests, the hazards they may encounter if there is too much standing water around the nests becomes a concern. Most institutions cease or reduce the watering necessary for nest maintenance, in order to insure the survival of the chicks. However, the disadvantage is impairment to nest maintenance and any further nest building and egg laying. Does this reduction or lack of watering curtail some of the potential breeding that could occur? In small flocks (20-40) this may not be a major concern, but in larger flocks (50+) it probably is. Larger flocks do seem to have a more extended breeding season. This requires extra duties to enhance chick survival, continued breeding and nest building. Careful water management is necessary to keep the substrate suitable for nest building without endangering chicks leaving the nests. Adding nest material if necessary, egg manipulation and management, chick management, and pinioning of chicks all require considerable skill and experience to perform without undue disturbance of the colony. This disruption can cause egg breakage, injury to chicks, and potential abandonment of nests. Inexperienced flamingo managers are urged to contact institutions with the necessary experience and knowledge. See also the Egg and Chick Management sections.

Pinioning and Fertility

Pinioning flamingos definitely impacts fertility of eggs (King, 1994). The degree of reduction in the percentage of fertility in eggs can be quite variable, ranging from only 25% fertility in San Antonio Zoo's pinioned male Caribbean flamingos (Perry & Atkins 1997) to higher percentages, like 100% fertility in the 14 eggs produced by the pinioned male Chilean flamingos at the San Antonio Zoo in 1997. The impact of pinioning is also variable amongst the other species of flamingos (Pickering 1992, King 1994, King 1997). Even amongst individuals of the same species, the effect of pinioning is variable. Some individuals have "the knack" to achieve proper copulation and produce fertile eggs, while others never seem to get it. The exact reason for this reduction of fertility is not clear. Probably the mechanical act of copulation is impaired, as all the long-legged birds seem susceptible to it (Pickering, 1992). The impact on reproduction in captive pinioned flamingo flocks is considerable. Large flocks can make up for it in sheer number of eggs and still achieve considerable hatching success. However, in smaller flocks, where the number of birds coming into breeding condition is low and egg production is low, considerable time is wasted brooding infertile eggs. Careful egg management, such as egg pulling, dummies, recycling, egg substitution, candling and artificial incubation, can help but won't solve the ultimate problem of low fertility.

One solution is the "long pinion" proposed by Peter Shannon in 1991. This pinioning method leaves a greater portion of the flight surface. It is hoped this will increase balance during copulation and increase fertility. The Audubon Zoo in New Orleans has been "long pinioning" since 1991 and the San Antonio Zoo since 1997. However, the data to support this is still pending. (Figure 5)
The other solution is to leave your flamingos full-winged. In enclosed exhibits, indoors or outdoors, this can be done without fears of the flamingos flying away. The full-winged breeding flamingos at the San Antonio Zoo were housed in an enclosed exhibit from before 1950 to 1988. Since 1988, the San Antonio Zoo's newer Caribbean flamingo exhibit is enclosed but has an open front with curtains that can be lowered at night or whenever work has to be done in the exhibit. The birds, in general, have shown no inclination to fly out. Only five birds have flown out of the exhibit. All of these were one or two-year-olds and were recovered. The pay-off is nearly 100% fertility in the eggs.

At the Basel Zoo in Switzerland, no chicks have been pinioned in many years so now the majority of the flock is full-winged. The exhibit is outdoors and not enclosed. While an occasional flamingo has left, the losses have been very acceptable (Studer-Thiersch, personal communication). There are also a number of examples of flocks that have or had a full-winged bird or two in them that don't fly off. The San Antonio Zoo has a smaller, outdoor, open exhibit where a full-winged bird has shown no inclination to fly off for two years. Another male has been left full-winged for six months without flying off. The San Antonio Zoo's goal is to have a few full-winged males amongst the flock of 20-25 birds to up the percentage of fertility.

It should be pointed out that leaving flamingos full-winged is not a guarantee of 100% fertility. Nomadic flamingos depend on synchronous breeding in their reproductive cycle. Any asynchrony that exists between males and females, whether it be from weather variations such as sudden drop in temperature or other reasons, could result in infertile eggs, even though the copulations may be technically perfect (Studer-Thiersch, personal communication).

With newer sexing techniques, it should be possible to sex chicks quickly, before they need to be pinioned. Females could be pinioned and males left full-winged. Newer ideas, management techniques, exhibit designs, and exhibit construction materials may allow for more full-winged birds to maximize egg fertility.

Egg Production and Incubation

Record Keeping and Observations

Good record keeping and observations, combined with colored, numbered plastic banding can help with reproductive management, including egg management and chick management. Knowing the reproductive history of your individual flamingos allows you to anticipate fertility/infertility in eggs and make informed decisions as to whether to pull, allow recycling, substitute a dummy, or allow continued incubation. Good records will also alert one to adept parents, ones with a history of chicks with problems, and any of the anomalous social units (trios, quartets, same-sex pairings).

Figure 6 is an example record sheet used at the San Antonio Zoo to keep track of eggs, chicks and parents during nesting season.

Clutch Size

All of the six flamingo species lay single-egg clutches. Multiple-egg clutches are rare and are discussed under Anomalies.

Incubation Period

Table 3 lists incubation periods for all the species, compiled from various sources.

Species	Mean Incubation Period	Incubation Period Range	Source
Caribbean	28.9	27-30	Pickering, 1992
Greater	29.7	26-32	Pickering, 1992
Chilean	29.1	28-31	Pickering, 1992
Lesser		28	Sea World San Diego, pers. comm.
Andean		27-31	del Hoyo, et al, 1992
James'		27-31	del Hoyo, et al, 1992

Table 3. Incubation Periods of Flamingos

Anomalies

Multiple-Egg Nests

Multiple-egg nests have been reported but are rare (King, 1994, Shannon, 2000, Studer-Thiersch, personal communication). The San Antonio Zoo has had only four cases of multiple-egg nests during the years 1984-2000. Shannon (2000) reports one female regularly laying two eggs in one nest at 5-9 days apart at the Audubon Park Zoo. Multiple-egg nests can also result from some of the trios, quartets and same-sex pairings, which occur amongst flamingo colonies (Shannon, 2000). In multiple-egg nests, the survival of the eggs is reduced. When the same female lays a second egg, the first egg will probably be buried with continued nest building prior to the laying of the second egg. With the social dynamics of the various trios, quartets and same-sex pairings, the first egg is generally lost, and the chances of the second egg surviving are also reduced. In other words, the chances of both eggs surviving in a multiple-egg clutch are nil, and the chances of the remaining egg are also reduced. Due to the unlikely success of multiple-egg clutches, consideration should be given to managing the eggs by pulling one or both, and/or using dummies (see also the Trios, Quartets and Same-sex Pairings section).

Uneven Sex Ratio

When there is a significant variance from an even sex ratio, observers find there are problems with nesting and egg breakage. This is probably a result of unpaired birds trying to pair up with or take part in the breeding activities of paired birds. The most easily observed is a flock of Caribbean or greater flamingos skewed towards males. The larger males can be seen trying to pair and copulate with the shorter females of a bonded pair. This interrupts the normal activities and can result in nest abandonment and egg breakage. If a manager has the facilities, the troublesome birds can be removed from the flock for the duration of the breeding season. This would be more difficult to observe in the less sexually dimorphic flamingo species.

Even though a more or less-balanced sex ratio is desirable, it still does not prevent the formation of trios, quartets and same-sex pairings, which can cause more disturbances than heterosexual pairs (Studer-Thiersch, personal communication).

Egg Breakage

It seems to be a normal phenomenon for some egg breakage to occur in the gregarious, colonial nesting flamingo. The normal acceptable level needs to be defined. At the San Antonio Zoo, the successful Caribbean flamingo flock has suffered from 10 to 50% egg breakage each year. King (1994) reports egg losses of 28% in 1992 and 48% in 1993 for the Caribbean and greater flamingo flock at the Rotterdam Zoo. Pickering (1992) reports egg losses ranging from 13 to 37% for Slimbridge's greater, Caribbean and Chilean flamingos. Is this normal? How does it compare to colonies in the wild? Can some of it be prevented or managed?

Adelheid Studer-Thiersch's paper, "Behavioral Demands on a New Exhibit for greater flamingos at the Basel Zoo, Switzerland (2000)", offered some well-studied answers and solutions to egg breakage. The increased size of the new Basel Zoo exhibit allowed for greater separation of various activities, such as feeding, resting, exploring, and displaying. The higher vegetation barriers allowed for visual separation. The new wintering quarters resulted in fewer disturbances to preparations for breeding. This made for calmer flamingos, higher breeding motivation and increased synchronization of egg laying, thus reducing egg breakage. Fewer females had to recycle and lay additional eggs. The number of eggs laid by the females was reduced from 2.5/female per season to 1.6/female to achieve the same degree of breeding success.

Trios, Quartets and Same-Sex Pairings

Even though heterosexual pairings and fidelity are more common in flamingo social relationships, other relationships do exist. In captive populations, homosexual pairs may comprise five to six percent of the couples (Bagemihl, 1999). Same-sex pairs will feed, call, sleep and deal with aggression by other birds together. Mountings and copulations may also take place. When nesting, these couples act the same as heterosexual pairs and have been known to successfully hatch and raise foster chicks (King, 1994). Peter Shannon's paper, "Social and Reproductive Relationships of Captive Caribbean Flamingos" (2000), details homosexuality and multiple-partner relationships and their impact on reproductive activities. Table 6 from that paper summarizes these relationships (see also King, 1993b, 1994). These other relationships can impact egg laying and chick rearing, not only in that particular relationship, but on those nesting around them. This can impact egg management. For example, in relationships involving two females, two eggs and the possibility of the eggs being fertile, one or both of the eggs are more vulnerable to being lost. If a manager is aware of the situation, those eggs could be saved through careful egg management (see also Multiple Egg Nests and Egg Management sections). To detect and monitor for these trios, quartets and same-sex pairings requires an investment of observation time. Beginners may require considerable time to gain these observations, but experienced observers and careful record keeping can reduce, significantly, the time necessary to gain this knowledge and insight.

Extended Monogamy

* A single male and a single female
* Multi-year monogamous relationship
* Little or no promiscuous behavior by either bird
* Relationship usually ended only with the death of one partner or if the female chose a new, exclusive partner

Serial Monogamy

* A single male and a single female
* Typically one or two-year monogamous relationship, lasting throughout the nesting season
* Either bird more likely to have been promiscuous than birdsin extended monogamous relationships

Trios (one male and two females)

* Formed when a second female joined an established pair (usually the new female remained subordinate to the original female), or a female attracted a male from a established pair, and his previous mate remained attached to the male (the new female became the dominant female)
* Typically did not last longer than one season
* Associative – all three birds maintained the same nest
* Disassociative – the second female maintained a separate nest without assistance from the male or the other female

Trios (two males and one female)

* Usually formed when a female changed mates and the former mate remained attached to her, or the second male had a relationship with her sometime in the past and had no current mate, or the two males were paired with each other in previous years, and one of them then accepted a female mate
* Once established, typically lasted for several seasons
* Usually associative – all three birds maintained the nest, although depending on the group's history, sometimes the second male merely stayed close and helped defend the nest

Trios (other)

* In two cases, the chick from the previous year participated in the parent's nesting activity, never incubating but sometimes feeding the current chick

Quartets (two male and two females)

* Usually developed when a trio was formed from partners of two previously established pairs and the fourth bird remained attached to the group of four, or the birds routinely switched partners among the group of four
* Typically a long-term relationship among the group

* Other birds outside the group could be seasonal partners of one member of the quartet, but they did not remain a long-term member of the group

Same-sex pairs

* Often seen among juvenile birds
* Sometimes occurred when the female of a two male:one female trio died or chose a new partner
* Adult female seemed more prone to same-sex pairings than adult males, although female:female pairings generally lasted only one season, whereas male:male pairings could continue over several seasons

Table 4. Characteristics of typical breeding relationships among captive Caribbean Flamingos at the Audubon Park Zoo, 1981-83. Used with permission of The Waterbird Society

Egg Size

Table 5 lists egg dimensions for all flamingo species. Table 6 focuses on egg dimensions of Caribbean and Chilean flamingos from two zoos.

Table 5

SPECIES	MEAN (mm)	n	RANGE
Caribbean	90.7 x 55.0	115	82.6-104.0 x 49.0-59.4
Greater	89.1 x 54.6	402	77.0-103.5 x 47.7-61.6
Chilean	92.0 x 53.1	51	82.7-106.0 x 49.8-59.7
Andean	86.6 x 55.0	27	80.9-94.0 x 52.0-60.0
James'	82.8 x 51.0	19	78.1-87.8 x 48.4-55.2
Lesser	82.3 x 49.9	124	52.0-94.0 x 38.0-56.0

Table 5. Egg dimensions for all species of flamingos. Data from a variety of wild and captive sources, adapted from Kear & Duplaix-Hall (1975, Appendix 5.

Table 6

CARIBBEAN FLAMINGO EGG MEASUREMENTS

Zoo	Seasons	# of eggs	Measurements (Mean)	Measurements (Range)	Weights (Mean)	Weights (Range)
			in millimeters	in millimeters	in grams	in grams
San Antonio	84-98	60	91.4 x 56.0	79.22-103.5 x 49.9-61.4		
	85-98	27			155.6	117.0 - 187.2
Audubon Park	81-92	250	90.25 x 57.0	79.5-101.0 x 56.0-58.0		
	81-92	20			153	123.8 - 183.4

CHILEAN FLAMINGO EGG MEASUREMENTS

Zoo	Seasons	# of eggs	Measurements (Mean)	Measurements (Range)	Weights (Mean)	Weights (Range)
			in millimeters	in millimeters	in grams	in grams
San Antonio	90-97	10	91.1 x 56.1	85.3-95.2 x 53.0-58.4		

Table 6. Caribbean and Chilean Flamingo Egg Dimensions and Weights from the San Antonio and Audubon Park Zoos

Hatching & Development

Parental Care

During the hatching process, the brooding parent will fidget and may rise (weather dependent) more often to check on the hatching chick, especially as the chick vocalizes. Here is where the chick-parental bond is cemented. While eggs may be freely substituted, chicks cannot, nor can pipping eggs be switched. Once vocalizations have started, whether from the internally pipped egg, the externally pipped egg or the newly hatched chick, no exchanges can be made. Eggs need to be switched or substituted before vocalizations have started. In Caribbean, greater, Chilean and lesser flamingos, the internal pip will be around day 26 or slightly before.

During the hatching process and once a chick hatches, good parents will sit tight to the nest, never leaving it unattended. They will be very solicitous of the chick, even when standing up. As the parent moves around on top of the nest, they step “gingerly” to avoid undue pressure on the hatching egg or chick. When standing, a good parent will be frequently and “solicitously” touching the bill to the hatching egg or chick. Observations have shown that a parent may actually help the hatching process. Parents can help the chick emerge from the egg by gently pulling on shell fragments or membranes with their bills. A parent may ingest some of the hatched shell fragments and materials.

An inexperienced parent may lack in some of these “solicitous” behaviors, actually appearing “alarmed” at the hatching events and easily displaced by curious or other aggressive flamingos. If an aggressive non-parent gets on the nest with the hatching egg or newly hatched chick, the response is usually immediate and fatal. They may attack the egg or chick by hitting it aggressively with their bill. In some of the rare anomalous social groupings (triads, quartets, same-sex pairs), the non-parent can be solicitous and exhibit good parental behaviors. However, the potential for competition and/or friction between that group’s members could lead to inappropriate results, such as the chick or egg being crushed or displaced out of the nest.

Immediately after hatching, an exhausted chick will look wet, very “flattened” and immobile. Inexperienced observers can be alarmed and think the chick is dead or crushed. However, the chick should begin trying to lift its head and vocalize within an hour.

The chick will fluff out and begin sticking its head up between the parent's body and wrist joint of the wing. This is usually how the chick will receive its first food, as the parent drools the red crop milk from its beak tip into the upraised bill of the chick. Both parents will normally feed, however, occasionally only one parent will do the feeding of the chick. A single parent is capable of rearing a chick if it is in good condition. Sometimes over zealous feeding will result in the red crop milk getting all over the grayish chick's down. This blood-like crop milk may alarm zoo visitors (and staff also), who are convinced that there is blood everywhere.

While the chick is on the nest, one or both of the parents will always be in attendance, whether brooding, standing on the nest over the chick, or standing at the side of the nest when the parents are relieving one another.

Leaving the Nest

Chicks will leave the nest as early as three days and as late as eleven, with five to seven days old the most common. When the chick is ready to leave the nest, there will be a few days when the chick will leave or fall off the nest and clamber back up. The chick's ability to do this is amazing, even when they leave as early as three days, or when it involves a nest as high as 2.8 feet (0.76 meter) tall. The parents and chick will use a nest other than their own, if one is available. A chick trying to climb back up an occupied nest will be re-buffed by the adults. Considerable bickering and fighting can occur between the parents trying to defend their chick and the nest occupants defending their nest site.

When the chick leaves the nest, the parents will stand over it, or just to the side of it, and guard it from all other flamingos. They will brood and feed the chick off the nest just like they did on it. At this point, it is important to discontinue the water that has been supplied for nest building. A chick that leaves early is less able to walk to drier ground and may be vulnerable to drowning or being trampled. Aggression from other flamingos is another obstacle. A parent that is brooding its chick off the nest may even engage in nest building while brooding.

This is a vulnerable time for the chick and where parental experience plays a big factor. Veteran or adept parents that have a record of success will ably brood, feed, lead and protect the chick. First-time or novice parents may not be as adept or confident in caring for their chick and may suffer losses. Good record keeping, banding, and observations are valuable assets in monitoring a chick's progress. Once leaving the nest, over the next few days, a chick will expand its boundaries by exploring the water area around the nest, all under the watchful eyes of the parents. The chick and parents may temporarily adopt a different, abandoned nest mound. The parents will gradually become more tolerant of the distance they allow the chick to wander away from the nest but will always be nearby and responsive to the chick's vocalizations. These wandering chicks may approach other adult flamingos and even beg to be fed. However, only the chick's parents will feed it; it will be rebuffed by other adults.

Weaning

It has been demonstrated that hand-reared flamingos can be weaned in as few as 23 days, but 30 days or longer is more typical (Perry & Atkins, 1997). When being parentally reared in captivity, this process can take much longer, in fact, almost a year. In other words, some parents can still be feeding their young as the next breeding season approaches. Some parents and juveniles break off the feeding in about four months while others do not. This prolonged feeding may relate to captivity, where the parents and juveniles are always in close proximity to each other. In the wild, the parents can fly off and, therefore, encourage weaning in the non-flighted juveniles. At the San Antonio Zoo, concerns have grown that this prolonged feeding of the juveniles may have negative effects on the health of the parent(s). The San Antonio Zoo's exhibit is a small one, 40 x 170 feet

(12.23 x 52 meters). This may contribute to this phenomenon more so than a larger, more spacious exhibit. The Basel Zoo reports that they regularly separate their greater flamingo parents and juveniles in the autumn. It is felt that when the juvenile stays too long with the parents (especially the male), it may adversely effect breeding in the following season (Studer-Thiersch, pers. comm.).

Adult Caribbean flamingos will loose their color while feeding their chick. One can detect the parents who are still feeding and the ones who are not, by the color in their plumage. The feeding parents will be pale, while the non-feeders will have more normal coloration. This is a gradual process as the rearing process progresses. This loss of color in the feeding parents is probably the result of a depleted blood supply of the pigment necessary for feather coloration. As the properly pigmented feathers are molted, they are replaced by feathers that lack the pigment. It gives the feeding parents a “mottled” appearance.

At the San Antonio Zoo, some three-month-old parentally reared young were pulled from the flock to keep some hand-reared flamingos company and aid in their socialization and weaning. They were separated from their parents for 1.5 months. Within a day of their return to the flock, the juveniles were being fed by their respective parents.

Fledging

When the feathers harden and the birds have the ability to fly, flamingo chicks are considered fledged. (They attain flight stage in 90 to 120 days (Allen, 1956)). For Caribbean flamingos, fledging is 70 to 75 days (Shannon, pers. comm.). In the Camargue, greater flamingo chicks have been know to fledge as early as 62 days. If pressed, wild lesser flamingo chicks can fly at 65 days (Brown, et al, 1982). In areas where adult lessers have to travel long distances to feed, the chicks develop slower and flight can be delayed as long as 90 days.

Sexual Maturity

Greater, Caribbean and Chilean flamingos are capable of breeding in their second year. In other words, a 1996 hatch bird can breed in 1998. However, the majority of those birds wait until later. Young, juvenile flamingos will participate in ritual displays and nest building. This practice probably “hones” these skills and prepares them for the future.

Bonding and Pair Formation

Observations and records with the San Antonio Zoo's Caribbean flamingo flock show that the initial pair bond of young flamingos is almost always with a peer, when peers are available. In other words, a 1996 hatch bird will pair with a 1996 bird. After the initial bonding, if a mate dies or if a new mate is acquired, then the age of a new mate is much more variable.

Reproductive/Egg Management

General Record Keeping

Egg and chick management depends on good record keeping and observations, as well as banding the birds with colored, numbered plastic bands. Knowing the reproductive history of your individual flamingos allows anticipating fertility in the eggs and making informed decisions as to whether to pull, recycle, substitute a dummy egg or allow continued incubation. Good records also help alert one to non-adept parents or parents with a history of chicks with medical problems.

Removing Eggs From the Colony

If one must remove eggs, for whatever reason, to minimize disturbance to the flock and other incubating birds, it helps to take the shortest route to the particular egg. Allow time, by moving slowly, for the flamingos to know you are entering and to get off their nests with the least amount of panic. In other words, allow enough time to allow the birds to rise up slowly, in a controlled way from their eggs and walk away from the nest(s). This will hopefully prevent any egg breakage or eggs falling out of the nests. If the birds won't walk away when given the opportunity, get low by going on your hands and knees, or duck walk for the final approach to the nest. If the birds stubbornly refuse to vacate the nest for the final grab, extend your hand, palm down over the egg as quickly as you can without totally spooking the bird. That way, if the parents strike out with their bill, it will hit your hand and not the egg. Most normal flamingos should leave the nest, but long-term captives, and especially hand-reared birds may be inclined to defend the nest from a human intruder to the end. It also pays to watch, or have an assistant to watch the return of the flamingos to the nests and make sure all returns to normal. The brooding parents should be highly motivated to return first and are easily identifiable by their bands and solicitous behavior to the egg. Non-parent birds returning to the nest will be aggressive to the egg.

Sometimes problems, such as egg breakage, disease, or predation, will require the removal of eggs. Eggs should be removed as soon after laying to ensure their safety and the pair given a dummy egg as a replacement. The handler should wear disposable gloves to reduce the transmission of germs to the egg, and the egg should be placed in a bowl lined with a paper towel and immediately transported to the incubator room where any excess dirt on the egg can be gently wiped off with a paper towel. To denote parentage, the egg is marked with a number or letter using a pencil or felt tip pen. The egg should be weighed and measured and all information entered into a data book. The egg should then be immediately placed in an incubator (37.5 C, 55% relative humidity). The entire process of egg removal and data collection should take no more than five minutes.

A cautionary note on removing eggs when dealing with small flocks with only a few pairs nesting: more care is necessary. Keep your visits as brief as possible and do not make wholesale changes, only small limited changes. At the San Antonio Zoo our small auxiliary group of 20 Caribbean flamingos had three nests with eggs. It was determined all three eggs were infertile. All eggs were pulled at one time with intentions of getting the birds to recycle. However, doing it all at once caused abandonment of the nest site. The infertile eggs should have been removed one at a time (see other note under recycling pairs).

Candling

If the egg is clean and free of dirt, determination of fertility may be made as early as four days following laying. At this stage, fertile eggs have a uniform "rosy glow" about them. After seven days of incubation, eggs free of dirt may be discarded if they are candled infertile, as by this time fertility, or lack thereof, is quite evident. Eggs that are particularly dirty may not be easy to candle and, therefore, should not be discarded. (These eggs should be routinely smelled to ensure they are not becoming rotten. It is advisable to move these undetermined eggs to a second incubator if one is available). Candling should preferably be done by personnel familiar with the composition of flamingo eggs, as the strikingly orange yolk could be mistaken as a sign of fertility. The candling process should be done as quickly as possible so the egg does not cool off too much. The candler should ensure that the egg is not jarred during the process or does not become too hot from the light source. Eggs are candled once a week to monitor development. Any fertile eggs that die during incubation can be necropsied to determine cause of death.

Returning Eggs to the Colony

As the time of hatching approaches, eggs should be carefully monitored. If the egg is to be returned to the parents (and not hand-reared from day one), the optimal time is when the chick is just beginning to internally pip or just before. By returning the egg to its parents at this time, the egg is maintained in the safe environment of the incubator that much longer. However, circumstances may dictate that the egg may need to be returned when the chick is in the air cell. This method is used when hatch dates for several chicks are one to two days apart. This will help reduce the amount of stress placed on the nesting birds by minimizing the times one has to venture into the nesting colony.

When returning eggs to parents for hatching, it is important to remember the pipping egg does not need to be returned to its biological parents. To increase the odds of survival for the chick, the egg should be placed under a pair that has demonstrated good parental skills in the past. In the case of new breeding flocks, eggs are best placed under parents that have demonstrated good incubation techniques with their dummy egg. After the egg is placed back under the parent, it is critical that the pair be monitored to ensure that the egg remains on the nest and is not kicked off in the uproar and scuttle that occurs during the switching period. The same techniques used in returning eggs should be used in removing eggs.

Also, see the Parental Care section of this chapter.

Recycling Pairs

To increase the number of fertile eggs produced in one season, females can be encouraged to lay again. This is accomplished either by removing a dummy egg from the pair any time during the incubation period or by removing the nesting pair's egg for artificial incubation and not replacing it with a dummy egg. Although the production of a second egg will not always occur, if it is early enough in the nesting season, most pairs will lay a second egg, and even a third egg is possible. When using this technique to increase the number of eggs laid, it is important to remember to keep an appropriate number of pairs sitting on dummy eggs so that there are enough parents to raise all the chicks. Otherwise, one will be forced into hand-rearing a chick. If an institution has the skill and means to hand-rear chicks, this can be an effective way to maximize production. Properly hand-raised flamingo chicks are fully capable of integrating into the flock and are reproductively viable (Perry and Atkins, 1997). The San Antonio Zoo has had a hand-reared pair successfully rear chicks.

This can be an effective tool in a pinioned flock with a history of producing more infertile eggs than fertile ones. An egg can be pulled and replaced with a dummy while the egg is artificially incubated. If after seven days an egg is determined to be infertile, the dummy egg can be pulled and the nesting pair will hopefully recycle and possibly lay a fertile egg. This can significantly reduce the time wasted on incubating infertile eggs. If the egg proves to be fertile, it can be returned to the parents at the appropriate time or be a potential candidate for hand rearing.

At the San Antonio Zoo the small flock of 11 Chilean flamingos were breeding, with three pairs nesting. The conditions they were nesting in required hand rearing of any chicks produced. They were able to keep those three pairs nesting and recycling from July 1st until the end of November. The three pairs of flamingos produced a total of 13 eggs. They were able to do that by pulling one egg at a time, thereby leaving two pairs to continue brooding until the third pair recycled and laid their next egg. Then one of the eggs was pulled from the next longest sitting pair, allowing them to recycle, and so on. By keeping at least two pairs brooding, they were able to maintain nesting and recycling. Of the 13 eggs, 11 hatched, and nine were successfully reared.

Dummy Eggs

Flamingos will readily accept a substitute or "dummy" egg as a replacement for their real egg. The egg should be white and approximately the same shape, size and weight of a real flamingo egg (see Egg Size section). A chalky surface is not necessary. Dummy eggs made of plaster or wood will work well. Another way of creating dummy eggs is to save infertile eggs. The infertile egg can be blown out and refilled with sand or other suitable material. Also, if an infertile egg is not compromised with a crack or torn membrane, it will not become rotten too early, and may last long enough to function as a dummy. Infertile eggs can be refrigerated until needed.

End of Season Management

When the breeding season is near the end, there may still be one or more pairs still incubating eggs. However, the colonial nature of flamingos and the desire to join the flock may be strong enough to cause abandonment of the remaining egg(s). At this time, dummy substitution or just plain removal of the egg(s) for evaluation and potential hand rearing may be in order to prevent their loss.

Parent/Chick Management

Chicks may also require hand rearing when the chick itself is sick and needs veterinary attention or when the parents are neglectful or inept/inexperienced.

With an inexperienced pair, the chick will not be defended, brooded or fed like normal. One will see the chick more than momentarily alone and being abused by other flamingos. Long term, even a healthy chick will weaken, chill, and appear dirty from lack of parental preening and protection. If the chick lacks a feeding response and interest in attentive, solicitous parents, it may necessitate removal from the colony for veterinary attention and potential hand rearing. Please refer to the Chick Management section for further details.

Summary

Since zoos can no longer freely remove flamingos from the wild, captive propagation has become a high priority. Zoos should be able to achieve captive, self-sustaining populations for all flamingo species. Hopefully, the information provided in this chapter, and the entire Flamingo Husbandry Manual, will help the zoos not currently breeding their flamingos to do so and enhance the success of the zoos that are already breeding flamingos.

If your flock is not breeding, try something different. Separating a portion of the flock and re-introducing them later is being investigated as a stimulus for breeding. Introduction of nests and eggs can be tried. Use of mirrors to fool flamingos into thinking the flock is bigger has been used in the past. Moving the flock to a new location or setting up a new flock in a new exhibit can also be an effective stimulus. Introducing new birds to the flock can trigger reproduction. Never assume breeding cannot occur! For flamingos, change itself can be a stimulus.

Acknowledgements

I would like to thank all who have so freely shared information with me: Catherine King, Adelheid Studer-Thiersch, Peter Shannon, Sara Hallager, Susie Kasielke, Sherry Branch, Stephanie Costelow, Linda Henry, Sue Maher, Kim Smith and all I fail to mention. I especially have to thank Chris Brown and Sherry Mossbarger for their patience and guidance. Thanks to all the flamingo observers at the San Antonio Zoo, especially Clarita Johnson. Your work and insights are a part of this chapter.

Bibliography

Allen, R. P. 1956. The Flamingos: Their Life History and Survival. National Audubon Society Research Reports.

Bagemihl, B. 1999. Biological exuberance: Animal Homosexuality and Natural Diversity. St. Martin's Press, N.Y.

Brown, L. H., Urban, E. K., and Newman, K. 1982. The Birds of Africa, Vol. 1: Phoenicopteriformes. Academic Press, N.Y.

Hawk, V. 1999a. North American Regional Studbook for Chilean Flamingo (Phoenicopterus chilensis).

Hawk, V. 1999b. North American Regional Studbook for Lesser Flamingo (Phoeniconaias minor).

Johann, A. 1998. Maintenance of the Chilean flamingo at Rheine Zoo. Int. Zoo News. 45(7): 406-413.

Kahl, M. P. 1975. Ritualized displays in Flamingos (eds. J. Kear and H. Duplaix-Hall): 142-149.

King, C. E. 1993a. Ondergeschoven Kinderen- Flamingo Eieren Van Artis Naar Blijdorp [Foster Children- Flamingos from Amsterdam to Rotterdam]. Dieren 10(4): 116-19.

King, C. E. 1993b. Ongelukkige Flamingo Liefdes [Tales of Flamingo-Love Gone Awry]. Dieren 10(2): 36-39.

King, C. E. 1994. Maintenance and research implications of selected behaviors in a mixed colony of flamingos at Rotterdam Zoo. Int. Zoo Yearbook. 33: 103-113.

King, C. E. 1997. Pinioning: does it effect copulation. Harpij. 16(3): 2-3.

Ogilvie, M. and Ogilvie, C. 1986. Flamingos. Alan Sutton, Gloucester, England. 121 pp.

Perry, J. and Atkins, V. 1997. The weaning, socialization and breeding history of hand-reared Caribbean flamingos, Phoenicopterus ruber ruber, at the San Antonio Zoo. Proceedings of the 24th National Conference of the American Association of Zoo Keepers. 15-23.

Pickering, S. P. C. 1992. The comparative breeding biology of flamingos Phoenicopteridae at the Wildfowl and Wetlands Trust Centre, Slimbridge, Gloucester, England. International Zoo Yearbook 31: 139-146.

Shannon, P. W. 1996a. North American Regional Studbook for Caribbean Flamingo (Phoenicopterus ruber ruber).

Shannon, P. W. 1996b. North American Regional Studbood for Greater Flamingo (Phoenicopterus ruber roseus).

Shannon, P. W. 2000. Social and reproductive relationships of captive Caribbean flamingos. Waterbirds. 23(1): 173-178.

Studer-Thiersch, A. 1975. Group display in Phoenicopterus. in Flamingos (eds. J. Kear and N. Duplaix-Hall): 150-158.

Studer-Thiersch, A. 2000. Behavioral demands on a new exhibit for Greater flamingos at the Basle Zoo, Switzerland. Waterbirds. 23(1): 185-192.

Chick Management

Facilitators: Sherry Branch, Sea World Orlando; Susie Kasielke, Los Angeles Zoo; Catherine King, Rotterdam Zoo

Introduction

This chapter covers the special aspects of chick management. There are some general management guidelines that have been covered earlier in the Management Chapter. Please also see the chapters on Reproduction, Health and Housing for more information.

Chick management can be broken down into two main types: management of chicks being parent-reared or as part of a colony or flock, and management of chicks being hand-reared.

Colony Management

Managing flamingo chicks that are part of a colony presents unique challenges. Generally, chicks should only need to be manipulated if they are ill, abandoned, or regularly being picked on by other birds. In the event that it becomes necessary to manipulate a chick, the keeper should know that any intrusion will affect the dynamics of the entire colony and may increase the opportunity for injuries to occur.

In large colonies (50+ individuals) catching and restraining chicks is more risky than with smaller colonies. Flamingos panic easily, and it is wise to move slowly around them to avoid startling them, letting them move out of the way on their own. It is also important to use your most experienced staff when manipulating chicks within a colony. If the chick needs daily attention, it is recommended that it be removed until it is back to normal, rather than to attempt entering the colony and restraining the chick frequently.

Primary Concerns

Parental acceptance of the chicks is a primary concern (see Chick Abandonment). From hatching you should see both parents (in some cases you may only have one parent) feeding, brooding and protecting the chick. Most adults will vigorously defend the chick from other adults and other chicks. Some adults defend better than others, and you will need to make sure other adults aren't constantly harassing the chick. You may even see aggression between the pair who are feeding and brooding the chick. The chick should be very vocal from day one, and parents usually respond only to their own chick's vocalizations. Chicks can swim from the first day, although they can't swim for long periods. A general visual assessment of the chick should show you an active, vocal, healthy-looking chick that is being brooded, fed and defended by at least one parent.

Secondary Concerns

Other things to watch for with a newly hatched chick would be nest conditions and weather conditions. Nest conditions may include the level of the water around the nest and the height of the nest itself. If the nest is too high and the chick falls out, it may not be able to get back up into the nest. Sometimes a chick will use a nearby nest if it is unable to get back up into its own. Weather can be a problem too. If it rains continuously chicks can get wet and be unable to thermoregulate. Too much rain can also contribute to high water levels around the nest. Water that is deep around the nests may cause nest erosion, loss of eggs and even loss of chicks if they are unable to get out of the water.

Chicks may also eat dirt substrate from around the nest, which can lead to impaction.

You should step-up your predator control during this time, as gulls, herons, and other animals will predate the youngsters.

Pinioning

If your management program calls for pinioning, this is something you can do during a catch-up to assess the chicks. (See the Health and Medicine Chapter for pinioning techniques). One thing to consider when pinioning chicks is that it is better to do it when the chicks are younger (two to ten days old). You may need a general anesthesia if you do it when the birds are older. If you pinion at less than five days of age, the chick is usually still in the nest. You want to be very careful if there are other birds on eggs, as eggs may be smashed when catching up the chicks. Even young chicks can be very mobile and may prove difficult to catch. Novices may want to contact people from other zoos who have experience in doing this. (For restraint techniques see the Capture, Handling and Restraint section in the Flamingo Management Chapter or the Physical Restraint section in the Health and Medicine Chapter.)

During this catch-up you may also want to conduct other procedures such as weighing, taking blood for genetic sexing, tarsus measurement, banding, adding a transponder chip, egg candling of other eggs and nest management. Be aware of how long you are in the colony and try to keep all handling and disturbance to a minimum. This is a judgment call that should only be made by experienced staff.

If done properly, flamingos quickly adapt to the regular handling of young chicks and other nest management activities. A brooding parent may not even stand up when an egg or chick is removed from under him or her.

Banding and Chick Identification

You can permanently band a chick at 60 days, but some people prefer to use temporary bands before that. Plastic poultry bands work well temporarily. These must be checked for tightness often as the chick grows. A color dye works well if you have only a few chicks. Keep in mind that dyes may fade and wash off so frequent reapplication may be necessary.

Various flamingo holders solve their identification problems in different ways (input from the Web). San Diego Zoo, as well as Rotterdam Zoo staff place transponders in the chicks when they are pinioned. The birds are recaptured at a later date for final banding. Disney's Animal Kingdom places plastic bandettes on their Greater flamingo chicks when they do the neonatal exam. Pinioning and drawing blood for sexing are done at the same time. The bandettes have to be changed to a larger size at about one month of age. At two months old the chicks receive their adult bands. Past experience has shown the bandettes fall off before they become too tight. Many years ago, Audubon Park Zoo would alternate a chick's pinion site, depending on the order of hatching. Height and other definitive physical characteristics, such as color, were noted for each chick as it developed. This enabled the staff to definitively identify the chick when it was finally banded. This method has also worked well for older, parent-raised chicks, which can be further identified when their parent(s) feed(s) them. At the Wetlands and Wildfowl Trust in Slimbridge, England, they fit their five-day-old chicks with web tags until it is time to band and/or microchip them (see Marking Flamingos in the Management Chapter),

When permanently banding a bird at 60 days, if this is your first hands-on, you can sometimes do a physical exam at the same time. This can be used as a training opportunity for vets and keepers (see the Health and Medicine Chapter for sample collection information). Since there is some correlation between tarsus measurement and sex (see the Addendum to the Flamingo Management Chapter), you can also do a tarsus measurement (i.e. a larger tarsus = a male). If you have a lot of chicks, you may want to do just a brief visual check, weigh, pinion and return the birds.

Chick Issues

Chick Abandonment

The decision to pull a chick that has been abandoned is a difficult one. Sometimes chicks can be left alone for several hours but may not be abandoned. It depends on a lot of variables and should not be done without a great deal of consideration. It may also depend on your institution's policy on hand rearing. The decision to pull a chick should only be made by an experienced person who has spent a lot of time observing the situation. Things to look for include: chick is isolated, getting dirty, not being fed by either parent, shivering, lethargic, unable to stand, lack of good vocalizations and no contact with either parent. Other considerations may be approaching darkness, threat of predation, and continuous aggression from other flamingos. No other flamingo will accept any chick but its own so fostering to another pair is not possible.

If you must pull a chick you should immediately provide supportive care, i.e. heat, food, and/or fluids. Do this until you can stabilize the chick and then return it to its parents as soon as possible. Try to return it in the early a.m. so you have all day to watch. Chicks have been pulled for as long as two weeks and returned to the flock, and the parents have accepted them back. Your first choice should always be to return the chick to its parents.

Another option, if you are able to, may be to offer supplemental feedings to the chick while it is still in the colony (see the hand-rearing section of this chapter for diet). This option will work in some cases, but it requires thought on how to get the chick alone without too much disturbance to the rest of the flock.

As the chick gets older and starts eating food on its own, you should add extra pans of food so the chicks don't have to compete with the adults. Also, if the adults are fed a dry pelleted food, providing pans of food with water in them can help encourage feeding.

Hand-rearing

Sometimes it becomes necessary to hand-rear a chick for medical reasons or for reasons mentioned under chick abandonment. The concerns of hand-reared chicks becoming imprinted on humans have been raised, however, it has been proven that they slowly lose this dependence after being assimilated into the flock. San Antonio Zoo personnel were instrumental in formulating the early guidelines for hand-rearing flamingo chicks, and more recently the National Zoo staff has redefined the protocols for a more expedient, less labor-intensive process.

Care and Feeding

Early Chick Handling and Brooder Requirements

Once a chick has hatched and dried, the umbilicus is swabbed with a dilute betadine solution, and it is placed in a brooder with a clean towel substrate, with an initial temperature setting of 99˚ F (37.22˚ C). During the first two weeks after hatching, the brooder temperature is critical for a chick. If a chick is too cool or too warm, this in turn will affect proper food passage and, thus, the well being of the bird. Temperature guidelines must be utilized as just that, guidelines, as each bird is slightly different. The temperature is gradually lowered over an approximate two-week period until it is at room temperature. Heat can be provided by a forced-air brooder or a brooder with a 100-watt flood lamp that warms the surrounding air. If a chick is shivering, the temperature should be slightly increased. If a chick is panting or is lethargic, perhaps the temperature is too high. Also critical during the first two weeks after hatching is the chick's hydration. This can be controlled by dilution of the formula. If the chick's feces are thick and pasty or it seems to have trouble defecating, adding more water to the formula when feeding can increase the hydration, which in turn allows for better food passage. However, you don't want the formula to be so diluted that the chick is not receiving enough calories to gain weight. [Note: During the first couple of days it is not unusual for a chick to lose weight and then begin gaining weight under the formula dilution guideline.] Strengthening the formula too soon will lead to impaction and dehydration. Weighing the chick after hatching or retrieval from the colony gives you an important benchmark to work from. Thereafter, a morning weight, prior to the first feeding of the day, allows you to follow the developmental progress of the chick.

Feeding the Chick

1. Feed under a heat lamp on a clean towel to keep the chick warm. After warming the formula, stir well to avoid hotspots, then test it on your wrist. Keep the formula container in a bowl of warm water to prevent cooling off during feeding. The chick may refuse formula that has cooled.

2. Place index finger under lower mandible to cradle head and encircle the neck with the thumb to control head movement (forming a semi-circle). Once the chick is conditioned to feeding, it may sway its head side to side slightly. Cradling the head will offer better control (see photo).

3. When the chick elicits a feeding response, dribble formula slowly into the tip of the lower mandible with a syringe, either with a catheter tip syringe (diagram A) or with a luer lock

syringe with the lock cut off (diagram B). It is very important to feed slowly, making sure the chick is swallowing while you slowly push the plunger on the syringe. It is easy to aspirate a flamingo chick if you feed too fast. The chick will stop when full.

4. Wait approximately 8-10 hours after hatching before offering the first feeding. Thereafter, feedings should be 2-3 hours apart, between the hours of 6:00 AM and 10:00 PM. The amount given is gradually increased at each feeding, if the chick will take it. Start with an initial amount of 3-4 cc of lactated ringers or unflavored children's electrolyte-type product for a newly hatched chick. At the second feeding, formula is introduced at a 75% water/25% formula dilution initially. The formula is gradually strengthened over the next week or two (depending on the chick's hydration and feces consistency) to 100% formula (see Figure 1). IMPORTANT: Most problems observed with hand-rearing flamingos are seen in the first two weeks and are caused by feeding formula that is too thick, thus impacting the chick.

5. As the chick grows, the frequency at which the chick is fed decreases to three times per day (at approximately 30-40 days of age, depending on the bird), while the amount at each feeding is increased to a maximum of 60 cc. Larger syringes can be used as the amount fed increases.

Under the traditional hand-feeding method, as formulated by the San Antonio Zoo (Kunneman and Perry, 1992), amounts fed were gradually increased as the chicks were fed ad lib prior to weaning, up to as much as 180-200 cc each feeding, with the frequency fed reduced to three times per day (see Figures 2 and 3). This was continued until the chicks were 1 1/2 - 3 months of age, then the middle feeding was dropped. After a few days the morning feeding was dropped, then finally the evening feeding was dropped, as the chick increased foraging on its own to maintain its weight. This method kept the chicks full of formula but decreased self-feeding from the food pan, hence delaying the weaning process.

The accelerated method protocol defined by the National Zoo (Hallager, 1996; Bishop, 1998) limited the amount of formula fed to a maximum of 60 cc at each feeding. Formula was offered only three times per day by around day 12-15 (depending on the bird).

The five stages of this accelerated method are:

1. Stage One: The first feeding consists of lactated ringers or water. At the second feeding the birds are fed a diluted formula consisting of 75% water and 25% formula. The first 2-3 days they are fed every 2-3 hours, between 6:00 AM and 10:00 PM. The first stage is to gradually strengthen the formula to 100% over the next week, though this stage has ranged from 2-15 days, depending on the chick.

2. Stage Two: Gradually increase the volume to 60 cc, while decreasing the feeding frequency to three times per day. At the same time, gradually lower the temperature so that by around day 12 the chick is maintained at room temperature. A 100-watt amber flood lamp hung at one end of an open-air brooder provides a heat source. Solid food, a complete flamingo pelleted diet, broken into small pieces, is offered on day seven, served both dry and soaked in water. The chicks will instinctively begin picking at the pieces, however, initially, they will not be ingesting too much.

3. Stage Three: Maintain feeding the volume of 60 cc of formula three times per day until the chick is over 400 grams. This averages about 24 days old.

4. Stage Four: The weaning process involves reducing the volume of formula to 30 cc at one feeding and then discontinuing it. First, reduce the noon feeding and then discontinue it, then repeat the procedure with the afternoon and morning feedings. The reduction of formula in the weaning process is in direct proportion to the chick's ability to maintain or gain weight by self-feeding. Weaning should take an average of 10 days.

5. Stage Five: Post weaning, chicks are maintained in a back area away from flock competition until they are approximately 30 days old. Body weight is monitored daily until the chicks are introduced to the colony. After that, the chick's interactions with the flock should be watched as well as continuing to monitor its weight. The chick should be removed from the group in the evenings until you are certain it has adjusted well to the colony.

Chicks have been weaned between 29-42 days under this 30-day wean objective. Flexibility of process and individual evaluation of each chick, with changes based on differences in development, make this accelerated method successful, saving both time and labor.

Notes:

∗ Until the chick demonstrates a strong swallowing response the formula should be fed much diluted. The chick should be encouraged to stand while feeding. The continuous vocalizations during feeding are a good indication that all is proceeding well. All hand reared chicks should be weighed regularly. To ensure proper growth a weight gain in the region of 8% per day (Chilean Flamingo; Liggett 1989) to 10% per day (Caribbean; Kunneman & Perry 1990) should be expected. If weight gains exceed this the amount of food should be reduced. Chicks are normally fed five times a day, every two hours for the first ten days, four times per day up to ten weeks of age and twice a day from ten weeks until weaning. Unless the chick is showing a particularly slow growth rate, night feeds are not necessary. Hand reared chicks wean between 80 and 130 days.

∗ Flamingos chicks which have been abandoned by their parents may refuse to accept food from a syringe and may have to be fed via a catheter tube. When tube fed the formula must be liquidated to prevent clogging. All feeding equipment must be scrupulously cleaned and disinfected after each feed. Exercise is very important for young flamingos to reduce the risk of abnormal leg or wing development. Imprinting does not always occur in hand reared flamingo chicks but to reduce the risk of imprinting contact between human attendant and chicks should be minimized. Rearing chicks of a similar age together also avoids imprinting.

∗ Some chicks raised under the accelerated weaning process have experienced leg problems at fledging age. Captive hatched and reared flamingos are prone to developing "bow legged syndrome" found in other long legged birds (see the Metabolic Bone Disease section in the Health and Medicine, Chapter 6). This condition has been associated with nutritional factors in conjunction with growth rate (Brunning 1973, Humphreys 1985, Fowler et al 1987). Exercise and supplements of calcium and vitamins have shown some success in preventing these problems in other long legged birds (Brunning & Dolensek 1986, Duignan 1987).

Exercising the Chick

In a colony environment, the chicks would naturally exercise as they follow their parents around. In a brooder environment, chicks should be taken out on warm days for short walks to strengthen their legs after two weeks of age. A natural substrate is preferred. It is best not to walk the chick immediately after feeding. The chick will follow you closely, listening to your voice, so care should be taken not to accidentally trample it. A behavior that has been noted is that chicks will excitedly walk up to your feet and sit down suddenly.

Multiple Chicks

If it is necessary to rear multiple chicks, they may be introduced to one another as early as two weeks of age. Earlier introduction will not allow you to monitor the feces of the chick during that critical first two weeks when hydration is so important. Multiple chicks may reduce imprinting somewhat as the chicks have one another to focus on. Prior to introduction, the birds need to be identified in some manner. Various methods have proved useful and are listed near the start of this chapter (Banding and Chick Identification). Care must be taken upon introduction, as even a small chick can be aggressive to another. If aggression does occur, wait and try introducing at a later date. Placing the birds next to one another so they can see, or at least hear each other should ease the transition. Having a brooder mate will often times encourage picking at the solid food as they follow the leader.

Introduction of Chicks to the Flock

Once the chicks are weaned and have fledged, weigh more than two kilograms, are more than 100 days old, and are self-feeding well (as determined by maintaining or gaining weight), they may be introduced to the flock. This is best accomplished on a day when the chicks can be put out in the morning (in good weather) so observations can be made all day and when staffing allows for intermittent observations. Prior to introduction, using the same or similar food pans in the back area as the colony feeds from will benefit the chicks, as they may be hesitant about eating from an unfamiliar food pan. There may be some initial aggression by the flock, and the chicks may remain on the outside fringe until the group accepts them. If more than one chick has been hand-reared, waiting to put them out in small groups is preferred and beneficial over single introductions, as the chicks will have familiar “buddies” to mingle with until they acclimate to the flock. Minimal interaction with the chicks by aviculturists servicing the area will help as well. The chicks will gravitate towards the aviculturists when they enter the area, but this should not be reinforced through interaction. This gradual transition could take as long as a year. Monitoring the weight one week after introduction will indicate if the birds are utilizing the food pans and acclimating well.

References

Bishop, M. 1998. Accelerated weaning of Chilean flamingos at Seaworld Orlando. Presented at the Wetlands International/IUCN-SSC Flamingo Specialist Group Meeting, Miami, FL.

Hallager, S. 1996. Early Weaning of Hand-reared Flamingo Chicks at the National Zoological Park. Avicultural Magazine 102(1): 15-17.

Kunneman, F. and Perry, J. 1992. Hand-rearing the Caribbean flamingo *Phoenicopterus r. ruber* at the San Antonio Zoo. Proceedings of the 1990 Flamingo Workshop, pp30-40 (also published in the 1990 AAZPA Regional Conference Proceedings, pp225-231).

Figures

Figure 1 – Examples of hand raised flaming feeding records.

SPECIES: Chilean flamingo feeding record D.O.H. 11/2/93 WEIGHT: 80 grams TIME

Date	Day	Temp	Wt.	Time	Amount	Diet	Remarks	Morbidity
11/2/93	1	99°F	80 g.	1000a	3 cc	Lactated ringers only	Incubator hatched	
				1230p	3 cc	75% H2O/25% Formula	Fecal since being fed	
				300p	3.5 cc	75% H2O/25% Formula	Feces green. Bird is giving good feeding response (F.R.)	
		99°F		515p	3.5 cc	75%H2O/25% Formula		
				715p	3.5 cc	75%H2O/25% Formula	Good F.R.	
				920p	4 cc	75%H20/25% Formula	Good F.R.	
11/3/93	2	99°F	77 g.	400a	4 cc	75%H2O/25% Formula		
				700a	5 cc	75%H2O/25% Formula		
				930a	6 cc	75%H2O/25% Formula	Fecal consistency good	
				1130a	6 cc	75%H2O/25% Formula		
				130p	6 cc	75%H2O/25% Formula	Fecals look good. Good F.R.	
				430p	8cc	75%H2O/25% Formula		
				730p	8 cc	75%H2O/25% Formula	Eating well. Fecals look good.	
				1030p	8 cc	75%H2O/25% Formula		
11/4/93	3	99°F	76 g.	430a	8 cc	60%H2O/40% Formula	Started on 60%H2O/40% Formula. Good F.R.	

Date	Day	Temp	Wt.	Time	Amount	Diet	Remarks	Morbidity
				730a	8 cc	60%H2O/40% Formula	Stronger formula passed well.	
		98°F.		1030a	9 cc	60%H2O/40% Formula	Lowered temp. to 98°F.	
				130p	9 cc	60%H2O/40% Formula	Looks comfortable at new temp.	
				430p	9 cc	60%H2O/40% Formula		
				730p	10 cc	60%H2O/40% Formula		
				1030p	10 cc	60%H2O/40% Formula		
11/5/93	4	98°F.	80 g.	530a	10 cc	50% H2O/50% Formula	Started on 50%H2O/50% Formula.	
				830a	10 cc	50% H2O/50% Formula	Feces look good on 50/50 mix.	
		96°F.		1130a	10 cc	50% H2O/50% Formula	Lowered temp. to 96°F.	
				215p	19 cc	50% H2O/50% Formula	Good F.R. Very hungry.	
				530p	20 cc	50% H2O/50% Formula		
				800p	20 cc	50% H2O/50% Formula		
				1030p	20 cc	50% H2O/50% Formula		
11/6/93	5	94°F.	84 g.	600a	20 cc	50% H2O/50% Formula	Lowered temp. to 94°F.	
				900a	20 cc	50% H2O/50% Formula	Looks comfortable at new temp.	
				1230p	20 cc	50% H2O/50% Formula		
				330p	25 cc	50% H2O/50% Formula	Good F.R.	
				630p	20 cc	50% H2O/50% Formula	Eating well; vocal; good fecal discharge	
				945p	20 cc	50% H2O/50% Formula		
11/7/93	6	93°F.	89 g.	530a	20 cc	50% H2O/50% Formula	Lowered temp. to 93°F.	

Date	Day	Temp	Wt.	Time	Amount	Diet	Remarks	Morbidity
				845a	25 cc	50% H2O/50% Formula		
				1130a	20 cc	50% H2O/50% Formula		
				130p	20 cc	50% H2O/50% Formula		
				430p	30 cc	50% H2O/50% Formula		
				730p	25 cc	50% H2O/50% Formula		
				1030 p	25 cc	50% H2O/50% Formula	Feces look good.	
11/8/93	7	93°F	101 g.	530a	25 cc	25%H2O/75% Formula	Started on 25%H2O/75% Formula mix.	
				830a	25 cc	25%H2O/75% Formula	Feces look good on new mixture.	
		92°F.		1200p	25 cc	25%H2O/75% Formula	Lowered temp. to 92°F.	
				330p	25 cc	25%H2O/75% Formula	Great feeding response	
				730p	25 cc	25%H2O/75% Formula		
				1000p	25 cc	25%H2O/75% Formula		
11/9/93	8	90°F	110 g.	600a	25 cc	25%H2O/75% Formula	Lowered temp. to 90°F.	
				845a	25 cc	25%H2O/75% Formula	Looks comfortable at new temp.	
				1200p	30 cc	25%H2O/75% Formula		
				300p	35 cc	25%H2O/75% Formula		
				600p	35 cc	25%H2O/75% Formula	Fecals look good.	
				930p	35 cc	25%H2O/75% Formula		
11/10/93	9	90°F	119 g.	530a	35 cc	100% Formula	Started on 100% Formula.	
				845a	35 cc	100% Formula	Fecals look good on full strength formula.	

Date	Day	Temp	Wt.	Time	Amount	Diet	Remarks	Morbidity
				1130a	35 cc	100% Formula		
				300p	35 cc	100% Formula	Very vocal & active.	
				715p	35 cc	100% Formula		
				1030p	35 cc	100% Formula		11/11/93
	10	90°F	137 g.	600a	35 cc	100% Formula	Fecals look good.	
				915a	35 cc	100% Formula		
				1230p	35 cc	100% Formula		
				345p	40 cc	100% Formula		
				630p	45 cc	100% Formula		
				1000p	45 cc	100% Formula	Fecals look good.	
11/12/93	11	88°F	162 g.	615a	50 cc	100% Formula	Lowered temp. to 88°F.	
				1030a	40 cc	100% Formula		
				300p	40 cc	100% Formula		
				630p	45 cc	100% Formula		
				1030p	40 cc	100% Formula		
11/13/93	12	86°F	181 g.	600a	35 cc	100% Formula	Lowered temp. to 86°F.	
				1000a	40 cc	100% Formula		
				230p	40 cc	100% Formula	Eating well. Vocal & active.	
				630p	40 cc	100% Formula		
				1015p	40 cc	100% Formula		
11/14/93	13	86°F	206 g.	545a	45 cc	100% Formula	Very vocal. Good F.R.	

Date	Day	Temp	Wt.	Time	Amount	Diet	Remarks	Morbidity
				930a	50 cc	100% Formula		
				120p	50 cc	100% Formula		
				530p	50 cc	100% Formula	Good F.R.	
				1000p	50 cc	100% Formula		
11/15/93	14	86°F	235 g.	600a	50 cc	100% Formula		
				1030a	55 cc	100% Formula	Eating well	
				230p	55 cc	100% Formula		
				630p	60 cc	100% Formula		
				1030	60 cc	100% Formula		

Figure 1. Example of a typical chick feeding data sheet.

75 grams krill
75 grams capelin (heads, tails, & fins removed)
75 grams hard-boiled egg yolk
2 cups Gerber Oatmeal Baby Cereal (dry)
1 teaspoon Vionate
1/2 teaspoon calcium carbonate
1200 cc water

Blend well

Figure 2. Flamingo hand-rearing formula for chicks ranging from 1-30 days of age (Kunneman and Perry, 1992).

75 grams krill
75 grams capelin (heads, tails & fins removed)
75 grams hard-boiled egg yolk
1 cup Gerber Oatmeal Baby Cereal (dry)
1 cup Mazuri Flamingo Complete Maintenance pellets (soaked)
1 teaspoon Vionate
1/2 teaspoon calcium carbonate
1200 cc water

Blend well

Figure 3. Flamingo hand-rearing formula for chicks over 30 days of Age (Bishop, 1998).

Chapter 5

Nutrition

Facilitators: Ellen S. Dierenfeld, Saint Louis Zoo; Christine D. Sheppard, WCS/Bronx Zoo;
Debra L. McDonald, Healesville Sanctuary, Victoria, Australia

Executive Summary

Flamingos have highly specialized feeding mechanisms, primarily the bill, which can sieve small food particles from water. However, they appear highly adaptable to the availability of different types of food in the environment. The diet of a single individual of some species could vary from almost totally herbivorous (*Spirulina sp*. cultures) to essentially carnivorous (*Artemia salina*). Most flamingos consume a diversity of foods. A wide range of feeding behaviors has been described for flamingos, used to obtain food from parts of the environment as different as the surface of mud flats and the bottom of bodies of water.

A variety of commercially available, grain-based diets containing 20 to 40% protein, developed using the nutrient requirements of poultry and duck species, have proven successful for maintenance, growth, and reproduction of flamingos in captivity and should be provided as the staple diet. There is no evidence that different flamingo species have different nutrient requirements; most important is providing a particle size (for food as well as grit) optimized for the filtration mechanisms of any particular species (1-4 mm for the larger species; < 1 mm for the smaller species). Reflecting the size range of the flamingos (1.8 kg *Phoeniconaias minor* to 3.5 kg for *Phoenicopterus ruber*, energy estimates range from 160 to 200 kcal (660 to 830 kjoule) daily per individual to between 230 and 290 kcal (960 to 1200 kjoule), respectively, depending also on activity level. Energy needs would be supplied by 2-4% of body mass in dry food containing 3 to 3.5 kcal/g daily. If diets are presented as slurry (up to 75% water) this may represent 10% of body mass.

Little formal investigation has addressed the issue of management/enrichment foods for flamingos. The majority of captive flocks are maintained in outside ponds during much of the year, and birds can usually be seen feeding on naturally occurring foods. The importance of appropriate exhibit pools is essential for flamingo enrichment. In the absence of naturally occurring organisms, possible enrichment items could include a range of small whole prey such as krill, copepods, and aquatic insect larvae to duckweed (*Lemna sp*.), chopped greens, and algae species. At the Bronx Zoo, bird staff working with a group of young American flamingos determined that frozen krill could function as a food reward for operant conditioning.

Introduction (CDS)

Flamingos are best known for their vivid coloration and for the shape of their bills, both characteristics strongly related to feeding and nutrition. While we don't know, ultimately, why flamingos are pink instead of green or black or blue, we do know that their pink coloration depends on the ingestion of carotenoid pigments, which are chemically altered before deposition in the feathers. The shape of the beak is one of a complex of modifications that specialize various species for straining small food items from water – although the bill tip can still be used to 'grasp and throw' larger morsels (Zweers et al., 1995). The ability to filter small particles, coupled with the ability to tolerate water of high salinity, allows flamingos to exploit some food sources that are unavailable to other species.

The captive nutrition of specialized feeders like the hoatzin or koala is constrained by physiological and anatomical specializations that restrict the types of food the animals can process. While flamingos have specialized mechanisms for feeding, that specialization affects the size of items ingested, not the type. The diet of wild flamingos can actually be quite varied. Basic guidelines for the nutrition of ducks and poultry appear to adequately predict the nutritional requirements of flamingos, and a variety of commercial products are available to fulfill these requirements.

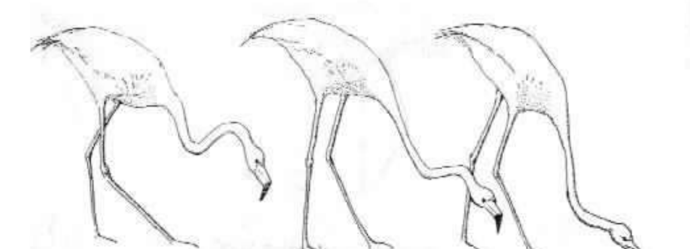
Feeding Behavior (CDS)

Flamingos have a repertoire of feeding behaviors, which allow them to feed on land, on water surfaces, on mud flats, at the water's edge, in the water column, or from benthic mud or sand (Allen, 1956; Jenkin, 1957). Rooth (1965, 1976) illustrated seven different feeding behaviors for the Caribbean flamingo. These behaviors generally target different types of organisms, found in different parts of the aquatic environment. Arengo and Baldassare (1999) report that in low-salinity ponds in Mexico, 99% of potential food was found in substrate samples. In high salinity ponds, only 13% of potential food items were found in the substrate, with 87% occurring in the water column. Arengo and Baldassarre (1998) also note that pond substrates changed, with increasing salinity, from mud and sand to algal mats to precipitates, which form a hard crust at very high salinity. Britton and Johnson (1987) noted hard, gypsum precipitates in high saline lakes in France and indicated that these crusts might preclude feeding from the lake bottoms.

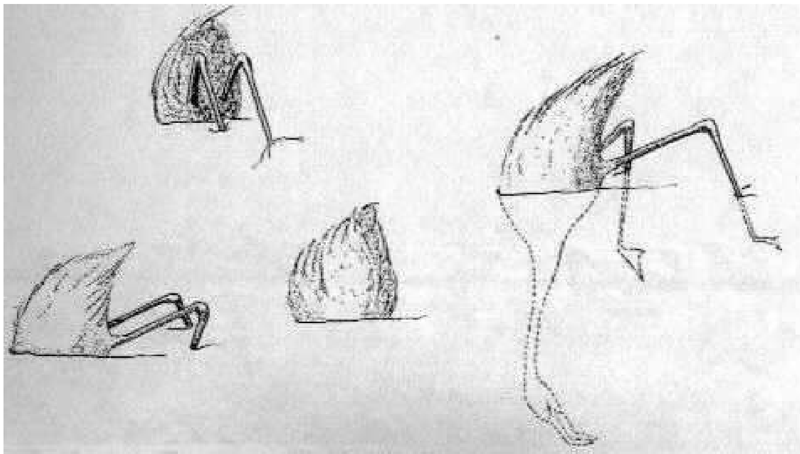
As feeding behaviors have not been reported in equal detail for all species, it is not known to what extent the repertoire of feeding behaviors is shared. It is probable that all *Phoenicopterus* species exhibit the range of feeding behaviors illustrated below, corresponding to the variety of foods used by these birds. The lesser, James', and Andean flamingos are less well studied and are more specialized feeders (Jenkin, 1957, Vareschi, 1978; Caziani and Derlindati, 2000). It is not known whether these species use all the methods of feeding described for *Phoenicopterus*, especially 'stomping' and 'grab and throw'. The following descriptions are based on Allen, (1956), Jenkin (1957) and Rooth (1965,1976).

(Illustrations from Rooth, 1976, used with permission from Dr. A. O. Debrot, Subdirector, Carmabi Foundation, STINPA, Netherlands Antilles)

Grab and Throw: the bill tip is used to pick up large food items -- small fish, mollusks, gastropods -- in very shallow water, on the water's surface, pond bottom or on shore. This occurs while stationary, walking or running. Rooth calls this 'running' and other authors 'pecking'.



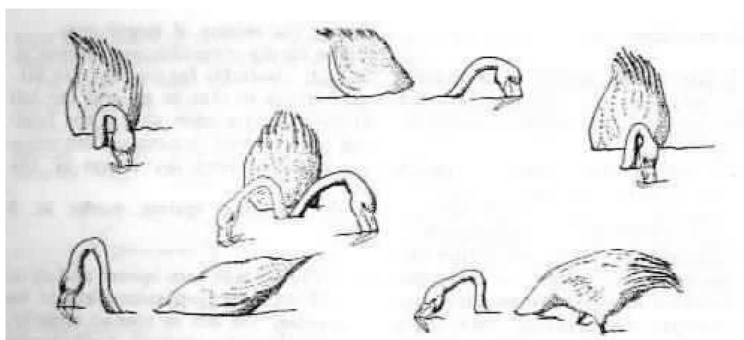
"Running" — heron-like.



"Grubbing".

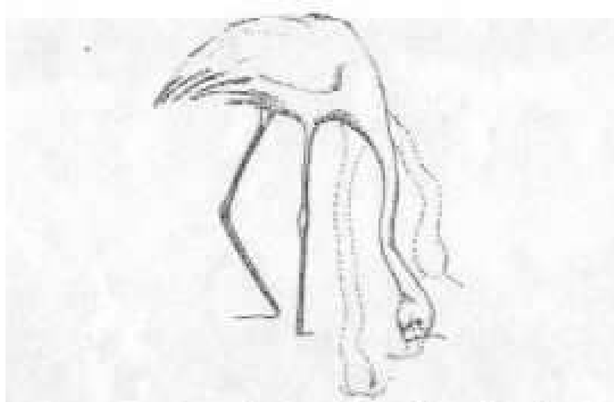
Grubbing: birds are floating in water, with the beak in substrate -- birds can reach the bottom at a depth equal to the length of their neck, which in *P. ruber*, is about 30 cm deeper than the length of their legs.

Skimming: the point of the bill skims through the upper layer of water as the bird walks or swims.

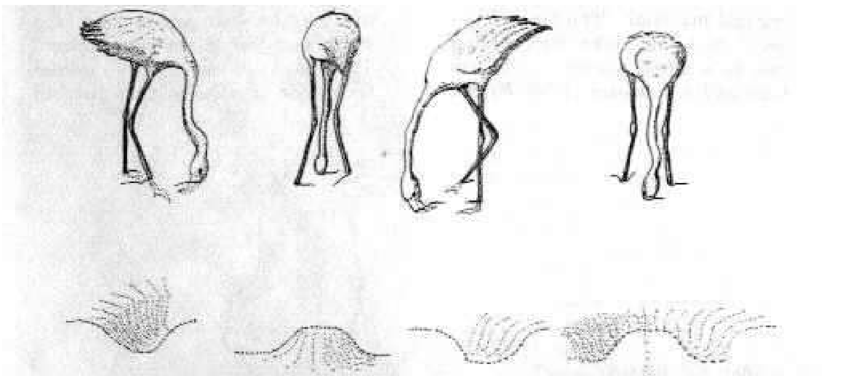


"Skimming", walking and swimming.

Stamping 1: marking time -- the heel joint is continually extended and retracted, alternating both legs; the head, inverted, is moved back and forth a short distance above the bottom. This can occur while the bird is stationary or moving slowly backwards. Food items from the substrate are filtered or pecked.



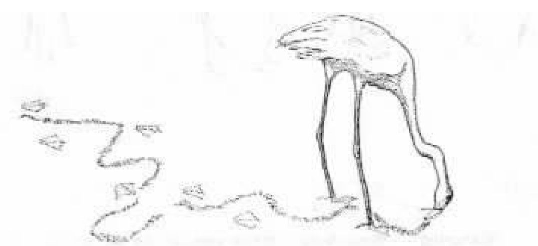
Stamping — "marking time".



Stamping — describing a circle around the bill as centre.

Stamping 2: circling around the bill -- the inverted bill is held at a center point, near the substrate, while the bird's feet stamp in a circle around it. A circle takes about a minute, and the bird's head is lifted and lowered several times. The action of the feet deposits a small mound at the center of the circle, containing mollusks, gastropods, and other invertebrates on a bed of sand. Lighter organic debris collects in the groove around the mound but is apparently not consumed.

Trailing: inverted bill is dragged lightly along the surface of mud or water, leaving a meandering track 1-2 cm deep. 'Organic ooze', algae, diatoms are ingested in this way. Tests showed organic content of mud near tracks to be 5-95% (Allen, 1956; Rooth, 1965, 1976). Rooth calls this behavior 'walking'.



Walking, leaving tracks of the bill.

Walking, while filtering in water column (no illustration)

Feeding -- Bill Structure and Mechanics (CDS)

Jenkin (1957) produced a monograph on flamingo feeding that is still the best single reference on the subject. She synthesized sources on flamingo diets going back to the 18th century. The specialization and proposed function of the structures comprising the flamingo bill are also described in detail. Jenkin's information has been widely used and cited by other authors. Mascitti and Kravetz (2002) provide additional detail on the bills of the three South American flamingo species.

In a 'typical' bird, when the beak is open, the gape has a 'V' shape, the width of the gape increasing with distance from the head. The characteristic 'bent' shape of the flamingo bill serves to keep the edges of the upper and lower mandible more or less parallel when the beak is opened, and especially when the beak is not fully opened. This facilitates the use of the lamellae on the bill surfaces as a filtration system or sieve by keeping the space between the mandibles constant. Where in most bird species the lower mandible moves against the upper, in flamingos the upper mandible moves to produce the gape. When filtering, the neck is curved down so that the upper mandible is in the water. This allows the birds to feed with their heads closer to their bodies than would be possible if feeding took place with the lower mandible in the water. This is especially important for feeding behaviors that involve stirring up food with the feet.

The flamingos can be divided into two groups based on the shape up the upper jaw. Birds in the genus *Phoenicopterus* have 'shallow-keeled' bills, while the other three species have 'deep-keeled' bills (Jenkin, 1957, Mascitti and Kravetz, 2002). In 'deep keeled' species, the upper bill is very narrow and fits into the lower so that it is not visible in profile (Jenkin, 1957). In all flamingo species, the upper and lower mandibles support a complex and diverse array of lamellae, which vary within and among species in their size, shape, spacing, placement and flexibility (see Figures 1 and 2). These lamellae function as sieves during feeding and, in some cases, also as devices that exclude large items. Mesh size can be adjusted by 'tuning the gape' (Zweers et al., 1995). Filtering can take place with the bill closed, as well as open.

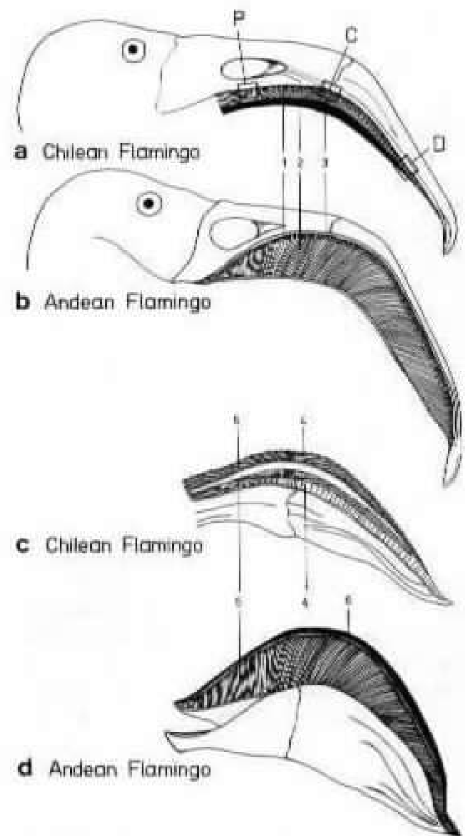


FIGURE 2. Lateral view of the jaws of two flamingo species. Upper jaw of (a) the shallow-keeled bill of Chilean Flamingo and (b) the deep-keeled bill of Andean Flamingo. Lower jaw of (c) the shallow-keeled bill of Chilean Flamingo and (d) the deep-keeled bill of Andean Flamingo. The upper jaw of Chilean Flamingo is wider than that of Andean Flamingo, and the free edge of the keel has a broad central portion uncovered by lamellae. In Andean Flamingo, the free edge of the keel is almost completely covered by lamellae. The lower jaw of Andean Flamingo has a large lamellated area in the inner sides of the bill. (1) marginal lamellae, (2) keel covered by inner submarginal rows, (3) free edge of the keel, (4) serrated ridgelike outer submarginal rows, (5) hillocklike inner submarginals rows, (6) Expanded inflexed borders of the lower jaw. Letters indicate regions of the bill: (P) proximal, (C) curvature, (D) distal.

Figure 1. Mascitti and Kravitz, 2002, p. 76, with express permission of the copyright holder, the Cooper Ornithological Society.

The flamingo tongue is substantial in all species, filling the mouth when the beak is closed. Withdrawal of the tongue produces a vacuum, drawing liquid into the mouth. The tongue then moves forward, forcing the liquid through the sieves formed by the bill (Zweers et al., 1995). Size and shape of the tongue vary, but in all species the tongue carries an array of spines, presumed to move food particles from the bill back into the throat (Jenkin, 1957). Taste buds are not found in the beak or tongue (Jenkin, 1957), but a group of taste buds has been described in mucosa of the ventral esophagus, which is behind the tongue (Bath, 1906). According to Jenkin (1957), two other types of sense organs are present in both jaw and tongue, especially near the bill tip and the edges of the mandibles. These organs, Herbst corpuscles and Grandry bodies, are found in the tongue and bill of waterfowl (Zweers et al., 1995) and may function primarily as pressure sensors.

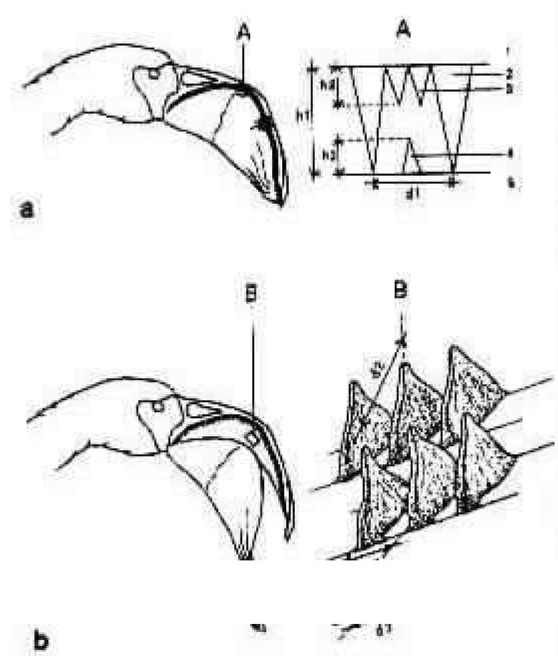


FIGURE 1. Measurements of the lamellae. (a) Generalized scheme of the closed bill and sieve showing the marginal lamellae of the upper jaw and the outer and inner submarginal lamellae of both jaws. In the sieve diagram (A), numbers represent (1) upper jaw, (2) marginal lamellae, (3) outer submarginal lamellae of the upper jaw, (4) outer submarginal lamellae of the lower jaw, (5) lower jaw. (b) Generalized picture of the open bill showing the inner submarginal rows, magnified in (B). Letters indicate measurements used in the analysis (see text). The positions of the scanning electron micrographs in Figures 3, 4 and 5 are indicated by the rectangle with arrow.

Figure 2. From Mascitti and Kravitz, 2002, p. 74, with express permission of the copyright holder, the Cooper Ornithological Society.

The process of feeding is an extremely dynamic and complicated coordination of different bill surfaces, tongue, throat and head (Jenkin, 1957; Allen, 1956; Rooth, 1965). Zweers et al. (1995) has developed a detailed description, building on the earlier work, from video recordings of feeding by a trained, captive flamingo (*P. ruber*). The tongue is used to bring water into the mouth, then to force it out through the sieve formed by the lamellae on the bill. Jenkin (1957) reports that fresh stomach contents are nearly dry and concludes that little water is swallowed during the feeding process. Differences in bill structures among the flamingo species make it likely that details of the feeding process differ as well. A given species may also use different methods to filter different types of food (Jenkin, 1957).

Zweers et al. (1995) confirmed the observation (Mascitti, 1998) that filtering by flamingos does not depend only on the size of particles. An individual greater flamingo (other birds were present in the facility) was offered monotypic suspensions of measured amounts of seeds of different sizes, ranging from millet and poppy seed to pea-sized pieces of bread. These corresponded to maximum measured diameters of 0.25 -12.0 mm. The optimal size for filtering was 2-4mm, based on the number of seeds filtered in 60 seconds. While most of the seeds tested were accepted, the smallest seeds were too small to filter, and the bird eventually refused to feed on them.
The largest seeds (peas and marrowfats) eventually discouraged the bird from feeding, as they were too large to filter. Interestingly, while the bird picked up pea-sized pieces of bread, it did not peck at the larger seeds. The video showed that the smallest seeds were filtered with the bill closed.

Offered mixtures of different seeds within the optimal size range, the bird was able to select grass seed (preferred) from barley, milos, or mung beans. In a test of discrimination among seeds of larger sizes, milos were ingested but not mung beans. Several mechanisms come into play here, including manipulation of the gape to create filters of different sizes, for both inflow and outflow, and using the tongue to direct water outflow to different places along the bill, corresponding to different filter sizes. Sympatric flamingo species, *P. ruber roseus/ Phoeniconaias minor* in Africa and *P. chilensis/Phoenicoparrus andinus* and *jamesi* in South America, have different optimal particle sizes and, therefore, may not compete directly for food (however, see Caziani and Derlindati, 2000). Table 4 (copied below) shows different sizes of particles found in the gizzards of the South American flamingo species.

TABLE 4. Gizzard contents of three South American flamingo species, classified by type of item and size. Items are percentages, presented as mean ± SD. Diatom percentages were calculated from the total number recorded in lake water samples at Laguna de Pozuelos (availability) or found in gizzards; seed and grit percentages were calculated only from gizzard contents. Chilean Flamingo (*n* = 1) and Andean Flamingo (*n* = 3) specimens were collected in May; James' Flamingo (*n* = 3) specimens were collected in December (Mascitti 1998).

	Availability in lake	Chilean Flamingo	Andean Flamingo	James' Flamingo	
		Gizzard	Gizzard	Availability in lake	Gizzard
Diatom size (μm)					
0–20	39.7 ± 9.6	0	11.6 ± 3.0	72.0 ± 15.0	27.2 ± 11.7
21–40	39.2 ± 8.8	0	0.5 ± 0.2	20.3 ± 10.4	51.9 ± 9.0
41–60	16.8 ± 7.8	0	2.1 ± 0.3	5.0 ± 4.4	14.8 ± 3.5
61–80	2.1 ± 1.9	0	33.0 ± 8.0	1.8 ± 1.8	2.2 ± 1.4
81–100	2.0 ± 1.0	0	51.2 ± 10.1	0.6 ± 0.8	0.6 ± 0.7
101–120	0.2 ± 0.2	0	1.6 ± 0.2	0.2 ± 0.2	2.4 ± 2.5
>120	0.1 ± 0.2	0	0.0 ± 0.0	0.0 ± 0.1	0.9 ± 1.0
Seed size (μm)					
700 × 1200		98.0	0.0 ± 0.0		0.0 ± 0.0
Grit size (μm)					
<60		1.0	2.0 ± 1.3		0.5 ± 0.3
60–90		0.5	1.3 ± 0.6		4.9 ± 5.6
91–150		0.5	1.2 ± 0.3		30.7 ± 8.1
151–250		1.0	1.7 ± 0.8		47.8 ± 31.2
251–500		5.0	3.2 ± 2.4		16.2 ± 20.9
501–1000		92.0	90.7 ± 4.5		0.0 ± 0.0

From Mascitti and Kravitz, 2002, p. 82, with express permission of the copyright holder, the Cooper Ornithological Society.

Comparative Digestive Anatomy (ESD)

Length of intestinal tract (gizzard to caeca) ranged from 1.7 to 2.9m in *Phoenicopterus sp*., and 2.3 to 4.4 m in the smaller species (*Phoeniconaias minor* and *Phoenicoparrus sp*.) (n=29; Kear and Duplaix-Hall, 1975). In the same birds, caeca length ranged from 2.9 to 4.6% of total intestinal length (*Phoenicopterus sp*.) but only 0.9 to 1.3% of total intestinal length in the latter group. These differences suggest that fermentation processes (to break down complex carbohydrates such as those of chitinous exoskeletons?) may play a larger role in digestive physiology of the more omnivorous species compared with enhanced digestive surface area of the more herbivorous species.

The Food of Wild Flamingos

Information on the food of wild flamingos derives from analyses of crop, gizzard and stomach contents (for example Allen, 1956; Jenkin, 1957; Mascitti and Kravetz, 2002; Tourenq et al., 2001), from sampling environments where flamingos feed (for example, Arengo and Baldassare, 1995, 1998, 1999, 2002; Mascitti, 1998; Soto, 1988; Casler and Este, 2000; Caziani and Derlindati, 2000) and comparing areas where flamingos feed to areas where they have been excluded (Hurlbert and Chang, 1983). Because flamingos can use different feeding methods and can filter selectively, and because some food items (algae, slime) are processed faster than others (seeds, mollusks), in most cases, the relative proportions of items consumed are not known. Flamingos of the same species, in nearby bodies of water, can be consuming very different diets (Jenkin, 1957; Hurlbert, 1982; Hurlbert et al., 1986; Vareschi, 1978;Arengo and Baldessari, 1999; Baldassare and Arengo, 2000). Feeding by large flamingo flocks has significant impact on the relative abundance of available food items in a given body of water (Tuite, 2000; Hurlburt et al., 1986). However, because in some areas flamingos feed on 'monocultures', we know that diets for individuals of some species can vary from 100% herbivorous (*Spirulina*) to 100% carnivorous (*Artemia*).

Foods reported for species of flamingos

Phoenicopterus ruber ruber

Polychaetes, mollusks, copepods, amphipods, chironomids, crustaceans, seeds of widgeongrass (*Ruppia maritima*), tubercles of muskgrass (*Chara fibrosa*) gastropods, organic 'ooze'/mud, annelids, insect larvae, invertebrate taxa: Mytilidae, Solecurtidae, Cephalaspidae, Chironomidae, Nematoda, Lymnaeidae, Oligochaeta, Veneridae, Malacostraca, Cerithidae, Batilaria, brine shrimp (*Artemia sp*.), brine flies (*Ephydra sp.*), shrimp, fish; grit **References**: Allen, 1956; Jenkin, 1957; Espino-Barros and Baldassare, 1989; Schmitz et al, 1990; Bildstein et al., 1991; Schmitz and Baldassarre, 1992; Arengo and Baldassare, 1998, 1999, 2002; Este and Casler, 2000; Casler and Este, 2000.

Phoenicopterus ruber roseus

Aquatic invertebrates, organic mud, mollusks, crustaceans, seeds of *Carex, Cyperus*, *Ruppia*, *Scirpus* and *Medicago sp*., insect larvae, annelid worms, vegetable matter, ants (!), corixid beetles; grit **References:** Allen, 1956; Jenkin, 1957; Johnson 1997; Tourenq et al., 2001.

Phoenicopterus chilensis

Calanoid copepods (5 species of Boeckella, *Parabroteas sarsi*), daphnia, brine shrimp, chironomid larvae, amphipods, corixids, cladocerans, ostrocods, snails, annelids, crustacea, mollusks, aquatic plants; grit **References:** Allen, 1956; Jenkin, 1957; Hurlbert, 1982; Hurlbert et al, 1986; Soto, 1988.

Phoeniconaias minor

Spirulina platensis and other sp., rotifers -- *Brachionus dimidiatus*, *B. plicatilis, Hexartha jenkinae , Anabaenopsis arnoldii; A. elenkinii* (algae), diatoms (*Bacillariophyceoe, Navicula*), nauplii and first copepodites, cyanophytes, corixid beetles, seeds of sedge, blue-green algae (*Myxophyceae*); grit **References:** Allen, 1956; Jenkin, 1957; Vareschi, 1978; Tuite, 2000

Phoenicoparrus andinus

Surirella sp. and other diatoms >80 microns, algae; protozoa, nematodes, organic mud; immature sand crabs; insect and crustacean larvae, grit **References**: Jenkin, 1957; Hurlbert, 1982; Hurlbert and Chang,1983; Caziani and Derlindati, 2000.

Phoencioparrus jamesi

Organic mud, algae, diatom frustules (25 species), vegetable residues (scant), preferring to forage in shallow (2 cm) water, consuming diatoms <60 microns; grit. **References:** Jenkin, 1957; Hurlbert, 1982; Mascitti, 1998

Phoenicoparrus andinus

Surirella sp. and other diatoms >80 microns, algae; protozoa, nematodes, organic mud; immature sand crabs; insect and crustacean larvae, grit **References:** Jenkin, 1957; Hurlbert, 1982; Hurlbert and Chang, 1983; Caziani and Derlindati, 2000.

Phoencioparrus jamesi

Organic mud, algae, diatom frustules (25 species), vegetable residues (scant), preferring to forage in shallow (2 cm) water, consuming diatoms <60 microns; grit **References:** Jenkin, 1957; Hurlbert, 1982; Mascitti, 1998

Composition of Native Foods (ESD)

No published reports of the specific chemical composition of native foods eaten by flamingos were found. A generic summary of nutrient composition of types of foods that may be consumed by free-ranging flamingos is found in Table 1. These data were extracted from the literature and do not

Nutrient	*Dried Spirulina sp.*[a]	*Artemia salin*[a]	*Copepods*[b]	*Diatoms*[b] *Mixed spp.*	*Shrimp-Penaeidae & Panalidae*[a]
Water, %	4.68	89.09		76.00	75.86
Protein, %	60.29	57.20	50.00	17.14	84.13
Crude Fat, %	8.10	12.85	35.00		7.17
Vitamins					
Vitamin A, IU/g	5.98	454.50		14.07	7.46
Vitamin E, IU/kg	52.45	1.41		7.17	33.97
Vitamin B_1, Thiamin, mg/kg	24.97				1.16
Vitamin B_2, Riboflavin, mg/kg	38.5				1.41
Vitamin B_3, Niacin, mg/kg	134.49				105.72
Vitamin B_6, Pyridoxine, mg/kg	3.82				4.31
Vitamin B_{12}, Cobalamin, IU/kg	0.00				2.11
Foalcin, mg/kg	0.99				0.12
Pantothenic Acid, mg/kg	36.51				11.43
Vitamin C, mg/kg	105.96	31.10			82.85
Minerals, %					
Calcium	0.13	0.07	0.30		0.22
Potassium	1.43	1.37	0.43		0.77
Magnesium	0.20	0.20	0.43		0.15
Sodium	1.10	2.32	1.27		0.16
Phosphorus	0.12	1.23	0.70		0.85
Ca:P Ratio	1.08	0.06			0.26
Concentration, mg/kg					
Copper	63.99	8.98	10.00		10.94
Iron	298.99	103.37	53.00		99.83
Manganese	19.93	19.68	4.00		2.07
Selenium	0.08				1.57
Zinc	20.98	125.98	90.00		45.98

Table 1. Nutritional content of some foods utilized by flamingos in the wild. Samples were commercially obtained and do not necessarily reflect wild dietary ingredients. All data (except water) is presented on a dry matter basis. Data extracted from [a]Zootrition software (Wildlife Conservation Society, 1999) and [b]WCS Wildlife Nutrition Laboratory, unpublished.

represent actual dietary samples; nonetheless, some general statements can be inferred from this information. On a dry basis, these types of foodstuffs contain a variable protein content (invertebrates ranging from 16 to about 66% on a dry basis; widgeongrass seeds, 6 to 17%), and moderate to high fat and carbohydrate concentrations (7% to >30%; 5 to >50%, respectively), as well as quite high concentrations of vitamin E, vitamin C (both antioxidant vitamins), and B vitamins. With natural foods providing good sources of vitamin C, it is conceivable that the flamingo has a dietary requirement for this nutrient, but the ascorbic acid synthetic ability of the flamingo has not been established. Vitamin A concentration, on the other hand, is relatively low in natural foodstuffs, while carotenoid pigments may be quite high; presumably the flamingo meets its vitamin A requirements through enzymatic conversion of dietary carotenes. Mineral concentrations vary; sodium and chloride concentrations reported are, in general, high whereas calcium (Ca) content is quite low. Only in algal species (and diatoms) are Ca:P ratios >1.

Carotenoids and Feather Pigmentation (DLM)

While we still do not understand the ecological significance of the pink color of flamingos, clearly, color-feeding is a significant aspect of flamingo feeding husbandry. Proper coloration from dietary carotenoids is important, not only aesthetically from an exhibition perspective, but may be a component of behavioral recognition, reproductive success, and impact other physiological and health processes. Between 500 and 600 carotenoid pigments have been identified in vertebrates, some specifically responsible for coloration of feathers, skin, eyes, scales, beaks, and egg yolks. Pigmentation of feathers and exposed tarsal and facial skin of flamingos is derived from yellow, orange and red molecular components found in the natural diet (Fox and Lint 1975). Only plants synthesize carotenoid pigments; however, many animals (including insects, mollusks, crustaceans and fish) concentrate and further metabolize them to provide a rich dietary food source for birds.

The deposition of pigment into specific tissues is dependent upon three primary factors:

1. The quantity of the appropriate carotenoid in the diet.
2. The bird's capacity to digest and absorb specific carotenoids and metabolize them to the correct chemical form (factors that improve fat digestion can improve carotenoid incorporation).
3. The capacities of specific tissues to take up carotenoids and insert them into the structure of growing tissue.

Dietary carotenoids may be used directly to pigment tissues or metabolized to other carotenoids prior to incorporation; as a consequence, tissue carotenoids may differ from those consumed. It is not known if the feather follicles can further metabolize carotenoids in order to change feather color, or if color discrimination only occurs at the level of carotenoid uptake from the blood. Each carotenoid appears to have its own individual pattern of absorption, plasma transport and metabolism, and there are considerable species differences in the types of carotenoids that are preferentially absorbed and metabolized (Stradi, 1998).

Pigmentation in the Flamingo

The pigments mainly responsible for the plumage color of flamingos are the red carotenoids canthaxanthin, phoenicoxanthin and astaxanthin (Comben, 1976), and metabolism has been studied in detail (Fox, 1975; Fox and Lint, 1975). Flamingos effectively absorb and utilize β-carotene as a precursor for skin and feather pigments (e.g. astaxanthin), but they do not readily utilize many dietary xanthophylls, including astaxanthin. Instead, astaxanthin is converted from canthaxanthin and deposited in feathers (Klasing, 1998). They demonstrate a selective metabolic preference for ingested carotenes over xanthophyllic fractions, and oxidize carotenes in a stepwise manner (first to ketones, such as echinenone and then to the chief derivatives, canthaxanthin from β-carotene and phoenicopterone from β-carotene) (Fox and Lint, 1975). The hydroxylation of canthaxanthin to phoenicoxanthin and astaxanthin occurs at the site of epidermal and feather growth (Fox, 1975). Trials with β-carotene, lycopene, and zeaxanthin failed to produce any detectable metabolic results (Fox, 1975).

Captive birds can live, reproduce, and appear healthy when consuming a diet devoid of carotenoids as long as vitamin A is provided. However, due to the highly developed social behavior of many species of free-living birds, carotenoids may be required for breeding success. There is some debate as to whether poorly colored birds are less likely to breed. Only sexually mature adult flamingos are fully colored, and it is possible that individuals ‘recognize’ potential breeding partners by the depth of their red coloration. According to early anecdotal literature and speculation (Kear, 1974), more consistent breeding results were achieved when zoos recognized the importance of the bright color in flamingos and added carotenoids to the diet. However, no significant correlation between coloration and reproductive fitness has been demonstrated experimentally in captive flamingos, information is clearly equivocal, and other factors apart from coloration appear more important in breeding success (AZA & EAZA Ciconiiformes Advisory Groups, CICAG, pers. comm.) On the other hand, captive flamingo diets are much less variable than wild diets, so variation in coloration may be less than in the wild.

Pigmentation Loss in the Flamingo

Although pigments are deposited in the liver, blood, fatty tissue, exposed tarsal and facial skin, feathers and yolk (Fox and Lint, 1975), if deprived of their natural food and carotenoid supplementation, flamingos become pale in color. Birds lose blood carotenoids on a carotene-deficient diet considerably faster than they restore canthaxanthin to the blood on a carotene supplement. This may be because the anabolic accumulation of canthaxanthin requires expenditure of chemical energy for oxidation of the hydrocarbon carotene (Fox and Lint, 1975).

The red leg color of the James’ flamingo tends to fade in captivity, and the violet chest of the Andean flamingo may also be lost (Kear and Palmes, 1980). Apart from diet, environmental conditions may also impact the ability of flamingos to express normal coloration. “Stress” can modify hormones such as thyroxine and corticosterone to negatively impact xanthophyll metabolism; direct effects of stress on flamingo pigmentation have not been examined.

Canthaxanthin, the primary feather pigment, is a rather unstable compound and warrants a continuous dietary supply as long as the birds are molting. At other times of the year, limited body stores in adipose and liver tissues can be utilized to maintain color. Canthaxanthin pigment is generally considered to be nontoxic, with an LD50 determined at about 25 mg/kg (in experiments conducted with laboratory model species). However, high levels of dietary carotenoids fed to flamingos have resulted in dull plumage, with the skin of the head developing a purplish tinge (Comben, 1976). Excesses in other species have resulted in mineral deposition in the retina. In addition, high levels of carotenoids can compete with fat-soluble vitamins (A, D, E, and K) for absorption, transport and deposition pathways within the body, and excessive levels can indirectly lead to deficiencies of these vitamins (Comben, 1976).

Pigmentation of Crop Milk

Once flamingos have laid and hatched their eggs, both adults feed the young by crop secretion for up to three months in the wild and up to one year, or even into the next breeding season, in captivity. This secretion (for nutrient composition see Handrearing Section) is formed by glands that lie close together in the upper digestive tract (Studer-Thiersch, 1975). Crop milk secretions fed to chicks are bright red in color for the first few weeks of the chick's life and gradually fade. While the red color was once accredited to blood in the secretion, it has been clarified that the coloration results from canthaxanthin carotenoids at a concentration of 0.4 mg/100mL (van Bocxstaele, 1974; Fox, 1975). Adults tend to lose plumage color during feeding of chicks. It has been surmised that they are meeting specialized needs of the chick for vitamin derivatives (Kear, 1974) through pigment mobilization. Despite carotenoids being made available to the developing chick in the egg yolk and crop milk, chicks fail to assimilate any pigments into tissues (Fox, 1975).

Health Issues Linked to Captive Diets (ESD, DLM)

Leg problems (see Health and Medicine, Chapter 6) and obesity in captive flocks may be associated with diets high in energy content that result in too rapid growth, but nutritional diseases/ imbalances have rarely been reported in flamingos. An imbalance of Ca and P due to high Ca relative to P more likely underlies this observation -- levels of Ca above 1% have been shown to result in bone deformations in poultry. Early diets designed for captive flamingos, comprising dried shrimp and cereal grains, resulted in mineral imbalances and vitamin deficiencies (Wackernagel, 1975) – in particular, vitamin A due to oxidative deterioration. The appearance of rachitic bones together with a hyperplastic parathyroid gland can result from vitamin A antagonism known to exist with vitamin D (Mertz et al., 1985). Chilean flamingos have exhibited a condition superficially similar to rickets, involving bending of the tibio-tarsus and thickening of the head of the bone (refer to Health and Medicine, Chapter 6 for further details). The condition has not been found in young under about four weeks old, but birds at all later stages of plumage have been affected (Humphreys, 1975), suggesting that yolk storage reserves and/or crop secretions may be better balanced with regard to fat-soluble vitamins compared to diets consumed by older birds. Vitamin A toxicosis has not been reported in flamingos; nonetheless, interactions among the fat-soluble vitamins (A, D, and E) probably warrant further investigation in/of this group. Vitamin E deficiency has been reported but not experimentally induced in captive flamingos (Fowler, 1986; Dierenfeld and Traber, 1992). Circulating concentrations of vitamins A and E in flamingos may be useful in evaluating health status (see below). High levels of vitamin E measured in wild foods (Table 1), along with elevated concentrations of polyunsaturated fatty acids (which oxidize readily) in both wild and captive diets suggest a possible increased dietary requirement for this nutrient in its role as an antioxidant. Hemosiderosis (iron accumulation in extraneous tissues) in flamingos has been reported anecdotally as a health issue (although not a primary pathology) and may be linked to excess dietary iron and/or antioxidant status in association with vitamins C and vitamin E; this condition is currently under investigation (Marques, pers. comm.)

Feeding Requirements of Captive Flamingos (ESD)

Placement of Feeders and Diet Form

Historically, it was recommended that flamingos be fed in bowls, troughs, or pools away from main water bodies to minimize fouling of exhibit water (Testa and Johnson, 1992; Kear, 1974). However, behaviorally as well as physiologically, feed or feeder placement directly in or on the water can provide an optimal feeding environment and this is recommended when possible. Bildstein et al. (1991) demonstrated that the food intake of juvenile Chilean flamingos was at most 82% that of adults due to aggressive displacement, hence, appropriately spaced and adequate numbers of feeding stations should be available to minimize aggression between birds. Feeding stations should have access from all sides to permit less dominant birds an easy escape if they are displaced.

Nutritionally complete diets ground to a fine particle size (fed either dry or mixed with water to provide a slurry), small-dimension (1-5 mm) dry crumbled diets, and larger (1 cm diameter) extruded floating diets have all been successfully fed to captive flamingos. This reflects their adaptability to different sizes and shapes of dietary ingredients. Feeding stations should be available for free-choice feeding throughout the day. The significance of filtration of nutrients directly from exhibit ponds should not be overlooked in the feeding of flamingos, although its contribution has not been quantified in captive birds.

Grit has been reported in digestive tract contents of all species. Unless it is available as part of the exhibit substrate, grit should be provided separately in the size range of 500 to 1000μm for the larger flamingo species, and 90-250μm for the smaller species.

Nutritional Requirements of the Flamingo

Water - Flamingos can survive by drinking ocean-strength seawater through efficient filtration mechanisms and secretion of hyperosmotic solutions of sodium chloride (Bildstein et al., 1995). Many free-ranging flamingos occasionally travel long distances to drink and bathe at freshwater sites; captive flamingos, however, showed no preference for feeding in fresh, saline, or hypersaline solutions during one short-term study (Bildstein et al., 1995). Fresh, potable water should be constantly available to flamingos in captivity.

Energy - Despite the variety of feeding habits among species, there are no data to surmise that nutritional requirements of flamingos differ substantially from those established for domestic ducks or geese, and biliary bile acid composition suggests that flamingos are more closely related to Anseriformes compared to other Ciconiiformes (Hagey et al., 1990). Seeds of grasses and tubers have been found in crops and stomachs of free-feeding flamingos, hence, plant-based diets (see also Table 1) appear entirely suitable for these species, and few nutritional problems have been reported for this group. Energetics calculations based on dry commercial feeds containing between 3 and 3.5 kcal/g (12.5 to 14.6 kjoule/g) suggest that a 3 kg *Phoenicopterus ruber* requires between 230 and 290 kcal per day (960 to 1200 kjoules per day) depending on activity level (Aschoff and Pohl, 1970). This level would be supplied by consumption of 65 to 100 g of dry food per individual (2-3% of body mass). If diets are presented as a slurry (up to 75% water), this may represent 260 to 400 g of food offered daily, or up to 10% of body mass. Similar calculations for a 1.8 kg *Phoeniconaias minor* result in energetics requirements of 160 to 200 kcal (660 to 830 kjoule), which would also be met by feeding a slightly higher percentage of body mass at 2.5 to 3.5%, or 45 to 65g of dry food (180 to 250g of slurry). Kear (1974) fed 364g (slurry) per bird to a flock of 275 in a mixed exhibit; other zoos feed between 200 – 300 g per bird daily (wet slurry).

Protein - Based on poultry nutrient requirements, Wackernagel (1975) recommended that diets for captive flamingos contain not less than 13% protein. The inclusion of a large proportion of animal ingredients and algae in the diet of free-ranging flamingos, however, might suggest a higher protein intake in nature (see Table 1 for nutrient composition of some native foods). Diets, however, are invariably diluted with plant materials, mud, and other filtrates to provide a lower overall protein content, and commercially available diets or mixes used in zoos containing between 20 and 45% protein (see Table A1) have been shown to support reproduction. Respondents from an earlier captive diet survey (Roberts and Hesch, 1992) reported that a majority of US zoos (83%) incorporated green produce, shrimpmeal and trout or even cat extrusions to commercial diets fed the lesser flamingo in an effort to meet presumed higher protein (or other nutrient) requirements of this species, but current data do not support this assumption. Species differences in protein requirements, variation due to physiological stage, and/or the importance of seasonality in dietary protein content or availability have not been examined in flamingos.

Vitamins and Carotenoids - Native foods eaten by flamingos appear to contain less vitamin A, and more vitamin E, than typical diets formulated for domestic poultry. Additionally, if high carotenoid supplementation is required for proper coloration, this may decrease absorption of vitamin E from the diet, thus increasing dietary vitamin E requirement. In general, domestic avian vitamin E requirements appear to underestimate dietary needs of this nutrient for flamingos in captivity. The ratio of A:D:E may be more important than any one fat-soluble constituent, with dietary concentrations of 20,000 IU vitamin A, 2000 IU vitamin D3, and 200 IU vitamin E per kg dry matter suggested as reasonable for captive flamingos. Due to potential toxicity problems with canthaxanthin reported in other species at levels >25 mg/kg, future inclusion of this pigment in animal diets may be limited or discontinued in Europe (EAZA Flamingo Husbandry Manual, 2002). Other pigments and/or mixed carotenoid products may prove effective in feeding and coloration of flamingos. Pigmentation is required in the diet for coloration only during feather formation; however, its inclusion year-round has not been shown to be detrimental to health (when levels are not excessive).

Minerals - Requirements do not appear to differ from those of domestic poultry species. Adult flamingos are unlikely to require more than about 1% calcium (dry basis). Accordingly, the dietary P content should be approximately 0.5%. The wild environment of the flamingo is highly saline, resulting in expectations of a captive diet high in salt. However, the flamingo excretes salt via supra-orbital glands and does not require a high salt intake in captivity; they also ingest very little water with their food. High concentrations of salt can lead to excessive consumption of water and attendant problems with ventilation control (NRC, 1994). Diets recommended for the domestic fowl, containing 0.5 % NaCl, have proven to be adequate (Wackernagel, 1975).

Composition of Captive Diets (ESD)

The chemical composition of a number of diets fed to flamingos in North American zoos is summarized in Appendix Table 1A, along with suggested recommendations for nutrient ranges. Diets included in the table represent commercially available products fed as sole items, as well as mixed practical rations utilized by two zoological institutions with proven reproductive success. Chemical analyses of commercial diets do not indicate any significant differences between breeding and maintenance diets, and zoos generally do not vary diets seasonally. Faced with a lack of published data from controlled, comparative studies, it is not possible to say whether these diets based on poultry requirements are adequate to support optimal reproduction or growth (NRC 1985; 1994). Based on available data, all formulated diets reported herein appear to be capable of maintaining captive flamingos, and at least minimally meet requirements for growth and reproduction. Hand-rearing information is presented in a separate chapter; no provision for geriatric animals has been identified.

Recommendations for standardized flamingo nutrient ranges are based on these practical diets in combination with information from native foods and domestic poultry requirements. Currently, vitamin A is being offered to captive flamingos in significantly higher concentration than those recommended by the NRC (1994) for laying poultry, with at least one commercial diet exceeding maximum tolerance levels suggested for poultry. While vitamin A toxicosis has not been reported in flamingos, imbalances of fat-soluble vitamins can result in antagonisms and overt deficiencies of other nutrients. With pigmentation of flamingos dependent on uptake of other fat-soluble constituents, further nutrient interactions must also be considered. Given that the presentation of flamingo diets is often in a liquid form, allowances have been made for potential oxidative deterioration of specific nutrients.

The majority of North American zoos use canthaxanthin as a pigment added to the diet: Roxanthin Red (10% dry canthaxanthin beadlets manufactured by Roche) or Carophyll Red (10% pure canthaxanthin) have been added in the range of 25mg/kg food (Wildlife Conservation Society) to 1g/kg food at Slimbridge (Griswold, 1975). Approximately 10 g of canthaxanthin has historically been fed on a daily basis to 275 birds at Slimbridge (Kear, 1974). Comben (1976) believes that delivery of the carotenoid through a ‘soup’ mixture is wasteful and that a pelleted mixture is more economical. Some zoos now use mixed carotenoid products, with some commercial feeds incorporating mixed carotenoids at manufacture. A suggested dose of pigmentation in flamingo diets, which has resulted in feather coloration equivalent to free-ranging birds when scored using a standardized color index (Wildlife Conservation Society, in preparation) is 23 mg canthaxanthin per kg dietary dry matter; 50 mg/kg mixed carotenoids (Betatene 7.5%) also provides suitable coloration.

Physiological Assessment of Nutritional Status (ESD)

It may be valuable to develop a standardized feather color scoring system for use in flamingo management to establish quantitative links between dietary constituents and bird appearance, as well as to compare geographic differences among flocks both in situ and ex situ. These data can then be correlated with reproductive and health parameters. Prototypes of such a system exist; conversion to an Internet-based system has been proposed, with funding, implementation, and dissemination pending (Dierenfeld and Sheppard, unpublished data). Color will be scored against fine-grade international color standards used in the graphics industry.

Fat-Soluble Vitamins A and E

Table 2 summarizes values of vitamin A (measured as retinol) and vitamin E (measured as tocopherol) in the blood of provisioned free-ranging Caribbean flamingos and captive Caribbean, Chilean and lesser flamingos. While vitamin E levels are not significantly different among flamingo species, the vitamin A levels in the free-ranging Caribbean flamingos are significantly lower than any of the species maintained in captivity. The detection of the retinyl palmitate ester (A-palmitate, Table 2) often indicates the presence of a synthetic source of vitamin A from the diet or can be an indication of high dietary levels of vitamin A. Retinyl esters were not measured in the zoo-held flamingos but were seen in the provisioned free-ranging birds with access to a commercial diet. Presumably these semi free-ranging flamingos were meeting vitamin A needs through conversion of dietary carotenoid pigments; the presence of the retinyl esters, then, may have been an indication of dietary excess.

There were no significant differences in circulating concentrations of vitamin E among flamingo species measured. Overall, the flamingo values reported here are more similar to ranges seen in carnivorous birds (10-40 µg/mL) rather than herbivorous/ granivorous species (2-10 µg/ml; (Dierenfeld and Traber, 1992). The Lesser Flamingo, which feeds predominantly on algae, tended towards the values for herbivorous species. Gamma-tocopherol, the predominant form found in seeds, although measured in all plasma samples, was only detected in blood samples from the provisioned free-ranging flamingos.

Species	Retinol (µg/ml)	A-palmitate (µg/ml)	a-Tocopherol (µg/ml)	g-Tocopherol (µg/ml)
Semi Free-ranging Caribbean (n=53)	0.046 ± 0.22 (.00312-1.443)	0.014 ± 0.072 (0.0005 - 0.4630)	19.04 ± 10.08 (4.3-38.9)	2.15 [a] + 0.91 (1.0-4.0)
Caribbean (n=15)	0.44 [b] ± 0.33 (0.12 - 0.77)	NA	15.41 ± 6.49 (0.26 - 25)	ND
Chilean (n=55)	1.23 [c] ± 0.56 (0.16 - 2.29)	NA	21.20 ± 8.9 (0.54 - 34.28)	ND
Lesser (n=6)	0.73 ± 0.16 (0.45 - 0.92)	NA	13.20 ± 2.11 (9.95 - 15.39)	ND

Table 2. Plasma or serum retinol, A-palmitate (retinyl palmitate), a-tocopherol and g-tocopherol levels (mean ± SD and range) measured in provisioned free-ranging Caribbean (*Phoenicopterus ruber ruber*) flamingos and captive Caribbean (2 facilities), Chilean (*P. chilensis*; 2 facilities) and lesser (*Phoeniconaias minor*) flamingos (Wildlife Conservation Society Nutrition Laboratory and Norkus, unpublished data). NA = not analyzed, ND = not detected.

Carotenoids

In flamingos, total blood carotenoid have been measured comprising 96% canthaxanthin at a total concentration of 2.64 mg/100 mg blood, with only 4% being β-carotene (Fox and Lint, 1975). A more recent assessment of circulating carotenoid concentrations in provisioned semi free-ranging Caribbean flamingos (Table 3) demonstrated a considerably different distribution, with almost 80% of total carotenoids (0.02/0.03) remaining as β-carotene. This might suggest that this compound was not needed for vitamin A synthesis in the provisioned birds.

	Lutein	Cryptoxanthin	β-Carotene	Total Carotenoids
Mean ug/mL ± SD	1.20 ± 0.72	0.61 ± 0.46	0.024 ± 0.037	0.0304 ± 0.021
Range ug/mL	0.20 - 2.89	0.04 - 2.26	0.001 - 0.207	0.004 - 0.092

Table 3. Carotenoid values from provisioned free-ranging Caribbean flamingos (n=41). Values for total carotenoids are based on a β-carotene standard (Norkus, unpublished data 1999).

Conclusion

In summary, there is very little published data pertaining to the nutrition of captive or wild flamingos, probably because nutritional problems are rare in flamingos. Aside from issues of feather pigmentation loss, there are few published references documenting nutritional deficiencies or toxicities in flamingos maintained in captivity. Diets currently being employed by zoological institutions vary substantially, and recommendations have been made for a uniform flamingo diet in Table A1, CicAG (Ciconiiformes Advisory Group) Diet. These recommendations are based on a combination of published requirements for the laying hen, inferential evidence from natural foods, and practical husbandry experience with flamingos and other avians. Given that the presentation of flamingo diets is often in a liquid form, allowances have been made for potential deterioration of specific nutrients.

In addition, there are several areas of flamingo nutrition suggested for further detailed research:

- Assessment of nutritional composition of wild diets
- Extent of conversion of carotenoids to vitamin A
- Interactions of fat-soluble vitamins and carotenoid supplementation
- Interactions among vitamin D, calcium and phosphorus
- Assessment of calcium status in adults and chicks throughout the breeding season
- Intake and digestion by different species, and responses to various commercial products
- Effects of temperature on intake and protein nutrition
- Vitamin E requirements
- Significance of vitamin E/Se in the prevention of capture myopathy
- Effect of fatty acid complex on oxidation and antioxidant nutrition
- Vitamin C metabolism.

References

Allen, R. P. (1956) The Flamingos: Their Life History and Survival. Research Report #5 of the National Audubon Society. National Audubon Society, New York, NY.

Arengo, F. and G. A. Baldassarre (1995). Effects of Food Density on the Behavior and Distribution of Nonbreeding American Flamingos in Yucatan, Mexico. Condor 97(2):325-335.

Arengo, F. and G. A. Baldassarre (1998) Potential Food Availability and Flamingo Use of Commercial Salt Impoundments in the Ria Lagartos Biosphere Reserve, Mexico. Colonial Waterbirds 21(2):211-221.

Arengo, F. and G. A. Baldassarre (1999) Resource Variability and Conservation of American Flamingos in Coastal Wetlands of Yucatan, Mexico. J. Wildl. Mang. 63(4):1202-1212.

Arengo, F. and G. A. Baldassarre (2002) Patch Choice and Foraging Behavior of Nonbreeding American Flamingos in Yucatan, Mexico. Condor 104(2):452-457.

Aschoff, J. and H. Pohl (1970). Rhythmic variations in energy metabolism. Fed. Proc. 29:1541-1552.

Baldassare, G. and F. Arengo (2000) A Review of the Ecology and Conservation of Caribbean Flamingos in Yucatan, Mexico. Waterbirds 23, Special Publication 1: 70-79.

Bath, W. (1906) Die Geschmakesorgane der Vogel und Crokodille. Arch Biontolog 1:5-47 reported in Zweers et al.

Bildstein, K. L., P. C. Frederick and M. G. Spalding (1991). Feeding Patterns and Aggressive Behavior in Juvenile and Adult American Flamingos. Condor 93(4):916-925.

Bildstein, K. L., C. B. Golden, B. J. McCraith, B. W. Bohmke and R. E. Seibels (1995). Feeding Behavior, Aggression and the Conservation Biology of Flamingos: Integrating Studies of Captive and Free-ranging Birds. Amer. Zool. 33(2):117-125

Britton, R. H. and A. R. Johnson (1987). An Ecological Account of a Mediterrranean Salina: the Salin de Giraud, Camargue (S. France). Biological Conservation, 42(3): 185-230.

Casler, C. L. and E. E. Este (2000) Caribbean Flamingos Feeding at a New Solar Saltworks in Western Venezulea. Waterbirds 23 (Special Publication 1):95-102.

Caziani, S. M. and E. E. Derlindati (2000) Abundance and Habitat of High Andes Flamingos in Northwestern Argentina. Waterbirds 23 (Special Publication 1):121-133.

Comben, N. (1976). Notes on feeding carotenoid pigments. International Zoo Yearbook 16: 17-20.

Dierenfeld, E. S. and M. G. Traber (1992). Vitamin E status of exotic animals compared with livestock and domestics. Vitamin E in Health and Disease. L. Packer and J. Fuchs. New York, Marcel Dekker, Inc.: 345 - 360.

Espino-Barros, R. and G. A. Baldassare (1989). Activity and Habitat-use Patterns of Breeding Caribbean Flamingos in Yucatan, Mexico. Condor 91(3):585-591.

Este, E. E. and C. L. Casler (2000). Abundance of Benthic Macroinvertebrates in Caribbean Flamingo Feeding Areas at Los Olivitos Wildlife Refuge, Western Venezuela. Waterbirds 23 (Special Publication 1):87-94.

Fowler, M. E., Ed. (1986). Zoo and Wild Animal Medicine. Philadelphia, Saunders Co.

Fox, D. L. (1975). Carotenoids in pigmentation. In: Flamingos, Kear, J. and N. Duplaix-Hall (eds). Berckhamsted, Poyser.

Fox, D. L. and K. C. Lint (1975). Carotene-rich dietary grass for natural pigmentation of flamingos. International Zoo Yearbook 15: 185-191.

Griswold, J. A. (1975). Pigment Feeding. Flamingos. J. Kear and N. Duplaix-Hall. Berckhamsted, Poyser.

Hagey, L.R., C.D. Schteingart, H-T. Ton Nu, S.S. Rossi, D. Odell and A.F. Hofmann. (1990). ß-Phocacholic acid in bile: biochemical evidence that the flamingo is related to an ancient goose. The Condor 92:593-597.

Humphreys, P. N. (1975). Pathological conditions. Flamingos. J. Kear and N. Duplaix-Hall. Berckhamsted, Poyser: 199-202.
Hurlbert, S. (1982). Limnological studies of flamingo diets and distribution National Geographic Research Reports 14: 351-356
Hurlbert, S. H. and C. C. Y. Chang (1983) Ornitholimnology: Effects of Grazing by the Andean Flamingo (Phoenicoparrus andinus) Proc. Natl. Acad. Sci. USA 80:4766-4769.

Hurlbert, S. H, W. Loayza and T. Moreno (1986) Fish-flamingo-plankton Interactions in the Peruvian Andes. Limnology and Oceanography, 31(3):457-468.
Jenkin, P.M. (1957). The filter-feeding and food of flamingos (Phoenicopteri). Phil. Trans. R. Soc. London B 240:401-493.
Johnson, A. R. (1997). Long-term Studies and Conservation of Greater Flamingos in the Camargue and Mediterranean. Colonial Waterbirds 20(2):306-315.
Kear, J. (1974). Notes on keeping flamingos in captivity. International Zoo Yearbook 14: 142-144.
Kear, J. and P. Palmes (1980). Andean and James' flamingos in captivity. International Zoo Yearbook 20: 17-23.
Kear, J. and N. Duplaix-Hall (1975). Flamingos. Berckhamsted, Poyser:
Klasing, K. C. (1998). Comparative Avian Nutrition. California, CAB International. 350 pp.
Mascitti, V. (1998). James flamingo foraging behavior in Argentina. Colonial Waterbirds 21(2):277-280
Mascitti, V. and F. O. Kravetz (2002). Bill morphology of South American flamingos. Condor 104(1):73-83.
Mertz, A.L., M.M. Walser et al. (1985) The interaction of vitamin A and vitamin D related to skeletal development in the turkey poult. Journal of Nutrition 15:929.
National Research Council (1985, 1994). Nutrient Requirements of Poultry. Washington D.C., National Academy Press.
Roberts, H. J. and C. Hesch (1992). Survey results concerning diets of flamingos in North American Zoos. 1990 Flamingo Workshop.
Rooth, J. 1965. The Flamingos on Bonaire: Habitat, Diet and Reproduction of Phoenicopterus ruber ruber. Natuurwetenschappelijke studiekring voor Suriname en de Nederlandse Antillen 141:1-151.
Rooth, J., 1976. Ecological Aspects of the Flamingos on Bonaire. pp 16-33 in Papers Ecology Conference on Flamingoes, Oil Pollution and Reefs 1975: STINAPA #11 E.A. van Geusau,W. Booi, I. Kristensen and HAM de Kruijf eds., Netherlands Antilles National Parks Foundation.
Schmitz, R. A. and G. A. Baldassarre (1992). Correlates of Flock Size and Behavior of Foraging American Flamingos Following Hurricane Gilbert in Yucatan, Mexico. Condor 94(1): 260-264.
Schmitz, R. A., A. A. Aguirre, R. S. Cook and G. A. Baldassarre (1990). Lead Poisoning of Caribbean Flamingos in Yucatan, Mexico. Wildl. Soc. Bull. 18:399-404
Soto, D. (1988). Relationships Between Zooplankton Biomass and Chilean Flamingo Population in Southern Chile Patagonic Lagoons. in I Taller Internacional de Especialistas en Flamencos Sudamerican. M Parada, J. Rottman and C. Guerra eds. Corporacion Nacional Forestal, Chile.
Stradi, R. (1998) The Colour of Flight. University of Milan.129 pp.
Studer-Thiersch, A. (1975). Basle Zoo. Flamingos. J. Kear and N. Duplaix-Hall. Berckhamsted, Poyser.
Testa, D. C. and R. E. Johnson (1992). Hialeah Park flamingos: historical perspective and management review. 1990 Flamingo Workshop, California.

Tourenq, C. S. Aulagnier, L. Durieux, S. Lek, F. Mesleard, A. Johnson and J Martin (2001) Identifying Rice Fields at Risk from Damage by the Greater Flamingo. J. Applied Ecology 38:170-179.
Tuite, C. H. (2000). The Distribution and Density of Lesser Flamingos in East Africa in Relation to Food Availability and Productivity. Waterbirds 23, Special Publication 1: 52-63.
Vareschi, E. (1978) The Ecology of Lake Nakuru. Oecologia 32:11-35.
van Bocxstaele, R. (1974). Attempts at hand-rearing the Caribbean flamingo. International Zoo Yearbook 14: 199-210.
Wackernagel, H. (1975). Dietary Requirements. Flamingos. J. Kear and N. Duplaix-Hall. Berckhamsted, Poyser: 196-198
Zweers, G, F. De Jong, H. Berkhoudt and J.C. Vanden Berge (1995). Filter Feeding in Flamingos (Phoenicopterus ruber). Condor 97(2):297-324.

Products Mentioned in the Text:

Betatene 7.5%, Cognis Corporation, Nutrition & Health, 5325 South Ninth Avenue, LaGrange, IL 60525

Carophyll and Roxanthin Red, Hoffmann-LaRoche, Inc., 45 Waterview Boulevard, Parsippany, NJ 07054

Flamingo Complete, Mazuri, P.O. Box 66812, St. Louis, MO 63166-6812

Flamingo Fancier, Zeigler Bros, Inc., 400 Gardners Station Rd., P.O. Box 95, Gardners, PA 17324

Flamingo Fare, Reliable Protein Products, Inc., 70-105 Frank Sinatra Drive, Rancho Mirage, CA 92270

Flamingo AP, HMS Zoo Diets, Inc., Bluffton, IN 46714

Nutrient	Mazuri Flamingo Complete	HMS Flamingo AP	Reliable Protein Flamingo Fare	Zeigler Flamingo Fancier	Diet Zoo A	Diet Zoo B	Wackernagel 1975	Breeding/ Laying Poultry (chicken, duck, geese) NRC, 1984, 1994	CICAG Diet 2002
Energy, ME (kcal/kg)	3410.00	2497.00		2860.00				2900 to 3200	3000.00
Water, %	10.00	10.00	45.00	15.00		10.00		10.00	
Protein, %	22.22	32.50	45.45	22.00	32.83	20.30	20.00	14 to 17	20 to 40*
Crude Fat, %	6.11	5.40	14.55	5.00	7.98	4.93	3.00	-	1% linoleic
Vitamins									
Vitamin A, IU/g	36.11	26.70	-	-	17.55	14.56	20.00	4.44	20.00
Vitamin D_3 IU/g	6.67	7.19	-	-	2.97	3.59	2.00	0.2 to 1.0	2.00
Vitamin E, IU/kg	81.11	133.33	-	-	26.32	240.90	75.00	5.5 to 11.1	200.00
Vitamin K, mg/kg	1.11		-	-	-	-	4.00	0.55	1.00
Vitamin B_1, Thiamin, mg/kg	18.89	1.26	-	-	1.55	4.71	6.00	0.89	5-10
Vitamin B_2, Riboflavin, mg/kg	13.33	15.28	-	-	5.30	15.20	8.00	2.4 to 3.8	10-20
Vitamin B_3, Niacin, mg/kg	113.33		-	-	36.15	64.90	-	11 to 20	25-35
Vitamin B_6, Pyridoxine, mg/kg	15.56		-	-	2.31	5.98	7.00	3 to 5	10-20
Vitamin B_{12}, Cobalamin, mg/kg	0.04	11.00	-	-	0.01	2.16	60.00	0 to 0.004	0.004
Folacin, mg/kg	2.00	2.55	-	-	0.79	1.23	2.00	0.28 to 0.35	1.5-3
Pantothenic Acid, mg/kg	25.56	52.11	-	-	10.00	31.10	35.00	2.44	10-20
Vitamin C, mg/kg	-		-	-	38.94	-	75.00	-	-
Calcium, %	1.72	2.80	-	-	2.59	0.89	4.00	2.5 to 3.8	1 to 3
Chloride, %	0.29		-	-	0.98	-	-	0.15	0.20
Magnesium, %	0.22	0.22	-	-	0.20	0.83	-	0.06	0.10
Phosphorus, %	1.03	1.28	-	-	1.05	0.33	1.20	0.33 to 0.43	0.5-1
Potassium, %	0.68	1.15	-	-	1.04	0.87	-	0.17	0.20
Sodium, %	0.17	0.50	-	-	0.86	0.19	-	0.15	0.20
Sulphur, %	0.27		-	-	0.15	0.75	-	-	-
Ca:P Ratio	1.67	2.19	-	-	2.47	2.70	3.33	7.5 to 8.8	2-5
Cobalt mg/kg	0.22		-	-	2.31	1.25	0.15	-	0.20
Copper, mg/kg	14.44	21.76	-	-	11.84	50.83	4.00	7 to 9	15.00
Iodine, mg/kg	1.67	2.13	-	-	2.49	1.25	0.70	0.33	0.5-1.0
Iron, mg/kg	355.56	330.00	-	-	107.11	181.00	75.00	50 to 70	50-100
Manganese, mg/kg	104.44	225.00	-	-	59.25	75.00	75.00	25 to 60	50-75
Selenium, mg/kg	0.34	0.44	-	-	2.25	0.72	-	0.1 to 0.2	0.2-0.3
Zinc, mg/kg	105.56	273.25	-	-	58.41	221.00	70.00	50 to 75	50-100

Table A1. Summary of nutrients (dry matter basis, except water) contained in diets utilized for flamingos maintained in captivity in North American zoological facilities. Data represent four major commercial formulations utilized, and 2 "in-house" mixtures.

*Maximum values are outlined for vitamins A, D, and E in the CICAG recommendations while all other values are minimum requirements or ranges. Wackernagel (1975) provides recommended values for the flamingo based on nutritional requirements of the laying hen.

Chapter 6

Health and Medicine

Facilitators: Terry M. Norton, DVM, Diplomate ACZM; James Raymond, DVM, Diplomate ACVP; Susan Clubb, DVM, Diplomate ABVP-Avian; Nandine Lamberski, DVM, Diplomate ACZM; Murray Fowler, DVM, Diplomate ACZM; Thomas H. Reidarson, DVM, Diplomate ACZM; Beth Chitick, DVM, Diplomate ACZM; Linda Henry

Husbandry Issues That Affect the Health of Flamingos

Flight restraint methods

It is encouraged to keep flamingos full-winged when the appropriate facilities are available and, hopefully, more zoos will account for this when designing facilities for flamingos in the future. Pinioning is the most common de-flighting method performed on flamingos maintained in outdoor enclosures. Successful pinioning has been performed on chicks from 2-10 days of age. Refer to Reproduction, Chapter 4 for further details on animal husbandry issues related to pinioning. The procedure may be performed with simple crushing of the tissue with a hemostat and cutting with a scissors or scalpel. The incision may be closed with tissue glue. General anesthesia is needed if the procedure is performed on adult-sized flamingos. For traditional pinioning, the site of amputation is determined by finding the alula and cutting the bone just distal to the base of this structure. Remove the flight feathers at the amputation site. Other feathers should be plucked and the skin surgically prepared. A circumferential skin incision is made, leaving enough skin to close the wound. The major vessels in this area are between the metacarpal bones, which are fused at either end. A figure eight transfixation ligature is placed loosely around the proximal ends of the bone. The bones are amputated with a sharp chisel, a bone-cutting forceps or a giggly wire. Once the distal end of the metacarpal bones is freed, the ligature is tightened. The skin is pulled into place to cover the end of the bones and sutured closed. A light pressure bandage is applied to assist in controlling hemorrhage. The bird usually removes the bandage in a day or two. Amputating less bone (i.e. “long pinioning”) may improve reproductive success, but it is still unclear if some birds are completely inhibited from flight. Tendonectomy is not recommended because it is more invasive and in some countries is forbidden. Birds often develop droopy wings, and the procedure frequently does not prevent the flamingo from flying.

When designing a new facility, efforts should be made to allow chicks to be retrieved for pinioning and other procedures with minimal disturbance to the flock. Refer to the Management and Housing Chapters for details.

Sexing Methods

Males and females are sexually monomorphic, although males are usually larger than females.

A non-blood feather technique utilizing PCR technology is currently available in the US (Avian Biotech, 1-800-514-9672, Fax: 850-386-1146, e-mail: agt@nettally.com, http://www.avianbiotech.com). This technique is the least invasive, easiest to perform, and the preferred method to be used for sexing flamingos by some institutions. A small amount of DNA is extracted from the shaft of a freshly plucked feather. It is then purified, and special primers are used to amplify a sex-specific DNA fragment. This technique still needs to be validated in flamingos.

European Laboratories that are able to sex flamingos by this methodology are as follows:

Austria

1) Pluma Osterreich
Lochauestrasse 2
6912 Hobranz
T: +43(0) 55 73 8 54 03
F: +43(0) 55 73 8 54 03

Czech Republic

1) Genservice, s. r. o.
Laborator molekulami genetiky
Palackeho 1-3
612 42 Brno
T: +420 5 41321229
F: +420 5 41562648
Email: genservice@volny.cz

2) Statni veterinarni ustav Brno
Palackeho 174
612 38 Brno
T: +420 5 41321229
F: +420 5 41211509, 41212383
Emai: svubrno@login.cz

Germany

1) Pluma GbR-Molekularbiologische Analytik
Postfach 70 03 59
70573 Stuttgart
T: +49(0) 711 990 59 23
F: +49(0) 711 990 59 24

2) Genedia GmbH
Burgstrasse 12
D-80331 Muenchen
T: +49 (0) 89 64289624
F: +49 (0) 89 64249666
Email: info@genedia.de

3) Loboklin
Prinzregentenstr. 3
D- 97688 Bad Kissingen
T: +49 (0) 971 72020
F: +49 (0) 971 68546
Email: laboklin@t-online.de

4) Tieraeztiches Institut
Georg-August-Universitaet Goettingen
Abt. Molekularbiologie
Groner Landstrasse 2
D-37073 Goettingen
F: +49(0) 531 393399
Email: ipfeiff@gwdg.de

The Netherlands

(1) Gendika
Industrieweg 1
9641 HM Veendam
T: +31 (0) 598 619343
F: +31 (0) 598 612194
Email: info@gendika.com

(2) Dr. van Haeringen Laboratorium BV
Agro Business Park 100
P.O. Box 408
6700 AK Wageningen
T: +31 (0) 317 416402
F: +31 (0) 317 426117
Email: vhl@bedrijf.diva.nl / info@vhlgenetics.com

United Kingdom

1) An-Gen
PO Box 60
Winchester
Hampshire S023 9XN
England
T: +44(0) 1962 882 986
F: +44(0) 1962 881 790
Email: parrots@an-gen.com

2) Avian Biotech International
PO Box 107
Truro
Cornwall TR1 2YR
T: +44 (0) 1872 262 737
F: +44 (0) 1872 262 737
Email: abluk@globlnet.co.uk

DNA testing from a blood sample for gender determination is a commonly used technique and is relatively non-invasive. Zoogen (PE AgGen, Inc) has validated the technique for most flamingo species. For ease of sampling from a chick, blood can be taken from the pinion site.

Surgical sexing via laparoscopy may be performed. The advantages of this method are that the gonad can be visualized directly (e.g. assessment of sexual maturity and activity can be made) and other body organs can be evaluated. The disadvantages are that the bird must be restrained, preferably with anesthesia, and the procedure is somewhat invasive. It is recommended to perform this technique on birds two years of age or older so that the bird is sexually mature and out of the age range where traumatic injury is most common.

Proper Environment to Prevent Bumblefoot

The most satisfactory enclosures for flamingos have a substrate of grass and several shallow pools for feeding and bathing. Refer to Housing, Chapter 2 for details. Hospitalized flamingos should be housed on soft, thick rubberized or meshed mats (again, refer to the Housing Chapter for details).

Housing

Avoid isolating flamingos by themselves. Sick flamingos should be housed with at least one other bird. If this is inappropriate for the specific medical problem (e.g. infectious disease issues), then mirrors or a tape recording of vocalizations can be used as alternatives. Another flamingo should be placed with the ill flamingo as soon as is appropriate, e.g. no infectious disease issues. Refer to Housing, Chapter 2 for specifics on enclosure design and size.

Life Span

Flamingos are long-lived, some reaching over 50 years (Fowler and Cubas, 2001). They are capable of reproducing at this age as well (Shannon, pers. comm., 1999). Geriatric medical problems start at approximately 35 years of age (Shannon, pers. comm., 1999).

Physical Restraint

Flamingos may be slowly herded into a corner, allowing handlers to capture them. The base of the neck is lightly, but securely, grasped with one hand and the body with the other, lifting the bird off its feet and directing the legs slightly away from the handler. The body with the wings of the bird folded in the natural position should be held next to the hip of the handler. Care must be used in controlling the long legs to prevent them from flailing about. A cloth hood may help calm the bird down. Manual restraint is adequate for physical examination, blood collection, and minor medical treatments and procedures. Refer to Management, Chapter 3 for specific details on proper manual restraint.

Anesthesia

General anesthesia is commonly used to facilitate positioning during radiography as well as to provide immobilization and analgesia during laparoscopy and other surgical procedures. Isoflurane is currently the preferred inhalant gas. Initially, the animal is manually restrained as described in the Management Chapter (3). The anesthetic gas is administered via a facemask (a converted one-liter plastic bottle or a large bell-shaped mask may be used). Due to the peculiar conformation of the bill, the mouth can only be opened wide enough to introduce the endotracheal tube, thus making visualization of the glottis difficult especially in smaller flamingo species (e.g. lesser flamingos). The glottis, however, may be visualized most of the time in larger species. Blind intubation may be attempted. Maintenance anesthesia may also be performed via facemask, if intubation is not possible. Surgical placement of an air sac tube is an option in critical situations where more controlled anesthesia is needed and intubation is not feasible. Attempts should be made to limit anesthetic episodes to two hours or less.

Ketamine at a dose of 20 mg/kg intramuscularly can be utilized if Isoflurane is unavailable (Fowler, 1986). However, recovery can be unpredictable and is more likely to lead to post-anesthetic problems. Monitoring the anesthetized bird is extremely important. Heart rate, respiratory rate, and body temperature should be monitored frequently throughout the procedure. An ultrasonic Doppler may be used to monitor the pulse. The most common site used is the ulnar (or basilic) artery. Pulse oximetry is also useful. A reflectance probe placed against the upper palate or a clamp on a digit works well. Careful attention must be given to maintenance of body temperature. Temperature probes may be placed in the esophagus or cloaca. The animal may be placed on a water-circulating heating pad, and hot packs may be placed along the body of the animal to help maintain the bird's position (like sand bags) and body temperature. Flamingos that become hypothermic while under anesthesia will have prolonged recoveries and fatalities may result. For longer procedures, warmed fluids should be administered intravenously at 20 ml/kg/hour. Subcutaneous fluids may be administered prior to recovering the flamingo if necessary.

Recovery from anesthesia may be dangerous because the bird may attempt to stand prematurely, which may traumatize the long legs. It is best to hold the bird until it has recovered. Alternatively, the bird may be placed in a 100% cotton, lightweight pillowcase, with the head extended through the opening. If the bird is held, the legs are usually extended and a finger is placed between the hocks to prevent abrasions.

Behavioral Signs of Disease in Adult Birds

It is important to observe the bird prior to going into the enclosure so that an accurate assessment can be made. Knowing individual bird behaviors may also be helpful. Clinical signs of disease may include lethargy, anorexia, one bird isolating itself from the flock or being picked on, "dull eyes", plumage deterioration, long-term pair bond breaks, leg trembling in combination with other signs, weakness, and lack of breeding behavior and egg production.

Physical Examination

Unusual anatomy

Flamingos have long, thin legs and can stand on one leg with the head tucked beneath a wing for a considerable period of time. The bill is uniquely adapted for filter feeding. The neck is proportionately the longest of any bird, containing 17 cervical vertebrae (Fowler, 2001). The feet are fully webbed with four digits in Caribbean and Chilean flamingos (Fowler, 2001). The hallux is absent in James and Andean flamingos (Fowler, 2001). Flamingo legs are very delicate and are more easily damaged than other long-legged bird species.

Physical examination

The physical examination is an important diagnostic tool in flamingos. A complete oral exam is difficult to perform due to the inability to open the beak wide enough. The feet should be examined carefully because pododermatitis and cracks in the feet are common. A pectoral musculature score assessment adapted from a model used for psittacines (Romagnono, 1999) has been utilized in flamingos at Sea World. It has been especially useful when the weight of the bird is normal but the actual muscle condition has changed. Normal flamingos are usually 2 to 2.5 on a scale 1 to 5 (Henry, pers. comm. 1999). A normal keel score rating will vary with the species of flamingo. It is a subjective determination to be evaluated in the context of the overall health and body weight of the bird.

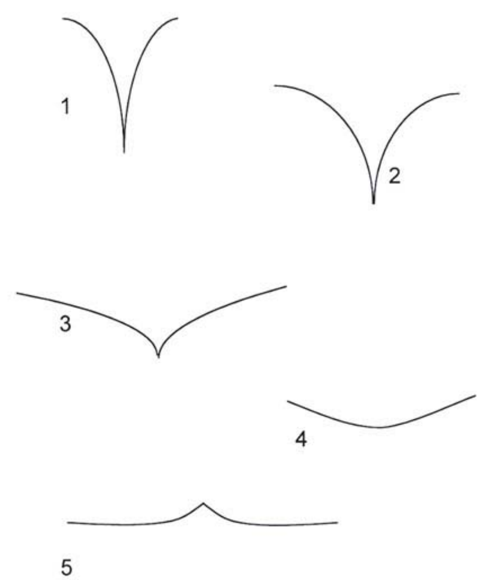
Keel Score Rating Guide

Linda Henry, Sea World San Diego

The guide is designed to provide a means for a more consistent assessment of a bird's palpated weight. The keel score ratings are listed below with their description and a sketch example of the degree of flesh. Sometimes a bird may seem to be between two scoring possibilities. In this case, a score of 1.5 or 2.5 may be appropriate.

Where possible, always pair the assessed keel score with the gram weight of the bird. Keep in mind that what is a *normal* keel score rating will vary with the species. It is a subjective

KEEL SCORE	DESCRIPTION	EXAMPLES
1	Emaciated, keeling severely and sharply.	
2	Keeling, only small amount of muscle dipped to either side of keel.	
3	Keel palpable but muscle firm to either side.	
4	Muscle appears straight across over keel, keel palpable between muscles.	
5	Cleavage, keel not palpable, muscle mounded to either side of keel.	



determination to be evaluated in the context of the overall health of the bird and the gram weight of the bird. If an increase in weight does not correspond with an increase in keel score, consider behavioral observations to determine if there is a health problem. Generally, keel score and weight are in agreement.

Factors that figure into weight vs. keel score ratings include age of the bird, pinioning, amputation, degree of hydration, and, in flamingos, height, etc.

This technique was borrowed and adapted from a parrot center in Florida.

Supportive Care

Tube Feeding

Tube feeding is similar to other avian species, although it is difficult to visualize the glottis in the flamingo. In addition, lesser flamingos have unusual tracheal anatomy and are more prone to having the trachea accidentally intubated and aspirating the formula (Lung, pers. comm. 1999). Personnel performing this procedure should be appropriately trained. Two people should be involved in tube feeding (one person to hold the bird and the other to place the tube) and should communicate with each other throughout the procedure. A 14 French red rubber feeding tube or similar type of tubing works well for this purpose (a smaller tube may be needed for lesser flamingos) and is directed toward the right side of the oral cavity and esophagus. The tube should be well lubricated prior to placement. Prior to administering fluids or gruel, the neck should be palpated to assure that the tube and the trachea can be palpated. It may be helpful to actually feel the tip of the tube as it goes down the esophagus, especially in lesser flamingos. A small amount of saline can be placed prior to administering formula to assure tube placement. If the bird coughs, the tube should be pulled out and redirected. It is recommended to make a gruel out of the flamingo's regular diet. The bird should be well hydrated prior to administering a gruel diet. In very ill birds, it is a good idea to dilute the gruel initially.

An alternative to tube feeding is to feed with a catheter-tipped syringe placed in the beak. This method was utilized for supportive care of a flamingo at the Denver Zoo and seemed to be less stressful and caused less struggling than tube feeding (Baier pers. comm. 1999).

Fluid Therapy

Fluids are administered to flamingos in a similar fashion as with other avian species. Methods of administration will depend on the severity of illness in the bird being treated. Oral, subcutaneous, and intravenous (bolus, IV catheter) fluid therapy methods are most common. The medial metatarsal vein is the preferred site for indwelling catheters. Intraosseous fluid therapy may be an option in critically ill flamingos.

Sling Use and Construction

A very functional sling has been designed by Sea World (Henry, unpublished information, 2002). This sling design is suitable for long-term slinging of long-legged birds for recovery of leg injuries or for short-term slinging required during treatment of myopathy. Flamingos have been slung for up to eight weeks continuously, with infrequent removal for routine weights or radiography. Ideally, flamingos should be in the sling for as short a time as is required for recovery.

Sea World Adventure Park San Diego has used this sling design for several years. Although the original sling consisted of nothing more than a foam pad, duct tape and cording, a few years ago several design elements were incorporated to make the sling more uniform, washable, adjustable and user friendly.

The Sea World sling now consists of fabric-covered foam pad with four webbing straps, which end in D-rings. The bird is suspended using additional straps that thread through the D-rings on the sling pad and are attached with hook and loop tape. The hook and loop segment at the D-rings allow for easy height adjustments to the sling without necessitating the removal of the bird. This is vital to finding a comfortable posture and height for the bird. The other end of the suspension straps is then affixed to the interior of the caging ceiling.

Once constructed, the sling can be machine-washed and dried, depending on the materials used. The Sea World sling is made using headliner fabric of 100% nylon fabric with polyester foam core. Velour may be substituted for the headliner fabric, but it is less durable. The foam insert is a medium density, one-inch polyurethane foam with a 1.9-pound resiliency. The hook and loop tape is nylon and is "sew-on" rather than adhesive. The webbing is polypropylene; cotton webbing is also available but not as sturdy. These supplies are readily available at upholstery suppliers or fabric stores.

To protect these long-necked birds from tangling and injuring themselves on the suspension webbing, it is recommended to cover the support straps with pipe insulation foam on all four straps, for approximately three feet of each strap.

Sling Set-up and Use

To place a bird in the sling, it is best to have two people, one to hold the body of the bird and a second person restraining and guiding the legs. Once in the sling, the flamingo must be wrapped into the sling around both the body and the sling. This is the portion of the slinging process that is the most difficult to standardize. Flamingos will often wriggle their way out of a sling if improperly secured. It often takes several attempts to find the wrapping method that works best for a particular bird. In general, the wrap should cover the body over the wings as well as secure the bird from forward and backward movement within the sling. Four-inch wide Vetwrap is the most effective bandage material for wrapping birds into the sling. Vetwrap is the product name for an elastic non-adhesive tape or bandage material that adheres to itself by the crimped nature of the product. Vetwrap comes in rolls and can be obtained through most veterinary or medical supply companies. It is important to monitor birds closely after slinging. Birds may loosen bandage material and come out of the sling; height and posture adjustments may be needed or bandaging may be too tight. Sometimes birds will appear limp and unresponsive. Such behavior may indicate further veterinary treatment. At other times, this behavior is the transition period where the bird is becoming familiar with the sling. It is recommended to wait 30-60 minutes, allowing time for the bird to acclimate to its new surroundings, before readjusting the sling. Once managers become more proficient at slinging and the bird becomes more accustomed to it, birds will not need to be watched as closely.

In slinging a bird, handlers must be mindful of the crop and vent locations. The vent should be unobstructed by either the sling pad or bandage material so that feces do not build up in this area.

The crop should not have undue pressure from the sling, which may interfere with proper feeding and natural processes of food digestion.

An additional consideration is the keel region. For most birds of adequate weight, the keel should be well protected by both the muscle/fat of the bird and the foam of the sling. However, for very thin birds or for birds in the sling for extended periods, the keel may need additional protection or cushioning. A small doughnut-shaped insert can be made of foam, with a cutout to accommodate the keel, and backed with hook and loop tape that can be attached to the sling pad for added protection for the keel.

Substrate for the bird to stand on while in the sling is another area of concern. Any soft matting are good substrates; even terry cloth toweling is sufficient. (See Housing, Chapter 2). Asphalt, bare concrete or other abrasive surfaces should be avoided.

Flamingos often will need to be tube fed during the slinging period. In the initial days, birds often refuse to eat. Even those eating may need supplemental tubing. We offer a food and water tray within easy reach of the bird, usually raised on an overturned crate to allow for easier access by the bird. The caution here is to prevent a struggling bird from inadvertently injuring itself by banging a leg into the food tray.

Adjustments to Height and Posture

If a bird is swinging too much, it may be unable to get its weight underneath enough to try to stand. If a bird fights too much, the front height may be too low. Generally, the front of the sling should be higher than the back. The goal is for the bird to be able to stand, even minimally, while in the sling. The sling functions to provide stability and safety.

Sling Construction

The following instructions work for both the large (Caribbean flamingo size) and the small (lesser flamingo size) slings. Full-size patterns are available from the AZA Ciconiiformes Taxon Advisory Group or the Aviculture Department of Sea World San Diego, California. Fabric yardages are available in standard widths of 60 inches. The half-yard specified might make more than one cover, but that is the smallest amount that you might be able to purchase for a single sling. Foam is available in bed sizes (i.e., full, queen, king). We recommend having more than one sling on hand.

Supplies list: yardages given are for one large sling

- 1/2 yard headliner fabric (e.g., Tempo)
- 1/2 yard of one-inch foam
- Up to 9 yards of one-inch nylon webbing
- Four one-inch D-rings
- Up to 4 yards of pipe insulation foam
- Hook and loop tape (e.g., Velcro)

Sling Pad Construction:

1. Cut two pad pieces (pattern A) from headliner fabric
2. Cut one foam insert (pattern B) from one-inch foam
3. Cut four eight-inch lengths from the one-inch webbing; melt the ends of the webbing

with a lighter flame to secure from ravels
4. Place fabric pieces A right sides together with webbing inserted between layers at each "X"
5. Sew seams around edges leaving V-shaped area between dots open as specified on pattern A
6. Reinforce stitching at each point where webbing is inserted
7. Clip corners and curves; turn right-sides-out
8. Insert foam at opening
9. Machine stitch opening closed
10. Sew D-rings to webbing straps

Support Straps: Cut four pieces of one-inch webbing at least 12 inches longer than needed. Sew six inches of male and six inches of female hook and loop tape to each end of these straps.

Sling completion: Put one end of each of the long webbing pieces through each D-ring, securing hook and loop tape. The other end of each long webbing piece should be secured to whatever is used to suspend the bird. Our indoor caging is seven feet high and the strap ends are secured to the caging ceiling (e.g. cable ties, bicycle rings).

Sling maintenance: Before using a sling, be sure to check each of the insert points of the webbing to be sure that each attachment is secure. The hook and loop tape may need replacement if the hook end becomes filled with lint/debris. This must also be very secure in its attachment. When using washable materials, the sling can be machine-washed and dried using warm water and gentle cycles.

Drug Therapy

Pharmacokinetic studies have not been performed on flamingos, thus drug dosages should be extrapolated from other avian species. Flunixin meglumine (Banamine) has been documented to cause renal toxicosis in flamingos and cranes, and thus should be avoided (Klein et al, 1994). Fenbendazole (Panacur), a commonly used anthelmintic, has recently been found to cause bone marrow suppression in several avian species (Howard et al, 1999). It should be used with caution in flamingos.

Diagnostic Evaluation

Blood drawing, hematology, and serum biochemistry

Blood can be collected from the jugular, medial metatarsal, or ulnar (or basilic) veins. The jugular is preferred if large volumes (>3.0 ml) are desired. The medial metatarsal vein is the preferred site for indwelling catheters. Blood is usually collected into a heparinized syringe or green-top tube. Lead poisoning is a concern for free-living birds (Aguirre et al, 1991), and whole blood collected to diagnose lead poisoning should be preserved in EDTA (purple-top tube). A complete blood count (CBC), chemistry panel, blood smear evaluation for hemoparasites, and plasma banking should be part of initial diagnostic evaluations. Normal CBC and chemistry values have been published for some flamingo species, and the results are consistent with other groups of birds (Tables 1 and 2, Norton, In Press; Merrit et al, 1996; Ball et al, 2000; Hawkey et al, 1984 and 1985). The plasma and serum from captive flamingos is orange and should not be confused with hemolysis.

Parameter	American (Merritt et al, 1996)	Chilean (Hawkey et al, 1984)	Greater (Hawkey et al, 1985)	Lesser (Hawkey et al, 1985)
RBC X 10^6/ul)	1.12-1.85	2.44-2.93	2.3-3.1	2.4-2.9
PCV (%)	37.95-57.83	41-51	43-57	46-54
Hemoglobin g/dl	9.22-17.65	14.1-18.1	16.6-20.9	15.2-19.5
MCV (fl)	234.31-419.06	161.7-182.4	168-210	179-195
MCH (pg)	57.82-125.35	57.3-64.8	62.9-73.9	55.4-70.5
MCHC (g/dl)	20.42-35.87	33.3-37.9	33.5-39.1	30.8-37.5
Leukocytes/ul	1,531-15,898	1,600-9,000	900-4,500	3,800-8,500
Heterophils/ul	589-12,445	410-4,740	570-2,620	1,700-6,870
Lymphocytes/ul	927-14,504	820-2,610	490-1,680	530-2,370
Eosinophils/ul	0-544	0-710	0-310	0
Monocytes/ul	3-1,418	0	0-130	0-340
Basophils/ul	0-4629	0-360	0-350	0-230
Thrombocytes	adequate	6000-33,000	1,400-35,000	3000-23,000
Plasma protein	5.29-8.08			
Fibrinogen (mg/dl)	40-600	130-360	140-330	140-290

Table 1. Reference range for hematologic parameters in flamingos (Norton 2002, Zoo and Wild Animal Medicine Fifth edition)

Parameter	American (captive) (Merrit et al, 1996)	American (captive) (mean and SD) (Ball and Port, 2000)	American (Semi-free-ranging) (mean and SD) (Ball and Port, 2000)	Chilean (captive) (mean and SD) (Norton, in press)
Total protein (g/dl)	3.18-4.94	4.5/0.4	4.3/0.6	4.9/0.5
Albumin (g/dl)		2/0.3	1.8/0.2	1.7/0.2
Globulin (g/dl)		2.5/0.4	2.5/0.4	
Calcium (mg/dl)	4.95-21.78	10.9/2	10.2/0.6	11.0/0.8
Phosphorous (mg/dl)	1.11-6.76	2.4/1	4.3/2.5	
Sodium (mEq/L)	139.5-160.2		157.5/2.7	153.1/3.0
Potassium (mEq/L)	1.86-6.76		3.2/1.3	2.2/0.3
Chloride (mEq/L)	110.55-123.30		117.0/4.5	116.4/2.8
Creatinine (mg/dl)				0.4/0.08
Urea nitrogen (mg/dl)				
Uric acid (mg/dl)	3.73-22.10		4.1/1.8	2.1/0.9
Cholesterol (mg/dl)			345/50.7	
Glucose (mg/dl)	107.22-288.32	238/52.9	162.4/40.8	270.7/55.7
LDH (IU/L)	47.74-696.94	175/115.5		151.0/72.6
ALP (IU/L)	18.26-737.55	17.9/6.4		
CK (IU/L)	157.15-3,521.44	460.3/228	1578.6/1692.4	
AST (IU/L)	70.42-475.72	221.9/36.8	233/140.2	255.3/94.9

Table 2. Reference ranges for plasma biochemical parameters in flamingos (Norton 2002, Zoo and Wild Animal Medicine, Fifth edition)

Fecal Evaluation (Parasites, Special Stains, Culture)

Fecal cytology (modified Wright's stain or Diff Quick stain), fecal gram stain, fecal acid fast stain, fecal flotation and direct smear, and fecal culture for Salmonella sp. may also be part of initial data collection. The presence of inflammatory cells in the feces is suggestive of an enteritis. Fecal gram stains may be used to approximate fecal flora and identify budding yeast. Fecal acid-fast stains are used to screen for the presence of acid-fast bacteria; however, shedding of these organisms is often intermittent and inconsistent. If fecal acid-fast bacteria are identified, fecal culture for *Mycobacterium spp*. should follow. Fecal flotation and a direct smear with saline are used to identify ova, parasites, and protozoa from feces.

Serology

After a review of the initial lab work is complete, banked plasma may be used to run additional tests such as protein electrophoresis and *Aspergillus spp.* and West Nile virus serology. Additional serology that may be useful but that has not been validated for flamingos includes titers for diseases such as equine encephalomyelitis virus, avian influenza, Paramyxovirus, and Mycoplasma spp.

Microbiology

Microbiology can be very useful in identifying specific etiologic agents. *Escherichia coli*, *Proteus spp., Pseudomonas spp*., *Enterobacter spp.*, and *Edwardsiella tarda* may be part of the normal flamingo intestinal flora but also may be pathogenic in some cases (Lamberski, 1998; Aguirre et al, 1991; Baylet et al, 1979; Glunder and Siegman, 1989; Shane et al, 1984). *Escherichia coli*, *Salmonella spp*., *Aeromonas hydrophila*, *Pasteurella multocida*, and *Streptococcus spp*. should be considered to be potential pathogens, as these organisms have been isolated from healthy as well as sick birds (Aguirre et al, 1991; Lamberski, 1998; Baylet et al, 1979; Glunder and Siegman, 1989; Shane et al, 1984).

Laparoscopy/Biopsy

Laparoscopy and biopsy of specific organs or lesions are often necessary to confirm a diagnosis. Laparoscopy is also used to surgically sex birds. These procedures are conducted similarly to other avian species.

Radiology

Radiography is a very useful diagnostic tool. Flamingos are positioned similar to other bird species (lateral and ventrodorsal views of the entire body). Due to their large size, it is not possible to include both the wings and legs on one cassette. Multiple cassettes are used. Animals that have lesions on the bottoms of their feet or have traumatized pinion sites should have these areas radiographed to rule out osteomyelitis.

Neonatal Medicine

(Refer to the Chick Management section of Chapter 2 for additional details)

Routine Physical Exam

A health assessment should take place when chicks are handled for other reasons. If feasible, a blood sample can be taken for CBC, plasma biochemical profile, sexing, and plasma banking. Normal clinical pathology for growing flamingo chicks has not been established.

Supportive Care and Medical Treatment

Medical and supportive care for flamingo chicks is similar to other avian species. If the chick is being parent-reared, the goal should be to get the chick back to the parents as quickly as possible. If aggressive therapy is needed, a commitment to hand-rearing may be necessary. Supportive care may include tube feeding (see Supportive Care section of Medical Chapter) fluids or formula, fluid therapy (subcutaneous, intravenous, or intraosseous depending on the severity of the problem), providing a warm dry environment, etc.

Rickets-like syndrome

A rickets-like condition was reported in young flamingos at WWT/Slimbridge, UK and has been noted at several other institutions (Humphreys et al, 1975). The birds exhibited bending of the tibiotarsus and thickening of the head of the bone. Affected birds became lame, appeared painful, and were stunted. The condition has been found in birds from four weeks to fully feathered. This syndrome has always been observed at the end of the breeding season. Radiographic examination reveals the upper third of the tibiotarsus to be bent medially with severe thinning of the bone. The medullary canal follows the curvature of the bone. On the lateral side of the tibiotarsus there is extensive soft replacement bone extending from below the bend to the epiphyseal junction. Remnants of the original shaft may be seen projecting downwards from the proximal epiphysis. There is an unusually large gap between the already ossified proximal epiphysis and the metaphysis due to thickening of the epiphysis growth line. There appears to be an interruption of normal ossification, which allows bending as the body weight increases. This condition differs from true rickets in that abnormalities in other long bones have not been demonstrated (Humphreys et al, 1975, Fowler, 2001). Similar conditions have been described in fast-growing broilers, which were fed a high protein diet and grew faster than normal (Humphreys et al, 1975). More research is needed in this area (refer to the necropsy protocol).

Metabolic Bone Disease

Metabolic bone disease is rare in captive flamingos, but it may occur if the parents are on a calcium-deficient diet, if chicks are not exposed to ultraviolet irradiation, or if birds are hand-reared on a calcium/vitamin D deficient diet (Fowler 1978; Fowler 1986). Many zoos have large indoor exhibits that do not have access to natural sunlight.

Fractures/trauma

Physeal fractures of the tibiotarsal-tarsometatarsal bones are not uncommon in chicks handled for pinioning and other procedures (eleven days to three months is the critical time for these fractures to occur). Fractures of any bone are possible. Physeal fractures are very difficult to repair (Fowler, 2001).

Tibiotarsal Rotation

Tibiotarsal rotation does occur in flamingos. However, it is not observed as commonly as in other long-legged birds such as cranes. Although there is not any published information on medical management of this problem, it should be handled in a manner similar to other species (i.e. decrease rate of growth by diet manipulation, increase exercise in hand-reared birds, surgical correction).

Omphalitis/Incomplete Closure of the Umbilicus

Omphalitis is most commonly caused by gram-negative bacteria in flamingos and other avian species (Griner, 1983). It may be prevented by providing a clean environment and swabbing the umbilicus at hatching with dilute povidine iodine. Antibiotics may be warranted in some situations. The umbilicus may require surgical removal.

Incomplete closure of the umbilicus may accompany a small yolk sac protuberance (Griner, 1983). If this protuberance starts to dry and turn black due to constriction, it is best to keep the area clean and place the chick on appropriate antibiotic therapy. It should not be forced into the abdomen and will usually fall off in a few days.

Noninfectious Diseases

Heat Stress

Captive flamingos are susceptible to heat stress, and care should be taken when handling or shipping birds in hot weather (refer to Management, Chapter 3 for details).

Capture or Exertional Myopathy

This condition may occur with prolonged restriction of limb movement, which may occur during shipping or recovery from anesthesia (Young, 1967). Vitamin E/selenium deficiency may predispose the bird to this condition (Dierenfeld, 1989). Lactic acid builds up in the muscles and causes necrosis of the muscle fibers. The flamingo may have difficulty standing or be unable to stand. A plasma biochemical profile will reveal elevations in muscle enzymes (creatinine phosphokinase, AST). Prognosis is guarded, but treatment can be successful. Treatment may consist of placing the bird in a sling, vitamin E/selenium supplementation (IM or oral), hydrotherapy, supportive care, and anti-inflammatory (dexamethasone) and muscle relaxant (robaxin) drugs as needed. Handling should be minimized. Supplementation of the diet with vitamin E prior to and after handling or shipment may aid in prevention of this problem.

Some flamingos have died while being handled (Fowler, 1978, Humphreys, 1975) and based on clinical assessment, the cause of death was thought to be cardiac related (Henry, pers. comm., 1999). Postmortem evaluation did not reveal typical gross or histopathological lesions suggestive of capture myopathy (Henry pers.comm., 1999). Further clinical attention and research are needed in this area.

Trauma

Leg fractures are the most common cause of morbidity and mortality in captive flamingos and usually occur when they are startled or when physically restrained. Growth plate fractures of the tibiotarsal-tarsometatarsal bones may occur when chicks are physically restrained. Fractures of the tarsometatarsus and the proximal tibiotarsus are the most common in adult birds.

Avulsion of the ligament of the femoral head, producing coxofemoral dislocations, and medial collateral avulsions of the intertarsal joint occasionally occur. Wing and rib fractures may also occur secondary to trauma. Leg tendon injuries are not uncommon. The tarsometatarsal fractures are almost always compound, involve the diaphysis, and frequently include damage to metatarsal dorsalis and superficial arteries and veins and extensor and flexor tendons. Wounds are usually contaminated, and significant blood loss is common (Reiderson pers. comm., 1999). The flamingo should be treated for shock, and supportive care should be instituted prior to surgical repair. Once the bird is stable, the bird should be anesthetized (refer to Anesthesia section) with Isoflurane. A lateral approach to tarsometatarsal fractures is recommended. A type 1 Kirshner-Ehmer external fixation apparatus where four to five pins are driven through both cortices and skin surfaces with one connecting bar has been successful in repairing these fractures. Closure of the skin and scales over the fracture is usually impossible, owing to the extensive skin damage and surgical swelling. The defect should be covered with a protective water-resistant transparent dressing, which allows good oxygen and moisture vapor permeability such as Tegaderm (3M Health Care, St. Paul, MN 55144, USA), BioDres (DVM Pharmaceuticals, Inc., Miami, FL 33178), or Duoderm.

One Chilean flamingo drowned when its lower beak became wedged between a leg band and the leg. The leg band had been placed around the distal segment of the leg rather than above the tibia-metatarsal articulation (Griner, 1983).

Predation by various predators is another common cause of flamingo mortality in captivity and the wild. Predator control is recommended. See the Management Chapter for additional information.

Foot Problems

Frostbite

Frostbite of the interdigital webs and digits has been documented when flamingos are exposed to below freezing temperatures (Fowler, 2001). Clinical signs include lameness, darkening of the interdigital web and eventual necrosis of the affected tissue. Prevention should include limiting exposure to temperatures below freezing. Refer to the Housing Chapter for details.

Pododermatitis/Bumble Foot

Flamingos are susceptible to abrasions of the feet due to contact with hard or rough surfaces such as concrete, which may result in pododermatitis. The skin on the plantar surface of the foot becomes cracked and swollen. This may lead to bacterial invasion (Staphylococcus sp is most common), which eventually may lead to osteomyelitis, joint infections, renal disease (the kidney is the most common site for bacteria to lodge in a variety of avian species) (Phelan et al, 1990)), and/or septicemia.

Clinical signs range from inconspicuous to severe lameness. Foot lesions may start as cracks or fissures (Grade 1) which get infected and then become nodular (Grade 2 when nodules are small). The nodules increase in size (Grade 3 when nodules are large), and then other structures become involved such as tendons and bone (Grade 4). Proliferative wart-like lesions may be secondary to a papilloma virus (Heldstab and Studer-Thiersch, unpublished data, 2002).

The following are predisposing factors for pododermatitis:

a. The condition occurs slightly more often in zoo-hatched birds than in birds from the wild (Heldstab and Studer-Thiersch, pers. comm., 2002).
b. Males develop symptoms more frequently than females (Heldstab and Studer-Thiersch, pers. comm., 2002).
c. Cold weather and water causes cracks in feet.
d. Larger flamingo species may be more susceptible to the condition.

Treatment may consist of one or all of the following depending on the severity:

1. Local antiseptic cleaning and bandaging
2. Various lubricating or moisturizing ointments
3. Systemic antibiotics
4. Surgical debridement

Prevention may include:

1. Providing a substrate of grass or similar short, dense vegetation and a shallow pool.
2. Good sanitation of the exhibit and water.
3. Winter housing should be well designed and allow birds access to outdoors when possible.
4. Increase the activity of the birds by stimulating them to forage, providing a larger flock size to stimulate normal social behaviors, and artificially increasing day length.

5. Salt water around the feeding areas may decrease the incidence of the condition (Heldstab and Studer-Thiersch, pers. comm., 2002).
6. When flamingos are confined for medical reasons, rubber or mesh mats should be utilized (rubberized flooring, 3M matting-Nomad, Dri-Dek).
7. Regular examination of feet so treatment can be initiated early in the course of the disease.
8. Some institutions have had success with birds walking through moisturizing-type solutions on a regular basis.

Unusual Forms of Pododermatitis

An unusual form of pododermatitis occurred at one institution while birds were housed for the winter. The housing situation was sub optimal (e.g. concrete floors with Dri-Dek being provided sporadically). Two birds presented with similar lesions on two different occasions. A hemorrhagic fluid-filled bullae developed on one foot. Local and systemic antibiotics were used to treat the lesion. The bullae disappeared, however, the skin sloughed and the interdigital webbing became very dark and dry. Eventually the skin sloughed, leaving a healthy granulation bed. The lesion resolved in a month. Approximately 1.5 years later, the flamingo avulsed her nail and developed an osteomyelitis on the adjacent bone. The cellulitis and infection spread despite antibiotic treatment until the base of the foot and distal tendons of the leg were involved. The infection ruptured through the scales approximately two-thirds down the length of the leg, which allowed drainage to occur. The tendons in the area were necrotic. The flamingo developed similar bullae on the interdigital webbing during this episode. Approximately, 3-4 cm of necrotic deep and superficial digital flexor tendons were removed. Once the necrotic tendons had been removed, healing was quite rapid. Two years later, the bird was still walking well. A second bird developed a very similar problem and was handled the same way and is now walking with no obvious abnormalities (Wallace, pers. comm., 1999).

Nutritional Diseases (Refer to Nutrition, Chapter 5 for further details)

The following are examples of nutrition-related diseases:

a) **Metabolic bone disease**. Chicks fed a diet low in calcium, an improper calcium/phosphorous ratio, or a diet low in vitamin D, or lack of exposure to ultraviolet irradiation, are the most susceptible to metabolic bone disease (Humphreys, 1975; Fowler, 1978). Some zoos have their flamingos housed indoors without access to natural sunlight.
b) **Tibiotarsus rotation** (see Neonatal Medicine).
c) **Atherosclerosis** occurs sporadically in some zoological collections. The etiology of this condition remains unknown (Griner, 1983).
d) **Vitamin E/selenium deficiency**. This condition may predispose birds to capture myopathy (Dierenfeld, 1989). Currently captive diets appear to be low in vitamin E, thus supplementing the diet is recommended (see Nutrition, Chapter 5 for details).
e) **Vitamin D toxicosis**. A toxic nephropathy has been noted in captive flamingos from Europe. Vitamin D toxicosis leads to hypercalcemia, resulting in calcium deposition in renal tissue. It was suspected that there was a dietary excess in vitamin D (Phalen, Ambrus, and Graham, 1990).

Neoplasia

Neoplasia is relatively uncommon in flamingos. A few cases have been reported and are as follows:

a) Complex hepatocellular carcinoma was found in a lesser flamingo. The bird presented with bilateral pododermatitis and had a systemic trematode infestation (Campbell et al, 1993).
b) Cholangiocarcinoma was documented in a lesser flamingo (Wadsworth et al, 1985).
c) Cholangiocarcinoma and hepatic megalocytosis was reported in a Caribbean flamingo (Lopez and Marino-Moncada, 1986).
d) An ovarian adenocarcinoma was found in a Caribbean flamingo (Wadsworth et al, 1985).
e) A cholangioma was found in two Caribbean flamingos by one of the authors (JR).

Gout

Visceral gout has been observed with some frequency in flamingos housed at several North American zoological institutions. It is not clear if these are primary cases of gout or secondary to dehydration caused by other clinical diseases. A survey will be conducted on morbidity and mortality factors in the North American captive flamingo population, and elucidating the causes of this condition will be one of the primary goals.

Toxicities

Heavy metal toxicity is not common in captivity but possible. Zinc toxicosis has been suspected at a few institutions however, the source of zinc remains unknown. Lead poisoning has been reported in free-ranging greater flamingos and Caribbean flamingos secondary to ingestion of lead shot consumed while foraging (Aguirre et al., 1991). The clinical signs included emaciation and high mortality. At necropsy lead pellets were found in the gastrointestinal tract. There was evidence of enteritis, and the ventricular lining was stained an intense green. Therapy has not been reported but should be similar to that used in psittacine birds and waterfowl.

Flunixin meglumine has induced renal toxicosis in flamingos and cranes, thus is not recommended to use this drug in flamingos (Klein et al, 1994).

Vitamin D toxicosis is covered in Nutritional Diseases (see above).

Algal Toxicosis

Microcystins are hepatotoxic cyclopeptides produced by some types of cyanobacteria. Ten adult captive Chilean flamingos (*Phoenicopterus chilensis*) died acutely. Concurrently, an algal bloom was noted in the exhibit pond in which the flock of over 100 birds resided. The 10 affected flamingos presented dead or moribund with clinical signs of extreme weakness, lethargy, recumbency, and dyspnea. Bleeding from injection sites was noted in the five birds in which venipuncture and treatment were attempted. Blood abnormalities included severe hypoglycemia and marked elevations in AST, CK, LDH, and iron. Therapeutic efforts focused on controlling shock, hypoglycemia, dehydration, and delayed hemostasis. Despite treatment attempts with fluids, dextrose, vitamin K, oxygen, vitamin E/Se, dexamethasone, and piperacillin, all birds died within eight hours of presentation. Initial differential diagnoses included toxicosis (e.g. anticoagulants, blue-green algae toxins), trauma, sepsis, or capture myopathy. Necropsies were performed on seven birds. Cultures from the liver, kidney, lung, and brain of three birds showed mixed bacterial growth but did not provide a causative etiologic agent for the epornitic. Consistent gross and histopathological lesions included multifocal areas of hemorrhage in the muscle, gastrointestinal, and respiratory tracts, severe hepatocellular dissociation and necrosis with hemorrhage and splenic congestion. High performance liquid chromatography (HPLC) was used to determine the presence of toxicological agents in pond water samples and internal organs of two birds. Liver tissues were negative for seven different anticoagulant rodenticides, while gastrointestinal contents and pond samples contained microcystins. Under light microscopy, pond water samples also contained non-filamentous granular clumps of cells surrounded by a clear calyx, consistent with the morphology of organisms of the genus *Microcystis*. It was determined that blue-green algae toxicosis caused the acute deaths seen in this flamingo flock. Further flamingo access to the exhibit pond was prohibited and no further mortalities occurred (Chitick et al, 2002).

Stress

Some flamingos fail to adjust to captivity (Humphreys et al, 1975). Malnutrition may develop. Occasionally captive flamingos collapse and die acutely. Acute deaths have been noted in physically restrained flamingos and are thought to be related to cardiac arrest. Chronic stress can cause immunosuppression and predispose to various infectious diseases (e.g. aspergillosis, malaria) (Humphreys et al, 1975).

Cardiovascular Diseases

Examples are as follows:

a) A lesser flamingo’s heart contained a myocardial infarct as well as foci of myocarditis. The bird’s liver contained a granuloma of undetermined etiology (Griner, 1983).
b) Atherosclerosis has been seen in the aorta, brachial, carotid, and internal iliac arteries of a Chilean flamingo (Griner, 1983). The intimal plaques in the left brachiocephalic trunk had almost occluded the vessels. The left pectoral muscles were ischemic, soft, and moist. Atheromatous plaques were also seen on the intimal surface of the aorta and brachiocephalic trunk of an American flamingo (Griner, 1983). Multiple renal granulomas, micro-calculi and glomerulosclerosis were also observed in this flamingo. A form of atherosclerosis characterized by intimal and medial fibromuscular hyperplasia and mineralization and sometimes with atheromas and cartilagenous metaplasia has been noted at necropsy in the aorta of several adult American flamingos by one of the authors (JR).
c) Cardiac arrest (see above for details).

Sand/Sand-like Impactions

Lesser flamingos appear to be predisposed to developing impactions with sand and material with similar consistency to sand (Henry, pers. comm., 1999). It is not clear in each case the source of material causing the impactions. Most birds have been found extremely debilitated or dead.

Parasitic Diseases

Parasites have only occasionally been reported to cause clinical disease in captive flamingos (Fowler, 2001) and are most commonly incidental in wild flamingos.

External Parasites

Lice belonging to the same genera as those found on waterfowl are seen in captive and free-living birds (Lamberski, 1998).

Internal Parasites

Tetrameres americana and *T. coccinea* are commonly found in ductal areas of the proventricular glands with no associated inflammation in wild *Phoenicopterus ruber ruber* (Aguirre et al, 1991; Griner, 1983; Rollin, 1981; Threlfall, 1981). *Tetrameres spp*. have been problematic in some captive flamingos at The Wildfowl and Wetlands Trust in Slimbridge (Humphries et al, 1976).

Cestodes in the genus *Amabilia*, *Cladogynia*, *Sobolevicanthus*, and *Gynandrotaenia*, have been found incidentally in free-ranging flamingos (Aguirre et al, 1991), however, cestodes were found to cause an intestinal diverticulosis in a captive lesser flamingo (Poynton et al, 2000). Artemia of saline lagoons have been recognized as intermediate hosts for the cysticercoides of cestodes parasitizing free-living flamingos in Camargue, France (Gabrion and MacDonald, 1980).

Trematodes are frequently found incidentally in wild flamingos (Aguirre et al, 1991). A disseminated trematode infection has been reported in a captive flamingo with concurrent hepatic neoplasia (Campbell et al, 1993). Schistosome ova were detected in histologic sections of six Chilean flamingos that died at the Calgary Zoo over a 10-year period. Death could be attributed in part to the presence of trematode ova in only one flamingo. Ova were most numerous and most consistently found in the pancreas, spleen, ventricular muscle, and proventricular submucosa. Other sites in which ova were found included the cerebellum, liver, kidneys, lungs, and skeletal muscle. Moderate inflammation was present around ova trapped in the hepatic parenchyma but was minimal or absent in all other sites. Examination of necropsy records suggested that infections occurred before the birds were caught in Chile in 1988. On the basis of ova found in the aorta and in arterioles, the trematode was tentatively identified as belonging to the genus *Dendritobilharzia* (Pare and Black, 1999).

Acanthocephalids have been reported in free-ranging flamingos (Aguirre et al, 1991). Besnotia-like sarcocyts were found in smooth muscle of small intestine in a wild Caribbean flamingo and Sarcocystis sp. merozoites were found in pectoral muscle tissue in free-living Caribbean and lesser flamingos (Agurirre et al, 1991; Fowler, 2001). *Sarcocystis phoeniconaii n sp*. Murata was identified as a new species of Sarcocystis in the lesser flamingo (*Phoeniconaias minor*). Tiny rice-like grains, measuring 3-5 x 1 mm were found in the skeletal muscle (Lamberski, 1998).

Flamingos may harbor hemoparasites asymptomatically and occasionally develop clinical disease. In one report, *Plasmodium spp*. (type of malaria) caused a flamingo to become anemic and weak (Fowler, 2001). A diagnosis was made by microscopic examination of a blood smear. Mosquitoes are the vector of this parasite.

Treatment

Antiparasitic drugs and dosages used in other avian species should be effective and safe in flamingos. Due to the possibility of causing bone marrow suppression, fenbendazole should be used with caution in all avian species (Howard et al, 1999).

Prevention

Routine fecal examinations should be performed on captive flamingos. The parasite load in the particular group of birds being examined should dictate the frequency of fecal examinations. A minimum of twice-yearly fecal examination is recommended. Preventive deworming is rarely needed but should be instituted if chronic parasite problems exist.

Infectious Diseases

Bacterial

Escherichia coli, Proteus spp., *Pseudomonas spp., Enterobacter spp.,* and *Edwardsiella tarda* may be part of the normal flamingo intestinal flora (Lamberski, 1998). *Escherichia coli*, *Salmonella spp*., *Aeromonas hydrophilia*, and *Pasteurella multocida* should be considered potential pathogens, as these organisms have been isolated from healthy as well as sick birds (Aguirre et al, 1991). Staphylococcal septicemia and synovitis have been reported (Griner, 1983). Septicemia occasionally arises from the infected lesions of bumblefoot, and pneumonia may occur in newly imported or stressed flamingos (Humphreys, 1975). *Salmonella spp*. can cause enteritis and septicemia in flamingos (Humphreys, 1975). Flamingos may also be asymptomatic carriers of *Salmonella spp*.

Mycobacterium

Mycobacterium avium complex is not a common problem in captive flamingos. It was found in six (1.9%) out of a sample of 306 flamingos examined over a 28-year period at The Wildfowl and Wetlands Trust in Slimbridge (Brown and Pickering, 1992). Some speculate that the low incidence of *Mycobacterium avium* in captive flamingos may suggest that they have some natural immunity (Cromie et al, 1991). However, *Mycobacterium avium* infections have also been reported in free-ranging flamingos (Cooper et al, 1975; Kock et al, 1999; Sileo et al, 1979). An epizootic in free-ranging lesser flamingos in Kenya resulted in more than 18,500 deaths over a few months in 1993. The disease was concentrated along the shores of Rift Valley Lakes Bogoria and Nakuru and did not involve any of the other avian or mammalian species frequenting the lakes. Discrete necrotic and granulomatous lesions were often noted in spleen and liver, and *Mycobacterium avium serovar* I was isolated from both organs. Furthermore, *Escherichia coli* and *Pseudomonas aeruginosa* were recovered in pure culture from the liver of a high percentage of the birds. Histopathology revealed lesions indicative of an acute septicemia. Algal toxicosis was initially suspected as the cause of the deaths due to a concurrent algal bloom; however, this was not confirmed (Kock et al, 1999).

Viral

Pox Virus

Cutaneous poxvirus lesions have been reported in captive flamingo chicks and adults. The lesions are usually on the legs in the adults and around the mouth and eyes in chicks. Surgical resection may be curative (McManamon et al, 1992), however, the condition can also be fatal in chicks (Arai et al, 1991). Sea World of Florida vaccinates their chicks with a commercially available avian pox vaccine (M. Walsh, pers. comm., 1999). Gross appearance of the lesion, histopathology and electron microscopy may be used to make a diagnosis.

Herpes Virus

Herpes viral infections are widespread in avian species and have been reported in Ciconiiformes (Ritchie, 1995; Kaleta, 1990; Gomex-Villamandos et al, 1998). Natural and experimental herpesviral infections have been previously reported in black and white storks and green herons (Gomex-Villamandos et al, 1998). A series of cases in three species of stork with hemorrhagic necrotic enteritis was recently reported (Gomex-Villamandos et al, 1998). Stork herpes viral infections are often fatal. Viral replication occurs in different cell populations resulting in tissue necrosis and organ failure. The stork herpes virus is currently unclassified.

A novel herpes virus has recently been identified as being responsible for mortalities in captive Caribbean flamingos in one zoological collection (Pers. comm. J. Raymond, 2002; Montali et al, 1998). Term embryo and neonatal flamingo chicks appear to be most susceptible to infection. Clinical signs are usually nonspecific and include weakness, lethargy, dyspnea, and diarrhea.

Gross necropsy lesions include an enlarged liver and spleen with pinpoint foci of necrosis, evidence of inflammation in the cloaca and intestinal tract, pale gritty kidneys, lesions indicative of pneumonia, and inanition. Histopathologic findings include bursal lymphoid depletion, necrotizing hepatitis, cloacitis, pneumonia, air sacculitis, enteritis, and eosinophilic intranuclear inclusion bodies in the liver, cloaca, and kidney. Syncytial cells have been observed in the liver and cloaca of infected chicks. Other less frequent histologic lesions are yolk peritonitis, renal gout, splenitis, and colitis. Electron microscopic examination of hepatocytes has been used to identify intranuclear viral particles with ultrastructural features compatible with herpes virus. Refer to the necropsy protocol for recommendations for collecting and processing tissues.

Treatment options are currently unknown. Some flamingo chicks infected with herpes virus may develop concurrent septicemia, and the use of antibiotics and supportive care are recommended. Acyclovir has been documented to reduce mortality in psittacine birds infected with herpes virus (Norton et al, 1991) but has not been evaluated in flamingos. Acyclovir pharmacokinetic data is available for psittacine birds (Norton et al, 1992) and could be extrapolated for use in flamingos.

Managerial changes that involve the reduction of stress (e.g. not pinioning chicks) and prevention of septicemia (e.g. prophylactic antibiotics) have decreased mortality from the virus at the National Zoological Park. The mode of transmission is currently unknown but appears to have a vertical component. Immunosuppression appears to play a role in the pathogenesis of this disease as evidence by the bursal lesions found in all flamingo chicks infected with herpes virus. The exact source of the herpes virus is still undetermined but may be indigenous in flamingos. Presently, the virus has not been isolated, but molecular viral techniques have identified it as a novel alpha herpes virus.

Paramyxoviruses

Newcastle's disease virus has caused mortality in free-living Caribbean flamingos (Fowler, 2001). The central nervous system is primarily affected. Clinical signs include tremors, paresis and paralysis. Free-living birds have been shown to have elevated antibodies to arboviruses. Paramyxovirus serotype 3 was isolated from tissues of captive flamingos (*Phoenicopterus ruber*) in Israel. The virus caused a high mortality, with respiratory system pathology being most notable (Shihmanter et al, 1998).

West Nile Virus

West Nile virus is caused by a flavivirus and is usually transmitted by mosquitoes. This virus may affect numerous avian species including flamingos. It also can affect humans and other mammalian species. Clinical signs are usually nonspecific; however, birds may exhibit signs of neurological disease such as abnormal head or neck posture, ataxia, tremors, circling, disorientation, unilateral or bilateral posterior paresis, and impaired vision. A bird may be found dead with no premonitory signs. The course of clinical illness is usually less than one week but may range from 1-24 days (Calle et al, 2000). Treatment is limited to supportive care and prevention of secondary infectious diseases. Vaccine trials are currently being conducted on flamingos at several institutions. The virus has affected flamingos in several North American captive collections.

Fungal

Aspergillosis

Aspergillosis may result in emaciation, lethargy, dyspnea, and increased mucous production in captive flamingos. Other than traumatic injuries, aspergillosis was the most important cause of mortality (3.1%) in the captive flamingo collection at The Wildfowl and Wetlands Trust at Slimbridge. Various forms of stress and housing birds indoors on straw in humid conditions were predisposing factors. Diagnosis and treatment are similar to other avian species. Prophylactic treatment may be a consideration under stressful conditions.

Cladosporium herbarum (Sooty Mold)

Fungal infections of the plumage associated with *Cladosporium herbarum* ("sooty mold") have been reported in the UK (Beer and Kear, 1975) and in Florida (S. Clubb, pers. comm., 1999). The fungus appears to be associated with Osier willows. This saprophytic fungus forms a black sclerotia, which ruptures the feather cortex, weakening it so that the distal part of the barb breaks off. The plumage of the back becomes unkempt, frayed, and the birds look wet and lack waterproofing. A black dust is often noted and is especially visible on birds with pale plumage. Birds may become wet through to the skin and chilled. Death by pneumonia or drowning (due to a loss of waterproofing and buoyancy) is a consequence. The condition has been described in Chilean, Andean, James' and Caribbean flamingos. The mold is slow growing at the optimal temperature of 24-25° C. Growth is reduced or inhibited at higher or lower temperatures. Because of this temperature requirement, only the outer feathers are affected. Badly affected feathers may be pulled out or cut off.

Prevention includes the following (N. Jarrett pers. comm., 2002):

a) Raising the environmental temperature to 30° C will inhibit growth of the fungus.
b) Good hygiene of enclosures and exhibits.
c) Removal of Osier willows or keeping birds away from the trees.
d) Provide winter quarters with ambient air temperatures of 15° C to prevent mold growth.
e) Provide clean water to encourage bathing after gross contamination has been removed or when lack of water for bathing has stopped the bird from preening.

Geotrichum candidum

Geotrichum candidum was isolated from skin lesions of three Caribbean flamingos that died showing necrotic inflammation of the skin of legs and the digital webbing of the feet (Spanoghe et al, 1976). Abundant mycelium and arthrospores were observed in the dermis and epidermis. This fungus was subsequently inoculated into chickens and mice where it produced granulomas or more purulent nodules with central growth of abundant mycelium. *Geotrichum candidum* was re-isolated from 20 of 28 experimental animals. The authors suggested that prolonged contact with pond water and the presence of small wounds, as well as the advanced age of the affected birds, were predisposing factors in development of this disease. *Geotrichum candidum* is a common saprophytic fungus frequently found associated with mucous membranes and skin of humans and animals but rarely associated with disease. In this case report, seven of 21 flamingos had lameness and the presence of whitish skin lesions on the legs and digital webs. The lesions were observed during the first warm period after a cold winter. Three birds died after the onset of the lesions. These birds had been kept at this zoo for 16 years. The remaining four birds were separated from the flock, placed in a dry environment, and treated with an acaricide and an antibacterial ointment. The lesions disappeared approximately three weeks after the onset of the disease, even though no antifungal therapy was used. As the lesions in the affected birds were only in areas with maximum exposure to the pond water, it was surmised that this was a predisposing factor.

Amyloidosis (J. Raymond, pers. comm., 1999)

Amyloidosis is a disease that involves pathologic proteinaceous substance deposited between cells, causing tissue and organ failure (Landman et al, 1998). There are a number of biochemically distinct forms of amyloid; however, the protein is always composed of nonbranching fibrils arranged in beta-pleated sheets. Ninety-five percent of amyloid is composed of fibril proteins and 5% is composed of the glycoprotein called P component. Amyloidosis occurs in most avian orders, however, Anseriformes, Gruiformes, and Ciconiiformes have the highest incidence. The disease is progressive, fatal and has a high incidence in older birds. Systemic amyloidosis can be associated with a variety of infectious and noninfectious chronic inflammatory conditions as well as stress (Landman et al, 1998).

There appears to be a high incidence of amyloidosis in some captive collections of Caribbean flamingos. Stress and concurrent inflammatory conditions play major roles in the development of the disease. Most cases of amyloidosis in flamingos have been associated with infectious and noninfectious inflammatory disease(s); however, some flamingos with amyloidosis have no evidence of concurrent disease.

The most common gross lesions associated with amyloidosis in flamingos are an enlarged, tan-brown spleen, light brown, swollen liver and enlarged tan kidneys. Histologically, amyloid deposits are found primarily in the spleen, kidney and liver. Blood vessels in the heart, pancreas, liver, spleen, thyroid glands, and kidneys frequently contain amyloid deposits. Other organs less frequently affected with amyloid include adrenal glands, ovaries, and testes.

In the kidneys, amyloid deposits are primarily found within glomerular tufts. In cases of glomerular amyloidosis, flamingos can present with clinical signs suggestive of renal failure, which includes dehydration, lethargy, weight loss, anorexia, and shock. Many of these flamingos have elevated plasma uric acid and phosphorous levels. Most of these flamingos have concurrent urate nephrosis.

Enteritis due to a variety of causes is a common concurrent inflammatory disease associated with amyloidosis in flamingos. Other common concurrent inflammatory diseases are pododermatitis, hepatitis, dermatitis, arthritis, and nephritis.

There is no treatment for amyloidosis. Supportive care, including fluids, is an option to use in flamingos with renal disease due to amyloidosis. Treatment and prevention of various inflammatory diseases may aid in decreasing the incidence of the disease in flamingos.

Preventive Medicine

A good preventive medicine program is the best way to ensure a healthy and long-lived captive flamingo population. Preventive medicine begins with quarantine. All new arrivals should be housed separately from the existing collection for a minimum of 30 days. During this time period, the following is recommended:

a) A thorough medical and husbandry history should be acquired from the sending institution. Dietary and methods of feeding changes should be avoided or at least very gradually changed. Flamingos may stop eating even with very subtle changes to their environments. It is preferred to move flamingos in groups.
b) Monitor fecal quality and quantity closely during quarantine.
c) Physical examination at the beginning and preferably end of the quarantine period including assessment of body condition, examination for ectoparasites, and examination of the plantar surface of the feet. If physical examination at the end of the quarantine period is not possible, a visual exam should suffice.
d) Body weight (refer to the Management Chapter for details on methods of weighing) should be obtained at the beginning and end of quarantine period and opportunistically (i.e. quarantine exam).
e) Feces should be collected at weekly intervals for a total of three samples for fecal flotation, direct smear, fecal cytology, and fecal gram stain.

f) Cloacal swab or fecal culture for *Salmonella spp*. should be done at least once and preferably 2-3 times during the quarantine period. Placing feces in enrichment media may increase the yield of enteric bacterial pathogens.
g) Blood collection for CBC, chemistry, sexing, and plasma banking.
h) Animals should be permanently identified using leg bands or microchips.
i) If animals are to be housed in open outdoor enclosure, provisions should be made to restrict flight such as wing clipping or pinioning.

Birds housed in the collection should be examined opportunistically (i.e. when bringing in for the winter or moving for other management purposes). The husbandry and veterinary staffs of the individual institution should dictate the frequency of examination. It is important to catch birds prior to the breeding season, as not to disturb the nests and/or eggs. Routine health assessments should include the following:

a) Physical examination, including assessment of body condition, examination for ectoparasites, and examination of the plantar surface of the feet.
b) Body weight determination (refer to Management, Chapter 3 for details on weighing methods).
c) Feces should be collected at regular intervals for fecal flotation, direct smear, fecal acid-fast stain, fecal cytology, and fecal gram stain.
d) Cloacal swab or fecal culture for *Salmonella spp*.
e) Blood collection for CBC, chemistry panel, and serum banking. *Aspergillus spp*. serology and protein electrophoresis can be evaluated in healthy birds in order to establish reference intervals for these individuals.

Postmortem Evaluation

A thorough necropsy should be performed on all flamingos that die. Institutions are encouraged to perform a cosmetic necropsy for museum specimens; however, this should not compromise obtaining a complete set of tissues.

A complete and detailed history should be included. The bird should be sexed at necropsy and, if it was sexed antemortem, methods of sexing should be included so that sexing techniques may be standardized.

a) Collect a small section of all major tissues (heart, lung, air sac (on a piece of paper towel), thymus, bursa, crop, proventriculus, multiple sections of intestine, pancreas, kidney, adrenal gland, gonad, oviduct, muscle, bone marrow, gizzard, eye, tongue, esophagus, trachea, aorta, spleen, skin, peripheral nerve, and brain in 10% buffered formalin. Collect bone from chicks with suspected boney abnormalities.
b) Include a description of the gross findings, body weight in grams at the time of death, and important clinical history (including current diet).
c) Anaerobic, aerobic, and fungal cultures of various lesions should be taken when indicated.
d) Liver, kidney, spleen, bursa and any abnormal tissue should be frozen (-70° C) pending histopathology findings.

North American zoos should send the pathology report (gross and histopathology) or glass slides and culture results to Dr. James Raymond. If you suspect herpes virus, please call or email Dr.

Raymond for instructions and send a complete set of slides or formalinized tissues in conjunction with frozen (-70° C) samples of liver, kidney, spleen, and bursa of fabricus mailed overnight in a cooler of dry ice to:

Dr. James Raymond
Zoo Path
PO Box 1398
Harpers Ferry, WV 25425
Phone and fax number: 304-725-9212
Email: Zoopath2@aol.com

References

Aguirre, A.A., Cook, R. S., McLean, R. G., Quan, T. J., and Spraker, T. R. 1991. Occurrence of potential pathogens in wild Caribbean flamingos (*Phoenicopterus ruber ruber*) during a lead poisoning die-off in Yucatan, Mexico. J Zoo Wildlife Med 22:470-475.

Arai, S., Arai, C., Fujimaki, M., Iwamoto, Y., Kawarada, M., Saito, Y., Nomura, Y., Suzuki, T. 1991. Cutaneous tumor-like lesions due to pox virus infection in Chilean flamingos. J Comp Path 104(4):439-442.

Ball, R. L. and Port, M. R. 2000. Translocation of a large flock of American flamingos (*Phoenicopterus ruber ruber*) and comparisons of hematology and plasma biochemical values with a semi-free ranging population. Proceedings of the Annual Meeting of the American Association of Zoo Veterinarians, New Orleans, LA. pp 313-316 .

Brown, M. J. and Pickering, S. P. C. 1993. The mortality of captive flamingos at Slimbridge 1975-89. Wildfowl 43:185-193.

Baylet, R. and Rollin, P. E. 1979. Edwardsiella tarda et sp, et Salmonella typhinurium chez des oiseaux en Camargue. Bull. Soc. Pathol. Exot. 72: 405-410.

Calle, P. P., Ludwig, G. V., Smith, J. F., et al. 2000. Clinical aspects of West Nile virus infection in a zoological collection. Proceedings of the Annual Meeting of the American Association of Zoo Veterinarians, New Orleans, LA. pp 92-96.

Campbell, T., and Johnson, L. K. 1993. Complex hepatocellular carcinoma in an African lesser flamingo (*Phoeniconaias minor*). Proceedings of the Annual Meeting of the American Association of Zoo Veterinarians, St. Louis, MO. pp 408-409.

Chitick, E., Puschner, B., Walsh, M., Gearhart, S., St. Leger, J., Skocelas, E., and Branch, S. 2002. Blue-green algae microscystin toxicosis in captive Chilean flamingos. Proceedings of the Annual Meeting of the American Association of Zoo Veterinarians, Milwaukee, WI. in press.

Cooper, J. E., Karstad, L., and Boughton, E. 1975. Tuberculosis in flamingos in Kenya. Journal of Wildlife Disease 11:32-36.

Cromie, R. H., Stanford, M. J., Brown, M. J., and Price, D. J. 1990. Epizootiology of avian tuberculosis at The Wildfowl and Wetlands Trust at Slimbridge. , In Proceedings of the Zoological Society of London. British Veterinary Autumn Meeting.

Dierenfeld, E.S. 1989. Vitamin E deficiency in zoo reptiles, birds, and ungulates. J Zoo and Wildlife Med 20(1): 3-11.

Fowler, M. E. 1978. Phoenicopteriformes. In Fowler, M. E. (ed). Zoo and Wild Animal Medicine, W. B. Saunders Company, Philadelphia, PA. pp 160-163.

Fowler, M. E. 1986. Storks and flamingos (Ciconiiformes and Phoenicopteriformes). In Fowler, M. E. (ed). Zoo and Wild Animal Medicine, W. B. Saunders Company, Philadelphia, PA. pp 327-331.

Fowler, M. E. 2001. Phoenicopteriformes. In Fowler, M. E. and Cubas, Z. S. (eds). Biology, Medicine and Surgery of South American Wild Animals. Iowa State Press.

Gabrion, C. and MacDonald, G. 1980. *Artemia sp*. (Crustace, Anostrace), hote intermediaire d Eurycestus avoceti Clark 1954 (Cestode Cyclophyllide) parasitede l'avocette en Camargue. Annales de Parasitologie (Paris) 55(3): 327-331.

Glunder, G. and Siegman, O. 1989. Occurrence of *Aeromonas hydrophila* in wild birds. Avian Pathol, 18:685-695.

Gobel, E., Erber, M., and Grimm, F. 1986. *Sarcocystis phoeniconaii n sp.* Murata, 1986 (Apicomplexa: Sarcocystidae) des lesser flamingo (*Phoeniconaias minor*: Ciconiiformes) {German}. [*Sarcocystis phoeniconaii n. sp*. Murata, 1986 (Apicomplexa: Sarcocystidae) from the lesser flamingo (*Phoeniconaias minor*: Ciconiiformes)]. Berliner Und Muenchener Tieraeztliche Wochenschrift 109(6-7): 239-244.

Gomex-Villamandos, J. C. et al. 1998. Hemorrhagic enteritis associated with herpes virus in storks. Avian Pathology. 27:229-236.
Greenwood, A. G. 1992. Laparoscopic salpingectomy in a hybrid flamingo. Veterinary Record 131:349.
Griner, L. A. 1983. Pathology of Zoo Animals, 1st ed. Zoological Society San Diego. pp 153-157.
Hawkey, C., Hart, M. G., and Samour, H. J. 1984. Age-related haematological changes and haematological responses in Chilean flamingos (*Phoenicopterus chilensis*). Avian Pathology 13:223-229.
Hawkey, C. M., Hart, M. G., and Samour, H. J. 1985. Normal and clinical haematology of greater and lesser flamingos (*Phoenicopterus roseus* and *Phoeniconaias minor*). Avian pathology 14:537-541.
Howard, L. L., Papendick, R., Stalis, I.H., Allen, J. L., Sutherland-Smith, M., Zuba, J. R., Ward, D., and Rideout, B. A. 1999. Benzimidazole Toxicity in Birds. Annual Meeting of the American Association of Zoo Veterinarians, Columbus, OH. p. 36.
Humphreys, P. N. 1975. Pathological conditions. In Flamingos. Kear, J. and Duplaix-Hall, N. (eds.). T. and A. D. Poysner, Berkhamsted, Hertfordshire, England.
Kaleta, E. F. 1990. Herpes viruses of birds. A review. Avian Pathology 19: 193-211.
Kear, J. and Duplaix-Hall, N., (eds.) 1975. Flamingos. T. and A. D. Poyser, Berkhamsted, Hertfordshire, England,. pp 162-182.
Klein, P. N., Charmatz, K., and Langenberg, J. 1994. The effect of flunixin meglumine (Banamine) on the renal function in northern bobwhite (Colinus virginianus): an avian model. Proceedings of the Annual Meeting of the American Association of Zoo Veterinarians. Pittsburgh, PA. pp 128-131.
Klein, P. N., Cranfield, M. R., and Wagner, R. A. 1997. The novel use of hinged braces as external support devices for soft tissue joint injuries in long-legged birds. Proceedings of the Annual Meeting of the American Association of Zoo Veterinarians, Houston, TX. pp 332-333.
Kock, N. D., Kock, R. A., Wambua, J., Kamau, G. J., and Mohan, K. 1999. Mycobacterium avium-related epizootic in free-ranging lesser flamingos in Kenya. J Wildlife Dis 35:297-300.
Lamberski, N. 1998. The medical management of flamingos. Proceedings of the North American Veterinary Conference, Orlando, FL. pp 880-882.
Landman, W. J. M. et al. 1998. Avian amyloidosis. Avian Pathology 27: 437-449.
Lopez, A. and Merino-Moncada, M. 1986. Cholangiocarcinoma and hepatic megalocytosis in a captive flamingo, *Phoenicopterus ruber*. J Zoo An Med 17:147-148.
Merritt, E. L., Fritz, C. L., and Ramsay, E. C. 1996. Hematologic and serum biochemical values in captive American flamingos (Phoenicopterus ruber ruber). J Avian Med and Surgery 10: 163-167.
Montali, R. J., Hallager, S., Tomassoni, P. E., Cooper, G., and Richman, L. 1998. Proceedings of 1998 Meeting of the Colonial Waterbird Society and the Flamingo Specialist Group. pp. 17-18.
MacMananomon, R., Powel-Johnson, G., Dubielzig, R. R., Rakich, P. L , and Latimer, K. S. 1992. Surgical management of a pox virus lesion in a Chilean flamingo (Phoenicopterus chilensis). Proceedings, Joint Meeting AAZV/AAWV, p 179.
Murata, K. 1986. A case report of sarcocystis infection in a lesser flamingo. Jpn. J. Parasitlol. 35; 555-557.
Norton, T. M. Phoenicopteriformes, In Fowler, M. E. and Miller, R. E. (eds). In press. Zoo and Wild Animal Medicine, Current Therapy 5. W.B. Saunders Company, Philadelphia, PA.
Norton, T. M., Kollias, G. V., Clark, C. H., Gaskin, J., Wilson, R. C., and Coniglario, J. 1992. Acyclovir (Zovirax) pharmacokinetics in Quaker parakeets, Myiopsitta monachus. J Vet Pharmacol Therap, 15: 252-258.

Norton, T. M., Gaskin, J., Kollias, G. V., Homer, B., Clark, C. H., and Wilson, R. 1991. Efficacy of acyclovir against herpes virus infection in Quaker parakeets. Am J Vet Res, 52(12): 2007-2009.

Pare, J. A., and Black, S. R. 1999. Schistosomiasis in a collection of captive Chilean flamingos (Phoenicopterus chilensis). J Zoo Wildlife Med 13: 187-191.

Poynton, S. L., Mukherjee, G., and Strandberg, J. D. 2000. Cestodiasis with intestinal diverticulosis in a lesser flamingo (*Phoeniconaias minor*). J Zoo Wildlife Med 31: 96-99.

Ritchie, B. W. 1995. Herpesviridae. In: Avian Viruses: Function and control. Harrison, L. R. (ed). Wingers Publishing Company, Inc., Lake Worth, FL. pp. 171-222.

Rollin, P. E. 1981. Index of disease of Phoenicopteriformes. Special Report No. 1. Flamingo Working Group-Old World, Paris, France.

Rollin, P. E., Baylet, R., and Johnson, A. R. .Intestinal microflora of young Greater flamingos (*Phoenicopterus ruber roseus*) in the Camargue. J of Wildlife Dis 19: 61-62.

Romagnano, A. 1999. Examination and preventive medicine protocols in psittacines. In: The Veterinary Clinics of North America, Exotic Animal Practice. May, p. 338.

Shane, S. M., Harrington, K. S., Montrose, M. S., and Roebuck, R. G. 1984. The occurrence of Aeromonas hydrophila in avian diagnostic submissions. Avian Dis 28: 804-807.

Shihmanter, E., Weisman, Y., Lublin, A., et al. 1998. Avian paramyxoviruses serotype 3 isolated from captive birds in Israel: clinical signs, pathology, and antigenic characterization. Avian Dis 42(2): 418-422.

Sileo, L., Grootenhuis, J. G., Tuite, G. H., and Holcraft, B. D. 1979. Mycobacteriosis in the lesser flamingo of Lake Nakuru, Kenya. Journal of Wildlife Disease 15:387-390.

Spanoghe, L., Devos, A., and Viaene, N. 1976. Cutaneous geotrichosis in the Red Flamingo (*Phoenicopterus ruber*). Sabouraudia 14:37-42.

Threlfall, W. 1981. Helminth parasites of an American flamingo from Newfoundland, Canada. Proceedings of the Helminthological Society of Washington 48(1): 89-90.

Wadesworth, P. F., Jones, D. M., and Pugsley, S. L. 1985. A survey of mammalian and avian neoplasms at the zoological society of London. J Zoo An Med 16:73-80.

Young, E. 1967. Leg paralysis in the greater flamingo and lesser flamingo following capture and transportation. International Zoo Yearbook, 7:226.

Bumble foot: some experiences from the Basel zoo.

Andreas Heldstab, Adelheid Studer-Thiersch, Zoo Basel

Foot problems are normally inconspicuous and therefore often not detected. Only when a bird begins to limb, we realize that something might be wrong

Short description of the symptoms:

Two different and independent ways of infections occur: an infection with bacteriae and one with the papilloma virus. The bacterial infection leads to infected wounds as cuts, fissures -> nodes -> balls (extremely large nodes); the virus infection to warts.

Both probably start with small cracks, cuts or fissures in the skin and may occur together.

Adult birds:

In the Basel zoo foot problems in the flamingos were recognized since long and were regarded mainly as problem of reduced blood circulation in the feet. Therefore, when the new exhibit for the flamingos was built in 1991, we tried to improve the conditions for the feet by natural precautions:

- by increasing the general activity of the birds i.e. foraging, walking around, stimulating social behaviour,
- by including the winter quarter into the exhibit enabling a regular moving in and out of the birds whenever possible also in the cold seasons,
- by adding a saltwater circle (concentration between normal seawater to double seawater-concentration) around the feeding pan
- by providing the resting places with dense, short vegetation.

Before the birds were transferred to the new exhibit in May 1991 the symptoms at the feet of all birds were checked and noted. This was repeated a few years later in December.

The comparison of the two checks showed following results:

- At both places (old and new exhibit) foot infections occurred a little more often in the zoo hatched birds than in birds from the wild.
- At both places (old and new exhibit) the males had somewhat more symptoms than the females.
- The feet had clearly become better in the new exhibit, the amount of the symptoms and the degree of infections having decreased.
- Active infections had become very rare.
- The papilloma infection had decreased only slightly.

- In birds from the wild the decrease of symptoms was more pronounced than in the birds hatched in the zoo

Young birds:
The young birds of the year are caught for the first time in August/September for individual leg banding. In October-December they are separated from the group and, if they remain at Basel, spend the winter at a different quarter.

Between late summer (scarcely any symptoms) and early winter there is a clear increase in cracks or cuts and nodes, virus infections are very rare.

In the winter quarter:

1. Odd asphalt floor covered with straw:
   - dramatic increase of symptoms, concerning bacterial and virus infections. (These birds are still living in our group. We lost 2 males in the following months due to foot problems, but the feet of the others underwent a drastic change, most of symptoms having disappeared within the following months in the outdoor exhibit. If these birds retain a susceptibility to later infections is not known.)
2. Smooth concrete.
   - Increase of the virus infections, but only to a low degree.
   - Combined with very shallow saltwater (for resting): no increase or even slight decrease of bacterial infections
   - Combined with Encamat mats (for resting): slight increase of bacterial infections but compared to the asphalt floor only to a low degree.

Summary of the experiences in the Basel zoo:

1. Males generally seem to suffer to a somewhat higher degree from the infections than females, as do birds hatched in the zoo compared to birds from the wild.
2. The infections leading to bumble feet are a dynamic process, the feet can get worse in a short time but the contrary is also true. Especially in young birds symptoms may disappear without leaving clear traces. Old chronic infections may also be reduced, but leave scars.
3. A steady disinfection of the feet by saltwater seems to reduce the rate of infections.
4. Papilloma infection seems to be more difficult to reduce and the degree may perhaps also be influenced by stress and similar factors. Indirectly this infection may be reduced by reducing the rate of small wounds, a probable entrance of the virus.
5. The cold and dark seasons seem to favour foot problems.

The conditions in the outdoor exhibit during the warm seasons could be improved by the different preventive measures. But there remain problems during the cold and dark seasons: Due to the low temperatures blood circulation will be reduced in the legs causing the skin of the feet to become hard and brittle leading to cracks and cuts in the skin thus enabling infections. Additionally the decreasing day length and the lacking sun reduce the general activity of the birds.
Under different climatic conditions than those in Middle Europe the situation might be different.

Proposals to reduce foot problems in flamingos by general preventive measures (not by medical treatment):

1. Saltwater through which the birds have to pass regularly, in outdoor and indoor enclosures.
2. Soft and slightly humid floor at the resting places (outdoor: short and dense vegetation, indoor: we experienced with woodchips this winter.)
3. Prolongation of the period the birds stay indoor at night to avoid the low night-temperatures
4. Increasing the general activity:

    Outdoor:

    - by offering large areas of shallow water with plankton production for extended foraging behaviour,
    - by offering different resting places for different day times according to the position of the sun,
    - by stimulating social behaviour.

    Indoor:

    - by adding artificial light to extend the short day length in winter and compensate for the lacking sun.
    - by large winter quarter allowing display behaviour.

Chapter 7

Behavior and Research

Facilitators: Catherine King, Rotterdam Zoo; Sue Maher, Disney's Animal Kingdom;
Elizabeth Stevens, Disney's Animal Kingdom

Authors' note: in determining the best way to approach this chapter, we felt it would be most useful to summarize flamingo behavior using classic references on flamingos. Rather than summarize every single research project that has been done, the reader is directed to the reference chapter for an extensive list of flamingo research projects that have been published. Lists of some current research projects and potential research projects with captive flamingos are included in this chapter. To provide readers and potential researchers with some guidance these projects have been divided into topics: Research Currently Underway, Workshop Projects, Potential Studies of Captive Flamingos to Benefit Wild Populations.

Flamingo Behavior

Flamingos have the longest legs and necks relative to body size of any group of birds and are well known for their unusual bill. These morphological attributes are accompanied by a set of unusual behaviors. Flamingos are extremely social during all phases of the life cycle. While breeding colonies of some flamingo species can be relatively small, numbering tens of pairs, colonies are often huge, including many thousands of individuals. A colony of 1,100,000 lesser flamingos has been documented (del Hoyo et al. 1992). Once they leave the nest at approximately a week or two of age, chicks remain in a creche. The term creche means "day nursery" in diverse languages, but when used in relation to flamingos, creche refers to a group of chicks congregated together, chaperoned by a single or small group of adults. The parents visit only to feed their young, and how they find their own offspring among the teeming mass of vocalizing chicks remains somewhat of a mystery. Flamingos are one of the few groups of filter-feeding birds and are the only filter-feeding birds to feed the young a "milk" secretion. The production of such a secretion in the upper digestive tract of the parents is a rearing strategy shared by just a few groups of birds.

Observations on flamingo behavior have long appeared in the literature, but the first formal comparative study of reproductive and ritualized flamingo behavior, initiated in the 1950's, was undertaken by Adelheid Studer-Thiersch at Basle Zoo in Switzerland and in the wild in Spain (Studer-Thiersch 1964, 1967, 1972, 1974 and 1975). Through his comparative study of ritualized flamingo behaviors, Phil Kahl (1975) also made a substantial contribution to our understanding of flamingo behavior and to descriptions and terminology for these behaviors.

Group Displays

Flamingos nesting in temperate latitudes are seasonal breeders. In the sub-tropics and tropics, where the flamingos mainly live, flamingos are nomadic, and breeding is opportunistic, occurring year-round when conditions are favorable. Food availability, primarily dependent on rainfall, is thought to be the most important factor determining timing of breeding. Group-displays are a spectacular part of flamingo breeding. Most of the displays appear to be derived from comfort behaviors, and as the behaviors became ritualized they became more stiffly performed, more contagious among group members, and "non-functional" in the sense of the comfort behaviors they resemble. Both sexes participate in group-displays, and it is thought that these displays are necessary to synchronize the physiological reproductive state of flamingos. Sizes of groups of marching flamingos can be enormous, however many common ritualized behaviors (e.g. wing salute, inverted wing salute, twist-preen, wing-leg stretch) are mainly performed by smaller groups within large congregations of flamingos.

Kahl (1975) studied ritualized behaviors of all six taxa (the Andean, James, Caribbean and Chilean flamingos of the New World, and the greater and lesser flamingos of the Old World), however some taxa were more closely observed than others. He reported some subtle differences between taxa: in general, he found that the closely related Caribbean, greater, and Chilean flamingos perform displays that are more similar than those performed by the other taxa. Studer-Thiersch (1975) concluded that the Caribbean flamingo is the most primitive of the three *Phoenicopterus* taxa in ritualized behavior. Based on her comparative study of their behavior she concurred with the current, most widely used taxonomic treatment, i.e. differentiating Caribbean and greater flamingos at sub-species level and awarding Chilean flamingos full-species status.

Behavioral Research: the Basics

A prerequisite to almost any flamingo research project is being able to individually identify individuals. Plastic rings/bands with individual codes appropriate for marking flamingos are now widely available from different sources, as discussed in the Management Chapter. Zoos are strongly urged to use such rings/bands if they do not already do so, as these rings/bands are also essential to the most fundamental flamingo management, e.g. identifying breeding pairs.

An ethogram is a catalogue of an animal's different behaviors. It is a standard tool used for any behavioral study. Depending upon the research question of the behavioral study, the ethogram is constructed to allow the researcher to measure the particular behaviors addressed in the research question, therefore no two ethograms are necessarily the same. Below is a sample ethogram taken from Beastly Behaviors (Janine Benyus, Addison-Wesley Publishing, 1992) that, with some additions, is designed to be a complete listing of all flamingo behaviors. Many behaviors (e.g. filter-feeding, treading, wing stretch) have been seen in chicks as young as five days old. Descriptions of ritualized behaviors are largely adapted from Kahl (1975). Names of some displays have been altered to depict only movements involved rather than motivation, in keeping with current philosophy (e.g. Hancock et al. 1992).

Sample Ethogram

Locomotion

- **walking** - individually or in groups.
- **running** – an integral part of becoming airborne for flight (except in sufficiently high wind), and a common response to perceived danger. Is also associated with marching (described in ritualized behaviors), as flamingos may alternate running with walking during marching episodes. A group of flamingos may at other times begin running for no apparent reason.
- **flying** - a flamingo flies with neck outstretched and legs trailing behind.

- **landing -** a flamingo circles overhead before landing, then runs several meters before stopping.
- **swimming -** a flamingo swims with the head above water and wings folded, using the feet to propel itself.

Feeding

- **treading -** a flamingo places its bill in the mud or water, lifting and then setting down one foot at a time in a treading motion, presumably to stir the mud or water contents. The flamingo may slowly walk in a circle as it treads or it may tread in place.
- **mud dredging -** a flamingo walks forward, moving its filtering bill back and forth through the algae-coated mud.
- **tipping up -** a flamingo in deeper water submerges its head, tipping the distal part of the body up. This allows flamingos to feed at greater depths than other wading birds of similar size can reach.
- **filter-feeding -** flamingos primarily feed with the bill lowered “up-side down” into the mud or water. The tongue acts as a piston, pumping water or mud in and out of the bill. Tiny food particles are allowed through lamellae lining the inner part of the mandibles. The (species characteristic) distance between the lamellae as well as the size of the gap between the two mandibles determines the size of food items that can be filtered.
- **ground feeding -** a flamingo picks up pieces of food from the ground, without using filter-feeding mechanism.

Comfort Behaviors

- **preening**
- **stretching**
- **bathing**
- **foot shaking**
- **sleeping -** usually on one leg with neck folded along the back and bill tucked into their feathers. Flamingos may also sleep sitting up with the legs tucked under the body.
- **wing salute, inverted wing salute, twist-preen, wing-leg stretch**: these terms refer to ritualized forms of some flamingo comfort behaviors: when performed as (stretching) comfort behaviors the behaviors are performed by individual flamingos, usually following a period of physical inactivity. The ritualized versions are performed by groups, are usually stiffer or otherwise more exaggerated in execution, and often are performed in predictable sequences.

Ritualized Behaviors

- **alert posture -** a flamingo stands erect with neck stretched vertically upward, moving the head side to side in horizontal arcs with bill held high and nearly horizontal. Is performed when something occurs in surroundings, and is accompanied by a honking vocalization. Performance of alert posture by a flamingo usually triggers performance by other nearby individuals.
- **hooking -** a flamingo extends neck fully and inclines it forward between 30°- 60° from the vertical, with the bill tip aiming toward its own chest. Scapulars and back feathers are erected. A flamingo may approach another flamingo in the hooking posture. Hooking is often performed by the dominant bird before and after a fight and is regularly performed (particularly by males) before or after copulation. Hooking is sometimes also performed by groups of marching flamingos.

- **neck-swaying -** A flamingo extends its neck horizontally, swaying it sinuously in wide horizontal arcs. A series of low grunting calls accompanies the display. Neck-swaying is often performed on the nest, usually following hooking and preceding a physical fight.
- **sparring -** two or more flamingos direct neck-swaying displays at each other, just missing contact between the bills.
- **pecking -** one flamingo directs pecks at another.
- **feather sleeking -** flamingo lowers its head and sleeks it feathers. Is associated with withdrawal from an agonistic encounter with one or more conspecifics.
- **marching -** a group of flamingos masses closely together, walking with an erect posture in a synchronized "quick-step", going first one direction and then another. The tail may be wagged during marching. Size of marching groups can range from a few flamingos to many thousands. Marching can be performed any time of the year but is particularly common during the onset of breeding attempts.
- **false-feeding** - marching flamingos suddenly slow down, bending their necks forward in unison, and trail the bills in the water making chomping movements with the bill, the group then proceeds with marching again.
- **head-flagging -** exaggerated alert posture, the head is flagged from side to side in precise, horizontal arcs; some species issue loud honks when flagging. Head - flagging is often associated with marching.
- **wing-salute -** usually follows head-flagging: while still standing erect with the neck stretched upward, a flamingo quickly opens its wings fully to the sides, revealing its black primary feathers. A series of short grunting vocalizations is made.
- **inverted wing-salute -** commonly follows head-flagging and wing-salutes; with neck extended, the flamingo tilts its body forward and down, cocking the tail higher than the shoulders; it then lowers its neck, flashes its wings partially open, and holds the wings behind its back for a moment, with black primaries tipped skyward. The display is accompanied by a soft, nasal call.
- **twist-preen** – a flamingo twists its neck and bill back along the body to one side and briefly flashes the wing on the same side downward, exposing the black primary feathers. The flamingo appears to preen behind the wing for 1-2 seconds with its bill, but does not actually do so.
- **wing-leg stretch** – The leg and wing on one side are stretched outward to the rear. A brief, sighing call accompanies performance of this behavior.
- **pair-walk** – performed by a pair: the female leads and the male follows step for step. Side by side or parallel, their strides are highly synchronized and ritualized, in contrast to pairs moving together to feed or to another location. The pair-walk generally precedes copulation, but can also terminate without a copulation attempt being made.
- **copulation -** male mounts female and cloacal contact is made. While the entire copulation process often takes several minutes, actual cloacal contact only lasts a few seconds. Copulation attempts performed by same-sex pairs may be similar to those performed by male-female pairs.
- **triumph ceremony -** the pair calls together with necks stretched out, sometimes directed towards the ground, following copulation.

Parenting Behavior

- **nest building** – a pair of flamingos wanting to nest pulls nesting material (e.g. mud, pebbles, feathers and grasses) to one place to form a mound. Once incubation of an egg begins, the sitting bird continues to incorporate material around it into the mound, and mounds can become quite high if much material is available. Mounds may be virtually non-existent if nesting material is unavailable.

- **incubation** - the parents take turns incubating the egg. Sitting is interspersed with standing and stretching behaviors.
- **contact call** – adult puts its head close to the egg and makes a high-pitched contact call. Presumably the chick responds with its own contact call.
- **feeding chick** - both parents (and sometimes helpers) drool a “crop milk” secretion from their bills into the chick’s bill. The secretion is initially blood red, but can become less red as the chick ages.
- **creching** - when flamingo chicks band together, chaperoned by a few adults.
- **food begging** - chicks call and peck at an adult’s neck.

References

Benyus, J.M. 1992. Beastly Behaviors. Addison-Wesley Publishing Company, Reading, Massachusetts. pp.167-177.

Hancock, J.A., Kushlan, J.A. and Kahl, M.P. 1992. Storks, Ibises and Spoonbills of the World. Academic Press, London.

Hoyo, J. del, Elliot, A., and Sargatal, C. 1992. Handbook of Birds of the World, Volume 1, Ostrich to Ducks. Lynx Edicions, Barcelona.

Kahl, M.P. 1975. Ritualized Displays. In Kear, J. and Duplaix-Hall, N. (eds.) Flamingos, pp.142-149. T & AD Poyser, Berkhamsted

Ogilvie, M. and Ogilvie, C. 1986. Flamingos. Alan Sutton, Gloucester.

Studer-Thiersch, A. 1967. Beitrage zur Brutbiologie der Flamingos (Gattung *Phoenicopterus*). Der Zoologische Garten 34(4/5):159-229 (in German).

Studer-Thiersch, A. 1972. Beobachtungen an freilbende flamingos in Sudspanien. Der Ornithologische Beobachter 69:239-252 (in German with English summary).

Studer-Thiersch, A. 1974. Die Balz der Flamingogattung *Phoenicopterus*, unter Besonderer Berucksichtigung von *Ph. ruber roseus*. Zeitschrift fur Tierpsychologie 36:212-266. (in German with English summary).

Studer-Thiersch, A. 1975. Group display in *Phoenicopterus*. In Kear, J. and Duplaix-Hall, N. (eds.) Flamingos, pp.150-158. T & AD Poyser, Berkhamsted.

Flamingo Research: Past, Present and Future

If you are interested in any of the below projects you can contact the primary researcher if one is noted. It was agreed at the Flamingo Specialist Group Meeting in 1998 that North American and European zoos wishing to support field research or conservation projects or carry out ex situ research would communicate their activities to their respective Taxon Advisory Groups (TAGs). The TAGs can facilitate contacts with relevant parties and help to avoid duplication of effort when it would not be useful.

Published Research

See the Bibliography for published papers.

Research Currently Underway

There are a number of several projects being worked on currently. Contributions on some current long-term projects, in the field as well as in zoos, are found in Conservation Biology of Flamingos, G. Baldassarre, F. Arengo and K. Bildstein, eds. Waterbirds Vol. 23, Special Publication (1): 2000.

Some other projects are included here with a short summary.

1. Flamingo Crop Milk Secretion and Gland Development.

   Primary Researcher: A. Studer-Thiersch, Basle Zoo, Switzerland (Oberwilerstr.135, CH-4054 Basle Switzerland, (Adelheid.Studer@datacomm.ch)

   Summary: Crops of all dead flamingos from Rotterdam Zoo and Basle Zoo were removed during postmortem examinations for histological study. The stage of development of crop milk secretion glands and their prevalence will be compared with age, sex and reproductive status of the birds at the time of their deaths.

2. Understanding the Movements of Lesser Flamingos and Greater Flamingos Between the Alkaline Lakes of the East African Rift Valley: Relationship between Alkalinity and Food Supply

   Primary Researcher: Andrew M. Burton (Mexico), Neil and Liz Baker (Tanzania), Mike Winterbourn (New Zealand). (andrew@ucol.mx or spizaetus@yahoo.com) or http://www.ucol.mx/ocean/ or http://www.zool.canterbury.ac.nz/mjw.htm)

   Summary: The goal is to determine the movements of flamingos between the East African soda lakes beginning in northern Tanzania. The main objective will be to unravel the complex interrelationship between water alkalinity, food availability, and movements of flamingos.

3. Correlates of Reproductive Behavior in Captive Chilean Flamingos

   Primary Researcher: Chuck Siegel, Dallas Zoo (csiegel@mail.ci.dallas.tx.us)

   Summary: Data on group-display activity and on steroid levels in fecal urates and blood are being collected throughout the year to be analyzed in relation to each other.

4. Flamingo Reproductive Behavior

Primary Researcher: Catherine King, Rotterdam Zoo (C.King@RotterdamZoo.nl)

Summary: This is a long-term project to evaluate stability of pair and triad associations, whether copulation success among associations improves over time, how newly acquired birds integrate into the group, reproductive success of flamingos born into the colony. Nesting habits (e.g. nest location, neighbors, position in laying-order) will be analyzed to determine whether these are consistent among individuals and associations over the long term.

5. Flamingo Dominance Study

Primary Researcher: Catherine King, Rotterdam Zoo (C.King@RotterdamZoo.nl)

Summary: This project evaluates the social position of individual birds within the hierarchy of the colony. The relationship between social position and breeding success, as well as the relationship between position of parents and position of offspring within the group will be evaluated.

6. Factors Influencing Copulation Behavior of Phoenicopterus ruber in Captivity

Primary Researcher: Catherine King, Rotterdam Zoo (C.King@RotterdamZoo.nl)

Summary: Study is being undertaken to determine which factors influence copulation success of Phoenicopterus ruber and the relative importance of these factors.

7. Previously Undescribed Behaviors of Chilean Flamingos

Principal Researcher: Sherry C. Mossbarger, Dallas Zoo (birdkeeper44@yahoo.com)

Summary: Descriptions of previously undescribed Chilean flamingo behaviors.

8. Causes of Bumblefoot, and Possible Management Options.

Primary Researcher: A. Studer-Thiersch, Basle Zoo, Switzerland (Oberwilerstr.135, CH-4054 Basle Switzerland, (Adelheid.Studer@datacomm.ch)

Summary: An effort will be made to systematically determine how factors such as substrate, diet, water quality, temperature, nutrition and space influence manifestation of bumblefoot in zoos. More flamingo managers willing to periodically assess foot condition of their flamingos are needed for this project.

9. Nutrient Composition of American (Caribbean) Flamingo Crop Milk.

Researchers: Ann Ward (Award@fortworthzoo.org), Amy Hunt, and Mike Maslanka, Fort Worth Zoo, and Chris Brown, Dallas Zoo (cdbrown@mail.ci.dallas.tx.us)

Summary: Crop milk samples (30 ml) were collected from juvenile (6-7 weeks old) Caribbean flamingos (Phoenicopterus ruber ruber, n = 14) in the Ria Lagartos Biosphere Reserve (El Cuyo, Yucatan, Mexico) on the northern coast of the Yucatan Peninsula. The samples are being analyzed for dry matter, crude protein, fat, minerals (calcium, phosphorus, magnesium, manganese, sodium, potassium, iron, copper, manganese, molybdenum, zinc), vitamin A, vitamin E, lutein and zeaxanthin, beta-cryptoxanthin, echinenone, canthaxanthin, and beta-carotene. In addition, anthropometric measurements and blood samples were taken at the time of sample collection. This information will allow us to learn more about crop milk and avian lactation and, most practically, to aid in flamingo hand-rearing efforts.

10. In-situ lesser flamingo conservation research in the Rift Valley of Kenya.
Primary Researcher: Dr. R. B. Childress, Department of Biology, University of Leicester, UK and the Wildfowl & Wetlands Trust, Slimbridge, UK.

Summary: The research focuses on four areas: 1. Health – Using blood samples from both well and sick birds, research will attempt to discover the cause of recent die-offs and develop a protocol for monitoring the species' health in the wild. 2. Ecology & Behaviour – The use of Ecological monitoring will be used to identify the essential lake ecosystem properties that sustain large numbers of lessers and to understand the birds' response to changes in these properties. Distribution on the lakes at various times, habitat usage, and time budgets in different climatic conditions are also being documented. 3. Biometric dataset – A long-term ringing program has been established which will enable migration patterns and longevity to be studied over time. 4. Gender Determination and Condition Indices – Principal component analysis is being used to develop condition indices for the various ages and genders as an additional method for monitoring the well being of this species.

Workshop Projects

The (by no means inclusive) list of topics below were brought up at the husbandry guidelines meeting or have been discussed on the AZA flamingo listserve as research areas that would aid in captive management of flamingos. These topics include:

1. Flamingo substrate use: What factors influence substrate (including water) use, and what recommendations can be made regarding substrate?
2. Regulation of pigmentation in feathers: How do nutrition, feeding of young and other variables influence feather pigmentation?
3. Other nutritional questions that could be analyzed across institutions: hypervitaminosis, mineral absorption, iron storage, relation of diet to physical occurrences (e.g. excess fat of orange color).
4. Chick leg problems: How do problems relate to (parental) nutrition, parental resources (e.g. number of eggs laid already in current season), time of reproductive season and time of year of hatch? Survey pathology and clinical records for leg problems such as rickets and excessive shakiness.
5. Sexing methods: What are the advantages and disadvantages of different methods? Can a combination of morphological measurements be reliably used to sex young of the year?
6. Diseases: Gout - What causes it? How serious a problem is gout in captive flamingo management? Are avian pox and botulism serious management problems?
7. Triggering breeding: influence of management practices, e.g. separation/reunion of flocks, use of mirrors, concentrating birds into a small area, and other potential flock stimuli on reproductive success.
8. Onset of Chilean flamingo breeding seasons in northern-hemisphere zoos: Is this species tending to breed progressively later in the year? If yes, what could be the explanation and what management steps could be taken to stimulate this species to breed earlier, as late breeding is often unfavorable for chick rearing.

9. Causes of mortality, nutritional needs and behavior of lesser flamingos compared to other flamingo taxa to determine special management requirements for this “difficult” species.
10. Fledgling age-determination (for management purposes) of useful chick age equivalent to fledging. The usual demarcations; leaving the nest, acquiring feeding independence and flying, are not appropriate: a chick usually leaves the nest within a week but may continue being fed by its parents for more than a year. Learning to fly is gradual and in most cases the chick will never fly because of pinioning.

Topics for Potential Studies of Captive Flamingos That May Benefit Wild Populations

The short list of potential projects appearing below is taken from: C. King. 2000. Captive flamingo populations and opportunities for research in zoos. In Conservation Biology of Flamingos, G. Baldassarre, F. Arengo and K. Bildstein, eds. Waterbirds Vol. 23, Special Publication (1): 2000. This paper is referred to for more detail and additional topics.

1. Display performance as an indicator of age: Qualitative and quantitative variation in performance of displays between individuals can be analyzed to ascertain if these provide proximate cues for assessing age as (at least greater) flamingos may have an age-assortative mating system.
2. Sexing and aging young flamingos in the field: An in depth study of growth rates and other aspects of morphological development might lead to finding reliable indicators of age independent of sex, so that ages of young birds can be more accurately assessed in the field. Sexual dimorphisms in growth need to be more closely studied, as these could also be important in interpreting field data. Developing a set of reliable morphometric measurements to sex young-of-year could be useful for both wild and captive birds.
3. Manipulation of gender of offspring: records on sex and hatching date of offspring and fate of eggs of known parents could be used in studies of potential manipulation of gender of offspring.
4. Flock synchronization: Relationships between display and breeding synchrony of individuals within groups, and between degree of synchronization among individuals and reproductive success.
5. Winners and losers: Factors (e.g. size, reproductive status, familiarity with surroundings) that can influence outcome of agonistic encounters
6. Vocalization acquisition: A study of vocalization development of parent-reared and foster-reared chicks could provide great insight into genetic and behavioral components of vocalization acquisition.
7. Recognition of vocalizations: Experimental studies involving transfer of eggs in various stages of hatching and of newly hatched chicks could help to determine when parental recognition of chick vocalizations and chick recognition of parental vocalizations occurs.
8. Coping with salts: Studies of behavioral and physiological response to salts, e.g. salt avoidance, processing and secretion are important in understanding flamingo ecology.
9. Nocturnal feeding: What are the advantages and disadvantages? Flamingos in the Camargue are reported to feed mainly at night when items eaten are actually less available. How prevalent is nocturnal feeding in captivity?
10. Pigmentation: Studies of pigment uptake and coordination of deposition of pigments with molt, feather growth, and chick feeding.

11. Molt: A thorough study of molt of individuals in relation to environmental factors and social interactions might shed light on stimulus and constraints of molt, and explain differences in timing and completeness of molt.
12. Flamingo vision: A study of flamingo vision would be interesting to help understand why flamingos are pink and what aspects of their visual systems allow them to be highly active both night and day.
13. Chick nutrition: Samples of chick crop contents can be collected in different institutions and analyzed to see how nutritional content of the crop secretion varies throughout chick rearing and whether the nutritional value of the crop contents varies with parental diet.
14. Flamingo marking: Methods for marking flamingos and fitting transmitters for radio and satellite tracking can be easily tested in captive flamingos.

15. Susceptibility to Tuberculosis (TB): While flamingos appear to have natural immunity to TB, huge numbers have died in the wild because of TB. A study of factors that can influence immunological response to this disease could be important in conservation of wild populations in the future.

16. Nutrient cycling: Information obtained by determination of fecal chemical composition and output of captive flamingos can be integrated into quantitative models of nutrient cycles in flamingo environments.

Summary

As can be seen in the Bibliography, numerous publications referring to flamingos have appeared. Nonetheless there is still much to be learned about these beautiful birds. The possibilities for research in zoos to benefit both captive management of flamingos and their in situ conservation are immense.

The lists of projects above also demonstrate that zoos can, with little effort, collect information that is useful in further developing captive management practices and in developing techniques useful in the field. There are also many field projects that zoos can help finance or provide materials and/or manpower. Zoo personnel are encouraged to review the list of projects and consider how you can contribute. As mentioned above, these lists are not complete. Perhaps you can think of other projects that you know would be useful and are within your capacity. Again, it is helpful to take up contact with your region's TAG so that the TAG can support you in carrying out your efforts as effectively as possible. Cooperation is essential in achieving our common goals: furthering knowledge and management expertise for flamingos both in the wild and in captivity.

Bibliography

Jeanette T. Boylan, Ph.D., Zoologist, Dallas Zoo

This bibliography contains over 2600 references and strives to be as complete as possible for all references regarding flamingos. Many sources were used for references and many of the historical references were not verified. The bibliography is divided into two sections – a historical bibliography and current bibliography. The historical bibliography contains references before 1975 and is ordered by author's last name. The current bibliography contains references from 1975 to 2005 and is divided into sections for ease of finding articles (Captive management and behavior; Conservation, Disease and veterinary aspects; Distribution, breeding sites and population size; Natural history and ecology; Species accounts, guide books; Taxonomy; and Miscellaneous).

Many people assisted with the input and validation of the references. Of special note are Kim Williams and LaVona Purcell of the Dallas Zoo, Cathy King of Rotterdam Zoo and Adelheid Studer-Thiersch of Basel Zoo. Please send any corrections, additions or copies of reprints to Jeanette T. Boylan, Dallas Zoo, 650 South R.L. Thornton Fwy, Dallas, TX 75203 (jboylan@mail.ci.dallas.tx.us).

** indicates references that the Dallas Zoo has available in its reprint library.

HISTORICAL FLAMINGO BIBLIOGRAPHY

Abdulali H. 1964. On the food and other habits of the greater flamingo (*Phoenicopterus roseus* Pallas) in India. Journal of the Bombay Natural History Society 61:60-68.

Abdulali H, Savage CDW. Status of wildfowl species in Western and Northern India. Proceedings of the Regional Meeting on Conservation of Wildfowl Resources; 1970; Leningrad. p 194-199.

Abram M. 1972. Breeding of flamingo in the Zoo Tel-Aviv. Journal of Zoo Animal Medicine 31(1):42-44. **

Ainsworth GC, Rewell RE. 1949. The incidence of aspergillosis in captive wild birds. Journal of Comparative Pathology 59:213-224.

Akeley C. 1924. In Brightest Africa. New York: Doubleday, Page and Co.

Akeley CE. 1912. Flamingos of Lake Hannington, Africa. American Museum Journal 12:304-308.

Akeley CE. 1916. Photograph: Flamingos on Lake Hannington. American Museum Journal 16:182.

Akhtar SA. 1946. Babar the Great on flamingos. Journal of the Bombay Natural History Society 46:545-547.

Akhtar SA. 1947. Ab-Istadeh, a breeding place of the flamingo (*Phoenicopterus ruber roseus* (Pallus)) in Afghanistan. Journal of the Bombay Natural History Society 47:308-314.

Alexander B. 1898. An ornithological expedition to the Cape Verde Islands. Ibis, 7th ser 13:110, 114.

Alexander JE. 1829. Note regarding the Sald Lake Inder in Asiatic Russia. Edinburgh, New Philosphical Journal:18-20.

Ali S. 1941. The birds of Central India. Journal of the Bombay Natural History Society 41:487.

Ali S. 1944. The common flamingo (*Phoenicopterus ruber*): An appeal. Journal of the Bombay Natural History Society 44:476-477.

Ali S. 1945. The Birds of Kutch. Publication for the government of Kutch by H. Milford, Oxford University Press.

Ali S. 1945. More about the flamingo (*Phoenicopterus ruber roseus* Pallas) in Kutch. Journal of the Bombay Natural History Society 45:586-593.

Ali S. 1946. The Book of Indian Birds. Bombay: Natural History Society.

Ali S. 1960. "Flamingo City" re-visited: Nesting of the rosy pelican (*Pelecanus onocrotalus* Linnaeus) in the Rann of Kutch. Journal of the Bombay Natural History Society 57:412-415.

Ali S, Ripley SD. 1968. Handbook of the Birds of India & Pakistan, Vol. 1. London: Oxford University Press.

Allen EG. 1936. Some sixteenth-century paintings of American birds. Auk 53:17-21. **

Allen GM. 1905. Summer birds in the Bahamas. Auk 22:120-121. **

Allen GM, Barbour T. 1904. Narrative of a Trip to the Bahamas. Cambridge, MA: privately printed.

Allen JA. 1893. The geographical origin and distribution of North American Birds, considered in relation to faunal areas of North America. Auk 10:99. **

Allen JA. 1909. The habitat groups of Norh American birds in the American Museum of Natural History. Auk 26:165-174. **

Allen RP. 1942. The Roseate Spoonbill. New York: National Audubon Society.

Allen RP. 1951. The flamingos of Inagua. Audubon Magazine 53:210-217, 264-265.

Allen RP. 1952. The Whooping Crane. New York: National Audubon Society.

Allen RP. 1953. Help wanted for the whooping crane. Audubon Magazine 55:210-213, 224.

Allen RP. 1954. Comments on the status of the flamingo in Florida. Everglades Natural History 2:115-118.

Allen RP. 1954. A report on the flamingo. Audubon Magazine 56:24-28, 47.

Allen RP. 1956. The Flamingos: Their Life History and Survival. New York: National Audubon Society. **

Allen WR. 1921. The birds at Lake Poopó, Bolivia. Auk 38:340-344. **

Allouse BE. 1950. A Handlist of the Birds of Iraq. Iraq Natural History Museum publ. no. 2. Baghdad: Government Press.

Andersson CJ. 1865. Note on the two flamingos of South Africa. Ibis, new series 1:64-67.

Anonymous. 1877. Capture of a rare bird. Forest and Stream 9(4):64.

Anonymous. 1904. The remarkable photograph of flamingo nests. National Geographic Magazine 15(2):83.

Anonymous. 1905. The story of the flamingo. National Geographic Magazine (1):50.

Anonymous. 1916. Contributions since the last meeting. From proceedings of the meeting held on 17th February 1916. Journal of the Bombay Natural History Society 24(3):619.

Anonymous. 1922. A bird sanctuary in the Bahamas. Bird-Lore 24(4):249-250.

Anonymous. 1923. Flamingo protection in the Bahamas. Bird-Lore 25(4):286-287.

Anonymous. 1923. Protecting the flamingos. Bird-Lore 25(3):222-223.

Anonymous. 1925. The Andean flamingo. Natural History 25(5):501-502.

Anonymous. 1927. Flamingo in Hampshire: An escape from captivity. British Birds 20(9):228.

Anonymous. 1931. The Birds of Louisiana. Baton Rouge: Louisiana Department of Conservation.

Anonymous. 1932. Flamingo and white stork in Aberdeenshire. British Birds 25(10):307.

Anonymous. 1933. Flamingo protected in Cuba by presidential decree. Bird-Lore 35(5):301.

Anonymous. 1933. Northern division, minutes of regular monthly meeting, November 1932. Condor 35(1):45-48. **

Anonymous. 1935. Lista Systemática de las Aves Argentinas. [Systematic list of Argentinean birds.] El Hornero 6(1):174. {Spanish}

Anonymous. 1938. Flamingo in Lewis. British Birds 32(7):239.

Anonymous. 1939. Flamingos in Yorkshire and Lincolnshire. British Birds 33(5):141.

Anonymous. 1942. Flamingo in Sussex. British Birds 36(5):100.

Anonymous. 1950. Birds' plumage for millinery. Annual report of the International Committee for Bird Preservation, British Section. 38 p.

Anonymous. 1952. Editorial notes: West Indies. Oryx 1(5):218.

Anonymous. 1952. Editorial notes: West Indies. Oryx 1(7):315.

Anonymous. 1952 February 14. Protection provided in Bahamas to save flamingo colonies. New York Times (Reprinted in Audubon Magazine 54(2): 90-91).

Anonymous. 1952 November 20. The troubled flamingo (editorial). New York Herald Tribune.

Anonymous. 1953. 53rd Christmas Bird Count. Coot Bay-Everglades National Park, Florida 7(2):106.

Anonymous. 1953. Editorial notes: Flamingos. Oryx 2(3):139-140.

Anonymous. 1953. Greater flamingos: Rondevlei Bird Sanctuary. Bokmakierie 5(2):cover photo.

Anonymous. 1954. 54th Christmas Bird Count. Coot Bay-Everglades National Park, Florida 8(2):121.

Anonymous. 1954. Editorial Notes: Flamingos. Oryx 2(4):206.

Anonymous. 1955. 55th Christmas Bird Count. Coot Bay-Everglades National Park, Florida 9(2):134.

Anonymous. 1961. Flamingos at New York (Bronx) Zoo. International Zoo Yearbook 2:76. **

Anonymous. 1970. Pochemu flamingo rozovye: (Po materialam zhurnala "La vi de bet" Frantsiya). [Why are the greater flamingos rose (On materials of the journal "La vi de bet" - France).] Nauka i zhizn' [Science and Life] 3. {Russian}

Apicius MG. 1933. Les Dix Livres de Cuisine d'Apicius. Traduits du Latin pour la Première fois et Commentés par Bertrand Guégan. [The Ten Cookbooks of Appicius. Translated From Latin For the First Time and Commented on by Bertrand Guégan.]. Paris: René Bonnel. {French}

Appert O. 1971. Die Flamingos der Mangokygegend in Südwest-Madagaskar. [The flamingos of the Mangoky Region in Southwest Madagascar.] Der Ornithologische Beobachter 68(6):271-276. {German}

Appleby EC. 1969. Tumours in captive wild animals: Some observations and comparisons. Acta Zoologica et Pathologica Antwerpiensia 48:77-92.

Aravena E. 1928. Notas sobre la alimentación de las aves. [Notes on the feeding of birds.] El Hornero 4(2):155. {Spanish}

Armstrong EA. 1947. Bird Display and Behaviour. New York: Oxford University Press.

Arribalzaga EL. 1920. Las aves del Chaco. [The birds of the Chaco.] El Hornero 2(2):87. {Spanish}

Arribalzaga EL. 1924. Nombres vulgares Argentinos de las aves silvestres de la Republica. [Common Argentinean names of the wild birds of the republic.] El Hornero 3(3):270. {Spanish}

Arrigoni Degli Oddi E. 1929. Ornithologia Italiana. [Italian Ornithology.]. Milan: Hoepli. {Italian}

Arthur SC. 1918. The Birds of Louisiana. New Orleans: Louisiana Department of Conservation.

Astley HD. 1914. Flamingos. Avicultural Magazine, 3d ser 5(10):287-289.

Attwater HP. 1891. Southwestern Game. Ornithologist and Oölogist 16(7):109-110.

Audubon JJ. 1837. Letters of John James Audubon 1826-1840. Boston: The Club of Odd Volumes.

Audubon JJ. 1838. Letters of John James Audubon 1826-1840. Boston: The Club of Odd Volumes.

Audubon JJ. 1839. Ornithological Biography, or an Account of the Habits of the Birds of the United States of America. Edinburgh: Adam and Charles Black (1831-1839).

Audubon JJ. 1839. A Synopsis of the Birds of North America. Edinburgh: Adam and Charles Black.

Baer JG. 1957. Répartition et endémicité des cestodes chez les reptiles, oiseaux et mammifères. [Distribution and endemicity of cestodes in reptiles, birds and mammals.] In: Baer JG, editor. First Symposium on Host Specificity among Parasites of Vertebrates. Neuchatel: Paul Attinger. p 270-292. {French} **

Bailey HH. 1921. Save the flamingos. Oölogist 38(11):148-149.

Bailey HH. 1925. The Birds of Florida. Baltimore: Privately printed.

Bailey HH. 1928. Regarding a late Florida record of the flamingo. Wilson Bulletin 40(3):197-198. **

Bailey HH. 1931. Wild flamingos in Florida. Oölogist 48(5):67.

Bailey HH. 1932. Nature faking in Florida. Oölogist 49(6):69.

Baird SF, Brewer TM, Ridgway R. 1884. The Water Birds of North America. Boston: Little, Brown.

Baker ECS. 1898. Indian ducks and their allies. Journal of the Bombay Natural History Society 11(1):2-9.

Baker ECS. 1929. The Fauna of British Indian Birds. London: Taylor & Francis.

Baker ECS. 1935. The Nidificaton of Birds of the Indian Empire. London: Taylor & Francis.

Baker JH. 1950. News of wildlife and conservation. Audubon Magazine 52(4):256-257.

Baker JH. 1951. Allen studying flamingos. News of wildlife and conservation. Audubon Magazine 53(3):197.

Baker JH. 1952. Bahaman wardens on duty. The president reports to you. Audubon Magazine 54(3):178.

Baker JH. 1952. Flamingo motif. The president reports to you. Audubon Magazine 54(6):380.

Baker JH. 1953. Flamingo dividends. The president reports to you. Audubon Magazine 55(2):68-69.

Baker JH. 1953. Flamingos in Cuba. The president reports to you. Audubon Magazine 55(4):166.

Balston RJ, Sheperd CW, Bartlett E. 1907. Notes on the Birds of Kent. London: R. H. Porter.

Bang BG, Cobb S. 1968. The size of the olfactory bulb in 108 species of birds. Auk 85:55-61. **

Bangs O, Kennard FH. 1920. A List of the Birds of Jamaica. (Excerpted from The Handbook of Jamaica, 1920). Kingston: Government Printing Office.

Banks RC. 1974. Proceedings of the 91st stated meeting of the American Ornithologists Union. Auk 91:387-410. **

Bannerman DA. 1927. Report on the birds collected and observed during the British Museum Expedition to Tunisia in 1925. Ibis, 12th ser no. 3(Supplementary Number):182-185.

Bannerman DA. 1930-1951. The Birds of Tropical West Africa. London: Crown Agents for the Colonies.

Bannerman DA. 1953. The Birds of West and Equatorial Africa. Vol. I. London: Oliver & Boyd.

Barbour T. 1923. The Birds of Cuba. Memoirs of the Nuttall Ornithological Club:No. 6.

Barbour T. 1943. Cuban Ornithology. Memoirs of the Nuttall Ornithological Club:No. 9.

Barbour T, Phillips JC. 1911. Concealing coloration again. Auk 28(2):181-182. **

Barnes V, Jr. 1947. Additions to the Puerto Rican avifauna with notes on little-known species. Auk 62(3):401. **

Barrere P. 1741. Essai sur l'Histoire Naturelle de la France Equinoxiale, ou Dénombrement des Plantes, des Animaux et des Minéraux…dans l'Isle de Cayenne, les Isles de Rémire, sur les Côtes de la Mer, et dans le Continent de la Guyane. [Essay on the Natural History of the French Tropics, or Numbering of Plants, Animals and Minerals on the Isle of Cayenne, the Isles of Rémire, by the Coasts, and in Guyana.]. Paris: Piget. {Old French}

Barrere P. 1745. Ornithologiae specimen novum, sive series avium in Ruscinone, Pyrenaeis Montibus, atque in Galliâ Aequinoctiali Observatorum. Perpiniarii, Le Comte: Regis Typographum. {Latin}

Barrows WB. 1884. Birds of the Lower Uruguay. Auk 1(3):272. **

Bartholomew GA, Pennycuick CJ. 1973. The flamingo and pelican populations of the Rift Valley lakes in 1968-1969. East African Wildlife Journal 11:189-198.

Bartlett AD. 1869. Remarks upon the habits of the hornbills (Buceros). Proceedings of the Zoological Society of London:142-146.

Bartram W. 1791. Travels Through North and South Carolina, Georgia, East and West Florida. New York: Macy-Masius (1928).

Bath W. 1906. Die Geschmacksorgane der Vogel und Krokodille. Archiv für Biontologie 1:5-47.

Bauer KM, Glutz von Blotzheim UN, editors. 1966. Handbuch der Vögel Mitteleuropas, Vol. 1. [Handbook of the Birds of Central Europe, Vol. 1.]. Frankfurt am Main: Akademische Verlagsgesellschaft. {German}

Bauernfeind JC, Rubin SH, Surmatis JD, Ofner A. 1970. Carotenoids and fat-soluble vitamins: contribution to food, feed and pharmaceuticals. Internationale Zeitschrift Vitaminforschung 40(3):391-416.

Beck RH. 1902. Correspondence. Condor 4(4):99. **

Beck RH. 1904. Bird life among the Galápagos Islands. Condor 6(1):5-11. **

Beddard FE. 1898. The Structure and Classification of Birds. London: Longmans.

Bede P. 1915. Quelques observations sur les oiseaux des environs de Sfax (Tunisie). [Some observations on birds in vicinities of Sfax (Tunisia).] Revue Française d'Ornithologie 4(76-77):116-117. {French}

Bede P. 1928. Jardin Zoologique de Sfax. Notes d'Ornithologie. Fascicule I. [Zoological garden of Sfax. Notes of ornithology. Manual I.]. Sfax: Imp. Scichma. {French}

Bedford GAH. 1926. A check-list and host-list of the external parasites found on South African Mammalia, Aves and Reptilia. 11th and 12th Reports of the Director of Veterinary Services and Animal Industry. Union of South Africa. p 707-817.

Bedford GAH. 1932. A synoptic check-list and host-list of the external parasites found on South African Mammalia, Aves and Reptilia, 2d ed. 18th Report of the Director of Veterinary Services and Animal Industry. Union of South Africa. p 223-523.

Beebe CW. 1906. The Bird: Its Form and Function. New York: Holt.

Beebe MB, Beebe CW. 1910. Our Search for a Wilderness. New York: Holt.

Beer JV. 1969. Isolation of pathogenic fungi from waterfowl. In: Shapton DA, Gould GW, editors. Isolation Methods for Microbiologists. London: Academic Press. p 103-111.

Beer JV, Kear J. 1973. Fungal infections of the plumage in flamingos. Avicultural Magazine 79(5):163-164.

Behn F. 1944. Notas ornitologicas de un viaje a la Laguana del Maule. [Ornithological notes of a trip to the Laguana del Maule.] Boletin de la Sociedad de Biologia de Concepcion (Chile) 18:105-114. {Spanish}

Behn F, Johnson AW, Millie GR. 1957. Expedición ornitológica a la cordilleras del norte de Chile (Enero-Febrero 1957). [Ornithological expedition to the mountain ranges of northern Chile (January-February 1957).] Boletin de la Sociedad de Biologia de Concepcion (Chile) 32:95-131. {Spanish}

Belon P. 1555. L'histoire de la Nature des Oyseavx, Avec Leurs Descriptons, & Naifs Portraicts Retirez av Natvrel; Escrite en Sept Livres. [The History of the Nature of Birds, with their Descriptions, & Innocent Portraits Withdraw to the Natural; Written in Seven Books.]. Paris: Gilles Corozet. 382 p. {French}

Belousova LS, Borisov VA, Vinokurov AA. 1969. Zapovedniki i natsional'nye parki mira. [Nature Reserves and National Parks of World.]. Moscow: Nauka. 239 p. {Russian}

Belton W. 1959. Observations of whimbrel, *Numenius phaeopus*, and Chilean flamingo, *Phoenicopterus chilensis*, in June near the Straits of Magellan. Auk 76:104. **

Benson CW. 1967. The birds of Aldabra and their status. Atoll Research Bulletin 118:63-111.

Benson CW, Brooke RK, Dowsett RJ, Stuartirwin MP. 1971. The Birds of Zambia. London: Collins.

Benson CW, Penny MJ. 1971. The land birds of Aldabra. Philosophical Transactions of the Royal Society of London Series B, Biological Sciences 260:417-527.

Bent AC. 1924. Birds observed in southeastern Texas in May 1923. Wilson Bulletin 36(1):7. **

Bent AC. 1926. Life histories of North American marsh birds. US National Museum Bulletin, no 135:135.

Bernath EL. 1935. Notes sur l'Avifaune des Iles Baléares et Pityuses. [Notes on the birds of Iles Baléares and Pityuses.] L'Oiseau, ns 5(2):334.

Bernath EL. 1936. *Phoenicopterus ruber antiquorum*. L'Oiseau, ns 6(2):328.

Bernath EL. 1965. Observations in southern Chile in the southern hemisphere autumn. Auk 82:95-101. **

Bernis F. 1966. Presencia de un flamenco enano *Phoeniconaias minor* en el Sur de España. [Presence of a lesser flamingo (*Phoeniconaias minor)* in the South of Spain.] Ardeola 12:229. {Spanish}

Bernis F, Valverde JA. 1954. Sur le flamant rose dans la Péninsule Ibérique. [On the greater flamingo in the Iberian Peninsula.] Alauda 22:32-39. {French}

Berrill NJ. 1952. Journey into Wonder. New York: Dodd, Mead.

Berry HH. 1972. Flamingo breeding on the Etosha Pan, South West Africa, during 1971. Madoqua 1st ser. 5:5-31.

Berry HH. 1974. Differentiating between lesser and greater flamingo chicks for ringing purposes. Safring News 3(1):26-28.

Berry HH. 1974. Hand-rearing abandoned lesser flamingos. International Zoo Yearbook 14:203-210. **

Berry HH, Stark HP, van Vuuren AS. 1973. White pelicans *Pelecanus onocrotalus* breeding on the Etosha Pan, South West Africa, during 1971. Madoqua 7:17-31.

Bezdek FH. 1946. Bird notes from El Bahira, Tunis. Auk 63(3):378-381. **

Biddulph J. 1938. Birds of Rameswaram Island. Journal of the Bombay Natural History Society 40(2):256.

Bijleveld MF, Bijleveld IJ. 1973. Der Nakurusee. [Lake Nakuru.] In: Sitwell N, editor. Wildlife '73. München: Südwest Verlag. p 126-127. {German}

Birshtein YA, Vlasov BV, Gilyarov MSea. 1968. Otryad zhabronogikh. [Order Branchiopoda.]. Zhizn' zhivotnykh [Life of animals] Issue 2. Moscow: "Prosveshchenie" Publishers. p 383-386. {Russian}

Blaauw FE. 1934. Some notes on the Argentinian flamingo (*Phoenicopterus chilensis*). Avicultural Magazine, 4th ser 12(3):80-82.

Blake ER. 1953. Birds of Mexico. Chicago: University of Chicago Press.

Blake HA. 1887. Flamingos at home. Nineteenth Century 22(130):886-890.

Blake HA. 1888. The breeding habits of the flamingo. Ibis, 5th ser 6:150-152.

Blanco DE. Los humedales como habitat de aves acuaticas. Humedales Internacional-Americas. 208-217 p. {Spanish}

Blancou L. 1933. Contribution à l'etude des oiseaux de l'Ooubangui-Chari (Bassin de la Ouaka et de la Kandjia). [Contribution to the survey of birds of the Ooubangui-Chari (Basin of the Ouaka and the Kandjia).] L'Oiseau ns 3(1):29. {French}

Bock H-J, Hass G. 1974. Erstmalige künstliche Aufzucht eines Flamingos im Zoo Wuppertal. [First hand-rearing of a flamingo at Wuppertal Zoo.] Der Zoologische Garten 44(1/2):80-86. {German}

Bolle C. 1856. Die Vogelwelt auf den Inseln des Gruner Vorgebirges. [The world of birds on the islands of the Gruner foothills.] Journal für Ornithologie 4(1):27-28. {German}

Bonaparte C-LJL. 1856. Additions aux tableaux paralléliques de l'order des hérons, des pélagiens, et des précoces. Comptes Rendus de l'Académie des Sciences 43:992. {French}

Bond J. 1928. The distribution and habits of the birds of the Republic of Haiti. Proceedings of Academy of Natural Sciences of Philadelphia 80:491.

Bond J. 1947. Field Guide to the Birds of the West Indies. New York: Macmillan.

Bond J. 1950. Check-list of Birds of the West Indies. Philadelphia: Academy of Natural Sciences.

Bond J, de Schauensee RM. 1943. The birds of Bolivia, pt. 2. Proceedings of Academy of Natural Sciences of Philadelphia 95:173.

Bond RM. 1934. A partial list of birds observed in Haiti and the Dominican Republic. Auk 51(4):501. **

Bonnaterre JP. 1790. Tableau Encyclopédique et Méthodique des Trois Règnes de la Nature. Ornithologie. [Encyclopedic and Methodical Picture of the Three Kingdoms of Nature. Ornithology.]. Paris: Chez Mme. Veuve Agasse (1790-1823). {French}

Bosch GB. 1836. Reizen in West-Indie, en Door een Gedeelte van Zuid-en Noord-Amerike. [Travels in West Indies and through a part of Southern North America.]. Utrecht: N. Van der Monde (1829-1843). {Dutch}

Boswall JHR, North MEW. 1967. A discography of bird sound from the Ethiopian zoogeographical region. Ibis 109:521-533.

Boubier M. 1922. L'Oiseau et Son Milieu. [The Bird and Its Surroundings.]. Paris: Flammarion. {French}

Boucard A. On a collection of birds from Yucatan with notes by Osbert Salvin. Zoological Society of London; 1883. p 458.

Bourliere F. 1949. The Ornitholographia Americana of Father Plumier. Wilson Bulletin 61(2):103-105. **

Bourn WS. 1935. Sea-water tolerance of *Ruppia maritima* L. Boyce Thompson Institute Contributions 7(3):249-255.

Brack M, Stoll L. Infektion durch atypische Mykobakterien bei Zwergflamingos. [Infection from atypical mycobacteria in lesser flamingos.]. VI Internationales Symposium über die Erkrankung der Zootiere, Wien, 8 - 10 Mai 1964; 1964. p 109. {German}

Bradlee TS, Mowbray LL. 1931. A list of birds recorded from the Bermudas, with additional notes compiled by Warren F. Eaton. Boston Society of Natural History Proceedings 39(8):308.

Brehm AE. 1874. Bird-Life; Being a History of the Birds, Its Structure and Habits. London: Van Voorst.

Brewer TM. 1860. A list of Cuban birds. Boston Society of Natural History, Proceedings 7(20):305-308.

Brisson MJ. 1760. Ornithologie, ou Méthode Contenant la Division des Oiseaux en Ordres, Sections, Genres, Espèces and leurs Variétés. [Ornithology, or Method Containing the Division of Birds into Orders, Sections, Kinds, Species and their Varieties.]. Paris: Cl. Jean-Baptiste Bauche. {French}

Britton PL. 1970. Some non-passerine bird weights from East Africa. Bulletin of British Ornithological Club 90:142-144.

Brockmann H, Völker O. 1934. Der gelbe Federfarbstoffe des Kanarienvogels (*Serinus canaria canaris*) und das Vorkommen von Carotenoiden bei Vögeln. [The yellow feather pigment of the canary (*Serinus canaria canaris*) and the occurrence of carotenoids in birds.] Zeitschrift für Physiologische Chemie 224:193-215. {German}

Brodhead ML. 1910. Notes on birds in the Florida Keys. Bird-Lore 12(5):189-190.

Brodkorb P. 1953. A Pliocene flamingo from Florida. Natural History Misc Chicago Academy Science 124:1-4.

Brodkorb P. 1961. Birds from the Pliocene of Juntura, Oregon. Quarterly Journal Florida Academic Sciences 24:169-184.

Brodkorb P. Birds from the Upper Cretaceous of Wyoming. Proceedings from XIII International Ornithological Congr; 1963; Ithaca. p 55-70.

Brodkorb P. 1963. Catalogue of fossil birds, Part 1. Bulletin Florida State Museum 7:179-293.

Brodkorb P. 1964. Catalogue of fossil birds, pt. 2 (Anseriformes through Galliformes). Bulletin Florida State Museum 9:195-335.

Brodkorb P, Phillips AR. 1973. Pleistocene birds from the Valley of Mexico. Auk 90:438-440. **

Brown HD. 1957. The breeding of the lesser flamingo in the Mweru Wantipa, Northern Rhodesia. Ibis 99:688-692.

Brown LH. 1955. Breeding of the lesser and greater flamingos in East Africa. Journal East African Natural History Society 22:159-162.

Brown LH. 1955. A flamingo mystery solved. Country Life 117(3027):164-167.

Brown LH. 1958. The breeding of the greater flamingo *Phoenicopterus ruber* at Lake Elmenteita, Kenya colony. Ibis 100:388-420. **

Brown LH. 1959. Flamingos. Wild Life 1:8-12, 56.

Brown LH. 1959. Flamingos in Africa. Ostrich supplement no. 3:79-83.

Brown LH. 1959. The Mystery of the Flamingos. London, England: Country Life Ltd.

Brown LH. 1966. Greater flamingo in East Africa. Africana 2:21-27.

Brown LH. 1971. Flamingo. World of Birds 1:13-18.

Brown LH. 1971. The flamingos of Lake Nakuru. New Scientist and Science Journal 51:97-101. **

Brown LH. 1973. The Mystery of the Flamingos, 2d ed. Nairobi: East African Publishing House.

Brown LH, Powell-Cotton D, Hopcraft JBD. 1973. The breeding of the greater flamingo and great white pelican in East Africa. Ibis 115(3):352-374.

Brown LH, Root A. 1971. The breeding behaviour of the lesser flamingo *Phoeniconaias minor*. Ibis 113(2):147-172. **

Browne P. 1756. The Civil and Natural History of Jamaica. London: Printed for the author and sold by T. Osborne and J. Shipton.

Bryant H. 1866. Additions to a list of birds seen at the Bahamas. Boston Society of Natural History Proceedings 11:63-70.

Bryant H. 1866. A list of the birds of St. Domingo. Boston Society of Natural History Proceedings 11:97.

Bucknill JAS. 1910. On the ornithology of Cyprus, pt. 3. Ibis, 9th ser 4(15):393.

Budin E. 1931. Aves del N. O. Argentino (Provincia de jujuy). [Birds of northeast Argentina (Province of Jujuy).] El Hornero 4(4):405. {Spanish}

Buffon GLL. 1781. Histoire Naturelle des Oiseaux. [Natural History of Birds.]. Paris: Imprimerie Royale. {French}

Bullough WS. 1942. The reproductive cycles of the British and Continental races of the starling. London, Philosophical Transactions of the Royal Society, ser B 231:165-246.

Burmeister H. 1860. Systematisches Verzeichnis der in den La Plata-Staaten, beobachteten Vogelarten. [Systematic table of bird types in the La Plata states.] Journal für Ornithologie 8(4):241-268. {German}

Burmeister H. 1872. Synopsis of the *Lamellirostres* of the Argentine Republic. Zoological Society of London Proceedings:p. 364.

Burns FL. 1915. Comparative periods of deposition and incubation of some North American birds. Wilson Bulletin 27(1):282. **

Burns FL. 1929. Evolution in birds' eggs. Oölogist 46(4):50-55.

Burns FL. 1932. Charles W. and Titian R. Peale and the Ornithology Section of the Old Philadelphia Museum. Wilson Bulletin 44(1):26-27. **

Butler AW. 1924. A Florida flamingo. Auk 41(1):150-152. **

Buxton PA. 1921. Notes on birds from Northern and Western Persia. Journal of the Bombay Natural History Society 27(4):875.

Capek V. 1896. Flamingos und Zwergtrappe in Mähren. [Flamingos and little bustards in Moravia.] Ornithologisches Jahrbuch 7(1):35-36. {German}

Cardano G. 1557. Hieronymi Cardani Mediolanensis Medici. De Rerum Varietate Libri XVII Basileae [per Henrichvm Petri].

Carpenter GDH. 1920. A Naturalist on Lake Victoria. London: T. Fisher Unwin.

Carr NJ. 1971. A greater flamingo in the Luangwa valley. Bulletin of the Zambian Ornithological Society 3:59.

Carro C, Bernis F. 1968. Sobre los nombres de los flamencos (*Phoenicopterus* spp.). [On the names of the flamingos (*Phoenicopterus* spp.).] Ardeola 14:183-208. {Spanish}

Casares J. 1944. Aves de Estanzuela. [Birds of Estanzuela.] El Hornero 8(3):437. {Spanish}

Cassin J. 1855. Birds (In U. S. Naval Astronomical Expedition to the Southern Hemisphere During the Years 1849, 50, 51, 52. V. 2. Andes [?]). Washington.

Castan R. 1960. Le flamant rose en Tunisie. [The greater flamingo in Tunisia.] Alauda 28:15-19. {French}

Castan R. 1963. Notes de Tunisie (région de Gabès). [Notes of Tunisia (region of Gabès).] Alauda 31:294-303. {French}

Castellanos. 1931. Aves del Valle de los Reartes. [Birds of Valle de los Reartes.] El Hornero 4(3):387. {Spanish}

Catesby M. 1771. The Natural History of Carolina, Florida, and the Bahamas Islands, 3rd ed. London: Benjamin White.

Caum EL. 1933. Exotic birds of Hawaii. Bernice P Bishop Museum, Occasional Papers 10(9):1-55.

Cetti F. 1776. Gli Uccelli di Sardegna. [The Birds of Sardinia.]. Sassari: Tipografia G. Piattoli. {Italian}

Chabot F. 1927. Chronique Ornithologique. [Ornithological chronicle.] L'Oiseau 8(7):224. {French}

Chabot F, Plocq E. 1927. Chronique Ornithologique. [Ornithological chronicle.] L'Oiseau 8(1):31. {French}

Chandler AC. 1916. A study of the structure of feathers with reference to their taxonomic significance. University of California Publications in Zoology 13(11):243-446.

Chapin JP. 1932. The birds of the Belgian Congo. American Museum of Natural History, Bulletin no 65.

Chapman A. 1883. Notes on the breeding of *Phoenicopterus antiquorum*. Ibis, 5th ser 1:397-398.

Chapman A. 1884. Rough notes on Spanish ornithology. Ibis, 5th ser 2:66-99.

Chapman A. 1908. On Safari: Big-game Hunting in British East Africa with Studies in Bird-life. London: Edward Arnold.

Chapman A, Buck WJ. 1893. Wild Spain. London: Gurney and Jackson.

Chapman A, Buck WJ. 1910. Unexplored Spain. London: E. Arnold.

Chapman FM. 1903. Flamingos' nests. United States National Museum Annual Report 1903:573-575.

Chapman FM. 1904. A flamingo city. Century Magazine 69(2):163-180.

Chapman FM. 1904. Young flamingos. Bird-Lore 6:193-198.

Chapman FM. 1905. A contribution to the life history of the American flamingo (*Phoenicopterus ruber*) with remarks upon specimens. American Museum of Natural History Bulletin 21(7):53-77.

Chapman FM. 1908. Camps and Cruises of an Ornithologist. New York: D. Appleton and Co.

Chapman FM. 1916. The flamingo and its young: Color plate, photographic study. American Museum Journal 16(4):217.

Chapman FM. 1926. The distribution of bird-life in Ecuador. Bulletin of American Museum of Natural History 55:1-784.

Chapman FM. 1930. Habitat groups of North American birds. American Museum of Natural History Guide Leaflet, no 28.

Chapman FM. 1935. The courtship of Gould's Manakin (*Manacus v. vitellenus*) on Barro Colorado Island, Canal Zone. American Museum of Natural History Bulletin 68(7):471-525.

Charleton W. 1677. Gualteri Charletoni Exercitationes de Differentiis & Nominibus Animalium, 2nd ed. Oxoniae: et Theatro Sheldoniano.

Cheesman DF, Lee WL, Zagalsky PF. 1967. Carotenproteins in invertebrates. Biological Review 42:132-160.

Chekmenyov DI. Ocherki po biologii kolonial'no gnezdyashchikhsya ptits ozera Tengiz. [Sketches on biology of colonial nesting birds of the Tengiz Lake.]. Tr In ta zoologii AN KazSSR [Proceedings of Institute of Zool of Ac of Science of the KazSSR; 1964; Alma Ata. Nauka. p 70-76. {Russian}

Chel'tsov-Bebutov AM. 1958. Novoe gnezdovanie flamingo v Sovetskom Soyu. [New nesting colonies of the flamingo in the Soviet Union.] Ornitologiya 1:95-101. {Russian}

Chernoskutov IA, Badamshin BI. 1948. Bolshoe skoplenie flamingo v Kaspijskom more. [The great concentration of flamingos in the Caspian Sea.] Priroda [Nature] 4:83. {Russian}

Chigi F. 1908. Notizie Ornitologiche per la provincia di roma. [Ornithological news for the province of Rome.] Bolletino della Società Zoologica Italiana, 2d ser 9(3-6):199. {Italian}

Chubb C. 1916. Birds of British Guiana. London: Quaritch.

Clancey PA. 1964. The Birds of Natal and Zululand. London: Oliver & Boyd.

Clapp RB, Banks RC. 1973. Birds imported into the United States in 1970. U.S. Dept. Interior, Fish & Wildlife Service. 164 p.

Clark AH. 1905. The former status of the flamingo and the fish hawk in the Lesser Antilles. Auk 22(3):318-319. **

Clark HL. 1901. The classification of birds. Auk 18:370-381. **

Clark HL. 1918. Tail-feathers and their major upper coverts. Auk 35(2):116, 118, 122-123. **

Clark JW. 1870. Letters, announcements, etc. Ibis, ns 6(23):439-442.

Clarke G. 1966. Flamingos at Khormaksar, Aden Colony. Journal of the Royal Air Force Ornithological Society 1:11-19.

Clarke G. 1967. Bird notes from Aden Colony. Ibis 109:516-520.

Clarke WE. 1898. On the ornithology of the delta of the Rhone. Ibis, 7th ser 4:465-485.

Clay T. 1949. Some problems in the evolution of a group of ectoparasites. Evolution 3:279-299.

Clay T. Mallophaga of birds. [First Symposium on host specificity among parasites of Vertebrates.]. Premiere Symposium Sur la specificité parasitaire des parasites de Vertébrés; 1957. p 120-155.

Clay T. 1962. A new species of *Anatoecus* Cummings (Mallophaga) from *Phoenicopterus ruber* Linn. Entomologische Berichten 22:220-226.

Clay T. 1974. The Phthiraptera (Insecta) parasitic on flamingos (Phoenicopteridae: Aves). Journal of Zoology, London 172:483-490.

Comolli L, Gentili F. 1973. Osservazioni ornitologiche in Sardegna nel mese di agosto degli anni 1970-1971-1972. [Ornithological observations in Sardinia in August in the years 1970-1971-1972.] Rivista Italiana di Ornitologia 43:120-134. {Italian}

Compnayo L. 1863. Histoire naturelle du Département des Pyrénées Orientales. [Natural history of the Pyrenees Oriental Department.] Perpignan (1861-1864). {French}

Congo B. 1930-1934. Législation Edictée Durant les Années 1930-1934. Revue Internationale pour la Protection de la Nature, 1930, pp. 5, 10; 1931, p. 6; 1934, pp. 12, 14. (Brussells, 1936).

Conway W. 1958. It's carrot oil that makes our flamingos red, but why? Animal Kingdom 61(6):169-173.

Conway W. 1959. A new ration for flamingos. Avicultural Magazine 65(4-5):108-112.

Conway W. 1966. The zoo's first baby flamingo. Animal Kingdom 69(4):123-126.

Conway WG. 1960. To the high Andes for the rarest flamingo. Animal Kingdom 63(2):34-50.

Conway WG. 1960. To the high Andes for the rarest flamingo [16mm, color and sound movie, 22 minute]. New York: New York Zoological Society.

Conway WG. 1961. In quest of the rarest flamingo. National Geographic Magazine 120(1):90-105.

Conway WG. 1965. Care of James' flamingo (*Phoenicoparrus jamsei* Sclater) and the Andean flamingo (*Phoenicoparrus andinus* R. A. Philippi) in captivity. International Zoo Yearbook 5:162-164. **

Cooke WW. 1913. The distribution and migration of North American herons and their allies. US Biological Survey Bulletin no 45.

Cooper JE. 1968. Veterinary examination of exotic animals prior to export. Journal of Small Animal Practice 9:237-243.

Cordier C. 1965. A la recherche de Flamants dans les hautes Andes. [To the research of Flamingos in the high Andes.] Zoo Antwerpen 30:83-88. {French}

Cordier C. 1968. Flamingos in Bolivien. Freunde des Kolner Zoo 11(1):13-16.

Cory CB. 1881. List of the birds of Haiti, taken in different parts of the island between January 1 and March 12, 1881. Nuttall Ornithological Club Bulletin 6(3):155.

Cory CB. 1885. The Birds of Haiti and San Domingo. Boston: Estes and Lauriat.

Cory CB. 1887. The birds of the West Indies, including the Bahamas Islands, the greater and the lesser Antilles, excepting the islands of Tobago and Trinindad. Auk 4(4):322-323. **

Coues E. 1872. A Key to North American Birds. New York: Dodd, Mead.

Coues E. 1884. Key to North American Birds, 2d ed. Boston: Estes and Lauriat.

Coues E. 1903. Key to North American Birds, 5th ed. Boston: Dana Estes.

Cracraft J. 1970. A new species of *Telmabates* (Phoenicopteriformes) from the lower Eocene of Patagonia. Condor 72:479-480. **

Cracraft J. 1973. Continental drift, paleoclimatology, and the evolution and biogeography of birds. Journal of Zoology 169:455-545.

Crespon J. 1840. Ornithologie du Gard et des Pays Circonvoisins. [Ornithology of Gard and closed regions.]. Nismes: Bianquis-Gignoux. {French}

Crespon J. 1844. Faune Méridionale. Nimes: Author (self-published).

Curry RA. 1930. Bahamian Lore. Paris: Author (self-published).

Daanje A. 1950. On locomotory movements in birds and the intention movements derived from them. Behaviour 3:48-98.

Dabbene R. 1920. Sobre la nidificación del flamenco, *Phoenciopterus chilensis* Mol. [On the nesting of the flamingo, *Phoenciopterus chilensis* Mol.] El Hornero 2:134-135. {Spanish}

Dames W. 1890. Ueber Vogelreste aus dem Salthomskalk von Limhamn bei Malmö. [About bird-remains from the Salthomskalk von Limhamn by Malmö.] Bihang till Kongliga Svenska Vetenskaps-Akademiens Handlingar 16(4):1. {German}

Dampier W. 1697. A New Voyage Round the World Describing Particularly the Isthmus of America. London: James Knapton.

Danforth ST. 1929. Notes on the birds of Hispaniola. Auk 46(3):361. **

Danforth ST. 1934. The birds of Antigua. Auk 51:351-364. **

Danforth ST. 1935. Supplementary account of the birds of the Virgin Islands. Puerto Rico University Journal of Agriculture 19(4):466.

Danforth ST. 1938. Recent occurrence of the flamingo in Puerto Rico. Auk 55(4):667. **

Danforth ST. 1939. Birds of Guadeloupe and adjacent islands. Puerto Rico University Journal of Agriculture 23(1):20.

Danilevskiy S. 1952. Flamingo na Kaspijskom more. [The Greater Flamingo on the Caspian Sea.] Okhrana prirody [Nature Conservation] 15:150-153 Map. {Russian}

Dareste C. 1860. Note sur la langue du flamant. [Note on the language of the flamingo.] Comptes Rendus de la Société de Biologie (Paris), 3d ser 2:168. {French}

Darling FF. 1938. Bird Flocks and the Breeding Cycle: A Contribution to the Study of Avian Sociality. Cambridge: University Press.

Darling FF. 1940. Island Years. London: G. Bell and Sons.

Darling FF. 1941. The social life of animals. Royal Philosophical Society of Glasgow Proceedings 65:68-84.

Darluc M. 1782. Histoire Naturell de Provence. Vol. I. [Natural History of Province.]. Avignon: J. J. Niel. {French}

Darwin C. 1839. Journal and Remarks, 1832-1836 (in Narrative of the Surveying Voyages of His majesty's Ships Adventure and Beagle Between the Years 1826 and 1836). Fitzroy R, editor. London: H. Colburn.

Darwin CR. 1859. On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. London: John Murray.

Davie O. 1889. Nests and Eggs of North American Birds, 4th ed. Columbus, OH: Hann and Adair.

Davies BH, Hsu WJ, Chichester CO. 1965. The metabolism of carotenoids in the brine shrimp *Artemia salina*. Biochemical Journal 94:1-26.

Davis JH, Jr. 1940. The ecology and geologic role of mangroves in Florida. Carnegie Institution of Washington, Publication 517:303-412.

de Beauguesne B. 1909. Rencontres Fortuites. [Fortuitous meetings.] Revue Française d'Ornithologie 1(5-6):75. {French}

de Chapel F. 1904. La nidification des flamants. En Camargue à la recherche de nids de flamants. [The nesting of flamingos. In Camargue on the research of flamingo nests.] Bulletin de la Societe Nationale d'Acclimatation de France 51:207-212. {French}

de Chapel F. 1904. Les flamants en Camargue. [Flamingos in Camargue.] Bulletin Sci Nat Férussac 31:72-73. {French}

de Chapel F. 1910. Le flamant rose de la Méditerranée (*Phoenicopterus roseus*). [The greater flamingo of the Mediterranean.] Revue Francais Ornithologie 1:246-249. {French}

de Chapel F. 1921. Le flamant rose en France. [The greater flamingo in France.] L'Oiseau 2:102-106. {French}

de Charlevoix PFX. 1730. Histoire de l'Isle Espagnole ou de S. Domingue. [History of the Spanish Isles or San Domingo.]. Paris: F. Barois. {Spanish}

de Charlevoix PFX. 1733. Histoire de l'Isle Espagnole ou de S. Domingue. [History of the Spanish Isles or San Domingo.]. Amsterdam: F. L'Honoré. {Spanish}

de Charlevoix PFX. 1744. Histoire et Description Générale de la Nouvelle France. [History and General Description of the New France.]. Paris: Chez la Veuve Ganeau. {French}

de Flacourt E. 1661. Relation de la Grande Isle Madagascar, Contenant de qui s'est Passé entre les François et les Originaires de cette Isle depuis l'An 1642 Iusques en l'An 1655, 1656, 1657. [Relation of the Grande Isle Madagascar, Containing of that Happened himself between the François and the Original of this Isle since the year 1642 until the year 1655, 1656, 1657.]. Paris: Pierre l'Ami. {French} de Guirtchitch G. 1936. Chronique ornithologique Tunisienne pour l'année 1935. [Tunisian ornithological chronicle for the year 1935.] L'Oiseau, new ser 6(3):486. {French}

de Herrera y Tordesillas A. 1601. Descripción de las Indias Occidentales En Madrid: en la Emplenta real. (In his Hisotria general de los hechos de los Castellanos. Madrid, 1601-1615, v. 1). [Description of the Western India In Madrid: in the Emplenta real. (In his general history of the facts of the Castellanos. Madrid, 1601-1615, v. 1).]. {Spanish}

De Jong M. 1948. De Vogels van Curacao, Aruba en Bonaire. [The Birds of Curacao, Aruba and Bonaire.] Limosa 21(1):1-9.

de Laet J. 1640. L'Historie du Nouveau Monde, ou Description des Indes Occidentales. [The History of the New World, or Description of the West Indies.]. Leyde: B. and A. Elseviers. {French}

de Naurois R. 1959. Premières recherches sur l'avifaune des îles du Banc d'Arguin (Mauritanie). [First studies on the avifauna of islands of the Banc of Arguin (Mauritania).] Alauda 27:241-308. {French}

de Naurois R. 1965. Faits nouveaux concernant le peuplement avien de l'Archipel du Cap-Vert. [New facts concerning bird population of the archipelago of the Cap-Vert.] Comptes Rendus de l'Academie des Sciences Serie II A Sciences de la Terre et des Planetes 260:5911-5914. {French}

de Naurois R. 1965. Premières recherches sur la faunistique et l'écologie des Palmipèdes et Echassiers en Guinée Portugaise. [First studies on the fauna and the ecology of Waterfowl and Waterbirds in Portuguese Guinea.] Comptes Rendus de L'Academie des Sciences:1423-1426. {French}

de Naurois R. 1965. Une colonie réproductive du petit Flamant *Phoeniconaias minor* dans l'Aftout-es-Sahel (Sud-Ouest Mauritanien). [A breeding colony of lesser flamingos in the Aftout-es-Sahel (Southwest Mauritania).] Alauda 33:166-176. {French}

de Naurois R. 1969. Le Flamant rose (*Phoenicopterus ruber*) a-t-il niché en nombre et réguliérement dans l'archipel du Cap Vert? [The greater flamingo: Did it nest in number and regularly in the archipelago of the Capo Verde?] L'Oiseau et la R F O 39:28-37. {French}

de Naurois R. 1969. Peuplement et cycles de reproduction des oiseaux de la côte occidentale d'Afrique. [Bird community and reproductive cycles of birds of the western coast of Africa.] Mémoires du Museum National d'Histoire Naturelle. {French}

de Rochebrune AT. 1884. Faune de la Sénégambie. 3e livraison. Oiseaux. [Fauna of the Sénégambie. 3 delivery. Birds.]. Paris: Douïn. {French}

de Rochefort C. 1658. Histoire Naturelle et Morale des Iles Antilles de l'Amérique avec un Vocabulaire Caraîbe. [Natural history and Morals of the Antilles Islands of America With a Vocabulary Carib.]. Roterdam: A. Leers. {French}

de Schauensee RM. 1948. The birds of the republic of Colombia. Boletim do Instituto de Ciencias Biologicas Naturais; Universidad Nacional de Colombia 5(22):368.

de Varigny H. 1926. Revue des sciences. Protection de la nature. [Journal of sciences. Protection of nature.] Paris, Journal des Débats (16 Juillet). {French}

Dechambre E, Guillot G, Roth P. 1944. Quelques cas d'aspergillose chez des oiseaux de volière. [Some cases of aspergillosis in aviary birds.] Bulletin Academie Veterinaire de France 17:369-371. {French}

Delacour J. 1927. Les flammants et les kamichis. [The flamingos and the screamers.] L'Oiseau 8(11):321-323. {French}

Delacour J. 1931. Notes d'élevage. [Breeding notes.] L'Oiseau, ns 1(5):318. {French}

Delacour J. 1932. Les oiseaux de la mission zoologique Franco-Anglo-Américaine à Madagascar. [Birds of the zoological mission French-English-American to Madagascar.] L'Oiseau, ns 2(1):17. {French}

Delacour J. 1961. Anseriformes. In: Gray P, editor. The encyclopedia of the biological sciences. London: Chapman and Hall.

Delmas A. 1911. Catalogue des oiseaux observés dans l'Aveyron. [Catalog of birds observed in Aveyron.] Revue Française d'Ornithologie 2(32):216. {French}

Dement'ev GP, Karaev MK, Kartashev NN. 1955. Ptitsy Yugo Zapadnoi Turkmenii. [Birds of the South Western Turkmenia.] Uchen zap MGU Biologiya [Scientific Notes of Moscow St University Biology] (171). {Russian}

Dementiev GP, Gladkov NA, editors. 1951. Birds of the Soviet Union, Vol. 1. Jerusalem: Israel Program for Scientific Translation.

Des Murs MAPO. 1844. Notice et considérations oölogiques sur la place à assigner au genre ornithologique flamant (*Phoenicopterus,* L.). [Note and oological considerations on the position to assign to the flamingo ornithological genus (*Phoenicopterus*, L.).] Revue Zoologique 7(7):241-246. {French}

Descourtilz ME. 1809. Voyages d'un Naturaliste et ses Observations Faites dans Plusieurs Ports de Mer Française, en Espagne, au continent de l'Amérique Septentrionale, à Saint-Yago de Cuba, à St.-Dominque. [Journeys of a Naturalist and his Observation in Several French Sea Harbors, in Spain, in the Continent of North America, at Saint-Yago of Cuba, at St - Dominque.]. Paris: Dufart. {French}

Dice LR. 1952. Natural Communities. Ann Arbor: University of Michigan Press.

Dillon JT. 1782. Travels Through Spain, 2d ed. London: R. Baldwin.

Din NA, Eltringham SK. 1970. The lesser flamingo in Uganda. East African Wildlife Journal 8:201.

Ditmars RL, Crandall LS. 1951. Guide to the New York Zoological Park. New York: New York Zoological Society.

Dolgushin IA. O flamingo na ozere Tengiz (Tsentral'nyi Kazakhstan). [About Flamingos on the Tengiz Lake (Central Kazakhstan).]. Tr In ta zoologii AN Kazakhskoi SSR [Proceedings of Institute of Zool of Academy of Sciences of the KazakhSSR]; 1960; Alma Ata. Nauka. p 67-95, 125-132. {Russian}

Dolgushin IA. 1960. Otryad Flamingo [Flamingo order]. Ptitsy Kazakhstana [Birds of Kazakhstan Vol I]. Alma-Ata: Acad. Sci. Kazakh SSR. p 224-237. {Russian}

Dolgushin IA, Chekmenev DI. O flamingo na ozere Tengiz. [On flamingos on Tengiz Lake.]. Tez dokl 2 oi Vses orn konf [Abstracts of 2nd All Union Ornithology Conference], Part 2; 1959; Moscow. p 74-75. {Russian}

Domergue C. 1950. Le Chott Djérid station et lieu de ponte du Flamant rose (*Phoenicopterus roseus* Linné). [Chott Djérid post, place of laying of the pink flamingo (*Phoenicopterus roseus* Linné).] Bulletin de la Société des Sciences Naturelles de Tunisie 2:119-128. {French}

d'Orbigny AD, St. Hilaire IG. 1829. Sur une Nouvelle Espèce de Phénicoptère ou flamant (*Phoenicopterus ignipalliatus*). [On a new species of flamingo (*Phoenicopterus ignipalliatus*).] Annales de la Societe des Sciences Naturelles, ser 1 17:454-457. {French}

Dost H, Berger W. 1970. Beobachtungen und Untersuchungen an Flamingos auf Rügen. [Observations and checks of flamingos at Rügen.] Der Falke 17:310-311. {German}

Douglass J. 1716. The natural history and description of the Phoenicopterus or flamingo; with two views of the head, and three of the tongue, of that beautiful and uncommon bird. Royal Society of London, Philosophical Transactions 29(350):532-541.

Drees K. Sexing Chilean Flamingos by Weight. Des Moines, IA: Blank Park Zoo. **

Dresser H. 1908. Eggs of the Birds of Europe. London: Royal Society for the Protection of Birds.

Dresser HE. 1903. A Manual of Palaerctic Birds. London: Author.

Drosdow N. 1967. Verbreitung und Haufigkeit des flamingos in der USSR. [Distribution and abundance of the flamingo in the USSR.] Falke 14:367. {German}

Du Hamel JB. 1701. Regae Scientiarum Academiae Historia, 2d ed. Paris: J. B. Delespine.

du Preez L. 1973. Hand rearing of the lesser flamingo. Bokmakierie 25:105-107.

Du Tertre J-B. 1667. Historire Générale de Antilles Habitées par les François. [General History of the French Inhabitants of Antilles.]. Paris: Thomas Tolly.

Dupond C. 1943. Les Oiseaux de la Belgique. [The Birds of Belgium.]. Brussels: Musée Royal d'Histoire Naturelle de Belgique. {French}

Durnford H. 1877. Notes on some birds observed in the Chuput Valley, Patagonia, and in the neighboring district. Ibis, 4th ser 1(1):41.

Durnford H. 1878. Notes on the birds of central Patagonia. Ibis, 4th ser 2(8):400.

Dutcher W. 1903. Report of the A. O. U. committee on the protection of North American birds. Auk 20(1):119. **

Dyer WA, Walkinshaw LH. 1961. Flamingo in Michigan. Wilson Bulletin 73(4):383. **

Dyunin AG, Isakov YA. 1948. Chaika khokhotun'ya i flamingo na Kaspijskom more. [The Southern Herring Gull and Greater flamingo on the Caspian Sea.] In: G.P.Dement'yev, editor. Moscow. p 60. {Russian}

Egger K. 1965. Die Ketocarotinoide in *Adonis annua* L. [The ketocarotenoid in *Adonis annua* L.] Phytochemie 4:609-618. {German}

Elkin KF. 1969. O flamingo v Tsentral'nom Kazakhstane. [On Flamingos in Central Kazakhstan.]. Ornitologiya v SSSR [Ornithology in the USSR], Book 2: Ashkhabad. p 221-223. {Russian}

Elkin KF, Volkov EN. 1973. Pochemu sokhranilis' flamingo v Tsentral 'nom Kazakhstane. [Why have the Greater Flamingo been saved in Central Kazakhstan.] Priroda [Nature] 1. {Russian}

Elton C. 1927. Animal Ecology. New York: Macmillan.

Ennion HE. 1962. Notes on birds seen in Aden and the Western Aden Protectorate. Ibis 104:560-562.

Erickson BR. 1967. Fossil bird tracks from Utah. Museum Observer, Scientific Museum of Saint Paul (Minnesota) 5:6-12.

Eskildsen J. 1969. Flamingo. Feltornithologen 11:63-67.

Espinosa B. 1871. Zoologische Notizen aus Puerto Rico. [Zoological notes from Puerto Rico.] Der Zoologische Garten 12(11):348-351. {German}

Estes RD. 1973. The flamingo eaters of Ngorongoro. National Geographic Magazine 144(4):534-539.

Etchécopar RD, Hüe F. 1967. The Birds of North Africa. London: Oliver & Boyd.

Euwens PA. 1909. De flamingo (*Phoenciopterus ruber* L.). [The flamingos.] De Levende Natuur 14(1):16-19. {Dutch}

Featherstonhaugh D. 1947. The flamingos of Andros. Natural History 56(1):24-30.

Feduccia A, McGrew PO. 1974. A flamingo-like wader from the Eocene of Wyoming. Contributions to Geology, University of Wyoming) 13(2):49-62.

Ferguson DA. 1972. Waterfowl wintering, resting, and breeding areas of the southwest Caspian Lowlands. Wildfowl 23:5-24.

Fiora A. 1933. El peso de las aves. [The weight of birds.] El Hornero 5(2):180. {Spanish}

Fiora A. 1934. El peso de las aves. [The weight of birds.] El Hornero 5(3):365. {Spanish}

Fisher AK, Wetmore A. 1929. Report on birds recorded by the Pinchot Expedition of 1929 to the Caribbean and Pacific. United States National Museum Proceedings 79(2876):36.

Fisher J. 1939. Birds as Animals. London: Heinemann.

Fitzpatrick AL. 1928. Flamingo in Texas. Oölogist 45(12):166-167.

Forster JGA. 1777. A Voyage Round the World in His Britannic Majesty's Sloop Resolution, Commanded by Capt. James Cook, During the Years 1772, 1773, 1774, and 1775. London: B. White, J. Robson, P. Elmsly & G. Robinson.

Fowler HW. 1904. Birds observed in the Florida Keys. Auk 23(4):397. **

Fox DL. 1947. Carotenoid and indolic biochromes of animals. Annual Review of Biochemistry 16:443-470.

Fox DL. 1953. Animal Biochromes and Structural Colours. Cambridge: University Press.

Fox DL. 1955. Astaxanthin in the American flamingo. Nature 175:942-943.

Fox DL. 1960. Pigments of plant origin in animal phyla. In: Allen MB, editor. Comparative Biochemistry of Photoreactive Systems. New York: Academic Press.

Fox DL. 1962. Carotenoids of the roseate spoonbill. Comparative Biochemistry and Physiology 6:205-210.

Fox DL. 1962. Carotenoids of the scarlet ibis. Comparative Biochemistry and Physiology 5:31-43.

Fox DL. 1962. Metabolic fractionation, storage and display of carotenoid pigments by flamingoes. Comparative Bioochemisty and Physiology 6:1-40.

Fox DL. Selective uptake and display of ingested pigments by flamingos: A review and some continuing puzzles. Centennial Symposium on Scientific Research; 1974; Philadlephia Zoo. p 119-140. **

Fox DL, Hopkins TS. 1965. Exceptional carotenoid metabolism in the Andean flamingo. Nature 206:301-302.

Fox DL, Hopkins TS. 1966. Carotenoid metabolism in the scarlet ibis. Comparative Biochemistry and Physiology 19:267-278.

Fox DL, Hopkins TS. 1966. Comparative metabolic fractionation of carotenoids in three flamingo species. Comparative Biochemistry and Physiology 17:841-856.

Fox DL, McBeth JW. 1970. Some dietary carotenoids and blood carotenoid levels in flamingos. Comparative Biochemistry and Physiology 34:707-713.

Fox DL, McBeth JW, MacKinney G. 1970. Some dietary carotenoids and blood-carotenoid levels in flamingos II. Gamma-carotene and alpha-carotene consumed by the American flamingo. Comparative Biochemistry and Physiology 36:253-262.

Fox DL, Smith VE, Wolfson AA. 1967. Carotenoid selectivity in blood and feathers of lesser (African), Chilean and greater (European) flamingos. Comparative Biochemistry and Physiology 23:225-232.

Fox DL, Wolfson AA, McBeth JW. 1969. Metabolism of b-Carotene in the American flamingo *Phoeniopterus ruber*. Comparative Biochemisty and Physiology 29:1223-1229.

Fox JG, Snyder SB, Schmidt GD, Campbell LH. 1974. Infection with the nematode *Streptocara incognita* in the Chilean flamingo. Journal of Wildlife Diseases 10(1):66-69.

Fraser L. 1846-1848. Zoologia Typica, or Figures of New and Rare Mammals and Birds Described in the Proceedings, or Exhibited in the Collections of the Zoological Society of London. London: Author.

Freiberg MA. 1940. Nombres vulgares de algunas aves de entre rios. [Common names of some birds in rivers.] El Hornero 7(3):399. {Spanish}

Frézier AF. 1712-1714. Relation du Voyage de la Mer du Sud aux Côtes du Chili, du Pérou, et du Brésil fait Pendant les Années 1712, 1713, 1714. [Report of the Journey of the South Sea to the Coast of Chile, Peru, and Brazil made During Years 1712, 1713, 1714,.]. Amsterdam: P. Humbert. {French}

Friedmann H. 1930. Birds collected by the Childs Frick Expedition to Ethiopia and Kenya Colony, Pt 1. Non-Passeres U S National Museum Bulletin no 153.

Friedmann H, Griscom L, Moore RT. 1950. Distributional Check-list of the Birds of Mexico, Pt 1. Berkeley: Cooper Ornithological Club. **

Fritzsche K. 1969. Wesentliche diagnostische Befunde bei Vögeln des Kölner Zoologischen Gartens während der Jahre 1966-1967. [Basic diagnostic results of birds at the Cologne Zoo during the years 1966-1967.] Acta Zoologica et Pathologica Antverpiensia 48:369-371. {German}

Fuhrmann O. 1924. *Hymenolepis macracanthos* (v. Linstow). Considérations sur le genre Hymenolepis. [*Hymenolepis macracanthos* (v. Linstow). Considerations on the genus Hymenolepis.] Journal of Parasitology 11:33-44. {French}

Fuhrmann O. 1936. Un singulier ténia d'oiseau *Gynandrotaenia stammeri*, n. g., n. sp.. [A singular tapeworm of birds *Gynandrotaenia stammeri*, new genus, new species.] Annales de Parasitologie Humaine et Comparée 14(3):261-271. {French}

Fuhrmann O. 1942. Die Hymenolepisarten der Vögel. II. Allgemeiner Teil. [The *Hymenolepis* species of birds. II. General section.] Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene 1 Abt Originale Bd XLII(8):730-755. {German}

Gabriël A. 1938. Tschogogo. Aus dem Leben der Flamingos. [Tschogogo. Of the life of the flamingos.]. Stuttgart: Strecker und Schröder. {German}

Gabrielson IN, Allen RP, Cowan IM, Dumont PA, Pouch RH, Swanson GA. 1950. Report of the A. O. U. committee on bird protection, 1949. Auk 67:316-324. **

Gadow H. 1877. Anatomie des *Phoenicopterus roseus* Pall. und siene Stellung in System. [Anatomy of *Phoenicopterus roseus* and its position in the system.] Journal fur Ornithologie 25:382-397. {German}

Gadow H. 1891. Vögel I, Anatomischer Theil (In Broon's Klassen und Ordnungen des Thier-Reichs). [Birds I, Anatomy (in Broon's classes and orders of the animal kingdom).]. Leipzig: Winter. {German}

Gadow H. 1892. On the classification of birds. Zoological Society of London Proceedings:229-256.

Gadow H. 1893. Vögel II, Systematischer Theil (In Bronn's Klassen und Ordnungen des Thier-Reichs.). [Birds II, Systematics (in Bronn's classes and orders of the animal kingdom).]. Leipzig: Winter. {German}

Gallet E. 1949. Les Flamants roses de Camargue. [The Greater Flamingos of Camargue.]. Lausanne, Switzerland: Payot. {French}

Gallet E. 1950. The Flamingos of the Camargue. Oxford: Basal Blackwell. 127 p. **

Gandrille G, Trotignon J. 1973. Prospection post-estivale au Banc d'Arguin (Mauritanie). [Post-summer exploration at Banc d'Arguin (Maurintania).] Alauda 41(1/2):129-159. {French} **

Gardner LL. 1926. The adaptive modifications and the taxonomic value of the tongue of birds. U S National Museum Proceedings no 67 (Article 19):12-13.

Gassendi P. 1641. Viri Illustris Nicolai Claudii Fabricii de Peiresc. Parisus Sumptibus S Cramoisy.

Gaymer R. 1966. Aldabra-the case for conserving this coral atoll. Oryx 8:348-352.

Gaymer R. 1967. Observations on the birds of Aldabra in 1964 and 1965. Atoll Research Bulletin 118:113-125.

Geoffroy St. Hilaiare I. 1832. Phenicoptère. *Phoenicopterus*, Lin. Magazine de Zoologie, 2d year. {French}

Geoffroy St. Hilaire E. 1797. Sur une nouvelle espèce de *Phoeniciopterus* [*minor*]. [On a new species of *Phoeniciopterus [minor]*.] Millin Magas Encyclopedie 3(6):433-436. {French}

Geoffroy St. Hilaire E. 1798. Sur une nouvelle espèce de *Phoenicipterus* [*minor*]. [On a new species of *Phoenicipterus [minor]*.] Bulletin des Sciences de la Société Philomatique, 2d ser 1:97,98. {French}

Georg PV, Vielliard J. 1970. Midwinter observations on the birds of Central and South Iraq. Bulletin of the Iraq Natural History Museum 4:61-85.

Gerbe Z. 1877. Sur les plumes du vol et leur mue. [On flight feathers and their molt.] Bulletin de la Société Zoologique de France 2(5):289-291. {French}

Gerharts LD, Voous KH. 1968. Natural catastrophes in the flamingo colony of Bonaire, Netherlands Antilles. Ardea 56:188-192.

Géroudet P. 1948. Les Eschassiers, 2d ed. [Waterbirds, 2d ed.]. Neuchatel: Delachaus & Niestlé (La Vie des Oiseaux, v. 2). {French}

Gervais P. 1848-1852. Zoologie et Paléontologie Française (Animaux Vertébrés) ou Nouvelles Recherches sur les Animaux Vivants et Fossiles de la France. [French Zoology and Paleontology (Vertebrate Animals) or New Researches on the Living Animals and Fossils of France.]. Paris: A. Bertrand. {French}

Gesner K. 1555. Conradi Gesneri. Historiae Animalium Liber III qui est de Avium Natura. Tiguri: C. Froschovervm. {Latin}

Gesner K. 1555. Icones Avium Omnium quae in Historia Avium Conradi Gesneri Describuntur. Tiguri: C. Froschovervs. {Latin}

Gewalt W. 1964. Flamingos im Regensturm. [Flamingos in a pouring rain storm.] Beiträge zur Vogelkunde 10:233-234. {German}

Gibert A. 1924. Les flamants en Camargue. [Flamingos in Camargue.] Revue Française d'Ornithologie 8(184-185):449. {French}

Gibert A, Ménégaux A. 1925. Sur la nidification des flamants en Camargue. [On the nesting of flamingos in Camargue.] Revue Française d'Ornithologie 9(191):67-72. {French}

Gibson-Hill CA. 1949. Birds of the Coast. London: Witherby.

Gifford EW. 1913. The birds of the Galapagos Islands, with observations on the birds of Cocos and Clipperton Islands (Columbiformes to Pelecaniformes). Proceedings of California Academy of Science, 4th ser 2:1-132.

Giglioli EH. 1890. Inchiesta Ornitologica in Italia. [Ornithological Investigation in Italy.]. Florence. {Italian}

Gill EL. 1950. A First Guide to South African Birds, 4th ed. Cape Town: M. Miller.

Gladkov NA. 1957. The flamingo in the U.S.S.R. In: Bannerman DA, editor. The Birds of the British Isles Vol 6. London: Oliver & Boyd.

Glegg WE. 1924. On the nesting of the flamingo in the Camargue. British Birds 18(6):146-154.

Glegg WE. 1925. Further notes on the nesting of the flamingo in the Camargue. British Birds 19(6):145-148.

Glegg WE. 1931. The birds of "L'Ile de la Camargue et la Petite Camargue". Ibis, 13th ser 1(3):422-423.

Godfrey R. 1941. Bird-lore of the Eastern Cape Province. Johannesburg: Witwatersrand University Press.

Goldsmith O. 1774. A History of the Earth and Animated Nature. London: Caxton-Press (1840-43).

Goodall JD, Johnson AW, Philippi RA. 1951. Las Aves de Chile; su Conocimiento y sus Costumbres, v. 2. [The Birds of Chile; Their Knowledge and Their Habits, v. 2.]. Buenos Aires: Platt Establecimientos Graficos S. A. {Spanish}

Goodrich AL. 1947. The flamingo in Kansas. Auk 64:469-470. **

Goodwin TW. 1952. The Comparative Biochemsitry of the Carotenoids. London: Chapman & Hall.

Gorgas DM. 1969. Flamingos - stelzbeinige Wasservögel von vier Kontinenten. [Flamingos - long-legged waterbirds from four continents.] Freunde des Kölner Zoo 12(1):15-20. {German} **

Gorgas M. 1971. Erste Flamingobrut im Kölner Zoo. [First flamingo chick at Cologne Zoo.] Zeitschrift des Kölner Zoo 14(2):67-70. {German} **

Gosse PH. 1847. The Birds of Jamaica. London: Van Voorst.

Goubie R. 1899. Sur la nidification du flamant en Camargue. [On the nesting of the flamingo in Camargue.] Ornis 10(3):229-234. {French}

Gouttenoire G. 1955. Inventaire des oiseaux de Tunisie. [Inventory of birds of Tunisia.] Alauda 23:1-64. {French}

Grant CHB, Mackworth-Praed CW. 1934. On the correct name and exact type locality for the greater flamingo of Europe and Asia. Bulletin of the British Ornithologists' Club 54:16-17.

Gray GR. 1869. Notes on the bills of the species of flamingo (*Phoenicopterus*). Ibis, new ser 5:438-443.

Greene ER, Griffin WW, Odum EP, Stoddard HL, Tomkins IR. 1945. Birds of Georgia - A Preliminary Check-List and Bibliography (Georgia Ornithological Society, Occasional papers, No. 2). Athens: University of Georgia Press.

Grekov VS. 1962. O zimovke flamingo v Kzyl Agachskom zapovednike. [On the greater flamingo wintering in Kzyl Agach Nature Reserve.]. Ornitologiya [Ornithology], Issue 5. Moscow: Moscow University Press. p 356-362. {Russian}

Grew N. 1681. Catalogue and Description of the Natural and Artificial Rarities Belonging to the Royal Society and Preserved at Gresham College. London: W. Rawlings.

Grindley JR. 1959. Birds of the Orange River estuary. Ostrich 30:127-129.

Griscom L. 1926. The ornithological results of the Mason-Spinden Expedition to Yucatan. American Museum Novitates:235, 236.

Griswold JA. 1957. Catering to flamingos. America's First Zoo:9.

Griveaud P. 1960. Une mission de recherche de l'I.R.S.M. au Lac Ihotry (S.E. Morombe, Province de Tulcar). [A mission of research of the I.R.S.M. to the Lake Ihotry (S.E. Morombe, Province of Tulcar).] Nationale Malgache 12:33-41. {French}

Grzimek M, Grzimek B. 1960. Flamingos censused in East Africa by aerial photography. Journal of Wildlife Management 24(2):215-217.

Guichard G. 1960. Les Flamants de Camargue. [Flamingos of Camargue.] L'Oiseau 21:48-54. {French}

Guillou JJ, Vielliard J. 1969. Sur la signification possible de la première observation du flamant nain (*Phoeniconaias minor*) dans le domaine paléarctique. [On the possible significance of the first observation of lesser flamingo in the Palearctic region.] Alauda 37:160-161, 355-357. {French}

Gulyaev S. 1870. O flamingakh v Altaiskom gornom okruge. [On flamingoes in Altai mountain district (okrug).] Tomskie gubernskie vedomosti [Tomsk Provincial Gazette] 15. {Russian}

Gundlach J. 1875. Neue Beiträge zur Ornithologie Cubas. [New contributions to the ornithology of Cuba.] Journal für Ornithologie 23(4):368-371. {German}

Gundlach J. 1878. Apuntes para la Fauna Puerto-Riguena. [Notes on the Fauna Puerto-Riguena.] Anales de la R Sociedad Espanola de Historia Natural, Madrid 7:398. {Spanish}

Gundlach J. 1878. Neue Beiträge zur Ornithologie der Insel Portorico. [New contributions to the ornithology of the island of Puerto Rico.] Journal für Ornithologie 26(2):190. {German}

Günther RT. 1899. Contribution to the natural history of Lake Urmia, N. W. Persia and its neighbourhood. Proceedings of the Linnean Society London 27.

Gurney JH. 1918. Ornithological notes from Norfolk for 1917, 24th annual report. British Birds 11(11):255.

Gurney JH. 1921. Early Annals of Ornithology. London: Witherby.

Guyon D. 1856. Note concernant les flamants du lac de Tunis. [Note concerning flamingos of the lake of Tunis.] Revue de Zoologie pure et Appliquée, 2d ser 9:415-416. {French}

Gvosdev EV, Maksimova AP. 1971. To the helminthofauna of *Phoenicopterus roseus* Pallas in Kazakhstan. Trudy Institut Zoologii Alma Ata 31:41-46. {Russian}

Gvozdev EV, Maksimova AP. Novye vidy lentochnykh chervei (Cestoda: Hymenolepidopipidae) ot rozovogo flamingo (*Phoenicopterus roseus* Pall.). [New species of the tape worms (Cestoda: Hymenolepidopipidae) from Greater Flamingo.]. Izv AN Kaz SSR, ser biol [Proceedings of Academy of Science of the Kazakh SSR, ser biol], No 5; 1968. p 30-37. {Russian}

Haavie JH. 1962. A study of the phylogenetic relationships of the flamingos. [Master's Thesis]: Cornell University.

Hachisuka M. 1953. The Dodo and Kindred Birds; or the Extinct Birds of the Mascarene Islands. London: Witherby.

Hagar CN. 1944. Flamingo on the Texas coast. Auk 61(2):301-302. **

Hahn W. 1936. Die Invasion junger Flamingos in Schlesien im Herbst 1935. [The invasion of young flamingos in Silesia in the fall 1935.] Berichte Verhandlungen Schlesischer Ornithologen 21(1):10-15. {German}

Hainard R. 1932. Notes sur la Camargue, 27 mai au 25 Juin 1931. [Notes on the Camargue, 27 May to June 25, 1931.] Archives Suisses d'Ornithologie 1(1):10, 15. {French}

Hambleton JC. 1900. Feeding habits of the scarlet flamingo. Oologist 17:154-155.

Hamilton C. 1953. The pink birds of Nakuru. Country Life 113(2931):812-813.

Hardy E. 1946. A Handlist of the Birds of Palestine. Printed in the Office of the Command Education Officer, British Troops, North Levant, and Published by the Education Officer-in-Chief, G. H. Q. Middle East Forces.

Harper E, Drabble L. 1936. Sobre la nidificación de los flamencos (*Phoenicopterus ruber chilensis* Mol.). [On the nesting of the Chilean flamingo.] El Hornero 6:249-253. {Spanish}

Harper EC. 1950. Nidificación del flamenco en cautividad. [Nesting of the flamingo in captivity.] El Hornero 9(2):242-243. {Spanish}

Harper F. 1929. April birds of the Camargue. Auk 46(3):336-337. **

Harrison L. 1916. The genera and species of Mallophaga. Parasitology 9(1):1-156.

Hartert E. 1902. Die mit Sicherheit festgestellten Vögel der Inseln Aruba, Curaçao und Bonaire. [The birds definitively observed on the islands of Aruba, Curaçao and Bonaire.] Novitates Zoologicae 9:306. {German}

Hartert E. 1912-1922. Die Vögel der Paläarktischen Fauna Bd. 2. [The Birds of the Palaearctic Fauna, Vol. 2.]. Berlin: R. Friedländer und Sohn. {German}

Hartert E. 1923. Die Vögel der Palaearktischen Fauna. Nachtragsband. [The Birds of the Palaearctic Fauna. Addendum.]. Berlin: Friedländer und Sohn. {German}

Hartert E. 1932-1938. Die Vögel der Palaearktischen Fauna, Ergänzungsband. [The Birds of the Palaearctic Fauna, Supplement.]. Berlin: Friedländer und Sohn. {German}

Hartert EJO. 1893. On the birds of the islands of Aruba, Curacao and Bonaire. Ibis, 6th ser 5(19):307, 335-336.

Haverschmidt F. 1970. The past and present status of the American flamingo in the Guianas. Bulletin of the British Ornithology Club 90:74-78.

Hawkins J. 1565. The [second] voyage made by the worshipful M. John Haukins, Esquire, now Knight, Captaine of the Iesus of Lubek, one of her majesties shippes, and Generall of the Salomon, and her two barkes going in his companies to the coast of Guinea, and the Indies of Noua Spania, being in Affrika, and America: begun in An. Dom. 1564. London: Hakluyt Society, Works v. 57 (1878).

Haxo TT. 1950. Carotenoids of the mushroom *Cantharellus cinnabarinus*. Botanical Gazette 112:228-232.

Heim de Balsac H. 1952. Rythme sexuel et fécondité chez les oiseaux du Nord Ouest de l'Afrique. [Sexual rhythm and fertility of birds of the Northwest of Africa.] Alauda 20(4):213-242. {French}

Heim de Balsac H, Heim de Balsac T. 1951. Les migrations des oiseaux dans l'ouest du continent africain. [Migrations of birds in the west of the African continent.] Alauda 19(4):200. {French}

Heliodorus oE. 1575. Histoire Aethiopique. Lyon: Loys Cloquemin et Estienne Michel.

Hellebrekers WPJ. 1950. Measurements and weights of eggs of birds on the Dutch list. Leiden: Brill.

Hellmayr CE. 1932. The Birds of Chile. Field Museum of Natural History, Zoological Series, Publication 308 19:311-314.

Hellmayr CE, Conover B. 1948. Catalogue of Birds of the Americas and the Adjacent Islands. 13 pt. 1 ed. Chicago: Publications of the Field Museum of Natural History.

Hemmingsen AM. 1962. Europæisk Flamingo i og nær Danmark. Dansk Ornithologisk Forenings Tidsskrift 56:33-39.

Henderson M. 1921. Flamingos on migration in the Mediterranean. British Birds 14(10):234-235.

Herman O. 1907. The International Convention for the Protection of Birds Concluded in 1902; and Hungary, Historical Sketch. Budapest: Royal Hungarian Minister of Agriculture. 106, 163 p.

Hernandez F. 1615. Cuatro Libros de la Naturaleza y Virtudes de las Plantas y Animales de la Nueva España. [Four Books of the Nature and Virtues of the Plants and Animals of the New

Spain.]. Publicados en Mexico el Año de 1615 por Francisco Ximenez. Morelia, Imp. y lit. en la Escuelas des Artes à Cargo de J. R. Bravo (1888). {Spanish}

Hess A. 1924. Zum Erscheinen des Flamingos in der Schweiz. [On the appearance of the flamingo in Switzerland.] Der Ornithologische Beobachter 21(10):152-154. {German}

Hesse Ev. 1907. Über den inneren knöchernen Bau des Vogelschnabels. [About the inner bone construction of the bird beak.] Journal für Ornithologie 55:185-248, 476. {German}

Heuglin MTv. 1869-1873. Ornithologie Nordost Afrikas, der Nilquellen und Küsten-Gebiete des Rothen Meeres und des Nördlichen Somalilandes. [The Ornithology of Northeast Africa, the Sources of the Nile and the Coastal Areas of the Red Sea and Northern Somalia.]. Cassel: T. Fischer. {German}

Hickey JJ. 1952. Survival studies of banded birds.U. S. Fish and Wildlife Service. Special Scientific Report no. 15. Wildlife.

Hidalgo Argueso J. 1974. Sobre la mortandad massiva de Aves en las marismas del Guadalquivir durante el verana de 1973. [On the massive mortality of birds in the swamps of the Guadalquivir during the summer of 1973.] Ardeola 20:187-197. {Spanish}

Hillaby J. 1956. Death of flamingos in the Camargue. Nature 177:1247.

Hochbaum HA. 1944. The Canvasback on a Prairie Marsh. Washington: American Wildlife Institute.

Hoffman L. 1954. Premiers résultats de l'étude des migrations des flamants de Camargue. [First results of the survey of migrations of flamingos of Camargue.] Alauda 22:40-43. {French}

Hoffmann L. 1954. Essais de baguage de flamants en Camargue. [Tests of flamingo ringing in Camargue.] La Terre et la Vie 101(1):39-43. {French}

Hoffmann L. 1955. La nidification des Flamants en 1955. [The nesting of flamingos in 1955.] La Terre et la Vie 102:315-320. {French}

Hoffmann L. 1956. La nidification des Flamants en 1956. [The nesting of flamingos in 1956.] La Terre et la Vie 104:179-181. {French}

Hoffmann L. 1957. La nidification des Flamants en 1956. [The nesting of flamingos in 1956.] La Terre et la Vie 11:179-181. {French}

Hoffmann L. 1958. La nidification des Flamants en 1958. [The nesting of flamingos in 1958.] La Terre et la Vie 107:118-119. {French}

Hoffmann L. 1958. La nidification des Flamants en 1959. [The nesting of flamingos in 1959.] La Terre et la Vie 109:78-79. {French}

Hoffmann L. 1961. La nidification des Flamants en 1960 et 1961. [The nesting of flamingos in 1960 & 1961.] La Terre et la Vie 110:289-297. {French}

Hoffmann L. 1963. La nidification des Flamants en 1962 et 1963. [The nesting of flamingos in 1962 & 1963.] La Terre et la Vie 111:331-334. {French}

Hoffmann L. 1964. La reproduction des Flamants en 1962 et 1963. [The reproduction of flamingos in 1962 & 1963.] Revue d'Ecologie (Terre Vie) 18:331-333. {French}

Holt EG. 1924. Flamingos (*Phoenicopterus ruber*) in Florida. Auk 41(4):598-599. **

Holt EG. 1933. Recent records of the flamingo in Florida. Auk 50(2):207-208. **

Holub E, Pelzeln Av. 1882. Beiträge zur Ornithologie Südafrikas. [Contributions to the Ornithology of South Africa.]. Wien: A. Hölder. {German}

Hoogenhout H. 1972. Als een vlam in de lucht. [Like a flame in the sky.] Blijdorp Geluiden 20:3-5. {Dutch}

Hopkins GHE. 1942. The Mallophaga as an aid to the classification of birds. Ibis 84:94-106.

Hornaday WT. 1913. Our Vanishing Wild Life; Its Extermination and Preservation. New York Zoological Society.

Housse E. 1948. Les Oiseaux du Chili. [Birds of Chile.]. Paris: Masson. {French}

Howard H. 1950. Fossil evidence of avian evolution. Ibis 92:11-21.

Howard H. 1955. Fossil birds from Manix Lake, California. Professional Papers of the United States Geological Survey 264-J:199-205.

Howard H. 1969. Avian fossils from three Pleistocene sites in central Mexico. Contributions in Science 172:1-11.

Howe RH, Jr., King L. 1902. Notes on various Florida birds. Contributions to North American Ornithology 1:25-32.

Howell AH. 1928. Birds of Alabama, 2d ed. Montgomery: Alabama Department of Game and Fisheries.

Howell AH. 1932. Florida Bird Life. New York: Coward-McCann.

Howell JC. 1937. Flamingo seen in Florida. Auk 54:99. **

Hudson WH. 1918. Far Away and Long Ago. New York: Dutton.

Hudson WH. 1920. Birds of La Plata. vol. 2. New York: Dutton and Co.

Hudson WH. 1923. Idle Days in Patagonia. New York: Dutton.

Hughes RA. 1970. Notes on the birds of the Mollendo district, southwest Peru. Ibis 112(229-241).

Hugues A. 1933. Les flamants roses. [The greater flamingos.] Le Saint-Hubert 31(1):59-60. {French}

Hugues A. 1937. Contribution à l'etude des oiseux du Gard, de la Camargue et de la Lozère; avec quelques notes sur les oiseaux de la Corse. [Contribution to the survey of birds of the Gard, the Camargue and the Lozère; with some notes on birds of Corsica.] Alauda 3(9):151-209. {French}

Humboldt FHA, Bonpland JA. 1799-1804. Voyage aux Régions Equinoxiales du Nouveau Continent, Fait en 1799-1804. [Journey to the Equinox Regions of the New Continent, Made in 1799-1804.]. Paris: F. Schoell et G. Dufoux (1805-1837). {French}

Hummelinck PW. 1952. Islote Avre, een Vogelleiland in de Caraibische Zee. De West-Indische Gide 33:23-34.

Humphrey PS, Bridge D, Reynolds PW, Peterson RT. 1970. Birds of Isla Grande (Tierra del Fuego). Washington, D.C.: Smithsonian Institution.

Hungerford DA, Snyder RL, Griswold JA. 1966. Chromosome analysis and sex identification in the management and conservation of birds. Journal of Wildlife Management 30:707-712.

Huxley J. 1942. Evolution: The Modern Synthesis. New York: Harper.

Huxley TH. 1867. On the classification of birds, and on the taxonomic value of the modifications of certain of the cranial bones observed in that class. Proceedings of the Zoological Society of London:415-472.

Ingersoll E. 1923. Birds in Legend, Fable, and Folklore. New York: Longmans, Green.

Ingraham DP. Observations on the American flamingo *Phoenicopterus ruber*. In: Mrs. E. Irene Rood under the direction of Dr. Elliott Coues, editor. Papers presented to the World's Congress on Ornithology; 1893; Chicago. Charles H. Sergel Co., 1896. p 59-69.

Ingraham DP. 1894. Do wading birds swim? Nidiologist 2(2):25.

Ingram C. 1908. Bird life in the Rhône Delta. The Field 112(2206):467-468.

Ingram C. 1924. On the nesting of the flamingo in the Camargue. British Birds 18(7):198.

International Union for the Protection of Nature. 1950. The position of nature protection throughout the world in 1950. France: Pierre Doignon.

Ioganzen GE. 1911. Zabludivshiesya krasnokryly (*Phoenicopterus roseus*) v Sibiri v nachale zimy 1907 g. [The missed greater flamingo in Siberia at the beginning of winter in the year 1906.] Ornitologicheskiy Vestnik [Ornithological Bulletin] 3(4):332-342. {Russian}

Irby LHL. 1895. Ornithology of the Straits of Gibraltar. London: R. H. Porter.

Isakov YA. 1948. K voprosu o rasprostranenii flamingo v SSSP. [On question about distribution of flamingo in the USSR.]. Chajka khokhotun'ya i flamingo na Kaspiyskom more [Yellow-legged gull and flamingo in the Caspian Sea]. Moscow: Glavn. upravlenie po zapovednikam RSFSR [Main Department on Nature Reserves of the RSFSR. p 55-60. {Russian}

Isakov YA. 1948. Zametki po biologii flamingo. [Notes on the Flamingo biology.] Ibidem:45-55. {Russian}

Isakov YA, Formozov AN. 1946. Neperiodicheskie migratsii (zalety) flamingo v SSSR. [Nonperiodical migrations of flamingos in the U.S.S.R.] Zoologichesky Zhurnal 25(5):473-480. {Russian}

Jackson FJ. 1938. Birds of Kenya Colony and the Uganda Protectorate. London: Gurney and Jackson.

Jacob E. 1939-1940. Wege der Zusammenarbeit von Ornithologie und Parasitenforschung. [Ways of co-operation between ornithology and parasitology.] Zeitschrift für Parasitenkunde 11:607-610. {German}

Jacobi EF. 1971. Bezoek aan de flamingo's op Bonaire. [Visit to the flamingos on Bonaire.] Artis 17:40-45, 90-97. {Dutch}

Jacobi EF. 1974. Lake Nakuru. Artis 20:51-57. {Dutch}

Jeffries JA. 1881. On the number of primaries in birds. Nuttall Ornithological Club Bulletin 6(3):156.

Jeffries JA. 1882. Krukenberg on the coloring matter of feathers. Nuttall Ornithological Club Bulletin 7(2):115.

Jenkin PM. 1929. Biology of lakes in Kenya. Nature 124:574.

Jenkin PM. 1936. Reports on the Percy Sladen Expedition to some Rift Valley lakes in Kenya in 1929. Summary of the ecological results, with special reference to the alkaline lakes. Annual Magazine of Natural History, ser 10 18:133-181.

Jenkin PM. 1957. The filter-feeding and food of flamingos (Phoenicopteri). Philosophical Transactions of the Royal Society of London Series B no 674 240:401-493.

Jensen L, Jensen NH. 1934. Flamingoen ved Tipperne 1933. Dansk Ornithologisk Forenings Tidsskrift 28:25-28.

Joensen AH, Madsen J. 1895. Waterfowl and raptors wintering in wetlands of western Greece, 1983-85. Natura Jutlandica 21:169-200.

Johansen HV. 1908. *Phoenicopterus roseus* (Pall.): auf einem Irrfluge durch Sibierien. [*Phoenicopterus roseus* (Pall.): on a stray flight through Siberia.] Ornithologisches Jahrbuch 19:215-225. {German}

Johnson AR. 1966. Les Flamants en 1964 et 1965. [The flamingos in 1964 & 1965.] La Terre et la Vie 20:255-257. {French}

Johnson AR. 1970. La nidification des Flamants de Camargue en 1968 et 1969. [The nesting of flamingos in the Camargue in 1968 & 1969.] La Terre et la Vie 24:594-603. {French}

Johnson AR. 1973. La nidification des Flamants de Camargue en 1970 et 1971. [Nesting of Camargue's flamingos in 1970 and 1971.] La Terre et la Vie 27:95-101. {French}

Johnson AW. 1965. The Birds of Chile and Adjacent Regions of Argentina, Bolivia and Peru. Vol. 1. Buenos Aires: Platt Establecimientos gráficos.

Johnson AW. 1967. The Birds of Chile and Adjacent Regions of Argentina, Bolivia and Peru. Vol. 2. Buenos Aires: Platt Establecimientos gráficos.

Johnson AW. 1972. Supplement to the Birds of Chile and Adjacent Regions of Argentina, Bolivia and Peru. Buenos Aires: Platt Establecimientos Gráficos.

Johnson AW, Behn F, Millie WR. 1958. The South American flamingos. Condor 60(5):289-299. **

Johnston HH. 1881. Letters, extracts, announcements, etc. Ibis, 4th ser 5(17):173-174.

Johnston HH. 1902. The Uganda Protectorate. London: Hutchinson & Co.

Johnstone ST. 1970. 1969 breeding season. Wildfowl 21:138.

Johnstone ST. 1970. Keeping and breeding flamingos at Slimbridge. Avicultural Magazine 76:18-21.

Johnstone TS. 1973. Breeding flamingos at Slimbridge. Aviculture Magazine 79(3):84-87.

Jonstonus H. 1650. Historia Naturalis; de Avibus. Francofurti: Matth. Merian.

Jourdain FCR. 1924. Letter. British Birds 18(7):198.

Jourdain FCR, Witherby HF. 1910. Recent records from Staffordshire, Warwickshire and Worcester. British Birds 4(4):106.

Journal of the Bombay Natural History Society. 1901. Osteology of the flamingos. Annals of Carnegie Museum 1:295-324.

Kahl MP. 1970. East Africa's majestic flamingos. National Geographic Magazine 137(2):276-294.

Katayama T, Yokoyama H, Chichester CO. 1970. The biosynthesis of astaxanthin. International Journal of Biochemistry 1:438.

Keahey KK, Trapp AL. 1969. Diagnoses and classification of diseases in exotic animals. Journal of the American Veterinary Medical Association 115:1136-1140.

Kear J. 1969. A brief guide to flamingos. Wildfowl 20:141.

Kear J. 1970. The adaptive radiation of parental care in waterfowl. In: Crook JH, editor. Social Behavior in Birds and Mammals. London: Academic Press.

Kear J. 1974. Notes on keeping flamingos in captivity. International Zoo Yearbook 14:142-144. **

Keler S. 1939-1940. Zur kenntnis der Mallophagen-fauna polens. 2. Beitrag. [Contribution to the knowledge of Mallophaga fauna of Poland.] Zeitschrift für Parasitenkunde 11:47-57. {German}

Keler S. 1960. Über die dualistische differenzierung der gattung *Anatoecus* Cummings (Mallophaga). [Over the binaryistic differentiation of the genus *Anatoecus* Cummings (Mallophaga).] Zeitschrift für Parasitenkunde 20:207-316. {German}

Kenya. 1925-1929. Laws and regulations issued during the years 1925-1929. International Review of Legislation for the Protection of Nature, 1926 (Brussels, 1930) 1926, 1927:8, 1.

Khengarji MSoK. 1893. The flamingo breeding in India. Bombay Natural History Society Journal 8(4):553-554.

Khengarji MSoK. 1904. The flamingo (*Phoenicopterus roseus*) breeding on the Rann of Kutch. Bombay Natural History Society Journal 15(4):706-707.

Kingsley JS, editor. 1885. Standard Natural History. Boston: S. E. Cassino.

Kirkman FB, editor. 1913. The British Bird Book. London: Jack.

Kirkman FBB. 1937. Bird Behaviour: A Contribution Based Chiefly on a Study of the Black-headed Gull. London: T. Nelson & Sons.

Kittredge GL. 1916. Cotton Mather's scientific communications to the Royal Society. American Antiquarian Soc, Worcester, MA, Proceedings, new ser 26:18-57.

Klein JT. 1750. Historiae Avium Prodrous cum Praefatione de Ordine Animalium in Genere. Lubeck: Ionam Schmidt. {Latin}

Klingel GC. 1940. Inagua. New York: Dodd, Mead & Company.

Klockenhoff H, Madel G. 1970. Über die Flamingos (*Phoenicopterus ruber roseus*) der Dasht-e-Nawar in Afghanistan. [About the greater flamingos of the Dasht-e-Nawar in Afghanistan.] Journal für Ornithologie 111:78-84. {German}

Klohn W. 1972. Hidrografià de las zonas deserticas de Chile. [Hydrography of the desert zones of Chile.] Santiago de Chile: Programa de las Naciones Unidas para el Desarrollo. {Spanish}

Klös H-G. 1967. A brief note on breeding flamingos at West Berlin Zoo. International Zoo Yearbook 9:122. **

Knowlton FH. 1909. Birds of the World. New York: Holt.

Koeman JH, Pennings JH, de Goeij JJM, Tjioe PS, Olindo PM, Hopcraft J. 1972. A preliminary survey of the possible contamination of Lake Nakuru in Kenya with some metals and chlorinated hydrocarbon pesticides. Journal of Applied Ecology 9(2):411-416. **

Koenig A. 1932. Die Schwimmvögel (*Natatores*) Aegyptens; die Ruderfüsser (*Steganopodes*) Aegyptens; die Flügeltaucher (*Urinatores*) Aegyptens. Journal für Ornithologie 80:special number 81-91.

Kofoid CA. 1924. On the revealing and concealing coloration of birds: an unpublished letter by Theodore Roosevelt. Condor 26(3):94-98. **

Kolb P. 1727. Naaukeurige en Uitvoerige Beschryving van de Kaap de Goede Hoop. Amsterdam: B. La Keman. {Dutch}

Kolmogorov M. 1925. K zaletam flamingo v okrestnosti g.Ust ' Kamenogorska. [On records of vagrant flamingos in Ust' Kamenogorsk town vicinities.] Okhotnik Altaya [Hunter of Altai] 3(3). {Russian}

König H, al. e. 1967. Einige Mucormykosen bei Rind, Schwan, Katze, Reh und Flamingo. [Some mucormycosis in the cattle, swan, cat, roe deer and flamingo.] Schweizerisches Archiv für Tierheilkunde 5 109:260. {German}

Kozlova EV, Tugarinov AJ. 1947. Fauna SSSR. Ptitsy, t. 1, vyp. 3. Gagaroobraznye, trubkonosye, veslonogie, aistoobraznye, flamingo. [Fauna of USSR. Birds. Vol. 1, No. 3. Columbiformes, Procellariiformes, Pelecaniformes, Ciconiiformes, Phoenicopteriformes.]. Moscow: Izd-vo Akademii nauk SSSR. 285-299, 313 p. {Russian}

Kritzler H. 1942. Carotenoids in display plumages of African bishop birds. Anatomical Record Philadelphia 84:528.

Kritzler H. 1943. Carotenoids in the display and eclipse plumages of bishop birds. Physiological and Biochemical Zoology Chicago 16:241-255.

Krukenberg CFW. 1881. Die Farbstoffe der Federn. [The dyes of feathers.] Dessen Vergleichenden Physiologische Studien 1(5):72-92. {German}

Kumerloeve H. 1961. Zur Kenntnis der Avifauna Kleinasiens. [About the Knowledge of the Avifauna of Asia Minor.]. Bonner Zoologische Beiträge 12 Sonderheft. 318 p. {German}

Kumerloeve H. 1962. Der Flamingo, *Phoenicopterus ruber*, in Kleinasien und Syrien. [The flamingo, *Phoenicopterus ruber*, in Asia Minor and Syria.] Die Vogelwelt 83:177-181. {German}

Kumerloeve H. 1966. Le Lac Djabboul, a l'est d'Alep, Syrie, lieu d'hivernage des flamants. [Le Lac Djabboul, at the East of Alep, Syria, is the place of flamingo winter.] Alauda 34:39-44. {French}

Kurbanova D. 1973. [*Ptiloxenus phoenicopteri* (Megn. et Trt.) on the flamingo from Krasnovod (Gasankulii) Reserve.]. In: Tashliev AO, Meledzhaeva MA, editors. [Parasites of animals in Turkmenia]. Ashkhabad: Ylym. p 79-82. {Russian}

Kuschel R. 1970. Algunas observaciones ornitolgicas en valles y altiplano de los departaments de Arica y Pisaque, Provincia de Tarapacà. [Some ornithological observations in valleys and highlands of the departments of Arica and Pisaque, County of Tarapacà.] Boletin Ornitólogico 2:2-4. {Spanish}

La Lande JJIF. 1778. Des Canaux de Navigation et Spécialement du Canal de Languedoc. [Of Navigation Channels and Especially of the Channel of Languedoc.]. Paris: Desaint. {French}

Labat JB. 1722. Nouveau Voyage aux Isles de l'Amérique, Contenant l'Histoire Naturelle de ces Pays. [New Journey to the Island of America, Containing Natural History of These Countries.]. Paris: P. F. Giffart (v. 4, p. 425; v. 6, pp. 382-386; v.8, pp. 290-292.). {French}

Lambrecht K. 1933. Handbuch der Palaeornithologie. [Handbook of Paleornithology.]. Berlin: Gebrüder Borntraeger. {German}

Lang EM. 1958. Erstmals in einem europäischen Zoo: Junger Flamingo. [For the first time in an European zoo: A young flamingo.] ZOLLI-Bulletin des Vereins der Freunde des Zoologischen Gartens Basel 1:13. {German}

Lang EM. 1961. Flamingozucht in Basel. [Flamingo breeding at Basel.] Bijdragen tot de Dierkunde 31:51-52. {German} **

Lang EM. 1963. Flamingos raise their young on a liquid containing blood. Experientia 19:532-533. **

Lang EM, Thiersch A, Thommen H, Wackernagel H. 1962. Was füttern die Flamingos (*Phoenciopterus ruber*) ihren Jungen? [What do flamingos feed (*Phoenciopterus ruber*) their young?] Der Ornithologische Beobachter 59(6):173-176. {German} **

Latham J. 1785. A General Synopsis of Birds. London: Leigh, Sotheby & Son. (1781-1802).

Latham J. 1824. A General History of Birds. Winchester: Jacob & Johnson.

Lavauden L. 1924. Voyage de M. Guy Babault en Tunisie. Résultats Scientifiques: Oiseaux. [Journey of M. Guy Babault in Tunisia. Scientific results: Birds.]. Paris: Blondel-Laroughery. {French}

Lavauden L. 1926. Les Vertébrés du Sahara. [Vertebrates of the Sahara.]. Tunis: Imprimerie Albert Guénard. {French}

Lebedeva M. 1971. O mechenii flamingo. [On marking of flamingo.] Okhota i okhotn khoz vo [Hunt and hunting industry] 4. {Russian}

Lebedeva M, Shevarova T. 1971. O zaletakh flamingo. [On vagrant flamingos.] Ibidem 7:18-19. {Russian}

Lederer E. 1935. Echinenone et pentaxanthin: deux nouveaux carotenoids trouves dans l'oursin (*Echinus esculentus*). [Echinenone and pentaxanthin: two new carotenoids found in the sea urchin (*Echinus esculentus*).] Comptes Rendus de l'Academie des Sciences Paris 201:300-302. {French}

Ledru AP. 1796-1798. Voyage aux Iles Ténériffe, La Trinité, Saint Thomas, Sainte Croix et Porto-Ricco, depuis le 30 Septembre 1796 jusqu'au 7 Juin 1798. [Journey to the Island Ténériffes, The Trinidad, Saint Thomas, Saint Croix and Puerto-Ricco, since September 30, 1796 until June 7, 1798.]. Paris: Arthur Bertrand, 1810. 209 p. {French}

Legge WV. 1878-1880. A History of the Birds of Ceylon. London: Author (self-published).

Leguat F. 1708. Voyage et Aventures de F. L. & de ses Compagnons en Deux Isles Désertes des Indes Orientales. [Journey and Adventures of F. L. & of His Mates in Two Desert Isles of Oriental Indies.]. London: D. Mortier. {French}

Lehmann-Nitsche R. 1926. Las aves en el folklore Sudamericano. [The birds in South American folklore.] El Hornero 3(4):377-378, 383. {Spanish}

Lentheric CH. 1878. La Grèce et l'Orient en Provence, Arles, le bas Rhône, Marseille, 2d ed. [Greece and the Orient in Provence, Arles, the low Rhone, Marseille. 2nd ed.]. Paris: Plon. {French}

Lenz F. 1930. Ein Afrikanischer Salzwasser-*Chironomus* aus dem Mageninhalt eines Flamingos. [An African saltwater *Chironomus* from the stomach-content of a flamingo.] Archiv für Hydrobiologie 21(3):447-454. {German}

Leotard. 1888. Capture des flammants. [Capture of flamingos.] Feuille des Jeunes Naturalistes 18(208):54.

Lesson RP. 1831. Traité d'Ornithologie. [Treaty of Ornithology.]. Paris: F. G. Levrault. {French}

Lester CG. 1898. The flamingo breeding in India. Journal of the Bombay Natural History Society 11(2):321.

Lévêque R. 1963. Le status actuel des Vertebrés rares et menacés de l'archipel des Galapagos. [The present status of rare and threatened vertebrates of the Galapagos archipelago.] La Terre et la Vie 110:397-430. {French}

Lévêque R. 1963. The status of some rarer Galapagos birds. International Council for Bird Preservation 9:96-98.

Lévêque R. 1964. Notes sur la reproduction des oiseaux aux iles Galapagos. [Notes on the reproduction of birds in the Galapagos Islands.] Alauda 32:5-44; 81-96. {French}

Leybold F. 1873. Escursión a las Pampas Arjentinas; Hojas de mi Diario, Febrerio de 1871. [Excursion to Pampas Argentina. Pages of My Diary, February 1871.]. Santiago: Imprenta Nacional.

L'Herminier FJ. 1827. Recherches sur l'appareil sternal des oiseaux. [Research on the sternal apparatus of birds.] Mémoires de la Société Linnéenne de Paris no 6:1-93. {French}

L'Herminier FJ. 1827. Recherches sur l'appareil sternal des oiseaux. [Research on the sternal apparatus of birds.] Bulletin des Sciences Naturelles, Férussac 12(94):121. {French}

L'Herminier FJ. 1828. Recherches sur l'Appareil Sternal des Oiseaux, 2d ed. [Research on the Sternal Apparatus of Birds.]. Paris: Desbousseaux. {French}

Lilford TL. On the breeding of the flamingo in southern Spain. Zoological Society of London; 1880. p 446-450.

Lindeman RL. 1942. The tropic-dynamic aspects of ecology. Ecology 23(4):399-418.

Lindsay S, Chaikoff IL. 1963. Description of arterio-sclerotic lesions in the class Aves. In: Sandler GHBM, editor. Atherosclerosis and its Origins. New York: Academic Press.

Lint KC. Flamingos in captivity. Zoo Aviculturists Symposium. p 10-13. **

Lister M. 1678. Historiae Animalium Angliae Tres Tractatus. London: apud Joh. Martyn Regiae Societatis Typographum.

Liversidge R. 1958. The bird population of the dams of the Free State goldfields. Ostrich 29:107-111.

Liversidge R. 1962. Further notes on the wildfowl of the O.F.S. goldfields. Ostrich 33:29-32.

Liversidge R, Broekhuysen GH, Thesen AR. 1958. The birds of Langebaan Lagoon. Ostrich 29:95-106.

Lloyd W. 1887. Birds of Tom Green and Concho Counties, Texas. Auk 4(3):185. **

Lomont H. 1939. Nidification des Flamants en 1939. [Nesting of flamingos in 1939.] Bulletin de la Societe Nationale D'Acclimatation de France 87-88:79. {French}

Lomont H. 1950. Observations ornithologiques. [Ornithological observations.] La Terre et la Vie 1950:241-243. {French}

Lomont H. 1953. Sur le comportement nourricier de *Phoenicopterus ruber roseus* Pallas. [On the feeding behavior of *Phoenicopterus ruber roseus* Pallas.] Vie et Milieu, Laboratoire Arago – Universite de Paris 4(4):713-717. {French}

Lomont H. 1954. Observations ornithologiques sur les Flamants. [Ornithological observations on flamingos.] La Terre et la Vie 101(1):28-38. {French}

Lomont H. 1954. Rapport sur le baguage des jeunes flamants en 1953. [Report on the young flamingo ringing in 1953.] La Terre et la Vie 101(1):44-46. {French}

Lönnberg E. 1930. Einige Studien über die Lipochrome der Fische. [Some studies about the lipochrome of fish.] Arkiv för Zoologi 214(10):1-29. {German}

Lönnberg E. 1930. Zur Kenntnis der "Lipochrome" der Vogel. [To the knowledge of the lipochrome in birds.] Arkiv for Zoologi 214(11):1-12. {German}

Lönnberg E. 1934. On the occurrence of carotenoid pigments in the eggs of certain animals. Arkiv for Zoologi Stockholm 28A(4):1-14.

Loomis LM. 1886. *Phoenicopterus ruber* as a South Carolina bird. Auk 3(3):408. **

López RE. 1891. Los flamencos. [The flamingos.] El Zulia Ilustrado 1(26):211-213. {Spanish}

Lortet D, Gaillard C. 1909. La faune momifiée de l'Ancienne Egypte. Mollusques. [Fauna mummified of the ancient Egypt. Mollusks.] Archives du Musée d'Histoire Naturelle de Lyon 10(2):105-122. {French}

Loudon Hv. 1910. Meine dritte Reise nach Zentral-Asien und ihre ornithologische Ausbeute. II. [My third trip to central Asia and its ornithological results. II.] Journal für Ornithologie 58(1):1-90. {German}

Lowery GH, Jr., Dalquest WW. 1951. Birds from the State of Vera Cruz, Mexico. University of Kansa, Museum of Natural History Publications 3(4):549.

Lucas FA. 1890. Catalogue of skeletons of birds collected at the Abrolhos Islands, Brazil, the Straits of Magellan, and the Galápagos Islands, in 1887-1888. (Scientific Results of Explorations by U. S. Fish Commission Steamer Albatross. No. XIII). U S National Museum Proceedings 13(798):129.

Lucas J. 1974. Flamingos of the World. In: Sitwell N, editor. Wildlife '74. p 62-67.

Lydekker R, editor. 1895. The Royal Natural History. London: Frederick Warne.

Mackworth-Praed CW, Grant CHB. 1952. Birds of Eastern and Northeastern Africa. African Handbook of Birds. London: Longmans, Green & Co.

Macnae W. 1960. Greater flamingoes eating crabs. Ibis 102:325-326.

Madon P. 1932. Contribution à l'étude du régime de Flamant rose. [Contribution to the study of the diet of the greater flamingo.] Alauda (2e ser) 4:37-40. {French}

Magaud D'Aubusson L. 1906. Le flamant rose. [The greater flamingo.] Le naturaliste, 2d ser 20(469, 468):191-192; 206-208. {French}

Mainardi D. 1962. Immunological data on the phylogenetic relationships and taxonomic position of flamingos. Ibis 104(3):426-428.

Malbrant R. 1936. Faune du Centre Africain Française (Mammifères et Oiseaux). [Fauna of the Central French Africa (Mammals and Birds).]. Paris: Paul Lechevalier. {French}

Malbrant R, Maclatchy A. 1949. Faune de l'Equateur African Française. Oiseaux. [Fauna of the Equitorial French Africa. Birds.]. Paris: Paul Lechevalier. {French}

Malzy P. 1967. Le flamants à Madagascar. [The flamingos of Madagascar.] L'Oiseau 37:242-243. {French}

Manigault GE. 1885. Monthly report of the South Carolina Department of Agriculture Circular #5, new ser., August 1.

Mann WM. 1938. Wild Animals In and Out of the Zoo. New York: Smithosonian Scientific Series, Inc.

March WT. 1864. Notes on the birds of Jamaica. Proceedings of the Academy of Natural Sciences of Philadelphia 16:65.

Marchand A. 1877. Poussins des oiseaux d'Europe. [Chicks of birds of Europe.] Revue et Magazin de Zoologie, 3rd ser 5:432-434. {French}

Markham BJ. 1971. Censo invernal de cisnes y flamencos en Magallanes. [Winter census of swans and flamingos in Magallanes (Chile).] Anales del Instituto de la Patagonia 2(1-2):146-157. {Spanish}

Martini E. 1974. Vogelreste aus dem Miozän von Ravolzhausen (Kr. Hanau, Hessen). Notizbl Hess Landesamtes Bodenforsch Wiesbaden 102:136-142.

Mathews FB. 1898. Expeditions. Nassau Mission Quarterly September.

Matthews GVT. 1971. A visitor survey at Slimbridge. Wildfowl 22:126-132.

Mayaud N. 1938. L'avifaune de la Camargue et des Grands Etangs Voisins de Berre et de Thau. [The birds of the Camargue and the big neighboring ponds of Berre and Thau.] L'Oiseau, new ser 8(2):284-349. {French}

Mayaud N. 1945. Les passages accidentels de flamants roses *Phoenicopterus ruber roseus* Pallas en France. [The incidental crossings of greater flamingos in France.] L'Oiseau, new ser 15:107-110. {French}

Maynard CJ. 1881. The Birds of Eastern North America, rev. ed. Newtonville, MA: C. J. Maynard & Co.

Maynard CJ. 1888. Notes on the breeding habits of the American Flamingo. Oologist 5:108-110.

Mayr E. 1946. History of the North American bird fauna. Wilson Bulletin 58(1):3-41. **

McAtee WL. 1911. Winter ranges of geese on the Gulf Coast; notable bird records for the same region. Auk 28(2):274. **

McAtee WL. 1932. Effectiveness in nature of the so-called protective adaptations in the animal kingdom, chiefly as illustrated by the food habits of Nearctic birds. Smithsonian Miscellaneous Collections 85(7):1-201.

McCann C. 1939. The flamingo (*Phoenicopterus ruber antiquorum* Temm.). Journal of the Bombay Natural History Society 41(1):12-38.

McCann C. 1947. Flamingos in Kutch - a comment. Journal of the Bombay Natural History Society 47:164-166.

McGrew PO. 1971. An Eocene flamingo nesting area, Sweetwater County, Wyoming. National Geographic Society Research Reports 12:473-478.

McLachlan GR, Liversidge R. 1970. Roberts' Birds of South Africa. Cape Town: Trustees John Voelcker Book Fund.

Mees GF. 1952. Notes sur quelques oiseaux de la Corse. [Notes on some birds of Corsica.] Alauda 20(2):81. {French}

Meiklejohn MFH. 1935. Some autumnal notes on the birds of the Camargue. Ibis, 13th ser 5(1):204.

Meinertzhagen R. 1928. Some biological problems connected with the Himalaya. Ibis, 12th ser 4(3):480-533.

Meinertzhagen R. 1930. Nicholl's Birds of Egypt. London: Hugh Rees.

Meinertzhagen R. 1954. The Birds of Arabia. Edinburgh: Oliver & Boyd.

Meinertzhagen R. 1958. Greater flamingoes in Kenya. Ibis 100:624.

Menegaux A. 1934. Les Oiseaux de France. [The Birds of France.]. Paris: Paul Lechevalier. {French}

Menegaux HA. 1909. Etude d'une collection d'oiseaux provenant des hauts plateaux de la Bolivie et du Pérou Meridional. [Study of a bird collection resulting from the high plateaus of Bolivia and Southern Peru.] Bulletin de la Société Philomatique 10(1):205-229. {French}

Menegaux HA. 1915. Le flamant pygmée du Centre de l'Afrique. [The lesser flamingo of the Center of Africa.] Revue Française d'Ornithologie 4(72):49-52. {French}

Merrem B. 1812-1813. Tentamen Systematis Naturalis Avium. Ex Osteologiae Principiis. Abhandlungen Preuss Akad Wiss:237-259.

Meyer de Schauensee R. 1970. A Guide to the Birds of South America. Wynnewwod, PA: Livingston Publ. Co.

Middlemiss E. 1953. Flamingos in the Rondevlei Bird Sanctuary. Bokmakierie 5(1):9-12.

Middlemiss E. 1958. Feeding habits of lesser flamingos. Ostrich 29:5-9.

Middlemiss E. 1961. Notes on the Greater Flamingo. Bokmakierie 12(1):9-14.

Miller AH. 1944. An avifauna from the Lower Miocene of South Dakota. University of California, Publications Bulletin of the Department of Biological Science 27:85-100.

Miller AH. 1963. The fossil flamingos of Australia. Condor 65(4):289-299. **

Miller L. 1944. A Pliocene flamingo from Mexico. Wilson Bulletin 56(2):77-82. **

Miller L. 1950. A Miocene flamingo from California. Condor 52(2):69-73. **

Miller L. 1952. The avifauna of the Barstow Miocene of California. Condor 54(5):296-301. **

Milne-Edwards A. 1869-1871. Recherches Anatomiques et Paléontologiques pour Servir à l'Histoire des Oiseaux Fossiles de la France. [Anatomical and Paleontological Research as a Tool for Understanding the History of the Fossil Birds of France.]. Paris: Masson. {French}

Milon P, Petter J-J, Randrianasolo G. 1973. Faune de Madagascar. Oiseaux. [Madagascar Fauna: Birds.]. Tananarive / Paris: ORSTOM / CNRS. {French}

Misonne X. 1953. Les grands quartiers d'hiver du Sud-Est de la Mer Caspienne. [The big districts of wintering birds of the Southeast of the Caspian Sea.] Le Gerfaut 43(2-3):103-127. {French}

Mitchell C. 1957. Ballerinas in Pink. National Geographic Magazine 102(4):553-571.

Mitchinson MJ, Keymer IF. 1972. Tuberculosis aortitis in birds. Journal of Comparative Pathology 82:483-486.

Moehring PHB. 1752. Avium genera. Venevnt Bremae: Apud Ger. Gvil. Rvmp. Avricae, Typis Tapperisanis.

Molina JI. 1782. The Geographic, Natural and Civil History of Chile. Alsop TftoibR, translator. Middletown, Conn: I. Riley, 1808.

Molodovskiy AV. 1963. Flamingo na Yuzhnom Mangyshlake. [The greater flamingo on Southern Mangyshlak.] Zool zhurnal [Zoological Journal] 42(12):1885-1886. {Russian}

Moltoni E. 1953. Alcune catture di Fenicottero, *Phoeenicopterus ruber roseus* Pallas, avvenute sul continente italiano. [Some captures of flamingo, *Phoeenicopterus ruber roseus Pallas*, that occurred on the Italian continent.] Rivista Italiana di Ornitologia 23:39-40. {Italian}

Moreau de Saint-Mery MLE. 1797-1798. Description Topographique, Physique, Civile, Politique et Historique de la Partie Française de l'Ile Saint-Dominque. [Topographic, Physical Description, Civilian, Politics and History of the French Part of Saint-Dominque.]. Philadelphia: Author. {French}

Moreau RE. 1944. Clutch-size: A comparative study with special reference to African birds. Ibis 86(3):286-347.

Morillo C. 1973. Nueva cita de *Phoeniconaias minor* en España. [New reference of *Phoeniconaias minor* in Spain.] Ardeola 19:14-15. {Spanish}

Morrison T. 1968. Three flamingos of the high Andes. Animals 11(7):305-309.

Morrison T. 1972. The rarest flamingo. Oryx 11:270-272.

Mourgue M. 1920. Oiseaux observés en Tunisie du 8 mai au 8 Juin 1920. [Birds observed in Tunisia of May 8 to June 8, 1920.] Revue Française d'Ornithologie 6(136-137):124. {French}

Mulsow R. 1969. La colonia andaluza de *Phoenicopterus ruber* en agosto de 1966. [The Andalusian colony of *Phoenicopterus ruber* in August of 1966.] Ardeola 13:244. {Spanish}

Munn PW. 1926. Additional notes on the birds of the Balearic Islands. Ibis, 12th ser 2(3):472.

Muravlev GG. Rozovoe flamingo v tsentralnykh raionakh Kazakhstana. [The greater flamingo in the central regions of Kazakhstan.]. Uch Zap Kazakhsk Un ta [Proceedings of Kazakhstan University]; 1960. p 140-141. {Russian}

Murphy RC. 1924. The marine ornithology of the Cape Verde Islands. American Museum of Natural History Bulletin 50(3):277-278.

Murphy RC. 1925. Bird Islands of Peru. New York: Putnam.

Nazarow PS. 1886. Recherches zoologiques des steppes des Khirgiz. [Zoological researches in steppes of the Khirgizes.] Bulletin de la Société des Naturalistes Moscow 62(4):365. {French}

Neifel'd IA, Neruchev VV, Khudyakov IV. 1967. Novye dannye o flamingo na severo vostochnom poberezh'e Kaspiya. [New data on flamingos in the North Eastern shore of the Caspian Sea.]. Ornitologiya [Ornithology]. Moscow: Moscow University Press. p 375-377. {Russian}

Newman TH. 1910. Notes from Northwest Africa. Avicultural magazine 3d ser 1(7):218.

Newton A. 1893-1896. A Dictionary of Birds. London: Adam and Charles Black.

Newton A, Newton E. 1857-1858. Observatons on the birds of St. Croix, West Indies, made between February 20 and August 6, 1857, and between March 4 and September 28, 1858. Ibis 1: 59-69, 138-150, 252-264, 365-379.

Nice MM. 1938. The ninth international ornithological congress. Bird Banding 9:190-195. **

Nice MM, Schantz WE. 1959. Head-scratching movements in birds. Auk 76:339-342. **

Nicoll W. 1925. A reference list of the trematode parasites of British birds. Parasitology 15:151-202.

Niedfeld G. 1923. Nombrees vugares de Algunas aves de Santa Fe. [Common names of birds at Santa Fe.] El Hornero 3(2):188. {Spanish}

Niethammer G, editor. 1938. Handbuch der Deutschen Vogelkunde. Band 2. [Handbook of German Ornithology.]. Leipzig: Akademische Verlagsgesellschaft. {German}

Niethammer G. 1953. Zur Vogelwelt Boliviens. [About the world of birds of Bolivia.] Bonner Zoologische Beiträge 4:195-303. {German}

Niethammer G, Schwind HV. 1969. "Operation Flamingo" in der Etoschapfanne (SW-Afrika). ["Operation Flamingo" at the Etosha Pan (SW-Africa).] Journal für Ornithologie 110:505. {German}

Niethammer J. 1967. Zwei Jahre Vogelbeobachtungen an stehenden Gewässern bei Kabul in Afghanistan. [Two years of bird watching at standing waters in Afghanistan close to Kabul.] Journal für Ornithologie 108:119-164. {German}

Niethammer J. 1970. Die Flamingos am Ab-i-Istada in Afghanistan. [The flamingos at the Ab-i-Istada in Afghanistan.] Natur und Museum 100(5):201-210. {German}

Nieuwendijk JG. 1972. De Camargue, land van zout, moeras en riet. [The Camargue; land of salt, marsh and reed.] Artis 18:18-23. {Dutch}

Ninni E. 1911. Cattura di un fenicottero in Provincia di Venezia. [Capture of a flamingo in Province in Venice.] Rivista Italiana di Ornitologia 1(1-2):84. {Italian}

Nitzsch CL. 1833. Pterylographia Avium Pars Prior. Halle: Typis Expressum Gebaueriis. {Latin}

Nitzsch CL. 1839. Observationes de Avium Arteria Carotide Communi. Halle.

Nitzsch CL, Burmeister CCH. 1840. System der Pterylographie. Halle: Eduard Anton.

Nogge G. 1974. Beobachtungen an den Flamingobrutplätzen Afghanistans. [Observations at the breeding places of flamingos in Afghanistan.] Journal für Ornithologie 115(2):142-151. {German}

Northrop JI. 1891. The birds of Andros Island, Bahamas. Auk 8(1):78-79. **

Nouvel J, Bullier P, Rinjard J. 1957. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique pendant l'année 1956. [Report on the mortality and birthrate recorded at the Zoological Park during the year 1956.] Bulletin du Muséum d'Histoire Naturelle, 2d série 29(4):297-309. {French}

Nouvel J, Bullier P, Rinjard J. 1958. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique pendant l'année 1957. [Report on the mortality and birthrate recorded at the Zoological Park during the year 1957.] Bulletin du Muséum d'Histoire Naturelle, 2d série 30(3):241-254. {French}

Nouvel J, Chauvier G, Strazielle L. 1961. Rapport sur la mortalité et la natalité enregistrées à la Ménagerie du Jardin des Plantes pendant l'année 1959. [Report on the mortality and birthrate recorded at the Ménagerie du Jardin des Plantes during 1959.] Bulletin du Muséum d'Histoire Naturelle, 2d série 33(1):63-78. {French}

Nouvel J, Chauvier G, Strazielle L. 1965. Rapport sur la mortalité enregistrées à la Ménagerie du Jardin des Plantes pendant l'année 1963. [Report on the mortality recorded at the Ménagerie du Jardin des Plantes during 1963.] Bulletin du Muséum d'Histoire Naturelle, 2d série 37(4):563-579. {French}

Nouvel J, Chauvier G, Strazielle L. 1965. Rapport sur la mortalité et la natalité enregistrées à la Ménagerie du Jardin des Plantes pendant l'année 1964. [Report on the mortality and birthrate recorded at the Ménagerie du Jardin des Plantes during 1964.] Bulletin du Muséum d'Histoire Naturelle, 2d série 37(6):891-906. {French}

Nouvel J, Rinjard J, Ciarpaglini P, Pasquier M-A. 1965. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1964. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1964.] Bulletin du Muséum d'Histoire Naturelle, 2d série 37(5):747-759. {French}

Nouvel J, Rinjard J, Ciarpaglini P, Pasquier M-A. 1965. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1964. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1964.] Bulletin du Muséum d'Histoire Naturelle, 2d série 37(4):580-592. {French}

Nouvel J, Rinjard J, Ciarpaglini P, Pasquier M-A. 1967. Effectif, moralité et la natalité enregistrée au Parc Zoologique de Paris pendant l'année 1966. [Total number, mortality and birthrate recorded at Paris Zoological Park during 1966.] Bulletin du Muséum d'Histoire Naturelle, 2d série 39(4):615-631. {French}

Nouvel J, Rinjard J, Ciarpaglini P, Pasquier M-A. 1967. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1966. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1966.] Bulletin du Muséum d'Histoire Naturelle, 2d série 39(2):241-253. {French}

Nouvel J, Rinjard J, Ciarpaglini P, Pasquier M-A, Prot-Lassale J. 1964. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1962. [Report on the mortality and birthrate recorded at Paris Zoological Park during 1962.] Bulletin du Muséum d'Histoire Naturelle, 2d série 36(6):727-739. {French}

Nouvel J, Rinjard J, Pasquier M-A. 1959. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique pendant l'année 1958. [Report on the mortality and birthrate recorded at the Zoological Park during the year 1958.] Bulletin du Muséum d'Histoire Naturelle, 2d série 31(2):121-133. {French}

Nouvel J, Rinjard J, Pasquier M-A. 1960. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique pendant l'année 1959. [Report on the mortality and birthrate recorded at the Zoological Park during 1959.] Bulletin du Muséum d'Histoire Naturelle, 2d série 32(6):455-472. {French}

Nouvel J, Rinjard J, Pasquier M-A. 1961. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique pendant l'année 1960. [Report on the mortality and birthrate recorded at the Zoological Park during 1960.] Bulletin du Muséum d'Histoire Naturelle, 2d série 33(6):549-562. {French}

Nouvel J, Rinjard J, Pasquier M-A. 1963. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1961. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1961.] Bulletin du Muséum d'Histoire Naturelle, 2d série 35(2):123-135. {French}

Nouvel J, Rinjard J, Pasquier M-A. 1968. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1967. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1967.] Bulletin du Muséum d'Histoire Naturelle, 2d série 40(3):453-464. {French}

Nouvel J, Rinjard J, Pasquier M-A. 1969. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1968. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1968.] Bulletin du Muséum d'Histoire Naturelle, 2d série 41(3):609-621. {French}

Nouvel J, Rinjard J, Pasquier M-A, Perrin F. 1970. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique de Paris pendant l'année 1969. [Report on the mortality and birthrate recorded at the Paris Zoological Park during 1969.] Bulletin du Muséum d'Histoire Naturelle, 2d série 42(5):817-829. {French}

Nouvel J, Rinjard J, Pasquier M-A, Perrin F, Leclerc M. 1972. Rapport sur la mortalité et al natalité enregistrées au Parc Zoologique pendant l'année 1970. [Report on the deaths and births recorded at the Zoological Park during 1970.] Bulletin du Muséum National d'Histoire Naturelle Paris Zoologie, 3rd Série 23:2-15. {French}

Nouvel J, Saez H. 1961. Différentes souches d'Aspergillus recueillies sur des oiseaux du Parc Zoologique au cours de l'année 1959. [Different strains of Aspergillus collected on birds from the Zoological Park during the year 1959.] Bulletin du Muséum d'Histoire Naturelle, 2d série 33(2):218-220. {French}

Nouvel J, Saez H. 1961. Un cas de Candidose pulmonaire du Ragondin *Myocastor coypu* Molina et autres mycoses observées au Parc Zoologique de Paris. [A case of pulmonary Candidose of the Ragondin *Myocastor coypu* Molinas and other mycoses observed at the Paris Zoological Park.] Bulletin du Muséum d'Histoire Naturelle, 2d série 33(3):346-347. {French}

Nouvel J, Saez H. 1963. Cas d'aspergilloses aviaires observés au Parc Zoologique de Paris au cours de l'année 1961. [Case of avian aspergillosis observed at the Zoological Park of Paris during the year 1961.] Bulletin du Muséum d'Histoire Naturelle, 2d série 35(1):106-110. {French}

Nouvel J, Seguy E. 1946. Quelques ectoparasites des animaux sauvages du Parc Zoologique du Bois de Vincennes. [Some ectoparasites from the wild animals at the Bois de Vincennes Zoological Park.] Bulletin du Muséum d'Histoire Naturelle, 2d série 18(1):65-68. {French}

Nouvel J, Strazielle L, Chauvier G. 1961. Rapport sur la mortalité et la natalité enregistrées à la Ménagerie du Jardin des Plantes pendant l'année 1960. [Report on the mortality and the birthrate recorded at the Ménagerie du Jardin des Plantes during 1960.] Bulletin du Muséum d'Histoire Naturelle, 2d série 33(3):244-258. {French}

Oberholser HC. 1938. The Bird Life of Louisiana (Louisiana Department of Conservatoin bulletin #28). New Orleans: T. J. Moran & Sons.

Odham G, Stenhagen E. 1971. The chemistry of preen gland waxes of waterfowl. Accounts of Chemical Research 4(4):121-128. **

Ogilvie MA. 1972. Large numbered leg bands of individual identification of swans. Journal of Wildlife Management 36:1261-1265.

Olivier G. 1950. The Camargue - "Everglades" of southern France. Audubon Magazine 52(1):14-20.

Olney PJS, Ellis P. 1960-2000. Census of birds bred in captivity. International Zoo Yearbook 1-37:various pages.

Ormond JF. 1941. Vols d'Oiseaux: Instantanés. [Flights of birds: Instantaneous.]. Geneva: Roto-Sadag. {French}

Osche G. 1958. Beiträge zur Morphologie, Ökologie und Phylogenie der *Ascaridoidea* (Nematoda). Parallelen in der Evolution von Parasit und Wirt. [Contributions to the morphology, ecology and phylogeny of the Ascaridoidea (Nematoda). Parallels in the evolution of parasite and host.] Zeitschrift für Parasitenkunde 18:479-572. {German}

Oustalet JFE. 1886. Les flamants. [Flamingos.] La Nature 14(1):134-138. {French}

Owen R. 1832. On the anatomy of the Flamingo. Proceedings of the Zoological Society London 1832:141-144.

Pallas PS. 1811. Zoographia Rosso-Asiatica. Petropoli in Officina Caes. Academiae Scientiarum Impress. Edit 1831.

Palmer LS. 1922. Carotinoids and Related Pigments. The Chromolipids. New York: Chemical Catalog Co.

Palmer RS, editor. 1962. Handbook of North American Birds, Volume 1. New Haven, CT: Yale University Press.

Paludan K. 1959. On the birds of Afghanistan. Videnskabelige Meddelelser Dansk Naturhistorisk Forening 122:332.

Pan American Union. 1942. Convention and Documentary Material on Nature Protection and Wild Life Preservation in the Western Hemisphere. Washington.

Panouse JB. 1958. Nidification des Flamants Roses au Maroc. [Nesting of the greater flamingo in Morocco.] Comptes Rendus de l'Academie des Sciences Nat Maroc 24:110.

Parker H. 1886. Notes from Ceylon. Ibis 5th ser 14:188.

Patrick R. 1961. Results of researches in the Antofagasta ranges of Chile and Bolivia, II: Diatoms (Bacillariophyceae) from the alimentary tract of *Phoenicoparrus jamesi* (Sclater). Postilla 49:43-57.

Pearson DL, Plenge MA. 1974. Puna bird species on the coast of Peru. Auk 91(626-631). **

Pearson J. 1965. "Save the flamingo": was it a good idea? Oryx 8:48-50.

Pearson TG. 1924. Campaigning in Panama and Cuba. Bird-Lore 26(4):294-300.

Pearson TG. 1924. Flamingoes in Cuba. Auk 4:599. **

Pearson TG. 1932. The large wading birds. National Geographic Magazine 62(4):444, 452-453, 468-469.

Pearson TG. 1936. The flamingo comes to Florida. American Forests 42(9):410-411, 435-436.

Pearson TG. 1937. Adventures in Bird Protection. New York: D. Appleton-Century.

Peña LE. 1961. Explorations in the Antofagasta range, with observations on the fauna and flora. Postilla 49:3-42.

Peña LE. 1962. Notes on South American flamingos. Postilla 69:1-8.

Penard FP, Penard AP. 1908. De Vogels van Guyana (Surinam, Cayenne en Demerara). [The Birds of Guyana (Surinam, Cayenne and Demerara).]. Paramaribo's-Gravenhage: Martinus Nijhoff. {Dutch}

Pennak RW. 1942. Ecology of some copepods inhabiting intertidal beaches near Wood's Hole, Massachusetts. Ecology 23(4):446-456.

Pennycuick CJ, Bartholomew GA. 1973. Energy budget of the lesser flamingo (*Phoeniconaias minor* Geoffroy). East African Wildlife Journal 11:199-207.

Pereyra JA. 1937-1938. Aves de la Zona Riberena Nordeste de la Provincia de Buenos Aires. Memorias del Jardin Zoologico. [Birds in the zone of the Northeast Bank of Buenos Aires. Memories of the Jardin Zoo.] Tome IX (2a parte). {Spanish}

Perez Vigueras I. 1941. Nota sobre varios vermes encontrados en el "Flamenco" (*Phoenicopterus ruber*). [Notes on several variations found in the "Flamingo".] Memorias de la Sociedad Cubana de Historia Natural 15(3):327-336. {Spanish}

Perrault C. 1734. Description anatomique d'un Bécharu (*Phoenicopterus*). [Anatomical description of a flamingo.] Mémoires de l'Académie des Sciences depuis 1666 jusque 1699 3(3):42-49. {French}

Pesard A. 1941. Etude quantitative comparée des cellules de Purkinje du Cervelet des oiseaux et de quelques mammifères. [Quantitative compared studies of cells of Purkinje of birds and some mammals cerebellum.] Bulletin de l'Institut Royal des Sciences Naturelles de Belgique Biologie 75(1):1-87. {French}

Peters JL. 1931. Check-list of the Birds of the World. Vol. I. Cambridge, MA: Harvard Univ. Press.

Petersen E. 1959. Flamingo ved Roskilde. [Flamigos in Roskilde.] Feltornithologen 1:34. {Danish}

Pététin M, Trotignon J. 1972. Prospection hivernale au Banc d'Arguin (Mauritanie). [Winter exploration at the Banc d'Arguin (Mauritania).] Alauda 40(3):195-213. {French} **

Petrides GA. 1943. Variation in the outermost greater primary covert as related to method of flight. Auk 60:264-265. **

Phelps WH, Phelps WH, Jr. 1958. Lista de las Aves de Venezuela con su distribución. Tomo II, Parte I. No Passeriformes. [List of the birds of Venezuela with their distribution. Volume II, Part I. No Passeriformes.] Boletin de la Sociedad Venezolana Ciencias Naturales 19:1-317. {Spanish}

Plotnikov VN. 1908. O flamingo (Pavlodarskiy uezd Semipalatinskoi obl.). [On flamingo (Pavlodar uzed of Semipalatinsk Region).] Okhotnichya Gazeta [Hunting Newspaper] 35:363-364. {Russian}

Poley D. 1971. Flamingos. Die Gerfiederte Welt 95(5):92-95. {German}

Poncy. 1926. Biologie et migration du flamant rose, *Phoenicopterus ruber antiquorium*. [Biology and migration of the greater flamingo.] Bulletin de la Société Zoologique de Géneve 3:5-433. {French}

Poncy R. 1925. Distribution géographique des lieux de ponte du Flamant rose (*Phoencopterus ruber antiquorum* Temm.) et de quelques autres espèces d'échassiers et palmipèdes. [Geographical distribution of the laying sites of the greater flamingo and of a few other species of water birds and waterfowl.] Revue Francaise d'Ornithologie 9:112. {French}

Poncy R. 1928. Complément à la biologie du Flamant rose *Phoeniciopterus ruber antiquorum* (Brehm). [Complement to the biology of the greater flamingo.] Ornithologische Beobachter 25:168-171. {French}

Porter RN, Forrest GW. 1974. First successful breeding of Greater Flamingo in Natal, South Africa. Lammergeyer 21:26-33.

Poulding RH. 1957. Tuberculosis in gulls: a preliminary investigation. Bulletin of the British Ornithologists' Club 77:144-149.

Poulsen H. 1967. Flamingoer i Zoo. Naturens Verden 50:239-243.

Radford CD. 1952. The mites (*Acarina*: Analgesidae) living on or in the feathers of birds. Parasitology 42:199-230.

Rahner C. 1887. Briefliches über *Phoenicopterus jamesi* Rahm. [Correspondence about *Phoenicopterus jamesi*.] Journal für Ornithologie 35:160-162. {German}

Rand AL. 1936. The distribution and habits of Madagascar birds. Bulletin of the American Museum of Natural History 72:143-499.

Rao K. 1896. The Flamingo (*Phoenicopterus roseus*) breeding on the Rann of Kutch. Journal of the Bombay Natural History Society 15(4):706-707.

Ratcliffe HL. 1946. Tuberculosis in captive wild birds: decrease of its incidence following a change in diets. American Review of Tuberculosis 54:389-400.

Ratcliffe HL. 1956. Adequate Diets for Captive Wild Animals. Philadelphia Zoo: Penrose Research Lab.

Rechnitzer AB. 1958. Flamingo in a Southern California Slough. Condor 61:156. **

Rendón-Martos M, Ramirez JM, Rendon MA, Vargas JM, Calderon J, Chans JJ, Garcia L, Canas C. Anillamiento de Pollos de Flamenco en la Reserva Natural "Laguna de Fuente de Piedra". [Banding Flamingo Chicks at the Nature Reserve Laguna de Fuente de Piedra.]. Junta de Andalucia: Consejeria de Medio Ambiente. 14 p. {Spanish} **

Rich F. 1932. Phytoplankton from the Rift Valley lakes in Kenya. Annals and Magazine of Natural History, ser 10 10:233-262.

Ridgway R. 1895. On birds collected by Doctor W. L. Abbott in the Seychelles, Amirantes, Gloriosa, Assumption, Aldabra, and adjacent islands, with notes on habits, etc. by the collector. Proceedings United States Natural Museum 18:509-546.

Ridley MW. 1954. Observations on the diet of flamingos. Journal of the Bombay Natural History Society 52:5-7.

Ridley MW, Moss BL, Percy RC. 1955. The food of flamingoes in Kenya Colony. Journal East African Natural History Society 22(5):147-158.

Ridley MW, Percy RC. 1953. Notes on the birds of Lake Elmenteita, Kenya Colony. Proceedings of the Univesity of Durham Philological Society 12:103-118.

Riley JH. 1905. List of birds collected or observed during the Bahama expedition of the Geographic Society of Baltimore. Auk 22:349, 351. **

Ritter K. 1836. Naturhistorische Reise nach der Westindischen Insel Hayti, auf Kosten Sr. Majestät des Kaisers von Oesterreich. [Natural historic expedition to the West Indian island Haiti, on expenses of his Majesty the Emperor of Austria.]. Stuttgart: Hallberger. {German}

Riviere BB. 1931. Ornithological report for Norfolk for 1930. British Birds 24(11):315.

Riviere BB. 1932. Ornithological report for Norfolk for 1931. British Birds 25(12):350.

Riviere BB. 1935. Ornithological report for Norfolk for 1934. British Birds 28(12):362.

Roberts A. 1940. The Birds of South Africa. London: Witherby.

Robin AD. 1966. Nidifications sur l'Iriki, daya temporaire du Sud-Marocain en 1965. [Breeding on Iriki, temporary lake in South-Morocco in 1965.] Alauda 34:81-101. {French}

Robin P. 1968. L'avifaune de l'Iriki (Sud-Marocain). [The avifauna of the Iriki (South-Moroccan).] Alauda 36:237-253. {French}

Rohr W. 1964. Beobachtungen bei der Erstzucht eines Rosaflamingos in Deutschland im Berliner Zoo. [Observations made during the first rearing of a greater flamingo in Germany at the Berlin zoo.] Die Gefiederte Welt 88:46-49. {German}

Rondelet G. 1554-1555. Gvlielmi Rondeletii. Libri de Piscibus Marinis, in quibus Verae Piscium Effigies Expressae Sunt. Lungduni: apud matthiam Bonhomme.

Roosevelt T. 1910. African Game Trails. New York: Scribner.

Rooth J. 1965. The flamingos on Bonaire (Netherlands Antilles): habitat, diet, and reproduction of *Phoenicopterus ruber ruber*. Uitgaven Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen No. 41:1-151.

Rooth J. 1967. De soorten flamingo's en hun verspreiding. [Flamingo species and their distribution.] Vogeljaar 15:304-309. {Dutch}

Rooth J. 1974. De ontwikkelingen in het flamingoreservaat op Bonaire. [The developments in the Flamingo Reserve on Bonaire.] Stinapa 8:50-57. {Dutch} **

Rossi JAH. 1956. Notas ornitologicas I observaciones sobre el flamenco (*Pheonicopterus ruber chilensis* Molina) en cautividad. [Observations on the Chilean flamingo in captivity.] El Hornero 10:166. {Spanish}

Rossi JAH. 1969. Notas ornitologicas II observaciones sobre el flamenco (*Pheonicopterus ruber chilensis* Molina) en cautividad. [Ornithological notes II: observations on the Chilean flamingo in captivity.] Acta Zoologica Lilloana 25(1):1-6. {Spanish} **

Rothausen K. 1966. Fossile Flamingos im Tertiar des Mainzer Bekens. [Fossilized flamingos in the Tertiar des Mainzer Bekens.] Zeitschrift Rheinishche Naturforschende Gesellschaft 4:26-31. {German}

Rothschild LW, Hartert EJO. 1897. A review of the ornithology of the Galápagos Islands, with notes on the Webster-Harris Expedition. Novitates Zoologicae 6(2):182, 202.

Rothschild M, Clay T. 1957. Fleas, Flukes & Cuckoos: a Study of Bird Parasites. New York: Macmillan. 305 p. **

Russell A. 1756. The Natural History of Aleppo and Parts Adjacent. London: printed for A. Millar.

Rutgers A, Norris KA, editors. 1970. Encyclopedia of Aviculture, Volume 1. London: Blandford.

Ryman CP. 1908. Capture of the flamingo at Lake Worth, Florida. Auk 253(313). **

Rzehak. 1895. Capture de flamants en Silésie. [Capture of flamingos in Silésie.] Feuille des Jeunes Naturalistes, 3d ser 26:38. {French}

Saez H. 1961. Quelques cas d'Aspergillose aviaire observés au Parc Zoologique de Paris: le Parasite et l'Hôte. [A few cases of avian Aspergillosis observed at the Paris Zoological Park: the parasite and the host.] Annales de Parasitologie Humaine et Comparée 36:154-165. {French}

Saez H. 1965. *Aspergillus fumigatus* Fresenius, isolé chez l'animal. Analyse portant sur 4 années de recherche. [*Aspergillus fumigatus* Fresenius, isolated from animals. Analysis on 4 years of research.] Annales de Parasitologie Humaine et Comparée 40:105-118. {French}

Saez H. 1971. Analyse des facteurs: sexe, age, importation, réceptivité animale dans l'aspergillose aviaire, basée sur 10 années de recherche chez des sujets sauvages captifs. [Analysis of factors: gender, age, importation, animal receptiveness in avian aspergillosis, based on 10 years of research on captive wild-caught subjects.] Revue de Medecine Veterinaire 147:1063-1077. {French}

Salas R, Kast R, Montecinos R, Sallas I. 1966. Geología y recursos minerales del departamento de Arica. [Geology and mineral resources of the department of Arica.]. Chile, Santiago de Chile: Boletin No. 21 Instituto de Investigaciones Geológicas. {Spanish}

Salerne F. 1767. L'Histoire Naturelle, Eclaircie dans une de Ses Parties Principales, l'Ornithologie. [Natural History, Cleared Up in One of Its Principal Parts, Ornithology.]. Paris: Chez Debure Père. {French}

Salvadori AT. 1864. Catalogo degli Uccelli di Sardegna. [Catalog of the Birds of Sardinia.]. Milano: Tip. Bernardoni. {Italian}

Salvadori AT. 1872. Uccelli. [Birds.]. Mialano: F. Vallardi. {Italian}

Salvadori AT. 1895. Catalogue of the Birds of the British Museum, v. 27. *Chaenomorphae, Crypturi*, and *Ratitae*. British Museum.

Salvin O. 1885. On a collection of birds from the island of Cozumel. Ibis, 5th ser 3(10):186.

Salvin O. 1888. A list of birds of the islands of the coast of Yucatan and the Bay of Honduras. Ibis, 5th ser 6(22):259.

Salvin O, Godman FD, editors. 1879-1904. Biologia Centrali-Americana. [Biology Central-American.]. London: Taylor and Francis. {Italian}

Santos Gollan J. 1951. Un refugio de aves acuaticas; el Parque Nacional Laguna Blanca. [A refuge of aquatic birds; the Parque Nacional Laguna Blanca.] El Hornero 9(3):286. {Spanish}

Sauer EGF, Rocher CJV. 1966. Flamingo nests and eggs on Etosha Pan, South West Africa. Special publication no. 6. Windhoek, Namibia: S. W. A. Scientific Society.

Saunders H. 1871. A list of the birds of southern Spain. Ibis, 3d ser 1(4):394-396.

Savage C. 1964. Lake Rezaiyeh: a specialized summer habitat for shelduck and flamingos. Wildfowl Trust Annual Report 15:108-113.

Savage C. 1973. Die Camargue. [The Camargue.] In: Sitwell N, editor. Wildlife '73. München: Südwest Verlag. p 122-125. {German}

Savage CDW. The wildfowl and wetlands situation in West Pakistan; ditto in the Levant; Notes on secondary production in the lake Rezaiyeh ecosystem in Iran. Proceedings of the Tech Meeting of the Wetland Conservation IUCN pub No 12 Morges; 1968.

Scaliger JC. 1556. Ivlii Caesaris Scaliger in Libros Duos, qui Inscribvntur de Plantis, Aristotele Avtore, Libri Duo. Lvtetiae: ex Officina M. Vascosani.

Schaeck FD. 1890. Note sure les migrations des oiseaux à travers les montagnes. [Note on migrations of birds through mountains.] Bulletin de la Société Zoologique de France 15(1):18-19. {French}

Schaeck FD. 1910. Les flammants ou Phénicoptères. [The flamingo or Phoenicopteres.] Le naturaliste, 2d ser 32:55-56. {French}

Schelley GE. 1871. Contributions to the ornithology of Egypt. Ibis, 3d ser 1(3):314.

Schomburgk MR. 1840-1844. Reisen im Britisch-Guiana in den Jahren 1840-1844, 3: 761. [Expeditions in British Guiana in the years 1840-1844.]. Leipzig: J. J. Weber. {German}

Schönwetter M. 1960-1967. Handbuch de Oologie, Bd. 1. [Handbook of Oology, Vol. 1.]. Berlin: Akademie-Verlag. {German}

Schorger AW. 1938. Unpublished manuscripts by Cotton Mather on the passenger pigeon. Auk 55(3):474-475. **

Schüz E. 1959. Die Vogelwelt des Südkaspischen Tieflandes. [The world of birds of the South Caspian lowland.]. Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung. {German}

Sclater PL. 1857. On a collection of birds received by M. Sallé from southern Mexico. Proceedings of the Zoological Society of London 25:236.

Sclater PL. 1867. Notes on the birds of Chili. Proceedings of the Zoological Society of London 35:334,339.

Sclater PL. 1868. List of birds collected in the Straits of Magellan by Dr. Cunningham, with remarks on the Patagonian avifauna, XV. Ibis, ns 4(14):189.

Sclater PL. 1880. Remarks on the present state of the Systema Avium. Ibis, 4th ser 4(16):399-410 [Reprinted in Nuttall Ornithological Club Bulletin 396(392): 373-384, 1881.].

Sclater PL. 1886. List of a collection of birds from the Province of Tarapacá, Northern Chili. Proceedings of the Zoological Society of London (June):399-401.

Sclater PL. 1910. Revised List of the Birds of Jamaica (Based on the List of Alfred and Edward Newton in the 'Handbook of Jamaica for 1881'). Reprinted from Handbook of Jamaica for 1910, p. 16. Kingston: Institute of Jamaica.

Sclater PL, Salvin O. 1868. List of birds collected at Conchitas, Argentine Republic, by Mr. William H. Hudson. Proceedings of the Zoological Society of London 26:145.

Scott P. 1965. "Save the flamingo": was it a good idea? Oryx 8:50-51.

Scott WED. 1889. A summary of observations on the birds of the Gulf Coast of Florida. Auk 6(1):13-14. **

Scott WED. 1890. An account of flamingos (*Phoenicopterus ruber*) observed in the vicinity of Cape Sable, Florida. Auk 7(3):221-226. **

Scott WED. 1891. Observations on the birds of Jamaica, West Indies. II. A list of birds recorded from the island, with annotations. Auk 8(4):365. **

Seba A. 1734-1765. Locupletissimi Rerum Naturalium Thesauri Accurata Descriptio, et Iconibus Artificiossimis Expressio, per Universam Physices Historiam. Armstelaedami: apud Janssonio-Waesbergios.

Seebohm H. 1882. Notes on the birds of Astrakhan. Ibis, 4th ser 6(22):227.

Selevin Va. 1927. Zalety flamingo (Phoenicopterus rubber antiquorum) v Semipalatinskuyu guberniyu. [Records of vagrant Greater Flamingos (Phoenicopterus rubber antiquorum) in Semipalatinsk Province.] Uragus 4(5):9-13. {Russian}

Serie P. 1918. Nombres vulgares y científicos de aves de Buenos Aires. [Common and scientific names of birds of Buenos Aires.] El Hornero 1(2):71. {Spanish}

Shattuck GB, editor. 1905. The Bahama Islands Geographical Society of Baltimore. New York: Macmillan.

Shiras III G. 1909. Camps and cruises of an ornithologist. National Geographic Magazine 20(5):438-463.

Shivrajkumar of Jasdan RMN, Lavkumar of Jasdan KS. 1960. A visit to the flamingos in the Great Rann of Kutch. Journal of the Bombay Natural History Society 57:465-478.

Shufeldt RW. 1891. Tertiary fossils of North American Birds. Auk 8(4):365-368. **

Shufeldt RW. 1892. Comparative oölogy of North American birds. Annual Report of U.S. National Museum for 1892.

Shufeldt RW. 1892. A study of the fossil avifauna of the Equus beds of the Oregon desert. Journal of the Academy of Natural Sciences of Philadelphia, Series 2 9(3):389-425.

Shufeldt RW. 1901. Osteology of the flamingos. Annals of the Carnegie Museum 1(2):295-324.

Sibley CG, Corbin KW, Haavie JH. 1969. The relationships of the flamingos as indicated by the egg-white proteins and hemoglobins. Condor 71(2):155-179. **

Siller WG. 1970. Tibeal dyschondroplasia in the fowl. Journal of Pathology 101:39-46.

Slater WL. 1906. Birds of South Africa. London: R. H. Porter.

Sloane H. 1707-1725. A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica. London: Author.

Sludskiy A. 1959. Na gnezdov'jakh flamingo. [On nesting places of flamingos.] Okhota i okhotnich'e khoz vo [Hunt and Hunting Industry] 3:24. {Russian}

Sludskiy AA. 1960. Flamingo v SSSR i zadachi ego okhrany. [Flamingo in the USSR and tasks of its conservation.]. Ptitsy vodoyomov; (Okhrana prirody i ozelenenie) [Birds of water bodies; (Nature conservation and planting of greenery). Moscow: Vseros. o vo okhrany prirody [All Russian Society of Nature Conservation]. p 95-98. {Russian}

Smithers R, Paterson M. 1959. Notes on avifauna of the eastern sector of the great Makarikari Lake, Bechuanaland Protectorate. Ostrich Supplement 3:133-143.

Snethlage E. 1914. Catalogo das aves amazonicas contendo todas as especies descriptas e mencionadas ate 1913. [Catalog of Amazonian birds containing all the species described and mentioned before 1913.] Boletim do Museu Paraense Emílio Goeldi 8:112-113. {Portuguese}

Snodgrass RE, Heller E. 1904. Papers form the Hopkins-Stanford Galapagos Expedition, 1898-1899. XVI. Birds. Proceedings from the Washington Academy of Sciences 5:231-272.

Soler FL, Piazza L, Soler C. 1931. Las carótidas en las aves. [The carotids in the birds.] Revista de la universitad de Buenos Aires (2nd ser) 8(4):225-227 [Reviewed in El Hornero 225(222): 253-254.]. {Spanish}

Spangenberg EP. 1951. Otryad flamingo. [Flamingo order.]. Moscow: "Sov. Nauka" Publishers. 341-349 p. {Russian}

Spangenberg EP. 1958. Flamingo. Okhota i okhotn khoz vo [Hunt and hunting industry] 4:29. {Russian}

Sprunt A. 1964. Wild flamingos on parade. Audubon 65(6):353-355.

Sprunt A, Crego-Bourne A. 1974. The capture and transport of young Caribbean flamingos. International Zoo Yearbook 14:64-66. **

Sprunt A, Jr. 1937. The flamingo in the Florida Keys. Auk 56(1):99. **

Sprunt A, Jr. 1937. Nesting of the flamingo in the United States. Auk 54(4):531-532. **

Sprunt A, Jr. 1939. Flamingos again in the Florida Keys. Auk 56(2):181. **

Sprunt A, Jr. 1954. Florida Bird Life. New York: Coward-McCann.

Sprunt A, Jr., Chamberlain EB. 1949. South Carolina Bird Life. Columbia: Univeristy of South Carolina Press.

Stark AC, Sclater WL. 1900-1906. The Birds of South Africa. London: R. H. Porter.

Steinbacher G. 1938. Über einige brutbiologische Beobachtungen im Berliner Zoologischen Garten im Jahre 1937. [About some observations on breeding biology in the Berlin Zoological Garden in 1937.] Beiträge zur Fortpflanzungsbiologie der Vögel 14(2):55-56 [Abstracted in Bird-Banding 59(53):160.]. {German}

Stemmer HJ. 1936. Die Entoparasiten der in Schlesien 1935 beobachteten Flamingos. [The endoparasites of the flamingos observed in Silesia in 1935.] Berichte Verhandlungen Schlesischer Ornithologen 21:15-17. {German}

Stimson LA. 1939. Wild flamingos on West Lake near Cape Sable. Florida Naturalist 12(4):97-98.

Stockley CH. 1949. Flamingos of Lake Hannington. Country Life 105(2714):154, 157.

Stoddard HL. 1928. The flamingo in northwest Florida. Auk 45(2):201-202. **

Stone DD. 1885. Bird visitors at a Florida lighthouse. Ornithologist and Oölogist 10(10):158.

Strecker JK, Jr. 1912. The birds of Texas: an annotated checklist. Baylor University Bulletin 15(1):15.

Stresemann E. 1959. The status of avian systematics and its unsolved problems. Auk 76(3):269-280. **

Stresemann E, Stresemann V. 1966. Die Mauser der Vögel. [The molt of the birds.] Journal für Ornithologie 107(Sonderheft):311-313. {German}

Studer-Thiersch A. 1964. Balzverhalten und Systematik der Gattung Phoenicopterus. [Courtship display and systematics of the genus *Phoenicopterus*.] Der Ornithologische Beobachter 61(3):99-102. {German} **

Studer-Thiersch A. 1966. Altes und Neues über das Fütterungssekret der Flamingos *Phoenicopterus ruber*. [Old and newest results about the feeding secretions of the flamingos *Phoenicopterus ruber*.] Der Ornithologische Beobachter 63(3):85-89. {German} **

Studer-Thiersch A. 1966. Die sogenannte Balz der Flamingos (Gattung *Phoenicopterus*).[The so-called courtship display of flamingos.] [Ph.D. Dissertation]: University of Münster. {German}

Studer-Thiersch A. 1967. Beiträge zur Brutbiologie der Flamingos (Gattung *Phoenicopterus*). [Contributions to the breeding biology of flamingos.] Der Zoologische Garten 34(4/5):159-229. {German} **

Studer-Thiersch A. 1968. Die Flamingos. [The Flamingos.]. Grzimek's Tierleben. Zürich: Kindler Verlag. p 239-245. {German} **

Studer-Thiersch A. 1972. Beobachtungen an freilebenden Flamingos in Südspanien. [Observations of free-living flamingos in southern Spain.] Der Ornithologische Beobachter 69:237-252. {German} **

Studer-Thiersch A. 1974. Die Balz der Flamingogattung *Phoenicopterus*, unter besonderer Berücksichtigung von *Phoenicopterus ruber roseus*. [The courtship display of the flamingo genus *Phoenciopterus* with special reference to *Phoenciopterus ruber roseus*.] Zeitschrift für Tierpsychologie 36:212-266. {German} **

Studer-Thiersch A, Wackernagel H. 1969. Beobachtungen an den Basler Flamingos aus dem Jahr 1968. [Observations on Basle's flamingos in 1968.] Der Ornithologische Beobachter 66(3):65-69. {German} **

Stünzi H. 1957. Über eine bisher unbekannte Beulenkrankheit beim Flamingo. [About a so far unknown bump disease in the flamingo.] Deutsche tierärztliche Wochenschrift 64:120-122. [abstracted in: Der Zoologische Garten 122 (124/126) 1959:1936]. {German}

Stünzi H. Beulenkrankheit bei Flamingos, Kardiopathie beim Kamel und Toxoplasmose beim Pinguin, drei ungewöhnliche Krankheiten aus dem Zürcher Zoo. [Bump disease seen in flamingos, cardiopathy in the camel and toxoplasmosis in the peguin, three unusual diseases from the Zürcher Zoo.]. VII Internationales Symposium über die Erkrankungen der Zootiere, Zürich und Basel; 1965 7 - 9 April 1965. p 82. {German}

Suchantke A. 1959. Die Paarung beim Flamingo. [The mating of the flamingo.] Der Ornithologische Beobachter 56:94-97. {German} **

Surkov M. 1969. Rozovyi flamingo na ozere Tengiz. [The greater flamingo on Tengiz Lake.] Okhota i okhotnichiye khoz vo [The hunt and hunting industry] 7. {Russian}

Suschkin PP. 1900. Die Vögel des Kirgisischen Steppengebiets. [The birds of the Kirgisian grassland/steppe.] Journal für Ornithologie 48(1):147. {German}

Suschkin PP. 1914. Die Vögel der Mittleren Kirgisensteppe. [The birds of mid-kirgisian grassland/steppe.] Journal für Ornithologie 62:297-333; 557-607. {German}

Sushkin PP. 1908. Ptitsy Srednej Kirgizskoj stepi (Turgajskaja oblast' i vostochnaja chast' Ural'skoj). [Birds of the Middle Kirghiz steppe (Turgai region and eatsern part of the Ural Region).]. Materialy k poznaniju fauny i flory Rossijskoj imperii Otd nie zoologii [Materials on the study of fauna and flora of Russian Empire Department of zoology]. Moscow. {Russian}

Swaen AEH. 1943. De Flamingo's van Bonaire. [The flamingos of Bonaire.] Ardea 32:163-179.

Swann HK. 1896. A Concise Handbook of British Birds. London: John Wheldon.

Swann HK. 1916. A Dictionary of English and Folk-names of British Birds. London: Witherby.

Swift JJ. 1960. Densité des nids et notion de territoire chez le flamant de Camargue. [Density of nests and notion of territory by the flamingo of Camargue.] Alauda 28:1-14. {French}

Taczanowski L. 1877. Liste des oiseaux recueillis en 1876 au nord du Pérou occidental par MM Jelski et Stolzmann. [List of birds gathered in 1876 in the north of western Peru by Jelski and Stolzmann.] Proceedings of the Zoological Society of London:319-333. {French}

Tandan BK, Brelih S. 1971. A new species of *Anaticola* (Phtiraptera: Ischnocera). The Entomologist 104:268-275.

Tannehill IR. 1952. Hurricanes; Their Nature and History, Particularly Those of the West Indies and the Southern Coast of the United States. Princeton University Press.

Tatum J, Tatum E. 1942. Flamingo in Sussex. British Birds 36(4):74-75.

Temminck CJ. 1820-1840. Manuel d'Ornithologie, ou Tableau Systématique des Oiseaux qui se Trouvent en Europe. [Manual of Ornithology or Systematic Table of Birds Found in Europe.]. Paris: Gabriel Dufour; Edmond D'Ocagne; H. Cousin. {French}

Ternier L. 1910. Note sur la présence du flamant rose (*Phoenicopterus roseus*) en Baie de Seine. [Note on the presence of the greater flamingo in the Bay of Seine.] Revue Française d'Ornithologie 1(10):152-153. {French}

Thayer AH. 1911. Concealing-coloration: a demand for investigation of my tests of the effacive power of patterns. Auk 28:460-464. **

Thayer GH. 1909. Concealing Coloration in the Animal Kingdom. New York: Macmillan.

Thommen H, Wackernagel H. 1963. Isolierung und Nachweis von Canthaxanthin im Kleinen Flamingo (Phoeniconaias minor). [Isolation and identification of canthaxanthin in the lesser flamingo.] Biochimica et Biophysica Acta 69:387-396. {German} **

Thompson DAW. 1895. A Glossary of Greek Birds. Oxford: The Clarendon Press.

Thorburn A. 1916. British Birds. London: Longmans, Green.

Ticehurst CB. 1923. The birds of Sind. (Part V). Ibis, 11th ser 5:438-474.

Ticehurst CB. 1928. The birds of British Baluchistan. Journal of the Bombay Natural History Society 32(1):92.

Ticehurst CB, Buxton PA, Cheesmna RE. 1922. The birds of Mesopotamia. Journal of the Bombay Natural History Society 23(3):657.

Ticehurst CB, Cheesman RE. 1925. The birds of Jabrin, Jafura, and Hasa in central and eastern Arabia and of Bahrein Island, Persian Gulf. Ibis, 12th ser 1(1):31.

Ticehurst CB, Cos P, Cheesman RE. 1926. Additional notes on the avifauna of Iraq. Journal of the Bombay Natural History Society 31:91-119.

Tinbergen N. 1939. The behavior of the snow bunting in spring. Transactions of the Linnaean Society of New York 5(1):83.

Tinbergen N. 1952. "Derived" activities; their causation, biological significance, origin and emancipation during evolution. Quarterly Review of Biology 27:1-32.

Tippenhauer LG. 1893. Die Insel Haiti. [The Island Haiti.]. Leipzig: F. A. Brockhaus. {German}

Tixier R. 1945. Contribution à l'étude de quelques pigments pyrroliques naturels de mollusques, de l'oeuf d'emeu et du squelette du corail blue (*Heliopora caerulea*). [Contribution to the study of some pyrrolitic natural pigments of mollusks, of the egg of emu and the skeleton of blue coral.] Annales de l'Institut Océanographique Monaco 22:343-397. {French}

Tomilin AG. 1974. V mire kitov i del'finov. [In the world of whales and dolphines.]. Moscow: "Znanie" Publishers. 206 p. {Russian}

Tremoleras J. 1920. Lista de aves Uruguayas. [List of birds in Uruguay.] El Hornero 2(1):16. {Spanish}

Tristram HB. 1868. On the ornithology of Palestine XXVII: Part VIII. Ibis 4(15):327.

Trois EF. 1885. Annotazioni sopra un fenicottero roseo preso nel veneto (*Phoenicopterus roseus*). [Annotations concerning a greater flamingo taken by the Venetian one.] Atti R Inst Ven Ecc (ser 6) Venezia: Tipo, G Antonelli 4:125-129. {Italian}

Troubridge THC. 1926. Rare birds seen in Hampshire. British Birds 20(6):156-157.

Trouche L. 1937. Le flamant rose en Camargue. [The greater flamingo in Camargue.] Alauda 9(3):3-4. {French}

Trouche L. 1938. Le flamant rose en Camargue erratique? Sédentaire? Nicheur? [The greater flamingo in erratic Camargue? Sedentary? Nesting?] Alauda 10(3):159-187. {French}

Tucker BW. 1948. Studies of some species rarely photographed: the flamingo. British Birds 41(12):375-376, Pl. 361-369.

Tucker JJ. 1971. Greater flamingo *Phoenicopterus ruber* near Lusaka. Bulletin of the Zambian Ornithological Society 3:23.

Turner W. 1544. Turner on Birds. A Short and Succinct History of the Principal Birds Noticed by Pliny and Aristotle. First published by Doctor William Turner, 1544 Edited by A. H. Evans Camridge University Press (1903).

Uganda. 1925-1930. Laws and regulations issued during the years 1925-1929. International Review of Legislation for the Protection of Nature 1926 (Brussels, 1930):16.

Urbain A, Bullier P, Nouvel J. 1944. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes en 1943. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park in 1943.] Bulletin du Muséum d'Histoire Naturelle, 2d série 16:56-65. {French}

Urbain A, Guillot G. 1938. Les aspergilloses aviaires. [Avian aspergillosis.] Revue Path Comp et Hyg Gen 503:929-955. {French}

Urbain A, Guillot G. 1938. Les aspergilloses aviaires. [Avian aspergillosis.] L'Oiseau, ns 8(4):558. {French}

Urbain A, Nouvel J, Bullier P. 1946. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes en 1945. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park in 1945.] Bulletin du Muséum d'Histoire Naturelle, 2d série 18(2):146-157. {French}

Urbain A, Nouvel J, Bullier P. 1947. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1946. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1946.] Bulletin du Muséum d'Histoire Naturelle, 2d série 19(2):137-150. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1949. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1948. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1948.] Bulletin du Muséum d'Histoire Naturelle, 2d série 21(2):178-193. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1950. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1949. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1949.] Bulletin du Muséum d'Histoire Naturelle, 2d série 22(2):181-196. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1951. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1950. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1950.] Bulletin du Muséum d'Histoire Naturelle, 2d série 23(2):157-172. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1952. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1951. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1951.] Bulletin du Muséum d'Histoire Naturelle, 2d série 24(2):157-173. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1953. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1952. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1952.] Bulletin du Muséum d'Histoire Naturelle, 2d série 25(2):111-126. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1954. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1953. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1953.] Bulletin du Muséum d'Histoire Naturelle, 2d série 26(2):171-187. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1955. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1954. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1954.] Bulletin du Muséum d'Histoire Naturelle, 2d série 27(2):117-134. {French}

Urbain A, Nouvel J, Bullier P, Rinjard J. 1956. Rapport sur la mortalité et la natalité enregistrées au Parc Zoologique du Bois de Vincennes pendant l'année 1955. [Report on the mortality and birthrate recorded at the Bois de Vincennes Zoological Park during 1955.] Bulletin du Muséum d'Histoire Naturelle, 2d série 28(2):164-176. {French}

Urban EK, Brown LH. 1971. Checklist of the Birds of Ethiopia. Addis Ababa: University Press.

Uys CJ, Broekhuysen GJ, Martin J, MacLeod JG. 1961. Mass breeding of the greater flamingo (*Phoenicopterus ruber roseus*) in the Bredasdorp District. Ostrich 32:92-93.

Uys CJ, Broekhuysen GJ, Martin J, MacLeod JG. 1963. Observations on the breeding of the greater flamingo, *Phoenicopterus ruber* Linnaeus in the Bredasdorp District, South Africa. Ostrich 34(3):129-154.

Uys CJ, MacLeod JGR. 1967. The birds of the De Hoop Vlei Region, Bredasdorp, and the effect of the 1957 inundation over a 10-year period (1957-1966) on the distribution of species, bird numbers and breeding. Ostrich 8:233-254.

Uys CJ, Martin J. 1961. The breeding of the greater flamingo in the Bredasdorp District. African Wild Life 15:97-105.

Valverde JA. 1964. La reproduccion de flamencos en Andalucía en al año 1963. [Flamingo reproduction Andalusia during 1963.] Ardeola 9:55-65. {Spanish}

van Bocxstaele R. 1972. Considérations sur quelques résultats d'élevage - Flamant rouge (*Phoenicopterus ruber* L.). [Considerations on some results of rearing - greater flamingos.] Bulletins de la Societe Royal de Zoologie d'Anvers 38:2. {French}

van Bocxstaele R. 1974. Attempts at hand-rearing the Caribbean flamingo. International Zoo Yearbook 14:199-203. **

van Kempen C. 1905. Flamant rose (*Phoenicopterus roseus* Pall.) Tué près de Dunkerque. [Greater flamingo (*Phoenicopterus roseus* Pall.) killed close to Dunkerque.] Bulletin de la Société Zoologique de France 30:151. {French}

Vanden Berge JC. 1970. Comparative study of the appendicular musculature of the order Ciconiiformes. American Midland Naturalist 84(2):289-364. **

Vasques de Espinosa A. 1628-1629. Compendium and Description of the West Indies [Translated by Charles Upson Clark]. Smithsonian Miscellaneous Collections 102; 552(1331: 1942).

Vian J. 1886. Monographie des poussins oiseaux d'Europe. [Monograph of chicks and birds of Europe.] Bulletin de la Société Zoologique de France 11(1-3):340-419. {French}

Vielliard J. 1972. Données biogéographiques sur l'avifaune d'Afrique centrale, II. [Biogeographical data on the avifauna of central Africa, II.] Alauda 40:70 (63-92). {French}

Völker O. 1934. Die Abhängigkeit der Lipochrombildung bei Vögeln von pflanzlichen Carotinoiden. [The dependence of bird lipochrome formation on vegetable Carotene.] Journal für Ornithologie 82:439-450. {German}

Völker O. 1936. Ueber den gelben Federsfarbstoff des Wellensittichs (*Melopsittacus undulatus* (Shaw)). [The yellow feather-dye of the budgerigar (*Melopsittacus undulatus* (Shaw)).] Journal für Ornithologie 84:618-630. {German}

Völker O. 1939. Gelbes und rotes Lipochrom im Integument der vögel. [Yellow and red lipochromes in the integument of birds.] Journal für Ornithologie 87:639-643. {German}

Völker O. 1944. Die Stofflichen Grundlagen der Pigmentierung der Vögel. [The material bases of the pigmentation of birds.] Biologische Zentralblatt 64:184. {German}

Völker O. 1950. Astaxanthin als Federpigment. [Astaxanthin as a feather pigment.] Naturwissenschaften 37:309-310. {German}

Völker O. 1958. Die Rotfärbung der Flamingos (*Phoenicopterus*) in Freileben and Gefangenschaft. [The red coloring of flamingos (*Phoenicopterus*) in the wild and in captivity.] Journal für Ornithologie 99:209-217. {German}

Völker O. 1961. Die chemische Charakterisierung roter Lipochrome im Gefeder der Vogel. [The chemical characterization of red lipochrome in the plumage of the bird.] Journal für Ornithologie 102:430-438. {German}

Völker O. 1963. Die Bedeutung der Carotinoide für des tierische Farbkleid, erläntert en einigen Beispielen. [The importance of carotenoids for animal coloration coloring, expounded in some examples.] Wissenschaftliche Veröffentlichungen Deutsche Gesellschaft Ernährung 9:282-292. {German}

Volkov EN. 1972. Gnezdovanie flamingo v Tsentral'nom Kazakhstane. [Resources of waterfowl of the USSR, their reproduction and wise management.] Resursy vodoplavayushchikh ptits SSSR, ikh vosproizvodstvo i ispol'zovanie 2:17-19. {Russian}

von Berlepsch H. 1908. On the birds of Cayenne. Novitates Zoologicae 15:312.

von Berlepsch H, Stolzmann J. 1902. On the ornithological researches of M. Jean Kalinowski in central Peru, pt. 2. Proceedings of Zoological Society of London 2:53.

von Burg G, Knoepfli W. 1930. Les Oiseaux de la Suisse. [Birds of Switzerland.]. Berne: Dept. Fédéral de l'Intérieur. 3593-3599 p. {French}

von Hagen W. 1937. The flamingos of the Galapagos Islands. Natural History 39:136-139.

von Heuglin MT. 1859. List of birds observed and collected during a voyage in the Red Sea. (edited and translated by G. Hartlaub). Ibis 1(4):337-352.

von Ihering H, von Ihering R. 1907. As Aves do Brazil. Catalogos da Fauna Brazileira. [Birds of Brazil. Catalogs of Brazilian Fauna.]. São Paulo: Museu Paulista.

von Linne C. 1758. Caroli Linnaei. Systema Naturae per Regna Tria Naturae. Ed. 10, reformata. Holmiae: Imprensis L. Salvii (1758-1759).

von Mandelslo JA. 1727. Voyages Célèbres & Remarquables Faits de Perse aux Indes Orientales. Nouv. edit. [Famous Journeys & Remarkable Facts of Persia to Oriental Indies. New Edition.]. Amsterdam: M. C. Le Cène. {French}

von Pelzeln A. 1817-1835. Zur Ornitholgie Brasiliens. Resultate von Johann Natterers Reisen in den Jahren 1817 bis 1835. [Brazilian Ornithology. Results of the Trips of Johann Natterers: 1817-1835.]. Wien: Druck und Verlag von A. Pichlers Witwe & Sohn (1871). {German}

von Tschudi JJ. 1844. Avium Conspectus quae in Republica Peruana. Archiv der Freunde der Naturgeschichte in Mecklenburg 10(1):313.

von Zedlitz O. 1910. Meine Ornithologische Ausbeute Nordost-Afrikas. [My ornithological harvest of Northeast-Africa.] Journal für Ornithologie 58(2; 4):290-394; 731-807. {German}

Voous KH. 1955. De Vogels van de Nederlandse Antillen. [The Birds of the Netherlands Antilles.]. Utrecht, Foundation for Scientific Research in Surinam and the Netherlands Antilles. {Dutch}

Voous KH. 1957. The birds of Aruba, Curacao, and Bonaire. Uitgaven Natuurwetenschappelijke Studiekring voor het Caraibisch Gebied No. 14.

Wace RH. 1917. Lista de Aves de las Islas Falkland. [Bird list of the Falkland Islands.] El Hornero 2(3):199. {Spanish}

Wackernagel H. 1959. Ein Bruterfolg beim Chilenischen Flamingo im Zoologischen Garten Basel. [Breeding success of the Chilean flamingo at the Basel Zoo.] Der Ornithologische Beobachter 56(2):33-40. {German} **

Wackernagel H. 1959. Höchstalter europäischer Vögel im Zoologischen Garten Basel. [Life span of European birds in Basel Zoo.] Ornothogische Beobachter 61:128-132. {German}

Wackernagel H. 1959. Some results with colour feeding of carotenoids in birds at the Basel Zoological Garden. Avicultural Magazine 65:20-21.

Wackernagel H. 1960. Breeding flamingos at Basle Zoo, Switzerland. International Zoo Yearbook 1:45-46. **

Wackernagel H. 1964. Was füttern die Flamingos ihren Jungen? [What do flamingos feed their young?] Internationale Zeitschrift für Vitaminforschung 34:141-143. {German}

Wackernagel H. 1969. Unsere Flamingokolonie im Hagelsturm. [Our flamingo colony in a hail storm.] ZOLLI-Bulletin des Vereins der Freunde des Zoologischen Gartens Basel 21:14-15. {German}

Walcott FC. 1925. An expedition to the Laguna Colorada, Southern Bolivia. The Geographical Review 15(3):345-366. **

Walker EP. 1941. Care of captive animals. Smithosonian Institution Annual Report for 1941:350 (1942).

Wallach JD, Flieg GM. 1969. Frostbite and its sequelae in captive exotic birds. Journal of the American Veterinary Medical Association 155(7):1035-1038.

Ward TB. 1941. Los flamencos de Mar Chiquita. [The flamingos of Mar Chiquita.] Hornero 8:118-120. {Spanish}

Watson GE. 1960. Flamingos in Greece. Ibis 102:135-136.

Watts WA. 1941. Flame feathered flamingos of Florida. National Geographic Magazine 79(1):56-65.

Wayne AT. 1887. *Phoenicopterus ruber* as a South Carolina bird. Auk 4(1):72. **

Wayne AT. 1910. Birds of South Carolina. Contribution of the Charleston Musem, No 1.

Weber MM. 1949. Red halophilic microorganisms: a problem in the biochemical foundation of an ecological specialization. Biological Review 11(19-14).

Weldon FR. 1883. On some points in the anatomy of *Phoenicopterus* and its allies. Proceedings of the Zoological Society of London. p 141-143.

Wellington JE. 1938. The Kunene river and the Etosha plain. South African Geograpy Journal 20:150.

West H. 1794. Beyträge zur Beschreibung von St. Croix, St. Thomas, St. Jean, Tortola, Spanishtown, und Krabbenneyland. Kopenhagen: Bey C. G. Proft.

Westermann JH. 1946. Bird preservation in the territory of Curacao. Uitgaven Studiekring Suriname Curacao I, Jaarboek 1945-1946. Utrecht: Foundation for Scientific Research in Surinam.

Westermann JH. 1952. Conservation in the Caribbean. Utrecht: Foundation for Scientific Research in Surinam and the Netherlands Antilles, No. 7.

Westermann JH. 1952. Nature preservation in the Caribbean. In Proceedings of the International Union for the Protection of Nature, 3rd General Assembyl, Caracas, September 1952, Bruxelles, 1954.

Westermann JH. 1953. Nature Preservation in the Caribbean. Utrecht: Foundation for Scientific Research in Surinam and the Netherlands Antilles, No. 9.

Westernhagen Wv. 1966. Der See der Flamingos. [The lake of the flamingos.] Vogelkosmos 3:59-65. {German}

Westernhagen Wv. 1970. Über die Brutvögel der Banc d'Arguin (Mauretanien). [About the breeding birds of the Banc d'Arguin (Mauritania).] Journal für Ornithologie 111(2):206-226. {German} **

Wetmore A. 1916. Birds of Puerto Rico. U S Department of Agriculture, Bulletin 326.

Wetmore A. 1916. The birds of Vieques Island, Porto Rico. Auk 33(4):410. **

Wetmore A. 1917. The birds of Culebra Island, Porto Rico. Auk 34(1):57. **

Wetmore A. 1926. Observations on the birds of Argentina, Paraquay, Uruguay, and Chile. U S National Museum, Bulletin 133.

Wetmore A. 1926. Report on a collection of birds made by J. R. Pemberton in Patagonia. University of California Publications in Zoology 24(4):414.

Wetmore A. 1927. The birds of Puerto Rico and the Virgin Islands (Colymbiformes to Columbiformes). New York Academy of Sciences Scientific Survey of Porto Rico and the Virgin Islands 9(3):305-306.

Wetmore A. 1930. The Rabié paintings of Haitian birds. Auk 47(4):481-486. **

Wetmore A. 1937. Ancient records of birds from the Island of St. Croix with observations on extinct and living birds of Puerto Rico. University of Puerto Rico, Journal of Agriculture 21(1):5-16.

Wetmore A. 1938. Bird remains from the West Indies. Auk 55(1):53. **

Wetmore A. 1950. Recent Additions to Our Knowledge of Prehistoric Birds, 1933-1949. Proceedings of the Xth International Ornithological Congress, Uppsala, 1950. Uppsala: Almquist & Wiksells (1951).

Wetmore A, Lincoln FC. 1934. Additional notes on the birds of Haiti and the Dominican Republic. Proceedings of the U S National Museum 82(25):19.

Wetmore A, Miller WD. 1926. The revised classification for the fourth edition of the A. O. U. Check-list. Auk 43(3):341. **

Wetmore A, Swales BH. 1931. The birds of Haiti and the Dominican Republic. US Natural Museum Bulletin 155:95.

Whitaker JIS. 1905. Birds of Tunisia. London: R. H. Porter.

Whitlock R. 1953. Rare and Extinct Birds of Britain. London: Phoenix House.

Whymper C. 1909. Egyptian Birds; for the Most Part Seen in the Nile Valley. London: Adam and Charles Black.

Wilgus AC, editor. 1952. The Caribbean: Peoples, Problems and Prospects. Gainesville: University of Florida Press.

Williams JG. 1963. Freeing flamingos from anklets of death. National Geographic Magazine 124(12):935-944.

Willughby F. 1678. The Ornithology of Francis Willughby. London: printed by A. C. for John Martyn, Printer to the Royal Society.

Wilson A. 1829. American Ornithology, or the Natural History of the Birds of the United States. New York: Collins.

Winterbottom JM. 1964. Results of the Percy FitzPatrick Institute - Windhoek State Museum Joint Ornithological Expeditions: Report on the birds of Game Reserve No. 2. Cimbebasia 9.

Witherby HF, Jourdain FCR, Ticehurst NF, Tucker BW. 1938-1941. The Handbook of British Birds (5 volumes). London: Witherby.

Witherby HF, Ticehust NF. 1908. On the more important additions to our knowledge of British birds since 1899. British Birds 2(1):24.

Wolley J. 1907. Ootheca Wolleyana; an Illustrated Catalogue of the Collection of Birds' Eggs Begunby the Late John Wolley, jun. and Continued with Additions by the Editor, Alfred Newton. Newton A, editor. London: R. H. Porter.

Wood C. 1936. Some of the commoner birds of Ceylon. U S National Museum, Annual Report for 1936:298 (1937).

Wood C. 1937. Curious and beautiful birds of Ceylon. U S National Museum, Annual Report for 1934:248 (1935).

Wood HB, Wood MHB. 1931. Bird census by automobile. Oölogist 48(5):71.

Worm O. 1655. Museum Wormianum. Lugduni Batavorum: Elzevir.

Wright C, Melendez E. 1963. Environment, Soil and Land Use in the Department of Arica, Province of Tarapaca, Northern Chile. FAO-Chile, Santiago.

Wurdemann G. 1857. Letter relative to the obtaining of specimens of flamingos and other birds from south Florida. U S National Museum, Annual Report for 1860:426-460 (1861).

Yeates GK. 1948. Some supplementary notes on the birds of the Rhône delta. Ibis:425-433.

Yeates GK. 1950. Flamingo City. Country Life.

Yeates GK. 1951. Flamingos of the Rhone Delta, France. Audubon Magazine 53(4):253.

Young E. 1967. Leg paralysis in the greater flamingo and lesser flamingo (*Phoenicopterus ruber roseus* and *Phoeniconaias minor)* following capture and transportation. International Zoo Yearbook 7:226-227. **

Zahl PA. 1947. The flamingos of Andros. Scientific Monthly 64(4):277-288.

Zahl PA. 1951. Flamingos' last stand on Andros Island. National Geographic Magazine 99(5):635-652.

Zahl PA. 1952. Flamingo Hunt. Indianapolis: Bobbs-Merrill.

Zaletaev VS. 1960. Novye svedenija o raspredelenii flamingo v Zapadnoj Turkmenii. [New data on the greater flamingo distribution in Western Turkmenia.]. Ptitsy vodoemov; (Okhrana prirody i ozelenenie) [Birds of water bodies; (Nature conservation and planting of greenery)]. Moscow: Vseros. o vo okhrany [All Russian Society of Nature Conservation]. p 99-101. {Russian}

Zotta A. 1932. Notos sobre el contenido estomacal de algunas aves. [Notes on the stomach content of some birds.] El Hornero 5:77-81. {Spanish}

Zotta A. 1940. Lista sobre el contenido estomacal de las aves Argentinas. [A list of the stomach contents of Argentinean birds.] El Hornero 7:402-411. {Spanish}

Zukowsky L. 1963/64. A-Hypovitaminose und Gicht bei Flamingos. [A-Hypovitaminosis and gout in flamingos.] Der Zoologische Garten 28(5):266-268. {German}

Zumpt F. 1961. Genus Halleria (Family: Freyanidae, Suborder: Sarcoptiformes, Order: Acarien). In: Zumpt F, editor. The Arthropod Parasites of Vertebrates in Africa South of the Sahara Vol 1 (Chelicerata). Johannesburg: South African Institute for Medical Reserch. p 235.

CURRENT BIBLIOGRAPHY

CAPTIVE MANAGEMENT AND BEHAVIOR

Alraun R. 1993. Die ersten Lebenswochen eines Zwergflamingos. [The first weeks of life of a lesser flamingo.] Der Zoofreund 87:8-11. {German} **

Alraun R, Hewston N. 1997. Breeding the lesser flamingo *Phoeniconaias minor*. Avicultural Magazine 103(4):175-181.

Anonymous. 1977. Flamingoeltern vergassen ihr Kind nicht. [Flamingo parents did not forget their young.] Der Zoofreund 26:20. {German}

Anonymous. 1978. Zoo Federation news. Flamingo Gardens & Zoological Park. International Zoo News 25(8):28.

Anonymous. 1982. Wildfowl Trust avicultural report 1981. Wildfowl 33:174-175.

Anonymous. 1983. Wildfowl Trust avicultural report 1982. Wildfowl 34:174-175.

Anonymous. 1984. Wildfowl Trust avicultural report 1983. Wildfowl 35:182-183.

Anonymous. 1986. [Zoomingoes.]. Fugle 6(4):7. {Danish}

Anonymous. 1987. Wildfowl Trust Avicultural Report, 1986. Wildfowl 38:156-157.

Anonymous. 1990. Flamingoes. Zoon (Pretoria) 1990(1):11.

Anonymous. 1990. They do it with mirrors. Wildfowl & Wetlands 103:6.

Anonymous. 1992. Flamingo fantasy. Gnu Gnews - Little Rock Zoological Gardens 17(2):4-5.

Anonymous. 1992. Flamingos on parade. Discover 13:16.

Anonymous. 1995. The fascinating flamingo. ZooGram - The Baltimore Zoo 20(1):3, 8.

Anonymous. 2001. Flamingo's flight is a first. Geographical 73(10):11. **

Anonymous. 2001. Hand-rearing flamingos. Wildfowl & Wetlands 137(Autumn):8.

Babbitt G. The effect of colony size on reproduction in captive flamingoes. Direct stimulation, social facilitation or random chance? American Zoo and Aquarium Association Regional Conference Proceedings; 1997. p 183-186.

Barzdo J, Pollock S. 1980. Survey of flamingos in British Zoos. Ratel 7(1):3-10.

Beauchamp G, McNeil R. 2003. Vigilance in greater flamingos foraging at night. Ethology 109(6):511-520.

Beauchamp G, McNeil R. 2004. Levels of vigilance track changes in flock size in the greater flamingo (*Phoenicopterus ruber ruber*). Ornitologia Neotropical 15(3):407-411.

Bennett C. Breeding and reproduction of the Chilean Flamingo (*Phoenicopterus chilensis*) at the Santa Barbara Zoo. AAZPA 1987 Regional Conference; 1987. p 313-320. **

Benyus JM. 1992. Beastly Behaviors. [Greater Flamingo, pp. 166-177.]. New York: Addison-Wesley Publishing Company. 366 p. **

Berry HH. 1975. Hand-rearing Lesser Flamingos. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 109-117. **

Berry HH, Berry CU. 1976. Hand rearing abandoned Greater Flamingoes *Phoenicopterus ruber* L. in Etosha National Park, South West Africa. Madoqua 9(3):27-32.

Bharucha E. 1987. Some aspects of behaviour observed in the Greater Flamingo at Bhigwan. Journal of the Bombay Natural History Society 84(3):677-678. **

Bildstein KL. The use of zoo collections in studies of the feeding ecology and conservation biology of wading birds (Aves: Ciconiiformes). AAZPA 1990 Regional Conference; 1990; Wheeling, WV. p 353-360. **

Bildstein KL, Frederick PC, Spalding MG. 1991. Feeding patterns and aggressive behavior in juvenile and adult American Flamingos. Condor 93(4):916-925. **

Bildstein KL, Golden CB, McCraith BJ, Bohmke BW, Seibels RE. 1993. Feeding behavior, aggression, and the conservation biology of flamingos: integrating studies of captive and free-ranging birds. American Zoologist 33(2):117-125. **

Bishop M. Handrearing Flamingos. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. South Florida Water Management District, University of Florida, Florida International University, Florida Atlantic University, Florida Park Service. p 4 (abstract only). **

Blaszkiewitz B, Reinhard R. 1986. Die Entwicklung des Flamingobestandes im Zoologischen Garten Berlin. [The development of the flamingo populations at Berlin Zoo.] Der Zoologische Garten 56(1):70-76. {German}

Blaszkiewitz B, Reinhard R. 1988. Zur Haltungsdauer vom Zwergflamingo *Phoeniconaias minor*. [About life-span of lesser flamingos in captivity.] Die Gefiederte Welt 112(12):358. {German}

Blythe ET. 1994. The history of the lesser flamingos (*Phoeniconaias minor*) at the Baltimore Zoo.Unpublished manuscript.

Bohmke B. New flamingo winter quarters: Planning, construction and operation. 1985 AAZPA Regional Conference; 1985. p 73-80.

Boylan J. 2002. Banding flamingos in captivity. Animal Keepers' Forum 29(4):170-172. **

Boylan JT. 2000. Sonographic analysis of the vocalizations of Chilean and Caribbean flamingos. Waterbirds 23(Special Publication 1):179-184. **

Brown SG, Shannon P, Farnell G. 1983. Renesting and brooding in the Caribbean flamingo. Zoo Biology 2(2):137-141. **

Bruning D. 1981. Hand-rearing flamingo chicks. American Pheasant and Waterfowl Society Magazine 81-9:14-18.

Burch LE, Gailband C. 2000. Comparison of hand-reared Caribbean flamingos and lesser flamingos at Seaworld California. Waterbirds 23(Special Publication 1):193-197. **

Cézilly F. 1993. Nest desertion in the greater flamingo, *Phoenicopterus ruber roseus*. Animal Behaviour 45(5):1038-1040. **

Colo T. 1993. 'Tis the Season. Riverbanks Magazine 11(3):2-5. **

Comben N. 1976. Notes on feeding carotenoid pigments. International Zoo Yearbook 16:17-20. **

Congdon ER, Searles S. Breeding behavior in a captive colony of *Phoenicopterus chilensis*, Chilean flamingo. AZA Western Regional Conference Proceedings; 1997. p 244-247. **

Conners S. 1992. If at first you don't succeed . . . Step by step breeding progess with flamingos. Animal Tracks - Birmingham Zoo 25(6):4-6.

Cooper JE. 1975. Capture in Kenya. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 106-108. **

Cover LI. 1981. The management and propagation of greater flamingos at the Fresno Zoo. Animal Keepers' Forum 8(12):333-337. **

Cusson E. Nesting Behavior in Chilean Flamingos (*Phoenicopterus chilensis)* at Zoo Atlanta. 16th National Conference of AAZK; 1990. p 130-137. **

Cziulik M, Law AY. 2003. Reproducao em cativeiro do flamingo rosa (*Phoenicopterus ruber roseous* [*roseus*]) estimulada pelo uso de espelhos. [Reproduction of the greater flamingo instigation using mirrors.] Atualidades Ornitologicas 115:3. {Portuguese}

D'Alessandro A. 1998. Breeding greater flamingos at the Rome Zoo. Solitaire No. 5:6-8. **

Davies WG. 1978. Cluster analysis applied to the classification of postures in the Chilean flamingo (*Phoenicopterus chilensis*). Animal Behaviour 26(2):381-388. **

Dejonghe JF, Czajkowski MA. 1983. Sur la longevite des oiseaux bagues en France metropolitaine, dans les département d'outre-mer et dans les pays d'Influence francaise. [On the longevity of bird banding in metropolitan France, overseas region and in French influenced countries.] Alauda 51:27-47. {French}

Dekker D. 1984. Flamingokuiken in de groei. [Growing flamingo chicks.] Artis (Amsterdam) 29(5):151-153. {Dutch}

Diamant K. 1997. A flourishing flock of flamingos. ZooNooz - San Diego Zoo 70(5):8-13.

Dittrich L. 1983. Flamingobrut zwischen Büschen. [Flamingo breeding amongst shrubs.] Der Zoofreund 49:5-7. {German}

Dittrich L. 1987. Wie sich die Methoden gleichen. Flamingo-Transporte. [How methods can be alike. Flamingo-transports.] Der Zoofreund 65:13. {German}

Duplaix-Hall N, Kear J. 1975. Breeding requirements in captivity. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamstead, England: Poyser. p 131-141. **

Elliot S. Maintaining a successful breeding flock of flamingos year round in New England. AZA Regional Conference; 1998. p 430. **

Farrell MA, Barry E, Marples N. 2000. Breeding behavior in a flock of Chilean flamingos (*Phoenicopterus chilensis*) at Dublin Zoo. Zoo Biology 19(4):227-237. **

Forbes S, Reinertsen M, Bloomsmith M, Stevens B, Maple T. The use of volunteer staff to facilitate research and hand rearing of flamingos at Zoo Atlanta, Georgia, USA. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. p 11. ** abstract only

Fox DL. 1975. Carotenoids in pigmentation. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 162-182. **

Fox DL, Lint KC. 1975. Carotene-rich dietary grass for natural pigmentation of flamingos. International Zoo Yearbook 15:185-191. **

French NA, Board RG. 1983. Water vapour conductance of wildfowl eggs and incubator humidity. Wildfowl 34:144-152.

Gangloff B, Gangloff L. 1994. Erfahrungen mit der Handaufzucht von Chileflamingos (*Phoenicopterus chilensis* Molina, 1782). [Experiences with hand-rearing Chilean flamingos.] Der Zoologische Garten 64(3):163-184. {German}

Geron R. 1981. Inhibition of flight in captive birds by tentonomy of the extensor pollicis brevis. International Zoo Yearbook 21:172-173. **

Griswold JA. 1975. Pigment feeding. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 193-195. **

Hallager S. 1995. Aspergillosis in a hand-reared flamingo chick. Animal Keepers' Forum 22(9):367-372. **

Hallager S. 1996. Early weaning of hand-reared flamingo chicks at the National Zoological Park. Avicultural Magazine 102(1):15-17. **

Hawk V. 1998. North American Regional Studbook for Chilean Flamingos. Atlanta, Georgia: Zoo Atlanta.

Hawk V. 1998. North American Regional Studbook for Lesser Flamingos. Atlanta, Georgia: Zoo Atlanta.

Hildenbrand M. 1992. Stellungnahme zum Flamingotransport im Flugzeug. [Comment on flamingo transportation in airplanes.] Der Praktische Tierarzt 73(6):546. {German}

Horton J. 1999. Keeping and breeding the lesser flamingo (*Phoeniconaias minor*) at Hillside Bird Oasis. Zoo! 13:7-??

Hötzel T. 1995. Zwergflamingos - bis zur Nachzucht ein schwieriger Weg. [Lesser flamingos - a difficult road to breeding in captivity.] Die Gefiederte Welt 119(4):126-128, 130. {German}

Hudson L. 1996. Historic hatching of flamingo chicks. Roar! Magazine of the Fort Worth Zoo:4-5.

Jarrett N, Mason V, Wright L, Levassor V. 2003. Using egg density and egg mass techniques for incubation stage assessment to predict hatch dates of greater flamingo *Phoenicopterus ruber roseus* eggs. Wildfowl 54:131-142.

Johann A. 1998. Maintenance of the Chilean flamingo at Rheine Zoo. International Zoo News 45(7):406-413. ** available on-line at http://www.zoonews.ws/IZN/288/IZN-288.html#Rheine

Johnston GB. 1997. Courtship and breeding behavior in the Sacramento Zoo's flamingo flock. Exotic Bird Report 9(3):2-3.

Kahl MP. 1975. Ritualized displays. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 142-149. **

Kawata K. 1996. Large wading birds in Japanese collections, 1994. International Zoo News 43(2):100-106.

Kear J. 1986. Captive breeding programmes for waterfowl and flamingos. International Zoo Yearbook 24/25:21-25. **

Kear J, Palmes P. 1980. Andean and James' flamingos *Phoenicoparrus andinus* and *P. jamesi* in captivity. International Zoo Yearbook 20:17-23. **

King CE. 1993. Ondergeschoven kinderen- Flamingo eieren van Artis naar Blijdorp. [Foster children flamingo eggs from Amsterdam Zoo to Rotterdam Zoo.] Dieren 10(4):116-119. {Dutch with English translation available} **

King CE. 1993. Ongelukkige flamingo liefdes. [Tales of flamingo-love gone awry.] Dieren 10(2):36-39. {Dutch with English translation available} **

King CE. 1994. Management and research implications of selected behaviours in a mixed colony of flamingos at Rotterdam Zoo. International Zoo Yearbook 33:103-113. **

King CE. 1995. EEP Ciconiiformes/Phoenicopteriformes TAG Annual Report 1995. In: Rietkerk F, Brouwer K, Smits S, editors. EEP Yearbook 1994/1995, including the Prodeedings of the 12th EEP Conference, Poznan 30 June - 2 July 1995. Amsterdam: EAZA/EEP Office. p 298-310.

King CE. 1999. The Flamingo Specialist Group Meeting. EAZA News 26:20-21. **

King CE. 2000. Captive Flamingo populations and opportunities for research in zoos. Waterbirds 23(Special Publication 1):142-149. **

Klös HG. 1975. News from the Berlin Zoo (Jan-Jun 75). Aviculture Magazine 81:170-173.

Klös HG. 1976. News from the Berlin Zoo (Jan-Sept. 76). Aviculture Magazine 82:175-177.

Krapels B, Flierman H, Burman G. 1989. Kunstmatige opfok van een Chileense Flamingo in het Noorder Dierenpark. [Hand-rearing of a Chilean flamingo at Emmen Zoo.] De Harpij 8:3-4. {Dutch}

Kulatunga S. 1996. Dance of the flamingoes. Loris 21(2):30-32.

Kunneman F, Perry J. Hand-rearing the Caribbean flamingo, *Phoenicopterus r. ruber* at the San Antonio Zoo. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992; New Orleans. Audubon Park Zoo. p 30-40 (also published in 1990 AAZPA Regional Conference Proceedings, pp. 1225-1231). **

Kunnemann F, Perry J. 1990. Hand-rearing the Caribbean flamingo *Phoenicopterus ruber ruber* at San Antonio Zoo. International Zoo Yearbook 29:95-99. **

Künzel A. 1991. Flamingos - Die neue Anlage aus der Sicht des Gartenarchitekten. [Flamingos - the new exhibit from the view of the garden architect.] ZOLLI-Bulletin des Vereins der Freunde des Zoologischen Gartens Basel 67:6-7. {German} **

Lane A, Mitchell M. Successful reproduction in a small flock of Chilean flamingos at Dickerson Park Zoo. Proceedings of the 24th National Conference AAZK; 1997; Houston, TX. p 118-121. **

Lanthier C. 1995. Successful breeding in a small colony of greater flamingos. Avicultural Magazine 101(2):52-57.

Liggett C. 1989. Breeding season of the Chilean flamingos at Martin Mere in 1988. In: Wooldridge A, editor. Martin Mere Avicultural Report 1988.

Lincoln T. 1990. Reflections on mating behaviour. Nature 345:113.

Lindgren CJ, Pickering SPC. 1997. Ritualised displays and display frequencies of Andean Flamingos *Phoenicoparrus andinus*. Wildfowl 48:194-201. **

Lindsay N. 1998. Flamingos at Whipsnade. Avicultural Magazine 104(3):100-101.

Lint Wv. 1992. Flamingo's. Een onderzoek naar de voortplanting in dierentuinen. [Flamingos: a study of breeding in zoos.]. Dronten: CAH. {Dutch}

Lubbock M. 1980. Wildfowl Trust avicultural report, 1979. Wildfowl 31:174-175.

Magill R. 2002. Think Pink. Wildlife Conservation 105(6):14.

Mangalraj Johnson J. 1984. Puddle-feeding of flamingos *Phoenicopterus roseus* in inland tanks. Journal of Bombay Natural History Society 81(2):467-468. **

McDermott L. 2004. The study of the Chilean flamingo, *Phoenicopterus chilensis*, during the summer of 2003, when these birds bred in Dublin Zoo. Ratel 31(4):17-24.

Mendel H. 1992. Zum Verhalten von Flamingos (*Phoenicopterus ruber*). [About the behavior of flamingos.] Ornithologische Mitteilungen 44(9):231. {German}

Muñoz J. 1977. Chilean flamingo court and dance. Natural History 86(10):72-78. **

Nakao R. 1997. [The new flamingo house at Tama Zoo.]. Animals and Zoos 49(10):12-13. {Japanese}

Nota Y. 1995. [Mating and depigmentation in Caribbean flamingos, *Phoenicopterus ruber ruber*.]. Journal of Japanese Association of Zoological Gardens and Aquariums 37(2):63-66. {Japanese}

Ounsted M. 1992. Flamingos: a zoo's most valuable exhibit. In: Stevens PMC, editor. 4th International Symposium On Zoo Design And Construction. Paignton: Whitley Wildlife Conservation Trust. p 239-243.

Palmes P. 1981. The riddle of the fickle flamingo. Wildfowl World 85:16-19.

Parada ME, Kurte R, Novoa FF, Rodriguez E. Artificial incubation and rearing of flamingo chicks project. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. p 19. ** abstract only

Perry JJ, Atkins V. The weaning, socialization and breeding history of hand-reared Caribbean flamingos, *Phoenicopterus ruber ruber*, at the San Antonio Zoo. 24th National Conference AAZK; 1997. p 15-23. **

Peters L. 1996. Voortplantingssucces Chileense Flamingo's (*Phoenicopterus chilensis*) in Dierenprk Amersfoort.[Reproductive success of Chilean Flamingos at Amersfoort Zoo.] [Thesis]. The Netherlands: University of Utrecht. {Dutch}

Pickering S. 1989. Flamingos: pink, bizarre and puzzling. Wildfowl & Wetlands 101(September):14-17.

Pickering S, Creighton E, Stevens-Wood B. 1992. Flock size and breeding success in flamingos. Zoo Biology 11(4):229-234. **

Pickering SPC. 1992. The comparative breeding biology of flamingos *Phoenicopteridae* at The Wildfowl and Wetlands Trust Centre, Slimbridge, Gloucester, England. International Zoo Yearbook 31:139-146. **

Pickering SPC, Duverge L. 1992. The influence of visual stimuli provided by mirrors on the marching displays of lesser flamingos, *Phoeniconaias minor*. Animal Behaviour 43(6):1048-1050. **

Poulsen H. 1975. Copenhagen Zoo. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 117-120. **

Poulsen H. 1978. [Animals in focus: flamingos.]. Naturens Verden 1978(7-8):230-239. {Danish}

Powell DM. Lack of sex differences in display behavior of Caribbean flamingos: evidence for the reproductive priming hypothesis. American Zoo and Aquarium Association Regional Conference Proceedings; 1996. p 333-338.

Powell DM. 1997. Display behavior and breeding biology of Caribbean Flamingos (*Phoenicopterus ruber ruber*). Animal Keeper's Forum 24(9):395-405. **

Reinertsen M, Forbes S, Bloomsmith M, Stevens B, Marr J, Maple T. Pairing in captive Chilean flamingos as a function of separation methods. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. p 21. ** abstract only

Reinhard R. 1984. Berliner Zoo: Andenflamingos gezüchtet! [Successful breeding of Andean flamingos in the Berlin Zoo!] Die Gefiederte Welt 108(1):24. {German}

Reo J, O'Gara JD. 2001. Color me pink: Five new flamingo chicks are thriving at Stone Zoo. http://zoonewengland.com/main/pr/flamhatch00.html.

Richter NA, Bourne GR. 1990. Sexing greater flamingos by weight and linear measurements. Zoo Biology 9(4):317-323. **

Richter NA, Bourne GR, Diebold EN. 1991. Gender determination by body weight and linear measurements in American and Chilean flamingos, previously surgically sexed: Within-sex comparison to greater flamingo measurements. Zoo Biology 10(5):425-431. **

Rickter N. Sexual dimorphism in greater flamingos. The Joint Conference of AAZV and AAWV; 1988. p 102-103. **

Roberts HJ, Hesch C. Survey results concerning diets of flamingos in North American Zoos. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992; New Orleans. Audubon Park Zoo. p 22-27 (also published in 1990 AAZP Regional Conference Proceedings, pp. 1219-1224). **

Rogel AC. Comportamiento de la colonia reproductora de flamencos. Yucatán 1982. [Behavior of the reproductive colony of flamingos. Yucatan 1982.]. XXIX Reunión Annual del IWRB, La Rábida, Mayo 1983; 1983. {Spanish}

Rösing J. 1992. Erfolgreiche Handaufzucht von drei Chile-Flamingos (*Phoenicopterus chilensis*). [Successful hand-rearing of three Chilean flamingos.] Jahresbericht des Zoologischen Gartens der Stadt Frankfurt am Main 116-130 für 1974-1991:64-69. {German}

Rüedi D. 1991. Flamingos - wie in Afrika. [Flamingos - just like in Africa.] ZOLLI-Bulletin des Vereins der Freunde des Zoologischen Gartens Basel 67:3-4. {German} **

Ruempler G. 1989. In's Licht gerückt - 1988 im Allwetterzoo. [Moving into light - 1988 at the Allwetter Zoo.] Münster Zoo Nachrichten 1:23. {German}

Ruempler G. 1990. In's Licht gerückt - 1989 im Allwetterzoo. [Moving into light - 1989 at the Allwetter Zoo.] Münster Zoo Nachrichten 1:11. {German}

Schenker A. 1978. Hochstalter europaischer Vogel im Zoologischen Garten Basel. [The high age of European birds in the Basel Zoological Garden.] Ornothogische Beobachter 75:96-97. {German}

Schetini De Azevedo C, Faggioli AB. 2004. Effects of the introduction of mirrors and flamingo statues on the reproductive behaviour of a Chilean flamingo flock. IZN International Zoo News 51(8):478-483.

Schifter H. 1995. Vogel aus dem Tiergarten Schonbrunn im Naturhistorischen Museum Wien. [Birds at the Schonbrunn Zoo in the Vienna Natural History Museum.] Der Zoologische Garten 65:101-134. {German}

Schifter H, Studer-Thiersch A. 1997. Bemerkenswertes Alter von Rosaflamingos (*Phoenicopterus ruber roseus*) in Menschenhand. [Remarkable age of greater flamingos in captivity.] Der Zoologische Garten 67(6):390. {German} **

Schröpel M, Puschmann W. 1988. Zum stimmlichen Wiedererkennen von Mutter und Jungvogel bei Rosaflamingos (*Phoenicopterus ruber roseus*). [Vocal recognition by mother and young in greater flamingos.] Felis 6:33-38. {German}

Scott P. 1987. Breeding flamingos at the Wildfowl Trust. Wildlife 2:58-59.

Shannon PW. 1981. Social hierarchy in Chilean flamingos (*Phoenicopterus chilensis*) at the Fort Worth Zoo. Animal Keepers' Forum 8(8):189-194. **

Shannon PW. Flamingo management at Audubon Park Zoo and the benefits of long-term research. AAZPA Southern Regional Proceedings; 1985. p 226-236. **

Shannon PW. Just another face in the crowd: individual identification of colonial waterbirds. AAZPA Annual Conference Proceedings; 1986. p 218-225. **

Shannon PW. Concepts in flamingo exhibit design. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992. p 41-45 (also published in 1990 AAZPA Annual Conference Proceedings, pp. 1226-1230). **

Shannon PW. Introduction to Flamingo Workshop and Flamingo Workshop Survey. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992. p 3-11 (also published in 1990 AAZPA Regional Conference Proceedings). **

Shannon PW, editor. 1992. Proceedings of the 1990 Flamingo Workshop. New Orleans: Audubon Park Zoo. 68 p. **

Shannon PW. 1996. North American Regional studbook for Andean and James' flamingos. Atlanta, Georgia: Zoo Atlanta.

Shannon PW. 1996. North American Regional studbook for Caribbean flamingo. Atlanta, Georgia: Zoo Atlanta.

Shannon PW. 1996. North American Regional studbook for Greater flamingo. Atlanta, Georgia: Zoo Atlanta.

Shannon PW. 2000. Plumages and molt patterns in captive Caribbean flamingos. Waterbirds 23(Special Publication 1):160-172. **

Shannon PW. 2000. Social and reproductive relationships of captive Caribbean flamingos. Waterbirds 23(Special Publication 1):173-178. **

Siegel CE. Flamingos in captivity: Results of the 1990-1996 American Zoo and Aquarium survey. 1998 Meeting of the Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 28 (abstract only). ** abstract only

Silveri A. Demographics of flamingos in captivity. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992. p 12-16 (also published in 1990 AAZPA Regional Conference Proceedings, pp. 1209-1213). **

Sincage J. Notes on capturing and moving flamingos. AZA Annual Conference; 2000. p 419. **

Sivelle C. 1984. Management and propagation of Chilean flamingos in a private collection. American Pheasant and Waterfowl Society Magazine 84(10):1-3. **

Sprunt A, Crego-Bourne A. 1975. Capture and transport of young Caribbean Flamingos. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 103-105. **

Stevens EF. 1990. Summary of reproduction data from survey. AAZPA Regional Conference Proceedings 1990:214-218.

Stevens EF. 1991. Flamingo breeding: The role of group displays. Zoo Biology 10(1):53-63. **

Stevens EF. Display synchrony. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992. p 48 (also published in 1990 AAZPA Regional Conference Proceedings). **

Stevens EF. Research directions for flamingos. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992. p 46-47 (also published in 1990 AAZPA Regional Conference Proceedings). **

Stevens EF. Summary of reproductive data from survey. In: Shannon PW, editor. 1990 Flamingo Workshop; 1992. p 17-21 (also published in 1990 AAZPA Regional Conference Proceedings, pp. 1214-1218). **

Stevens EF, Beaumont JH, Cusson EW, Fowler J. 1992. Nesting behavior in a flock of Chilean Flamingos. Zoo Biology 11(3):209-214. **

Stevens EF, Pickett C. 1994. Managing the social environments of flamingos for reproductive success. Zoo Biology 13(5):501-507. **

Studer-Thiersch A. 1975. Basle Zoo. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 120-130. **

Studer-Thiersch A. 1975. Group display in *Phoenicopterus*. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 150-158. **

Studer-Thiersch A. 1983. 25 Jahre Flamingozucht in Basel. [25 years of flamingo breeding in Basel.] Zolli-Bulletin 50:5-6. {German}

Studer-Thiersch A. 1986. Phoenicopteriformes. In: Robiller F, editor. Lexikon der Vogelhaltung [Husbandry Manual for Birds]: Edition Leipzig. {German}

Studer-Thiersch A. 1986. Tarsus length as an indication of sex in the flamingo genus *Phoenicopterus*. International Zoo Yearbook 24/25:240-243. **

Studer-Thiersch A. 1991. Flamingos - Ethologischer Beitrag zur Planung der neuen Anlage. [Flamingos - Ethological contribution to the planning of the new exhibit.] ZOLLI-Bulletin des Vereins der Freunde des Zoologischen Gartens Basel 67:4-5. {German} **

Studer-Thiersch A. 1998. Basle Zoo's veteran flamingos. Flamingo Specialist Group Newsletter 8:33.

Studer-Thiersch A. 2000. Behavioral demands on a new exhibit for greater flamingos at the Basle Zoo, Switzerland. Waterbirds 23(Special Publication 1):185-192. **

Studer-Thiersch A. 2000. What 19 years of observation on captive greater flamingos suggests about adaptations to breeding under irregular conditions. Waterbirds 23(Special Publication 1):150-159. **

Studer-Thiersch A. 2001. Basel Zoo's veteran flamingos. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 44. **

Studer-Thiersch A. 2003. Phoeniconaias, Phoenicoparrus, Phoenicopteridae, Phoenicopteriformes, Phoenicopterus. In: Robiller F, editor. Das grosse Lexikon der Vogelpflege, Bd 2 [The Encyclopedia of Bird Care, Vol2]. Stuttgart: Verlag Ulmer. p 617-620. {German}

Susotl H. 1986. Flamingos at Hagenbeck's Tierpark. Ratel 13(3):76-80.

Testa DC, Johnson RE. Hialeah Park flamingos: historical perspective and management review. In: Shannon PW, editor. 1990 Flamingo Workshop at 1990 AAZPA Western Regional Conference, Sacramento, California; 1992; New Orleans. Audubon Park Zoo. p 49-57. **

Thommen H. 1975. Carotenoid metabolism in ornamental birds. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 183-192. **

Treep JM. 1980. Flamingo's in het Noorder Dierenpark. [Flamingos in the Emmen Zoo.] Zoo Informatie 7:1-12 (19/23-34). {Dutch}

Tysome T. 2003. Flamingos show individuality. Times Higher Education Supplement 1589:56.

Vidakovits I, Pinter A. 2002. Breeding greater flamingos at Budapest Zoo. International Zoo News 49(6):332-334. **

Wackernagel H. 1975. Dietary Requirements. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 196-198. **

Weber G, Wagner D. Chilean flamingo breeding. . . a natural progression. Proceedings of the 1998 Joint Conference AAZK, EMA, AZH; 1998; Indianapolis, Indiana. p 93-101. **

Wicklein VD. 1979. Haltung und Bruterfolg von Chilenischen Flamingos. [Keeping and breeding success of Chilean flamingos.] Die Gefiederte Welt 103(9):162-166. {German} **

Wilkinson R. 1989. Breeding and management of flamingos at Chester Zoo. Avicultural Magazine 95(2):50-61. **

Williamson JE, Penning M, Louis EE. Hybridization between species of flamingos, family Phoenicopteridae: Fact or fiction? 1st International Symposium on Assisted Reproductive Technology for the Conservation & Genetic Management of Wildlife; 2001; Omaha, Nebraska. p 191-192. **

Wilson J. 1994. A dabchick (and flamingos) high and dry. WBC News 166:7.

Yoshitake M, Suzuki T, Yasufuku M, Murata K. 1988. [Breeding flamingos during the last five years (1983-1987) at Kobi Oji Zoo.]. Journal of Japanese Association of Zoological Gardens and Aquariums 29(4):93-98. {Japanese}

Yoshitake W, Suzuki T, Yasufuku M, Murata K. 1992. [Two records of a second egg laying by successful breeders of the European flamingo (*Phoenicopterus ruber roseus*).]. Journal of Japanese Associaton of Zoological Gardens and Aquariums 34(1):4-7. {Japanese}

<u>CONSERVATION</u>

Adil AW. The status of flamingos at the heart of the semi-dry land in Afghanistan. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. p 1. ** abstract only

Alés EE, García Novo F. 1993. La conservacion en Doñana: un modelo a revisar. [Conservation in Doñana: a model to review.] Quercus 92:16-20. {Spanish}

Anderson M. 2000. The status of flamingos in the Northern Cape Province, South Africa. Ostrich 71(3-4):430-434. **

Anderson MD. 1996. A breeding island for flamingos at Kamfers Dam, Kimberley. Kimberley: Northern Cape Nature Conservation Service.

Anderson MD. 2000. Greater flamingo. In: Barnes KN, editor. The Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland. Johannesburg: Birdlife South Africa. p 138.

Anderson MD. 2000. Lesser flamingo. In: Barnes KN, editor. The Eskom Red Data Book of Birds of South Africa, Lesotho, and Swaziland. Johannesburg: Birdlife South Africa. p 138.

Andrade G, Morales J. 1988. Informe de la situación de los flamencos en Colombia. [Report on the situation of the flamingos in Colombia.] Flamingo Specialist Group Newsletter 4:31-40. {Spanish}

André P, Johnson AR. 1981. Le problème des flamants roses dans les rizières de Camargue et les résultats de la campagne de dissuasion du printemps 1981. [The problem of greater flamingos in rice fields of Camargue and results of the campaign of dissuasion in the spring 1981.] Courrier du Parc Naturel Régional de Camargue 22/23:20-35. {French}

Andrusenko NN. 1986. Problemy okhrany i mery po uvelicheniyu chislennosti flamingo v SSSR. [Problems of conservation and methods on increase of the greater flamingo number in the USSR.]. Izuchenie ptits SSSR, ikh okhrana i ispol'zovanie (Tez Dokl 9 i vsesoyuz ornit konf) [The study of birds of the USSR, their conservation and wise management] Part 1 L. p 37-38. {Russian}

Anonymous. 1979. Abroad. National Review 31(38):B143. **

Anonymous. 1982. Kak prognat' flamingo. [How to drive away the flamingo.] Sotsialisticheskaya industriya [Socialistic industry] July 27. {Russian}

Anonymous. 1984. Camarque. IUCN Bulletin 15(4-6):50-52.

Anonymous. 1986. Successful first conference on bird conservation in Turkey. Bulletin of the Ornithological Society of the Middle East 17:21-22.

Anonymous. 1987. Un paradis pour flamants roses: la Turquie. [A paradise for greater flamingos: Turkey.] L'Oiseau Magazine 8:5. {French}

Anonymous. 1993. Flamingos face uncertain future. Kenya Birds 2:6.

Anonymous. 1994. Apoyo espanol para la proteccion de los flamencos caribenos. [Spanish support for the protection of the Caribbean flamingos.] Quercus 95:41. {Spanish}

Anonymous. 1996. Where have the birds gone? News & World Report 121(5):46.

Anonymous. 1997. Flying colors. Travel Holiday:52-55.

Anonymous. 2001. Rescate de flamencos. [Flamingo rescue.] Quercus 186:54. {Spanish}

Anonymous. 2003. Asian countries team up to save desert wetland. Environment 45(3):4.

Anonymous. 2004. The Great Flamingo Roundup. Wildlife Conservation 107(4):10-13.

Antas PdTZ. 1994. Migration and other movements among the lower Parana River valley wetlands, Argentina, and the south Brazil/Pantanal wetlands. Bird Conservation International 4(2-3):181-190.

Archibald TJ. 1991. Etosha flamingoes and the rescue operation in 1989. Lanioturdus 26(1):36-39.

Arengo F. 1997. Habitat Use and Conservation of American Flamingos (*Phoenicopterus ruber ruber*) in Yucatán, Mexico. [Ph.D. Dissertation]. Syracuse, NY: State University of New York. **

Arengo F. 2000. Oil watch in Bolivia. Wildlife Conservation 103(3):21. **

Arengo F, Baldassarre GA. 1997. American flamingos and ecotourism on the Yucatan Peninsula, Mexico. In: J. A. Bissonette RPK, editor. Integrating People and Wildlife for a Sustainable Future, Proceedings of the First International Wildlife Management Congress. Bethesda, Maryland: The Wildlife Society. p 207-210.

Arengo F, Baldassarre GA. 1999. Resource variability and conservation of American flamingos in coastal wetlands of Yucatan, Mexico. Journal of Wildlife Management 63(4):1201-1212. **

Arinaitwe J. 1999. Wetlands and waterbird conservation in East Africa. Wetlands International Publication 55:46-47.

Arnhem R. 1985. Des flamants roses morts pour rien. [Greater flamingos die for nothing.] L'Homme et l'Oiseau 23:172-175. {French}

Arnhem R. 1991. Le trafic des oiseaux exotiques: assez de drames. Des actes! [The exotic bird traffic: enough dramas. Some acts!] L'Homme et l'Oiseau 29:87-98. {French}

Atzeni A, Carta M, Masala MA, Murgia PF, Nissardi S, Pisano G, Porra V, Puglisi M, Zucca C. 1995. Ruolo del volontariato nella tutela della prima nidificazione del fenicottero rosa (*Phoenicopterus ruber roseus*) in Italia. [The role of voluntary service in the protection of the first nesting of the greater flamingo in Italy.] Supplemento alle Ricerche de Biologia della Selvaggina 22:437-438. {Italian}

Aves J. 1992. Flamingoes in a changing world. Marunga 10(60):19-21.

Bahena ACR. Situación de los flamencos en el Estado de Yucatán. [Status of flamingos in the State of Yucatan.]. IWRB Symposium; 1983; Edmonton, May 1982. p 108-111. {Spanish}

Bannikov AG, Flint VE. 1982. My dolzhny ikh spasti: Ocherki o zhyvotnykh iz Krasnoi knigi. [We must save them: Sketches about animals from Red Data Book.]. Moscow: "Mysl': Publishers. 174 p. {Russian}

Barbosa A. 1993. Morphometric variation of the hindlimb of waders and its evolutionary implications. Ardeola 40:65-75.

Barbosa A. 1997. Las Aves Limicolas en Espana. Madrid: Organismo Parques Nacionales (Ministerio de Medio Ambiente).

Barnes KN, editor. 2000. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Johannesburg: BirdLife South Africa.

Bass TA. 1985. Fooling flamingos. Audubon 87(4):90-93.

Bennun LA. 1994. Threats to lesser flamingos in East Africa. In: Howard G, editor. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Nairobi, Kenya: IUCN East Africa Programme, Lake Bogoria Conference. p 31-33.

Bergman C. 2000. In the Pink. Wildlife Conservation Nov/Dec 2000:36-43. **

Blanco DE, Minotti P, Canevari P. 1996. Exploring the value of the neotropical waterbird census as a conservation and wildlife management tool, part I. Report to the Canadian Wildlife Service. 19 p. **

Blanco DE, Minotti P, Canevari P. 1996. Exploring the value of the neotropical waterbird census as a conservation and wildlife management tool, part II. Report to the Canadian Wildlife Service. 18 p. **

Blizzard MJ. 1989. Underground power cables benefit flamingos. Birding in Southern Africa 41(4):128.

Boraiko AA. 1992. In the pink (Chile's flamingos). International Wildlife 22(4):4-11.

Borns PL. 1996. Flamingo fortunes. Wildlife Conservation 99:18. **

Breuker C, Vargas H. 1998. Naturalist guides assist in monitoring flamingos. Noticias de Galápagos 59:29-33.

Britton RH, Johnson AR. 1987. An ecological account of a Mediterranean Salina: The Salin de Giraud (Southern France). Biological Conservation 42(3):185-230.

Brock-Doyle A. 1998. A note on the flamingos in Kyambura Wildlife Reserve, Uganda. EANHS Bulletin 28(1):11-12.

Brooke RK. 1984. South Africa Red Data Book. Pretoria: Council for Scientific and Industrial Research.

Brown C. 2000. Flamingos in Flux. Communique (August):17-18. **

Brown C. Caribbean flamingo ecology in coastal Yucatan, Mexico. American Zoo and Aquarium Association Regional Conference Proceedings; 2003. p 27-29.

Brown C, Boylan JT. 2003. An overview of the conservation of the Caribbean flamingos *Phoenicopterus ruber ruber* in Mexico. Flamingo Specialist Group Newsletter 11:21-23.

Bucher EH. 1992. Population and conservation status of Flamingos in Mar Chiquita, Cordoba, Argentina. Colonial Waterbirds 15(2):179-184. **

Campos L. 1988. Conservación de flamencos en Bolivia: una visión integral. [Conservation of flamingos in Bolivia: an integral vision.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama, Chile: Corporación Nacional Forestal y Sociedad Zoológica de Nueva York. p 160-167. {Spanish} **

Campos LC. 1987. Distribution, human impact, and conservation of flamingos in the high Andes of Bolivia. [Master's Thesis]. Gainesville: University of Florida.

Castro Nogueira H. 1991. Areas de especial interés para el flamenco y su conservatión en Andalucía: Las salinas de Cabo de Gata (Almera). [Areas of special interest for the flamenco and its conservation in Andalusia: The salinas of Cabo de Gata (Almera).] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 207-226. {Spanish} **

Catry P, Araujo A. 1996. O impacto da caca nas aves aquaticas da Lagoa de Santo Andre. [On the impact of hunting on waterfowl in Santo Andre Lagoon.] Airo 7(2):49-57. {Portuguese}

Caziani SM, Marconi P. 1997. Evaluación del estado de conservación del Monumento Natural Laguna de los Pozuelos y propuesta de manejo integrado de este y otros humedales de la Puna Argentina. [Evaluation of the state of conservation of the Natural Monument Laguna de los Pozuelos and proposal for integrated management of this and other wetlands of the Puna Argentina.] In: Liberman M, Baied C, editors. Desarrollo Sostenible en Ecosistemas de Montaña: Manejo de Áreas Frágiles en los Andes. La Paz, Bolivia: The United Nations University. p 313-320. {Spanish} **

Caziani SM, Sureda AL. 2000. Talleres de capacitación para el manejo integrado de los Humedales altoandinos de Argentina, Bolivia, Chile y Perú. [Training workshops for the integrated management of the altoandinos wetlands of Argentina, Bolivia, Chile and Peru.] Técnicas para el monitoreo de condiciones ecológicas y de especies indicadoras Conferencias y Materiales Programa de Humedales Altoandinos, Argentina. {Spanish}

CDC-UNALM and Dirección de Flora y Fauna Silvestres del Ministerio de Agricultura del Perú (DDF). Especies amenazadas de la fauna silvestre Peruana-clasificación oficial. [Threatened species of wild Peruvian fauna-official classification.]. Centro de Datos para la Conservación de la Universidad Nacional Agraria La Molina; 1990; Lima, Perú. {Spanish}

Cézilly F, Johnson AR. 1992. Exotic flamingos in the Western Mediterranean region: a case for concern? Colonial Waterbirds 15(2):261-263.

Chiweshe NC. 1998. Flamingo - the thunder and lightning bird. Honeyguide 44(1):49.

Clark RR, Mosqueira ME. The value of flamingos as a tourism resource in Laguna Pozuelos Natural Monument. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. p 8-9. ** abstract only

Collar NJ, Andrew P. 1988. Birds to Watch. The ICBP World Checklist of Threatened Birds. Cambridge, England: ICBP Technical Publication 8.

Collar NJ, Crosby MJ, Stattersfield AJ. 1994. Birds to Watch 2. The World List of Threatened Birds. Cambridge, England: Birdlife International.

Collar NJ, Gonzaga LP, Krabbe N, Madroño Nieto A, Natanjo LG, Parker TA, Wege DC. 1992. Threatened bids of the Americas: the ICBP/IUCN Red Data Book (third edition, part 2). Cambridge, U.K.: International Council for Bird Preservation.

Colli C. 1996. Return of the Flamingos. BVI Welcome Tourist Guide 25:1-4.

Correa J, Boege E. 1992. Diagnostico de los problemas que afectan al Refugio Faunístico de Ría Lagartos. [Diagnosis of the problems that affect the wildlife refuge of Ría Lagartos.] Flamingo Research Group Newsletter 6:41. ** {Spanish}

Coulson I, Liversidge TN, Letlhare B. 1991. Nata Sanctuary Management Plan. Gaborone, Botswana: Kalahari Conservation Society - Nata Conservation Trust.

de Boer BA. 1984. Grupo de estudio de los flamingos del mundo nuevo. [Research group of new world flamingos.] ICBP-IWRB Flamingo Working Group Newsletter 2:7-10. **

de Boer B, Johnson AR. 1984. ICBP-IWRB Flamingo Working Group Newsletter. 2. **

de Boer B, Johnson AR. 1986. ICBP-IWRB Flamingo Working Group Newsletter. 3. **

de Boer B, Johnson AR. 1988. ICBP-IWRB Flamingo Working Group Newsletter. 4. **

de Boer B, Johnson AR. 1989. ICBP-IWRB Flamingo Working Group Newsletter. 5. **

de Boer BA. 1991. Flamingoproblemen. [Flamingo Problems.] Het Vogeljaar 39(5):220-222. {Dutch} **

do Nascimento JLX. 1993. Developing an integrated monitoring programme for waterbirds in Brazil. IWRB Special Publication 26:23-24.

Dollinger P. 1988. Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora. Indentification Manual, Volume 2. Aves. Lausanne, Switerland: Secretariat of the Convention.

Eliot JL. 1992. Shielded by volcanoes, flamingos still need help. National Geographic Magazine 182(2).

Eminov A, Meredov M, Kekilova AF. 1979. O flamingo, serom zhuravle i ikh okhrane v Turkmenistane. [On the greater flamingo, common crane and their conservation in Turkmenistan.]. Okhrana prirody Turkmenistana [Nature conservation of Turkmenistan], Issue 5: Ashkhabad. p 100-102. {Russian}

Erwin RM. 1996. The relevance of the Mediterranean region to colonial waterbird conservation. Colonial Waterbirds 19(Special Publication 1):1-11.

Finlayson CM, Hollis GE, Davis TJ, editors. 1992. Managing Mediterranean Wetlands and their Birds. Slimbridge: International Waterfowl and Wetland Research Bureau.

Flint VE, Cherkasova MV. 1985. Redkie i ischezayushchie zhivotnye. [Rare and endangered animals.]. Moscow: "Pedagogika" Publishers. 111 p. {Russian}

Fox VE, Lindeque PM, Simmons RE, Berry HH, Brain C, Braby R. 1997. Flamingo 'rescue' in Etosha National Park, 1994: technical, conservation and economic considerations. Ostrich 68(2-4):72-76. **

Galand P. 1985. Maïs ou vont les Flamants roses? [Corn or the greater flamingos go?] L'Homme et l'Oiseau 23:116-118. {French}

Galicia E, Baldassarre GA. 1997. Effects of motorized tourboats on the behavior of nonbreeding American flamingos in Yucatan, Mexico. Conservation Biology 11(5):1159-1165. **

García Fernández J, Ojeda R, Frga R, Díaz GB, Baigún R, editors. 1997. Mamíferos y Aves Amenazadas de Argentina. Libro Rojo. [Red Book of Mammals and Threatened Birds of Argentina.]. Buenos Aires, Argentina: FUCEMA, SAREM, AOP and APN. {Spanish}

Gichuki NN, Gichuki CM. 1993. Developing an integrated monitoring programme for waterbirds in Kenya. IWRB Special Publication 26:25-31.

Githaga JM. 1997. Research on lesser flamingos: utilization patterns and inter-lake movements of the lesser flamingo and their conservation in the saline lakes of Kenya. In: Howard G, editor. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Nairobi, Kenya: IUCN East Africa Programme, Lake Bogoria Conference. p 11-21.

Githaiga JM. The lesser flamingos of Lake Nakuru: past research and mangement implications. In: Barua EN, editor. Use of Reserch Findings in the Management and Conservation of Biodiversity A case of Lake Nakuru National Park; 1995 4-8 December 1994; Nakuru, Kenya.

Glade DAA. 1986. Breve description del proyecto "Conservacion de flamencos en el Norte de Chile". [Brief description of the project "Conservation of flamingos in the North of Chile".] Flamingo Research Specialists Group Newsletter 3:29-30. {Spanish} **

Glade AA. 1988. Red List of Chilean Terrestrial Vertebrates. Santiago: Chilean Forest Service (CONAF).

Gómez López JA, Giménez Ripoll M. 1991. Estatus de conservación de las áreas de especial interés para el flamnco rosa (*Phoenciopterus ruber roseus*) en la Comunidad Valenciana. [Status of conservation of the areas of special interest for the greater flamingo in the Valenciana Community.] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 165-172. {Spanish} **

Gomez R, Ma J. The conservation of priority species national project: case study: flamingos. 1998 Meeting of the Flamingo Specialists Group; 1998; North Miami Beach, Florida. p 23. {Spanish} ** abstract only

Groombridge B, editor. 1994. IUCN Red List of Threatened Animals. Switerzland & Cambridge, UK: IUCN.

Grussu M. 1999. La nidificazione del fenicottero *Phoenicopterus ruber roseus* in Sardegna. [The breeding of the greater flamingo in Sardinia (Italy).] Aves Ichnusae 2(1-2):3-46. {Italian}

Gustin M, Brunner A, Rossi P, Celada C. 2003. Efficacia del sistema delle IBA e della rete delle ZPS per la conservazione di alcune specie di non passeriformi nidificanti in Italia. [Efficacy of IBA and SPA systems for conservation of some breeding non-passerine species in Italy.] Rivista Italiana di Ornitologia 72(2):151-159. {Italian}

Hafner H, Fasola M. 1992. Workshop on colonial waterbirds in the Mediterranean: A summary. Colonial Waterbirds 15(1):159-160.

Harper DM, Childress RB, Harper MM, Boar RR, Hickley P, Mills SC, Otieno N, Drane T, Vareschi E, Nasirwa O, Mwatha WE, Darlington JPEC, Escute Gasulla X. 2003. Aquatic biodiversity and saline lakes: Lake Bogoria National Reserve, Kenya. Hydrobiologia 500:259-276.

Hellyer P. 1994. Disaster for UAE flamingo colony. Oman Bird News 15:10-11.

Hidalgo de Argüeso J. 1991. Las Salinas: Su importancia como hábitat para los flamencos. [The Salinas: Their importance as habitat for flamingos.] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 173-178. {Spanish} **

Hinkelmann C. 1988. Zur Situation des roten Flamingos (*Phoenicopterus ruber ruber*) in Kolumbien. [On the situation of the American flamingo in Colombia.] Trochilus 9(4):131-132. {German}

Hinrichsen D. 1993. Blasting flamingos, gunning for goats (The collapse of the Soviet Union is leaving wildlife in danger from poachers). International Wildlife 23:20.

Hoffer RM, Boyle SC, Boyle TP, Bucher EH. Remote sensing, GIS, and GPS to assess flamingo habitat in the Altiplano of Argentina. Proceedings of the ASPRS/ACSM/RT92 National Convention on "Mapping and Monitoring Global Change"; 1992. p 64-71.

Hoffer RM, Boyle TP, Bucher EH. 1995. Use of Remote Sensing, GIS, and GPS to Assess Aquatic Habitat Critical to Flamingos in the Argentine Altiplano. National Geographic Society Committee for Research and Exploration. 43 p.

Hoogesteijn R, Boede EO. 1980. El flamenco venezolano y los peligros de su super vivencia. [The Venezuelan flamingo and the dangers for its survival.] Natura, Venezuela 69:41-44. {Spanish}

Hopcraft J. 1975. Conservation problems at Lake Nakuru. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamstead, England: Poyser. p 49-52. **

Howard GW, editor. 1994. Understanding wetland biodiversity in East Africa. Gland: IUCN.

Howard GW, editor. 1997. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Proceedings of a Workshop at Lake Bogoria, Kenya. Nairobi, Kenya: IUCN Eastern Africa Regional Programme.

Huertas Pedrero J. 1989. Oficina Valenciana de Anillamiento, balance annual 1988. [Valenciana Office of Banding, annual balance 1988.] Medi Natural 1:15-24. {Spanish}

Hussain SA. 1991. Flamingo breeding-conservation action needed. Newsletter for Birdwatchers 31(3-4):5-6.

Jimenez X, Soler E. 1996. El Conflicto Entre los Flamencos y los Arroceros en el Delta del Ebro. [The conflict Between Flamingos and the Rice Dealers in Delta del Ebro.]. Limonium S.C.P., Tarragona: Estudio Preliminar. 48 p. {Spanish}

Johnson AR. 1975. Construction of breeding island for flamingos. Manual of Wetland Management. Slimbridge, England: International Waterfowl Research Bureau. p 1-6.

Johnson AR. 1979. L'importance des zones humides algériennes pour les Flamants roses (*Phoenicopterus ruber roseus*). [The Algerian humid zone's importance for the greater flamingos.]. Semin Int Avifauna Algerienne, 5-11 Juin 1979. {French}

Johnson AR. 1980. L'Importanza dello stagno di Sale Porcus per i fenicotteri del Mediterraneo. [The importance of the pond of Sale Porcus for the flamingos of the Mediterranean.] Pro Avibus 15(4):15. {Italian}

Johnson AR. 1982. Construction of a breeding island for flamingos in the Camargue. In: Scott D, editor. Managing Wetlands and their Birds. Slimbridge, Glos., England: International Waterfowl Research Bureau. p 204-208.

Johnson AR. 1982. Protection of flamingo colony, Camargue. WWF Yearbook 1982:208-209.

Johnson AR. 1983. Conservation of breeding flamingos in the Camargue (Southern France). Species 17:33-34.

Johnson AR. 1992. The western Mediterranean population of Greater Flamingo: Is it at risk? IWRB Special Publication 20:215-219.

Johnson AR. 1996. WI/SSC Flamingo Specialist Group. Species 24:68.

Johnson AR. 1997. Long-term studies and conservation of greater flamingos in the Camargue and Mediterranean. Colonial Waterbirds 20(2):306-315. **

Johnson AR, editor. 1998. Flamingo Specialist Group Newsletter No. 8. Annual reports 1995-1996. 41 p.

Johnson AR, editor. 1998. Flamingo Specialist Group Newsletter No. 9. Annual report 1997.

Johnson AR. 2000. Flamingo Specialist Group: past, present, and future activities. Waterbirds 23(Special Publication 1):200-205. **

Johnson AR, Arengo F, editors. 2001. WI/IUCN Flamingo Specialist Group Newsletter No. 10. Arles, France: Station Biologique de la Tour du Valat. 60 p. **

Johnson AR, Bennun L. 1994. Lesser Flamingos: concern over Lake Natron. International Waterfowl Research Bureau News 11:10-11.

Johnson AR, de Boer B. 1980. ICBP-IWRB Flamingo Working Group Newsletter. 1.

Johnson AR, de Boer B. 1992. IWRB-ICBP Flamingo Research Group Newsletter. 6.

Johnson AR, de Boer B. 1995. IWRB Flamingo Specialist Group Newsletter. 7.

Johnson AR, Green RE. 1990. Survival and breeding of greater flamingos, *Phoenicopterus ruber roseus*, in the wild after a period of care in captivity. Wildfowl 41:117-121.

Johnson AR, Henry PY. 1998. Annual report 1996. In: Johnson A, editor. Flamingo Specialist Group Newsletter 8. p 11-18.

Johnson AR, Henry PY. 1998. Annual report 1997. In: Johnson A, editor. Flamingo Specialist Group Newsletter 9. p 3-10.

Johnson AR, Mesléard F. 1997. Les flamants et la riziculture. [Flamingos and rice cultivation.] In: Clergeau P, editor. Oiseaux à Risques en Ville et à la Campagne. Paris: INRA. p 53-60. {French}

Jordan KC, editor. 1989. A summary of conservation trends in the Bahamas. Gainesville, Florida: Sandhill Crane Press. 839-844 p.

Kahl MP. 1975. Flamingo Group. Bulletin of the International Council for Bird Preservation 12:220-221.

Kairu JK. 1994. Pesticide residues in birds at Lake Nakuru, Kenya. International Journal of Salt Lake Research 3(1):31-48.

Kear J, Duplaix-Hall N, editors. 1975. Flamingos. Berkhamstead, England: Poyser. **

Keenan J. 1996. Pretty in pink. Nature Conservancy 46(2):16-23. **

Khrokov V. 1981. Zapovednik Kurgal'dzhino. [Kurgal'dzhino Nature Reserve.]. Alma Ata: "Kainar" Publishers. 176 p. {Russian}

Khrokov VV. 1978. Flamingo. Krasnaya kniga Kaz SSR [The Red Data Book of the Kazakh SSR], Part 1 Pozvonochnye [Vertebrates]. Alma Ata. p 100-102. {Russian}

Khrokov VV. 1991. Flamingo. Krasnaya kniga Kazakhskoi SSR [The Red Data Book of the Kazakh SSR] Vol1 Zhivotnye [Animals] 2nd edition. Alma Ata. p 136-137. {Russian}

Khrokov VV. 1996. Flamingo. Krasnaya kniga Kazakhstana [The Red Data Book of Kazakhstan] Vol1 Zhivotnye [Animals] Part 1 Pozvonochnye [Vertebrates] 3rd edition. Almaty Istambul. p 108-109.

Kiefer M. 1994. Of pandas & principles: with the logic of science and the art of persuasion, world-renowned zoologist George Schaller has shaped wildife protection around the globe. International Wildlife 24:30-35.

King CE. 2001. The 1998 Flamingo Specialist Group meeting. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 35-36. **

Kirst B. 1987. Keeping flamingos under his wing; a seventy-one-year-old Bahamian named Jimmy Nixon tends the Caribbean's largest colony of the elegant pink birds. International Wildlife 17:46-51.

Kirst B. 1988. Jimmy Nixon's Flamingos. Animals 121(4):29-31.

Kirwan G. 1991. Karapinar Ovasi, a little-known Turkish IBA. Bulletin of the Ornithological Society of the Middle East 27:24-27.

Kohler P, Kohler U. 1996. The Bazaruto Archipelago, Mozambique, a site of potential international importance for Palearctic waterbirds. Ostrich 67(3-4):165-167. **

Kumar RA. 1986. Rise in global mean sea level has it affected the flamingo breeding grounds? Journal of the Bombay Natural History Society 83(2):433-435.

Kumar SV. 1998. Eco-development works: Impact on bio-diversity conservation in Irkam Island of Pulicat Bird Sanctuary in Andhra Pradesh: A case study. Indian Forester 124(5):280-286.

Lazell J. 2001. Restoration of the greater flamingo (*Phoenicopterus ruber*) to Anegada, British Virgin Islands. Pitirre 14(3):113-114.

Lazell J. 2002. Restoring vertebrate animals in the British Virgin Islands. Ecological Restoration 20(3):179-185.

Lentino MR. 1990. Proyecto de conservación y monitoreo de las poblaciones de flamencos. [Conservation project and monitoring of the populations of flamingos.]: Pequivén, Gerencia Desarrollo de Occidente. {Spanish}

Lincer JL, Zolkind D, Brown LH, Hopcraft J. 1981. Organochlorine residues in Kenya's Rift Valley lakes. Journal of Applied Ecology 18(1):157-171. **

Line L. 1997. Dangerous decline reported in South American flamingos. New York Times (May 6 1997):C6.

Liversedge TN, Greer KR, Letlhare B. 1989. Proposed Nata Sanctuary. Gaborone, Botswana: Kalahari Conservation Society.

Lucena J. 1991. Estudio integral de la laguna de Fuente de Piedra (Málaga, España) como vía de conservación de la misma y sus repercusiones sobre el flamenco (*Phoenicopterus ruber roseus* Pall). [Integral study of the lagoon of Fuente de Piedra (Málaga, Spain) as method of conservation of it and its repercussions on the greater flamingo.] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 185-196. {Spanish} **

Luke A. 1992. Spanish pilots force flamingos to flee. New Scientist 135(1837):7.

Luke A. 1995. Lead kills Spanish birds as hunters shoot wild. New Scientist 146(1980):7.

Luy G. A, Rodner C. 1994. Sociedad conservationista Audubon de Venezuela. [Audubon Conservationist Society of Venezuela.] World Birdwatch 16(1):19. {Spanish}

Manakadan R. 1994. Impact of salt works on waterbirds and their habitats in the Great Vedaranyam Swamp. In: Daniel JC, Rao YN, editors. Ecology of Point Calimere Sanctuary (An Endangered Ecosystem) Final Report (1988-1991). Bombay: Bombay Natural History Society. p 95-131.

Manakadan R. 1995. Impact of salt works on the status, population of the greater flamingo *Phoenicopterus ruber roseus* the lesser flamingo *Phoeniconaias minor* in the Great Vedaranyam Swamp. Journal of the Bombay Natural History Society 92(3):364-371.

Marconi P, Caziani SM. 1998. Flamingo conservation and natural protected areas in northwestern Argentina. International Flamingo Meeting, Florida.

Martin MRP, Ojeda SP, Rendon-Martos M, Johnson AR, editors. 1991. Reunion Tecnica Sobre la Situacion y Problematica del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterraneo Occidental y Africa Noroccidental. [Technical meeting on the Situation and Problem of the Greater Flamingo in the Western Mediterranean and Northwestern Africa.]. Sevilla: Junta de Andalucia. 238 p. {Spanish} **

Martos MR, Johnson AR. 1996. Management of nesting sites for greater flamingos. Colonial Waterbirds 19(Special Publication 1):167-183.

Mascitti V. 1997. Aves de Laguna: Los Flamencos. Estrategias de alimentación en grupos multiespecíficos. [Birds of Lagoon: The Flamingos. Feeding strategies in mulitspecies groups.] In: ORCYT-UNESCO-FUCEMA, editor. Bases para la Conservación Manejo de la Puna y Cordillera Frontal en la Argentina El rol de las Reservas de Biósfera. p 110-126. {Spanish} **

McCulloch GP, Borello WD. 2000. The importance of the Makgadikgadi Salt Pans in Botswana for flamingos in Africa. Waterbirds 23(Special Publication 1):64-68. **

Meininger PL, Mullie WC. 1981. Egyptian wetlands as threatened wintering areas for waterbirds. Sandgrouse 3:62-77.

Meininger PL, Mullié WC. 1981. The Significance of Egyptian Wetlands for Wintering Waterbirds. New York: The Holy Land Conservation Fund.

Milbrink G. 1977. [Nakuru: A bird paradise in danger?]. Fauna och Flora (Stockholm) 72(4):164-174. {Swedish}

Mocci Demartis A. 1991. Perspectivas de conservación en Cerdeña de las áreas húmedas visitadas por el flamenco rosa (*Phoenicopterus ruber roseus* Pallas). [Conservation perspectives in Cerdeña of the wetlands visited by the greater flamingo.] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 179-184. {Spanish} **

Morgan NC. 1982. An ecological survey of standing waters in North West Africa: II. Site descriptions for Tunisia and Algeria. Biological Conservation 24(2):83-113.

Morgan NC. 1982. An ecological survey of standing waters in North West Africa: III. Site descriptions for Morocco. Biological Conservation 24(3):161-182.

Morrison T. 1975. Conservation in South America. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 80-83. **

Mrozek CV. 1991. Living lagoons and the last wet and wild lands of the Yucatan coast (of Mexico): A video documentary. [MS]. New York: State University of New York. 113 p. {English}

Mullié WC, Meininger PL. 1983. Waterbird trapping and hunting in Lake Manzala, Egypt, with an outline of its economic significance. Biological Conservation 27:23-43.

Murimi SK. 1994. Falling water levels in saline lakes of the central Rift Valley of Kenya: the case of Lake Elmenteita. International Journal of Salt Lake Research 3:65-74.

Nasirwa O. 2000. Conservation status of flamingos in Kenya. Waterbirds 23(Special Publication 1):47-51. **

Navrud S, Mungatana ED. 1994. Environmental valuation in developing countries: the recreational value of wildlife viewing. Ecological Economics 11(2):135-151. **

O'Connor A. 2002. Flamingo paradise is losing its luster. New York Times 151(52188):F3.

Ojeda-C MM. 1997. Wildlife management in Venezuela: Experiences and future perspectives. Wildlife Society Bulletin 25(1):49-56.

Ormazabal C. 1988. Determinación de los lugares de importancia para la conservación de los flamencos en Chile. [Determination of the important sites for conservation of flamingos in Chile.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama, Chile: Corporación Nacional Forestal y Sociedad Zoológica de Nueva York. p 168-184. {Spanish} **

Ottenwalder JA, Woods CA, Rathburn GB, Thorbjarnarson JB. 1990. Status of the greater flamingo in Haiti. Colonial Waterbirds 13(2):115-123.

Oza GM. 1986. Threats to unique wildlife through Indian habitat destruction. Environmental Conservation 13(2):131-136.

Ozesmi U. 1989. Protection of Sultan Marshes, Turkey. Sandgrouse 11:73-75.

Paracuellos M, Castro H, Nevado JC, Oña JA, Matamala JJ, García L, Salas G. 2002. Repercussions of the abandonment of Mediterranean Saltpans on waterbird communities. Waterbirds 25(4):492-498. **

Parada M. 1987. Conservación de flamencos en el norte de Chile. Informe de proyecto (or periodo comprendido entre Mayo de 1985 y Abril de 1987). [Conservation of flamingos in the north of Chile. Project report.] Antofagasta, Chile (unpublished): Corporación Nacional Forestal de Chile and New York Zoological Society. {Spanish}

Parada MM, editor. 1988. Primer Taller Internacional de Especialistas en Flamencos Sudamericanos. [First International Workshop of Specialists in South American Flamingos.]. San Pedro de Ataca Chile: CONAF-NYZS. {Spanish}

Pardo H, Este E. 1988. Perspectivas ecologicas para la conservacion y manejo de la poblacion de flamencos en las costas de Venezuela. [Ecological perspectives for the conservation and handling of the population of flamingos in the coast of Venezuela.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoologica de Nueva York. p 154-159. {Spanish} **

Patel T. 1994. French aim their sights on pink flamingos (an endangered species becomes a nuisance to humans). New Scientist 144:9.

Perera BL. 1987. The flamingoes at Bundala. Loris 17(6):236-237.

Perez-Hurtado A, Hortas F. 1993. Actividad trofica de limicolas invernantes en salinas y cultivos piscicolas de la Bahia de Cadiz, Donana. [Trophic activity of wintering shorebirds in saltmines and fish cultures of the Bahia of Cadiz, Donana.] Acta Vertebrata 20:103-124. {Spanish}

Perez-Hurtado A, Hortas F, Ruiz J, Solis F. 1993. Importancia de la Bahia de Cadiz para las poblaciones de limicolas invernantes e influencia de las transformaciones humanas. [Importance of the Bahia of Cadiz for the winter populations of shorebirds and the influence of the human transformations.] Ardeola 40:133-142. {Spanish}

Perrins CM, Ogilvie MA. 1998. The Complete Birds of the Western palearctic [CD-ROM]. Version Version 1.0. Oxford: Oxford University Press, Optimedia.

Pfeifer C. 2001. Aviculture in Action: Aviculture helps flamingos in the Yucatan of Mexico. AFA Watchbird 28(4):61,63. **

Pickering S. 1991. The role of studies on captive flamingos in the conservation and management of wild populations. In: Junta de Andalucia, editor. Reunión Técnica sobre la situación y problemática del flamenco rosa, *Phoenicopterus ruber roseus*, en el Mediterraneo Occidental y Africano Nor Oriental. p 129-133. **

Préfecture de Région Landuedoc Roussillon. 1992. Le comblement des étangs. [The filling of ponds.]. Service Maritime et de Navigation du Languedoc Roussillon. {French}

Pulido V. 1991. El Libro Rojo de la Fauna Silvestre del Perú. [The Red Book of Wildlife in Peru.]. Lima, Perú: Pedro Aguilar. {Spanish}

Register F. 1985. Revised list of migratory birds. Federal Register 50(60):13708-13712.

Rendón M. Situacion actual de la colonia de flamencos (*Phoenicopterus ruber roseus*) en la laguna de Fuente de Piedra. [Current situation of the flamingo colony at the lagoon of Fuente de Piedra.]. Las II Jornadas Ibéricas sobre estudio y proteccion de las zonas humedas; 1988. {Spanish}

Rendón M. 1997. Anillamiento para lectura a distancia: los flamencos de Fuente de Piedra. [Banding for studying at a distance: the flamingos of Fuente de Piedra.] La Garcilla: Boletin-circular de Sociedad Española de Ornitologia 100:31-33. {Spanish} **

Rendón-Martos M, Johnson AR. 1996. Management of nesting sites for greater flamingos. Colonial Waterbirds 19(Special Publication 1):167-183. **

Rocha O. 1994. Contribución preliminar a la conservación y el conocimiento de la ecología de flamencos en la Reserva Nacional de Fauna Andina Eduardo Avaroa, Departamento de Potosí, Bolivia. [Preliminary contribution to the conservation and the knowledge of the ecology of flamingos in the National Reserve of Andean Fauna Eduardo Avaroa, Department of Potosí, Bolivia.] La Paz, Bolivia: Informe técnico de la expedición del Museo de Historia Natural. {Spanish}

Rogel-Bahena A. 1982. Situación de los flamencos en el Estado de Yucatán. [Status of flamingos in the State of Yucatan.] In: Boyd H, editor. First Western Hemisphere Waterfowl and Waterbird Symposium. Edmonton, Alberta, Canada: Waterfowl Research Bureau. p 108-111. {Spanish}

Rooth J. 1975. Caribbean flamingos in a man-made habitat. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 75-79. **

Rooth J. 1982. A manmade breeding sanctuary for flamingos on Bonaire, Netherlands Antilles. In: Scott D, editor. Managing Wetlands and their Birds. Slimbridge, Glos., England: International Waterfowl Research Bureau. p 172-176.

Rubio JC. 1986. Estudio de la comunidad de limicolas de las Marismas del Odiel (Huelva). [Study of the community of shorebirds in the salt marshes of the Odiel.] Oxyura 3:97-132. {Spanish}

Santoro AV. 1988. Situacion de los flamencos y su relacion con los proyectos de areas silvestres protegidos en los Andes de Antofagasta. [Situation of the flamingos and their relationship with the projects of wild areas protected in the Andes of Antofagasta.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoologica de Nueva York. p 185-212. {Spanish} **

Schlüter U. 2002. Der Nationalpark Souss Massa – ein Vogelschutzgebiet im Südwesten Marokkos. [The national park Souss Massa – a bird protectorate in southwest Morocco.] Die Gefiederte Welt 126:134. {German}

Schürmann A. 1989. Millionen in Rosa. [Millions in pink.] Kosmos (Stuttgart) 85(3):50-61. {German}

Schuster G. 1996. The flight of the flamingos. World Press Review 43(11):39.

Senra A. 1985. Laguna de Fuente de Piedra: Soluciones actuales a viejos problemas. [Lagoon of Fuente de Piedra: Current solutions to old problems.] Bios 1:6-10. {Spanish}

Senra Martinez A, Abeledo J, Ales EE. 1991. El Flamenco rosa (*Phoenicopterus ruber roseus*) en Andalucia: Situacion actual y problematica de conservacion. [The greater flamingo in Andalusia: Current situation and conservation problem.] Fuente Piedra: Jornadas de Zonas Humedas Andaluzas. 19-31 p. {Spanish}

Shank CC, Rodenburg WF. 1977. Management Plan for Ab-I-Estada and Dashte Newar Flamingo and Waterfowl Sanctuaries. Kabul: United Nations Department Programme FAO.

Shcherbakov BV. 1982. [On some rare birds in eastern Kazakhstan.]. In: Gvozdev EV, editor. [The animal world of Kazakhstan and the problems of its conservation]. Alma Ata: Nauka. p 201-203. {Russian}

Simion L. 1991. Tra i fennicotteri della Camargue: Dove si Costruisce un Futuro Rosa. [Among the flamingos of the Camargue: Where they're building a rosy future.] Airone 118(Febbraio):78-99. {Italian}

Simmons RE. 1996. Population declines, viable breeding areas, and management options for flamingos in southern Africa. Conservation Biology 10(2):504-514. **

Simmons RE. 1997. The lesser flamingos in southern Africa - a summary. In: Howard G, editor. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Nairobi, Kenya: IUCN East Africa Programme, Lake Bogoria Conference. p 50-61.

Simmons RE. 2000. Declines and movements of lesser flamingos in Africa. Waterbirds 23(Special Publication 1):40-46. **

Simmons RE, Anderson M, McCulloch G. 2001. Flamingo survey in Namibia, Botswana and South Africa. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 37-40. **

Soler-Garcia-de-Oteyza E, Jimenez i Llobera X. 2000. El conflicte entre els flamencos i els arrossaires al Delta de l'Ebre. [The conflict between flamingoes and rice growers of the Ebro Delta.] Depana en Accio 16:3-5. {Catalan}

Stattersfield AJ, Capper DR, editors. 2000. Threatened Birds of the World. Cambridge: BirdLife International.

Thorbjarnarson J. 1997. New park declared (Lago Enriquillo National Park, Dominican Republic). Wildlife Conservation 100:8.

Tindle RW. 1978. Galapagos conservation and tourism - 11 years on. Oryx 17(3):126-129.

Torres B. 1992. Directorio de ornitología del Perú. [Directory of ornithology of Peru.]. Lima, Perú: Grupo Aves Acuáticas del Perú. {Spanish}

Tourenq C, Aulagnier S, Durieux L, Lek S, Mesléard F, Johnson A, Martin J-L. 2001. Identifying rice fields at risk from damage by the greater flamingo. Journal of Applied Ecology 38(1):170-179. **

Tourenq C, Aulagnier S, Mesléard F, Durieux L, Johnson A, Gonzalez G, Lek S. 1999. Use of artificial neural networks for predicting rice crop damage by greater flamingos in the Camargue, France. Ecological Modelling 120(2-3):349-358. **

Tourenq C, Sadoul N, Beck N, Mesléard F, Martin J-L. 2003. Effects of cropping practices on the use of rice fields by waterbirds in the Camargue, France. Agriculture, Ecosystems & Environment 95(2/3):543-549. **

Tupiza A. 1980. Flamingos en peligro. [Flamingos in danger.] Noticias de Galápagos 32:19. {Spanish}

Ugarte J, Mosaurieta L. 1998. Informe a American Bird Conservancy del proyecto "Los Flamencos de la Reserva Nacional Salinas y Aguada Blanca." [Report to American Bird Conservancy of the project "The Flamingos of the salinas and Aguada Blanca National Nature Reserve."]. Arequipa, Perú. {Spanish}

Ugarte-Núñez JA, Mosaurieta-Echegarary L. 2000. Assessment of threats to flamingos at the salinas and Aguada Blanca National Nature Reserve (Arequipa, Perú). Waterbirds 23(Special Publication 1):134-140. **

Van der Have TM, Van den Berk VM, Cronau JP, Langeveld MJ. 1989. Importance of the Cukurova deltas, southern Turkey, for migrating waders and other waterbirds in spring. Sandgrouse 11:76-88.

Velasquez CR. 1992. Managing artificial saltpans as a waterbird habitat: species' responses to water level manipulation. Colonial Waterbirds 15(1):43-55.

Velasquez CR, Hockey PAR. 1992. The importance of supratidal foraging habitats for waders at a south temperate estuary. Ardea 80(2):243-253.

Venter J. 1997. Broeiplek van Grootflaminke (*Phoenicopterus ruber)*. Kimberley: Northern Cape Nature Conservation Service. 1-3 p.

Volkov EN. 1976. O flamingo v Tsentral'nom Kazakhstane i merakh po ikh okhrane. [On the greater flamingo in Central Kazakhstan and measures on their conservation.]. Okhrana prirody i prirodopol'zovanie v Kazakhstane [Nature Conservation and Nature Management in Kazakhstan]. Tselinograd. p 201-204. {Russian}

Wetten Jv, Mbaré CO, Binsbergen M, Spanje Tv. 1990. Zones humides du sud de la Mauritanie. [Humid zones in southern Mauritania.]. Leersum, Holland: RIN report 1. {French}

Wiens JA. 1992. The Ecology of Bird Communities Vol. 1: Foundations and Patterns. Cambridge: Cambridge University Press.

Williams AJ. 1986. Wetland birds of the Orange River mouth and their conservation significance. Bontebok 5:17-23.

Woike M. 2001. Schutz und Entwicklung des Nationalparks Djoudj in der Republik Senegal. [Protection and development of the Djoudj National Park in Senegal.] Landesanstalt fur Okologie Bodenordnung und Forsten Jahresbericht 2001:42-51. {German} **

Yosef R. 2000. Individual distances among greater flamingos as indictors of tourism pressure. Waterbirds 23(Special Publication 1):26-31. **

DISEASE AND VETERINARY ASPECTS

Acuna DG, Inostrosa AM, Ibanez CB, Contreras LR, Leigh JG. 2001. Ausencia de parasitos gastrointestinales en flamencos Chilenos (*Phoenicopterus chilensis*, Molina 1782) juveniles del Salar de Surire. [Absence of gastrointestinal parasites in Chilean flamingo fledglings of Salar de Surire.] Boletin Chileno de Ornitologia 8:27-30. {Spanish}

Aguirre AA, Cook RS, McLean RG, Quan TJ, Spraker TR. 1991. Occurrence of potential pathogens in wild Caribbean flamingos (*Phoenicopterus ruber ruber*) during a lead poisoning die off in Yucatán, Mexico. Journal of Zoo and Wildlife Medicine 22(4):470-475. **

Alonso-Andicoberry C, García-Villada L, Lopez-Rodas V, Costas E. 2002. Catastrophic mortality of flamingos in a Spanish national park caused by cyanobacteria. Veterinary Record 151:706-707. **

Amiard-Triquet C, Pain D, Delves HT. 1991. Exposure to trace elements of flamingos living in a biosphere reserve, the Camargue (France). Environmental Pollution 69(2-3):193-201.

Arai S, Arai C, Fujimaki M, Iwamoto Y, Kawarada M, Saito Y, Nomura Y, Suzuki T. 1991. Cutaneous tumour-like lesions due to Poxvirus infection in Chilean flamingos. Journal of Comparative Pathology 104(4):439-441. **

Arenas A, Carranza J, Perea A, Miranda A, Maldonado A, Hermoso M. 1990. Type A influenza viruses in birds in Southern Spain: serological survey by ELISA and hemaglutination inhibition tests. Avian Pathology 19(3):539-546.

Ashford R, Cézilly F, Hafner H, Gory G. 1995. Scarcity of Haematozoa in some colonical [sic] birds in southern France. Ekologija 4:33-35.

Aue A, Ochs A, Burkhardt S, Hentschke J, Wittstatt U. Tumorförmige Pockenerkrankung bei einem Andenflamingo (*Phoenicoparrus andinus*). [Tumor-like smallpox-disease in an Andean flamingo.]. Verhandlungsbericht des 36 Internationalen Symposiums über die Erkrankungen der Zoo- und Wildtiere, Kristiansand; 1994. p 205-211. {German}

Babero BB, Cattan PE, Jensen LA. 1981. Helmintofauna de Chile: 9. *Flamingolepis chileno* sp. n. parasito de *Phoenicoparrus andinus* Philippi (Cestoda: Hymenolepididae). [Helminth fauna of Chile: 9. *Flamingolepis chileno*, new species, parasite of *Phoenicoparrus andinus* (Cestoda, Hymenolepididae).] Museo Nacional de Historia Natural Boletin (Santiago) 38:105-109. {Spanish}

Ballot A, Krienitz L, Kotut K, Wiegand C, Metcalf JS, Codd GA, Pflugmacher S. 2004. Cyanobacteria and cyanobacterial toxins in three alkaline rift valley lakes of Kenya - Lakes Bogoria, Nakuru and Elmenteita. Journal of Plankton Research 26(8):925-935.

Bayle P, Dhermain F, G. K. 1986. Three cases of lead-poisoning in greater flamingos (*Phoenicopterus ruber roseus)* in Southeastern France. Flamingo Research Specialists Group Newsletter 3:14-16. **

Bayle P, Dhermain F, Keck G. 1986. Trois cas de saturnisme chez le flamant rose *Phoenicopterus ruber* dans la region de Marseille. [Three cases of lead poisoning in the greater flamingo in the Marseille region, France.] Bulletin de la Societé Linneane de Provence 38:95-98. {French}

Baylet R, Rollin PE. 1979. *Edwardsiella tarda* et sp., et *Salmonella typhimurium* chez des oiseaux en Camargue. [*Edwardsiella tarda* and sp., and *Salmonella typhimurium* from birds in Camargue.] Bulletin de la Société ete de Pathologie Exotique et de ses filiales 72:405-410. {French}

Bech C, Johansen K, Maloiy GMO. 1979. Ventilation and expired gas composition in the flamingo (*Phoenicopterus ruber*) during normal respiration and panting. Physiological Zoology 52(3):313-328.

Beer JV, Kear J. 1975. Fungal infections of the plumage. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 203-205. **

Benito V, Devesa V, Munoz O, Suner MA, Montoro R, Baos R, Hiraldo F, Ferrer M, Fernandez M, Gonzalez MJ. 1999. Trace elements in blood collected from birds feeding in the area around Donana National Park affected by the toxic spill from the Aznalcollar mine. Science of the Total Environment 242(1-3):309-323.

Berkhoudt H, Zweers GA. 1995. Anatomical correlates of inverted filter-feeding in flamingos. European Journal of Morphology 33(4):325.

Bertault G, Joulia D, Johnson AR, Raymond M. 1999. Sex determination in greater flamingo chicks through DNA analysis. Waterbirds 22(2):282-284. **

Board RG. 1981. The microstructure of avian eggshells, adaptive significance and practical implicatinos in aviculture. Wildfowl 32:132-136.

Bonet A, Olivares C, Picó ML, Sales E. 1995. L'acumulació de perdigons de plom al Parc Natural del Fondó d'Elx (Alacant): distribució espacial i propostes dáctuació. [Lead shot accumulation in the Parc Natural del Fondó d'Elx i Crevillent F(Alacant; SE Spain): spatial distribution and alternative proposals.] Butlletí Institució Catalana d'Història Natural 63:149-166.

Brand CJ, Duncan RM. 1983. Avian cholera in an American flamingo, *Phoenicopterus ruber*: a new host record. California Fish and Game 69(3):190-191.

Brayton C. 1992. Amyloidosis, hemochromatosis, and atherosclerosis in a roseate flamingo (*Phoenicopterus ruber*). In: Williams JC, K. M. Kocan KM, Gibbs EPJ, editors. Tropical veterinary medicine: Current issues and perspectives; First Biennial Conference of the American Society of Tropical Veterinary Medicine, San Juan, Puerto Rico, February 5-8, 1991. New York: New York Academy of Sciences. p 184-190. **

Brown MJ, Pickering SPC. 1993. The mortality of captive flamingos at Slimbridge 1975-89. Wildfowl 43:185-193.

Burger J, Gochfeld M. 2001. Metal levels in feathers of cormorants, flamingos and gulls from the coast of Namibia in southern Africa. Environmental Monitoring and Assessment 69:195-203. **

Burr EW, Huchzermeyer FW, Riley AE. 1981. Laparoscopic examination to determine sex in monomorphic avian species. Journal of the South African Veterinary Association 52(1):45-47.

Bush M, Smith EE. 1980. Clinical chemistry and haematology as diagnostic aids in zoological medicine. In: Montali RJ, Migaki G, editors. Comparative Pathology of Zoo Animals. Washington D.C.: Smithsonian Institution Press. p 615-620. **

Campbell T, Johnson L, Kirk C. Complex hepatocellular carcinoma in an African lesser flamingo (*Phoeniconaias minor*). Proceedings of the American Association of Zoo Veterinarians; 1993. p 408-409. **

Camus A, Roberts C, Heatley JJ, Pirie G. 2002. What is your diagnosis? Journal of Avian Medicine & Surgery 16(1):69-71. **

Clay T. 1975. Feather Lice. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 159-161. **

Codd GA, Metcalf JS, Morrison LF, Krienitz L, Ballot A, Pflugmacher S, Wiegand C. 2003. A cyano-anomaly? cyanobacterial toxins as contributors to lesser flamingo mass deaths. Harmful Algae News 24:1-2.

Cooper JE, Karstad L, Boughton E. 1975. Tuberculosis in lesser flamingos in Kenya. Journal of Wildlife Diseases 11(1):32-36.

Cosson RP. 1989. Relationships between heavy metal and metallothionein-like protein levels in the liver and kidney of two birds: the greater flamingo and the little egret. Comparative Biochemistry & Physiology - C: Comparative Pharmacology & Toxicology 94(1):243-248. **

Cosson RP, Amiard J-C, Amiard-Triquet C. 1988. Trace elements in little egrets and flamingos of Camargue, France. Ecotoxicology and Environmental Safety 15:107-116.

Cosson RP, Amiard-Triquet C, Amiard JC. 1988. Utilisation des plumes dans la recherche des sources de contamination des oiseaux par les éléments traces: Cd, Cu, Hg, Pb, Se, et Zn chez les flamants de Camargue, France. [Utilization of feathers in the research of sources of bird contamination by trace elements: Cd, Cu, Hg, Pb, Se, and Zn in the flamingos of Camargue, France.] Water Air and Soil Pollution 42(1-2):103-115. {French}

Cosson RP, Metayer C. 1992. Étude de la contamination des flamants de Camargue par quelques elements trace: Cd, Cu, Hg, Pb, Se et Zn. [Survey of the contamination of flamingos of Camargue by some trace elements: Cd, Cu, Hg, Pb, Se and Zn.] Flamingo Research Group Newsletter 6:53. {French} **

Cosson RP, Metayer C. 1993. Étude de la contamination des flamants de Camargue par quelques éléments traces: Cd, Cu, Hg, Pb, Se et Zn. [Survey of the contamination of flamingos of Camargue by some trace elements: Cd, Cu, Hg, Pb, Se and Zn.] Bulletin d'Ecologie 24(1):17-30. {French}

Daicker B, Brückner R, Heldstab A, Pagan O. 1996. Struktur und Funktion der Nickhaut beim Rosaflamingo *Phoenicopterus ruber roseus*. [Structure and function of the nictitating membrane in the greater flamingo.] Der Ornithologische Beobachter 93(1):59-68. {German} **

El Shater SAA. 1996. Mycoplasma infection in greater flamingo, grey Chinese goose and white pelican. Veterinary Medical Journal Giza 44(1):31-36.

Ellis TM, Barry Bousfield R, Bissett LA, Dyrting KC, Luk GSM, Tsim ST, Sturm-ramirez K, Webster RG, Guan Y, Malik Peiris JS. 2004. Investigation of outbreaks of highly pathogenic H5N1 avian influenza in waterfowl and wild birds in Hong Kong in late 2002. Avian Pathology 33(5):492-506.

Ferreira Garcia RG, Schonhofen CA. 1984. Broncopneumonia aspergilica em Flamingo. [Aspergillic bronchopneumonia in a flamingo.] Arquivos de Biologia e Tecnologia (Curitiba) 27(3):341-352. {Portuguese}

Fowler ME. 2001. Order Phoenicopteriformes (flamingos). In: Fowler ME, Cubas ZS, editors. Biology, Medicine, and Surgery of South American Wild Animals. Ames, Iowa: Iowa State University Press. p 95-102.

Gabrian C, MacDonald G. 1980. *Artemia* sp. (Crustace, Anostracea), hôte intermédiaire d'*Eurycestus avoceti* Clark, 1954 (Cestode, Cyclophyllidae) parasite de l'avocetta en Camargue. [*Artemia* sp., intermediate host of *Eurycestus avoceti* Clark, parasite of avocets in Camargue.] Annales de Parasitologie Humaine et Comparée (Paris) 55(3):327-331. {French}

Galaz JL, Gaytan P, Rubilar L, Brevis C. 1999. Presencia de malofagos (Insecta: Phthiraptera) en crias de flamenco chileno (*Phoenicopterus chilensis*) en el Salar de Surire, I Region de Chile. [Presence of Mallophaga (Insecta: Phthiraptera) on young Chilean flamingo in the Surire Salt Lake, I Region of Chile.] Boletin Chileno de Ornitologia 6:17-22. {Spanish}

Garcia-Ruiz JM, Rodriguez-Navarro AB. 1994. The mineral structure of the avian eggshell: A case of competitive crystal growth. Bulletin de d'Institut Oceanographique (Monaco) Special Issue 14(1):85-94.

Gaud J. 1982. Acariens Sarcoptiformes plumicoles des oiseaux Ciconiiformes d'Afrique 2. Parasites des Ciconiidae, Scopidae et Phoenicopteridae. [Arachnid (Sarcoptiformes) plumicoles of African Ciconiiformes. Parasites of Ciconiidae, Scopidae and Phoenicopteridae.] Revue de Zoologie Africaine 96(2):335-357. {French}

Gobel E, Erber M, Grimm F. 1996. *Sarcocystis phoeniconaii* n. sp. Murata, 1986 (Apicomplexa: Sarcocystidae) des Zwergflamingo (*Phoeniconaias minor*:Ciconiiformes). [*Sarcocystis phoeniconaii* n. sp. Murata, 1986 of the lesser flamingo.] Berliner und Münchener Tierärztliche Wochenschrift 109(6-7):239-244. {German}

Godovac Zimmermann J, Braunitzer G. 1984. The amino acid sequence of alpha-A-chain and beta-chain from the major hemoglobin component of American flamingo (*Phoenicopterus ruber ruber*). Hoppe-Seyler's Zeitschrift für Physiologische Chemie 365(4):437-444.

Greenwood AG. 1992. Laparoscopic salpingectomy in a hybrid flamingo. Veterinary Record 131(15):349.

Grimont PAD, Grimont F, Richard C, Sakazaki R. 1980. *Edwardsiella hoshinae*, a new species of enterobacteriacae. Current Microbiology 4:347-351.

Griner LA. 1983. Pathology of Zoo Animals: A Review of Necropsies Conducted over a Fourteen-Year Period at the San Diego Zoo and San Diego Wild Animal Park. Zoological Society of San Diego, California.

Grootenhuis JG. 1995. An overview paper on wildlife disease in Lake Nakuru National Park. In: Barua EN, editor. Use of Reserch Findings in the Management and Conservation of Biodiversity A case of Lake Nakuru National Park. Workshop proceedings, Nakuru, Kenya 4-8 December 1994 ed.

Gutierrez JM, Mateo R, Prats C, Guitart R. 1997. Organochlorine residues in normal and lead-poisoned greater flamingos: Relationships with the fatty acid composition. Journal of Environmental Science & Health, Part A: Environmental Science & Engineering & Toxic & Hazardous Substance Control A32(4):853-863.

Gvosdev EV, Maksimova AP. 1979. Morfologiya i tsikl razvitiya tsestody Gynandrotaenia stammeri (Cestoidea: Cyclophyllidae), parazitiruyushchei u flamingo. [Morphology and developmental cycle of the cestode *Gynandrotaenia stammeri* (Cestoidea, Cyclophyllidea), a parasite of *Phoenicopterus roseus*.] Parazitologiia 13(1):56-60. {Russian}

Gvozdev EV, Maksimova AP. 1985. [On the systematic position of cestodes (Hymenolepididae) from the flamingo *Phoenicopterus roseus* Pall.]. Trudy Gel'Mintologicheskoi Laboratorii 33:36-43. {Russian}

Hassan M, G., Abd El Aal AA. 1999. Studies on helminth parasites infesting some wild birds in Suez canal area and Sinai Peninsula. Assiut Veterinary Medical Journal 40(80):103-118.

Hawkey C, Hart MG, Samour HJ. 1984. Age-related hematological changes and hemopathological responses in Chilean flamingos (*Phoenicopterus chilensis*). Avian Pathology 13(2):223-230. **

Hawkey C, Hart MG, Samour HJ. 1985. Normal and clinical haematology of greater and lesser flamingos (*Phoenicopterus ruber roseus* and *Phoeniconaias minor*). Avian Pathology 14(4):537-541.

Hawkey C, Hart MG, Samour HJ, Knight JA, Hutton RE. 1984. Hematological findings in healthy and sick captive rosy flamingos (*Phoeniciopterus ruber ruber*). Avian Pathology 13(2):163-172. **

Heldstab A. 1991. Flamingos - Medizinischer "check" beim Umzug. [Flamingos - medical check while being moved.] ZOLLI-Bulletin des Vereins der Freunde des Zoologischen Gartens Basel 67:10-11. {German} **

Herkt B. 1977. Vergleichende Anatomie der Nasenhöhle und Nasennebenhöhle bei Stelzvögeln (Ardeidae, Ciconiidae sowie Phoenicopteridae).[Comparitive anatomy of the Nasal Cavities and Sinus Cavities in Ardeidae, Ciconiidae and Phoenicopteridae.] [Ph.D. dissertation]: Universität Hannover.

Hernandez LM, Gomara B, Fernandez M, Jimenez B, Gonzalez MJ, Baos R, Hiraldo F, Ferrer M, Benito V, Suner MA, Devesa V, Munoz O, Montoro R. 1999. Accumulation of heavy metals and arsenic in wetland birds in the area around Donana National Park affected by the Aznalcollar toxic spill. Science of the Total Environment 242(1-3):293-308.

Humphreys PN. 1975. Pathological conditions. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 199-202. **

Humphreys PN, Morgan AJ, Davies RL. 1989. Abnormalities of leg growth in young Chilean flamingoes (*Phoenicopterus chilensis*). Erkrankungen Der Zootiere 31:117-120.

ICONA. 1992. Lead poisoning in flamingos, *Phoenicopterus ruber*, during the spring of 1991 in Donana National Park. In: Pain DJ, editor. Lead Poisoning in Waterfowl: IWRB Special Publication. p 91.

Jones A, Khalil LF. 1978. *Gynandrotaenia stammeri*, an unusual cestode from lesser flamingo in Kenya. Parasitology 77:R46.

Jones A, Khalil LF. 1980. The helminth parasites of the lesser flamingo, *Phoeniconaias minor* (Geoffrey), from Lake Nakuru, Kenya, including a new cestode, *Phoenicolepis nakurensis* new genus, new species. Systematic Parasitology 2(1):61-76.

Kairu JK. 1996. Heavy metal residues in birds of Lake Nakuru, Kenya. African Journal of Ecology 34(4):397-400.

Kaleta EF, Marschall HJ. 1981. Newcastle disease in a zoo affecting demoiselle cranes (*Anthropoides virgo*), greater flamingos (*Phoenicopterus ruber*) and a pied imperial pigeon. Avian Pathology 10(3):395-401.

Keller P, Schulze J, Rüedi D. 1986. Organenzymmuster und Plasmaenzymaktivitäten bei Huhn, Strauss und dem Flamingo. [Organ enzyme activity and plasma enzyme activity in the hen, ostrich and flamingo.] Schweizerisches Archiv für Tierheilkunde 128(8):407-718. {German}

Kock N, Kock R. Disease epidemic in lesser flamingos (*Phoeniconaias minor*) in Kenya. Proceedings of the Joint Conference of AAZV, WDA, AAWV 1995; 1995. p 115. **

Kock ND, Kock RA, Wambua J, Kamau GJ, Mohan K. 1999. *Mycobacterium avium*-related epizootic in free-ranging lesser flamingos in Kenya. Journal of Wildlife Diseases 35(2):297-300. **

Kramer JM, Montali RJ, Strandberg JD, Fortner JH. 1980. Avian amyloidosis. In: Montali RJ, Migaki G, editors. Comparative Pathology of Zoo Animals. Washinton, D.C.: Smithsonian Institution Press. p 317-325. **

Krienitz L, Ballot A, Kotut K, Wiegand C, Pütz S, Metcalf JS, Codd GA, Pflugmacher S. 2003. Contribution of hot spring cyanobacteria to the mysterious deaths of Lesser Flamingos at Lake Bogoria, Kenya. Fems Microbiology Ecology 43(2):141-149. **

Kuroda N. 2003. Fragmental notes on avian morpho-anatomy: 5. Myological analysis of a greater flamingo *Phoenicopterus ruber.* Journal of the Yamashina Institute for Ornithology 34(2):335-340.

Lamberski N. Medical management of flamingos. Proceedings of the North American Veterinary Conference; 1988. p 880-882.

Lanciotti RS, Roehrig JT, Deubel V, Smith J, Parker M, Steele K, B. C, Volpe KE, Crabtree MB, Scherret JH, Hall RA, MacKenzie JS, Cropp CB, Panigrahy B, Ostlund E, Schmitt B, Malkinson M, Banet C, Weissman J, Komar N, Savage HM, Stone W, McNamara T, Gubler DJ. 1999. Origin of the West Nile virus responsible for an outbreak of encephalitis in the northeastern United States. Science (Washington D C) 286(5448):2333-2337.

Lion LW, Nelson YM, DiSante CJ, Motelin GK, Raini JA, Thampy RJ. 1998. Model for trace metal exposure in filter-feeding flamingos at alkaline Rift Valley Lake, Kenya. Environmental Toxicology and Chemistry 17(11):2302-2309.

Lopez A, Merino-Moncada M. 1986. Cholangiocarcinoma and hepatic megalocytosis in a captive flamingo, *Phoenicopterus ruber*. Journal of Zoo Animal Medicine 17(1):147-148. **

Luechtefeld NW, Cambre RC, Wang WLL. 1981. Isolation of *Campylobacter fetus jejuni* from zoo animals. Journal of the American Veterinary Medical Association 179(11):1119-1122.

Maksimova AP. Osobennosti gelmintofauny obyknovennogo flamingo - *Phoenicopterus roseus* Pall. [Peculiarities of helminthofauna of the greater flamingo.]. Tez Dokl XVIII Mezhdunar ornitol kongr [Abstracts of XVIII International Ornithological Congress]; 1982; Moscow. p 193. {Russian}

Maksimova AP. 1991. [On ecology and biology of *Eurycestus avoceti* (Cestoda, Dilepididae).]. Parazitologiya (St Petersburg) 25(1):73-76. {Russian}

Martinez GF, Becerra C, Dominiguez de Tena M, Rodriquez SH. 1981. Mallophaga parasitos del flamenco comun *Phoenicopterus ruber*, Linneo 1758 (Aves: Phoenicopteridae). [Mallophaga parasites of the common flamingo *Phoenicopterus ruber*, Linneo 1758 (Aves: Phoenicopteridae).] Revista Ibérica de Parasitología 41(2):213-224. {Spanish}

Mateo R, Carles Dolz J, Aquilar Serrano JM, Belliure J, Guitart R. 1997. An epizootic of lead poisoning in greater flamingos (*Phoenicopterus ruber roseus*) in Spain. Journal of Wildlife Diseases 33(1):131-134.

McManamon R, Powell Johnson G, Dubielzig RR, Rakich PL, Latimer KS. Surgical management of a pox virus lesion in a Chilean flamingo (*Phoenicopterus chilensis*). American Association of Zoo Veterinarians Annual Proceedings; 1992. p 179.

Mendelsohn JM, Brown CJ. 1989. Wing areas and other dimensions of greater and lesser flamingos. Cimbebasia 10:71-73.

Merritt E, Fritz CL, Ramsay EC. 1996. Hematologic and serum biochemical values in captive American Flamingos (*Phoenicopterus ruber ruber*). Journal of Avian Medicine and Surgery 10(3):163-167.

Midtgard U. 1981. The rete tibiotarsale and arterio-venous association in the hind limb of birds: A comparative morphological study on countercurrent heat exchange systems. Acta Zoologica 62(2):67-88.

Misawa N, Shinohara S, Satoh H, Itoh H, Shinohara K, Shimomura K, Kondo F, Itohc K. 2000. Isolation of *Campylobacter* species from zoo animals and polymerase chain reaction-based random amplified polymorphism DNA analysis. Veterinary Microbiology 71(1-2):59-68.

Misra V, Bakre PP. 1994. Organochlorine contaminants and avifauna of Mahala water reservoir, Jaipur, India. Science of the Total Environment 144(1-3):145-151.

Mocci Demartis A. 1988. [Studies on the mesological factors of the principal sardinian ponds visited by *Phoenicopterus ruber roseus* Pallas: the best conditions selected by it.] Rivista di Idrobiologia 27(1):89-120. {Italian}

Mohan Rae MRK, Choudary C. 1980. Pneumomycosis in a flamingo (*Phoenicopterus ruber* L.). Indian Veterinary Journal 57(9):774-775.

Montali RJ, Hallager S, Tomassoni PE, Cooper G, Richman L. Fatal herpesvirus infections in American flamingo chicks. Meeting of the Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 17-18. ** abstract only

Motelin G, R., Doros T, Doros D. An ecotoxicological study of the potential roles of metals, pesticides and algal toxins on the 1993/5 Lesser Flamingo mass die-offs in Lake Bogoria and Nakuru, Kenya; and the health status of the same species of birds in the Rift Valley Lakes during the 1990s. Proceedings of the East African Environmental Forum; 2000 May 2000; Nairobi. East African Environmental Network. p 11–12.

Murata K. 1986. [A case report of Sarcocystis infection in a lesser flamingo.]. Japanese Journal of Parasitology 35(6):555-557. {Japanese}

Murata K. 1988. [A survey of antibodies against *Toxoplasma gondii* among 2-ME treated plasma samples from zoo animals.]. Journal of Japanese Association of Zoological Gardens and Aquariums 30(4):107-109. {Japanese}

Murata K. 1989. [A serological survey of *toxoplasma gondii* infection in zoo animals and other animals.]. Japanese Journal of Veterinary Science 51(5):935-940. {Japanese}

Murata K, Suzuki T, Yasufuku M, Yoshitake W. 1987. [Ultrastructure of *Sarcocystis* sp. in a lesser flamingo, *Phoeniconaias minor*.] Journal of Japanese Association of Zoological Gardens and Aquariums 29(3):51-54. {Japanese}

Nelson YM. 1997. Formulation, verification and application of integrated models for trace metal phase distribution in laboratory microcosms and aquatic environments (biofilm, lead). [Ph.D. Dissertation]: Cornell University. 327 p.

Nikolov PN, Georgiev BB, Gulyaev VD. 2004. New data on the morphology of species of *Leptotaenia* Cohn, 1901 (Cestoda: Progynotaeniidae). Syst Parasitol 58(1):1-15.

Nusbaum KE, Wright JC, Johnston WB, Allison AB, Hilton CD, Staggs LA, Stallknecht DE, Shelnutt JL. 2003. Absence of humoral response in flamingos and red-tailed hawks to experimental vaccination with a killed West Nile Virus Vaccine. Avian Diseases 47:750-752. **

Odening K, Wolf P, Kellermann F, Stolte M, Bockhardt I. 1998. *Sarcocystis phoeniconaii* (Sporozoa) beim Zwergflamingo - eine Art Einkapselung der Wirtszelle. [*Sarcocystis phoeniconaii* (Sporozoa) in the lesser flamingo: A sort of encapsulation of the host cell.] Der Zoologische Garten 68(1):56-62. {German}

O'Halloran J, Duggan PF, Myers AA. 1987. Determination of haemoglobin in birds by a modified alkaline haematin (D-575) method. Comparative Biochemistry and Physiology B Comparative Biochemistry 86(4):701-704.

Okoh AEJ, Onazi M. 1980. Notes on *Salmonellae* isolated from wildlife in Kana Zoological Gardens. Journal of Wildlife Diseases 16(1):7-10.

Oyugi J. 1994. Lesser flamingos hit by mystery disease. Kenya Birds 2:5-6.

Pain D. 1992. Trace metal exposure of Camargue flamingos. Flamingo Research Group Newsletter 6:53. **

Palma RL, Johnson AR, Cezilly F, Thomas F, Renaud F. 2002. Diversity and distribution of feather lice on greater flamingoes (*Phoenicopterus ruber roseus*) in the Camargue, southern France. New Zealand Entomologist 25:87-89.

Paré JA, Black SR. 1999. Schistosomiasis in a collection of captive Chilean flamingos (*Phoenicopterus chilensis*). Journal of Avian Medicine and Surgery 13(3):187-191.

Peinado VI, Polo FJ, Viscor G, Palomeque J. 1992. Haematology and blood chemistry values for several flamingo species. Avian Pathology 21(1):55-64. **

Pence PA. 1996. Degenerative diseases. In: Rosskopf W, Woerpel R, editors. Diseases of Cage and Aviary Birds. Baltimore, MD: Williams & Wilkins. p 461-462.

Peterson PC, Atyeo WT. 1977. An odd species of feather mite from flamingoes (Acarina: Alloptidae). Acarologia 18(4):723-728.

Petit T. 1993. Myopathie de capture chez des flamants. [Capture myopathy in flamingos.] Le Point Vétérinaire 25(153):253-256. {French}

Phalen DN, Dahlhausen B. 2004. West Nile virus. Seminars in Avian and Exotic Pet Medicine 13(2):67-78.

Portugal MASC, Reboucas MM, Joppert AM, Macruz R, Oliveira JM. 1999. Sarcocystosis in flamingos lesser (*Phoeniconaias minor*) by *Sarcocystis rileye* (Stiles, 1893) Minchin, 1903, in the state of Sao Paulo, Brazil. Arquivos do Instituto Biologico Sao Paulo 66(1):131-133.

Poynton SL, Mukherjee G, Strandberg JD. 2000. Cestodiasis with intestinal diverticulosis in a lesser flamingo (*Phoeniconaias minor*). Journal of Zoo and Wildlife Medicine 31(1):96-99. **

Puerta ML, Garcia del Campo AL, Abelenda M, Fernandez A, Huecas V, Nava MP. 1992. Hematological trends in flamingos, *Phoenicopterus ruber*. Comparative Biochemistry and Physiology--A 102(4):683-686.

Puerta ML, Huecas V, Garcia del Campo AL. 1989. Hematology and blood chemistry of the Chilean Flamingo. Biochemistry & Physiology A-Comparative Physiology 94(4):623-625.

Ramo C, Sanchez C, Hernandez Saint-Aubin L. 1992. Lead poisoning of greater flamingos *Phoenicopterus ruber*. Wildfowl 43:220-222.

Robert F, Gabrion C. 1991. Cestodoses de l'avifaune Camarguaise. Role d'Artemia (Crustacea, Anostraca) et strategies de rencontre hote parasite. [Cestodes of birds in Camargue: Importance of *Artemia* and meeting strategy between hosts and parasites.] Annales de Parasitologie Humaine et Comparée 66(5):226-235. {French}

Roder FEd. 1990. Mortality of waterbirds in N.E. Greece. WIWO Report No 20, Birds of the Wetlands in NE Greece:264-266.

Rollin PE. 1981. Index of diseases of Phoenicopteriformes. Special Report No. 1. Paris, France: Flamingo Working Group -- Old World. **

Rollin PE, Baylet R, Johnson AR. 1983. Intestinal microflora of young greater flamingos (*Phoenicopterus ruber roseus* Pallas) in the Camargue. Journal of Wildlife Diseases 19(1):61-62.

Rollin PE, Rollin D, Baylet R, Johnson AR. 1981. Recherche de Mycobactéries dans le tractus digestif de flamants rose (*Phoenicopterus ruber roseus* Pallas). [Research on Mycobacteria in the digestive track of greater flamingos.] Bulletin de la Société de Pathologie Exotique et de ses Filiales 74(4):391-393. {French}

Rüedi D. Flamingos: Stressuntersuchungen bei Transport innerhalb des Zoo Basel. [Stress related examinations during relocation within the Basle Zoo.]. 11 Arbeitstagung der Zootierärzte im deutschsprachigen Raum; 1991; Stuttgart. Tagungsbericht. p 121-124.

Rysavy B, Sitko J. 1995. New findings of tapeworms (Cestoda) of birds from Moravia and synopsis of bird cestodes from Czech Republic. Prirodovedne Prace Ustavu Akademie Ved Ceske Republicky v Brne (Acta Scientiarum Naturalium Academiae Scientiarum Bohemicae Brno) 29(5):1-66.

Sabat P, Novoa FF, Parado M. 2001. Digestive constraints and nutrient hydrolysis in nestlings of two flamingo species. Condor 103(2):396-399. {English} **

Schaller K. 1995. Stelzvögel, Kraniche, Flamingos. [Waders, cranes, flamingos.] In: Göltenboth R, Klös HG, editors. Krankheiten der Zoo und Wildtiere. Berlin: Blackwell Wissenschafts-Verlag. p 425-438. {German}

Schläfer W. 1979. Qualvoller Tod eines Chileflamingos *Phoenicopterus chilensis*. [Agonizing death of a Chilean flamingo.] Luscinia 44(1-2):90-91. {German}

Schmitz RA, Aguirre AA, Cook RS, Baldassarre GA. 1990. Lead poisoning of Caribbean flamingos in Yucatan, Mexico. Wildlife Society Bulletin 18(4):399-404. **

Schönwetter M. 1985-1992. Handbuch der Oologie, Bd. 4. [Handbook of Oology, Vol. 4.]. Berlin: Akademie-Verlag. {German}

Seidel B. Perosis bei Zoovögeln - zur Prävention und Therapie. [Perosis in zoo birds - about preventive medecine.]. 12 Arbeitstagung der Zootierärzte im deutschsprachigen Raum; 1995 3. - 5. November 1995; Karlsruhe. p 17-27. {German}

Seidel Bv. 1980. Beitrag zur Blutmorphologie von Kranichen (Gruidae), Flamingos (Phoenicopteridae), Pelikanen (Pelicanidae) und Wehrvögelen (Anhimidae). [Contribution to the blood morphology of cranes, flamingos, pelicans, and screamers.] Milu 5(3):466-473. {German}

Sharma S, Mathur KM. 1984. A new species of Armadoskrjabinia (cestode: *Hymenolepididae*), from Indian flamingo (*Phoenicopterus minor*). Pavo 22(1-2):80-83.

Shihabi ZK, Goodman HO, Holmes RP, O'Connor ML. 1989. The taurine content of avian erythrocytes and its role in osmoregulation. Comparative Biochemistry & Physiology A-Comparative Physiology 92(4):545-550.

Shihmanter E, Weisman Y, Gruenberg R, Lipkind M, Eshkar G. 1996. First isolation of avian paramyxovirus serotype 3 in Israel. Veterinary Record 138(6):144.

Shihmanter E, Weisman Y, Lublin A, Mechani S, Gruenberg R, Horowith H, Lipkind M. 1998. Avian paramyxoviruses serotype 3 isolated from captive birds in Israel: Clinical signs, pathology, and antigenic characterization. Avian Diseases 42(2):418-422.

Sileo L, Grootenhuis JG, Tuite CH, Hopcraft JBD. 1979. Mycobacteriosis in the lesser flamingos (*Phoeniconaias minor*) of Lake Nakuru, Kenya. Journal of Wildlife Diseases 15(3):387-390.

Slifka KA, Bowen PE, Stacewicz-Sapuntzakis M, Crissey SD. 1998. A survey of serum and dietary carotenoids in captive wild animals. Journal of Nutrition 129:380-390. {English} **

Spanoghe L, Devos A, Viaene N. 1976. Cutaneous geotrichosis in the red flamingo (*Phoenicopterus ruber*). Sabouraudia-Journal of Medical and Veterinary Mycology 14:37-42.

Steele KE, Linn MJ, Schoepp RJ, Komar N, Geisbert TW, Manduca RM, Calle PP, Raphael BL, Clippinger TL, Larsen T, Smith J, Lanciotti RS, Panella NA, McNamara TS. 2000. Pathology of fatal West Nile Virus infections in native and exotic birds during the 1999 outbreak in New York City, New York. Veterinary Pathology 37:208-224. **

Suarez-R. C, Urios V. 1999. La contaminacion por saturnismo en las aves acuaticas del parque natural de el hondo y su relacion con los habitos alimenticios. [Lead poisoning in aquatic birds of El Hondo Natural Park and its relation to their feeding habits.] Humedales Mediterraneos 1(1999):83-90. {Spanish} **

Thiery A, Robert F, Gabrion C. 1990. Distribution des populations d'Artemia et de leur parasite *Flamingolepis liguloides* (Cestoda, Cyclophyllidea), dans les salins du littoral méditerranéen francais. [Distribution of populations of Artemia and their parasitic *Flamingolepis liguloides* (Cestoda, Cyclophyllidea), in the saline of the French Mediterranean coastline.] Canadian Journal of Zoology 68(10):2199-2204. {French}

Threlfall W. Helminth parasites of an American flamingo from Newfoundland, Canada. Proceedings of the Helminthological Society of Washington; 1981. p 89-90.

Tomasulo AM, Del Lama SN, Rocha CD. 2002. Molecular method of sexing waterbirds without DNA extraction. Waterbirds 25(2):245-248. **

Trott DJ, Atyeo RF, Lee JI, Swayne DA, Stoutenburg JW, Hampson DJ. 1996. Genetic relatedness amongst intestinal spirochaetes isolated from rats and birds. Letters in Applied Microbiology 23(6):431-436. **

Van De Grift ER, III, DeCourcey D. 1975. Erysipelas in Chilean flamingos. Journal of Zoo Animal Medicine 6(1):16. **

Vanden Berge JC. 1976. M. iliotibialis medialis and a review of the M. iliotibialis complex in flamingos. Auk 93(3):429-433. **

Vick K. 2000 March 7, 2000. Kenya's pink death. Washington Post;12.

Wadsworth PF, Jones DM. 1981. An ovarian adenocarcinoma in a greater flamingo (*Phoenciopterus ruber roseus*). Avian Pathology 10(1):95-99.

Wadsworth PF, Majeed SK, Brancker WM, Jones DM. 1978. Some hepatic neoplasms in non-domestic birds. Avian Pathology 7(4):551-555.

Wanjiru J. 2001 July 16, 2001. Kenya's pink flamingos weighted down by heavy metals. Environment News Service.

Webster WA. 1982. Internal parasites found in exotic birds imported into Canada. Canadian Veterinary Journal (La Revue Veterinaire Canadienne) 23(7):230.

Wölms C. 1997. Auswertung von Untersuchungsergebnissen über Todesursachen, Erkrankungen bei Flamingos (Familie Phoenicopteridae), Pelikanen (Familie Pelecanidae) und Pinguinen (Familie Spheniscidae) sowie deren Therapie und Haltung im Zoo (Untersuchungszeitraum 1953 bis 1994).[Evaluation of results concerning death and diseases in flamingos (Phoenicopteridae), pelicans (Pelecanidae) and penguins (Spheniscidae) from the period 1953 - 1994 as well as their therapy and husbandry in the zoo.]: Freie Universität Berlin. {German}

Wood NA. 1975. Tuberculosis. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 206-207. **

Wu Y-H, Liu F-J, Lin S-C, Wang F-L. 1993. [Etiology, prevention and control of visceral gout in flamingos.]. Journal of the Chinese Society of Veterinary Science 19(4):243-248. {Chinese}

Zschiesche W. 1987. Jahreszeitliche Abhängigkeit der Amyloidose bei Zoovögeln. [Seasonal dependence on Amyloidosis in zoo birds.] Biologisches Zentralblatt 106(2):201-205. {German}

Zschiesche W, Linke R. 1989. Immunohistochemical characterization of spontaneous amyloidosis in captive birds as AA-type using monoclonal and polyclonal anti-AA antibodies against mammalian amyloid. Acta Histochemica 86(1):273-278.

DISTRIBUTION, BREEDING SITES AND POPULATION SIZE

Abdi AM, Javed S. 2003. Breeding of greater flamingo in Abu Dhabi, UAE. Flamingo Specialist Group Newsletter 11:20.

Agencia de Medio Ambiente. 1994. El flamenco vuelve a criar en la laguna de Fuente de Piedra. [Flamingos breed again in the lagoon of Fuente de Piedra.] Quercus 103:47. {Spanish}

Ajimuratov K. 1987. Zametki o letnem prebyvanii flamingo v del'te Amudar'i. [Notes on the summer presence of the greater flamingo in AmuDaria R. Delta.]. Mlekopitayushchie i ptitsy Uzbekistana [Mammals and birds of Uzbekistan]. Tashkent. p 48-49. {Russian}

Albanese G, Baccetti N, Magnani A, Serra L, Zenatello M. 1997. Breeding of the greater flamingo, *Phoenicopterus ruber roseus,* in Apulia, southeastern Italy. Alauda 65(2):202-204. **

Ali S, Hussain SA. 1980-86. Studies on the Movement and Population Structure of Indian Avifauna. Annual Reports 1-4. Bombay: Bombay Natural History Society.

Allan DG, Sinclair JC, Rossouw J. 1999. The waterbirds (Aves) of Durban Bay: Current status and historical trends. Durban Museum Novitates 24:1-21.

Alonso Carballo H. 1988. Composicion quimica de lagunas posibles habitat de flamencos en el Altiplano Andino de la region de Antofagasta, Chile. [Chemical composition of possible lagoon habitats for flamingos in the Andean highland of the region of Antofagasta, Chile.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoologica de Nueva York. p 80-83. {Spanish} **

Amat JA. 1984. Las poblaciones de aves acuaticas en las lagunas andaluzas : composiciony diversidad durante un ciclo nual. [The populations of aquatic birds in the Andalusian lagoons: composition and diversity during an annual cycle.] Ardeola 31:61-79. {Spanish}

Amat JA, Garcia L. 1979. Distribucion y fluctuaciones mensuales de aves acuaticas en Andalucia Occidental. Invierno 1977/78. [Distribution and monthly fluctuations of aquatic birds in Western Andalusia. Winter 1977/78.] Doñana; Acta Vertebrata 6(1):77-90. {Spanish}

Anderson MD. 1994. Greater flamingo breeding attempt at Kamfers Dam, Kimberley. Mirafra 11(3):45-46.

Anderson MD. 1998. Flamingos at Kamfers Dam. Bird Numbers 7(3):16. **

Anderson MD. 2004. Lesser flamingo breeding attempt at Kamfers Dam, Kimberley. Bird Numbers 13(2):19-22.

Andrade GI. 1987. Distribucion actual y problematica de conservacion del flamenco del Caribe en Colombia. [Current and problematic distribution of conservation of the American flamingo in Colombia.] Rupicola 7(5-6):1-4. {Spanish}

Andrews IJ, Naylor K. 2002. Records of species and subspecies recorded in Scotland on up to 20 occasions. Scottish Birds 23(2):1-56. **

Andrusenko NN. 1981. Dinamika chislennosti kolonial'nykh okolovodnykh ptits v gnezdovyj period na oz. Tengiz. [Dynamics of numbers of colonial water birds in nesting period on the Tengiz Lake.]. Razmeshchenie i sostoyanie gnezdoviy okolovodnykh ptits na territorii SSSR [Distribution and status of nesting places of water birds in territory of the USSR]. Moscow: "Nauka" Publishers. p p. 118, 120. {Russian}

Andrusenko NN. 1984. [Methods of flamingo census.]. Migratsii Ptits v Azii 7:246-252. {Russian}

Anonymous. 1982. Flamingo vozvrashchayutsya. [Flamingos are returning.] Za rubezhom [Abroad] 52. {Russian}

Anonymous. 1983. Flamingo na l'du. [Flamingo on ice.] Trud [Labour] 8. {Russian}

Anonymous. 1984. Some noteworthy recoveries - sightings. ICBP-IWRB Flamingo Working Group Newsletter 2:33. **

Anonymous. 1986. Marine Observers log. January, February, March. Birds. Western Mediterranean Sea. Marine Observer 56(291):16. **

Anonymous. 1987. The 1987 flamingo census. Noticias de Galápagos 45:5.

Anonymous. 1987. Censos de flamencos. [Flamingo census.] Cuadernos de Ornitologia 1:1. {Spanish}

Anonymous. 1988. Some noteworthy recoveries - sightings. Flamingo Research Specialists Group Newsletter 4:44. **

Anonymous. 1989. Flamingo ringing in 1988. Flamingo Research Group Newsletter 5:39. **

Anonymous. 1990. Cria record del flamenco en Fuente de Piedra. [Breeding record of the flamingo in Fuente de Piedra.] Quercus 56:38. {Spanish}

Anonymous. 1990. El flamenco rosa bate este año todos los récords de nidificación. [The greater flamingo beats this year all the nesting records.] Medioambiente 11:9. {Spanish}

Anonymous. 1990. Soda Ash Botswana - The paradox of Sua. African Wildlife 44:244-246.

Anonymous. 1990. WIWO, the eastern Mediterranean wader project 1990, preliminary report, September. 75 p.

Anonymous. 1992. Flamingo ringing in 1989 and 1990 (old world). Flamingo Research Group Newsletter 6:31-32. **

Anonymous. 1992. Technical seminar on the status and conservation problems of the greater flamingo (*Phoenicopterus ruber roseus)* in the Western Mediterranean and Northwest Africa. Flamingo Research Group Newsletter 6:16-19. **

Anonymous. 1994. Flamingos nesting in Gujarat City. Hornbill (Bombay) 1994(1):14, 16-17.

Anonymous. 1996. Lesser flamingos do it again. Kenya Birds 4(2):62.

Anonymous. 1996. Ringing returns. Oman Bird News 19:1.

Anonymous. 1998. Flamingo ringing in 1995-1996. Flamingo Specialist Group Newsletter 8:20-21.

Anonymous. 2001. Flamingo marking schemes 1998-2000. Flamingo Specialist Group Newsletter 10:33-34.

Anonymous. 2004. Lost Flamingo. Russian Life 47(1):10. **

Antas PTZ. 1990. Novos registros para a avifauna do Rio Grande do Sul. [New records to the avifauna of Rio Grande do Sul.] VI Encontro Nacional de Anilhadores de Aves Pelotas:80-81. {Portuguese}

Antunez A, Blacso M, Vargas JM. 1979. Informe sobre *Phoenicopterus ruber* L. en la laguna de Fuente Piedra durante 1978. [Report on *Phoenicopterus ruber* L. in the laguna de Fuente Piedra during 1978.]. Dept. de Zoologia, Universidad de Malaga. {Spanish}

Antunez A, Vargas JM, Blasco M. 1980. Avifauna de la Laguna de Medina (Cadiz). [Avifauna of Laguna de Medina (Cadiz).] Boletín de la Estacíon Central de Ecología 9:55-62. {Spanish}

Aragoneses J, Echevarrías Escuder JL. 1998. El flamenco vuelve a criar en los humedales del sur de Alicante. [Flamingos breed again in the wetlands of southern Alicante.] Quercus 144:15-18. {Spanish}

Archibald TJ, Nott TB. 1988. The breeding success of flamingos in Etosha National Park, 1986. Madoqua 15(3):269-270.

Arengo F. 1998. Recent population estimates and nesting activity of American Flamingos (*Phoenicopterus ruber ruber*) in Yucatan, Mexico. Flamingo Specialist Group Newsletter 9:16-18.

Arinaitwe J. Current status and distribution of lesser flamingos in East Africa, especially in Uganda. 1998 Meeting of Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 2-3. ** abstract only

Aspinall SJ, Hellyer P. 1999. Greater flamingos breed in Abu Dhabi. Phoenix 16:17-18.

Aspinall SJ, Hirschfeld E. 1993. The first breeding of greater flamingo *Phoenicopterus ruber* in the UAE. Tribulus 3(2):5-6, 18.

Aspinall SJ, Hirschfeld E. 1993. Greater flamingos breed in the United Arab Emirates in 1993. Phoenix 10:14-15.

Associazione Faunisti Veneti. 2004. Rapporto Ornitologico per la regione Veneto. Anno 2003. [Ornithological report for 2003 in the Veneto region (NE Italy).] Bollettino del Museo Civico di Storia Naturale di Venezia 55:171-199.

Aukes P. 1989. Cukurova: een vogelrijke delta in Turkije. [Curkova: a bird-rich delta in Turkey.] Panda 3:10-11. {Dutch}

Baccetti N. 1995. First recorded breeding by flamingos on Mainland Italy. IWRB Flamingo Specialist Group Newsletter 7:48. **

Baccetti N, Basso M, De Faveri A, Talamelli A. 1997. Resightings of greater flamingos in Tunisia, February 1994. WIWO Report 54:111-118.

Baccetti N, Cianchi F, Dall'Antonia P, DeFaveri A, Serra L. 1994. Nidificazione di fenicottero, *Phoenciopterus ruber*, nella Laguna di Orbetto. [Nesting of the greater flamingo in the Orbetello Lagoon.] Rivista Italiana di Ornitologia 64(1):86-87. {Italian}

Baccetti N, Dall'Antonia P, Magagnoli P, Melega L, Serra L, Soldatini C, Zenatello M. 2002. Risultati dei censimenti degli uccelli acquatici svernanti in Italia :distribuzione, stima e trend delle popolazioni nel 1991-2000. [Results of censuses of the water birds wintering in Italy: distribution, status and trends of the populations in 1991-2000.] Biologia e Conservazione della Fauna 111:(68-69 greater flamingo). {Italian}

Baker NE. 1984. Counts of greater flamingos in Eastern Lybia. ICBP-IWRB Flamingo Working Group Newsletter 2:19-22. **

Balmer DE. 2001. Lesbos: an eastern Mediterranean hotspot. Sandgrouse 23(1):18-23.

Bapat NN. 1991. Greater flamingo in Kutch. Newsletter For Birdwatchers 31(1-2):11-12.

Bapat NN. 1992. A visit to the Flamingo City' in the Great Rann of Kutch,Gujarat. Journal of the Bombay Natural History Society 89(3):366-367.

Batllori E, Correa J, Murgula R, Boege E. 1992. Reporte de la vista al ecosistema lagunar de la Ria Lagartos. [Report on the view of the lagoon ecosystem of Ria Lagartos.] Flamingo Research Group Newsletter 6:40. {Spanish} **

Beaubrun P, Thevenot M. 1983. Recensement Hivernal d'Oiseaux d'Eau au Maroc - Janvier 1983. [Winter Census of Water Birds in Morocco - January 1983.]. Rabat: Institut Scientifique, Dept. de Zoologie et Ecologie Animale & Direction des Eaux et Forets, Division de la Chasse, de la Peche et Protection de la Nature. 22 p. {French}

Bege LAR, Pauli BT. 1990. Primer reporte de *Phoenicoparrus andinus* en Brasil. [First report of *Phoenicoparrus andinus* in Brazil.] Volante Migratorio 14:6. {Spanish}

Bege LAR, Pauli BT. 1990. Two birds new to the Brazilian avifauna. Bulletin of the British Ornithologists' Club 110(2):93-94.

Bellatreche M, Chalabi B. 1988. Recensements internationaux d'oiseaux d'eau, Algerie-1987. [International census of waterbirds, Algeria-1987.] El Harrach: Report I.N.A. {French}

Bellatreche M, Ochando B. 1987. Recensements hivernaux d'oiseaux d'eau, Aglerie-1987. [Winter census of waterbirds, Algeria-1987.] El Harrach: Report I.N.A. {French}

Bennun LA. 1994. The status of lesser and greater flamingos in Kenya. In: Howard GW, Nasirwa O, editors. Wetland Biodiversity in East Africa: Proceedings of a GEFWorkshop, Nakuru, 9–13 November 1993. Nairobi: IUCN. p 10–26.

Bennun LA, Nasirwa O. 2000. Trends in waterbird numbers in the southern Rift Valley of Kenya. Ostrich 71(1-2):220–226.

Benson CW. 1984. Origins of Seychelles land birds. In: Stoddart DR, editor. Biogeography and ecology of the Seychelles Islands. The Hague, Netherlands: Dr. W. Junk Publication. p 469-486.

Berezovikov NN. 1989. Ptitsy Markakol'skoi kotloviny (Yuzhnyi Altai). Alma Ata: "Nauka" Kazakhskoi SSR.

Berger J. 1982. Chile Flamingo an den Eschefelder Teichen. [Chilean flamingos at the Eschefelder Ponds.] Der Falke 29(1):30. {German}

Berndt RK, Busche G. 1987. Ornithologischer Jahresbericht für Schleswig-Holstein 1985. [Ornithological annual report for Schleswig-Holstein 1985.] Corax 12(3):161-207. {German}

Berry HH. 1975. The great flamingo trek. African Wildlife 26:58-60.

Berry HH. 1975. South West Africa. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 53-60. **

Bijlsma RG, de Roder FE. 1986. Notes on the birds of some wetlands in Turkey. WIWO Report 12:1-32.

Blanco D, Canevari P, editors. 1992. Censo Neotropical de Aves Acuáticas 1992. Humedales para las Americas. [Neotropical Census of Aquatic Birds 1992. Wetlands of the Americas.]. Buenos Aires, Argentina. 62 p. {Spanish}

Blanco D, Canevari P. 1993. Censo Neotropical de Aves Acuáticas 1993. Humedales para las Americas. [Neotropical Census of Aquatic Birds 1993. Wetlands of the Americas.]. Buenos Aires, Argentina. 105 p. {Spanish}

Blanco D, Canevari P. 1994. Censo Neotropical de Aves Acuáticas 1994. Humedales para las Americas. [Neotropical Census of Aquatic Birds 1994. Wetlands of the Americas.]. Buenos Aires, Argentina. 88 p. {Spanish}

Blanco D, Canevari P, editors. 1995. Censo Neotropical de Aves Acuáticas 1995. Humedales para las Americas. [Neotropical Census of Aquatic Birds 1995. Wetlands of the Americas.]. Buenos Aires, Argentina. 69 p. {Spanish}

Blanco D, Canevari P. 1996. The Neotropical Waterbird Census: evaluation of the first five years. Gibier Faune Sauvage, Game WIldl 13(2):221-226 (Wetlands International Pub. 240).

Blasco M, Lucena J, Rodriquez J. 1979. Los flamencos de Fuente Piedra. [The flamingos of Fuente Piedra.] Bolletí de la Societat d'Història Natural de les Balears [Naturalia Hispanica, Instituto para la Conervación de la Naturaleza (ICONA), Madrid] 23:1-55. {Spanish}

Bond J. 1978. Supplement 22: Check-list of Birds of the West Indies. Philadelphia: Academy of Natural Sciences.

Borello WD. 1997. Comment on early records of flamingo breeding in Sua Pan, Makgadikgadi Pans, Botswana. Babbler (Gaborone) 32:41-43.

Borello WD, Borello RM, Taylor PM, Ward AM. 2002. Aerial survey of lesser flamingos *Phoeniconaias minor* breeding at Sua Pan, Makgadikgadi Pans, Botswana in January 2002. Babbler (Gaborone) 40:23-27.

Borello WD, Mundy PJ, Liversedge TN. 1998. Movements of greater and lesser flamingos in Southern Africa. Torgos 28:201-218.

Bornschein MR. 1992. Nova ocorrência de *Phoenicoparrus andinus* para o Brasil. [New occurrence of *Phoenicoparrus andinus* for Brazil.]. I Congresso Brasileiro de Ornitologia: Campo Grande. {Portuguese}

Bornschein MR, Reinert BL. 1996. The Andean flamingo in Brazil. The Wilson Bulletin 108(4):807-808. **

Boshoff AF. 1979. A breeding record for the greater flamingo in the Cape Province. Ostrich 50(2):124.

Boutin J, Chérain Y, Vandewalle P. 1991. Suivis de populations naturelles, compte rendu ornithologique camarguais pour les années 1988-1989. [Following of natural populations, camarguais ornithological report for years 1988-1989.] La Terre et la Vie (Revue d'Ecologie) 46:263-289. {French}

Branco MBC, Rocha O, Dias MM. 2001. The occurrence of *Phoenicopterus chilensis* Molina (Aves, Phoenicopteridae) in Sao Paulo State reservoirs. Brazilian Journal of Biology 61(4):703-704.

Brichetti P. 1983. Distribuzione geografica degli uccelli nidificanti in Italia, Corsica e Isole Maltesi. 3. Famiglie Phoenicopteridae, Ardeidae (generi *Botaurus*, *Ixobrychus*). [Geographical distribution of the nesting birds in Italy, Corsica and Maltese Islands. 3. Families

Phoenicopteridae, Ardeidae (genera *Botaurus*, *Ixobrychus*).] Natura Bresciana 20:197-234. {Italian}

Briot J-L. 1989. Boeing 747 encounters flock of flamingos in flight. Flamingo Research Group Newsletter 5:24. **

Broekhuysen GJ. 1975. South Africa. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamstead, England: Poyser. p 61-64. **

Brooks T, Davalos LM. 2001. The birds of Ile-a-Vache, Haiti. Caribbean Journal of Science 37(1-2):112-115. **

Brown LH. 1975. East Africa. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamstead, England: Poyser. p 38-48. **

Bruner AW. 2004. From the archives - part 5 Ciconiiformes continued - family Threskiornithidae (ibis, spoonbill), Ciconiidae (wood stork), Carthartidae (vultures), and Phoenicoperidae (flamingo). Indiana Audubon Quarterly 82(1):19-43.

Bucher EH, Chani JM, Echevarria AL. 2000. Andean flamingos breeding at Laguna Brava, La Rioja, Argentina. Waterbirds 23(Special Publication 1):119-120. **

Bucher EH, Echevarria AL, Juri MD, Chani JM. 2000. Long-term survey of Chilean flamingo breeding colonies on Mar Chiquita Lake, Córdoba, Argentina. Waterbirds 23(Special Publication 1):114-118. **

Bucher EH, Herrera G. 1981. Communidades de aves acuaticas de la laguna Mar Chiquita (Cordoba, Argentina). [Colonies of aquatic birds at the Mar Chiquita lagoon (Cordoba, Argentina).] Ecosur 8:91-120. {Spanish}

Bucher EN. 1977. Estado actual de las colonias de flamencos de la Laguna de Mar Chiquita, Cordova, Argentina. [Current status of the flamingo colonies at the Laguna de Mar Chiquita, Cordova, Argentina.]. Resumenes del Septimo Congreso Latinoamericano de Zoologia. Tucaman, Argentina. {Spanish}

Buden DW. 1990. The birds of Rum-Cay, Bahama Islands. Wilson Bulletin 102(3):451-468. **

Buden DW. 1992. The birds of Long Island, Bahamas. Wilson Bulletin 104(2):220-243. **

Buden DW. 1992. The birds of the Exumas, Bahama Islands. Wilson Bulletin 104(4):674-698. **

Carp E. 1992. The flamingo colony at the Laguna de Llancanelo (Provincia de Mendoza) Argentina. Flamingo Research Group Newsletter 6:45. **

Carp E, Scott DA. 1979. The Wetlands and Waterfowl of Iraq. Report on the Joint Expedition of the International Waterfowl Research Bureau and the University of Basrah, Iraq: 10th January to 3rd February 1979. Unpublished report in IWRB files. 34 pp.

Casalis de Pury RJ, Greenburg DA. 1978. Greater flamingo (*Phoenicopterus ruber*) at Luanshya. Bulletin of the Zambian Ornithological Society 10(1):31-32.

Casler CL, Esté EE. 2000. Caribbean flamingos feeding at a new solar saltworks in western Venezuela. Waterbirds 23(Special Publication 1):95-102. **

Casler CL, Esté EE, Pardo HM. 1994. Breeding of the greater flamingo in western Venezuela. Colonial Waterbirds 17(1):28-34. **

Casler CL, Lira JR. 1983. Estudio faunístico de los manglares del Sector Los Olivitos, Distrito Miranda, Estado Zulia. [Faunistic study of the swamps of the Sector Los Olivitos, District Miranda, Zulia State.]. Maracaibo, Venezuela: Serie Informes Científicos. {Spanish}

Castro H. 1993. Las Salinas de Cabo de Gata. Almeria: Institution De Estudios Almerienses. {Spanish}

Castroviejo J. 1980. Nidificacion de los flamencos (*Phoenicopterus ruber*) en las Marismas de Guadalquivir. [Nesting of the flamingos (*Phoenicopterus ruber*) in the Swamps of Guadalquivir.] Reunion Iberoamericana de Conservacion de Zoologia de Vertebrados 1980:66. {Spanish}

Catry P. 1999. [Extinctions of breeding birds in mainland Portugal: a review.]. Airo 10(1):1-13. {Portugese}

Caziani SM, Derlindati E. 2000. Abundance and habitat of high Andes flamingos in northwestern Argentina. Waterbirds 23(Special Publication 1):121-133. **

Caziani SM, Derlindati EJ. 1999. Humedales altoandinos del noroeste de Argentina: su contribución a la biodiversidad regional. [High Andean wetlands of the northwest of Argentina: their contribution to the regional biodiversity.] In: Malvárez AI, editor. Tópicos sobre Humedales Subtropicales y templados de Sudamérica. Buenos Aires, Argentina: Universidad de Buenos Aires. p 1-13. {Spanish} **

Caziani SM, Derlindati EJ, Tálamo A, Sureda AL, Trucco CE, Nicolossi G. 2001. Waterbird richness in altiplano wetlands of Northwestern Argentina. Waterbirds 24(1):103-117. **

Celletti S, Meschini A. 1995. Lo svernamento del fenicottero, *Phoenicopterus ruber*, alle Saline di Tarquinia (Viterbo). [Wintering of greater flamingos in the Tarquinia salines (Viterbo, Central Italy).] Rivista Italiana di Ornitologia 64(2):153-154. {Italian}

Centre d'Etude sur les Ecosystemes de Provence. 1990. Rubrique naturaliste. [Naturalist column.] Garrigues 29:14-16. {French}

Cézilly F, Gowthorpe P, Lamarche B, Johnson AR. 1994. Observations on the breeding of the greater flamingo, *Phoenicopterus ruber roseus*, in the Banc d'Arguin National Park, Mauritania. Colonial Waterbirds 17(2):181-183. **

Chapman BR, Buckley PA, Buckley FG. 1979. First photographic record of greater flamingo in Texas. Bulletin of the Texas Ornithological Society 12(1):20-21.

Chenaux RR. 1995. Of vultures, night herons and flamingos. Honeyguide 41(2):107.

Childress B, Harper D, Hughes B, Van den Bossche W, Berthold P, Querner U. 2004. Satellite tracking lesser flamingo movements in the Rift Valley, East Africa: pilot study report. Ostrich 75(1):57-65.

Cooper J, Hockey P. 1981. The Atlas and Site Register of South African Coastal Birds. Cape Town, South Africa: University of Cape Town.

Correa-Sandoval J, Batlori E. 1990. Dispersión de flamencos (*Phoenicopterus ruber*) en la costa de la Peninsula de Yucatan. [Dispersion of flamingos on the coast of the Yucatan Peninsula.] Yucatán, Mexico: Unidad Mérida. {Spanish}

Correa-Sandoval J, García-Barrón J. 1992. Estado actual de la población de flamencos en la Península de Yucatán. [Current status of the flamingo population on the Yucatan Pennisula.] Yucatán, Mexico: Unidad Mérida. {Spanish}

Correa-Sandoval J, García-Barrón J, Migoya R. 1994. Flamencos anidando en Los Petenes, Campeche. [Flamingos nesting in Los Petenes, Campeche.] Sian Ka'an Serie Documentos 2:62-63. {Spanish}

Cremers HC. 1992. Flamingos flourish in northern Germany. New Scientist 136(3 October):4. **

Dakki M, Baouab RE, El Agbani M-A. 1991. Recensement hivernal d'oiseaux au Maroc: Janvier 1991. [Winter census of birds in Morocco: January 1991.] Doc Institut Scientifique, Rabat 14:1-30. {French}

Dall'Antonia P, Baccetti N, Cianchi F. 1996. Origine, fenologia e movimenti dei fenicotteri della laguna di Orbetello. [Origin, phenology and movements of greater flamingos at Orbetello Lagoon, Central Italy.] Rivista Italiana di Ornitologia 66(2):97-117. {Italian}

Daneel ABC, Robertson HG. 1982. Two previously undocumented breeding records of the greater flamingo in the Orange Free State. Ostrich 53(1):51-52. **

Danilenko EA, Danilenko AK, Chibisova VV. 1977. O raspredelenii flamingo v poslegnezdovoe vremya na yuge Turgaiskoi lozhbiny. [On flamingo distribution in post nesting time in the south of turgai depression.] Ornitologiya (13):202-204. {Russian}

de Boer B, Rooth J. Notes on a visit to Chichiriviche (Venezuela). CCA Ecology Conference Bonaire; 1976 September 1975. Netherlands Antilles National Parks Foundation. p 40-41. **

de Boer BA. Flamingos on Bonaire and in Venezuela. 1979; Curaçao, Netherlands Antilles. Netherlands Antilles National Parks Foundation (Stichting Nationale Parken Nederlandse Antillen Documentation). p 1-59.

de Boer BA. 1986. News from the regions (new world). Flamingo Research Specialists Group Newsletter 3:17-18. **

de Boer BA. 1988. News from the regions (new world). Flamingo Research Specialists Group Newsletter 4:21-23. **

de Boer BA. 1989. News from the regions (new world). Flamingo Research Group Newsletter 5:25-37. **

de Boer BA. 1992. News from the regions (new world) 1990. Flamingo Research Group Newsletter 6:37-39. **

de Fraine R, Herroelen P. 1987. [Recent reports.]. Ornis Flandriae 6(4):121-132. {Dutch}

de Grahl W. 1990. Der Flamingo Brutvogel in deutscher Natur. [The flamingo breeding in German nature.] Die Gefiederte Welt 114(4):119-120. {German}

de la Puente J, Lorenzo JA. 2001. Noticiario ornitologico 2001. [Ornithological news.] Ardeola 48(1):137-147. {Spanish}

de Roder FE. 1985. Waterbirds on some of Turkey's wetlands. WIWO Publication No. 5.

Dellelegen Y, Desta S. 1998. Flamingos in Ethiopia. (A brief status report on lesser flamingo *Phoenicopterus minor* in some Ethiopian Rift Valley lakes). In: Johnson A, editor. Flamingo Specialist Group Newsletter 8. p 28-30.

Demey R. 1997. Recent reports. Bulletin of the African Bird Club 4(2):142-145.

Dempsey E. 1995. Greater flamingo in Ireland. Irish Birdwatching 4(4):10-13.

Dijk AJv, Dijk Kv, Dijksen LJ, van Spanje TM, Wymenga E. 1986. Wintering waders and waterfowl in the Gulf of Gabes, Tunisia, January-March 1984. W.I.W.O Report No. 13.

Dijksen LJ, Blomert A-M. 1989. Midwinter waterfowl census Turkey January 1989. WIWO-report. Zeist, The Netherlands 31:1-48.

Dijksen LJ, Koning FJ. 1986. Midwinter waterfowl census, Turkey January 1986. W.I.W.O. Report No. 13.

Dijksen LJ, Wolf Pvd. 1987. Midwinter waterfowl census, Turkey January 1987. W.I.W.O. Report No. 18.

Din NA, Eltringham SK. 1976. Early records of the lesser flamingo (*Phoenciconaia minor*) in western Uganda with a note on it present status. East African Wildlife Journal 14(2):171-175.

Dittmar R. 1985. Flamingo im Kreis Strausberg. [Flamingo in the Strausberg region.] Der Falke 32(2):66. {German}

Dodman T, de Vaan C, Hubert C, Nivet C. 1997. African Waterfowl Census 1997. Wageningen, Netherlands: Wetlands International.

Dodman T, Diagana CH. 2003. African Waterbird Census/Les Dénombrements d'Oiseaux d'Eau en Afrique 1999, 2000, 2001. Wetlands International Global Series N16. The Netherlands: Wageningen.

Dodman T, Taylor V. 1995. African Waterfowl Census 1995. Slimbridge, UK: International Waterfowl Research Bureau.

Dodman T, Taylor V. 1996. African Waterfowl Census 1996. Slimbridge, UK: International Waterfowl Research Bureau.

Downs CT, Wirminghaus JO. 1997. The terrestrial vertebrates of the Bazaruto Archipelago, Mozambique: a biogeographical perspective. Journal of Biogeography 24:591-602. **

Dubois PJ, Comité d'Homologation National. 1990. [List of rare birds in France in 1989]. Alauda 58(4):245-266. {French}

Dudley B, Martin P, Metcalfe N, Milligan B, Moser M, Symonds F, Webb A. 1978. Durham University Expedition to Sidi Moussa, Morocco--September, 1980. Bulletin Wader Study Group 30:17.

Dugan PJ. 1984. Lesser flamingos (*Phoeniconaias minor*) in West Africa. ICBP-IWRB Flamingo Working Group Newsletter 2:12. **

Dupuy AR. 1976. Reproduction de Flamants roses (*Phoenicopterus ruber*) au Sénégal. [Greater flamingo reproduction in Senegal.] L'Oiseau et Revue Français d'Ornithologie 46:294-296. {French}

Dupuy AR. 1979. Reproductions des Pélicans blancs et Flamants roses au Sénégal. [Reproduction of white pelicans and greater flamingos in Senegal.] L'Oiseau et Revue Français d'Ornithologie 49(4):322-324. {French}

Durán JJ, Arengo F, Cleary S. 1992. Informe del censo ereo realizado el dia 22 de noviembre de 1992. [Report of the census carried out on November 22, 1992.] Mérida, Yucatán, Mexico: SEDESOL, Delegación Estatal. {Spanish}

Dwenger R. 1983. Chileflamingos im Ostseebodden. [Chilean flamingos in Ostseebodden.] Falke 30(3):93. {German}

El Agbani M-A, Dakki M. 1992. Recensement hivernal d'oiseaux au Maroc: Janvier 1992. [Winter census of birds in Morocco: January 1992.] Documents de l'Institut Scientifique, Rabat 15:1-32. {French}

Elias GLL, Reino M, Silva T, Geraldes P, editors. 1998. [Atlas of the Wintering Birds of Baixo Alentejo - Portugal.]. Lisboa: Sociedade Portuguesa para o Estudo das Aves. 416 p. {Portugese}

Elliott CCH. 1983. Unusual breeding records made from a helicopter in Tanzania. Scopus 7(2):33-36.

Eltringham SK, Din NA. 1976. Early records of the lesser flamingo *Phoeniconaias minor* in Western Uganda with a note on its present status. East African Wildlife Journal 14:171-175.

Espinoza F. 1995. Flamingo population surveys (air and terrestrial) in the coast of Venezuela. Caracas, Venezuela: Marn-Profauna.

Espinoza F, Parra L, Aranguren J, Martino A, Quijada M, Pirela D, Rivero R, Rutierrez T, Jimenez N, Leal S, Leon E. 2000. Numbers and distribution of the Caribbean flamingo in Venezuela. Waterbirds 23(Special Publication 1):80-86. **

Farinha JC, Costa H. 1999. Pássaros aquáticos de Portugal. Uma Guia Do Campo. [Aquatic Birds of Portugal. A Field Guide.]. Istituto da Conservação da Natureza. 268 p. {Portuguese}

Farinha JC, Serra Guedes R, Encarnação V, Severo A, Monteiro P. 1992. Recenseamento e distribuição do Flamingo *Phoenicopterus ruber roseus*, em Portugal em 1992. [Censuses and distribution of the greater flamingo in Portugal in 1992.] Airo 3(2):64-66. {Portuguese}

Feare CJ, Watson J. 1984. Occurrence of migrant birds in the Seychelles. In: Stoddart DR, editor. Biogeography and Ecology of the Seychelles Islands. The Hague, Netherlands: Dr. W. Junk Publication. p 559-574.

Felgueiras M, Archer M, Beale V. 2002. Systematic list of the birds at Quinta da Rocha in 2000 and 2001. In: Beale V, Felgueiras M, Simonson W, editors. A Rocha Observatory Report 2000 and 2001. Portimão, Portugal: Associação A Rocha. p 6-8. {English} **

Fernandez-Cruz M. 1984. Sobre el flamenco en Europa occidental. La reproduction en Espana en 1984. [On the flamingo in western Europe: Reproduction in Spain in 1984.] La Garcilla 64:47-48. {Spanish}

Fernández-Cruz M. 1982. La reproduccion de los flamencos (*Phoenicopterus ruber*) en España en 1982. [Reproduction of greater flamingos in Spain in 1982.] La Garcilla: Boletin-circular de Sociedad Española de Ornitologia 62:34, 35. {Spanish}

Fernández-Cruz M, Martín-Novellas C, París M, Fernández-Alcáraz G, Sánchez EG, Nevado JC, Rendón-Martos M, Rubio JC. 1991. Dinámica de la población del flamenco (*Phoencicopterus ruber roseus*) en España. [Dynamics of the flamingo population in Spain.] In: Junta de Andalucia, editor. Reunión técnica sobre la situación y problemática del flamenco rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. p 11-45. {Spanish} **

Fernández-Cruz M, Martín-Novellas C, París M, Izquierdo E, Camacho M, Rendón M, Rubio JC. 1988. Revisión y puesta al día de la invernada del flamenco (*Phoenicopterus ruber roseus*) en la Península Ibérica. [Review and location to the day of the wintering of the greater flamingo in the Iberian Peninsula.] In: Tellería JL, editor. Invernada de Aves en la Península Ibérica, Monografías de la Sociedad Española de Ornitología 1. Madrid, Spain: Sociedad Española de Ornitología. p 23-53. {Spanish}

Ferrer X. 1985. Cens d'anatides, limicoles i altres aquatiques. Delta de l'Ebre; 14-17 de Gener del 1985. [Census of waterfowl, shorebirds and other waterbirds. Delta de l'Ebre; 14-17 January of 1985.] Bulletin del Parc Natural Delta de l'Ebre 1:6-10. {Catalan}

Ffrench R. 1982. Some recent additions to the avifauna of Trinidad and Tobago. Living World 1982:35-36.

Fitzharris J. 1998. Irish Rare Birds Committee Report. Irish Birds 6(1):91-96.

Foers R. 1984. Greater flamingo (*Phoenicopterus ruber*) in Cyprus-1978. An analysis of records and migratory trends from 1956-1978. Cyprus Ornithological Society Bird Report 10:46-57.

Furmanek M. 2000. Awifauna Wisly pod Solcem w cyklu rocznym w latach 1993-1999. [Avifauna of the Vistula River near Solec in the annual cycles of 1993-1999.] Kulon 5(2):137-181. {Polish}

Gallagher MD. 1986. Additional notes on the birds of Oman, Eastern Arabia, 1980-1986. Sandgrouse 8:93-101.

Garau JM, Garcia D, Martinez O, Mendez J. 2002. Recompte hivernal d'aus aquatiques i limicoles a les Balears, gener de 2002. [Winter census of wildfowl and shorebirds in the Balearic Islands, January 2002.] Anuari Ornitologic de les Balears 16:47-55. {Catalan}

Garcia L, Amat JA, Sanchez A. 1980. Resultados de los censos de aves acuaticas en Andaluvia Occidental durante el invierno 1978-79. [Results of the census of aquatic birds in western Andalucia during the winter 1978-79.] Doñana, Acta Vertebrata 7(1):19-27. {Spanish}

García L, Ibáñez F, Garrido H, Arroyo JL, Máñez M, Calderón J. 2000. Prontuario de la Aves de Doñana. Anuario Ornitológico de Doñana, nº 0, Diciembre 2000. [Handbook of the Birds of Doñana. Ornithological Yearbook of Doñana.] Almonte (Huelva), Spain: Estación Biológica de Doñana y Ayuntamiento de Almonte (Huelva). {Spanish} available on web at http://www-rbd.ebd.csic.es/segu/aves/aves.htm

Garcia Rodriguez L, Castro Nogueira L, Miralles Garcia JM, Castro Nogueira H. 1982. Cabo de Gata. Guia de la Naturaleza. Perfil ecologico de una zona arida. [Cabo de Gata. Nature Guide. Ecological profile of an arid area.]. Madrid: Everest S. A. {Spanish}

Gaultier T, Smart M. 1989. Observations de flamants roses en Tunisie en 1988. [Observations of greater flamingos in Tunisia in 1988.] Flamingo Research Group Newsletter 5:18-22. {French} **

Gavrilov EI. 1979. Sezonnye migratsii ptits na territorii Kazakhstana. [Seasonal migrations of birds in territory of Kazakhstan.]. Alma Ata. 256 p. {Russian}

Gilissen N, Naanstra L, Delaney S, Boere G, Hagemeijer W. 2002. Numbers and distribution of wintering waterbirds in the Western Palearctic and Southwest Asia in 1997, 1998 and 1999. Results from the International Waterbird Census. Wageningen, The Netherlands.

Gillard L. 1979. Lesser flamingo - breeding. Witwatersrand Bird Club News No. 104:15.

Ginn PJ. 1976. Birds of the Makgadikgadi: a preliminary report. Wagtail 15:4-12.

Giovacchini P, Corsi F. 1996. Sulla presenza del fenicottero (*Phoenicopterus ruber*) nella palude della Trappola (GR) nell'inverno 1966-67. [The presence of the greater flamingo in the 1966-67 winter season in the Trappola marsh.] Atti del Museo Civico di Storia Naturale (Grosetto) 15:163-164. {Italian}

Girardin N, Christy P. 1982. Observation du petit flamant *Phoeniciopterus minor* au Gabon. [Observation of the lesser flamingo in Gabon.] Oiseau et la Revue Francaise d'Ornithologie 52(1):90-91. {French}

Gistsov AP. 1994. [Flamingoes in the north-east part of the Caspian basin.]. Selevinia 2(3):89-92. {Russian}

Gloe P. 1992. Einige Vogelbeobachtungen im April 1988 auf Kreta. [Some bird observations on Crete in April 1988.] Kartierung Mediterraner Brutvögel 8:3-20. {German}

Goodwin ML. 1988. La situacion de los flamencos en Venezuela. [The situation of the flamingos in Venezuela.] Flamingo Research Specialists Group Newsletter 4:24-43. {Spanish} **

Goodwin ML, Rodner C. 1987. Flamencos (*Phoenicopterus ruber ruber*). Informe sobre la situación en Venezuela. [Flamingos. Report on the situation in Venezuela.] Caracas, Venezuela: Sociedad Conservacionista Audubon de Venezuela. {Spanish}

Goodwin ML, Rodner C. 1987. Informe sobre los sitios de alimentación de flamencos (*Phoenicopterus ruber ruber*) en Venezuela. [Report on the feeding locations of flamingos in Venezuela.] Caracas, Venezuela: Audubon Society of Venezuela. {Spanish}

Gordon T. 1983. Greater flamingo at Darwendale Dam. Honeyguide 32:113.

Green RE. 1991. Population dynamcis of greater flamingos in the west Mediterranean region. In: Junta de Andalucia, editor. Reunión Técnica sobre la situación y problemática del flamenco rosa, *Phoenicopterus ruber roseus*, en el Mediterraneo Occidental y Africano Nor Oriental. p 99-102. **

Griesohn-Pflieger T. 1995. Flamingos brüten in Deutschland! [Flamingos breed in Germany!] Der Falke 42(7):205-209. {German}

Griesohn-Pflieger T. 1995. Neues aus Zwillbrock: Jetzt brüten auch Karibische Flamingos! [News from Zwillbrock: Now also Caribbean flamingos started to breed!] Der Falke 42:278-279. {German}

Grobler N. 1981. Possible breeding attempt by lesser flamingos in western Transvaal. Bokmakierie 33(3):67.

Groen NM, Zomerdijk PJ, editors. 1994. Waders and Waterbirds Along Part of the Atlantic Coast of Morocco, Autumn 1991-Spring 1992. WIWO Report No. 47.

Grosse K. 1988. Chileflamingo überwintert auf dem Salzhaff. [Chilean flamingo winters on the Salzhaff.] Der Falke 35(11):380-381. {German}

Group Ornithologique Aunis Saintonge. 1983. L'annee ornithologique (juillet 1981 - Juin 1982) en Charente Maritime. [The ornithological year (July 1981-June 1982) in Charente Maritime.] Annales de la Societe des Sciences Naturelles de la Charente Maritime 7(1):33-43. {French}

Grussu M. 2000. Nuovo sito di nidificazione di fenicottero, *Phoenicopterus roseus*, in Sardegna. [New breeding colony of greater flamingo in Sardinia.] Rivista Italiana di Ornitologia 70(1):84-86. {Italian}

Grussu M, Poddesu G. 1987. Osservazioni ornitologische in Tunisia e Algeria. [Ornithological observations in Tunisia and Algeria.] U D I 12:58-66. {Italian}

Guedes RCBdS. 1986. Censos feitos aos bandos de flamingos no estuario do Rio Tejo. [Completed census of flamingo flocks at the Rio Tejo estuary.] Flamingo Research Specialists Group Newsletter 3:10-12. {Portuguese} **

Guillou JJ, Pages J. 1987. Le flamant nain *Phoeniconaias minor* pénètre à l'intérieur des terres en Afrique de l'Ouest. [The lesser flamingo penetrates inside the grounds in West Africa.] Alauda 55(3):233-234. {French}

Gutierrez R. 1998. Flamant roses en Espagne. [Greater flamingos in Spain.] Ornithos 5(2):94. {French}

Guzmán HM. 1986. Feeding areas and relative abundance of the American Flamingo along the coast of Venezuela. American Birds 40(3):535-541.

Haas V, Siebenrock KH. 1983. Successful breeding of greater flamingo *Phoenicopterus ruber* at Lake Nakuru, Kenya. Scopus 7(3-4):91-92.

Hadjisterkotis E, Charalambides M. 2002. The first evidence for the breeding of the greater flamingo *Phoenicopterus ruber* on Cyprus. Zeitschrift fuer Jagdwissenschaft 48:72-76.

Hafner H, Johnson A, Walmsley J. 1979. Compte-rendu ornithologique camarguais pour les années 1976 et 1977. [The Camargue bird report 1976-1977.] La Terre et la Vie 33(2):307-324. {French}

Hafner H, Johnson AR, Walmsley JG. 1980. Compte-rendu ornithologique camarguais pour les années 1978 et 1979. [The Camargue bird report 1978-1979.] La Terre et la Vie 34(4):621-648. {French}

Hafner H, Johnson AR, Walmsley JG. 1982. Compte rendu ornithologique camarguais pour les années 1980 et 1981. [The Camargue bird report 1980-1981.] La Terre et la Vie 36:573-601. {French}

Hafner H, Johnson AR, Walmsley JG. 1985. Compte rendu ornithologique camarguais pour les années 1982 et 1983. [The Camargue bird report 1982-1983.] La Terre et la Vie 40:87-112. {French}

Ham I. 1986. Naselja Ptica Ulcinjske Solane U Drugoj Dekadi Jula. [Bird communities of the Ulcini salt-pan in the second week of July.] Larus 36/37:125-142. {Serbo-Croatian}

Hamerlynck O, Messaoud B-O. 2000. Suspected breeding of lesser flamingo *Phoeniconaias minor* in Mauritania. Bulletin of the African Bird Club 7(2):109-110.

Hancock P. 1990. The flamingos of Sowa. Bushcall 1:16-21.

Handrinos GI. 1989. Mid-winter numbers and distribution of greater flamingos (*Phoenicopterus ruber roseus)* in Greece. Flamingo Research Group Newsletter 5:15-17. **

Harcourt S. 1981. The Galapagos flamingo *Phoenicopterus ruber ruber*.

Harcourt S. 1982. Galapagos flamingo census - 1982. Noticias de Galápagos No. 36:15-16.

Harcourt S. 1982. Report on the status of the flamingo (*Phoenicopterus ruber*) in the Galapagos Archipelago. Estacion Cientifica Charles Darwin Informe Anual 1981:56-58. {Spanish}

Heinze J, Hunyady J. 1993. Il rifugio di flora e fauna selvatiche di Guido di Bolgheri/San (il Livorno/Livorno, Italia Centrale), 1967-1992. [The wildlife refuge of Bolgheri/San Guido (Leghorn/Livorno, Central Italy), 1967-1992.] Rivista Italiana di Ornitologia 63(1):115-119. {Italian}

Heller M. 1982. Auftreten von freifliegenden Flamingos im Kreis Haldensleben. [Appearance of free-flying flamingos in Haldensleben circle.] Falke 29(12):426-427. {German}

Hellyer P. 1993. Flamingos breeding in Abu Dhabi. Oman Bird News 14:29.

Hellyer P. 1993. Flamingos found breeding in Abu Dhabi. Emirates News 9 June 1993:1-2.

Hellyer P. 1994. Greater flamingos: first time breeding in the UAE. Arabian Wildlife 1:11.

Hernández MA. 1979. Reproduccíon y tamaño de la población de flamencos en Yucatán.[Reproduction and size of the flamingo population in Yucatan.]. Mexico D. F., Mexico: Instituto Politécnico Nacional (Escuela Nacional de Ciencias Biológicas). {Spanish}

Herremans M. 1992. Fifth three-monthly activity report: Ornitholgical research February - April 1992. Report to the Department of Wildlife and National Parks, Botswana.

Herremans M. 1993. Activity report 1993 of the ornithology research unit. Department of Wildlife and National Parks, Botswana.

Herrmann E, Anderson MD, Seaman M. 2004. Occurrence and abundance of waterbirds at an ephemeral pan in the Northern Cape Province, South Africa. Ostrich 75(4):275-284.

Himmatsinhji MK. 1990. Occurrence of *Ciconia ciconia* Gruidae and breeding of Phoenocopteridae in Kutch, Gujarat. Journal of the Bombay Natural History Society 86(3):443-444.

Himmatsinhji MK. 1991. The 'Flamingo City' in the Rann of Kutch. Newsletter for Birdwatchers 31(5-6):3-4.

Hirons G. 1988. Breeding ecology of Camargue flamingos during the breeding season. Flamingo Research Specialists Group Newsletter 4:7-8. **

Hoffmann TW. 1983. The 1983 mid-January duck (and flamingo) count in Sri Lanka. Loris 16(3):116-123.

Howard G. 1994. East African flamingos surveyed. IUCN Wetlands Programme Newsletter 10(November):5.

Howard GW, Olivier R. 1995. Lesser flamingo breeding event at Lake Natron, 1995. East Africa Natural History Society Bulletin 26(1):11-13.

Hudee K, Hora J. 1981. The presence of flamingos in Czechoslovakia. Ziva 29(2):72-73. {Czech}

Huertas-Pedrero J, Prosper Candel P. 1995. Notas sobre el intento de reproduccion del flamenco rosa (*Phoenicopterus ruber)* en Las Salinas de Santa Pola (Alicante), Espana, ano 1992. [Flamingos nest-building in the salinas of Santa Pola (Alicante), Spain in1992.] IWRB Flamingo Specialist Group Newsletter 7:44. {Spanish} **

Hughes RA. 1984. Further notes on Puna bird species on the coast of Peru. Condor 86(1):93. **

Hundrieser A. 1984. Flamingo bei Hiddensee. [Flamingo at Hiddensee.] Falke 31(4):141. {German}

Hurlbert SH. 1978. Results of five flamingo censuses conducted between November 1975 and December 1977. Andean Lake and Flamingo Investigations Technical Report 1: San Diego State Univ. p 1-16.

Hurlbert SH. 1981. Results of three flamingo censuses conducted between December 1978 and July 1980. Andean Lake and Flamingo Investigations Technical Report 2: National Geographic Society; San Diego State Univ. p 1-9.

Hurlbert SH, Keith JO. 1979. Distribution and spatial patterning of flamingos in the Andean altiplano. Auk 96:328-342. **

Hussain SA. 1992. Flamingoes on the Rann. Asian Wetland News 5(1):24.

Ilani G, Shalmon B. 1984. Flamingos in the Valley of Jezreel. Israel - Land and Nature 10(1):37.

Jacob J-P, Jacob A. 1980. Nouvelles données sur l'avifaune du Lac de Boughzoul (Algérie). [New data on the avifauna of the Lac de Boughzoul (Algeria).] Alauda 48:209-219. {French}

Jadhav A, Parasharya BM. 2004. Counts of flamingos at some sites in Gujarat State, India. Waterbirds 27(2):141-146. **

Jalving R, Vos R. 2003. Waterbirds in Lake Orumieh, Iran. WIWO Report 79:1-67.

Jennings MC. 1985. New breeding species. Phoenix 2:2.

Jennings MC. 1996. A visit to the Dhofar Province, October/November 1995. Oman Bird News 18:19-20.

Jennings MC. 1996. A visit to the Dhofar Province, Oman; October/November 1995 (ABBA Survey No. 18). Phoenix 13:7-9.

Johnson AR. 1975. Camargue flamingos. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 17-25. **

Johnson AR. 1975. La nidification des flamants de Camargue en 1972 et 1973. [Nesting of Camargue's flamingos in 1972 and 1973.] La Terre et la Vie 29:113-115. {French}

Johnson AR. 1976. La nidification des flamants de Camargue en 1974 et 1975. [Nesting of Camarque's flamingos in 1974 and 1975.] La Terre et la Vie 30(4):593-598. {French}

Johnson AR. 1977. La reproduction des flamants roses en 1977. [Greater flamingo breeding in 1977.] Courrier Parc Nat Rég Camargue 12:4-12. {French}

Johnson AR. 1978. Les flamants roses: la reproduction en Camargue en 1978 et quelques réflexions sur l'abondance actuelle de l'espèce dans le delta. [Greater flamingos: reproduction in Camargue in 1978 and some reflections on the present abundance of the species in the delta.] Courrier Parc Nat Rég Camargue 16:20-25. {French}

Johnson AR. 1980. News from the regions (Old World). ICBP-IWRB Flamingo Working Group Newsletter 1:4-8. **

Johnson AR. 1982. La nidification des flamants roses en Camargue. [Nesting of greater flamingos in Camargue.] Panda (France) 11:20-23. {French}

Johnson AR. 1984. Greater flamingos in Greece. ICBP-IWRB Flamingo Working Group Newsletter 2:23. **

Johnson AR. 1984. La nidification des flamants roses en Camargue. [Nesting of greater flamingos in Camargue.] Courrier Parc Nat Rég Camargue 27:19-21. {French}

Johnson AR. 1984. Le sauvetage des flamants roses en Camargue. [Rescue of greater flamingos in Camargue.] Panda (France) 18:16-20. {French}

Johnson AR. 1984. News from the regions. ICBP-IWRB Flamingo Working Group Newsletter 2:3-6. **

Johnson AR. 1984. A review of flamingo ringing activities throughout the Old World. ICBP-IWRB Flamingo Working Group Newsletter 2:29-32. **

Johnson AR. 1984. Storm-driven flamingos in France. ICBP-IWRB Flamingo Working Group Newsletter 2. **

Johnson AR. 1986. News from the region (Old World). Flamingo Research Specialists Group Newsletter 3:3-5. **

Johnson AR. 1988. News from the regions (Old World). Flamingo Research Specialists Group Newsletter 4:3-6. **

Johnson AR. 1989. Notes from the regions (Old World). Flamingo Research Group Newsletter 5:3-6. **

Johnson AR. 1992. News from the regions (Old World) 1990. Flamingo Research Group Newsletter 6:27-30. **

Johnson AR. 1992. Notes from the regions (Old World) 1989. Flamingo Research Group Newsletter 6:5-8. **

Johnson AR. 1992. Taking a closer look at the flamingos on Cyprus in winter. Gli Uccelli d'Italia 15(1-4):5-10.

Johnson AR. 1995. Flamingo ringing in 1991-1994. IWRB Flamingo Specialist Group Newsletter 7:37-38. **

Johnson AR. 1995. News from the regions 1993 (Old World). IWRB Flamingo Specialist Group Newsletter 7:21-26. **

Johnson AR. 1995. Notes from the regions 1991 (Old World). IWRB Flamingo Specialist Group Newsletter 7:5-11. **

Johnson AR. 1995. Notes from the regions 1992 (Old World). IWRB Flamingo Specialist Group Newsletter 7:13-18. **

Johnson AR. 1995. Notes from the regions 1994 (Old World). IWRB Flamingo Specialist Group Newsletter 7:29-35. **

Johnson AR. 2001. Flamingos continue to colonize new sites in the Mediterranean. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 43. **

Johnson AR, Arengo F. 2003. Flamingo specialist group. Annual reports 2001. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 11. Arles, France: Station Biologique de la Tour du Valat. p 35. **

Johnson AR, Bennun L. 1995. Workshop on Lesser flamingos, Nakuru, Kenya, November 1993. IWRB Flamingo Specialist Group Newsletter 7:40. **

Johnson AR, Durand C, Arengo F. 2001. Flamingo specialist group. Annual reports 1998, 1999, 2000. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 3-32. **

Johnson AR, Farris E, Gaudenzi G, Fasola M. New colonies of the greater flamingo *Phoenicopterus ruber* in the Mediterranean Region. Annual Meeting of the Colonial Waterbird Society; 1998. p resentation only.

Johnson DN. 1986. Flamingo expedition to the Free State. Bokmakierie 38:107-109.

Jorga W. 1980. Chileflamingo im Kreis Bad Liebenwerda. [Chilean flamingo in the district Bad Liebenwerda.] Der Falke 12:428-429.

Kahl MP. 1975. Distribution and numbers: a summary. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 93-102. **

Kakebeeke B, Lamont G. 1993. Dwarf greater flamingos at Strandfontein. Promerops 209:9.

Kalejta-Summers B, Allen DG, Longrigg TD. 2001. Long-term trends, seasonal abundance and energy consumption of waterbirds at Strandfontein, Western Cape, South Africa 1953-1993. Ostrich 72:80-95.

Kanuscak P, Matousek B. 1975. Flamingo (*Phoenicopterus ruber*) - a new member of the Slovakian world of birds. Aborník Slovenského Národného Muzea Prirodne Vedy 21:265-268. {Slovkian}

Karim SI. 1985. Breeding evidence of flamingo *Phoenicopterus roseus* in mud-flats beyond Golarchi district Badin, Sind. Records Zoological Survey of Pakistan 10(1-2):121.

Karpowicz Z. 1985. Wetlands in East Asia. A Preliminary Review and Inventory. Cambridge, England: ICBP.

Kasparek M. 1984. On the occurrence of the greater flamingo *(Phoenicopterus ruber roseus)* on the Sultan marshes (Turkey). ICBP-IWRB Flamingo Working Group Newsletter 2:24-26. **

Kasparek M, Robel D, Siering M. 1994. Bemerkungen zu einigen Vogelarten des Jemen. [Remarks on some bird species of Yemen.] Zoology in the Middle East 10(1994):17-22. {German}

Katondo JM, Mwasaga BC. 1997. Status of lesser flamingos in Tanzania. In: Howard G, editor. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Nairobi, Kenya: IUCN East Africa Programme, Lake Bogoria Conference. p 25-27.

Kayser Y, Girard C, Massez G, Cherain Y, Cohez D, Hafner H, Johnson A, Sadoul N, Tamisier A, Isenmann P. 2003. Compte-Rendu ornithologique camarguais pour les annees 1995-2000. [The Camargue Bird Report 1995-2000.] Revue d'Ecologie (la Terre et la Vie) 58:5-76. {French} **

Kebede E, Hillman JC. 1989. First recorded breeding of greater flamingos (*Phoenicopterus ruber roseus)* in Ethiopia. Flamingo Research Group Newsletter 5:7. **

Kessler P, Gutenberg J. Comparative breeding behavior of a free-living mixed population of three *Phoenicopterus* taxa in Western Europe. 1998 Meeting of the Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 14-15. ** abstract only

Khacher L. 2002. Some clarifications regarding the lesser flamingo *Phoenicopterus minor* and the crab plover *Dromas ardeola*. Journal of the Bombay Natural History Society 99(1):106-107.

Khokhlov AN, Gerasimov SN. 1984. [Flamingos invade Stavropol.]. Priroda (Moscow) 1984(11):98-99. {Russian}

Khrokov VV, Andrusenko NN. 1979. Kurgal'dzhinskoe divo. [The Kurgal'dzhino wonder.]. Zhivye sokrovishcha Kazakhstana [The living treasures of Kazakhstan]. Alma Ata: Kazakhstan. p 77-89. {Russian}

Kilic A. 1988. The Eregli Marshes: a new nesting site for the greater flamingo (*Phoenicopterus ruber*) in Turkey. Zoology in the Middle East 2:39-42.

Kirwan G. 1991. Around the region (Oman: 2nd record of lesser flamingo). Bulletin of the Ornithological Society of the Middle East 26:62.

Kirwan G. 1992. A freshwater breeding record of greater flamingo *Phoenicopterus ruber* in Turkey. Sandgrouse 14(1):56-57.

Kirwan GM. 2001. Around the Region. Sandgrouse 23(1):76-80.

Kivit H, Nijmeijer H, Ovaa A, editors. 1994. Wader and Waterfowl Migration in the Cukurova Deltas, South Turkey, Spring 1990. WIWO Report.

Kiziroglu I, Turan L, Erdogan A. 1993. A bio-ornithological study on Sultansazligi, one of the important wetlands ofTurkey and Europe: New bird species in the area and the current situation. Doga Turk Zooloji Dergisi (Turkish Journal of Zoology) 17(2):179-188.

Koning FJ, Rooth J. 1975. Greater flamingos in Asia. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 33-34. **

Krivonosov GA, Vasil'yev VI, Morozkin NI. Flamingo na Kaspijskom more. [Flamingo on the Caspian Sea.]. VIIth Vsesoyuzn Ornitol Konf [VIIth All Union Ornithology Conference], Part 2; 1977; Kiev. p 222-223. {Russian}

Kruger O. 1998. Fluctuations and movements in a group of lesser flamingos *Phoeniconaias minor* in Kyambura Game Reserve, southwest Uganda. Scopus 20:33-38.

Kumar S, Bhargava RN. 1998. Sambhar Lake: A new breeding ground of flamingoes in India. In: Johnson A, editor. Flamingo Specialist Group Newsletter 8. p 26.

Kunz A, Dietzen C. 2002. Die Vögel in Rheinland-Pfalz - Eine aktuelle Artenliste. [The Birds of the Rhineland-Palatinate - A checklist.] Fauna Flora Rheinland-Pfalz 28:207-222. {German} **

Kurup DKN, Kumar CM. 1992. The flamingo *Phoenicopterus roseus* Pallas in Kerala. Journal of the Bombay Natural History Society 89(3):365-366.

Labutin YV. Zaletnye flamingo v Yakutii. [Vagrant Flamingos in Yakutia.]. Tez dokl 2 i Vsesoyuz konf po migratsiyam ptits [Abstracts of the 2nd All Union Conference on Bird Migrations], Part 2; 1978; Alma Ata. p 84-85. {Russian}

Lamont G, Myburgh N. 1990. Records from the Brandvlei-Calvinia area. Promerops 194:7-9.

Lankin P. 1981. Flamingo v Vostochnom Prikaspii. [Flamingo in Eastern Cis Caspian Sea area.] Okhota i okhotnich'e khoz vo [Hunt and hunting industry] 12:14-15. {Russian}

Lankin PM. 1983. Flamingo v antropogennykh landshaftakh Mangyshlaka. [The flamingo in the anthropogenic Mangyshlak landscapes (Kazakh, USSR).] Byulleten' Moskovskogo Obshchestva Ispytatelei Prirody Otdel Biologicheskii 88(5):35-38. {Russian}

Lassey PA. 1994. First record of lesser flamingo *Phoenicopterus minor* in Egypt. Sandgrouse 16(1):52-53.

Lensink R. 1996. De opkomst van exoten in de Nederlandse avifauna; verleden, heden en toekomst. [The rise of exotic bird species in the Dutch avifauna; past, present and future.] Limosa 69(3):103-130. {Dutch}

Lentino M. 1984. Conteo de flamencos (*Phoenicopterus ruber ruber*) en Venezuela. Mayo 1984. [Count of flamingos (*Phoenicopterus ruber*) (May 1984).]: Fundación para la Defensa de la Naturaleza, Sociedad Conservacionista Audubon de Venezuela, and New York Zoological Society. Unpublished report. {Spanish}

Lentino M. 1984. Conteo de flamencos (*Phoenicopterus ruber ruber*) en Venezuela. Octubre 1984. [Count of flamingos (*Phoenicopterus ruber*) in Venezuela. (October 1984).] Caracas, Venezuela: International Council for Bird Protection, Fundación Phelps, and Sociedad Conservacionista Audubon de Venezuela. Unpublished report. {Spanish}

Lentino M. 1986. Conteo de flamencos (*Phoenicipterus ruber ruber*) en Venezuela. Agosto 1986. [Count of flamingos (*Phoenicopterus* ruber *ruber*) in Venezuela. August 1986.]: Fundación para la Defensa de la Naturaleza, Sociedad Conservacionista Audubon de Venezuela, and New York Zoological Society. Unpublished report. {Spanish}

Lentino M. 1986. Conteo de flamencos (*Phoenicipterus ruber ruber*) en Venezuela. Mayo 1986. [Count of flamingos (*Phoenicopterus ruber ruber*) in Venezuela. May 1986.]: Fundación para la Defensa de la Naturaleza, Sociedad Conservacionista Audubon de Venezuela, and New York Zoological Society. Unpublished report. {Spanish}

Lentino M. 1986. Conteo de flamencos (*Phoenicipterus ruber ruber*) en Venezuela. Noviembre 1986. [Count of flamingos (*Phoenicopterus ruber ruber*) in Venezuela. November 1986.]: Fundación para la Defensa de la Naturaleza, Sociedad Conservacionista Audubon de Venezuela, and New York Zoological Society. Unpublished report. {Spanish}

Lentino M. 1986. Estudio de los flamencos por la costa de Venezuela. [Study of flamingos on the Venezuelan coast.]: Acta Cientifica Venezuelica. Supp. 36. {Spanish}

Lentino M. 1987. Conteo de flamencos (*Phoenicipterus ruber ruber*) en Venezuela. Agosto 1987. [Count of flamingos (*Phoenicopterus ruber ruber*) in Venezuela. August 1987.]: Fundación para la Defensa de la Naturaleza, Sociedad Conservacionista Audubon de Venezuela, and New York Zoological Society. Unpublished report. {Spanish}

Lentino MR. 1990. Proyecto de conservación y monitoreo de las poblaciones de flamencos. [Conservation project and monitoring of the populations of flamingos.] Final Research Report 1: Pequivén, Gerencia Desarrollo de Occidente. {Spanish}

Lentino MR, Goodwin ML. 1988. Situación del flamenco (*Phoenicopterus ruber ruber*) en Venezuela. [Situation of flamingos in Venezuela.] In: Parada M, Rottman J, Guerra C, editors. I Taller Internacional de Especialistas de Flamencos Sudamericanos. San Pedro de Atacama: Corporación Nacional Forestal y Sociedad Zoológica de Nueva York. p 27-41. {Spanish} **

Lied HC. 1989. Zwergflamingo (*Phoeniconaias minor*) im Meldorfer Speicherkoog (Schleswig-Holstein). [Lesser flamingos in the Meldorfer retention polder (Schleswig-Holstein).] Ornithologische Mitteilungen 41(1):23-24. {German}

Litvinova NA, Tkachencko EE, Litvinov VP. 1984. [Nesting of the flamingo (*Phoenicopterus roseus*) in Kyzyl-Agach nature preserve, Azebaidjan SSR.]. Ornitologiya 19:182-183. {Russian}

López E. 1988. Informe sobre nidificación de flamencos en la Ciénaga de Los Olivitos. [Report on flamingo nesting in the swamps of Los Olivitos.] Zona 5, Maracaibo: Ministerio del Ambiente y de los Recursos Naturales Renovables. {Spanish}

Lopez-Ornat A, Ramo C. 1992. Colonial waterbird populations in the Sian Ka'an Biosphere Reserve (Quintana Roo, Mexico). Wilson Bulletin 104(3):501-515. **

Love I, A. L. 1975. A lesser flamingo at Lusaka. Bulletin of the Zambian Ornithological Society 7:28.

Macouzet TM, Escalante-Pliego P, Villanueva-Sosa M. 1999. Two notable records of birds for Cozumel Island, Quintana Roo, Mexico. Cotinga 12:79-80.

Magnin G, Yarar M. 1994. Some notes on the breeding of greater flamingo, *Phoenicopterus ruber roseus*, and white pelican, *Pelecanus onocrotalus*, in Turkey. Bulletin of the Ornithological Society of the Middle East 32:28-30.

Maier RT, Kelly A, Robinson KB. 1994. Bolivian Puna Expedition 1992/1993. Final Report. Norwich: University of East Anglia.

Maksimova AP. Gel'minty flamingo, gnezdyashchikhsya i linyayushchikh na oz. Tengiz. [Helminthes of flamingos, breeding and moulting on Tengiz Lake.]. Tez Dokl 2 i Vsesoyuz Konf po migratsiyam ptits [Abstracts of the 2nd All Union Conference On Bird Migrations], Part 2; 1978; Alma Ata. p 268. {Russian}

Makyao A. 2001. Greater flamingos build nests at Lake Magadi. CCA Ecological Journal 3:176.

Mallya M. 2002. Flamingo in Ngorongoro crater. CCA Ecological Journal 4:50.

Manakadan R. 1992. Biology of the greater flamingo in the Great Vedharanyam Swamp, Point Calimere Sanctuary, India. Flamingo Research Group Newsletter 6:20-24. **

Marteijn ECL, Meininger PL. 1988. Greater flamingos in N.E. Greece, Spring 1987. Flamingo Research Specialists Group Newsletter 4:14-19. **

Martin R, Pepler D. 1995. Attempted breeding of greater flamingo near Karoopoort. Promerops 219:14.

Martinez Vilalta A. 1995. La nidification del flamenco (*Phoenicopterus ruber roseus)* en el Delta del Ebro, Tarragona, Espana, Durante 1993. [Breeding of the greater flamingo in the Ebro Delton (Terragona) in Spain 1993.] IWRB Flamingo Specialist Group Newsletter 7:45-47. {Spanish} **

Martínez Vilalta A. 1991. El flamenco en el Delta del Ebro. [Flamingos in the Delta del Ebro.] In: Andalucia Jd, editor. Reunión técnica sobre la situación y problemática del flamenco rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. p 47-51. {Spanish} **

Mascitti V. 2001. The South American flamingos in Laguna de Pozuelos Biosphere Reserve. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 45-46. **

Mascitti V, Bonaventura SM. 2002. Patterns of abundance, distribution and habitat use of flamingos in the high Andes, South America. Waterbirds 25(3):358-365. **

Mascitti V, Caziani S. 1997. La retracción de la Laguna de los Pozuelos (Argentina) y los cambios asociados en la comunidad de aves acuáticas. [The retraction of the Lagoon de los Pozuelos (Argentina) and the associated changes in the community of aquatic birds.] In: Liberman M, Baied C, editors. II Simposio Internacional Desarrollo Sostenible de Ecosistemas de Montaña: Manejo de Áreas Frágiles en los Andes. La Paz, Bolivia: The United Nations University. p 321-330. {Spanish} **

Mascitti V, Nicolossi G. 1992. Nidificación del flamenco austral, (*Phoenicopterus chilensis*), en la Laguna de Pozuelos, Puna de Jujuy. [Nesting of the Chilean flamingo in the Laguna de Pozuelos, Jujuy County.] El Hornero 13(3):240-242. {Spanish} **

Matagi SV. 2004. A biodiversity assessment of the Flamingo Lakes of eastern Africa. Biodiversity 5(1):13-26.

McCulloch G, Irvine K. 2004. Breeding of greater and lesser flamingos at Sua Pan, Botswana 1998-2001. Ostrich 75(4):236-242.

McFarlane RW. 1975. Northern Chile. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 84-90. **

McNair DB, Gore JA. 1998. Assessment of occurrences of flamingos in northwest Florida, including a recent record of the greater flamingo (*Phoenicopterus ruber*). Florida Field Naturalist 26(2):40-43.

Meininger PL, Wolf PA, Hadoud DA, Essghaier MFA. 1993. Ornithological survey of the coast of Libya, July 1993. WIWO Report No. 46.

Michelutti PL. 1994. Presencia de la parina chica (*Phoenicoparrus jamesi*) en la Reserva de Mar Chiquita, Córdoba. [Presence of the James' flamingo in the Reserva de Mar Chiquita, Cordoba.] Nuestras Aves 12(30):26-27. {Spanish}

Milstein PLS. Wetland bird surveys in Mozambique. Proceedings of the Pan African Ornitholgical Congress; 1984. p 639-664.

Ming M. 1999. Greater flamingo *Phoenicopterus ruber* and rufous-tailed scrub robin *Cercotrichas galactotes*: two new species for China. Forktail 15:105-106.

Ming M. 2001. Greater flamingo *Phoenicopterus ruber* and rufous-tailed scrub robin *Cercotrichas galactotes*: two new species for China. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter no 10. Arles, France: Station Biologique de la Tour du Valat. p 44. **

Ming M, Lin J-C, Zhang FH. 2000. [A new record of bird from China (Aves: Phoenicopteriformes-Phoenicopteridae)]. Acta Zootaxonomica Sinica 25(2):238-239. {Chinese}

Mitchell P. 1988. Unusual sighting reports. Bird Observer (Nunawading) 678:87-88.

Mocci Demartis A. 1985. Analisi ricapitolativa sulla distribuzione europea del fenicottero rosa (*Phoenicopterus ruber roseus*) e sua densita in alcuni stagni sardi dal 1977 al 1985. [Summary analysis on the European distribution of the greater flamingo and its density in some Sardinian ponds from 1977 to 1985.] Rendiconti del Seminario Facolta di Science Dell'Universita di Cagliari 55(2):85-106. {Italian}

Mocci Demartis A. 1995. Censimenti invernali del Fenicottero (*Phoenicopterus ruber roseus* L.) in Sardegna nel quadriennio 1990-1993, e rapporti con la prima nidificazione massiva del 1993. [Population of wintering greater flamingos in Sardinia from 1990 to 1993, and causes of their first nesting in 1993.] Bollettino della Societa' Sarda di Scienze Naturali 30:83-95. {Italian}

Mohamed SA. 1991. On the movement and distribution of the greater flamingo, *Phoenicopterus ruber*, in Bahrain, Arabian Gulf. Arab Gulf Journal of Scientific Research 9(3):133-142.

Moreira F. 1993. Winter macrohabitat selection by birds in the Tagus estuary; (Portugal): herons, flamingos, gulls and ducks. Portugaliae Zoologica 2(2):16-23.

Morrison RIG, Ross RK, Espinoza F, Madriz M. 1985. Aerial survey of shorebirds and other wildlife in South America: some preliminary results. Canadian Wildlife Service Progress Notes 148:1-22.

Morrison T, Vogt H-H. 1996. Flamingos im Andenhochland. [Flamingos in the Andean highlands.] Die Gefiederte Welt 120(2):59-61. {German}

Moser M. 1986. Greater flamingos nest-building in Dubai Creek. Flamingo Research Specialists Group Newsletter 3:13. **

Moser ME. 1985. Flamingos on Dubai Creek. British Trust for Ornithology, Tring report. 18 p.

Mourer-Chauvire C, Bour R, Ribes S, Moutou F. 1999. The avifauna of Reunion Island (Mascarene Islands) at the time of the arrival of the first Europeans. Smithsonian Contributions to Paleobiology 89:1-38.

Mughogho DEC, Rutina L, Mosugelo D. 1998. Aerial surveys of flamingos at Sua Pan in 1996. Babbler (Gaborone) 34:20-22.

Mundkur T. 1984. Occurrence of lesser flamingo *Phoeniconaias minor* (Geoffroy) in Poona, Maharashtra. Journal of the Bombay Natural History Society 81(2):468.

Mundkur T. 1997. The lesser flamingo - a summary of its current distribution and conservation in Asia. In: Howard G, editor. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Nairobi, Kenya: IUCN Lake Bogoria. p 62-72.

Mundkur T, Pravex R, Khachar S, Naik RM. 1989. Hitherto unreported nest site of lesser flamingo *Phoeniconaias minor* in the Little Rann of Kutch, Gujarat. Journal of the Bombay Natural History Society 86(3):281-285.

Mundkur T, Taylor V. 1993. Asian Waterfowl Census 1993. Slimbridge, UK: IWRB. 142 p.

Mundy PJ, Borello WD. 1990. Northeast section of Sowa Pan (Makgadikgadi Pan): bird survey in winter 1990, with proposals for future monitoring. Botswana Bird Club Report 1.

Muñoz J, Muñoz C. 1975. Chubut province, Argentina. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamstead, England: Poyser. p 91-92. **

Muñoz T, Escandell R. 1994. Waterfowl Census 1993. Anuari Ornitològic de les Balears 8:61-65.

Nankinov D. 1992. Big flocks of flamingoes (*Phoenicopterus ruber*) in Bulgaria. Ornithologische Mitteilungen 44(4):102.

Nankinov D, Daraktchiev A. 1982. The flamingo (*Phoenicopterus roseus*) in Bulgaria. Nauchni Trudove Biologiia / Plovdivski Universitet "Paisii Khilendarski" 20(4):209-212. {Bulgarian}

Narayana Kurup DK, Mohan Kumar C. 1992. The flamingo *Phoenicopterus roseus* Pallas in Kerala. Journal of the Bombay Natural History Society 89(3):365-366.

Nasirwa O. 1994. Kenya wetlands working group. Kenya Birds 3:53-54.

Nasirwa O. 1997. Status of lesser flamingos in Kenya. In: Howard G, editor. Conservation of the Lesser Flamingo in Eastern Africa and Beyond. Nairobi, Kenya: UICN Lake Bogoria. p 22-24.

Navarro Medina JD, Navarro Garcia J. 1982. La avifauna de los embalses de "El Hondo" (Alicante). [The avifauna of the reservoirs of El Hondo" (Alicante).] Mediterranea 6:109-139. {Spanish}

Negi AS. 1993. A visit to the flamingo city in the great Rann of Kutch (Gujarat). Indian Forester 119(5):354-359.

Nesis KN. 1985. Podvodnye nablyudenija za antarkticheskim krilem. [Under water observations for Antarctic kriel.] Priroda 5:101-103. {Russian}

Nicolossi G. 1990. Nidificación del flamenco común en la Laguna de Pozuelos. [Nesting of the common flamingo in the Laguna of Pozuelos.]. Argentina: Informe interno Administración de Parques Nacionales. {Spanish}

Nicolossi G. 1992. Estudio de las poblaciones de las especies de flamencos en Laguna Pozuelos. [Study of the population of flamingo species at Laguna Pozuelos.]. Argentina: Informe interno Administración de Parques Nacionales. {Spanish}

Nicolossi G. 1993. Censo de Flamencos en la Laguna de Vilama. [Flamingo Census at Laguna de Vilama.]. Argentina: Informe interno Administración de Parques Nacionales. {Spanish}

Nicolossi G. 1993. Censo de Flamencos en Laguna Pozuelos. [Flamingo census at Laguna Pozuelos.]. Argentina: Informe interno Administración de Parques Nacionales. {Spanish}

Nicolossi G. 1993. Censos de Flamencos en Laguna Vilama, Abril 1993. Argentina. {Spanish}

Niepieklo B, Taylor JR. 1977. Rare bird species observed in estuary of the river Reda district Gdansk Poland. Notatki Ornitologiczne 18(3-4):123-125.

Noli-Peard KR, Williams AJ. 1991. Wetlands of the Namib Coast. Madoqua 17:147-153.

Obando C. 1988. Fluctuaciones trimestrales de la población de *Phoenicopterus chil*ensis en el área de Paracas (Perú) desde 1977 a 1985. [Quarterly fluctuations in the population of Phoenicopterus chilensis in the area of Paracas (Peru) from 1977 to 1985.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporación Nacional Forestal y Sociedad Zoológica de Nueva York. p 42-51. {Spanish} **

Ochando B, Malher F, Bellatreche M. 1981. Recensements internationaux d'oiseaux d'eau en Algerie, 1981. [International censuses of waterbirds in Algeria, 1981.]: Institut National de la Recherche Agronomique d'Algérie. {French}

Olioso G. 1997. [1996 Provence (France) ringing report]. Faune de Provence 18:83-88. {French}

Oliver G. 1980. Les flamants roses *Phoenicopterus ruber roseus* de l'étang de Canet (Pyrénées-Orientales). [Greater flamingos at the pond of Canet (Pyrenees-Orientals).] Alauda 48(4):255-257. {French}

Ollacarizqueta J. 2000. Observacion de flamenco comun (*Phoenicopterus ruber*) en la balsa de la Estanca (Corella, Navarra). [Sighting of greater flamingo in the raft of La Estanca (Corella, Navarre [Navarra], northern Spain).] Anuario ornitologico de Navarra 5:69-70. {Spanish}

Orsini P. 1979. Migration et stationnements du flamant rose *Phoenicopterus ruber roseus* Pallas 1811 sur la presq'ile de Gieus (Var). [Migration and stopover of the greater flamingo on the Giens Peninsula, Var Department, France.] Alauda 47(3):173-182. {French}

Orsini PH. 1984. Les Flamants roses dans le Var. [The greater flamingo in Var.] Annales de la Societe des Sciences Naturelles de Toulon et du Var 36:225-232. {French}

Ortali A. 1981. Anche nel 1981 i fenicotteri *Phoenicopterus ruber roseus* a S. Rossore. [Also in 1981 the flamingos *Phoenicopterus ruber roseus* at S. Rossore.] Gli Uccelli d'Italia 6:182-184. {Italian}

Ortiz Crepo FI. Ecudorean wetlands: past, present and future, with special mention of waterfowl. First western hemisphere waterfowl and waterbird symposium, IWRB; 1983; Edmonton (Canada). p 127-132.

Ottenwalder JA. 1986. The American flamingo in Haiti: Aerial surveys and review of status. Flamingo Research Specialists Group Newsletter 3:19-23. **

Ottenwalder JA. 1988. Flamingos in Haiti. World Birdwatch 10(3-4):8.

Ottenwalder JA. 1991. Situación del Flamenco del Caribe (*Phoenicopterus ruber ruber*). [Status of Caribbean flamingos.] In: Junta de Andalucia, editor. Reunión Técnica sobre la situación y problemática del flamenco rosa, *Phoenicopterus ruber roseus*, en el Mediterraneo Occidental y Africano Nor Oriental. p 83-91. {Spanish} **

Owino AO, Bennun LA, Nasirwa O, Oyugi JO. 2002. Trends in waterbird numbers in the southern Rift Valley of Kenya, 1991-2000. Waterbirds 25(2):191-201. {English} **

Owino AO, Oyugi JO, Nasirwa OO, Bennun LA. 2001. Patterns of variation in waterbird numbers on four Rift Valley lakes in Kenya, 1991–1999. Hydrobiologia 458:45-53. **

Oyarzo Rodriguez H, Cepeda HC. 1988. Comunidad avial asociada a la Laguna del Negro Francisco. [Avian community associated with the Laguna del Negro Francisco.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporación Nacional Forestal y Sociedad Zoológica de Nueva York. p 122-131. {Spanish} **

Palmes P. 1984. Flamingos in Gujarat (India). ICBP-IWRB Flamingo Working Group Newsletter 2:27-28. **

Paolillo G, di Giorgio A. 1988. Segnalazioni di fenicottero, *Phoenicopterus ruber*, in Calabria. [Reports of flamingo, *Phoenicopterus ruber*, in Calabria.] Rivista Italiana di Ornitologia 58(1-2):85. {Italian}

Parada ME. 1988. Flamencos en el norte de Chile y su reproducción. [Flamingo breeding in northern Chile.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoológica de Nueva York. p 132-139 (English 140-147). {Spanish and English} **

Parada ME. 1988. Flamencos en el norte de Chile: distribución, abundancia y fluctuaciones estacionales del número. [Flamingos in northern Chile: distribution, abundance and seasonal fluctuations of numbers.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama, Chile: Corporacion Nacional Forestal y Sociedad Zoológica de Nueva York. p 54-79. {Spanish and English} **

Parada MM. 1988. Flamencos en el norte de Chile: Decrementos invernales y proposicion de movimientos migratorios. [Flamingos in northern Chile: winter decrease and proposition of migratory movements.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoologica de Nueva York. p 148-153. {Spanish} **

Parker ICS. 1975. A census of Ostriches *Struthio camelus* in the vicinity of the Mak-gadi-kgadi Pans of Botswana. 65 p.

Passarella M, Altieri E, Bena M, Boschetti E, Tenan S, Verza E. 1999. Svernamento di fenicottero *Phoenicopterus roseus* nel Delta del Po (Rovigo). [Wintering of the greater flamingo in the Po delta (Rovigo).] Avocetta 23(1):59. {Italian}

Passarella M, Tinarelli R, Arveda G. 1995. Primo svernamento di fenicottero, *Phoenicopterus ruber*, nelle Valli di Comacchio. [First wintering of greater flamingos in the Valli di Comacchio (NE Italy).] Rivista Italiana di Ornitologia 64(2):174-175. {Italian}

Paterson A. 1991. Fuente de Piedra. Birds Magazine, RSPB 13(6):52-56.

Pejoves J. 1989. Breve observacion de parinas en Las Lagunas de Mejia, Peru. [Brief observation of flamingos in the Lagoons of Mejia, Peru.] Flamingo Research Group Newsletter 5:38. {Spanish} **

Perrenou CP. 1991. African Waterfowl Census 1991. [The Wildfowl International Censing in tropical Africa.]. Slimbridge, UK: International Waterfowl and Wetlands Research Bureau. 88 p.

Perrenou CP. 1991. Les Recensements Internationaux d'Oiseaux d'eau en Afrique Tropicale. [The Wildfowl International Censusing in Tropical Africa.]: IWRB Publication. Report nr 15. {French}

Perrenou CP. 1992. African Waterfowl Census 1992. Slimbridge, UK: International Waterfowl and Wetlands Research Bureau. 87 p.

Perrenou CP, Mundkur T, Scott DA. 1994. The Asian waterfowl census 1987-1991: distribution and status of Asian waterfowl. IWRB Special Publication 24; AWB Special Publication 86.

Petersen A. 1985. [New bird species for the Icelandic checklist.]. Bliki (Reykjavik) 4:57-66. {Icelandic}

Petursson G, Olafsson E. 1988. Rare birds in Iceland in 1985. Bliki (Reykjavik) 6:33-68.

Philippona J. 1985. Waterbirds at some wetlands in Turkey and Greece. WIWO Publication No. 3.

Pickering S. 1992. A short report on the 1990 Slimbridge (U.K.) flamingo breeding season. Flamingo Research Group Newsletter 6:33-36. **

Pickering S. 1992. The Wildfowl and Wetlands Trust Flamingo Project. Flamingo Research Group Newsletter 6:9-10. **

Pietrelli L, Menegoni P, Biondi M, Guerrieri G. 1993. Avvistamento di fenicottero, *Phoenicopterus ruber*, e silvia del ruppell, *Sylvia rueppelli*, nell'isola di Zannone (Lazio). [Observation of greater flamingo and Rueppell's warbler at Zannone Island (Latium, Central Italy).] Rivista Italiana di Ornitologia 63(1):112-114. {Italian}

Pineau O. 1979. Le flamant rose (*Phoenicopterus ruber roseus* Pallas) dans les Etangs de l'Herault: variations annuelles de la population.[The greater flamingo at the pond of Herault: annual population variations. Languedoc, Montpellier.] [Higher diploma]. Languedoc, Montpellier: Universite des Sciences et Techniques. {French}

Pirela DE. 1994. Monitoreo de la población de flamencos (*Phoenicopterus ruber ruber*) en el Refugio de Fauna Silvestre y Reserva de Pesca Ciénaga de Los Olivitos, Estado Zulia, Venezuela. [Monitoring of the flamingo population in the Los Olivitos Wildlife Refuge, Estado Zulia, Venezuela.]. Memorias del II Taller Internacional Conservación del Flamenco del Sur del Caribe. Chichiriviche, Estado Falcón, Venezuela: Embajada Real de los Paises Bajos, Oficina del Consejero Agricola. {Spanish}

Pirela DE. 2000. Monitoring Caribbean flamingos at Los Olivitos Wildlife Refuge, western Venezuela. Waterbirds 23(Special Publication 1):103-108. **

Platt JB. 1990. The flamingos of Dubai. Gazelle (Dubai Natural History Group) 5(11):5.

Platt JB. 1992. Greater flamingos, *Phoenicopterus ruber*, at Khor Dubai, United Arab Emirates. Sandgrouse 14(2):72-80.

Pomeroy D, Byaruhanga A, Wilson M. 2004. Waterbirds of alkaline lakes in western Uganda. Journal of East African Natural History 92(1-2):63-79.

Poslavskiy AN, Sabinyevskiy BV, Luri VN. 1977. Flamingo v Severo-Vostochnom Prikaspii. [Flamingo in the Northeastern Caspian Sea.] In: M. GU, editor. Redkie i ischezajushchie ptitsy i zveri Kazakhstana [Rare and Vanishing Animals and Birds of Kazakhstan]. Alma-Ata: Nauka. p 209-214. {Russian; IWRB translation from Russian to English available}

Poslavskiy AN, Shirekov RS. 1990. Redkie vidy veslonogikh, golenastykh i flamingo v Vostochnoi Turkmenii. [Rare species of Pelecaniformes, Ciconiiformes and Phoenocopteriformes in Eastern Turkmenia.]. Redkie i malooizuchennye ptitsy Srednei Azii [Rare and little studied birds of the Central Asia]. Tashkent. p 35-38. {Russian}

Powell GVN, Bjork RD, Ogden JC, Paul RT, Powell AH, Robertson WBJ. 1989. Population trends in some Florida bay wading birds. Wilson Bulletin 101(3):436-457. **

Preiswerk G. 2004. Seltene Vogelarten und ungewoehnliche Vogelbeobachtungen in der Schweiz im Jahre 2003. [Rare birds and unusual observations in Switzerland in 2003.] Ornithologische Beobachter 101(4):261-280. {German}

Preiswerk G, Maumary L. 2004. Oiseaux rares et observations inhabituelles en Suisse en 2003. 13o rapport de la Commission de l'avifaune suisse. [Rare birds and unusual observations in Switzerland in 2003.] Nos Oiseaux 51(4):227-240. {French}

Proctor D, Fleming LV, editors. 1999. Biodiversity: the UK Overseas Territory. Peterborough: Joint Nature Conservation Committee. **

Pyrtherch R, Everett M. 1990. News and comments. Record year for flamingos. British Birds 83:567.

Rainbolt RE, Augeri DM, Pierce SM, Bergeson MT. 1997. Greater flamingos breed on Aldabra Atoll, Republic of Seychelles. Wilson Bulletin 109(2):351-353. **

Ramadan Jaradi G, Bara T, Almecija M, Ramadan Jaradi M. 2004. Significant bird notes from Lebanon during 2002-03. Sandgrouse 26(1):29-34.

Ramirez Gonzales JM. 1992. Primeros resultados de los anillamientos de flamencos (*Phoenicopterus ruber roseus)* en la Laguna de Fuente de Piedra. [Initial results of greater flamingo banding at la Laguna de Fuente de Piedra.] Flamingo Research Group Newsletter 6:13-15. **

Ramirez JM, Rendon M. 1992. La reproduccion del flamenco (*Phoenicopterus ruber roseus)* durante 1990 en La Reserva Natural Laguna de Fuente de Piedra (Malaga). [The reproduction of the greater flamingo during 1990 at La Reserva Natural Laguna de Fuente de Piedra (Malaga).] Flamingo Research Group Newsletter 6:46-49. {Spanish} **

Ramirez-Gonzalez JM, Rendon-Martos M. 1993. Fuente de Piedra, la laguna salina mas grande de Andalucia. [Fuente de Piedra, the largest saline lagoon in Andalusia.] Quercus 86:6-15. {Spanish}

Ramo C, Busto B. 1984. Censo aereo de corocoras (*Eudocimus ruber ruber*) y otras aves acuáticasa en Venezuela. [Aerial census of scarlet ibis and other aquatic birds in Venezuela.] Boletín de la Sociedad Venezolana de Ciencias Naturales 39(142):65-68. {Spanish}

Randla T. 1978. A flamingo on the coast of Rohuneeme. Loodusvatlusi 1:112-113. {Estonian}

Rendón M. 1986. Anillamiento de flamenco (*Phoenicopterus ruber roseus)* en Fuente de Piedra (Espana). [Banding the greater flamingo at Fuente de Piedra (Espana).] Flamingo Research Specialists Group Newsletter 3:9. {Spanish} **

Rendón M. 1986. La reproduccion del flamenco (*Phoenicopterus ruber roseus*) en Fuente del Piedra (Espana). Ano 1986. [The reproduction of the greater flamingo at Fuente del Piedra (Espana) 1986.] Flamingo Research Specialists Group Newsletter 3:6-8. {Spanish} **

Rendón M, Ramirez JM. 1992. La gestion de la colonia de flamencos (*Phoenicopterus ruber roseus)* en Fuente de Piedra, Espana durante el ano 1990. [Management of a colony of greater flamingos at Fuente de Piedra, Spain during 1990.] Flamingo Research Group Newsletter 6:50-52. {French} **

Rendón-Martos M. 1988. La reproduccion del flamenco (*Phoenicopterus ruber roseus)*. [The reproduction of the greater flamingo.] Flamingo Research Specialists Group Newsletter 4:9-13. {Spanish} **

Rendón-Martos M. 1989. Reserva integral Laguna de Fuente de Piedra - La reproduccion del flamenco (*Phoenicopterus ruber roseus)* durante 1988. [Integral Reserve of Laguna de Fuente de Piedra - Reproduction of the greater flamingo during 1988.] Flamingo Research Group Newsletter 5:8-10. {Spanish} **

Rendón-Martos M. 1992. Situacion del flamenco en La Laguna de Fuente de Piedra (Espana) durante el ano 1989. [Situation of the flamingo at La Laguna de Fuente de Piedra (Spain) during 1989.] Flamingo Research Group Newsletter 6:11-12. {Spanish} **

Rendón-Martos M, Nogueira C. 1989. Proyector de mejora del habaitat del flamenco (*Phoneicopterus ruber roseus)* en Las Salinas del Cabo de Gata, Almeria, Espana. [Projecting the improvement of the flamingo habitat at Las Salinas del Cabo de Gata, Almeria, Spain.] Flamingo Research Group Newsletter 5:13-14. {Spanish} **

Richardson C. 1986. Will Flamingos soon breed in Dubai? Phoenix 3:6.

Richardson IM. 2003. A long-term bird survey of Kulu Golu, Turkey (2001-2002). Sandgrouse 25(2):110-121. {English} **

Ridgely RS. 1980. Notes on some rare or previously unrecorded birds in Ecuador. American Birds 34:242-248.

Riera J, Palerm JC. 2000. Recompte hivernal d'aus aquatiques i limicoles a Mallorca i Les Pitiüses, Gener de 2001. [Winter census of wildfowl and shorebirds in Mallorca and Eivissa/Formentera, January 2001.] Annuari ornithològic de les Balears 15:19-26. {French}

Roberts L. 1989. Birds at Alexander Bay. Promerops 189:6-7.

Robertson HG, Johnson PG. 1979. First record of greater and lesser flamingos breeding in Botswana. Botswana Notes and Records 11:115-119.

Robertson I. 1996. Recent reports. Bulletin of the African Bird Club 3(2):139-140.

Rocha O. 1997. Fluctuaciones poblacionales de tres especies de flamencos en Laguna Colorada, Provincia Sud Lípez, Departamento de Potosí (Bolivia). [Population fluctuations of three species of flamingos in Laguna Colorado.] Revista Boliviana de Ecología y Conservación Ambiental 2:67-76. {Spanish}

Rocha O, Quiroga C. 1997. Primer censo simultáneo internacional de los flamencos (*Phoenicoparrus jamesi* y *Phoenicoparrus andinus*) en Argentina, Bolivia, Chile y Perú, con especial referencia y análisis al caso boliviano. [First simultaneous censuses of flamingos in Argentina, Bolivia,Chile, and Peru.] Ecologiá en Bolivia 30:33-42. {Spanish}

Rocha O, Quiroga C, Martinez O. 2003. Poblacion de tres especies de flamencos en los lagos Poopo y Uru Uru, Oruro- Bolivia. [The population of three species of flamingoes from the lakes of Poopo, Uru Uru and Oruro - Bolivia.] Flamingo Specialist Group Newsletter 11:24-26. {Spanish}

Rodrigo D, Rodrigo N. 1996. Flamingos at Yala. Loris 21(1):13-14.

Rodriguez de los Santos M. 1983. Sobre la nidificación del flamenco rosa (*Phoenicopterus ruber roseus*) en las Marismas del Guadalquivir en el año 1979. [On the breeding of the greater flamingo in the marshes of Guadalquivir during 1979.] Alytes 1:249-254. {Spanish}

Rodríguez E. 1996. Manual Para el Censo Simultáneo de Flamencos en el Norte de Chile. [Manual for the Simultaneous Census of flamingos in Northern Chile.]. Antofagasta, Chile: Corporación Nacional Forestal. {Spanish}

Rodriquez E, Contreras JP. Distribution and abundance of flamingos in Northern Chile: Period 1990-1997. 1998 Meeting of the Flamingo Specialists Group; 1998; North Miami Beach, Florida. p 25. {Spanish} ** abstract only

Romè A. 1980. Il fenicottero (*Phoenicopterus ruber roseus*) in Toscana. [The greater flamingo in Tuscany.] Rivista Italiana di Ornitologia 50(2-3):158-166. {Italian}

Romè A. 1981. Ulteriori dati sulla presenza del Fenicotteri in Toscana. [Further data on the presence of flamingos in Tuscany.] Gli Uccelli d'Italia 6:57-58. {Italian}

Rosa S, Palmeirm JM, Moreira F. 2003. Factors affecting waterbird abundance and species richness in an increasingly urbanized area of the Tagus Estuary in Portugal. Waterbirds 26(2):226-232. **

Rose P, Scott D. 1997. Waterfowl Population Estimates, 2d ed. Wageningen, Netherlands: Wetlands International Publication 44.

Rose PM, Scott DA. 1994. Waterfowl Population Estimates. International Waterfowl and Wetlands Research Bureau Publication 29.

Rusanov GM, Krivonosov GA. 1988. Flamingo (*Phoenicopterus roseus* Pall.) na Severnom i Severo-Vostochnom Kaspii v usloviyakh sovremennogo povysheniya urovnya vody. [The greater flamingo in the northern and northeastern parts of the Caspian Sea in the conditions of the sea tide.] Byulleten' Moskovskogo Obshchestva Ispytatelei Prirody Otdel Biologicheskii [Bulletin of Moscow Naturalists' Society] 93(3):13-20. {Russian}

Rusanov GM, Krivonosov GE, Anisimov EI. 1991. Chislennost' i razmeshchenie flamingo u severnogo i severo vostochnogo poberezh'ya Kaspiya. [Number and distribution of the Greater flamingo near northern and north eastern shore of the Caspian Sea.]. Redkie ptitsy i zveri Kazakhstana [Rare birds and mammals of Kazakhstan]. Alma Ata. p 76-77. {Russian}

Rutjes PPM, Wijk RJv. 1978. The Avifauna of Wetlands in East and South Spain During the Summer of 1978 (with special attention for the flamingo *Phoenicopterus ruber roseus* Pallas). [Doctoral disertation]. Wageningen / Nijmegen: Agricultural University / Catholic University of Nijmegen.

Salathé T. 1984. Predation of flamingos in the Camargue by herring gulls. ICBP-IWRB Flamingo Working Group Newsletter 2:13. **

Samarasekera MJ. 1986. Do flamingos nest in Sri Lanka? Loris 17(4):183.

Sanchez Moreno A. 1979. Resultados de los censos de aves acuaticas invernantes en el sur-oeste de España. Inviernos de 1975/76 y de 1976/77. [Results of the censuses of aquatic birds wintering in the south-west of Spain. Winters 1975/76 and 1976/77.] Doñana, Acta Vertebrata 6(1):67-75. {Spanish}

Sangha HS. 1998. Flamingo surveys at Sambhar Lake (Rajasthan), India. In: Johnson A, editor. Flamingo Specialist Group Newsletter 8. p 24-25.

Sarmiento J, Barrera S, Caziani S, Derlindati EJ. 1998. Región 6 Andes del sur (Argentina). In: Canevari P, Blanco DE, Bucher EH, Castro G, Davidson I, editors. Los Humedales de Argentina. Buenos Aires, Argentina: Wetlands International Publication 46. p 171-181(or 169-181). {Spanish} **

Sayre R. 1982. Creatures. Pink flamingos are returning to Lake Nakuru. Audubon 84(5):28.

Schenk H, Murgia PF, Nissardi S. 1995. Prima nidificazione del Fenicottero rosa (*Phoenicopterus ruber roseus*) in Sardegna e problemi di conservazione delle specie coloniali nello stagno di Molentargius. [First breeding of the greater flamingo in Sardinia and conservation problems of colonial waterbirds in the Molentargius wetland.] Supplemento alle Ricerche di Biologia della Selvaggina 22:313-321. {Italian}

Schricke V, Triplet P, Yesou P. 2001. Contributions Françaises à la connaissance des oiseaux d'eau Paléarctiques hivernant dans le delta du Sénégal. [French contribution to the knowledge of western Palaearctic water birds overwintering in the Senegal River delta.] Alauda 69(1):135-148. {French}

Schulenberg TS, T. A. Parker I. 1981. Status and distribution of some northwest Peruvian birds. Condor 83(3):209-216. **

Schweizer M. 2003. Seltene Vogelarten und ungewoehnliche Vogelbeobachtungen in der Schweiz im Jahre 2002. 12. Bericht der Schweizerischen Avifaunistischen Kommission. [Rare birds and unusual observations in Switzerland in 2002.] Ornithologische Beobachter 100(4):293-314. {German}

Schweizer M, Maumary L. 2003. Oiseaux rares et observations inhabituelles en Suisse en 2002. 12e rapport de la Commission de l'avifaune suisse. [Rare birds and unusual observations in Switzerland in 2002.] Nos Oiseaux 50(4):261-276. {French}

Scott DA. 1975. Iran. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 28-32. **

Scott DA, editor. 1989. A Directory of Asian Wetlands. Gland, Switzerland & Cambridge, England: IUCN. **

Scott DA, Carbonell M, editors. 1986. A Directory of Neotropical Wetlands. Cambridge, England: IWRB, Slimbridge and IUCN.

Seriot Jea. 2001. Les oiseaux nicheurs rares et menacés en France en 1999. [The rare and threatened native birds in France in 1999.] Ornithos 8(4):121-135.

Serra Guedes R, Teixeira AM. 1991. O Flamingo em Portugal. [Flamingos in Portugal.] In: Junta de Andalucia, editor. Reunión técnica sobre la situación y problemática del flamenco rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. p 53-61. {Portuguese} **

Serra L, Brichetti P. 2002. Uccelli acquatici nidificante: 2000. [Report on Breeding of Water Birds 2000.] Avocetta 26(2):123-129.

Sharrock JTR, Davies C. 2000. The European Bird Report - Non-passerines, including near-passerines. British Birds 93(3):114-128.

Sielfeld W, Amado N, Herreros J, Peredo R, Gallardo P. 1998. Poblacion de flamencos en el Salar del Huasco durante el verano 1993-1994. [The flamingo population at Huasco Salt lake during the summer 1993-1994.] Boletín Chileno de Ornitología 5:10-15. {Spanish}

Sielfeld W, Amado N, Herreros J, Peredo R, Rebolledo A. 1996. La avifauna del Salar del Huasco: Primera Region, Chile. [The avifauna of Huasco Salt Lake: Primera Region, Chile.] Boletin Chileno de Ornitologia 3:17-24. {Spanish}

Siki M, Öktem N. 1992. La révision des espèces d'oiseaux de la pêcherie de Homa dans la Saline de Camalti. [Review of bird species of the Homa fishery in the Saline of Camalti.] Journal of the Faculty of Science Ege University Series B 14(1):39-51. {French}

Silan P. 1987. Phenologie et structure des populations d'oiseaux d'eau hivernants dans le Languedoc Roussillon, saison 1984-1985. [Phenology and structure of populations of waterbirds wintering in the Languedoc Roussillon, 1984-1985 season.] Le Guepier 5:33-75. {French}

Skerrett A. 1995. Greater flamingo breeds on Aldabra. Bulletin of the African Bird Club 2(2):75.

Smart M. 2001. Flamingo observations in Tunisia in 1998. In: Johnson A, Arengo F, editors. WI/IUCN Flamingo Specialist Group Newsletter No 10. Arles, France: Station Biologique de la Tour du Valat. p 41-42. **

Sosnovskiy IP. 1982. O redkikh zhivotnykh mira. [On rare animals of the World.]. Moscow: "Prosveshchenie" Publishers. 192 p. {Russian}

Sowrirajan TV. 1994. Are there flamingoes in Sewri? Hornbill (Bombay) 1:2-7.

Spottiswood C, Underhill L. 1994. Lesser flamingos at Wellington. Promerops 216:12.

Sprunt A. 1975. The Caribbean. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 64-74. **

Sprunt A. A new Colombian site for the American flamingo (*Phoenicopterus ruber*). CCA Ecology Conference Bonaire; 1976. Netherlands Antilles National Parks Foundation. p 34-39. **

Sugathan R. 1982. Some interesting aspects of the avifauna of Point Calimere Sanctuar, Thanjavur District, Tamil Nadu. Journal of the Bombay Natural History Society 79:567-575.

Tamisier A, Grillas P. 1994. A review of habitat changes in the Camargue: an assessment of the effects of the loss of biological diversity on the wintering waterfowl community. Biological Conservation 70:39-47.

Tarboton WR. 1993. Lake Crissie flamingo breeding project. Chief Directorate Nature & Environmental Conservation, Transvaal Provincial Administration. Unpublished Report.

Taylor V. 1993. African Waterfowl Census 1993. Les Dénombrements Internationaux d'oiseaux d'eau en Afrique, 1993. Slimbridge, UK: International Waterfowl Research Bureau. 156 p.

Taylor VR, P. M. 1993. Western Palearctic and South West Asia Waterfowl Census 1993. Slimbridge, UK: International Waterfowl Research Bureau. 215 p.

Taylor VR, P. M. 1994. African Waterfowl Census 1994. Les Dénombrements Internationaux d'oiseaux d'eau en Afrique, 1994. Slimbridge, UK: International Waterfowl Research Bureau. 184 p.

Teixeira DM, Best RC. 1981. Adendas a ornitologia do territorio federal do Amapa. [Contributions to the ornithology of the Amapa Federal Territory, Brazil.] Boletim do Museu Paraense Emilio Goeldi Nova Serie Zoologia No. 104:1-25. {Portuguese}

Thakker PS. 1982. Flamingos breeding in Thol Lake Sanctuary near Ahmedabad. Journal of the Bombay Natural History Society 79(3):668.

Theler G. 1989. Summary of observations of breeding flamingos at the Lagoon of Fuente de Piedra (Malaga) and in the Marismas (Huelva-Sevilla), Spain, 1986-1988. Flamingo Research Group Newsletter 5:11-12. **

Thévenot M, Bergier P, Beaubrun P. 1980. Compte-rendu d'Ornithologie Marocaine, Année 1979. [Moroccan Ornithology Report, 1979.]. Document No. 5, Inst. Scient. Univ. Mohammed V, Rabat. {French}

Thiede W, Gloe P. 1987. Zwergflamingos (*Phoeniconaias minor*) in Europa. [Lesser flamingos in Europe.] Ornithologische Mitteilungen 39(10):256-260. {German}

Toschi A. 1975. Sardinia. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 26-27. **

Treep J. 1991. Summer quarters of flamingoes sighted in the Netherlands. Dutch Birding 13(1):17.

Treep JM. 1994. Zijn flamingo's *Phoenicopteridae* blijvertjes in Nederlandse wateren? [Have flamingos become residents in Dutch wetlands?] Het Vogeljaar 42(5):208-217. {Dutch}

Treep JM. 1995. Feral flamingos in Germany and the Netherlands. IWRB Flamingo Specialist Group Newsletter 7:50-51. **

Triplet P, Yésou P. 1994. Oiseaux d'eau dans le delta du Sénégal en janvier 1994. [Waterbirds in the delta of Senegal in January 1994.] Bulletin Mensuel de la Office National de la Chasseo 190:2-11. {French}

Trolliet B, Fouquet M. 2001. La population ouest africaine du flamant nain *Phoeniconaias minor*: effectifs, repartition et isolement. [Size, distribution and isolation of the west African population of lesser flamingo.] Malimbus 23(2):87-92. {French}

Trotignon E, Trotignon J. 1981. Recensement hivernal 1979-1980 des spatules, des flamants, et des pélicans blancs sur le Banc d'Arguin (Mauritanie). [Winter census, 1979-1980, of spoonbills, flamingos, and white pelicans on Arguin Bank, Mauritania, West Africa.] Alauda 49(3):203-215. {French}

Trotignon J. 1975. Mauritania. In: Kear J, Duplaix-Hall N, editors. Flamingos. Berkhamsted, England: Poyser. p 35-37. **

Trujillo D. 1993. Flamenco. [Flamingo.] Ardeola 40:89. {Spanish}

Tuite C. 1980. Lesser flamingoes in East Africa: A review 1969-1976. ICBP-IWRB Flamingo Working Group Newsletter 1:8-11. **

Tuite CH. 1979. Population size, distribution and biomass density of the lesser flamingo in the eastern Rift Valley, 1974-1976. Journal of Applied Ecology 16(3):765-776. **

Tuite CH. 1981. Flamingoes in East Africa. SWARA, East African Wildlife Society 4(4):36-38.

Tuite CH. 2000. The distribution and density of lesser flamingos in East Africa in relation to food availability and productivity. Waterbirds 23(Special Publication 1):52-63. **

Turner D. 1995. Declining waterbirds on Lake Nakuru. Bulletin of the African Bird Club 2(2):75.

Tutaev D, Samedov Z. 1982. Novaja rodina flamingo. [New native land of flamingo.] Priroda Azerbajdzhana [Nature of Azerbaijan] 5:17-18. {Russian}

Umpierrez S. Status of *Phoenicopterus chilensis* in Uruguay. 1998 Meeting of the Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 33. {Spanish} ** abstract only

Underhill LG, Tree AJ, Oschadleus HD, Parker V. 1999. Review of Ring Recoveries of Waterbirds in Southern Africa. Avian Demography Unit, University of Cape Town.

Vaidya AA. 1987. Spotting of habshi flamingos in Nani-Banni. Journal of the Bombay Natural History Society 83(3):661-662.

Valle CA, Coulter MC. 1987. Present status of the flightless cormorant, Galapagos penguin and greater flamingo populations in the Galapagos Islands, Ecuador, after the 1982-83 El Niño. Condor 89(2):276-281. **

Valqui M, Caziani SM, Rocha-O. O, Rodriquez-R. E. 2000. Abundance and distribution of the South American altiplano flamingos. Waterbirds 23(Special Publication 1):110-113. **

van den Berg AB. 1987. Voorkomen, herkenning en status van flamingo's in Nederland. [Presence, identification and status of flamingos in the Netherlands.] Dutch Birding 9(1):2-7. {Dutch} van den Berg AB. 1994. WP reports. Dutch Birding 16(2):77-83.

van der Ven J. 1987. Midwinter observations in some Asian countries. I. W. R. B.

van der Ven JA, Gheyselinck GF. 1980. Some bird observations on Cyprus, 22-29 Aug. 1980. Utrecht: Cyclostyled report.

Van Dijk K, Van Dijk AJ, Dijksen LJ, Wymenga E. 1984. Counts and observations of individually marked flamingos in Tunisia. ICBP-IWRB Flamingo Working Group Newsletter 2:16-18. **

van Impe J, Boesman P. 1988. [First records of the lesser flamingo in Belgium.]. Oriolus 54(4):180-181. {Dutch}

Vargas H. 1996. Present status of waterbirds resident in lagoons near populated zones on Isabela and San Cristobal islands. Charles Darwin Research Station Annual Report 1988-1989:102-104.

Vargas Yañez JM, Blasco Ruiz M, Antunez Corrales A. 1983. Los vertebrados de la Laguna de Fuente de Piedra (Malaga). [Vertebrates of Laguna de Fuente de Piedra.]. ICONA Monografias. {Spanish}

Vasil'yev VI. 1976. Materialy po sezonnomu razmeshcheniyu, chislennosti i ekologii flamingo na Vostochnom Kaspii. [Materials on the seasonal distribution and ecology of flamingo in the Eastern Caspian Sea.]. Materialy soveshchaniya po promyslovoi ornitologii [Materials of Meeting on Hunting Ornithology]. Moscow. p 137-138. {Russian}

Vassallo M. 1978. Uccelli non comuni da me preparati, presi recentemente nella Liguria di Ponente ed in Piemonte (Provincia di Cuneo). [Rare birds that I prepared, recently taken in the Liguria of West and in Piedmont (Province of Cuneo).] Rivista Italiana di Ornitologia 48:180-183. {Italian}

Vatev IT. 1991. Observations du flamant rose, *Phoenicopterus ruber*, en Bulgarie. [Observations of greater flamingos in Bulgaria.] Alauda 59(1):53-54. {French}

Velarde D. 1998. Resultados de los censos Neotropicales de aves acuáticas en el Perú 1992-1995. [Results of the Neotropical censuses of aquatic birds in Peru 1992-1995.]. Lima Perú: Programa de Conservación y Desarrollo Sostenido de Humedales. {Spanish}

Verschuren J. 1978. [Ornithological observations in the national parks of Zaire 1968-1974.] Gerfaut 68(1):3-24. {French}

Verschuren J. 1991. [Ornithological observations in Zaire, principally in the Virunga National Park.] Gerfaut 81(3-4):139-150. {French}

Vides-Almonacid R. 1990. Observaciones sobre la utilización del hábitat y la diversidad de especies de aves en una laguna de la puna Argentina. [Observations about the use of the habitat and the diversity of species of birds in a lagoon of the Argentinian Puna.] Hornero 13(2):117-128. {Spanish}

Vilina Y, Martinez G. Habitat association of three species of flamingo in Salar de Ascotan, Chile. 1998 Meeting of the Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 35. ** abstract only

Volkov EN. O sezonnom razmeshchenii, chislennosti i merakh okhrany flamingo tsentralno kazakhstanskoi populyatsii. [On the seasonal distribution, number and measures on conservation of flamingos of the Central Kazakhstan population.]. Materialy Vsesoyuz konf po migratsiyam ptits [Materials of All Union Conference On Bird Migrations], Part 2; 1975; Moscow. p 257-259. {Russian}

Volkov EN. 1977. Dinamika obvodnennosti ozer i razmeshchenie tsentralno kazakhstanskoi populaytsii flamingo. [Dynamics of water abundance of lakes and distribution of the Central Kazakhstan population of the greater flamingo.]. Fauna i biologiya guseobraznykh ptits [Fauna and biology of Anseriformes birds]. Moscow. p 82-85. {Russian}

Volkov EN. 1977. O razmeshchenii i chislennosti tsentral'nokazakhstanskoj populyatsii flamingo. [Distribution and numbers of the central Kazakhstan population of flamingos.] In: al. EIGe, editor. Redkie i ischezajushchie zveri i ptitsy Kazakhstana (Rare and endangered mammals and birds of Kazakhstan). Alma-Ata. p 153-167. {Russian}

Volkov EN. O zimovochnom areale famingo. [On winter range of the greater flamingo.]. VII ya Vsesoyuz Ornitol Konfer [VIIth All Union Ornithological Conference], Part 2; 1977; Kiev. p 201. {Russian}

Volkov EN. O migratsiyakh flamingo tsentralno kazakhstanskoi populyatsii. [On migrations of the greater flamingo of the Central Kazakhstan population.]. Vtoraya Vses konf po migratsiyam ptits [The 2nd conference on bird migrations], Part 2; 1978.; Alma Ata. p 30-32. {Russian}

Volkov EN. 1984. O nekotorykh osobennostyakh razmnozheniya flamingo v Tsentral'nom Kazakhstane. [On some peculiarities of the greater flamingo breeding in the Central Kazakhstan.]. Izuchenie i okrana zapovednykh ob' yektov [The study and conservation of protected natural objects]. Alma Ata. p 44-45. {Russian}

von Meyer A, Espinosa L. 1998. Situacion del flamenco Chileno (*Phoenicopterus chilensis*) en Chile y sur de la Provincia de Llanquihue. [Status of the Chilean flamingo in Chile and the south of Llanquihue Province.] Boletín Chileno de Ornitología 5:16-20. {Spanish}

Vorob'ev KA. 1978. Zapiski ornitologa. [Notes of an ornithologist.]. Moscow: "Nauka" Publishers. 225 p. {Russian}

Vyawahare PM, Kulkarni AB. 1986. Checklist of birds from Jaikwadi Dam area - Paithan, Aurangabad, Maharashtra. Pavo 24(1-2):9-24.

Walmsley JG. 1994. An assessment of the greater flamingo population in Egypt in winter and spring 1989-1990. In: Meininger PL, Atta GAM, editors. Ornithological Studies in Egyptian Wetlands 1989/90; FORE Report Nr 94-01 WIWO Report Nr 40. p 261-272.

Weiss Y. 1996. Paarl Bird Sanctuary. Bird Numbers 6:28-29. **

Welch GR, Welch HJ. 1992. Djibouti 3. Migrant raptor count. Saxmundham, Suffolk: Minsmere Reserve. 123 p.

Wennrich G. 1983. Chile-Flamingo (*Phoenicopterus chilensis*) in der Bucht von Sejero (Dänemark). [Chilean flamingo in the bay of Sejero (Denmark).] Ornithologische Mitteilungen 35(2):50. {German}

Whitelaw DA, Underhill LG, Cooper J, Clinning CF. 1978. Waders (Charadrii) and other birds on the Namib coast, South West Africa: Counts and conservation priorities. Madoqua 11(2):137-150.

Wickramasinghe RH. 1997. Greater flamingos at Bundala, Sri Lanka. Bulletin of the Oriental Bird Club 26:52-53.

Wiley JW, Wiley BN. 1979. Status of the American flamingo in the Dominican Republic and eastern Haiti. Auk 96(3):615-619. **

Winden Av, Mostert K, Rutiers P, Siki M, Waard Hd. 1989. Waders and waterfowl in spring 1988 at Eber Golu, Turkey. WIWO Report No. 28.

WIWO. 1990. The eastern Mediterranean wader project 1990, preliminary report. WIWO.

Wolff P. 1977. [Early historical flamingo findings at the lake of Rezaijeh in Iranian Azerbaijan.] Annalen des Naturhistorischen Museums in Wien 81:475-478. {German}

Woodworth BL, Farm BP, Mufungo C, Borner M, Ole Kuwai J. 1997. A photographic census of flamingos in the Rift Valley lakes of Tanzania. African Journal of Ecology 35(4):326-334.

Young G, Smith DC, Jenoure D. 2002. A note on the occurrence of a flamingo at the little salt pond, Yallahs, St.Thomas Jamaica. Birdlife Jamaica Broadsheet 79:7. **

Zhatkanbayev AZ-U. Current status of the greater flamingos in Kazakstan. 1998 Meeting of the Flamingo Specialist Group; 1998; North Miami Beach, Florida. p 35-36. ** abstract only

Zimmerli E. 1983. Flamingo auf Fultersuche. [Flamingo on Fultersuche.] Voegel der Heimat 54(2):46. {German}

NATURAL HISTORY AND ECOLOGY

Ade B. 1989. African fish eagle kills greater flamingo. Honeyguide 35(1):19.

Alam M. 1982. The flamingos of Sambhar Lake. Journal of the Bombay Natural History Society 79(1):194-195.

Albrecht S. 1991. News and information: 10,000 birds killed by hailstones. Bulletin of the Ornithological Society of the Middle East 26:36-37. **

Alcocer J, Hammer UT. 1998. Saline lake ecosystems of Mexico. Aquatic Ecosystem Health and Management 1(3-4):291-315.

Andrusenko NN. Letnie nakhodki molodykhg flamingo na ozere Tengiz (Tsentral'nyi Kazakhstan). [The summer finds of young greater flamingo on Tenzig Lake.]. Materialy konf molodykh uchenykh In-ta zoologii AN Kaz SSR [Materials of the conference of young scientists of Inst of Zoology of Ac of Sc of Kaz SSR]; 1978; Alma-Ata. p 15-16. {Russian}

Andrusenko NN. Sroki gnezdovaniya flamingo na oz. Tengiz i ikh zavisimost' ot vremeni vesennego prileta. [The dates of the greater flamingo nesting on Tengiz Lake and their dependence on the time of the spring arrival.]. Tez Dokl "Ekol Gnezdov ptits i metody eyo izucheniya" [Abstracts of "Nesting ecology of birds and methods of its study"]; 1979; Samarkand. p 16-17. {Russian}

Andrusenko NN. 1980. Flamingo. Priroda (Moscow) 1980(12):72-75. {Russian}

Andrusenko NN. 1981. O posledovatel'noj lin'ke pervostepennykh makhovykh u obyknovennogo flamingo. [On consecutive moulting of primaries in greater flamingo.]. Ekologiya i okhrana ptits; Tez dokl Vsesoyuz ornitol konf [Ecology and conservation of birds Abstracts of All Union Orn Conf]. Kishinev: "Shtiintsa" Publishers. p 10. {Russian}

Andrusenko NN. 1986. Osennie migratsii flamingo v SSSR. [Autumn migration of the flamingo in the USSR.] In: Gavrilov EI, Ravkin YS, editors. Migratsii Ptits v Azii [Bird migration in Asia]. Novosibirsk: Nauka. p 150-158. {Russian}

Andrusenko NN. 1998. Nekotorye aspekty sotsialnogo povedeniya obyknovennogo flamingo. [Some aspects of social behavior of the greater flamingo.] Ornitologiya 28:236. {Russian}

Andrusenko NN, Zhuliy VA. O gnezdovanii i linke flamingo na ozere Tengiz v 1976. [On nesting and moulting of the greater flamingo on Tengiz Lake in the year 1976.]. VII-aya vsesoyuz Ornitol Konfer [VIIth All-Union Orn Conf]; 1977; Kiev. p Part 2. pp.189-190. {Russian}

Anonymous. 1982. Flamingos on Isabela. Noticias de Galápagos 35:2.

Anonymous. 1984. Penguins, cormorants, and flamingos in 1984. Noticias de Galápagos 40:2-3.

Anonymous. 1985. European cold spell kills lapwings and flamingos. World Birdwatch 7(1):3.

Anonymous. 1995. Meeting of extremes: life on Namibia's Skeleton Coast (photographs by Jim Brandenburg). Sea Frontiers 41:36-43.

Anonymous. 2001. Flamencos en el rio Llobregat. [Flamingos in the river Llobregat.] Quercus 187:36. {Spanish}

Anonymous. 2001. Flamingojongen in Zwillbrocker Venn. [Young flamingos in Zwillbrocker Venn.] Vogels 6:7. {German}

Anonymous. 2001. Migration mysteries of the lesser flamingo. Wildfowl & Wetlands 137(Autumn):7.

Anonymous. 2003. Following flamingos by satellite. Earthwatch Institute Journal 22(1):5. **

Arengo F, Baldassarre GA. 1995. Effects of food density on the behavior and distribution of nonbreeding American flamingos in Yucatan, Mexico. Condor 97(2):325-334. **

Arengo F, Baldassarre GA. 1998. Potential food availability and flamingo use of commercial salt impoundments in the Ría Lagartos Biosphere Reserve, Mexico. Colonial Waterbirds 21(2):211-221. **

Arengo F, Baldassarre GA. 2002. Patch choice and foraging behavior of nonbreeding American flamingos in Yucatán. Condor 104(2):452-457. **

Asensio B. 1990. Informe sobre la campaña de anillamiento de aves en España. Año 1989. [Report on the banding campaign of birds in Spain. Year 1989.] Ecologia 4:239-295. {Spanish}

Asensio B, Cantos FJ. 1991. Informe sobre la campaña de anillamiento de aves en España. Año 1990. [Report on the banding campaign of birds in Spain. Year 1990.] Ecologia 5: 275-319. {Spanish}

Asensio Nistal B, Barbosa Alcon A. 1989. El marcaje de aves. [Banding of birds.] Quercus 46:22-24. {Spanish} **

Ashtiani Zarandi MA. 1977. Breeding Biology of the Greater Flamingo (*Phoenicopterus ruber roseus*) in Lake Rezaiyeh National Park, Iran. [Masters Thesis]: Michigan State University. 88 p.

Avilova KV. 1983. Pozvonochnye zhyvotnye. Ptitsy. [Vertebrate animals. Birds.]. Moscow: "Prosveshchenie" Publishers. 159 p. {Russian}

Azhimuratov K. 1987. [Notes on the summer stay of the flamingo in the Amu-Darya Delta.]. In: Mitropolskii OV, editor. Mlekopitayushchie i ptitsy Uzbekistana Tezisy dokladov soveshchaniya uzbekskikh otdelenii VTO i VOO, Tashkent-Samarkand, 4-5 fevralya 1985 [Mammals and Birds of Uzbekistan]. Tashkent: FAN. p 48-49. {Russian}

Baldassarre GA, Arengo F. 2000. A review of the ecology and conservation of Caribbean flamingos in Yucatán, Mexico. Waterbirds 23(Special Publication 1):70-79. **

Balfour D. 2001. Flamingos dying at Lake Bogoria. Africa – Birds & Birding (Oct-Nov):16.

Barbraud C, Johnson AR, Bertault G. 2003. Phenotypic correlates of post-fledging dispersal in a population of greater flamingos: the importance of body condition. Journal of Animal Ecology 72(2):246-257. **

Bayly IAE. 1993. The fauna of athalassic saline waters in Australia and the Altiplano of South America: comparisons and historical perspectives. Hydrobiologia 267(1-3):225-231. **

Bayly IAE. 1995. Distinctive aspects of the zooplankton of large lakes in Australasia, Antarctica and South America. Marine & Freshwater Research 46(8):1109-1120.

Behrouzi-Rad B. 1992. On the movements of the greater flamingo, *Phoenicopterus ruber*, in Iran. Zoology in the Middle East 6:21-27.

Berruti A. 1983. The biomass, energy consumption and breeding of waterbirds relative to hydrological conditions of Lake St Lucia (South Africa). Ostrich 54(2):65-82. **

Bertault G, Raymond M, Rousset F, Cézilly F, Johnson AR. 2000. Evidence of seasonal sex ratio manipulation in the greater flamingo. Waterbirds 23(Special Publication 1):20-25. **

Blanco R P, Sanchez O B, del Pozo P. 2002. Recapturas del flamenco rosado (*Phoenicopterus ruber*) en Cuba durante el periodo de 1966 al 2000. [Recaptures of the American flamingo in Cuba from 1966 to 2000.] Pitirre 15(1):31-33. {Spanish}

Britton RH, de Groot ER, Johnson AR. 1986. The daily cycle of feeding activity of the greater flamingo in relation to the dispersion of the prey *Artemia*. Wildfowl 37:151-155.

Brown LH, Britton PL. 1980. The breeding season of East African birds. Nairobi: East African National Historial Society.

Bruderer B, A. B. 2001. Flight characteristics in birds: 1. Radar measurements of speeds. Ibis 143:178-204.

Campredon P. 1987. La reproduction des oiseaux d'eau sur le Park National du Banc d'Arguin (Mauritanie) en 1984-1985. [Reproduction of waterbirds in the National Park of Banc d'Arguin (Mauritania) in 1984-1985.] Alauda 55:187-210. {French}

Casas Grande J, Ramos Losada B. 1991. Bases para la valoración de la posible incidencia del Flamenco Rosa (*Phoenicopterus ruber roseus*) en los ecosistemas del Parque nacional de Doñana. [Bases for the appraisal of the greater flamingo's possible impact in the ecosystems of the national park of Doñana.] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 157-164. {Spanish} **

Cézilly F. 1985. Premier bilan de la vague de froid survenue en janvier 1985 pour quelques espèces d'échassiers hivernant en Camargue. [First evaluation of the intervening cold weather wave in January 1985 for some species of water birds wintering in Camargue.] Faune et Nature ARPON 27:23-24. {French}

Cézilly F. 1997. Demographic studies of wading birds: An overview. Colonial Waterbirds 20(1):121-128. **

Cézilly F, Boy V, Green RE, Hirons GJM, Johnson AR. 1995. Interannual variation in greater flamingo breeding success in relation to water levels. Ecology 76(1):20-26. **

Cézilly F, Boy V, Johnson AR. 1995. Reproductive strategies in an obligate colonial waterbird: results from a long-term study of the Camarque population of Greater Flamingos (*Phoenicopterus ruber roseus*). Avocetta 19(1):34. **

Cézilly F, Boy V, Tourenq CJ, Johnson AR. 1997. Age-assortative pairing in the greater flamingo *Phoenicopterus ruber roseus*. Ibis 139(2):331-336. **

Cézilly F, Johnson AR. 1995. Re-mating between and within breeding seasons in the greater flamingo *Phoenicopterus ruber roseus*. Ibis 137(4):543-546. **

Cézilly F, Tourenq C, Johnson A. 1994. Variation in parental care with offspring age in the greater flamingo. Condor 96(3):809-812. **

Cézilly F, Viallefont A, Boy V, Johnson AR. 1996. Annual variation in survival and breeding probability in greater flamingos. Ecology 77(4):1143-1150.

Chel'tsov Bebutov AM. 1982. Ekologiya ptits. [Bird Ecology.]. Moscow: Moscow University Press. 128 p. {Russian}

Childress B. 2003. First evidence of linkage between African lesser flamingo population groups and the oldest known lesser flamingo. Babbler 43:50.

Childress B. 2004. Unravelling lesser flamingo mysteries. Kenya Birds 11(1):5-6.

Christensen R. 1992. Flamingoernes forekomst i Danmark. [The status of flamingos in Denmark.] Dansk Ornithologisk Forenings Tidsskrift 86(2):123-127. {Danish} **

Conway W. 1991. The secret lives of the volcano Flamingos. Wildlife Conservation 94(6):56-63.

de Boer BA. 1981. De Flamingo - Broedkolonie op Bonaire. [Flamingos - breeding colony on Bonaire.] Panda (Holland) 7/8:109-111. {Dutch}

de Boer BA. 1981. Ecological factors influencing the abundance and distribution of the Bonaire breeding population of flamingos. Unpublished Report.

de Jong F, Zweers GA. 1981. Filter feeding of flamingos (*Phoenicopterus ruber ruber*). Netherlands Journal of Zoology 31(3):612-613.

de los Santos MR. 1983. Sobre la nidificacion del flamenco rosa (*Phoenicopterus ruber roseus* L.) en las Marismas del Guadalquivir en el año 1979. [On the breeding of the greater flamingo in the Guadalquivir Marshes in 1979.] Alytes (Merida) 1:249-253. {Spanish}

de Miranda MA, Locci A, Mocci Demartis A. 1981. Relation entre les paramètres physiques et chimiques des eaux, le benthos et la population de *Phoenicopterus ruber*. [Relationship between the physical and chemical parameters of water, the benthos and the population of *Phoenicopterus ruber*.] Rapports et Procès-verbaux des Réunions Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée Monaco 27(9):79-83. {French}

de Miranda Restivo MA, Demartis AM. 1985. Presenza di popolazioni *di Phonicopterus rub*er ed analisi dei fattori trofici in allume zone umide sarde. [Presence of populations of *Phonicopterus ruber* and analysis of the trophic factors in Sardinian alum damp zones.]

Rendiconti del Seminario della Facoltà di Scienze dell' Universitâ di Cagliari 55(2):117-132. {Italian}

de Silva R, Rhaman DS. 1987. An ecological study of the Karagan Lewaya. Loris 17(6):240-246.

Derlindati E. 1998. Los flamencos de James y andino (*Phoenicoparrus jamesi y P. andinus*): patrones de abundancia y características de sus hábitats en los lagos altoandinos de Jujuy, Argentina.[The James' and Andean flamingos: patterns of abundance and characteristic of their habitats in the high mountain lakes of Jujuy, Argentina.]: Universidad Nacional de Salta. {Spanish}

Dijk KV. 1986. Observations on flamingos. In: Van Dijk AJVD, K.; Dijksen, L. J.; van Spanje, T. M.; Wymenga, E., editor. Wintering Waders and Waterforwl in the Gulf of Gabes, Tunisia, Jan-March 1984. Zeist: W.I.W.O. Report 11.

Espino-Barros R. 1988. Aspects of the Ecology of the Caribbean Flamingo (*Phoenicopterus ruber ruber*) in Yucatan, Mexico. [Master's thesis]. Auburn, Alabama: Auburn University. **

Espino-Barros R, Baldassarre GA. 1989. Activity and habitat-use patterns of breeding Caribbean Flamingos in Yucatan, Mexico. Condor 91(3):585-591. **

Espino-Barros R, Baldassarre GA. 1989. Numbers, migration chronology, and activity patterns of nonbreeding Caribbean flamingos in Yucatan, Mexico. Condor 91(3):592-597. **

Esté E, Casler C, Pardo H. 1988. Algunos aspectos ecológicos y biológicos relacionados con el flamenco (*Phoenicopterus ruber*) de la ciénaga de Los Olivitos. Venezuela. [Some ecological and biological aspects related to the flamingo (*Phoenicopterus ruber*) of the marsh of Los Olivitos, Venezuela.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos:. San Pedro de Atacama, Chile: Corporación Nacional Forestal y Sociedad Zoológica de Nueva York. p 116-121. {Spanish} **

Esté EE. 1988. Inventario y análisis de abundancia de los invertebrados benticos del área ocupada por el flamenco (*Phoenicopterus ruber*) en la Ciénaga de Los Olivitos, Distrito Miranda, Estado Zulia.[Inventory and analysis of abundance of the benthic invertebrates of the area occupied by the flamingo (*Phoenicopterus ruber*) in the Ciénaga de Los Olivitos, Distrito Miranda, Estado Zulia.] [Trabajo Especial de Grado]. Maracaibo, Venezuela: Universidad del Zulia. {Spanish}

Esté EE, Casler CL. 2000. Abundance of benthic macroinvertebrtes in Caribbean flamingo feeding areas at Los Olivitos Wildlife Refuge, western Venezuela. Waterbirds 23(Special Publication 1):87-94. **

Farinha JC. 1990. Anilhagem de juvenis de flamingos *Phoenicopterus ruber* na Lagoa de Fuente de Piedra (Andaluzia, Espanha). [Banding of young flamingos *Phoenicopterus ruber* at Fuente de Piedra Lagoon (Andalusia, Spain).] Airo 2:10. {Portuguese}

Fernández-Palacios JM. 1991. Notas sobre el flamenco en los complejos lagunares gaditanos (Año 1988-1989). [Notes on the flamingo in the Cadiz lagoon complex (1988-1989).] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa

(*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 197-206. {Spanish} **

Flint VYF. 1981. Flamingo. Biologiya v shkole [Biology at School] 3. {Russian}

Foers R. 1981. Greater flamingo in Cyprus-1979-a review of records and migratory trends from 1956-1978. Cyprus Ornitholgical Society Annual Report 27:101-111.

Foers R. 1982. A note on the study of the greater flamingo (*Phoenicopterus ruber*) at Akrotiri Salt Lake. Cyprus Ornithological Society Bird Report 7:51-53.

Franzmann NE. 1985. [Fewer flamingoes in Nissum Fjord.]. Fugle 5(4):7. {Danish}

Galicia E. 1995. Impact of Motorized Tour Boats on the Behavioral Activities of Non-breeding American flamingos (*Phoenicopterus ruber ruber*) in Yucatan, Mexico. [Masters Thesis]: State University of New York. 44 p.

García CM, García-Ruiz R, Rendón M, Niell FX, Juan L. 1997. Hydrological cycle and interannual variability of the aquatic community in a temporary saline lake (Fuente de Piedra, Southern Spain). Hydrobiologia 345(2-3):131-141. **

Gavrilov E. 1986. Individually marked flamingos from Kazakhstan. Ring 128-129:236.

Glassom D, Branch GM. 1997. Impact of predation by greater flamingos *Phoenicopterus ruber* on the macrofauna of two southern African lagoons. Marine Ecology Progress Series 149(1-3):1-12.

Glassom D, Branch GM. 1997. Impact of predation by greater flamingos *Phoenicopterus ruber* on the meiofauna, microflora, and sediment properties of two southern African lagoons. Marine Ecology-Progress Series 150(1-3):1-10.

Gloe P. 1998. Ringförmige Strukturen der Nahrungsaufnahme von Rosaflamingos, *Phoenicopterus ruber*. [Circular feeding traces by greater flamingos.] Ornithologische Mitteilungen 50(11):344-345. {German}

Gould SJ. 1985. Red wings in the sunset. Natural History 94(5):12-24.

Graber JW, Graber RR, Kirk EL. 1978. Illinois birds: Ciconiiformes. Biological Notes Ill Natural History Survey No 109:1-80.

Green RE, Hirons GJM, Johnson AR. 1989. The origin of long-term cohort differences in the distribution of greater flamingos *Phoenicopterus ruber roseus* in winter. Journal of Animal Ecology 58(2):543-555. **

Green RE, Hirons MGJ. 1988. Effects of nest failure and spread of laying on counts of breeding birds. Ornis Scandinavica 19(1):76-78.

Harman D. 2001. Chemical culprit suspected in deaths of Kenya's flamingos. Christian Science Monitor 93(149):8.

Harwin RM. 1994. Movements and staying power of lesser flamingos. Honeyguide 40(1):23.

Hernández MA, García-B. J. 1976. Estudio del flamenco en la peninsula de Yucatán. [Sudy of the flamingos of the Yucatan Peninsula.] Bosques y Fauna 13(2):3-13. {Spanish}

Hernandez-Carrasquilla F, Gomez-Manzaneque A. 2000. Informe sobre campana de anillamiento de aves en espana. Ano 1999. Ecologia 14:291-330. **

Hirons GJM. 1991. The feeding ecology of greater flamingos in the breeding season. In: Junta de Andalucia, editor. Reunión Técnica sobre la situación y problemática del flamenco rosa, *Phoenicopterus ruber roseus*, en el Mediterraneo Occidental y Africano Nor Oriental. p 95-98. **

Hoffmann L, Johnson AR. 1991. Extent and control of flamingo damage to rice crops in the Camargue (Rhone delta, Southern France). In: Junta de Andalucia, editor. Reunion Técnica Sobre la Situacion y Problematica del Flamenco Rosa *(Phoenicopterus ruber roseus*) en el Mediterraneo Occidental y Africa Noroccidental. Seville, Spain: Imprenta Galan. p 119-127. **

Hogan J. 2002. Bug suspect in bird deaths. New Scientist 176(2368):8. **

Hoyle J. 1998. More birds in odd places. Christian Science Monitor 90(42):17.

Hunt M. 2000. Counting flamingos on Great Inagua. New York Times 149(51304):18.

Huntington SJ. 1998. A flamingo flies the coop to fame. Christian Science Monitor 90(28):16.

Hurlbert SH. 1978. The measurement of niche overlap and some relatives. Ecology 59(1):67-77. **

Hurlbert SH. 1982. Limnological studies of flamingo diets and distributions. National Geographic Society Research Report 14:351-356.

Hurlbert SH, Chang CCY. 1983. Ornitholimnology: effects of grazing by the Andean flamingo (*Phoenicoparrus andinus*). Proceedings of the National Academy of Sciences of the USA 80(15):4766-4769. **

Hurlbert SH, Flores EI. 1988. Mortalidad de los flamencos en la Laguna Colorada, Bolivia, 1986-1987. [Flamingo mortality in Laguna Colorada, Bolivia.] In: Parada M, Rottman J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoologica de Nueva York. p 15-26. {Spanish} **

Hurlbert SH, Loayza W, Moreno T. Fish-flamingo interactions in the Peruvian Altiplano. International Congress of Limnology Abstracts; 1983; Lyon (France).

Hurlbert SH, Loayza W, Moreno T. 1985. Fish-flamingo interactions in the Central Andes. Internationale Vereinigung für Theoretische und Angewandte Limnologie Verhandlungen 22(4):2691.

Hurlbert SH, Loayza W, Moreno T. 1986. Fish-flamingo-plankton interactions in the Peruvian Andes. Limnology & Oceanography 31(3):457-468. **

Hurlbert SH, López M, Keith JO. 1984. Wilson's phalarope in the Central Andes and its interaction with the Chilean flamingo. Revista Chilena de Historia Natural 57:47-57.

Ientile R. 2003. Fenelogia del fenicottero *Phoenicopterus ruber* in Sicilia: analisi tratte dalla lettura di anelli colorati. [Phenology of the greater flamingo in Sicily: analysis by discussion of ringing.] Avocetta 27(Proceedings of the XII Italian Ornithological Congress). {Italian}

Jacobi EF. 1991. [Bonaire (1) flamingo island.]. Dieren 7(5):150-153. {Dutch}

Janss GFE, Ferrer M. 1998. Rate of collision with power lines: effects of conductor-marking and state wire-marking. Journal of Field Ornithology 69(1):8-17. **

Johnson AR. 1979. Greater flamingo (*Phoenicopterus ruber roseus*) ringing in the Camargue and an analysis of recoveries. Ring 100:53-58.

Johnson AR. 1983. Etho-écologie du Flamant rose (*Phoenicopterus ruber roseus* Pallas) en Camargue et dans l'ouest paléarctique.[Etho-ecology of the greater flamingo in Camargue and in the western Palearctic.] [doctoral dissertation]. Toulouse, France: Universite Paul Sabatier de Toulouse. {French}

Johnson AR. 1985. The effects of the January 1985 cold spell on flamingos wintering in France. ICBP-IWRB Flamingo Working Group Report 1.

Johnson AR. 1989. Movements of greater flamingos (*Phoenicopterus ruber roseus*) in the western Palearctic. La Terre et la Vie (Revue d'Ecologie) 44(1):75-94.

Johnson AR. 1989. Population studies and conservation of greater flamingos in the Camargue. In: Spaans AL, editor. Wetland en Watervogel. Wageningen, The Netherlands: Pudoc. p 49-63.

Johnson AR. 1991. An overview of the distribution, numbers, and movements of flamingos in the western Mediterranean and North-West Africa. In: Junta de Andalucia, editor. Reunion Tecnica Sobre la Situacion y Problematica del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterraneo Occidental y Africa Noroccidental. p 63-81.

Johnson AR. 1992. What is the potential life-span of a greater flamingo? Flamingo Research Group Newsletter 6:54. **

Johnson AR. 1998. A noteworthy recovery. Flamingo Specialist Group Newsletter 9:12.

Johnson AR. 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(Special Publication 1):2-8. **

Johnson AR, Cezilly F, Boy V. 1993. Plumage development and maturation in the greater flamingo, *Phoenicopterus ruber roseus*. Ardea 81(1):25-34. **

Johnson AR, Green RE, Hirons GJM. 1991. Survival rates of greater flamingos in the west Mediterranean region. In: Perrins CM, Lebreton J-D, Hirons GJM, editors. Bird Population Studies: Relevance to Conservation and Management. Oxford: Oxford University Press. p 249-271.

Kahl MP. 1980. Population ecology of the flamingos of the world. National Geographic Society Research Report 12:407-415.

Kolberg H, Kolberg H. 1978. Beobachtungen an den Swakopmunder Klaerteichen. [Observations at the Swakopmunder Klaerteichen.] Mitteilungen der Ornithologischen Arbeitsgruppe SWA (Sued West Afrika) Wissenschaftlichen Gesellschaft 14(1-2):1. {German}

Kristensen I. Discussion on flamingos. CCA Ecology Conference Bonaire; 1975; Netherlands Antilles National Parks Foundation. p 42-43. **

Kunkel R. 1992. Ngorongoro. London: Harvill. 314 p.

Lebreton J-D, Burnham KP, Clobert J, Anderson DR. 1992. Modeling survival and testing biological hypotheses using marked animals: a unified approach with case studies. Ecological Monographs 62(1):67-118.

Levitina N. 1985. Dialog skvoz' skorlupu. [Dialogue through egg shell.] Priroda i chelovek [Nature and Man] 6:26-29. {Russian}

Lopez M. 1988. Alimentacion de flamencos altiplanos, con enfasis en *Phoenicoparrus andinus* (Phillipi) en Salar de Carcote, Chile. [Feeding of highlands flamingos, with emphasis on *Phoenicoparrus andinus* (Phillipi) in Salar of Carcote, Chile.] In: Parada M, Rottmann J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama. p 84-89. {Spanish} **

MacDonald GH. 1980. The use of *Artemia* cysts as food by the flamingo (*Phoenciopterus ruber roseus*) and the shelduck (*Tadorna tadorna*). In: Persoone G, Soregeloos P, Roels O, Jaspers E, editors. The Brine Shrimp *Artemia* Volume 3 Ecology, culturing, use in aquaculture. Belgium: Universa Press. p 97-104.

Mañez M. 1991. Sobre la reproducción del flamenco (*Phoenicopterus ruber roseus*) en las Marismas del Guadalquivir (SW de España), con especial referencia al año 1988. [On flamingo reproduction (*Phoenicopterus ruber roseus)* in the swamps of Guadalquivir (SW of Spain), with special reference to the year 1988.] In: Junta de Andalucia, editor. Reunión Técnica sobre la situación y problemática del flamenco rosa, *Phoenicopterus ruber roseus*, en el Mediterraneo Occidental y Africano Nor Oriental. p 111-117. {Spanish} **

Marchiono-Ortu A, Mocci Demartis A. 1984. La presenza e la distribuzione di *Ruppia* in Sardegna sono legate a particolari vettori? [Are the presence and the distribution of *Ruppia* in Sardinia tied to particular vectors?] Giornale Botanico Italiano 118(supp. 2):119-120. {Italian}

Marquez F. 1993. El anillamiento de flamencos en Fuente de Piedra. [Banding flamingos in Fuente de Piedra.] Quercus 86:10-11. {Spanish}

Martin M, Ferrer L, Escute X, Garcia M. 2001. Biólogos catalanes estudian por qué se mueron los flamencos enanos. [Catalan biologists study what kills young flamingos.] Quercus 183(May):46-47. {Spanish}

Martinez J. 1982. La spéciation acoustique chez les flamants.[The acoustic speciation in flamingos.] [Diplome d'études approfondies]. Languedoc, France: Academie de Montpellier. {French}

Mascitti V. 1993. Flamencos, los caminos de la convivencia. [Flamingos, the paths of cohabitation.] Ciencia Hoy 4(24):26-33. {Spanish} **

Mascitti V. 1997. Partición del recurso en la comunidad de flamencos de la Laguna de Pozuelos, Jujuy, Argentina.[Resource partitioning in the community of flamingos of Laguna de Pozuelos, Jujuy, Argentina.] [Ph.D. Thesis]. Buenos Aires, Argentina: Universidad de Buenos Aires. {Spanish} **

Mascitti V. 1998. James' flamingo foraging behavior in Argentina. Colonial Waterbirds 21(2):277-280. **

Mascitti V. 2001. Habitat changes in Laguna de Pozuelos, Jujuy, Argentina: Implications for South American flamingo populations. Waterbirds 24(1):16-21. **

Mascitti V, Kravetz FO. 2002. Bill morphology of South American flamingos. Condor 104(1):73-83. **

Mathevon N. 1996. What parameters can be used for individual acoustic recognition by the greater flamingo? Comptes Rendus de L'Academie des Sciences Serie III, Sciences de la Vie 319(1):29-32. {French, English}

Mathevon N. 1997. Individuality of contact calls in the greater flamingo (*Phoenicopterus ruber roseus*) and the problem of background noise in a colony. Ibis 139(3):513-517.

McCulloch G. 2002. Saltwater lake survivors: Flamingoes of the Makgadikgadi. Africa Birds and Birding 7(4):24-30.

McCulloch G, Aebischer A, Irvine K. 2003. Satellite tracking of flamingos in southern Africa: the importance of small wetlands for management and conservation. Oryx 37(4):480-483. **

Mcneil R, Rodriguez SJR, Ouellet H. 1985. Bird mortality at a power transmission line in northeastern Venezuela. Biological Conservation 31(2):153-166.

Merz A. 1980. Marabou stork kills lesser flamingo. EANHS (East African Natural History Society) Bulletin 1980:97-98.

Miranda Restivo MAd, Mocci Demartis A. 1985. Presenza di popolazioni *Phoenicopterus ruber* ed analisi dei fattori trofici in alcune zone umide sarde. [Presence of populations of *Phoenicopterus ruber* and analysis of the factors in some damp zones in Sardinia.] Rendiconti del Seminario Facolta di Science Dell'Universita di Cagliari 55:117-132. {Italian}

Mizutani H, Fukuda M, Kabaya Y. 1992. 13C and 15N enrichment factors of feathers of 11 species of adult birds. Ecology 73(4):1391-1395. **

Mocci Demartis A. 1988. Influence du Cl- sur la niche spatiale du flamant rose *(Phoenicopterus ruber roseu*s, Pall). [Influence of Cl- on the spatial niche of the greater flamingo.] Oxyura 5(1):31-43. {French}

Mocci Demartis A. 1989. Caratteristiche mesologiche dei principali "stagni" sardi visitati da *Phoenicopterus ruber roseus* (Pallas), ed optimum delle condizioni da esso ricercate. [Characteristic ecology of the main Sardinian "ponds" visited by greater flamingos, and optimum conditions of them researched.] Rivista di Idrobiologia 27(1):89-119. {Italian}

Mocci Demartis A. 1989. Considerazioni sulla nicchia ecologica di *Phoenicopterus ruber*. [Considerations on the ecological niche of *Phoenicopterus ruber*.] Gli Uccelli d'Italia 12(1-4):39-45. {Italian}

Mocci Demartis A. 1989. La presenza del fenicottero (*Phoenicopterus ruber roseus*) in acque dolci. [The presence of the greater flamingo in sweet waters.] Ecologia SITE Atti 7:1061-1062. {Italian}

Mocci Demartis A, Carta M, Dessole G, Porra V. 1999. Influenza degli aviogetti sulla tranquillità di una colonia di fenicotteri. [The influence of jet planes on the tranquility of a flamingo colony.] Reniconti del Seminario Della Facolta di Scienze Dell 'Universita di Cagliari 69:113-124. {Italian}

Mondragón SJ. 1979. Los flamencos en Yucatán. [The flamingos in Yucatan.] Bosque y Fauna 2. {Spanish}

Montes C, Bernues M. 1991. Incidencia del flamenco rosa (*Phoenicopterus ruber roseus*) en el funcionamiento de los ecosistemas acuáticos de la Marisma del parque Nacional de Doñana (SW España). [Repercussion of the greater flamingo in the operation of aquatic ecosystems of the swamps of the National Park of Doñana (SW Spain).] In: Junta de Andalucia, editor. Reunión Técnica sobre la situación y problemática del flamenco rosa, *Phoenicopterus ruber roseus*, en el Mediterraneo Occidental y Africano Nor Oriental. p 103-110. {Spanish} **

Moreira F. 1997. The importance of shorebirds to energy fluxes in a food web of a south European estuary. Estuarine, Coastal & Shelf Science 44(1):67-78. **

Moreno Alastrue I, Munoz Rodrigo R. 1998. Observacion de flamenco comun (*Phoenicopterus ruber*) en La Laguna (Sarinena, Huesca). [Observation of the greater flamingo at La Laguna (Sarinena, Huesca).] Lucas Mallada 9:211-212. {Spanish}

Mundy PJ, Chabikwa EC. 1991. Collision of greater flamingoes with overhead powerlines. Honeyguide 37(4):174-176.

Nager RG, Johnson AR, Boy V, Rendón-Martos M, Calderon J, Cézilly F. 1996. Temporal and spatial variation in dispersal in the greater flamingo (*Phoenicopterus ruber roseus*). Oecologia 107(2):204-211. **

O'Connell-Rodwell CE, Rojek N, Rodwell TC, Shannon PW. 2004. Artificially induced group display and nesting behaviour in a reintroduced population of Caribbean Flamingo *Phoenicopterus ruber ruber*. Bird Conservation International 14:55-62. **

Panov EN. 1983. Povedenie zhivotnykh i ekologicheskaja struktura populyatsiy. [Animals behaviour and ethological structure of populations.]. Moscow: "Nauka" Publishers. 423 p. {Russian}

Panzera S, Durante MA. 1993. Eccezionale passo di fenicottero, *Phoenicopterus ruber* L., 1758 nel Salento (Puglia). [Exceptional migration of greater flamingo, in the Salento (Puglia).] Picus 19(2):67-69. {Italian}

Parada M, Santoro A. 1988. Antecedentes Ecologicos de los Flamencos. [Ecological Antecedents of the Flamingos.]. Antofagasta: CONAF/MINSAL. 73 p. {Spanish}

Pascual Trillo JA. 1990. El flamenco (*Phoenicopterus ruber roseus*) en la Peninsula Iberica. [The greater flamingo in the Iberian Peninsula.]. Federacion de Amigos de la Tierra Aves zancudas: anuario ornitologico. Madrid: Miraguano Ediciones. p 89-119. {Spanish}

Pollard CJW. 1989. More on African fish eagle killing flamingos. Honeyguide 35(3):113.

Pradel R, Johnson AR, Viallefont A, Nager RG, Cezilly F. 1997. Local recruitment in the greater flamingo: a new approach using capture-mark-recapture data. Ecology 78(5):1431-1445.

Pringle A. 1992. Observations of waterbirds during a storm. WBC News 158:15.

Prytherch R, Everett M. 1989. News and comments. Spanish flamingos. British Birds 82:92. **

Rattenborg NC, Amlaner CJ, Lima SL. 2000. Behavioral, neurophysiological and evolutionary perspectives on unihemispheric sleep. Neuroscience and Biobehavioral Reviews 24(2000):817-842. **

Rendón M, Ramírez JM, Garrido A, Rendón MA, Vargas JM. 1998. Manual Para el Anillamiento de Flamencos. [Manual for Banding Flamingos.]. Junta de Andalucía. 39 p. {Spanish} **

Rendón M, Vargas JM, Ramirez JM. 1991. Dinámica temporal y reprodución del flamenco común (*Phoenicopterus ruber roseus*) en la laguna de Fuente de Piedra (Sur de España). [Temporal dynamics and reproduction of the greater flamingo in the Laguna de Fuente de Piedra (South of Spain).] In: Junta de Andalucia, editor. Reunión Técnica Sobre la Situación y Problemática del Flamenco Rosa (*Phoenicopterus ruber roseus*) en el Mediterráneo Occidental y Africa Noroccidental. Sevilla: Agencia de Medio Ambiente. p 135-153. {Spanish} **

Rendón MA, Garrido A, Ramirez JM, Rendon-Martos M, Amat JA. 2001. Despotic establishment of breeding colonies of greater flamingos, *Phoenicopterus ruber*, in southern Spain. Behavioral Ecology & Sociobiology 50(1):55-60. **

Rendón-Martos M. 1996. La Laguna de Fuente de Piedra en la dinámica de la población de flamencos (*Phoenicopterus ruber roseus*) del Mediterráneo Occidental.[The Laguna de

Fuente de Piedra in the dynamics of the flamingo population of of the Western Mediterranean.] [dissertation]. Málaga, Spain: Universidad de Málaga. {Spanish}

Rendón-Martos M, Rendón-Martos MA, Garcia CM, Vargas JM, Ramirez JM, Garrido A. The relationship between the phenology of the flamingo and the crustacean community in a seasonal wetland. 1998 Meeting of the Flamingo Specialist Group; 1998 October 1998; North Miami Beach, Florida. p 21-22. ** abstract only

Rendón-Martos M, Vargas JM, Rendón MA, Garrido A, Ramírez JM. 2000. Nocturnal movements of breeding greater flamingos in southern Spain. Waterbirds 23(Special Publication 1):9-19. **

Robert M, McNeil R, Leduc A. 1989. Conditions and significance of night feeding in shorebirds and other waterbirds in a tropical lagoon. Auk 106:94-101. **

Robinson G, Harcourt S. 1982. Reconocimiento biologico de las lagunas de sal en Villamil Isabela (Islas Galapagos). [Biological reconnaissance of the salt lagoons of Villamil Isabela (Galápagos Islands).] Estacion Cientifica Charles Darwin Informe Anual 1981:35-50. {Spanish}

Rooth J. 1976. Ecological aspects of the flamingos on Bonaire. C.C.A. Ecology Conference BONAIRE, September 1975, Netherlands Antilles National Parks Foundation. Stinapa 11:16-33. **

Rooth J. 1982. Ecology and management of the flamingos on Bonaire, Netherlands Antilles. Netherlands Research Institute for Nature Management Annual Report 1981:54-55.

Rooth J. 1985. [The flamingos of Bonaire and Venezuela.]. Ardea 73(2):196-197. {Dutch}

Rowe A. 1993. Hell's nursery. BBC Wildlife 11(1):14-21. **

Ruempler G. 1985. Freilebende Flamingos brüten in der Bundesrepublik. [Free-living flamingos breed in Germany.] Geflügel-Börse 106:14. {German}

Rüppell G, Rüppell G-M. 1980. Überfall eines Fingerotters, *Aonyx capensis*, auf einen Zwergflamingo *Phoeniconaias minor*. [Attack of an African clawless otter on a lesser flamingo.] Der Zoologische Garten, Jena 50(4):274-275. {German}

Salathé T. 1981. Die Gelbfüssige Silbermöwe (*Larus cachinnans*) als Räuber am Rosaflamingo (*Phoenicpterus ruber roseus*) in der Camargue.[The yellow-legged gull hunting on the greater flamingo in the Camargue.]: University of Basle. {German}

Salathé T. 1983. La prédation du Flamant rose *Phoenicopterus ruber roseus* par le goéland leucophée *Larus cachinnans* en Camargue. [Predation of the greater flamingo by the yellow-legged herring gull in the Camargue.] La Terre et la Vie (Revue d'Ecologie) 37(1):87-116. {French}

Sanchez JM, Blasco M, De La Crus C, Da Silva E. 1989. Segregation and synchronicity of aquatic birds in the Fuente Piedra Lagoon, Malaga, Spain during the breeding season. Mediterranea 11:35-46. {Spanish}

Sanchez JM, Vargas JM, Blasco M. 1985. Historia y evolucion de la colonia de flamenco comun, *Phoenicopterus ruber* L., de la laguna de Fuente de Piedra. [History and evolution of the colony of greater flamingo at the lagoon of Fuente de Piedra.] Boletin de la Estacion Central de Ecologia 14(28):9-18. {Spanish}

Sanderson SL, Wassersug R. 1990. Suspension-feeding vertebrates. Scientific American 262(3):96-101.

Schmitz RA, Baldassarre GA. 1992. Contest asymmetry and multiple bird conflicts during foraging among nonbreeding American flamingos in Yucatan, Mexico. Condor 94(1):254-259. **

Schmitz RA, Baldassarre GA. 1992. Correlations of flock size and behavior of foraging American flamingos following Hurricane Gilbert in Yucatan, Mexico. Condor 94(1):260-264. **

Siegel-Causey D, Kharinotov SP. 1991. The evolution of coloniality. In: Power DM, editor. Current Ornithology, Vol 7. New York: Plenum Press. p 285-330.

Simmons RE, Barnard P, Jamieson IG. 1998. What precipitates influxes of wetland birds to ephemeral pans in arid landscapes? Observations from Namibia. Ostrich 70:145-148.

Simmons RE, Borello WD. 1999. Flamingo migration routes - a challenge for Mozambique. Bird Numbers 8(1):13-15. **

Simmons RE, Borello WD. 1999. Flamingo migration routes: A challenge for Mozambique. African Wildlife 53(6):4-6.

Singh DF, Yazdani GM. 1991. Flamingo-fish interaction in the Ujani wetland, Maharashtra. Geobios (Jodhpur) 18(1):38-40.

Soto D. 1988. Biomasa zooplanctonica de lagunas patagonicas y su relacion con la presencia del flamenco chileno. [Relationships between zooplankton biomass and Chilean flamingo population in Patagonian lagoons.] In: Parada M, Rottman J, Guerra C, editors. I Taller Internacional de Especialistas en Flamencos Sudamericanos. San Pedro de Atacama: Corporacion Nacional Forestal y Sociedad Zoologica de Nueva York. p 90-115. {Spanish} **

Sourribes VC. 1993. Etude du phénomène d'incursion des flamants roses dans les rizières de Camargue. [Study of the incursion phenomenon of flamingos in the rice fields of Camargue.]. Arles: Parc Naturel Régional de Camargue/Station Biologique Tour du Valat. 33 p. {French}

Spaans AL. 1976. Two misidentified eggs of the American flamingo from Surinam in the oological collection of the Penard brothers. Ardea 63(3-4):131-135.

Steyn P. 1993. Black-necked grebes and Cape teal feeding commensally with greater flamingoes. Promerops 207:10.

Tatu KS. 1997. Nest building activities of the flamingo (*Phoenciopterus roseus*) at Shahwadi (Ahmedabad). Journal of the Bombay Natural History Society 94(2):397-398.

Tavecchia G, Pradel R, Boy V, Johnson AR, Cézilly F. 2001. Sex- and age-related variation in survival and cost of first reproduction in greater flamingos. Ecology 82(1):165-174. **

Taylor RH. 1981. Stomach contents of a greater flamingo. Lammergeyer 31:45-46.

Thiede W. 1987. Bestimmungsmerkmale adulter Flamingos (Phoenicopteridae). [Identifying characteristics of adult flamingos.] Ornithologische Mitteilungen 39(2):36-38. {German}

Tiana V. 2000. Nidificazione e Inanellamento dei Fenicotteri in Sardegna. [Nesting and Banding of Flamingos in Sardinia.]. Cagliari: Associazione per il Parco Molentargius Saline Poetto. {Italian}

Tindle R. 1977. Studies on the greater flamingo (*Phoenicopterus ruber*) in the Galapagos Islands. Noticias de Galápagos 26:15-17.

Tourenq C. 1992. La formation de crèche chez le flamant rose de Camargue, *Phoenicopterus ruber roseus*.[Formation of nursery in the greater flamingo of Camargue.] [Master of Science thesis]. Toulouse: Université Paul Sabatier. {French}

Tourenq C, Bennetts RE, Kowalski H, Vialet E, Lucchesi J-L, Kayser Y, Isenmann P. 2001. Are rice fields a good alternative to natural marshes for waterbird communities in the Camargue, southern France? Biological Conservation 100(3):335-343.

Tourenq C, Johnson AR, Gallo A. 1993. Le comportement agressif de l'adulte flamant rose, condition préalable à la formation de crèches chez cette espèce? [The aggressive behavior of adult greater flamingos related to the formation of nurseries in this species.]. Actes du 25eme Colloque Annuel de la SFECA. Rennes. p 305-311. {French}

Tourenq C, Johnson AR, Gallo A. 1995. Adult aggressiveness and crèching behavior in the greater flamingo, *Phoenicopterus ruber roseus*. Colonial Waterbirds 18(2):216-221. **

Treep JM. 1995. Sind Flamingos (Phoenicopteridae) in niederländischen Gewässern heimisch geworden? [Did flamingos settle down in the waters of the Netherlands?] Ornithologische Mtiteilungen 47(8):208-214. {German}

Treep JM. 1996. Koude winter deert flamingo's niet. [Cold winter did not harm flamingos.] Het Vogeljaar 44(5):199-201. {Dutch}

Treep JM. 2000. Flamingos presumably escaped from captivity find suitable habitat in western Europe. Waterbirds 23(Special Publication 1):32-37. **

Tuite CH. 1978. The Lesser Flamingo (*Phoeniconaias minior* Geoffroy): Aspects of its Ecology and Behavior in the Eastern Rift Valley of Kenya and Northern Tanzania. [Ph.D. thesis]. United Kingdom: University of Bristol.

Tuite CH. 1980. The use of radio tracking in an ecological study of the lesser flamingo in the Eastern Rift Valley. In: MacDonald A, editor. A handbook of biotelemetry and radio tracking. Oxford: Pergamon Press Ltd. p 729-732.

Tuite CH. 1981. Standing crop densities and distribution of *Spirulina* and benthic diatoms in East African alkaline saline lakes. Freshwater Biology 11:345-360.

Tuite CH. 1984. Avian energetics: some pitfalls. Ibis 126:250-252. **

Tupiza A. 1985. Cambios en la Laguna del Cementerio y en Puerto Villamil, Isla Isabela, causados por el fenomeno 'El Nino' en 1982-1983. [Changes in the Laguna de el Cementerio and in Puerto Villamil, Isla Isabela, caused by the phenomenon ' El Nino' in 1982-1983.] In: Robinson G, del Pino EM, editors. El Nino en las Islas Galapagos: el evento de 1982-1983. Quito: Charles Darwin Foundation for the Galapagos Islands. p 273-278. {Spanish}

van Dijk K. 1986. Observations on flamingoes. WIWO Report 11:80-87.

Vareschi E. 1978. The ecology of Lake Nakuru (Kenya): 1. Abundance and feeding of the lesser flamingo. Oecologia 32(1):11-35.

Vareschi E, Jacobs J. 1984. The ecology of Lake Nakuru (Kenya): 5. Production and consumption of consumer organisms. Oecologia 61(1):83-98.

Vareschi E, Jacobs J. 1985. The ecology of Lake Nakuru, East Africa. 6. Synopsis of production and energy flow. Oecologia 65(3):412-424.

Vareschi E, Vareschi A. 1984. The ecology of Lake Nakuru (Kenya): 4. Biomass and distribution of consumer organisms. Oecologia 61(1):70-82.

Verhoeven JTA. 1980. The ecology of *Ruppia*-dominated communities in western Europe. 3. Aspects of production, consumption, and decomposition. Aquatic Botany 8(3):209-253.

Verhoeven JTA. 1980. Waterplantbegroeiingen in brakke wateren als voedselbron voor watervogels. [Water plant vegetation in brackish waters as a foodsource for waterbirds.] Het Vogeljaar 28:281-286. {Dutch}

Volkov EN. 1979. Migratsii flamingo - *Phoenicopterus roseus* Pall. [Flamingo migration.] In: Kishchinskij AA, editor. Migratsii ptits Vostochnoi Evropy i Severnoi Azii (Migrations of Birds of Eastern Europe and Northern Asia: Ciconiiformes, Anserformes). Moscow: Nauka. p 31-37. {Russian}

Walgenbach H. 1989. Flamingos nisten im Münsterland. [Flamingos nest in the Munster-country.]. Westfälische Nachrichten: Beilage Panorama. {German}

Walmsley JG. 1991. Feeding association of slender-billed gulls with greater flamingos. British Birds 84(11):508.

Ward AM, Hunt A, Maslanka M, Brown C. Nutrient composition of American flamingo crop milk. In: Edwards MS, Lisi KJ, Schlegel ML, Bray RE, editors. AZA Nutrition Advisory Group; 2001; Lake Buena Vista, FL. Zoological Society of San Diego. p 187-193. **

Wiley JP, Jr. 1992. Phenomena, Comment and Notes. Smithsonian 23(2):24-28.

Williams J. 1993. How far do lesser flamingos fly? Honeyguide 39(3):143.

Yosef R. Individual distances in greater flamingos (*Phoenicopterus ruber*) as a function of increasing human disturbance (abstract only). American Ornithologists' Union/Raptor Research Foundation Annual Meeting; 1996.

Yosef R. 1997. Physical distances among individuals in flocks of greater flamingoes (*Phoenicopterus ruber*) are affected by human disturbance. Israel Journal of Zoology 43(1):79-85.

Zackowitz MG. 2003. Hot pink: African flamingos on the move. National Geographic Magazine 204(6):78-97. **

Zweers G, de Jong F, Berkhoudt H, Vanden Berge JC. 1995. Filter feeding in flamingos (*Phoenicopterus ruber*). Condor 97(2):297-324. **

Zweers GA. 1992. Behavioral mechanisms of avian drinking. Netherlands Journal of Zoology 42(1):60-84.

Zweers GA, Berkhoudt H. 1990. Recognition of food in pecking, probing and filter feeding birds. Acta XX Congressus Intertanitalis Ornithologici.

SPECIES ACCOUNTS, GUIDE BOOKS

Ali S, Ripley SD. 1978. Handbook of the Birds of India & Pakistan, Vol. 1, 2nd ed. London: Oxford University Press.

Andrusenko N. 1984. V krayu rozovykh ptits. [Among rose birds.]. Raduga [Rainbow] Issue 2. Alma Ata: "Kainar" Publishers. p 94-103. {Russian}

Anonymous. 1984. Flamingo Facts. Wildfowl World:29.

Anonymous. 1992. Flamingo facts. National Geographic World 204(8):14-15.

Ash JS, Miskell JE. 1998. Birds of Somalia. New Haven, CT: Yale University Press. 304 p.

Bauer KM, Glutz von Blotzheim UN, editors. 1987. Handbuch der Vögel Mitteleuropas, Vol. 1. [Handbook of the Birds of Central Europe, Vol. 1.]. Wiesbaden: AULA-Verlag. {German}

Belton W. 1984. Birds of Rio Grande do Sul, Brazil. Part 1. Rheidae through Furnariidae. Bulletin of the American Museum of Natural History 178(4):369-636.

Belton W. 1994. Aves do Rio Grande do Sul: Distribuição e Biologia. [Birds of Rio Grande do Sul: Distribution and Biology.]. São Leopoldo, RS Brasil: Editora Unisinos. {Portuguese}

Blake ER. 1977. Manual of Neotropical Birds. Volume 1. Chicago: University of Chicago Press.

Britton PL. 1980. Birds of East Africa. Nairobi, Kenya: East African Publishing House.

Brown LH, Urban EK, Newman K. 1982. Phoenicopteriformes. The Birds of Africa, Volume I. New York: Academic Press. p 212-219.

Canevari P, Cabal GB. 1988. El flamenco común. [The common flamingo.] In: Cabal GB, editor. Fauna Argentina Aves Volume 6. Buenos Aires: Centro Editor de América Latina S. A. p 1-32. {Spanish}

Charalambides C, Charalambides M, Neophytou P. 1990. The Birds of Cyprus. C.O.S. Nineteenth Bird Report 1988. 6 p.

Christensen R. 1991. Artsbestemmelse af flamngoer. [Identification of flamingos.] Dansk Ornithologisk Forenings Tidsskrift 85(3-4):97-100. {Danish} **

Cramp S, Simmons KEL, editors. 1977. Handbook of the Birds of Europe, the Middle East and North Africa: The Birds of the Western Palearctic. Volume 1. Oxford, New York: Oxford University Press.

Cramp S, Simmons KEL, editors. 1977. The Birds of the Western Palearctic. Volume 1. Oxford: Oxford University Press.

da Rosa Pinto AA. 1983. Ornitologia de Angola, Volume 1 (non-passeres). [Ornithology of Angola, Volume 1.]. Lisbon: Instituto de Investigação Científica Tropical. {Portuguese}

de la Peña MR. 1986. Guía de Aves Argentinas. Vol. 1. [Guide of Argentinean birds.]. Buenos Aires: Literature of Latin America. {Spanish}

del Hoyo J. 1992. Family Phoenicopteridae (Flamingos). In: del Hoyo J, Elliot A, Sargatal J, editors. Handbook of the Birds of the World, Vol 1. Barcelona: Lynx Edicions. p 508-526. **

Dingle S. 1989. Flamingos. AFA Watchbird 15(6):44.

Fjeldså J, Krabbe N. 1990. Birds of the High Andes. Copenhagen / Denmark: Zoological Museum, University of Copenhagen & Svendborg / Apollo Books.

Flint PR, Stewart PF. 1983. The Birds of Cyprus. B.O.U. Checklist No. 6.

Géroudet P. 1978. Grands échassiers gallinacés râles d'Europe. [Large water birds, gallinacéses, grouse of Europe.]. Paris: Delachaux et Niestlé. {French}

Hines CJH. 1987. The birds of eastern Kavango, SWA/Namibia. Journal SWA (Southwest Africa) Scientific Society 40/41:115-147.

Johnson A. 1992. Les Flamants de Camargue. [The Flamingos of the Camarque.]. Marseille: PNRC, Imp. Du Collège. {French}

Johnson AR. 1994. Flamant rose *Phoenicopterus ruber roseus*. [Greater flamingo, *Phoenicopterus ruber roseus*.] In: Berthelot-Yeatman D, Jarry G, editors. Atlas des Oiseaux Nicheurs de France. Paris: Soc. Orn. de France. p 114-115. {French}

Johnson AR. 1997. *Phoeniconaias minor*, Lesser Flamingo. The Birds of the Western Palearctic Update 1. p 25.

Johnson AR. 1997. *Phoenicopterus ruber*, Greater Flamingo. The Birds of the Western Palearctic Update 1. p 15-23.

Kahl MP. 1979. Phoenicopteriformes. In: Mayr EC, G. William, editor. Check-list of Birds of the World Vol 1 (2nd edition). Cambridge, MA: Museum of Comparative Zoology. p 269-271.

Kear J. 1985. Flamingo. In: Campell BL, Elizabeth, editor. A Dictionary of Birds. Vermillion, SD: Buteo Books. p 217-218.

Kustanovich SD. 1986. Zhar-ptitsa iz Krasnoi Knigi: (Obyknovennyi Flamingo). [The Fire Bird of the Red book (Greater Flamingo).]. Moskva: Nauka. 80 p. {Russian}

Langrand O. 1990. Guide to the Birds of Madagascar. New Haven & London: Yale University Press.

Lebedeva M, Silaeva O. 1984. Proiskhozhdenie nazvaniy ptits. [Origin of bird names.] Ibidem 9:47-48. {Russian}

Lewis AP, D. 1989. A Bird Atlas of Kenya. Rotterdam, Netherlands: A. A. Balkema.

Lippens L, Willie H. 1976. Les Oiseaux du Zaïre. [The Birds of Zaire.]. Editions Lannoo Tie It. {French}

LIPU - Cagliari. 1994. Fenicottero Rosa. [Greater flamingo.] LIPU Ali Notizie 29(September):12. {Italian}

Louette M. 1981. The Birds of Cameroon. An Annotated Check-List. Brussels: Verhandeling Wetenschappen.

Maclean GL. 1985. Roberts' Birds of Southern Africa, 5th ed. Cape Town: Trustees of the John Voelcker Bird Book Fund.

Maclean GL. 1993. Roberts' Birds of Southern Africa, 6th ed. Cape Town: John Voelcker Bird Book Fund.

Marquez F. 1994. Flamencos. [Flamingos.] El Pais Semanal 179:56-63.

Morin R. 1991. Les flamants (genre *Phoenicopterus, Phoenicoparrus et Phoeniconaia*s) flamingo. [Flamingos (genera *Phoenicopterus, Phoenicoparrus and Phoeniconaias*).] Ecozoo 51(4):4-8. {French}

Nores M, Yzurieta D. 1980. Aves de Ambientes Acuáticos de Córdoba y Centro de Argentina. [Birds of Aquatic Environments of Córdoba and Central Argentina.]. Cordoba: Secretariá de Estado de Argricultura y Ganadería de la Provincia de Córdoba. {Spanish}

Ogilvie M. 1997. Shag, greater flamingo, lesser flamingo, whooper swan, pink-footed goose, lesser kestrel. BWP Update to the Handbook of the Birds of Europe, the Middle East and North Africa 1(1):1-62.

Ogilvie M, Ogilvie C. 1986. Flamingos. Gloucester, England: Alan Sutton.

Ono RD. 1984. Living rubies: the flamingos of Bonaire. Sea Frontiers 30(6):324-330.

Peña MRdl. 1992. Guía de Aves Argentinas. Segunda edición (incluye nidos y huevos). [Guide of Argentinean birds. Second edition (including nests and eggs). Volume I.]. Second ed. Buenos Aires: L.O.L.A. (Literature of Latin America). 139 p. {Spanish} **

Rensenbrink HP. 1979. Flamingo's (part 1). Artis 25(3):75-81. {Dutch}

Rensenbrink HP. 1979. Flamingo's (part 2). Artis 25(4):111-119. {Dutch}

Ridgway R. 1986. Birds of the Galapagos Archipelago. Proceedings of the US Natural History Museum 19:459-670.

Roberts TJ. 1991. The Birds of Pakistan, Volume 1. Karachi: Oxford Univ. Press.

Rodriquez de la Fuente F. 1982. Fauna, dieren van de hele wereld in eigen omgeving, deel. [Fauna, animals of the whole world in their habitats, Vol.]. Hasselt: Heideland. 82-97 p. {Dutch (translation of a Spanish book)}

Sedenko M. 2001. American Flamingo. www.whozoo.org/Intro98/marisede/marinased.htm **

Shirihai H. 1996. The Birds of Israel. London: Academic Press.

Sick H. 2001. Ornitologia Brasileira. Edição revista e ampliada por José Fernando Pacheco. [Ornithology in Brazil. Revised and enlarged edition by Joe Fernando Pacheco.]. Rio de Janeiro: Editora Nova Fronteira. 862 p. {Portuguese}

Sick H, do Rosário LA, de Azevedo TR. 1981. Aves do Estado de Santa Catarina. [Birds of the State of Santa Catarina.]. 1-51 p. {Spanish}

Silva F, Caye CE. 1992. Lista de Aves: Rio Grande do Sul. [List of Birds: Rio Grande do Sul.] Porto Alegre: Pontifícia Universidade Católica. {Spanish}

Sprunt A. 1988. The greater flamingo. In: Chandler WJ, editor. Audubon Wildlife Reports 1988/89. San Diego: National Audubon Society, Academic Press. p 552-564. **

Studer-Thiersch A. 1984. Flamingos. In: Grzimek B, editor. Grzimek's Animal Life Encyclopedia, vol 7 Birds 1. New York: Van Nostrand Reinhold Co. p 248-252. **

Vansteenkiste S. 1994. Le flamant du Chili. [The Chilean flamingo.] Anvers Planckendael Zoo 60(2):4. {French} **

Velasquez CR, Hockey PAR. 1995. Crimson-winged dancers of the salt seas: Africa's flamingos. Africa Environment and Wildlife Report No. 3.

Voous KH. 1983. Birds of the Netherlands Antilles, 2d ed. Zutphen: Walburg Pers.

Voous KH. 1988. Moerasvogels van Europa: Grote Flamingo. [Marsh birds of Europe: Greater Flamingos.] Vogels 43:36. {Dutch}

Williams AJ, Velasquez C. 1997. Greater flamingo. In: Harrison JA, Allan DG, Underhill LG, Herremans M, Tree AJ, Parker V, Brown CJ, editors. The Atlas of Southern African Birds, Vol 1. Johannesburg, South Africa: Birdlife South Africa. p 112-113.

Williams AJ, Velasquez C. 1997. Lesser flamingo. In: Harrison JA, Allan DG, Underhill LG, Herremans M, Tree AJ, Parker V, Brown CJ, editors. The Atlas of Southern African Birds, Vol 1. Johannesburg, South Africa: Birdlife South Africa. p 114-115.

TAXONOMY

Alvarenga H. 1990. Flamingos fósseis da Bacia da Bacia de Taubaté, Estado de São Paulo, Brasil: descrição de nova espécie. [A new fossil species of flamingo from Bacia da Bacia de Taubaté, Estado de Sao Paulo, Brazil.] Anais da Academia Brasileira de Ciências 62:335-345. {Portuguese}

Avery G. 1984. Late holocene avian remains from Wortel, Walvis Bay, SWA/Namibia, and some observations on seasonality and Topnaar Hottentot prehistory. Madoqua 14:63-70.

Baird RF, Vickers Rich P. 1998. Palaelodus (Aves: Palaelodidae) from the Middle to Late Cainozoic of Australia. Alcheringa 22(1-2):135-151.

Brooks JE. 1997. Characterization and evolution of a tandemly repetitive DNA component in birds (*Anser anser*, *Phoenicopterus chilensis*, *Vanellus spinosus*, *Molothrus ater*, Psittacidae). [Ph.D. Dissertation]: Florida State University. 270 p.

Cheneval J. 1983. Révision du genre *Palaelodus* Milne-Edwards, 1863 (Aves, Phoenicopteriformes) du gisement Aquitaine de Saint-Gérard-le-Puy (Allier, France). [Revision of the genus *Palaelodus* (Aves: Phoenicopteriformes) from the Aquitanian deposits of St. Gerand le Puy (Allier, France).] Geobios 16(2):179-191. {French}

Cheneval J. 1984. Les oiseaux aquatiques (Gaviiformes à Anseriformes) du gisement aquitainien de Saint-Gerand-le-Puy (Allier, France) : révision systematique. [The aquatic birds (Gaviiformes to Anseriformes) of layer aquitainien of Saint-Gerand-le-Puy (Allier, France): systematic revision.] Paleovertebrata (Montpellier) 14(2):33-115. {French}

Cheneval J. 1989. Fossil bird study, and paleoecological and paleoenvironmental consequences: Example from the Saint-Gérand-le-Puy deposits (lower miocene, Allier, France). Palaeogeography, Palaeoclimatology, Palaeoecology 73(3-4):295-309.

Cheneval J, Escuillie F. 1992. New data concerning *Palaelodus ambiguus* (Aves: Phoenicopteriformes: Palaelodidae): ecological and evolutionary interpretations. Natural History Museum of Los Angeles County Science Series 36:209-224.

Cheneval J, Ginsburg L, Mourer-Chauvire C, Ratanasthien B. 1991. The Miocene avifauna of the Li Mae Long locality, Thailand: systematics and paleoecology. Journal of Southeast Asian Earth Sciences 6(2):117-126.

Cheneval J, Ginsburg L, Mourer-Chauvire C. 1984. Découverte d'une avifaune dans le Miocene du nord de la Thailande. [Discovery of an avifauna in the Miocene in northern Thailand.] Compte Rendu Academy Science Paris t. 299, Série II, N. 19:1369-1372. {French}

Chubb AL. 2004. New nuclear evidence for the oldest divergence among neognath birds: the phylogenetic utility of ZENK (i). Molecular Phylogenetics and Evolution 30(1):140-151.

Cohen AS, Halfpenny J, Lockley M, Michel E. 1993. Modern vertebrate tracks from Lake Manyara, Tanzania and their paleobiological implications. Paleobiology 19(4):433-458. **

Corona-M E. 2003. Aves del cuatemario tardio en Tocuila, Mexico y sus implicaciones paleoambientales. [Birds from the Late Quaternary in Tocuila, Mexico and their paleoenvironmental implications.] Archaeofauna 12:21-27.

Corona-M E, Arroyo Cabrales J. 1997. New record for the flamingo (*Phoenicopterus* cf. *P. ruber* Linnaeus) from Pleistocene-Holocene transition sediments in Mexico. Current Research in the Pleistocene 14:137-138.

Corona-M E, Polaco OJ. 2000. Two new records for Pleistocene birds in central Mexico. Current Research in the Pleistocene 17:118-120.

Cracraft J. 1981. Toward a phylogenetic classification of the recent birds of the world (class aves). Auk 98:681-714. **

de Boer LEM, Van Brink JM. 1982. Cytotaxonomy of the ciconiiformes (Aves), with karyotypes of 8 species new to cytology. Cytogenetics and Cell Genetics 34(1-2):19-34.

Ducey J. 1992. Fossil birds of the Nebraska region. Transactions of the Nebraska Academy of Sciences 19(0):83-96.

Emslie SD. 1992. Two new late Blancan avifaunas from Florida and the extinction of wetland birds in the Plio-Pleistocene. In: Campbell KEJ, editor. Papers in Avian Paleontology No 36: Natural History Museum of Los Angeles County, Sciences Series. p 249-269.

Emslie SD. 1995. An early Irvingtonian avifauna from Leisey Shell Pit, Florida. Bulletin of the Florida Museum of Natural History 37(1-10):299-344.

Ericson PGP. 1999. New material of Juncitarsus (Phoenicopteriformes), with a guide for differentiating that genus from the Presbyornithidae (Anseriformes). Smithsonian Contributions to Paleobiology 89:245-251.

Feduccia A. 1976. Osteological evidence for shorebird affinities of the flamingos. Auk 93(3):587-601. **

Feduccia A. 1977. Hypothetical stages in the evolution of modern ducks and flamingos. Journal of Theoretical Biology 67(4):715-721.

Feduccia A. 1978. *Presbyornis* and the evolution of ducks and flamingos. American Scientist 66(3):289-304.

Feduccia A. 1980. The Age of Birds. Cambridge, MA: Harvard University Press.

Feduccia A. Evolution von Enten und Flamingos. [Evolution of ducks and flamingos.]. Proceedings of the 17th International Ornithological Congress (Acta XVII Congressus Internationalis Ornitholgicus, Berlin, Germany, 1978); 1980. p 1243-1248. {German}

Fjeldså J. 1985. Origin, evolution, and status of the avifauna of Andean Wetlands. In: Buckley PAF, M. S.; Morton, E. S.; Ridgely, R. S.; Buckley, F. G., editor. Neotropical Ornithology. Washington, DC: The American Ornithologists' Union. p 85-112.

Gould SJ. 1985. A clock of evolution. Natural History 94(4).

Haarhoff PJ. 1985. Upper Pleistocene greater flamingo *Phoenicopterus ruber* from South Africa. Ostrich 56(1-3):207-209. **

Hagey LR, Schteingart CD, Ton-Nu H-T, Rossi SS, Odell D, Hofmann AF. 1990. Beta-phocacholic acid in bile; biochemical evidence that the flamingo is related to an ancient goose. Condor 92(3):593-597. **

Harrison CJO. 1980. Fossil birds from Afrotropical Africa in the collection of the British Museum (Natural History). Ostrich 51(2):92-98.

Harrison CJO, Walker CA. 1976. Cranial material of Oligocene and Miocene flamingos: with a description of a new species from Africa. Bulletin of the British Museum of Natural History 27:305-314.

Harrison CJO, Walker CA. 1982. Fossil birds from the Upper Miocene of northern Pakistan. Tertiary Research 4(2):53-69.

Hugueney M, Berthet D, Bodergat AM, Escuillie F, Mourer Chauvire C, Wattinne A. 2003. La limite Oligocene-Miocene en Limagne: Changements fauniques chez les mammiferes, oiseaux et ostracodes des differents niveaux de Billy-Crechy (Allier, France). [The Oligocene-Miocene boundary in Limagne: Faunal changes in the mammals, birds and ostracods from the different levels of Billy-Crechy (Allier, France).] Geobios 36(6):719-731. {French}

Humphrey PS, Pefaur JE, Rasmussen PC. 1993. Avifauna of three Holocene cave deposits in Southern Chile. University of Kansas Museum of Natural History, Occasional Papers 154:1-37.

Jacob J, Hoerschelmann H. 1985. Klassifizierung der Flamingos (Phoenicopteriformes) durch vergleichende Analyse vom Bürzeldrüsensekret. [Classification of flamingos (Phoenicopteriformes) by comparative analysis of their uropygial gland secretions.] Zeitschrift für Zoologische Systematik und Evolutionsforschung 23(1):49-58. {German}

Knox AG, Collinson M, Helbig AJ, Parkin DT, Sangster G. 2002. Taxonomic recommendations for British birds. Ibis 144:707-710. **

Livezey BC. 1997. A phylogenetic analysis of basal Anseriformes, the fossil *Presbyornis*, and the interordinal relationships of waterfowl. Zoological Journal of the Linnean Society 121(4):361-428. **

Madsen CS. 1990. A comparative analysis of a major repeat DNA sequence prevalent among Anatidae (waterfowl). [Ph.D. Dissertation]: Florida State University. 157 p. **

Madsen CS, Brooks JE, De Kloet E, De Kloet SR. 1994. Sequence conservation of an avian centromeric repeated DNA component. Genome 37(3):351-355. **

Madsen CS, Kloet DHd, Brooks JE, Kloet SRd. 1992. Highly repeated DNA sequences in birds: The structure and evolution of an abundant, tandemly repeated 190-bp DNA fragment in parrots. Genomics 14(2):462-469.

Mayr G. 2004. Morphological evidence for sister group relationship between flamingos (Aves: Phoenicopteridae) and grebes (Podicipedidae). Zoological Journal of the Linnean Society 140(2):157–169.

Mayr G, Clarke J. 2003. The deep divergences of neornithine birds: a phylogenetic analysis of morphological characters. Cladistics 19(6):527-553.

McCracken KG, Shelton FH. 1998. Molecular and osteological heron phylogenies: Sources of incongruence. Auk 115(1):127-141. **

Mourer-Chauvire C. 2001. The systematic position of the genus *Basityto* Mlikovsky, 1998 (Aves: Gruiformes: Gruidae). Proceedings of the Biological Society of Washington 114(4):964-971.

Nasif NL. 1988. Primer registro de flamencos (Phoenicopteridae) del Terciario superior, Valle del Cajón (Provincia de Catamarca Argentina). [First record of flamingos from the Upper Tertiary of Valle del Cajón (Provincia de Catamarca, Argentina).] Ameghiniana 25(2):169-173. {Spanish}

Olson SL. 1980. The fossil record of birds. In: Farmer DS, King JB, Parker KC, editors. Avian Biology. New York: Academic Press. p 79-252. **

Olson SL. 1982. A critique of Cracraft's classification of birds. Auk 99:733-739. **

Olson SL, Feduccia A. 1980. Presbyornis and the origin of the Anseriformes (Aves: Charadriomorphae). Washington: Smithsonian Institution Press. 1-24 p.

Olson SL, Feduccia A. 1980. Relationships and evolution of flamingos (Aves: Phoenicopteridae). Washington: Smithsonian Institution Press. 73 p. **

Peklo AM. 1997. Katalog kollektsii Zoologicheskogo Muzeya NNPM NAN Ukrainy. Ptitsy. Vyp. 1: Nevorobinye Non Passeriformes (Pingvinoobraznye Sphenisciformes zhuravleobraznye Gruiformes). [Catalogue of the Zoological Museum, National Natural History Museum, Ukrainian Academy of Sciences. Birds. Vol. 1: Non-Passeriformes (Sphenisciformes - Gruiformes.]. Ukrainy, Kiev: Zoomuzei NNPM NAN. 156 p. {Russian}

Peters DS. 1987. *Juncitarsus merkeli* n. sp. stutzt die Ableitung der Flamingos von Regenpfeifervogeln (Aves:Charadriiformes: Phoenicopteridae). [*Juncitarsus merkeli* n. sp. supports the derivation of the flamingos from shorebirds (Aves:Charadriiformes: Phoenicopteridae).] Courier Forschungsinstitut Senckenberg 97:141-155. {German}

Rich PV. 1985. *Phoeniconotius eyrensis* Miller, 1963, the robust eyrean flamingo. In: Rich PV, van Tets GF, editors. Kadimakara Extinct vertebrates of Australia. Lilydale, Victoria, Australia: Pioneer Design Studio. p 200-204.

Rich PV, Van Tets GF. 1982. Fossil birds of Australia and New Guinea: their biogreographic, phylogenetic, and biostratigraphic input [*sic*]. In: Rich PV, Thompson EM, editors. The Fossil Vertebrate Record of Australasia. Clayton, Australia: Monash University. p 235-384.

Rich PV, van Tets GF, Rich THV, McEvey AR. 1987. The Pliocene and Quaternary flamingos of Australia. Memoirs of the Queensland Museum 25(1):207-226.

Rich PV, Walker CA. 1983. A new genus of Miocene flamingo from East Africa. Ostrich 54(2):95-104. **

Rozsa L. 1991. Points in question: flamingo lice contravene Fahrenholz. International Journal for Parasitology 21(2):151-152.

Sangster G. 1997. Species limits in flamingos, with comments on lack of consensus in taxonomy. Dutch Birding 19(4):193-198.

Sheldon FH, Slikas B. 1997. Advances in ciconiiform systematics 1976-1996. Colonial Waterbirds 20(1):106-114. **

Sibley CG, Ahlquist JE. 1985. The relationships of some groups of African birds, based on comparisons of the genetic material, DNA. In: Schuchmann KL, editor. Proceedings of the International Symposium on African Vertebrates: Systematics, Phylogeny and Evolutionary Ecology. Bonn: Museum Alexander Koenig. p 115-161. **

Sibley CG, Ahlquist JE. 1990. Phylogeny and Classification of Birds. New Haven: Yale University Press.

Sibley CG, Monroe BL. 1990. Distribution and Taxonomy of Birds of the World. New Haven & London: Yale University Press.

Snow DW. 1978. An atlas of speciation in African non-passerine birds. Phoenicopteridae. Publications of the British Museum of Natural History 787:44-45.

Stepanyan LS. 1979. O nomenklature flamingo (*Phoenicopterus*, Phoenicopteridae, Aves). [Nomenclature of the greater flamingo.]. Ashkhabad: Okhrana prirody Turkmenistana [Nature Conservation of Turkmenistan]. 123-126 p. {Russian}

Storer RW. 1982. Fused thoracic vertebrae in birds: their occurrence and possible significance. Journal of the Yamashina Institute for Ornithology 14:86-95.

Svec P. 1981. Lower Miocene birds from Dolnice (Cheb basin, western Bohemia, part II. Cas. Mineral. Geol. 26:45-56.

Ubilla M, Perea D, Tambussi C, Tonni EP. 1990. Primer registro fosil de Phoenicopteridae (Aves: Charadriiformes) para el Urugay (Mio-Plioceno). [First reported fossil of Phoenicopteridae for Uruguay (Mio-Pliocene).] Anais Da Academia Brasileira de Ciencias 62(1):61-68. {Portuguese}

van Tuinen M. 2000. A Molecular Perspective on the Early Evolutionary History of Birds. [Ph.D. Dissertation]: Pennsylvania State University. 189 p. **

van Tuinen M, Butvill DB, Kirsch JAW, Hedges SB. 2001. Convergence and divergence in the evolution of aquatic birds. Proceedings of the Royal Society: Biological Sciences 268(1474):1345-1350. **

van Tuinen M, Sibley CG, Hedges SB. 2000. The early history of modern birds inferred from DNA sequences of nuclear and mitochondrial ribosomal genes. Molecular Biology and Evolution 17(3):451-457. **

Visser HT. 1987. Een Karyologische studie van 5 vogelsoorten uit de orden Ciconiiformes en Phoenicopteriformes, waarvan 4 nieuw beschreven soorten.[A karytology study of 5 bird species of the order Ciconiiformes and Phoenicopteriformes, with 4 new described species.] [Doctoral dissertation]: University of Utrecht. {Dutch}

Zweers GA, Vanden Berge JC. 1997. Evolutionary transitions in the trophic system of the wader-waterfowl complex. Netherlands Journal of Zoology 47(3):255-287.

MISCELLANEOUS

Anonymous. 1978. Ozero "Krylatykh ognei". [The lake of the "winged flames".] Trud [Labour] July 6. {Russian}

Anonymous. 1990. Banding flamingos. Ranger Rick 24(4):32.

Anonymous. 1992. Flamingos flown in. Oryx 26:198.

Anonymous. 1998. Some recent literature on flamingos and their environment. Flamingo Specialist Group Newsletter 8:37-41.

Anonymous. 1998. Some recent literature on flamingos and their environment. Flamingo Specialist Group Newsletter 9:27-30.

Aragoneses J, Martinex F, Ruiz JB. 1993. En las salinas de Santa Pola se producen 6,000 atropellos de vertebrados cada año. [In the salines of Santa Pola 6,000 vertebrates are run over each year.] Quercus 83:20-21. {Spanish}

Baldassarre GA, Arengo F, Galicia E. 1998. The grace of the Mexican Flamingo. Pronatura 4:39-43.

Barrett A. 1994. Quest for a Phoenix. BBC Wildlife 12(3):16.

Barrs J. 1995 July 25. Flamingo fever. The Tampa Tribune;1 & 5.

Bayle P. 1992. EDF neutralise la ligne de Fos-sur-Mer. [EDF neutralizes the line of Fos-sur-Mer.] L'Oiseau Magazine 27:11.

Bildstein KL, Baldassarre GA, Arengo F. 2000. Flamingo science: current status and future needs. Waterbirds 23(Special Publication 1):206-211. **

Bouchardy C. 1987. Flamants: la vie en rose. [Flamingos: life in pink.] Le Chasseur Francais fevriere 1987. {French}

Buissink F. 1994. De roze parade. [The rose parade.] Grasduinen 8(Aug):4-11.

Conway W. 1995. Letter from Kenya. Wildlife Conservation 98:8.

Conway W. 2000. Overview and future directions: the summing-up. Waterbirds 23(Special Publication 1):212-213. **

Dakki M, De Ligny W, editors. 1988. The Knifiss Lagoon and its surrounding environment (Province of La'youne, Morocco). 172 p.

de Boer BA. 1979. The big birds of Bonaire, Flamingos in a changing environment. The Bajan:20-24.

Delannoy P. 1994. Les dandies du ciel. [Dandies of the sky.] Grands Reportages 154(Novembre):14-24. {French} **

Dupuy A, Verschuren J. 1978. Note sur les oiseaux, principalement aquatiques, de la région du Parc National du Delta du Saloum (Sénégal). [Note on birds, mainly aquatic, of the region of the National Park of the Delta of Saloum (Senegal).] Le Gerfaut 68:321-345. {French}

Eckhardt N. 1981. Ein Vogel ohne Feinde. [A bird without enemies.] Stern 28:22-38. {German}

Fitzharris T. 1992. Exposures of the soul. Wildlife Conservation 95(5):68-69.

Fitzharris T. 1999. Rift Valley shuffle (lesser flamingos in Kenya). International Wildlife 29(1):44-49.

Frisoni GF. 1990. Les Espaces Lagunaires du Languedoc-Roussillon: Connaissance et Aménagement. [Littoral Areas of the Languedoc-Roussillon - Knowledge and Installation.]. Montpellier: Institut des Aménagements Régionaux et de L'environnement. 95 p. {French}

Gerritsen A. 1991. Kuikens op de flamingokust. [Chicks on the flamingo shore.] Dieren 8(3):84-86. {Dutch}

Gosner KL. 1987. Salt ponds and flamingos. Underwater Naturalist 16(4):3-7.

Gould SJ. 1985. The Flamingo's Smile. Natural History 94(3):6-19.

Graham F, Jr. 1983. De Fillymingo Mon! Audubon 85(1):50-65.

Gutmann KM. 1989. Aufnahme von Vogeleiprofilen mit Hilfe eines Laserstrahls sowie Berechnung von Volumen und Fläche durch rechnergestützte Datenbearbeitung. [Determination of profiles of bird eggs and calculation of volume and surface area by laser beam and computer support.] Die Vogelwarte 35(2):85-93. {German}

Hellio J-F, Van Ingen N. 1992. Le flamant rose, prince de la Camargue. Patte à patte. [The greater flamingo, prince of the Camargue, foot to foot.]. Toulouse: Editions Milan.

Jacobi EF. 1988. Het drooggevallen Nakuremeer. [The cases of drying out of Lake Nakuru.] Dieren 7:150-152. {Dutch}

Jaramillo AP. 2000. Punta Rasa, South America's first vagrant trap? Cotinga 14:33-38.

Johnson A, Henry P-Y. 1998. Annual report 1995. Flamingo Specialist Group Newsletter 8:3-10.

Johnson AR. 1989. Histoires de flamants roses. [Stories of greater flamingos.] Faune et Nature, Arpon 31:20-23. {French}

Kahl MP. 1984. Images of Africa. International Wildlife 14(1):38-48.

Kasparek M. 1985. Die Sultanssumpfe Naturgeschichte eines Vogelparadieses in Anatolien Heidelberg. [The sultan-swamp nature-history of a bird-paradise in Anatolia Heidelberg.]:153. {German}

Künkel R. 1978. Rosa Pracht im Kratersee. [Pink beauty in the crater-lake.] Das Tier 3:24-26. {German}

Lanting F. 1994. Pink flamingos. Audubon 96:82-83.

Larkins J, Grover. 1993. Flamingo Fever. A boating adventure to see and photograph the only wild flamingos in Florida. WildBird 7(2):36-39.

Lee DS. 1987. Long-legged pink things: what are they? Where do they come from? Chat (Raleigh) 51(2):43-48.

Livermore B. 1994. The colors of Bonaire. Sea Frontiers 40:46-51.

Loohuis J. 1983. Flamingo's. Grasduinen 5:4-9. {Dutch}

Mari C, Collar N. 2000. Pink Africa. London: Harvill. 207 p.

Michael G, Pichner J. 1989. The pink phoenix. Minnesota Zoo Magazine:6-7.

Milner A. 1981. Flamingos, stilts and whales. Nature 289:347.

Muller KA. 1983. The immortal flamingo. Zoo Nooz (San Diego Zoo/Wild Animal Park) 56(5):14-17.

Nebelsiek U. 1980. Alle fischen aus dem Vollen. [All gain from unlimited resources.] Sielmann's Tierwelt 4:48-55. {German}

Osborne TO. 2001. A technique to catch free flying flamingos (or the saga of how I tried). Safring News 30(1):47-50.

Ounsted M. 1987. Flamingos were here first. Wildfowl World 97:9.

Piropato C. 1991. Flamingos: Pretty in pink. Zootails - Fort Wayne Zoological Society:F1-F3.

Porto A. 1992. Passageiros do Sol. [Sun Passengers.] Globo Rural No. 82:46-54. {Portuguese}

Rudavsky S. 1987. In the pink (photograph of lesser flamingos feeding on blue-green algae & greater flamingos on crustaceans). Natural History 96(10):104-105. **

Ruiu D. 1992. Fenicottero: Zingaro rosa. [Flamingo: Pink gypsy.] Oasis 10(Ottobre):34-59. {Italian}

Seaman MT, Ashton PJ, Williams WD. 1991. Inland salt waters of Southern Africa. Hydrobiologia 210(1-2):75-92.

Shannon PW. 1987. Flamingo bibliography. AAZPA Library Special Interest Group.

Sosnovskiy IP. 1981. Zhivye muzei. [Living Museums.]. Moscow: "Znanie" Publishers. 142 p. {Russian}

Tiercelin JJ. 1985. Bogoria quand la terre s'est entrouverte. [Bogoria when the earth half-opened itself.] Univers du Vivant N 2:56-69. {French}

Tomilin AG. 1984. Snova v vodu. [Again in the water.]. Moscow: "Znanie" Publishers. 192 p. {Russian}

Uys CJ. 1987. Border collie herding greater flamingos. Promerops 177:8.

Vladyshevskiy DV. 1982. V mire ptits. [In the world of birds.]. Novosibirsk: "Nauka" Publishers. 157 p. {Russian}

Vrignaud Y. 1994. Chili - sauvetage dans la Cordillère des Andes. [Chili - rescue in the Cordilläre des Andes.] Vivre avec les Oiseaux 6 Sept-Oct:34-37. {French}

Williams T. 1988. Walvis Bay and other coastal gems. African Wildlife 42:82-85.

Wylly M. 1988. Audubon's fabulous flamingo. Florida Naturalist 61(3):2-4.