

Current Threats to the Lake Texcoco Globally Important Bird Area¹

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Abstract

Lake Texcoco was reported as almost dry in the late 1960s, and as a consequence the aquatic life has been considered gone since then. However, the government undertook a reclamation/restoration project in the area beginning in 1971 to help alleviate some of the environmental problems of Mexico City. Although Lake Texcoco was not completely dry in that period, the basin containing the lake had already lost the local forms of the Clapper Rail (*Rallus longirostris*), American Bittern (*Botaurus lentiginosus*) and Black-pollled Yellowthroat (*Geothlypis speciosa*). With the restoration project an artificial lake was created (called Nabor Carrillo) with an area of 1,000 ha. The wetlands in total occupy approximately 8,000 ha in the wet season, and half that in the dry season. Both government agencies and students have studied the avifauna of this area for decades but the results are not available. We compiled data from theses and government agencies to establish the importance of the current avifauna of Lake Texcoco and provide an accurate picture of the effect of restoration to the bird populations. This information is of prime importance to evaluate the consequences of constructing a new airport within the boundaries of this area, both in terms of conservation and in terms of the security concerns for the airport operations. With the data presented, we will show that Lake Texcoco deserves to be considered as a Globally Important Bird Area because it maintains approximately 100,000 birds that occupy this area every year, among them significant populations of Wilson's Phalarope (*Phalaropus tricolor*), Northern Shoveler (*Anas clypeata*), Ruddy Duck (*Oxyura jamaicensis*), Snowy Plover (*Charadrius alexandrinus*), Killdeer (*Charadrius vociferus*), American Avocet (*Recurvirostra americana*), Black-necked Stilt (*Himantopus mexicanus*), and Solitary Sandpiper (*Tringa solitaria*).

Key words: airport, IBA, Lake Texcoco, multi-species conservation, restoration, waterfowl.

Introduction

Lake Texcoco is located in central Mexico, approximately 23 km east of Mexico City, between 19° 25' and 19° 35' North latitude and 98° 55' and 99° 03' West longitude, with an average altitude of 2,200 m. This body of water is a remnant of an ancient lake that covered most of the Valley of Mexico, a large, elevated valley (a closed hydrologic basin) surrounded by high mountains in the Central Mexican Plateau. Because the basin lies on the 19° parallel, it intersects with the Transversal Volcanic Axis, also called the Neo-Volcanic Axis (a line of volcanoes that extends across Mexico in an east-west direction.) The basin has the approximate form of an irregular rectangle inclined in NE-SW direction, with length over 120 km and less than 80 km in average, it has an approximate surface of 7,500 km² (Alvarez 1977).

Lake Texcoco is located in the central flyway for migratory waterfowl. The myriad of small lakes spread through the highlands of central Mexico were and still are important stopover and wintering grounds for several species of waterfowl and wading birds, as well as the breeding ground for several permanent residents. Pollution, desiccation, and urban sprawl are just some of the factors that have caused severe habitat degradation, a process in practically all of the Mexican highland lakes. Unfortunately, there is no assessment of how such habitat degradation has affected avian populations, but there is strong evidence that a serious loss of avian diversity is still under way, at least in Lake Texcoco. Our objectives are to outline the main characteristics and the current condition of Lake Texcoco, as the most important refuge left for migratory and resident waterfowl in the Valley of Mexico, and to point out current threats.

Lake History and Current Situation

During pre-Hispanic times, the Valley of Mexico was a huge marshy zone surrounded by extensive pine and oak forests (Lorenzo and Mirambell 1986). Transformation of the ancient lake started with natural climatic

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changes (Espinosa 1996). On the other hand, human-made changes probably started with the first civilizations in the area, around 100 B. C. In the late 1300s the Aztec empire was the climax of the pre-Hispanic alterations of the lake through the building of a complex system of aqueducts, bridges and dams, and the practice of intensive wetland agriculture. Finally, the basin has suffered its most radical transformation since the sixteenth century, after the fall of the Aztec empire, with the Spanish Colonial period and culminating in modern Mexico, with the construction of complex hydraulic structures (Alvarez 1977). The ultimate goal of those hydraulic constructions was flood control and drying out of the lakes in order to gain land for human habitation.

It has been assessed that the original lake of the Valley of Mexico had an area of approximately 1,575 km² (Alvarez 1977). The limits of Lake Texcoco never have been fixed. With the arrival of the Europeans, the largest lake in the Valley of Mexico at that time (the so called Lake Mexico-Texcoco) was still more than 10 meters deep in some places and had a surface area greater than 700 km². By 1864, only 15 percent (approximately 230 km²) remained of the original surface, and by 1891 only 95 km² (6 percent) remained. Towards the end of the 1950s, the lake could reach a surface area of up to 100 km² when there were abundant rains; but in the dry season it was reduced to a few ponds, although it is said that the lake covered some 270 km² at that time (Rzedowski 1957). Recently, of the former extensive lacustrine zone, there are just three vestiges. In order of importance they are: (1) Lake Texcoco, of very salty and alkaline water, whose size varies largely according to the season and from year to year, (2) Lake Zumpango, with a maximum surface of approximately 15 km² of moderate salinity, and (3) a network of canals of fresh water in Xochimilco, and a smaller one near Mixquic (both neighborhoods of Mexico City), that are kept artificially filled for tourism.

Plan Lake Texcoco

By the end of the 1960s and beginning of the 1970s, Lake Texcoco had practically disappeared. Because of the extreme salinity of the soil, for the most part no terrestrial vegetation grew. Additionally, urban wastewaters were poured into the area. Thus, during the dry season winds carried out dust from the desolate old dried lakebed all over Mexico City; such dust storms caused serious gastrointestinal diseases among the city's population. On the other hand, attempts to control flooding, changes in watershed land uses, and increased water use resulted in drastic changes in the hydrology of the basin. Thus, during the rainy seasons there were no adequate control of local water flows, and floods occurred in the nearby city. As a conse-

quence, in 1971 the Mexican government started a restoration project for the Lake Texcoco zone in order to ameliorate the environmental problems of Mexico City caused by the degraded area (Cruikshank 1994).

Plan Lake Texcoco was a set of programs to diminish the effects of erosion, water pollution, etc. This program represents the first successful environmental restoration model in Mexico and, in the words of its main architect, Gerardo Cruikshank (1994); Lake Texcoco has become again the most important refuge for wintering migratory aquatic birds in the Valley of Mexico.

The total area that currently encompasses the Lake Texcoco restoration plan is 11,600 ha. The project included the hydrologic management of the area and resulted in the building of a complex system that included the creation or restoration of a dozen artificial or semi-natural lakes. The most important of those is Nabor Carrillo, with an area of 1,000 ha and a maximum depth of 3.5 m.

Avian Diversity in the Valley of Mexico Loss and Gain of Diversity

There are numerous historical accounts and archeological evidence of the importance of the birds of Lake Texcoco for the local cultures. In fact, the lake was a representative example of what some authors have called an 'inextricable link' between biological and cultural diversity (Espinosa 1996, Posey 1998). Nevertheless, scientific accounts of the avifauna of the Valley of Mexico did not start until the end of the 19th and beginning of the 20th centuries.

One of the main consequences of the implementation of the lake reclamation project was the remarkable increase of diversity of both resident and migratory bird species. The return of numerous bird species (previously common and widespread on the area) was, of course, the direct consequence of changes in habitat availability; that is, the re-establishment of permanent water bodies, temporary pools, cattail, marshes, and patches of woods.

More than 30 studies have been done on the avifauna of Lake Texcoco, but most are unpublished, mainly as research theses or governmental reports (Villada 1883, Herrera 1888, Villada 1897, Madrigal and Hernández 1968, Halfter and Reyes 1975, Leopold 1977, Babb et al. 1982, Chávez and Huerta 1985, Chávez et al. 1986, Wilson and Ceballos-Lascurain 1993, González 1995, Bojorges 1997, González et al. 2000.) Our review of most of those documents allows us to determine that more than 200 bird species have been recorded for the lake or nearby areas. Of these, two species have been

recorded only as fossils, and are already extinct, and 24 can by now be considered as historical records (i.e., species not seen on the area since 1970). Of all species recorded, 57 percent are aquatic and 43 percent terrestrial, although some of the latter are species associated with wetlands. Of the total, 21 species have been recorded only as accidental or occasional for the area. Currently, 178 species of birds corresponding to 16 orders and 46 families can be found in the Lake Texcoco area (table 1). In a recent study of only Lake Nabor Carrilo, Meza (2000) found fewer species.

Table 1— Number and status of bird species recorded in Lake Texcoco area. Consejo Internacional para la Preservación de las Aves, Sección México's (CIPAMEX) literature review includes records from various wetlands within the Valley of Mexico but outside the Lake. Meza (2000) includes records only from Lake Nabor Carrillo.

Status	CIPAMEX	Meza (2000)
Permanent resident	37	45
Winter resident	64	37
Summer resident	2	2
Transient	19	11
Accidental/escaped	23	2
No data	33	n/a
TOTAL	178	97

Most of the species recorded at Lake Texcoco are rare, and less than 15 percent are either very abundant or abundant (fig. 1). Nevertheless, the desiccation of the lake with its severe habitat reduction and alterations has resulted in a big loss of biological diversity in general and of birds in particular. Almost 20 bird species have been extirpated from the Valley of Mexico before 1970 because of habitat alterations (table 2). In addition, local forms of two species (i.e., Clapper Rail [*Rallus longirostris tenuirostris*] and Black-pollled Yellowthroat [*Geothlypis speciosa*]) and a breeding population of American Bittern (*Botaurus lentiginosus*) had been wiped out from the area as well.

Waterfowl Population Trends

U.S. Fish and Wildlife Service Aerial Surveys

In the 19th century, more than half a million ducks were killed annually by hunters in the Valley of Mexico in the lakes of the area (Herrera 1890). Then, since the first decade of the 20th century, particularly between 1911 and 1945, the attempts to dry out Lake Texcoco increased (Arellano and Rojas 1956, Rzedowski 1957). In the 1950s, nevertheless, several ponds still existed in the Eastern portion of ex-Lake Texcoco, that, in spite of fluctuations in their degrees of dryness through the year, remained sufficiently wet to allow the existence of aquatic vegetation and its associated fauna.

The first significant attempt to study the birds of the lacustrine zones of the Valley of Mexico during the first half of the 20th century was 1948, when the U.S. Fish and Wildlife Service began winter aerial censuses of the aquatic birds of Mexico, including Lake Texcoco (Smith and Jensen 1955, cited in Arellano and Rojas 1956; Smith et al. 1960; Smith et al. 1962; Hanson and Pospichal 1965; Hanson and Smith 1970; Benning and Hanson 1977; Leopold 1977).

Table 2— Bird species extirpated from the Valley of Mexico before 1970.

Common name	Scientific name
Common Loon	<i>Gavia immer</i>
Horned Grebe	<i>Podiceps auritus</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Anhinga	<i>Anhinga anhinga</i>
Roseate Spoonbill	<i>Ajaia ajaja</i>
Wood Stork	<i>Mycteria americana</i>
Greater White-fronted Goose	<i>Anser albifrons</i>
Canada Goose	<i>Branta canadensis</i>
Wood Duck	<i>Aix sponsa</i>
Ring-necked Duck	<i>Aythya collaris</i>
Bufflehead	<i>Bucephala albeola</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Great Black-Hawk	<i>Buteogallus urubitinga</i>
Swainson's Hawk	<i>Buteo swainsoni</i>
Gray-necked Wood-Rail	<i>Aramides cajanea</i>
Sandhill Crane	<i>Grus canadensis</i>
Ringed Kingfisher	<i>Ceryle torquata</i>
Common Raven	<i>Corvus corax</i>

An inspection of the censuses conducted between 1951 and 1965 (fig. 2) indicates an enormous fluctuation in the number of waterfowl from approximately 63,000 individuals in 1955 to only three Northern Shovelers (*Anas clypeata*) in 1963. According to Saunders and Saunders (1981), the average number in the period was around 39,000 waterfowl. According to these authors, that represented 7.3 percent of the total average of waterfowl over all the Mexican Plateau. The maximum number of individuals for a species in a given year was for Green-winged Teal (*A. crecca carolinensis*) with 30,500 individuals in 1955.

Total numbers of waterfowl counted on each winter census were 57,540 individuals in 1952, 62,850 during 1955 (both years with eight species), 57,800 for the 1959 winter, 29,645 in 1960, whereas during the 1962 only three Northern Shoveler were seen, a year that severe drought made the Lake practically disappear. In 1965 the winter census gave a count of only 525 individuals, later reduced to 400 in 1970, the last year in which these censuses took place in Lake Texcoco.

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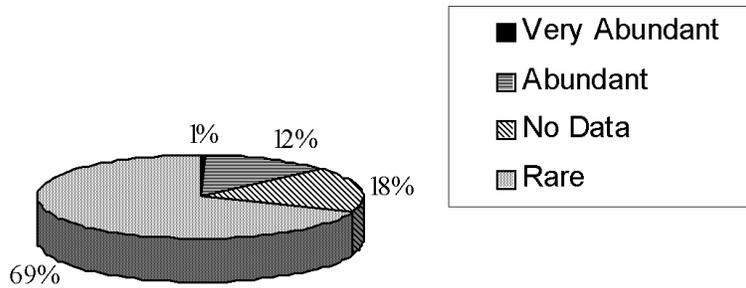


Figure 1— Lake Texcoco bird species by abundance categories. [Note: relative abundances were determined from CNA censuses, abundance categories based on Robbins et al. 1983. A guide to field identification, birds of North America (L. Gonzalez, pers. comm.).]

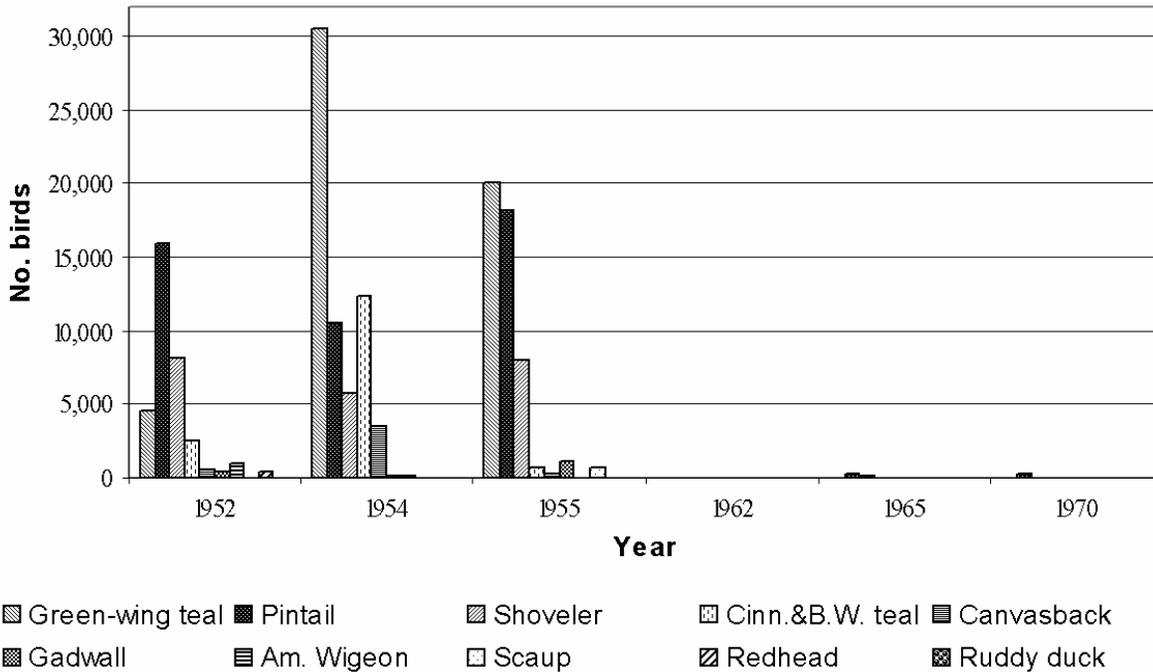


Figure 2— U.S. Fish and Wildlife Service - Lake Texcoco aerial surveys.

National Water Commission aquatic bird surveys

The recovery of the Lake resulted in a mosaic of different environments and the reestablishment of diverse populations of birds, characteristic of the old lacustrine zone of the Basin of Mexico (Cruikshank 1994). The censuses made by personnel of the Lake Texcoco Program (now under the Mexican National Water Commission, CNA by its Spanish acronym) during the last 16 years, document the presence in the zone of more than 150 species of birds. Considered as a whole, the population numbers including all the individuals of all the aquatic species have fluctuated between 100,000 and 150,000, reaching a maximum of 350,000 (fig. 3).

Consequently, the importance of this area for biodiversity in general, and for birds in particular, has been

widely recognized. For example, in 1971 the Mexican Secretary of Environment and Natural Resources (SEMARNAT) has considered Lake Texcoco as a “special region” which led to the implementation of Plan Texcoco. The Mexican ornithological and conservationist organization, Consejo Internacional para la Preservación de las Aves, Sección México (CIPA-MEX), declared the lake in 1996 as an Important Bird Area (IBA) (Arizmendi and Márquez 2000). The World Wildlife Fund has also identified Lake Texcoco as one of the Mexican highland lakes in need of urgent conservation. Finally, the Mexican National Commission for Awareness and Use of Biodiversity (CONABIO) recognizes the designation of Lake Texcoco as an IBA and considers it as part of its program High-priority Hydrologic Region under the category of threatened region (see <http://conabioweb.conabio.gob.mx/aicas/doctos/aicas.html>).

Threats to Lake Texcoco IBA – Alcántara and Escalante

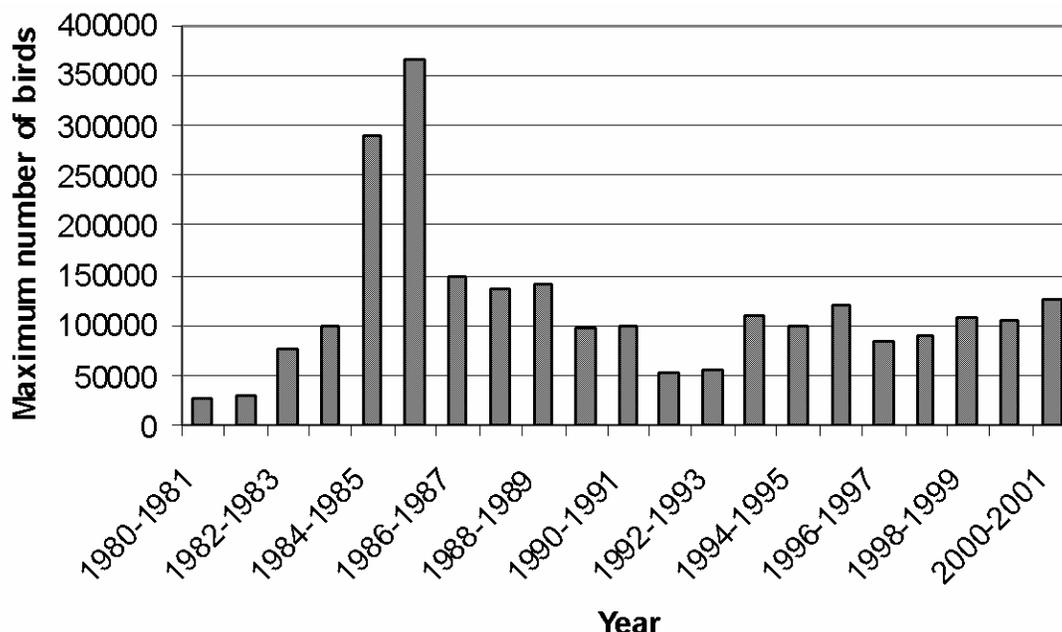


Figure 3— Comisión Nacional del Agua (CNA) aquatic bird censuses.

Table 3— Population numbers that qualify Lake Texcoco as a Continental and Globally Important Bird Area.

Scientific name	Common name	Maximum number of individuals registered in year 2000	1% population in the Americas (D. Wege ¹ and A. Estrada, pers. comm.)	1% population Central flyway (Morrison 2001)
<i>Phalaropus tricolor</i>	Wilson's Phalarope	66,271	15,000	8,271
<i>Anas clypeata</i>	Northern Shoveler	56,300	20,000	
<i>Oxyura jamaicensis</i>	Ruddy Duck	17,796	6,800	
<i>Charadrius alexandrinus</i>	Snowy Plover	122	160	71
<i>Charadrius vociferus</i>	Killdeer	676	10,000	394
<i>Recurvirostra americana</i>	American Avocet	4,479	4,500	3,253
<i>Himantopus mexicanus</i>	Black-necked Stilt	1,673	1,500	1,200
<i>Tringa solitaria</i>	Solitary Sandpiper	235	250	56

¹Numbers from Wege for shorebirds were also taken from Morrison (2001); those for waterfowl from Rose and Scott (1997).

More recently, the compilation of unpublished census bird data led to the realization that there are population levels of several bird species that qualify Lake Texcoco as a Continental and Globally Important Bird Area (table 3). Lake Texcoco deserves to be preserved as a wildlife refuge because it maintains regularly approximately 100,000 aquatic birds, among them significant proportions of Wilson's Phalarope (*Phalaropus tricolor*), Northern Shoveler, Ruddy Duck (*Oxyura jamaicensis*), Snowy Plover (*Charadrius alexandrinus*), Killdeer (*Charadrius vociferus*), American Avocet (*Recurvirostra americana*), Black-necked Stilt (*Himantopus mexicanus*), and Solitary Sandpiper (*Tringa solitaria*).

Current Threats

Being part of a city that has the largest urban population in the world living in a closed hydrologic basin, Lake Texcoco and its avifauna are in constant threat. The most important of those are:

- Feral dogs: a number of feral dogs proliferate in the area. There is no control or study of the impact of these animals on the avifauna. Most likely dogs have an effect on breeding birds.
- Pollution: Lake Texcoco still receives urban sewage and although most of the artificial lakes are filled with treated water (i.e., primary and secondary-treatment water), some

areas still have untreated water with unknown impact on the health of birds that feed in them.

- Hunting: although hunting is not allowed in the Valley of Mexico, poaching is still a common practice in the most remote areas of the lake, where there is little control. Trapping of live birds also seems to be a regular practice. The magnitude and effect of these activities on the conservation of waterfowl are unknown.
- Urban sprawl: there are constant attempts to establish irregular slums. The area encompassing the Lake Texcoco project is surrounded by inner city neighborhoods and ghettos and some semi-rural small towns (in total about 50 townships).
- A Sanitary Garbage Burial Field was established within Lake Texcoco that receives 11,000 tons of garbage from the metropolitan area and a proposal to extend it has been launched recently.
- International Airport: Mexican authorities announced that the Texcoco lakebed would be the site for construction of a new airport for Mexico City.

A New Airport, the Greatest Threat

In October 2001, Mexican authorities announced that Mexico city's new international airport would be build on the dry lakebed of Lake Texcoco, at a distance of 16 km (straight line) and 18 km by terrestrial routes from the present airport. This new terminal would meet the needs of a growing air traffic, which is expected to increase from 21 million passengers in 2000 to 29 million annually by 2005. The \$2.5 billion dollar project is expected to be completed in about six or seven years.

Proponents of establishing the new airport in Lake Texcoco argue that the effect on bird populations would be small because:

- The area represents a degraded ecosystem.
- The area has no status as a Natural Protected Area.
- It is not recognized as a Ramsar international important wetland.
- It is proposed that the project increase the protected area for waterfowl by 3,500 ha (including the construction of two new artificial lakes).

- There are no endemic species that will be affected, only eight are threatened, six under special protection, and just one is considered rare (and not found in their census).
- They allege that Lake Texcoco harbors only 11 percent of the total number of birds that arrive to the Valley of Mexico.

Conservation, the Best Option

Data gathered through more than 30 years by biologists and ornithologists working in Lake Texcoco are of prime importance to evaluate the consequences of constructing a new airport within the boundaries of this area, both in terms of conservation and in terms of the security concerns for the airport operations.

Such information suggests that the construction of the airport in the lake would be adverse because:

- A restored ecosystem has conservation value both for humans and wildlife, and Lake Texcoco is a clear example.
- The current national network of natural protected areas (Sistema Nacional de Áreas Naturales Protegidas) does not meet even at minimum the conservation needs of Mexican biodiversity.
- In fact, the lake meets Ramsar standards, as their norms are that any area that contains at least 1 percent, or 20,000 individuals, of a species' regional population could be considered an international important wetland (Owen and Black 1990), Lake Texcoco meets such criteria for several bird species.
- The conservation value of an area goes beyond the number of endemics or single-species considerations.
- Monitoring of the area for more than 15 years has given figures of 100,000-150,000 aquatic birds wintering each year in Lake Texcoco, far more than the 11 percent of the birds wintering in the Valley of Mexico (the latter is based on 10 one- or two-day census carried out in five years). In addition, there are no population data for more than 60 bird species.
- The claim of a 3,500 ha increase in the restored area of Lake Texcoco is flawed because there is no land available in the region for such a purpose. Lately, governmental con-

fiscation of agricultural land has produced local social unrest.

- Three parallel runways will be built in the middle of the shorebirds' breeding area, which will have a detrimental effect on resident populations. So far, there has not been any mention of any mitigation or translocation programs.
- Aircraft safety will likely be jeopardized because of the large numbers of waterfowl; a vast literature supports the principle that "birds and aircraft do not get along."

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Threats to Lake Texcoco IBA – Alcántara and Escalante

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