HPAI H5N1 Surveillance in Migratory Birds in Egypt
Avian Influenza in Migratory Birds

Ministry of Environment of Egypt
Naval Medical Research Unit 3
Avian Influenza in Migratory Birds

- Avian influenza, which is caused by Influenza A viruses, can affect a variety of domestic and wild bird species.

- Avian influenza viruses are ubiquitous and are maintained in nature by aquatic birds, mainly of the orders Anseriformes and Charadriiformes.
In the 20th century there were three pandemics: 1918 (H1N1), 1957 (H2N2) and 1968 (H3N2). Avian viruses were involved in each antigenic shift.
Avian Influenza in Migratory Birds

Since its appearance in 1996 in a domestic goose in Guangdong Province, People's Republic of China, avian influenza in humans caused by the highly pathogenic avian influenza (HPAI) subtype H5N1 has repeatedly been portrayed as one of the most prominent emerging disease threat faced by humanity.
Avian Influenza in Egypt

- **Poultry**
  - 17 Feb 2006
  - Egypt reports its first H5N1 in domestic poultry since 1965.

- **Humans**
  - 20 Mar 2006
  - Egypt confirms its first human case in a 30-year-old woman from Qalubiya (onset early March 2006).

Avian Influenza in Egypt

- Egypt remains the most affected country outside Asia. Among the 379 cases reported globally to WHO by the end of March 2008, Egypt represented 12.7% of the global number of cases, following Indonesia (35%) and Vietnam (28%).

- The exposure to sick/dead poultry from backyard flocks has been determined for almost all the cases confirmed in Egypt (45/47).
It has been suggested that migratory birds have played a role in HPAI H5N1 rapid dispersal across continents.
Migratory birds surveillance
AI Surveillance in Migratory Birds in Egypt

Objective

To detect the presence of HPAI H5N1 in migratory birds in Egypt.

Collaborative effort between the Ministry of Environment of Egypt and NAMRU-3
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Collection sites:
- Port Said
- Damietta
- El Fayoum
- Al Arish
- Sharm El Sheik
- Rasheed
- Ash Sharqiyah
- Rashid
- Aswan
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Geographical location of the HPAI H5N1 human cases

Geographical locations of the collection sites
Bird Trapping

Mist nets
Hunter-killed Birds

Sharkeya, Egypt
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Samples collected: cloacal swabs
Samples collected: oropharyngeal swabs
AI Surveillance in Migratory Birds

- AI Viral RNA detection
- Influenza A virus matrix gene is detected by real-time RT-PCR
- Positive samples are screened for H5 gene.
- H5 positive samples are further tested for the N1 gene.
Migratory Birds of Egypt: Species Most Frequently Sampled

- Coot
- Mallard
- Pintail
- Shoveler
- Teal
<table>
<thead>
<tr>
<th>Black and white storks</th>
<th>Egyptian goose</th>
<th>Mallard</th>
<th>Purple gallinule</th>
<th>Teal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black winged stilt</td>
<td>Falconiformes</td>
<td>Coot</td>
<td>Quail</td>
<td>Tern</td>
</tr>
<tr>
<td>Cattle egret</td>
<td>Gray heron</td>
<td>Pochard</td>
<td>Sandpiper</td>
<td>Waders</td>
</tr>
<tr>
<td>Cormorant</td>
<td>Great and little egrets</td>
<td>Pintail</td>
<td>Stint</td>
<td>Wagtail</td>
</tr>
<tr>
<td>Common moorhen</td>
<td>Gulls</td>
<td>Snipe</td>
<td>Shoveler</td>
<td>White pelican</td>
</tr>
<tr>
<td>Common pigeon</td>
<td>Heron</td>
<td>Plover</td>
<td>Not determined</td>
<td>Spoonbill</td>
</tr>
</tbody>
</table>
Species Sampled: Percentage of the Total (2003-2008)

Species

- Common teal
- Shoveler
- Pintail
- Quail
- Coot
- Mallard
- Wigeon
- Egrets
- Cormorant
- Others

% of the Total

- Common teal: 35%
- Shoveler: 25%
- Pintail: 15%
- Quail: 5%
- Coot: 5%
- Mallard: 10%
- Wigeon: 5%
- Egrets: 10%
- Cormorant: 15%
- Others: 25%
## AI Surveillance in Migratory Birds: Results

<table>
<thead>
<tr>
<th>Season (Sep-Apr)</th>
<th>Samples Collected</th>
<th>Positives</th>
<th>Percentage of Positives</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2004</td>
<td>2047</td>
<td>110</td>
<td>5.4 %</td>
</tr>
<tr>
<td>2004-2005</td>
<td>844</td>
<td>103</td>
<td>12.2 %</td>
</tr>
<tr>
<td>2005-2006</td>
<td>1454</td>
<td>205</td>
<td>14 %</td>
</tr>
<tr>
<td>2006-2007</td>
<td>2071</td>
<td>155</td>
<td>7.5 %</td>
</tr>
<tr>
<td>2007-2008</td>
<td>1262</td>
<td>158</td>
<td>12.5 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7678</strong></td>
<td><strong>731</strong></td>
<td><strong>9.5 %</strong></td>
</tr>
</tbody>
</table>
Samples Collected per Month per Season

<table>
<thead>
<tr>
<th>Months</th>
<th># of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep</td>
<td>2003-2004: 0</td>
</tr>
<tr>
<td>Oct</td>
<td>2004-2005: 0</td>
</tr>
<tr>
<td>Nov</td>
<td>2005-2006: 0</td>
</tr>
<tr>
<td>Dec</td>
<td>2006-2007: 0</td>
</tr>
<tr>
<td>Jan</td>
<td>2007-2008: 0</td>
</tr>
</tbody>
</table>

- **2003-2004**: Yellow
- **2004-2005**: Red
- **2005-2006**: Green
- **2006-2007**: Blue
- **2007-2008**: Pink
Percentage of Positives per Specie per Season

Season

% of Positives

Common Teal
Shoveler
Pintail
AI Surveillance in Migratory Birds: Results

- Wigeons: 11.5% positives (22 samples)
- Mallard: 6% positives (204 samples)
- Coot: 5% positives (389 samples)
- Quail: 5.4% positives (407 samples)
Others species found positive

- Blue throat
- Wheat eater
- Egrets
- Common tern
- Rock doves

- 1 Reed warbler
- Tufted ducks
- Egyptian geese
- Pied avocet
- Bar-tailed godwit
AI Surveillance in Migratory Birds: Results

- Four Spotted eagles and four falcons were negative for Influenza A.
Percentage of Positive Samples by Month and Season

First H5N1 case in poultry

First H5N1 human case
AI Surveillance in Migratory Birds: Results

AI in Damietta:
H5 in common teal

- October 2005:
  - H5 (LPAI)
- December 2005:
  - H5N1 (HPAI)
The H5N1 isolated from teal was closely related to H5N1 viruses isolated from humans and poultry circulating in Egypt.
Detection of HPAI H5N1 in a Common Teal just before poultry outbreaks and human cases in Egypt in December 2005 suggested the involvement of migratory birds as possible vectors for virus introduction in Egypt.

However as this bird was trapped and caged by a fisherman, the possibility that it could have been exposed to infected domestic poultry could not be rule out with certainty.
Percentage of Positive Samples by Month and Season

- **First H5N1 case in poultry**
- **First H5N1 human case**
AI Surveillance in Migratory Birds: Results

- Fecal samples from egrets roosting beside the Cairo Zoo (Greater Cairo Region) were collected in February 2006.
- HPAI H5N1 was identified in these samples.
AI Surveillance in Migratory Birds

Geographical location of the HPAI H5N1 human cases

Geographical locations of the collection sites
These results showed that HPAI H5N1 was present in Egypt before the first reports of this virus in poultry and humans.

After the identification of HPAI H5N1 in egrets in 2006 this virus was also detected in one crow (CLEB/NAMRU-3) in 2007.

The presence of HPAI H5N1 was not detected in migratory birds since February 2006 by this surveillance project.
Other mechanisms, most probably movement of poultry and poultry products related to human activities are implicated in virus maintenance and distribution in the country.
These findings highlight the need to optimize:

- The efficiency of HPAI active surveillance, improving the knowledge regarding the temporal and spatial characteristics of the flyways of each species in specific areas,
- To identify the mating and resting sites for each one of them.
- To determine the most appropriate time of the year and site for sample collection.
There is an urgent need for multidisciplinary studies to explore the ecology of avian influenza viruses in wild birds and the environment to support ecological interpretation of the source of disease outbreaks in poultry.
Common Pintail (*Anas acuta*)
Avian Influenza

- **Low Pathogenic Avian Influenza Viruses (LPAI):**
  - May not cause any illness in wild birds
  - Associated with mild illness in domestic poultry
  - Can evolve into highly pathogenic viruses
  - Associated with poultry outbreaks worldwide
  - Subtypes: H9

- **High Pathogenic Avian Influenza Viruses (HPAI):**
  - May not cause any illness in wild birds
  - High mortality in domestic poultry
  - High risk of disease in people
  - Subtypes: H5, H7