Several factors may play a role in the transmission of the Avian Influenza such as poor level of biosecurity in poultry production system, exchange of poultry and poultry products, trades through live birds market, presence of water (in ponds or lakes) which allows virus persistence outside the host, and a large range of wild birds which can carry low or highly pathogenic avian influenza (HPAI) virus strains.

Considering the risk of introduction and dissemination of the disease in this context, an integrated approach is proposed, combining knowledge about the migratory wild birds distribution in space and in time, the interfaces between wild and domestic avifauna, the persistence of the virus outside its hosts and the market routes for av-risk products. Such model could assess the risk of introduction and dissemination of the HPAI virus in a country or area free of disease and could identify the high risk areas where surveillance and control measures should be strengthened.

Because of the importance of the poultry sector (56 millions of poultry), the low level of biosecurity (mainly free-range chicken) and the relatively high number of migratory water birds wintering in the Rift Valley Lakes, Ethiopia is considered at risk of introduction and spreading for HPAI.

After several discussions with experts, a workshop on HPAI and a previous prevalence study done on wild birds in February 2006, two lakes in the Rift Valley (Ziway and Awassa) were selected to be the starting point of our risk assessment study. The research question is: what is the risk of introduction of H5N1 in the poultry population around a selected area in the Rift Valley in Ethiopia during the migratory season?

Our approach (Fig 1) is in line with the general scheme of the risk assessment process which can be split in our study in these three different steps: (i) risk release through the migratory birds and the legal or illegal poultry products marketing chains (ii) risk exposure by means of studying interfaces among imported and exposed poultry and among wild and domestic birds; (iii) risk consequences for establishing the probability of AI spreading within the poultry population and the probability of it escaping detection.

The risk of the Avian Influenza introduction will be dependent on spatial factors. Release and exposure pathways (Fig 2 and Fig 3) via trading and migratory birds were evaluated using data collected from several sources:

- Expert opinion (epidemiologists and ornithologists, Ethiopian wildlife specialists) and published literature
- Workshop and preliminary field study in Ethiopia (2005-2006)

The first step was to assess the wild birds pathway using quantitative methods and spatial tools. To determine the input parameters we used, in addition to expert opinion, data from the African Waterfowl Census (2002/2003 – 2004/2005 thanks to M. Wondafrash, EWNHS), and scientific publications (e.g. Establishment of multiple sublineages of H5N1 influenza virus in Asia: Implications for pandemic control (H. Chen et al., 2005)).

**Release and exposure assessment pathway via trade routes**

**Graph 1:** Conceptual framework for AI Risk Assessment

- **Release and exposure assessment** for introduction of HPAI via trade routes
- **Risk Management - Risk communication**
  - Multi-agent modelling
  - Surveillance system
  - Decision trees / QRA

**Release and exposure assessment pathway via migratory birds**

**Graph 2:** Risk of HPAI introduction via waterfowl

**Graph 3:** Risk of HPAI introduction via trade routes

**Results**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value Distribution</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of migratory bird species</td>
<td>16</td>
<td>Available from the literature</td>
</tr>
<tr>
<td>Number of migratory birds (WM)</td>
<td>Triangular (20, 50, 100)</td>
<td>African Waterfowl Census, EWNHS</td>
</tr>
<tr>
<td>Number of migratory Anatidae</td>
<td>Uniform (75, 105)</td>
<td>Veterinary Office annual Report</td>
</tr>
<tr>
<td>Proportion of H5N1 carrier (p)</td>
<td>0.05</td>
<td>Estimated from previous studies</td>
</tr>
</tbody>
</table>

**Conclusion**

- We focused on the potential exposure between wild and domestic birds in a buffer zone of 5 km around each lake.
- We assumed that the resident Anatidae and other waterbirds (Herons, Storks, Ibises) are susceptible and could excrete the virus and/or could be passive carriers acting as fomites.
- We assumed that the exposure probabilities between migratory Anatidae, resident Anatidae, other waterbirds and domestic chickens are proportional to the density of birds.
- We assumed that the spatial distributions of wild and domestic birds inside the buffer zones are homogeneous.