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The decline of an urban Hooded Vulture *Necrosyrtes monachus* population in Dakar, Senegal, over 50 years§

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As in many West African cities, in Dakar Hooded Vultures *Necrosyrtes monachus* have always been characteristic urban scavengers. The recent decline of Hooded Vultures in other parts of Africa, mainly eastern Africa, has been the reason in 2015 for up-listing of its status by the IUCN in the Red List of Threatened Species to Critically Endangered. As the Hooded Vulture is still common in the Lower Casamance, Senegal, in the Western Region of The Gambia and in Guinea-Bissau, without clear signs of a recent decrease, a survey of its current status in Dakar was undertaken and compared with historical data over the past 50 years. A strong decrease of >85% was noted from 3 000 individuals in 1969 to 400 in 2016. This decline is on the high end of the decline noticed over much of its range but in striking contrast with the apparently stable populations along the West African coast more to the south (The Gambia to Guinea). Likely causes are (1) exponential urbanisation resulting in loss of feeding sites and reduced food availability, (2) increased poisoning of feral dogs with strychnine sulphate due to an upsurge of rabies and (3) increased disappearance of suitable trees for nesting and roosting.

Déclin d’une population urbaine des Vautours charognards *Necrosyrtes monachus* sur 50 ans à Dakar, Sénégal

A Dakar, comme dans de nombreux centres urbains de l’Afrique de l’Ouest, les Vautours Charognards *Necrosyrtes monachus* ont toujours été des charognards caractéristiques de ces villes. Le récent déclin des Vautours Charognards dans d’autres parties de l’Afrique, principalement en Afrique de l’Est, a motivé, en 2015, son inscription sur la Liste rouge de l’UICN comme espèce menacée «En danger critique d’extinctions». Cependant le Vautour Charognard est encore commun en Basse Casamance (Sénégal), dans la partie occidentale de la Gambie et en Guinée-Bissau sans indicateurs d’un déclin de sa population. Ainsi une enquête sur son statut actuel à Dakar a été menée afin d’effectuer une comparaison avec les données disponibles des 50 dernières années. Une forte baisse (>85%) a été notée de 3 000 individus en 1969 à 400 en 2016. Ce déclin correspond aux chutes des populations ailleurs en Afrique mais contraste avec les populations apparemment stables de la Gambie à la Guinée. Les causes probables de déclin sont (1) une urbanisation galopante entraînant une perte de sites d’alimentation et une réduction de la disponibilité de nourriture, (2) une intoxication accrue de chiens sauvages avec du sulfate de strychnine due à une recrudescence de la rage et (3) une disparition accrue des arbres appropriés pour la nidification et le repos.

Keywords: cutting of trees, Hooded Vulture, *Necrosyrtes monachus*, poisoning, population estimate, slaughterhouse sanitation, urban development

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Introduction

Large declines in Hooded Vulture *Necrosyrtes monachus* across its African range were reported by Ogada and Bulj (2011) and Ogada et al. (2016) and the species was up-listed to the status of Critically Endangered (CR) in 2015 on the IUCN Red List of Threatened Species (BirdLife International 2016). Only recently did it become clear that

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in a restricted area in West Africa Hooded Vultures are still occurring in high densities and their populations might have suffered less than those from other areas within their range. This is the case in the Western Region of The Gambia (Jallow et al. 2016) where 3 416 individuals were counted on road transects; the Ziguinchor Department of southwestern Senegal where 2 350–2 700 pairs were estimated by Bruno Bargain (in BirdLife International 2016) and particularly in Guinea-Bissau where the total population was estimated to be 76 000 individuals based on transect counts (Henriques 2016) of which >7 000 occurred in the town of Bissau. In West Africa Hooded Vultures are mainly found close to human habitations where they exploit slaughterhouses, market places and rubbish dumps (Mundy et al. 1992; Ogada and Buij 2011). They breed and feed here in the same areas close to humans, which is not necessarily the case in East Africa (Odino et al. 2014) or, more generally, south of the Equator where they reportedly avoid close contact with humans (Mundy et al. 1992).

In the mid-1990s, Jean-Marc Thiollay (pers. obs.) already noticed spectacular and hitherto unexplained declines, if not complete extinctions, in several West African towns compared with the late 1960s. This was the case, among others, in Niamey (Niger), Bouaké (Ivory Coast) and Bobo-Dioulasso (Burkina Faso). Meanwhile, numbers in Ouagadougou (Burkina Faso) have also sharply decreased (BO Diallo 2010; Weesie in Ogada and Buij 2011).

Apart from the above-mentioned situation in the Depart-ment of Ziguinchor (Casamance), the Hooded Vulture situation in other parts of Senegal has received little attention. During a four-day trip in the western part of Senegal covering some 2 700 km in October 2016, a total of 581 Hooded Vultures were observed on road transects (data courtesy ARDB) or 21.5 individuals per 100 km, which is low compared with 252 individuals per 100 km in Guinea-Bissau (Henriques et al. 2017) and 1 750 individuals per 100 km in The Gambia (Jallow et al. 2016). Jean Delannoy (pers. comm.) estimated that in the town of Tambacounda in eastern Senegal during the rainy season some 100–200 Hooded Vultures are present. The current paper documents the known, albeit scattered, information on the urban Hooded Vulture population in Dakar, Senegal, since 1969.

Materials and methods

A first estimate of the number of Hooded Vultures was made on 14 January 1969, 28 July and 22 August 1971 by J-M Thiollay. Numbers roosting in trees, mostly within and near the main Muslim cemetery at Soumbedioune along the Corniche West as well as along the main avenues in Dakar, were estimated but not counted. The whole urban area was not covered at that time.

In 1997–1998 a quantitative study of urban scavengers in Dakar was conducted by Couzi (1998) with Hooded

![Figure 1: Morning (a) and afternoon (b) densities (individuals km$^{-2}$) of Hooded Vultures on counting units in 1997 in neighbourhoods of the Dakar peninsula, Senegal. The counting units with a + sign were not visited in 2016.](image)
Vultures, Cattle Egrets *Bubulcus ibis*, Yellow-billed Kites *Milvus parasitus* and Pied Crows *Corvus albus* being the targeted species. The study area was divided into 40 neighbourhoods, subdivided into 219 counting units, one to six per neighbourhood (Figure 1). In each unit, both during the wet season (June–September 1997) and the dry season (October 1997–March 1998), two counts were made. These counts were on a single day: 07:30–10:30 and 16:30–19:30, and all Hooded Vultures present were counted (perched, feeding and flying), detected by eye during 20 min.

During 2016, on 15–19 June (end of the dry season), 15–30 August (early rainy season) and 16–24 September (end of the rainy season), we counted Hooded Vultures sitting in, or flying near, roosts. Only total numbers were counted without making a distinction between age classes. Hooded Vultures were counted during both morning (*N* = 20) and evening visits (*N* = 19) in the three periods (Table 1). Roosts had been selected based on previous knowledge or were discovered during reconnaissance searches. The area of Dakar that was searched for roosts was similar to the area that had been covered by Couzi (1998), with the exception of the units indicated by the symbol ‘+’ in Figure 1a, which were not visited. Ngor Diarama and Yoff Tonghor roosts (Figure 2) were only counted from sunrise until 3 h thereafter. Counts on all other roosts were either in the morning or started generally 1.5–2 h before sunset and continued until 15–30 min thereafter. During evening counts, birds already present were counted and those arriving were added. On morning counts, birds leaving were counted and the individuals remaining in the roost at the end of the count were added. All counts were made by two observers with the exception of Cité SAR, Almadies-Yoff and Tonghor, which were counted by a single observer. For each roost the activity of the Hooded Vultures (perched, flying and feeding) and the type of perch (tree and species, and man-made structures such as antennas, buildings and street lights) were recorded. After the three counts had been completed, a new important roost was discovered on 28 November 2016. It was situated at the main slaughterhouse and was invisible from public roads.

The methodology for assessing numbers of Hooded Vultures present in Dakar, which was applied in each of the three distinct time periods, is different. We consider the 1969–1971 and 2016 methodology as being the most similar, allowing for a direct comparison of total numbers.

### Results

#### 1969–1971
The total estimate for the roosting sites visited in 1969 and 1971 was 3 000 birds. The numbers should be considered as a minimum and they did not seem to have markedly changed between the two years and seasons.

### Table 1: Number of daily counting periods of Hooded Vultures on roosts in Dakar during 2017 during the dry (June) and rainy (August and September) seasons. A few incidental observations were used to supplement roost counts. RC = roost count, IO = incidental observation

<table>
<thead>
<tr>
<th>Month</th>
<th>Type</th>
<th>Morning</th>
<th>Evening</th>
<th>Total</th>
</tr>
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<td>RC</td>
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<td>8</td>
<td>9</td>
</tr>
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<td>IO</td>
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<td>1</td>
</tr>
<tr>
<td>August</td>
<td>RC</td>
<td>6</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>IO</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>September</td>
<td>RC</td>
<td>6</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>IO</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>19</td>
<td>37</td>
</tr>
</tbody>
</table>

#### Figure 2: Distribution and number of Hooded Vulture roosting sites in 2016. The pie charts show activities and characteristics of perches. The size of the pies is proportional to the number of vultures counted (Table 3; also for roost codes). The later discovered roost at the slaughter house is not indicated on this map, but see text
Table 2: Counts of Hooded Vultures (number of individuals) in Dakar neighbourhoods in 1997–1998 during the rainy and dry seasons (summarised from Couzi 1998). Numbers of birds given are for all activities combined, i.e. flying, roosting and feeding. The surface areas of individual neighbourhoods are also given.

<table>
<thead>
<tr>
<th>No.</th>
<th>Neighbourhood</th>
<th>Counting units</th>
<th>Surface (ha)</th>
<th>Rainy season</th>
<th>Dry season</th>
<th>No.</th>
<th>Neighbourhood</th>
<th>Counting units</th>
<th>Surface (ha)</th>
<th>Rainy season</th>
<th>Dry season</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Anse Bernard</td>
<td>1–6</td>
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<td>8</td>
<td>1</td>
<td>21</td>
<td>Les Almadies</td>
<td>101–106</td>
<td>16.49</td>
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<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Anse des Madeleines</td>
<td>7–12</td>
<td>4.12</td>
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<td>1</td>
<td>22</td>
<td>Complex King Fahd</td>
<td>107–111</td>
<td>5.89</td>
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<tr>
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<td>Plateau</td>
<td>13–16</td>
<td>30.63</td>
<td>2</td>
<td>4</td>
<td>23</td>
<td>Ngor village</td>
<td>112–117</td>
<td>4.71</td>
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<td>1</td>
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<tr>
<td>4</td>
<td>Centre Ville</td>
<td>17–22</td>
<td>13.55</td>
<td>5</td>
<td>0</td>
<td>24</td>
<td>Warar</td>
<td>118–123</td>
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<tr>
<td>5</td>
<td>Grande Mosquée</td>
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<td>4</td>
<td>5</td>
<td>25</td>
<td>Yoff village</td>
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<td>43</td>
<td>56</td>
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<td>26</td>
<td>Ndoup zone agricole</td>
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<tr>
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<td>19.44</td>
<td>3</td>
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<td>27</td>
<td>Bel-Air Hann Plage</td>
<td>136–141</td>
<td>31.81</td>
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<tr>
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<td>Cimetière Soumbédious</td>
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<td>0</td>
<td>28</td>
<td>Hann Pêcheurs</td>
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<td>84.23</td>
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<tr>
<td>9</td>
<td>Université UCAD</td>
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<td>37.77</td>
<td>45</td>
<td>0</td>
<td>29</td>
<td>Park Hann</td>
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<td>14.14</td>
<td>40</td>
<td>71</td>
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<tr>
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<td>Fann-Résidence</td>
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<td>31.81</td>
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<td>0</td>
<td>30</td>
<td>Collège Mariste</td>
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<td>9.42</td>
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<tr>
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<td>48–53</td>
<td>38.29</td>
<td>2</td>
<td>0</td>
<td>31</td>
<td>CTO</td>
<td>159–164</td>
<td>25.92</td>
<td>37</td>
<td>16</td>
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<tr>
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<td>0</td>
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<td>29.27</td>
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<td>83.64</td>
<td>7</td>
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<td>33</td>
<td>Niayes Patte d’oe</td>
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<tr>
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<td>Point E</td>
<td>65–69</td>
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<td>0</td>
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<tr>
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<tr>
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<td>0</td>
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<td>Dagoudane Pikine</td>
<td>213–219</td>
<td>34.16</td>
<td>14</td>
<td>4</td>
</tr>
</tbody>
</table>

Total 1 592.71 408 196

1997–1998

Total numbers counted were respectively 196 in the dry season and 408 in the rainy season (Table 2). The total maximum estimate for the whole period was 500 birds, which was in the rainy season.

The spatial distribution of the birds is given in Figure 1.

2016

During the 2016 roost counts there was also a marked difference between late dry season (234 individuals) and early rainy season (335 individuals) (Table 3; raw data in Appendix S1). The visit to the slaughterhouse on 28 November 2016 recorded c. 50 birds, feeding on remains of carcasses and intestines. According to employees of the slaughterhouse, all slept in Casuarina equisetifolia trees elsewhere on the site and were also present during our previous counts (ML Ndiaye pers. comm.). Birds roosting in June in the periphery of the harbour were associated with nests. A total of nine vultures was associated with five (empty) nests (nos 7–10 in Figure 2). During the later counts, birds were not seen again near these nests but aggregated in one or more groups. In August, the two birds seen at Technopole (no. 25) were also seen near a nest. On this nest a chick had been raised during the preceding dry season and it was again occupied in April–May 2017. Total numbers seen in any of the three months likely were incomplete for the following reasons: (1) more birds may have roosted near other nests, which were not systematically searched for; (2) other roosts may have been present but were not found; and (3) more vultures were present on roosts but were not seen because they were hidden in dense foliage. Therefore, we estimate the early rainy season population of Hooded Vultures in Dakar to be at least 400 individuals.

Birds used various structures to roost (Table 3, Figure 2). Trees were widely used (84%, N = 282) and only at smaller roosts did birds use man-made structures (5%, N = 16). It cannot be excluded that in a few cases the latter were only pre-roosts. The remainder of the birds were either flying (7%, N = 22) or feeding (4%, N = 15). Of the trees, casuarinas (Casuarina equisetifolia) were the most used (66%, N = 186), followed by coconut palms (Cocos nucifera; 28%, N = 79) whereas only in the Parc de Hann, a zoo and botanical garden/recreational park, were other trees, such as baobab Adansonia digitata and eucalypts Eucalyptus spp., used to roost (6%, N = 17).

With the exception of Technopole, all roosts were in a narrow coastal band within 600 m from the seashore (Figure 2). Arrival and departure times on roosts depended on the weather, with birds leaving later in the morning when it was overcast. Most birds entered the roost within 1 h before dusk, but here also it varied with some birds already present at least 2 h before dusk (University Cheikh Anta Diop; UCAD) or staying all day and feeding or roosting on site (zoo). Donkeys were slaughtered three times a week in the zoo. Birds that had been feeding on their remains tended to stay until very late in their roost the next day. Within each counting period, the weather was fairly stable and typical for the season (Supplementary Appendix S2).

Discussion

Population trends and seasonality

Based on roost counts in Dakar, numbers have dropped from approximately 3 000 in 1969–1971 to 400 in 2016. In 1997 total numbers were estimated to be at least 500, but as the methodology applied was not similar, a
direct comparison is not appropriate and it is likely that true numbers were much higher. Nevertheless, the total decrease over almost half a century is >85% and this decline did not start recently, as is the case in many sites throughout the African continent (Ogada et al. 2016).

During the 1997 study, numbers counted during the rainy season were higher than during the dry season. This was also the case in 2016, but with only three surveys done it cannot be reliably assessed if the higher numbers are caused by seasonal migration or the simple result of redistribution of birds that were missed during the dry-season count, which corresponds to the breeding season of the species. Higher numbers during the rainy season were also mentioned to us from Tambacounda (J Delannoy, pers. comm.), but in The Gambia analysis of data collected from satellite-tagged individuals did not reveal such seasonal differences in occurrence (K Bildstein, pers. comm.). The possibility of seasonal migration of the Hooded Vulture on the south–north axis of Senegambia–Mauritania was previously discussed by Thiollay (1977), without mentioning the Dakar area specifically.

**General factors contributing to population decline**

The rapid decrease of Hooded Vulture populations in West Africa is attributed to a number of factors. Off-take of Hooded Vultures per annum for fetish and bush meat in West Africa was estimated by Buij et al. (2016) to be 975–1 462 individuals. The authors further state (p. 606) that this ‘represents a sizeable proportion of regional populations, suggesting that trade is likely to be contributing significantly to declines’. Similar findings came from South Africa where McKeen et al. (2013) collected evidence to suggest that traditional use was at least partly responsible for the rapid decline of vulture populations in that country.

Another factor that is frequently mentioned as contributing to the rapid decline, particularly in East Africa, is the intentional use of carbamate pesticides to poison carcasses of livestock by herders to kill predators and carcasses of elephants by poachers, most notably Furadan (carbofuran) (Otiemo et al. 2010; Roxburgh and McDougall 2012; Ogada et al. 2012, 2015; BirdLife International 2016). The latter type of poisoning is used intentionally to kill vultures as a means to avoid attracting attention to carcasses left behind by the poachers. Poisoning is widespread throughout Africa. In the pastoral areas of northern Senegal and southern Mauritania vultures have severely declined in recent decades (WCM pers. obs.). This was mainly due to the systematic use of strychnine to kill predators of livestock (Toure 1990). A recent case of poisoning of a cow carcass was discovered in early December 2015 by Jean Delannoy (pers. comm.) in the Reseau Naturelle Communautaire du Boudou, near Goudiry, eastern Senegal. Of a total of 35 dead birds discovered, 27 were Hooded Vultures. Although material for residue analysis was lost, the rapid death makes it likely the poison used was a carbamate.

The veterinary use of non-steroidal anti-inflammatory drugs, most notably Diclofenac, which was responsible for the massive declines of vultures in Asia (e.g. Green et al. 2004), is probably not yet a major concern in Africa, but...
this threat still lacks detailed studies (Anderson et al. 2005; Woodford et al. 2008).

Improvements in abattoir hygiene and rubbish disposal have also been attributed to the continent-wide declines of Hooded Vultures (Ogada and Buij 2011). Extinctions recorded in large towns in West Africa also appear to have followed the construction of large, modern and well-closed slaughterhouses leaving fewer left-overs for vultures.

**Causes of decline in Dakar**

**Increase in built-up areas and reduction of open space/cutting of trees**

Dakar is built on a peninsula and therefore can only increase either in density and/or height of buildings or by encroachment of the landside (eastern part) of the peninsula. Indeed, these factors act simultaneously and very rapidly. In 1970 Dakar had less than 700 000 inhabitants (ANSD 2009) and thus it was much smaller and less dense than in 2013 when the population had increased to 3.1 million inhabitants (ANSD 2016).

The exponential increase of built-up areas in Dakar and its surroundings will continue. The urbanisation of the Senegalese population is expected to be 56% in 2021 and the major part of this urban population will be concentrated in the greater Dakar area (Diou 2007).

The rapid increase in built-up areas and reduction of open space in Dakar goes hand-in-hand with an unprecedented cutting of large and suitable trees (Sudonline 2010; Sané 2014), which are used by Hooded Vultures both for roosting and breeding. Hooded Vultures in Dakar have a preference for casuarinas and to a lesser extent coconut palm trees for roosting. Other trees are rarely used, which is likely due to their scarcity. Only in the Hann botanical garden and at the zoo do Hooded Vultures also roost in other trees. In particular, the casuarinas along roads are under strong pressure and they have largely disappeared from some avenues, such as around the harbour and the Bay of Hann, and this may be an additional factor in the reduction of Hooded Vulture numbers. The cutting of trees that are used either for nesting or roosting has been mentioned by various authors in other regions on the continent as a likely cause of Hooded Vulture decline (Ssemmanda and Pomeroy 2010; Roberts 2013). Interestingly, B. Bargain (in BirdLife International 2016) also mentions a decline in the number of the Hooded Vultures’ favourite nesting tree species (Ceiba pentandra) in Casamance as a potential threat. Large-scale cutting of mature trees in towns is likely to have a larger impact where trees are already scarce, such as in Dakar.

A recent study confirms that the environment of the greater Dakar area is rapidly deteriorating with a decrease in green areas, farmlands and wetlands and an increase in air, water and soil pollution (JICA 2016). One could argue that the Hooded Vultures that were driven out of the areas that became less attractive, settled in the new neighbourhoods to the east. However, large numbers of Hooded Vultures were not recorded in visits to these areas. These newly developed neighbourhoods, often constructed without any urban planning (JICA 2016), typically lack mature trees, as existent trees are often cut to make space for construction. Therefore, these are very different from the old neighbourhoods of Dakar bordering the coast where the Hooded Vultures are currently concentrated and which still have many suitable trees. In fact, a road count from Dakar to Thies in 1969 produced 2 400 individuals (JMT pers. obs.). This was repeated on 22 October 2016 when only six individuals were observed. It appears, therefore, that the decrease of Hooded Vultures in these suburbs was even more dramatic than in the city of Dakar, making a simple shift of Hooded Vultures to the eastern suburbs unlikely.

When comparing the distribution of roosting/feeding in 1997 (Figure 1) with the roosting in 2016 (Figure 2) we see similarities and differences. In 1997, Hooded Vultures were still present in good numbers in the neighbourhoods of Yoff, Camerene, Hann, Mbaao and Pikine (corresponding with units 30–40 in Table 1). Meanwhile, these areas have been built up. The similarity is along the coasts where Hooded Vultures were concentrated in both periods. This is probably because these are the oldest built-up areas and therefore still have more and taller trees. A comparison between morning and afternoon distribution (Figure 1) suggests that birds stay in the same neighbourhood for feeding and roosting. Also in 2016, birds did not seem to undertake long-distance flights to and from roosts: within a radius of 2–3 km from the UCAD roost, there were always dozens of Hooded Vultures during the day. Without telemetry or marking birds, this can for the moment not be elucidated with certainty.

**Poisoning and direct persecution**

Poisoning of Hooded Vultures in Dakar may largely go unnoticed. An upsurge of rabies since 2009 in Senegal led to the establishment of a programme to reduce the feral dog population by the use of meat soaked in a strychnine sulphate solution. Poisoned bait is placed where stray dogs concentrate, such as land-fill sites, beaches, cemeteries, barracks, hospitals, markets and slaughter-houses (PMD Diallo 2010). Between 2011 and 2016, 21 329 stray dogs were eliminated nationwide (Anon. 2016), raising serious questions about the potential impact on vultures. Strychnine is known to be very highly toxic (oral LD$_{50}$ < 5 mg kg$^{-1}$) on an acute basis to a number of bird species, such as chicken Gallus gallus domesticus, Mallard Anas platyrhynchos, Feral Pigeon Columba livia, House Sparrow Passer domesticus and Common Starling Sturnus vulgaris (McLeod and Saunders 2013 and references therein). Incidentally, Hooded Vultures have been found poisoned at the Dakar University campus roost after stray dogs had been poisoned. Two such cases were reported in August 2016 by a local employee at the campus, and these may represent the tip of the iceberg rather than just being occasional incidents. According to Odino et al. (2014), little information on the scale of stray dog poisoning in Africa is available and the impact on vultures is likely underestimated. Vulture declines in Asia have been found to lead to a dramatic increase in feral dogs and a subsequent increase in rabies (Markandya et al. 2008; Ogada et al. 2012). If the upsurge of rabies in Senegal is linked to vulture decline remains an unanswered question.

Direct persecution of Hooded Vultures appears to be uncommon. In 2016 we were informed by the owner of a large hotel complex that he blamed the Hooded Vultures to have caused the death of some of the coconut palms in...
which they slept. He therefore deliberately destroyed an occupied nest elsewhere on the complex. Such cases are probably rare.

**Availability of food**

Although the rubbish disposal system of Dakar has improved over the years, the rapid population growth and problems with disposal in some neighbourhoods during the rainy season, or even complete absence of such services in others, provides potentially enough food for the remaining Hooded Vulture population. Nevertheless, Hooded Vultures in Dakar do not seem to exploit these resources if they are too close to houses. This is rather surprising, as e.g. in Bissau (Guinea-Bissau) and Conakry (Guinea) Hooded Vultures are freely mixing with humans around small rubbish heaps on street corners and beaches or waiting at local street restaurants to get their share from chicken bones and similar remains (Henriques 2016; BP pers. obs. 2016). They do, however, avoid the central land-fill site of Bissau because this is frequently being burnt (M Henriques, pers. comm.). In Ziguinchor, Casamance, Hooded Vultures also mainly frequent discharges of rubbish situated in the town’s periphery (B. Bargain, pers. comm.).

Beaches in Dakar are now extensively being used for recreational purposes and Hooded Vultures are rarely encountered. During 11 special missions along the beach from Dakar to Saint-Louis (170 km) since 2014, for the surveillance of marine vertebrate strandings (Mullié et al. 2014), a single Hooded Vulture was seen (WCM pers. obs.). However, in The Gambia Hooded Vultures are frequently seen on beaches where they also feed on carcasses of cetaceans. In the Casamance, Hooded Vultures are frequently seen on beaches where they also feed on stranded fish (WCM pers. obs., March 2016; BP pers. obs., October 2016 and March 2017). Thus, it appears that feeding behaviour varies over even rather short distances, as Banjul (The Gambia) is only 170 km from Dakar and Bissau 370 km. Within Dakar itself we noticed differences in behaviour, as at the main slaughterhouse of Dakar and at the slaughterunit of donkeys at the zoo in the Hann park, Hooded Vultures are rather tame and approachable. The discharges of carcasses at the zoo and the slaughterhouse are not open to the general public. It is plausible that the Hooded Vultures adapt readily to local differences in the attitude of people towards them. Behavioural plasticity is an important trait of birds living commensally with humans (Murgui and Hedblom 2017).

Although the Dakar slaughterhouse is still an important feeding site for Hooded Vultures, this is likely to change. A methane digesting pilot plant is already operational, using blood and undigested contents of the digestive tracts of slaughtered livestock. A large full-scale methane digestion facility, which will eliminate the majority of digestible left-overs, will be constructed. The non-usable remains will be stored in closed containers before disposal to the main rubbish dump facility, which would leave nothing for the vultures. Fortunately, the company was open to our suggestions to make adaptations to the plans in order to keep edible remains available for the vultures. Slaughterhouse sanitation in general might go unnoticed elsewhere and it could rapidly become ‘the sword of Damocles’ for this species already under considerable stress.

**Use as fetish/traditional medicine**

The use of vulture parts for fetish/traditional medicine is also known to occur in Dakar, although items might not be very numerous and even their origin is not clear as many traders come from abroad. The number of street vendors of fetishes in Dakar was estimated to be 130–150 (Bishop and Garzon 2003). In 2016, the Faunal Department of the Waters and Forests Directorate (DEFCS) in collaboration with the Directorate of Criminal Investigations (DIC) confiscated animals and animal parts for sale (Capt. A Sonko, pers. comm.). The origins of the confiscated material, also containing parts of Hooded Vultures, was from a wide geographical area, not limited to Dakar or even Senegal. Despite the uncertainty about their origins, there is definitely a demand for Hooded Vulture parts. Along the so-called Petite Côte, immediately south of Dakar, according to Reynaud (2007) Hooded Vulture parts are used either as a remedy against certain illnesses, such as leprosy (Bambara), stomach aches, sore kidneys, and ecto- and endoparasites (Bambara), or as charms to become invulnerable (Serere), pass an examination and/or be appointed to a position of responsibility, or to see one’s future (Wolof and Serere) (known ethnic groups in italics).

**Conclusion**

In summary, from the available information we deduce that the driving force for the >85% reduction in the population of urban Hooded Vultures in Dakar is likely a combination of three factors:

1. the exponential increase in built-up areas and densities of habitation causing the reduction or complete disappearance of open feeding areas and food sources and the sanitation of the main slaughterhouse
2. the continued and wide-scale use of strychnine sulphate to eradicate feral dogs
3. the major reduction of suitable trees for roosting and nesting.

Given the status as Critically Endangered and the ongoing population decline of Hooded Vultures on the Dakar peninsula, there is a pressing need to answer questions such as why populations are seemingly stable in the south (The Gambia to Guinea) and decline to the north of these. Such information should be used in conservation action to prevent further decline and restoration of the remnant Hooded Vulture population north of The Gambia.

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