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Threats to Blue Swallow *(Hirundo atrocaerulea)* Population in Sanyatwe Communal Lands of Zimbabwe

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ABSTRACT

Hirundo atrocaerulea population, breeding sites, habitat condition, and threats in the arable and non-arable lands of Sanyatwe community were evaluated. The relative frequencies of distribution of aardvark holes in the two sites were compared using the Mann-Whitney U-test. Correlations between frequencies of distribution of the Hirundo atrocaerulea and the holes across the sites were tested with the Spearman's rank correlation test. Twenty six birds, nine breeding pairs, six juveniles and two unsexed birds were observed. Frequencies of distribution of the Hirundo atrocaerulea in the two sites significantly differed from each other ($P<0.05$). The frequencies of distribution of holes and the Hirundo atrocaerulea in both sites were not associated ($P>0.05$). Invasive tree species and high drainage were the major threat to these birds in the non-arable land. Cultivation was a potential threat. There is need to consistently monitor and conserve Sanyatwe lands since they are an important area for the Hirundo atrocaerulea.

INTRODUCTION

When an environment is changed drastically and rapidly, specialized endemic species cannot adapt and are pushed into an extinction spiral (Wakelin, 2005). The Blue swallow (*Hirundo atrocaerulea)*, a migratory bird endemic to the eastern highlands of Zimbabwe is one such species.

Although habitat loss and fragmentation has been identified as major cause of declines in bird species populations, declines have also been observed in habitats that have remained relatively intact over time. This has indicated the involvement of additional factors that could include the degradation of breeding habitats. Very few studies have evaluated the impact of degradation of bird species breeding habitats on bird populations. Furthermore, little is known of how changes in habitat-specific demography of birds may be related to population declines (Lloyd and Martin, 2005).

A total of 1,230 Important Bird Areas (IBAs), covering an equivalent of 7% of Africa's total area have been identified. Of these, 20 IBAs are in Zimbabwe, eight of which are in the eastern highlands of Zimbabwe (Birdlife International, 2002). The *Hirundo atrocaerulea* is found in five of the IBAs in the eastern highlands. Sanyatwe communal lands are in one of the five IBAs that house the *Hirundo atrocaerulea.*

The international *Hirundo atrocaerulea* population is declining at an alarming rate (Birdlife International, 2004), including Zimbabwe. Childes (2001) reported a decline in *Hirundo atrocaerulea* population in Nyanga National Park from as much as 400 birds in 1988 to 271 birds in 1996. Further bird surveys reported 71 pairs in the entire Nyanga IBA in 2001. It has been difficult to attribute this decline to any particular cause because of the lack of regular and systematic monitoring of the *Hirundo atrocaerulea* habitat. However, recent trends in the agricultural sector have seriously threatened the habitats of these birds in Zimbabwe. *Hirundo atrocaerulea* breeding and foraging sites have been converted into croplands and human settlements, fragmenting their habitat in the process. There is inadequate data on current land use patterns, breeding trends, population numbers, and the threat status in the area. As such it has not been possible to come up with viable conservation strategies for this bird species as indicated by the decreasing trends in *Hirundo atrocaerulea* population in the Nyanga IBA over the years. This study evaluated the population of the *Hirundo atrocaerulea* in Sanyatwe communal lands, the condition of the potential breeding sites, and identified threats to the *Hirundo atrocaerulea* in relation to land use patterns in Sanyatwe Communal Lands of Nyanga.

MATERIALS AND METHODS

Study site

The study was carried out in Nyanga, Sanyatwe Communal Lands, 18^{o}E 35^{o}E, within Quarter Degree Square (QDS) 1832 B3 from November 2006 to May 2007. The area was stratified into sites of homogeneous vegetation types using the 1:50,000 Juliasdale 4 figure grid reference map. Six sites of 25 ha each were purposively selected basing on availability of *Hirundo atrocaerulea* and nests as proposed by Bibby *et al.* (1998). Sites were assigned numbers at random from 1-6. A Global Positioning System (G.P.S) was used to establish fixed coordinates within each site from which bird counts were conducted.

Sites descriptions

Site 1 was grassland with isolated invasive tree species and well-drained sandy soils. Villagers used this site for cattle grazing. Site 2 was also grassland but was within a cattle ranching farm. There were no settlements or fields, but few paths that were rarely used cut across the site. This site was well drained and had very few signs of erosion.

Sites 3 to 6 were in communities with some households and fields. These sites were relatively typical wetland grasslands that had been invaded by wattle trees (*Acacia menseii*). Site 4 had few patches of the miombo woodland and wattle thickets. Sites 1, 2 and 4 were non-arable, while sites 3, 5 and 6 were arable.

Estimation of Hirundo atrocaerulea population

An initial bird count was done to establish the availability of the *Hirundo atrocaerulea* in that area. These counts were also used in identification of the counting points within the site during the actual field counting. Total species point counting was done during the mornings when bird activity was high. Three fixed counting points per individual site were purposively chosen. A total of 20 minutes was spent per point during the counting to allow more contact and enabled relating the bird occurrence to habitat features (Bibby *et al*., 1998). All the sites had an equal number of visits from 07:00hrs-10:00hrs on different days in the same week to reduce bias as bird activity varies with time of day. An Opticron (Imagic TGA WP 10 X 42) model pair of binoculars was used for bird viewing. Bird calls also indicated availability of *Hirundo atrocaerulea*. Because of the sexual dimorphism exhibited by the *Hirundo atrocaerulea*, breeding pairs and juveniles were easily determined.

Evaluation and assessment of potential breeding sites

The number of aardvark holes in the study area represented the breeding sites. Partially or totally closed aardvark holes with soil or any other substances were not considered in the count since they were not available for use by the *Hirundo atrocaerulea*. Four belt transects of 100 m X 300 m, erected at an interval of 25 m per individual site were used to assess the density of aardvark holes. Full coverage of the area was ensured through walking on foot in a zigzag manner. All the holes that fell within and on the boundaries of transect were visually and physically counted.

Determination of threats to Hirundo atrocaerulea

Threats were identified and their intensity arbitrarily measured on a scale from 0 to 5 (0-No threat, 1-very low, 2-low, 3-medium, 4-high, and 5-very high). The extent of drainage was considered to be a threat since it influenced the abundance and distribution of *Hirundo atrocaerulea* more so at water points and in wetland areas (Del Hoyo *et al.,* 2004). The extent of drainage in an area was evaluated on the basis of the amount of water logging in the site. Higher soil drainage posed a greater danger to the *Hirundo atrocaerulea* than low drainage. The threat from humans was assessed in March since there was increased human activity due to cultivation in the crop fields.

Evaluation of habitat condition

The basal cover, plant height, plant species composition, tree density, erosion status, and drainage were determined. The dominant and co-dominant plant species were also identified. The step point method was used to determine the basal cover in the grassland as well as the dominant plant species in the six study sites. Three line transects of 300 m X 15 m interval were erected in a down slope form to ensure a full representation of all the plant species down the catena. Through the step point method, the species with the highest number of hits and misses was considered dominant. Plant species identification was done with the assistance of the national herbarium. Plant height was also measured in March using the step point method and a ruler. Plant species that directly touched the step point were measured for height from the crown to the inflorescence using a 30 cm ruler. Average plant height for each site was computed from these individual measurements.

Tree density

A total tree count approach was used since there were few trees. Tree density for the entire study area was estimated as the average for all the six sites.

Data analysis

Mann-Whitney U-test was used to compare the frequency of distribution of aardvark holes between arable land and non-arable land, as well as the frequency of the distribution of the *Hirundo atrocaerulea* between the arable and non-arable lands. Spearman's rank correlation test was used to establish if there was any association between frequencies of distribution of aardvark holes and the *Hirundo atrocaerulea*.

RESULTS

Hirundo atrocaerulea population

Figure 1 shows the population trend of the *Hirundo atrocaerulea* in Sanyatwe communal lands during the study period. The relative frequency of distribution of the *Hirundo atrocaerulea* in the arable site between November 2006 and January 2007 differed significantly ($P<0.05$) from that of the non-arable land. There was a steady increase in the total number of birds recorded in the entire study area during the study period. A total of 26 individual birds comprising of nine breeding pairs, six juveniles, and two unsexed birds were observed in the entire study area during the study period.

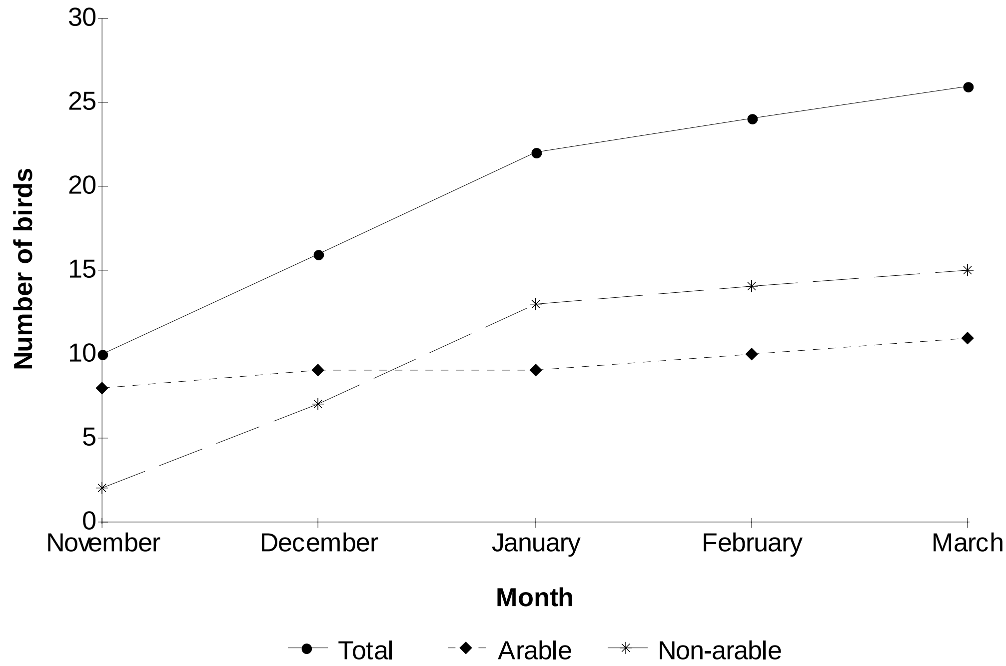

Figure 1: The *Hirundo atrocaerulea* population trend from November 2006-March 2007

The highest number of breeding pairs was observed in January 2007. Prior to January 2007, more birds were recorded in the arable land than in the non-arable land. However, there was an increase in the number of birds recorded in the non-arable land thereafter.

During the first three surveys, the *Hirundo atrocaerulea* was extremely isolated and territorial, but towards the end of the rain season, the birds were clumped and habitually seen foraging together.

Aardvark holes (breeding sites)

Table 1 (below) shows the number of aardvark holes counted in Sanyatwe communal lands. The frequency of distribution of the aardvark holes in the arable land was significantly different ($P<0.05$) to that of the non-arable land. The non-arable land had more aardvark holes than the arable sites. Most of the holes were upslope. There was no correlation ($P>0.05$) between the relative frequency of distribution of aardvark holes and that of the *Hirundo atrocaerulea*.

Table 1: The Number of Aardvark Holes for Sanyatwe Communal Lands

Arable land		Non-arable land	
Site	No. of aardvark Holes	Site	No. of aardvark Holes
3	15	1	21
5	8	2	67
6	59	4	90
Total	**82**	**Total**	**179**

Threats to Hirundo atrocaerulea

Table 2 (below) shows the identified threats to the *Hirundo atrocaerulea* in Sanyatwe. Nine potential threats were identified, characterised, and given an arbitrary score according to intensity.

Table 2: Potential Threats to *Hirundo atrocaerulea* in Sanyatwe Communal Lands

Site	Cultivation	Veld fires	No sink hole	Bird disturbance	Drainage	Overgrazing	Invasive. Species	Agric. Practices
1	0	5	3	1	4	5	5	2
2	0	5	2	1	5	2	5	1
4	3	3	1	2	3	4	5	4
N/Arable	**1**	**4**	**2**	**1**	**4**	**4**	**5**	**2**
3	5	3	4	3	2	2	4	5
5	2	5	5	2	3	5	3	5
6	4	3	1	3	2	5	4	5
Arable	**4**	**4**	**3**	**3**	**2**	**4**	**4**	**5**

The threat from cultivation was higher in the arable land, particularly sites 3 and 6, than in the non-arable land. High drainage was a major threat in the non-arable land. Invasive tree species posed a potential threat in both land use types.

Threat from humans

A total of 58.52 ha (39%) of the 150 ha under study were covered by human induced activities. Residential stands covered much of the human utilized area with an average of 54 households per hectare. Crop fields covered only 2.8 ha of the study area. The area covered by all the gardens combined was 1.72 ha in total. Sites 3 and 6 had relatively higher density of human settlements. Site 1 and 2 had no human settlements and were exclusively grazing areas. The greater percentage, 61%, of the study area was covered either by trees, grasses, or both.

Habitat condition

Table 3 shows the grass species composition and tree density for the study area. Overall mean grass height was 88.32 cm and tree density was 13 trees per hectare. Site 3 had the greatest number of trees per hectare. Generally, tree density for the study site indicated that *Eragrostis racemosa* was the most dominant grass species, whereas *Setaria sphacellata* and *Themeda triandra* were co-dominant.

Table 3: Grass Species Composition and Tree Density in Sanyatwe

Site	Mean grass height (cm)	Dominant species	Co-dominant species	Tree density (trees/ha)
1	75.68	*Eragrostis racemosa*	*Setaria sphacellata*	16
2	88.02	*Rhynchelytrum repens*	*Eragrostis racemosa*	8
4	91.52	*Eragrostis racemosa*	*Themeda triandra*	16
Non-arable	**85.07**			**12**
3	97.23	*Setaria sphacellata*	*Themeda triandra*	17
5	102.47	*Eragrostis racemosa*	*Hyparrhenia filipendula*	7
6	74.48	*Setaria sphacellata*	*Themeda triandra*	13
Arable	**91.4**			**12.3**
Average	88.23			13

Erosion and drainage

Erosion was negligible in all the sites since most of the sites' basal cover was relatively high. Very little erosion signs were seen in human developed paths but the extent was very moderate and was not a cause of concern in all the sites.

DISCUSSION

Generally, the population of the *Hirundo atrocaerulea* in this study was low, indicating a low number of birds migrating into the study area for breeding. This low number could probably have been due to the fact that the *Hirundo atrocaerulea* was highly vulnerable to nest disturbance (EWT, 2006) since a lot of potential threats were identified in this study.

The *Hirundo atrocaerulea* had been reported to commence migration into the study area in September (Birdlife International, 2004). Despite the low numbers, there was a steady increase in the number of birds recorded during the study period. This was probably due to breeding, since the number of observed breeding pairs remained constant from January to March 2007. Eight birds were recorded after the initial survey in the arable land, two of which were juveniles that were early offspring of the breeding pairs that had migrated into Sanyatwe communal lands. Of all nine breeding pairs identified, only three pairs had no recorded juveniles. As such, breeding was successful during the study period with a total record of six juveniles recorded. No juveniles were recorded in the month of March, implying that November to January was the peak breeding period for the *Hirundo atrocaerulea*. This conformed with the breeding season of September to February reported by Turner and Rose (1989) for the *Hirundo atrocaerulea*. The Spearman's rank correlation test proved that there was no association ($P>0.05$) between the number of aardvark holes (breeding sites) and the frequency of distribution of the *Hirundo atrocaerulea*. Birds were, thus, abundant in the arable land because of the abundance of foraging space, despite there being no accessible aardvark holes for nesting.

The relative frequency of distribution of the *Hirundo atrocaerulea* in the arable site differed significantly ($P<0.05$) from that of the non-arable land. More birds were observed in the arable land (site 3, 5 and 6) than in the non-arable land (1, 2 and 4) prior to January 2007. This could have been due to the presence of cattle in the arable area, which were being used for land cultivation. These attracted insects and flies with dung. However, after cultivation, the cattle were confined to the non-arable land for most periods; this might have attracted the *Hirundo atrocaerulea* to this area as they pursued flies and other anthropods. *Hirundo atrocaerulea* have been reported to feed on aerial arthropods, including *Diptera spp* and coprophageous beetles

(*Coleoptera*) (EWT, 2006). The increase in number of birds moving into the non-arable land during the late wet season could also have been due to regrouping of the birds as they prepared to migrate from the area. The high drainage and invasive tree species in this land appeared not to limit movement of the birds despite being identified as the most dominant and most threatening hazards to Nyanga grassland (Childes and Mundy, 2001; Timberlake *et al.*, 1996) suitable for *Hirundo atrocaerulea*.

CONCLUSION

Although the major threat to *Hirundo atrocaerulea* in Nyanga grasslands has been identified as the invasion by wattle (*Acacia menseii*) and pines *(Pinus patula)* (Childes and Mundy, 2001), these were low in sites 3 and 6. This could have contributed greatly to the higher *Hirundo atrocaerulea* numbers in the two sites, as there were more grasslands and space for the *Hirundo atrocaerulea* to forage and feed. Grass height had little, if any, effect on the population of the *Hirundo atrocaerulea* in the study sites since this was more or less the same for all the sites. The *Hirundo atrocaerulea* has been reported to favour grassland and shrublands less than 1 m (Childes, 2001; Grafton, 1997). The other possible reason could have been the low number of potential breeding sites which led the birds to other sites with ample nesting space.

The aardvark holes represented the potential breeding sites. Since there was no significant difference ($P>0.05$) in the relative frequency of distribution of aardvark holes in arable and non-arable land, these were evenly distributed across the study area. However, the distribution of the aardvark holes had no influence on the distribution of the *Hirundo atrocaerulea* since more birds were in the arable than in the non-arable land prior to January, as alluded to earlier. All the aardvark holes evaluated were not in use because they were in poor condition, most of them being covered by grass and soil. They were, thus, not accessible to the birds despite the fact that there were sufficiently numerous for a ratio as low as 1 breeding pair to 20 holes. Instead, the *Hirundo atrocaerulea* had built their nests in the dry parts of the two water wells in the community for breeding. The birds preferred using the wells probably because they were secluded and their depth provided them with safety.

The results from this study, though exploratory, indicated that very few *Hirundo atrocaerulea* birds were migrating to Sanyatwe communal lands for breeding, as indicated by the low number of birds observed in the sites. However, cultivation had significantly influenced the distribution of *Hirundo atrocaerulea* in the study area although it had no bearing on the breeding capacities of the said species due to the presence of alternative breeding sites. The potential breeding sites in the study area, the aardvark holes, were in poor condition and this could have influenced the low number of birds observed. The invasive tree species presented threats to the birds, as did drainage. These threatened the *Hirundo atrocaerulea* in its pristine environment.

References

Bibby, C.; Jones, M.; and Mardsen, S. (1998). "Bird survey, Expedition field techniques", Expedition advisory center, London.

Birdlife International (2002). "Globally threatened Birds, indicating priorities for action", Birdlife International, Cambridge, pg 33-39.

Birdlife International (2004). "Threatened birds of the world 2004", CD-ROM, BirdLife International, Cambridge.

Childes, S. L. (2001). "Blue Swallow (*Hirundo atrocaerulea*) Status and Distribution in Zimbabwe", Consultant's Report, 19 p + 2 maps BirdLife Zimbabwe, Harare.

Childes, S.L. and Mundy, P.J. (2001). "Important Bird Areas in Africa and Associated Islands", Harare, pg 50-55.

Del Hoyo; J., Elliot, A.; & Christie, D.A. (Eds) (2004). "Handbook of the Birds of the World", Volume 9, Cotingas to Pipits and Wagtails. Lynx Edictions, Barcelona pg 603-678.

Endangered Wildlife Trust (1997). "*A vision Fifth Annual*" the Endangered Wildlife Trust and Gold Field Environmental Centre, Johannesburg, pg iii.

EWT (2006). www.ewt.org.za/species/blue_swallow.htm.

Grafton, S. (1997). "A Blue Swallow Success story", *Africa Birds and Birding,* volume 2 Number 3, Black eagle publishing, Cape Town, pg 46-52.

Irwin, M.P.S. (1981). "The Birds of Zimbabwe", Quest publishing, Salisbury, pg 231-241.

Lloyd, D.J. and Martin, T.E. (2005). “Reproductive Success of Chestnut-Collared Longspurs in native and exotic Grassland” *The Condor, An International Journal Of Avian Biology*. Volume 107, Number 2, Lawrence Allan press, KS, pg 363-374.

Turner, A. and Rose, C. (1989). “A handbook to the Swallows and Martins of the world” Christopher Helm ltd, Kent, London pg 101-113.

Timberlake, J.R; Fagg, C.W.; Barnes, R.D. (1996). “Field Guide to the Zimbabwean Acacias”, Oxford, Cambridge pg 46-48.

Wakelin, J (2005) “Diminishing returns critical times for South Africa’s Blue Swallow” *Africa Birds and Birding*, Volume 9, Number 6 December 2004/January 2005, Black Eagle publishing Cape Town, pg 42 – 47