



**Some aspects of the breeding biology and
population status of the Rosy Bee-eater
Merops malimbicus on the middle River Niger,
North Central Nigeria**

by

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Abstract

Changing environmental conditions along the course of the River Niger is crucial to the conservation of the Rosy Bee-eater *Merops malimbicus* considering its obligate use of sandbars for breeding. This is crucial in the light of climate and land use uncertainties. The species has breeding records from only nine historic locations in Africa despite long river stretches across the continent. Factors determining selection of breeding habitats are not clearly known yet the species is of least concern on the IUCN red list. Our observations from about 13,000 breeding pairs suggest that the Rosy Bee-eater depends on insect abundance in its breeding habitat which seems to be influenced by nomadic cattle presence along the banks of the river. Seasonal flow pattern of the Niger River is becoming increasingly unpredictable and may lead to loss of breeding habitats, increased predation and destruction of colonies. We call for conservation attention and a robust review of the risk status of the Rosy Bee-eater, urging sustainable utilization of land and water resources on the Niger.

Introduction

The Rosy Bee-eater *Merops malimbicus* is an endemic intra-African migrant of least concern on the World Conservation Union's Red list threatened species (IUCN 2013), despite very little information on its current population status, breeding habitat quality and biology. The species has been reported in Angola, Benin, Burkina Faso, Republic of Congo, Democratic Republic of Congo, Ivory Coast, Equatorial Guinea, Gabon, Ghana, Nigeria, and Togo, with breeding records in Nigeria (River Niger and its tributaries), South Gabon (Gamba), Angola (Cabinda) and Coastal Congo (Conkonati and Tchimpounga Reserves) (Borrow and Demey, 2002) observed from nine locations on sandbars of the great rivers or coasts (Fry 1984, Birdlife 2013). Congregations of the species were part of the reasons for the designation of 24 locations as IBAs within Africa. In Nigeria the lower Kaduna-middle Niger flood-plain is designated as an IBA based on criterion A4 (ii) with respect to the Rosy Bee-eater.

To bridge the knowledge gap on the species, between April and July 2013, we set out to study the current status, breeding habitat quality and some aspects of the breeding biology of the Rosy Bee-eater in Nigeria.

Materials and Methods

Reconnaissance visits were made to historical breeding locations along Kaduna River (N 9°04', 5° 48' E), Eggan (N 8°40', 8° 30' E), Loko (N 8°00' 7° 48' E) and Simanka Rivers (N 8°10' 9° 45' E) from the 24th of April to 25th of May 2013. We took boat trips along the course of the rivers in search of breeding colonies on sandbars along the rivers. We observed activities at the breeding colony between 31st May and 10th June 2013. We also visited sandbars downstream and upstream of the active breeding colony and another sandbar (c. 4.3 Km North-east of the breeding colony) which held a breeding colony in the past. At the time of our visit the bank of the river where this sandbar was located had been completely deforested and converted to a crop farm probably due to improved soil fertility influenced by cattle manure left in the soil.

Within this period we assessed habitat characteristics, estimated the number of birds in the colony, number of nest holes and general nest characteristics, nest digging duration, insect diet composition by observing insects carried in the bill, frequency of nest visits with

insects, predators around the vicinity of the colony and general bird behaviour at the breeding colony. We also sampled insects and took vegetation characteristics and assessed land use within a 100m² plot at both banks of the river directly opposite the sandbar holding the breeding colony. From within the 100m² plots we marked out ten 20m² plots from which we took detailed vegetation measurements as follows: (i) number of trees and shrubs were counted, (ii) canopy cover was estimated by viewing through the reverse side of the binoculars, (iii) total vegetation cover was estimated by eye and (iv) tree height was estimated using the angle of elevation from the tree top by the Pythagoras theorem. Over a period of 8 days, the number of birds were counted at mid day (when the birds were most relaxed) in the colony and on a leafless tree perch that was used by the birds. Number of nest holes was determined by estimating the number of holes per square meter and multiplying by the total area occupied by the colony. Focal observations were carried out for one hour per nest on 23 nest holes during 8 days in order to estimate frequency of nest visits with insects. A repeated scan observation of the colony was carried out with a mounted spotting scope placed 70m away from the colony. Each observation period lasted one hour (9-10am, 12-1pm and 3-4pm) for each day over a period of 9 days. Insect parts around the vicinity of the colony were also collected for identification.

Observations

On the 26th of May 2013 we found a breeding colony on a sandbar along the middle River Niger (N 8°41' 6° 21' E); about 8 km from Katcha, a fishing community in Niger State, North Central Nigeria.

Location and habitat

The sandbar which held the breeding colony from which we made observations was situated in an area highly disturbed by humans, who had several fishing camps there (Plate 1). The sandbar also served as stop-over site for fishing boats.



Plate 1: A fishing camp in the vicinity of the Rosy Bee-eater colony.

Other key features of the area included two large nomadic cattle herder camps, an ephemeral pool and a rice farm situated on the right bank of the river and a newly cultivated maize farm on the left with its surrounding intensively logged. The area was about 46 km from the edge of the unprotected lower Kaduna-middle Niger flood-plain IBA (Ezealor 2002, Plate 2).

Within the sampled 100m² plot on the right bank of the colony, vegetation cover was 70%: comprising of 140 shrubs, 62 small trees below 50mm diameter at breast height (dbh), 53 small trees above 50mm dbh, 212 trees above 100mm dbh, 15% litter and 20% grass cover. Canopy cover was c.70%, bare ground 5% and the pool occupied 15% of the plot area. Maximum tree height within the plot was c.22 m while average tree height was 12 m. The sampled plot on the left bank was less dense but completely vegetated due to greater grass cover: with 120 shrubs, 12 small trees below 50mm dbh, 18 small trees above 50mm dbh, 20 trees above 100mm dbh, 40% litter and 60% grass cover. Canopy cover was c. 20%, maximum tree height was about 18 m (very few tall trees) while average tree height was 8 m.

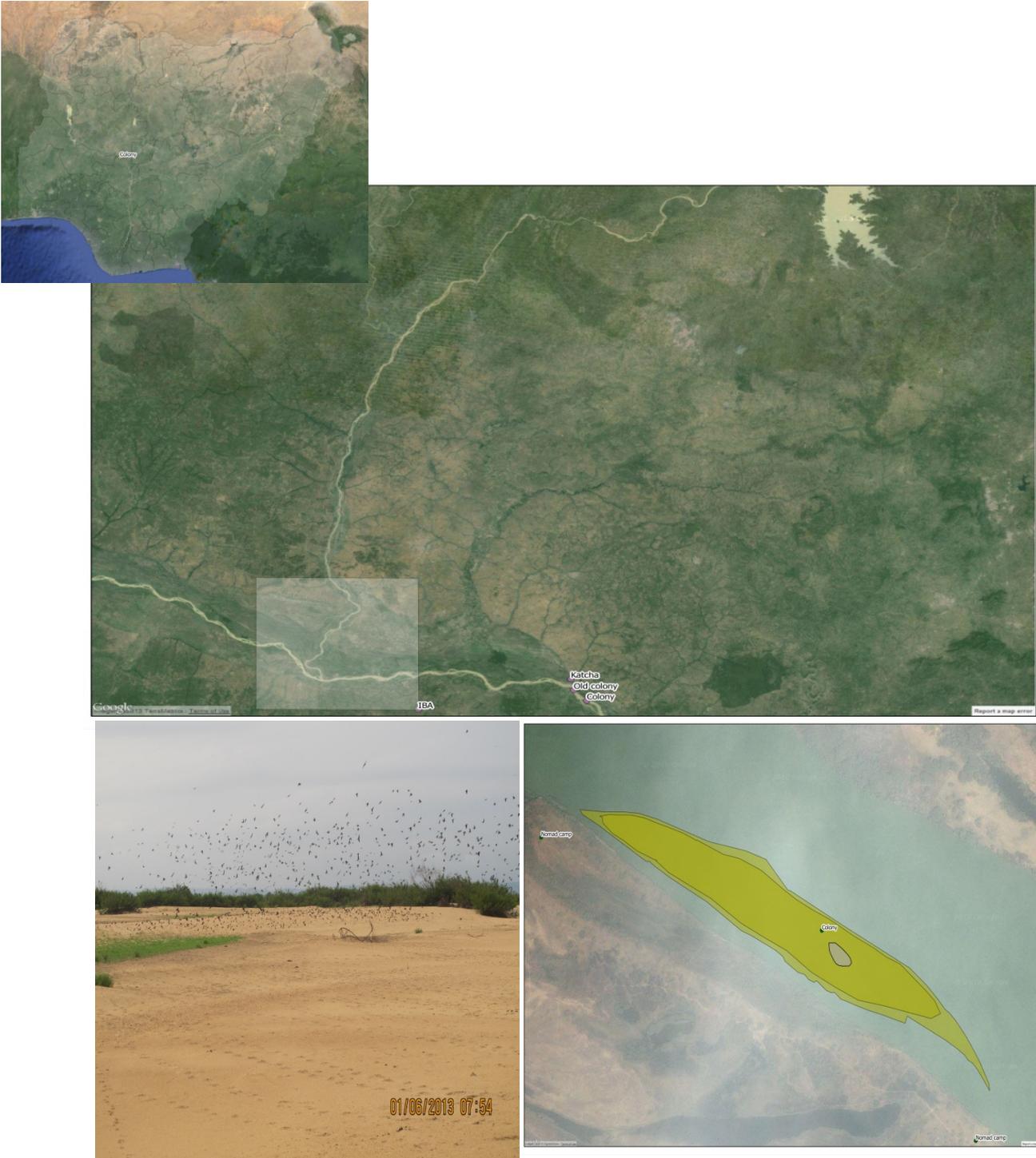


Plate 2: Top - location of current breeding area in Nigeria; Middle - location of breeding colony in relation to the lower Kaduna-middle Niger flood-plain IBA and the Kainji dam;

Bottom right - Sandbar with breeding colony, and nomadic herdsman camps on the bank showing water level difference between visits; Bottom left - Active breeding colony.

Colony size and nest characteristics

Rosy Bee-eater activities at the colony started at sunrise (06:00 - 06:20) and receded at sunset (07:00 - 07:06). A few individuals (few hundreds) were first observed flying high above the colony about two minutes before roosting individuals in the nest holes emerged. These 'flying in' individuals were probably non-breeding individuals roosting in the surrounding vegetation. Arrival with insects to the nest was observed about four minutes after emergence from the nest holes.

The total area of the sandbar in which the colony was situated was 111,040m² during the first visit. During the second visit (seven weeks later) the size of the sandbar had reduced to 83,390m². The colony itself occupied 1677m² (1.51% and 2.01% respectively) of the sand bar (plate 2). Average number of individual birds was 25,674±540 birds. Number of nest holes was estimated at 13,416 in the entire breeding colony. Since the Rosy Bee-eater is (likely) monogamous and two individuals were actively involved with nest digging thus assuming that each nest hole represent a breeding pair, we estimate between 24,000 - 27,000 birds in the colony. This nest approach could probably result in a slight estimation error as nest digging continued after the observation period; although increased digging coincided with observed intense nest predation by *Varanus niloticus* (Plate 4). Existing information suggests a single brood (Fry 1984), but nest predation and parasitism may have resulted in new nest initiation by pairs with failed nests. All new nests were located clearly away from the area of the colony frequently visited by *Varanus niloticus*.

Nest holes had one or two compartments (Plate 3). The first compartment was usually not present in all holes. This compartment was shorter and generally wider but variable in diameter ranging from 0.34 ± 0.07m (n=10). The inner nest compartment had a diameter of 0.09 ± 0.01m (n=10) and a trench depth of about 2.6 ± 0.16 m (n=3).



Plate 3: Left - Even distribution of nest holes in colony, Right - nest hole with dual compartment.

Frequency of nest visits

Frequency of nest visits was generally high but variable across nests. There were 7.3 ± 3.2 ($n=23$) visits per hour at an interval of 7.76 ± 7.54 minutes. This suggests that the foraging areas and the colony were relatively close or prey was relatively abundant at the site. However, while on regular boat rides downstream we observed a few individuals flying up to 3 km to pick insects back to the colony area. Another possible reason for very short visitation intervals is the entrance of two individuals at almost the same time to a nest hole.

Insect diet

From observation of insects carried in bill and of insect parts around the colony vicinity, six major insect orders constituted the diet of the Rosy Bee-eaters (Fig 1). Odonata (Dragonflies) and Lepidoptera (Butterflies) were recorded in higher numbers in the diet with only a marginal difference in their occurrence, followed by Hymenoptera, Diptera, Othoptera and Coleoptera respectively. Insects observed but not identified were classified as “others”.

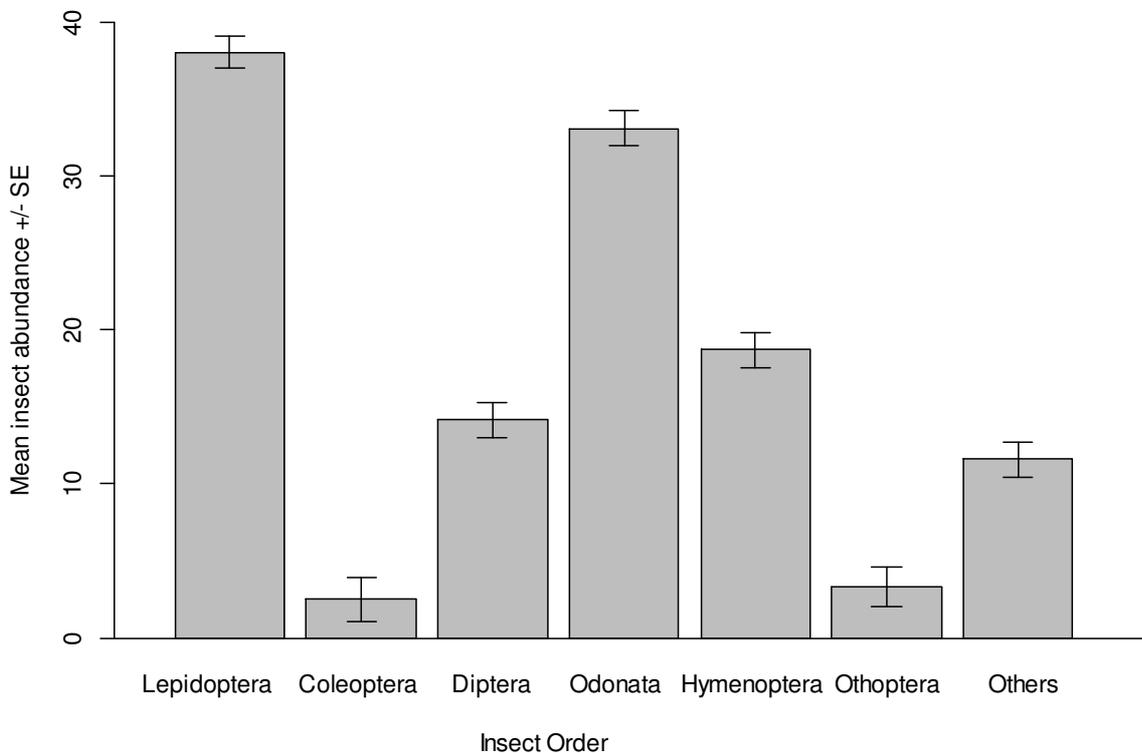


Fig 1: Insect diet composition of Rosy Bee-eaters *Merops malimbicus* from insect in bill and insect parts around colony vicinity on the Lower River Niger, North central Nigeria

Predators and brood parasites

Colonial and cavity nesting in the Rosy Bee-eater seem to increase vulnerability to predation and brood parasitism as this makes the species readily visible and accessible to both nest predators and brood parasites. Four avian predators, namely, Lanner Falcon *Falco biarmicus*, Ovambo Sparrowhawk *Accipiter ovampensis*, Black Kite *Milvus migrans* and African Harrier Hawk *Polyboroides typus* as well as reptilian predator, *Varanus niloticus* were recorded at the colony vicinity (Plate 4). The avian predators frequently visited the colony on a daily basis but were not observed taking any birds. The birds were however seen to take to sudden flight at the sight of large birds in the air. Predation by *Varanus niloticus* on the other hand seemed very efficient and this may have favoured the evolution of deep nest trenches in the bee-eaters. Reptiles visited daily between 10:00 and 16:00 hours. During each visit, reptiles probed nest holes and probably fed on the eggs.

No new nest holes were initiated around the area of the colony where intense nest predation was observed. The Greater Honeyguide *Indicator indicator* reported as brood parasite to the Rosy Bee-eater (Ezealor 2002) and other species of Bee-eaters (Fry 1984, Spottiswoode 2012) was very common around the colony and surrounding habitats. A chick which was observed leaving the nest on the 9th of June before the Rosy Bee - eater chicks fledged may have been a Honey guide (Plate 4). Few other observations of eggs, an embryo and hatchlings outside the nest before fledging occurred in the colony (Plate 4) may as well be related to brood parasitism in the colony. Brood parasitism by Honey guides has been described for other species of Bee- eaters (Fry 1984) with up to 65% of Little Bee-eater *Merops pusillus* nests (Spottiswoode 2012) parasitised; female Greater honey guides are known to puncture eggs of the host to prevent them from hatching while the hatchlings further kill foster siblings that survive egg puncturing with sharp bill hooks.

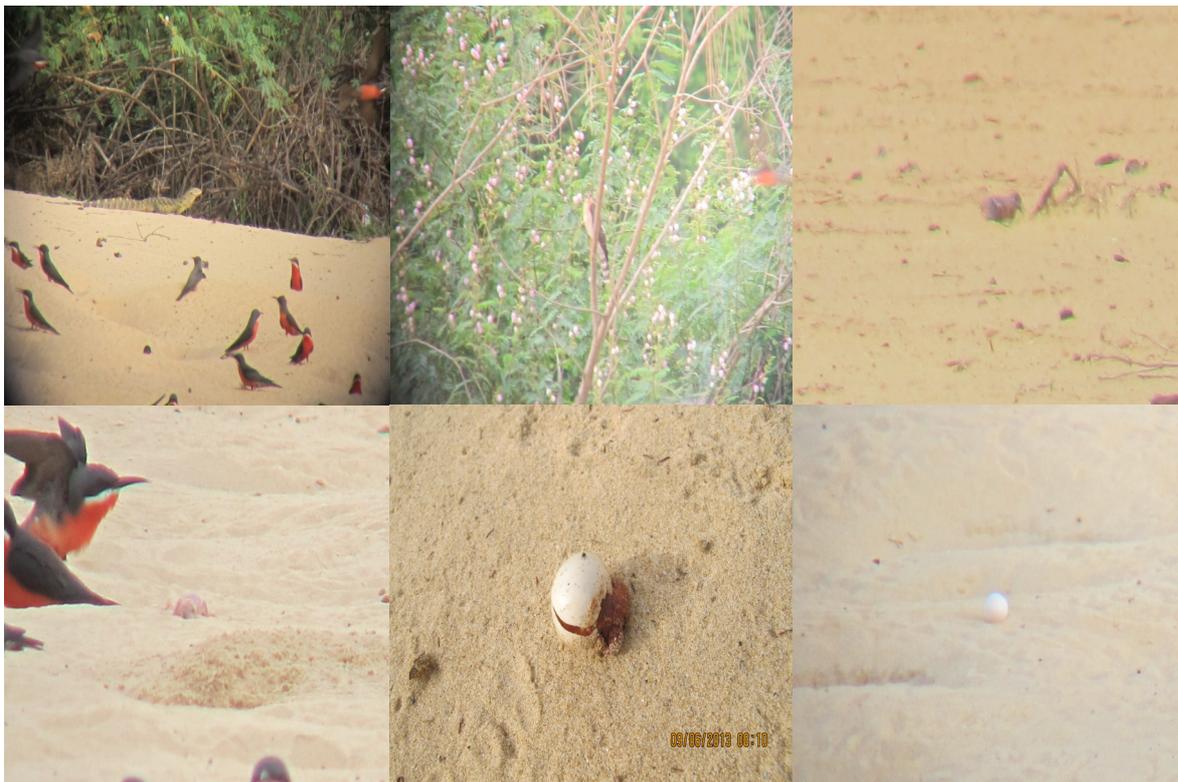


Plate 4: Top left - Nest predating *Varanus niloticus*; frequent visitor to the Rosy Bee-eater colony, Right, Top middle - An Ovambo Sparrow Hawk *Accipiter ovampensis* mobbed by Rosy Bee-eaters, Top right - Hatchling leaving nest, Bottom left - Hatchling outside nest, Bottom middle - Embryo outside nest and Bottom right - Egg outside nest.

Breeding time

It was difficult to establish a complete breeding time table from our period of observation because we found the breeding colony at an advanced stage in the breeding season; Insects were already being actively taken into most nest holes. We could not establish the presence of helpers in the colony but observed with certainty two individuals carrying whole insects into nests at about the same time. Active copulation was never observed around the vicinity of the colony; however the characteristic tripod digging gesture described by Fry (1984) as courtship behaviour by males was observed both by individuals carrying food and those that were not. Visible nest digging lasted 4 - 6 days for the few nest holes that were under construction during our visit. We could not estimate incubation period as it was difficult to spot nests where incubation was going on. We observed a dead hatchling on the 3rd June and a fledgling (possibly a Honey guide) leaving the nest on 9th June 2013. We also observed a few eggs and a pre mature hatchling outside some nest holes around the vicinity of the colony. By 24th July 2013 when we returned on a second visit the water level had changed horizontally by c. 12m but the sandbar was still intact with only 51 active nest holes. Based on our observation, the time between fledging and dispersal is about 6 - 7 weeks. This did not seem to be directly determined by changes in water level as there have been records of flooding destroying colonies in the past (Ezealor 2002) while in the current colony we recorded dispersal before a remarkable change in water level (see plate 2). It is therefore likely that stochastic events leading to early rains or massive early flooding of the sandbars due to the release of water from the upstream Kainji Dam (plate 2) could adversely affect the breeding success of this species.

Other observed behaviours

The Rosy Bee-eaters also displayed interesting behaviours observed in other species of bee-eaters such as sun basking (Plate 5). This was observed during periods of high sun light intensity. The Bee-eaters spread out their wings, open their gapes and lie on the sand. In some instances they sun bask with an insect held in their bill, as reported for the Blue-checked Bee-eater *Merops persicus* (Fry 1984). The reason for this behaviour is not understood. Clepto-parasitism was also commonly observed in the colony. This ranged

from snatching of insects in flight, intercepting falling insects in mid air, waiting at the nest entrance to snatch insects from returning birds to attempting to take over nest holes from pairs during construction. The birds also occasionally bathed by diving into and out of the river, then sitting on to a perch to dry-up in a leafless tree (plate 5) c.700m from the colony. This behaviour was observed from mid day to about 4:30pm. The birds may remain on the tree until sunset. This behaviour may serve for cleaning of sand and dust frequently associated with cavity nesting or for managing high temperatures during the day.



Plate 5: Sunbasking behavior in the Rosy Bee-eater, Top right - Sunbasking with a Dipteran fly in bill, Bottom left - drying up on a leafless tree after water bath.

Other threats

The kids in plate 6 below were seen approaching the colony with sticks. They were probably going to raid the colony and take eggs or the birds themselves. Of course we spoke with them and their parents to ensure that they did not return to the colony after we left.



Plate 6: Kids approaching Rosy Bee-eater colony with sticks

Nomadic cattle camps were also a threat to the colony. For example, it was not uncommon to see young cattle and goats that went out grazing unherded walking through the colony. The trampling probably destroyed nests together with their contents.



Plate 7: Free ranging livestock occasionally traversed the Rosy Bee-eater colony site (Such trespass could result in collapse of some nest tunnels)

Conclusion and future direction

We cannot draw categorical conclusions with regards to the population trend of Rosy Bee-eaters in the Middle Niger Floodplain because a global population estimate is not available and studies in the breeding area around the Niger-Benue floodplain in Nigeria have not been consistent over the years. However, the absence of active breeding colonies during our search in areas where birds were found previously and in areas with similar breeding habitats may suggest that the species may not be as common as it had been in the past. For example, Eggan (1942), the Kaduna-Niger confluence (1965) and the lower River Kaduna (1996) held an estimated 18,500, 23,700 and 15,000 nest holes respectively which are all higher than our current estimate. The designation of the lower Kaduna- middle Niger Flood-Plain as an Important Bird Area due to its importance for the

breeding of the species may not completely answer the conservation problems of the species as the breeding location of the Rosy Bee-eater has not remained static. The current location of the breeding colony lies outside the area designated as IBA in Ezealor (2002).

It would be extremely important to investigate factors determining breeding habitat selection over the next few years. The possible relationship between the breeding colony location and the movement of nomadic herdsman along the banks of the river which seem to have suspiciously coincided in the Kaduna River colony in 1996, a former breeding colony (Plate 2) as well as the current breeding location. It would also be important to study its insect diet composition in relation to seasonal insect abundance in the surrounding habitats because our present survey recorded an enormous amount of butterflies which was not emphasized in Fry (1984). Recent (November 2013) report from Tchimpounga Nature Reserve some 35 kms north of Pointe Noire, Republic of Congo reported 1000 + birds feeding young (Malcolm Wilson *pers comm*) with mostly Dragon flies. It may also be important to establish the composition of the breeding population in Nigeria as only few breeding locations have been reported in Africa with large aggregations.

References

BirdLife International (2013). Species factsheet: *Merops malimbicus*. Downloaded from <http://www.birdlife.org> on 25/04/2013.

BirdLife International (2013). IUCN Red List for birds. Downloaded from <http://www.birdlife.org> on 25/04/2013.

Borrow, N. and Demey, R. (2002). *A field guide to the birds of Western Africa*. Christopher Helm London.

Ezealor A.U., ed. (2002). *Critical sites for biodiversity conservation in Nigeria*. Nigerian Conservation Foundation: Lagos, Nigeria. Pp.51.

Fry C.H., (1984). *The Bee-eaters*. Town Head House, Calton, Water houses, Staffordshire, England.

Spottiswoode, C.N. and Jeroen, K. (2012). A stab in the dark: chick killing by brood parasite Honey guides. *Biology letters*.**8(2)**: 241 - 244.