Abundance and nesting sites characteristics of red-headed picathartes *Picathartes oreas* in Cross River State, Nigeria

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Abstract

This study assessed the abundance and nesting sites characteristics of red-headed picathartes (*Picathartes oreas*) in protected and unprotected forest in Cross River State, from August 2016 to January 2017. Data were collected through oral interviews, and field observations, using area search and quadrant methods. Data on bird and nest were tested using one-way ANOVA and *t*-test while tree species diversity indices were calculated using Paleontological Statistics Software Package, version 16. Results revealed that a mean of 38±52 individual bird from six colonies were sighted during the survey. Higher number of 20 (52.63%) individuals from two colonies was recorded in the undisturbed montane rain forest of the Okwangwo Division of the Cross River National Park than the disturbed montane rain forest with 18 (47.37%) individuals from four colonies. A total of 40 (50%; $n = 20$ each) nests of red-headed picathartes were sighted during the survey around the undisturbed and disturbed montane rain forest respectively. All (100%; $n = 40$) the nests observed were attached to the south-eastern side of the rocks and all the nests were constructed with mud mixed with grass. Colony Six was on the highest altitude with an elevation of 529 m, followed by colony two with an elevation of 342 m while the lowest elevation was 195 m recorded in colony three. Tree diversity index was higher in the protected forest (3.352; 3.227) than in the unprotected forest (1.846). Characteristic features of *Picathartes oreas* habitat were rock, hill, valleys and rivers and streams. It was evidenced by the study that *Picathartes oreas* still nests both in the disturbed and undisturbed forest but the level of disturbance and type of crops grown may have impact on the nesting behaviour. Therefore, anthropogenic activities should be regulated in the area, to ensure the conservation of *Picathartes oreas.*

Keywords: *Picathartes oreas*; abundance; nesting sites characteristics; unprotected and protected forest.
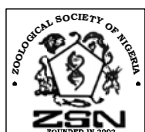
Introduction

The red-headed picathartes/Rock-fowl (*Picathartes oreas)* is a medium-sized bird in the family Picathartidae, with a long neck and tail. The red-headed picathartes typically chooses to live near streams and inselbergs and are restricted to the rocky areas of close-canopied tropical Lower Guinea forest of Nigeria, Equatorial Guinea, Gabon and Cameroon, with a highly fragmented and declining global population estimated at 2,500-10,000 individuals (Bian *et al* 2006; Thompson, 2007; Birdlife International, 2013). In Nigeria, it is only found in the nation's south-south corner near the coast and the Cameroon border (Fry, 2000). The red-headed picathartes is currently faced with an array of threats including habitat loss, predation, hunting and increasing human disturbance throughout much of its range. As a result of these, red-headed picathartes is currently classified as vulnerable under the IUCN/Birdlife threat criteria and listed in Appendix I of Convention on International Trade in Endangered Species (CITES) (Birdlife International, 2019).

All birds construct nests (which varies considerably between and even within taxa) in which to lay eggs and/or raise offspring. Traditionally, it was thought that natural selection and the requirement to minimize the risk of predation determined the design of completed nests (Heenan, 2013; Mainwaring *et al* 2014). The selection of a safe nesting site is an important determinant of reproductive success, and some birds have been shown to choose their nest sites in order to reduce the risk of predation (Schmidt *et al* 2006, Eggers *et al* 2006). According to Nalwanga *et al* (2004), Sawa *et al* (2011) nest site selection can be influenced by several factors, including nest predation risk, physiological tolerance to abiotic factors and interspecific competition. Nalwanga *et al* (2004); Kristan III (2007) noted that for birds, natural selection should favor individuals that choose habitats and

nesting sites that are adequate (high food availability, low abundance of predators) and have life history characteristics that reduce the negative effects of nest predation.

Martin (2001) stated that birds select nest-sites by assessing many biotic and abiotic environmental factors. Among the abiotic factors, the type of substrate chosen for nest construction is particularly important for cavity-nesting birds (Heneberg, 2003, 2004; Ramirez-Herranz *et al* 2017). Also, soil attributes are the driving forces that shape the distribution and abundance of tropical birds that nest in soil cavities (Meireles *et al* 2018).

A pre-requisite for nesting in red-headed picathartes seemed to be a rock-face at least 3 m high having an overhang sufficient to provide shelter from falling rain, and sufficient dry surface to permit a nest to be attached (Thompson, 2007). There is a record of a nest being constructed on the buttress root of a *Piptadeniastrum* tree above a small stream (Thompson, 2007). Two nests were even built onto a concrete bridge in Gabon's Lopé National Park (Christy, 2007). The height of nests above ground level varies greatly. Nests are constructed of mud intermixed with rootlets and vegetable fibres and set into a very hard stone-like structure. There is a considerable variation in nests size but the measurements of a typical nest are 400 mm long, 290 mm wide, and 140 mm thick (Thompson, 2007). The nests are almost always found near water, which can be in the form of either streams or forest pools (Harter *et al* 2007).

The nest itself is a half-cup, constructed with dry mud, mixed with grass fibres and dead leaves, often with the plant matter sticking out of the nest walls. It is either built onto the rock surface or, in some cases, is built more like a retaining wall across the opening of a small rock fissure (Fry, 2000). Nests are built at least one metre away from each other, and in some cases up to five metres (Harter *et al* 2007). The nest is normally 30 to 40 cm thick, though the nest is uneven in its construction as one nest was almost 140 cm (55 inches) thick (Fry, 2000). It was about 290 cm wide and 400 cm long and weighs about 3 kg (Fry, 2000).

We live in a world dominated by heavily human-impacted ecosystems such as warm oceans polluted by plastic and petrochemicals, rural areas farmed ever more intensively, and rapidly expanding urban areas (Ripple *et al* 2017). Avian species conservation in changing environments demands that there should be monitoring, integrated land management and concerted effort (Nelson, 2008). Therefore, steps are needed from multiple stakeholders, including wildlife managers, policy makers and local communities to ensure the preservation of bird diversity and retention of ecological processes such as nesting, breeding, feeding and roosting. Such steps will help local communities derive benefits from ecosystem services such as ecotourism, which depends on birds and other wildlife species (Snyman, 2012).

The forest of Cross River State is globally recognised as one of Africa's biodiversity hotspots and home to several endemic and highly threatened species of fauna and flora (Oates *et al* 2004; Rodrigues *et al* 2004). Unfortunately, most parts of the forest, including protected areas, are surrounded by poor communities that depend heavily on the forest for survival. The impact of these locals leaves an extensive array of threats, including illegal hunting, deforestation, logging and uncontrolled non-timber forest product collection, threaten the health and integrity of the entire forest ecosystem (Atuo *et al* 2015). Detailed information about the nesting habitats of birds, including those needed for successful nesting, can provide a better understanding of the ecological factors that permit existence of different species and may aid in conservation efforts (Diamond and Ross, 2019). The goals of our study were to determine the abundance and distribution of red-headed picathartes and their nest and to determine the factors responsible for nesting site selection.

Materials and methods

Study area

The Okwangwo Division of Cross River National Park (Figure 1), falls within two local government areas of Cross River State namely Boki and Obanliku. It lies between Longitude $6^0 4'$ and $6^0 29'$ N; and Latitude $9^0 00'$ and $9^0 27'$ E south-east of Obudu with the Eastern boundary extending along the Nigeria-Cameroon border immediately east of Afi River Forest Reserve. It is bordered to the east by Takamanda National Park, Cameroon. It is bordered with about 66 Support zones and three enclave communities. The Community forests are as follows; Bashu-Okpa, Bashu-Kaku, and Butatong, which falls under Boki Local Government Area of Cross River State.
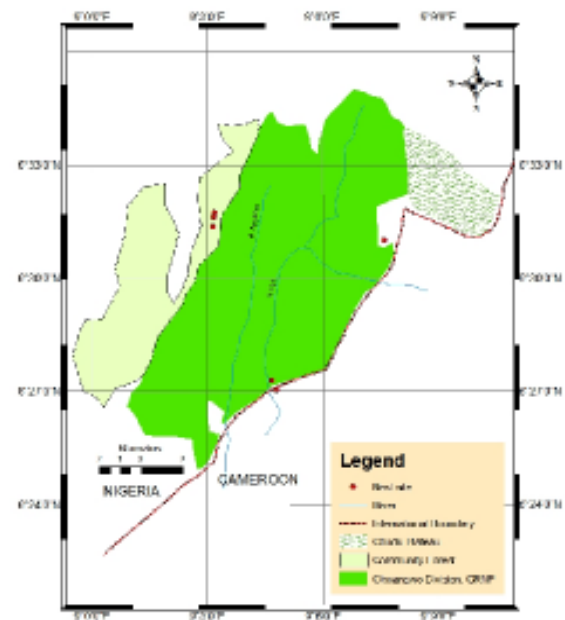

Figure 1. Map of Okwango Division of Cross River National Park and the community forest.

The main occupations of the inhabitants are basically farming in cocoa, cassava, banana, cocoyam and plantain, hunting, black-smiting, and artistry as well as weaving and carving (Marguba, 2002). Obot (1996) segregated the vegetation of the Okwangwo Division of the Cross River National Park into four different types namely: lowland rainforest in low lying areas; ridge/hill forest on the slopes of Mbe Mountain, sub-mountain forest on Obudu Plateau and Savanna woodland in Ikwete Hills. Okwangwo Division has about 1,545 documented species of plants in 98 families, some of which are extremely rare, (Obot, 1996). These include: This Division which is also home to the Cross River Gorilla (*Gorilla gorilla diehli*), Nigeria-Cameroon Chimpanzee (*Pan troglodytes ellioti*), drill monkey (*Mandrillus leucophaeus*) as well as 15 other primates. Two new species of butterfly discovered in the park are: *Tetrahanis okwangwo and Thermoniphas barahingam,* chevrotain, giant pangolin, the golden potto or *Calabar Angwantibo* and *Preuss guenon* are also some of the mammalian species endemic to the park (Marguba, 2002). The climate is seasonal-tropical with a distinct rainy season (March- November) and dry season (December-February). Rainfall is heavy up to 4280 mm distributed unevenly within the nine months. Ambient temperatures between 14^0C and 25^0C are recorded on the highland areas of Obudu Plateau and Sankwala Mountains (Obot, 1996). Topography is rugged with many disjointed and connected ridge systems, isolated peaks and rock outcrops. However, the land is generally at an elevation of 150 m above sea level (ASL), rising to around 1,500 m in Sankwala Mountains and up to 1,700 m on the Obudu Plateau. The park is well drained by three main tributaries of the Cross River; Oyi, Bemi and Okorn.

Methods of data collection

The red-headed picathartes is a rare and secretive forest species that breeds in highly specialised habitats, mainly caves, rock-faces and cliffs (Birdlife International, 2013). The bird does not have a distinctive song, hence conventional survey approaches including call counts that work well for most song birds may be difficult to apply for picathartes surveys. The protocol of direct nest search using historical knowledge and field searches (Area Search Method/Habitat Combing Method) as described by Atuo, *et al* (2016); Awa *et al* (2009); Monticelli *et al* (2011) were adopted for the study. Extensive searches were carried out both in the community forests and the Okwangwo Division of Cross River National Park to locate red-headed picathartes nests from August 2016 to January 2017. Permission to access the community forests was obtained from the community leaders. Information about the possible areas/locations where the nesting sites of Picathartes could be found was obtained by interviewing the park-rangers, local hunters and farmers. A conservation awareness poster from the park conservation education unit was used to ensure that the respondents were sure of the answers they gave on the bird. During the field survey, the identified areas were thoroughly and meticulously searched for all the potential nesting sites, such as overhanging rocks both around and far from streams, caves, crevices, valleys and sloppy areas. Survey was conducted during the day (from 700 hr to 17.00 hr) as long as the weather condition permitted and six times per season: twice per month for three months in the rainy season (August to October) and three months in the dry season (December to February). All the nests seen were counted and categorized as active (nest with eggs or chicks or any sign of occupancy), inactive (nests without any sign of occupancy or covered with cobwebs), under construction (incomplete nests with fresh mud-caps), dilapidated (when part of the nests has fallen off). The contents of the nests were examined/inspected either directly or using a reflective mirror attached to a wooden pole. Only the active nests were counted. The nest-height, number seen, materials used in nest construction, direction of the rock-face that nests were attached and distance to River or stream were recorded. The Global Positioning System (GPS) coordinates of the sites were obtained using Gamin 80 GPS unit. Each site was visited six times. Also, at each nesting site the number of Red-headed Picathartes seen were recorded. Bird abundance was determined using outer-bound method: Given as: $n = 2nk – nk-1$.

Where: n = population estimate,
nk = highest number.
nk-1= next highest number.

Vegetation assessment

Quadrat method as described by (Coker and Kent, 1992) was adopted. A total of 12 quadrat plots of 20 x 20 m (2 plots per colony/nesting site) were mapped out in picathartes preferred nesting sites. Total enumeration of tree species that were above 3 m in height and with Diameter at Breast Height (DBH) $\geq$ 10 cm was recorded. The trees were identified to species level and grouped into different families both in the disturbed (community forest) and undisturbed (National Park) forests.

The tree species diversity indices (Shannon index, Evenness, Dominance) were calculated as follows:

(a)   Shannon index; H = S (Pi)*In (Pi).
Where:
Pi   =   Number of individual of species.
i   =   Total number of species.
In   =   Natural logarithm.

(b)   Evenness = H/H$_{max}$.
H$_{max}$ =   Maximum diversity possible.

Data analysis

Data obtained were analysed through descriptive statistics (frequency, histograms, tables, graphs and charts). Data on nest heights was tested for significance using one-way ANOVA. *t*-test was used to test for significance in seasonal variation in bird abundance and bird abundance in the disturbed and undisturbed forest. The elevation was

correlated with bird abundance. Paleontological Statistics Software Package (Version 16) was used to analyse tree species diversity indices in the preferred habitat of the Rock-fowl. The nest abundance and avian abundance was subjected to linear regression analysis.

Results

Nest abundance and nest distribution

The result revealed that a total of Forty (40) nests of red-headed picathartes distributed across six colonies (Two-C1 and C2 ($n=20$; 50%) in the protected area and Four-C3, C4, C5 and C6 ($n=20$; 50%) in the unprotected area) were sighted during the survey. However, colony two (C2) had the highest number of nests (12) followed by colony five (C5) with nine (9) nests while colonies three and six (C3 and C6) had the least number of nests (three each) (Table 1). All the nests were constructed with a mixture of mud and grass.

Table 1: Nest abundance and mean number of red-headed picathartes recorded in each colony in the study-area.

Colony	Forest type	Number of nest	No of birds	Eleva-tion (m)	GPS coordinate
C1	UF	8	7±0.37	200	6^0 10′ N 9^0 13.5 E
C2	UF	12	13±0.37	340	6^0 13 N, 9^0 13′ E
C3	DF	3	3±0.5	195	06^0 20′ 26.1N 009^0 09′ 09.1 E
C4	DF	5	5±0.25	247	06^0 20′ 25.4 N 009^0 09′ 06.8 E
C5	DF	9	7±0.52	225	06^0 20′ 16.1 N 009^0 09′ 05.3 E
C6	DF	3	3±0.25	529	06^0 19′ 32.2 N 009^0 19′ 11.6 E
Total		**40**	**38 ± 1.52**		

A total of thirty-eight (38) individuals of red-headed picathartes from six (6) colonies were recorded during the survey (Table 1). Colony 2 had the highest number (13) followed by Colonies 1 and 5 with 7 individuals each, while Colony 6 and 3 had the least number of 3 individuals each. The results also showed that higher number ($n = 32$; 58.18% from two colonies) of red-headed picathartes was recorded in the undisturbed montane rain forest (Protected area) than in the disturbed montane rain forest (community forests) ($n = 23$; 41.82% from four colonies). (Table 1). There was significant difference in the mean abundance of *Picathartes oreas* between disturbed Community forests) and undisturbed (Okwangwo Division of Cross River National Park) forest ($f = 10.47$, $p = 0.009$). There is a near perfect/strong positive correlation ($r = 0.96082$) between nest abundance and bird abundance (Figure 2).

The result on the elevation of *Picathartes oreas* nesting site above the sea level (ASL), revealed that Colony 6 was on the highest altitude with an elevation of 529 m followed by Colony 2 with an elevation of 342 m while the lowest elevation was 195 m recorded for Colony 3. The mean heights of red-headed picathartes nest from the base of the rock was between 2.34 ± 0.24 m in Colony 2 (C2) to 10.74 ± 0.63 m in colony one (C1). In between, Colony 4 nest mean height was 10.44 ± 0.36 m, colony six was 6.33 ± 1.53 m followed by Colonies 5 and 3 with heights of 4.0 ± 0.31 m and 3.77 ± 0.25 m respectively (Table 2). Statistical mean variance test revealed that there was significant difference between the mean nest heights of *Picathartes oreas* across the different Colonies ($f = 6.55$, $p = 0.031$).

The result further revealed that all (100%; $n = 40$) the nests observed were found to be attached to the south-eastern side of rocks either in a café or with tree canopy providing cover. The other the common characteristic features of red-headed picathartes nesting sites were rocks, hills, valleys and rivers/streams both in the park (undisturbed Forest) and in the community forest (disturbed forest).
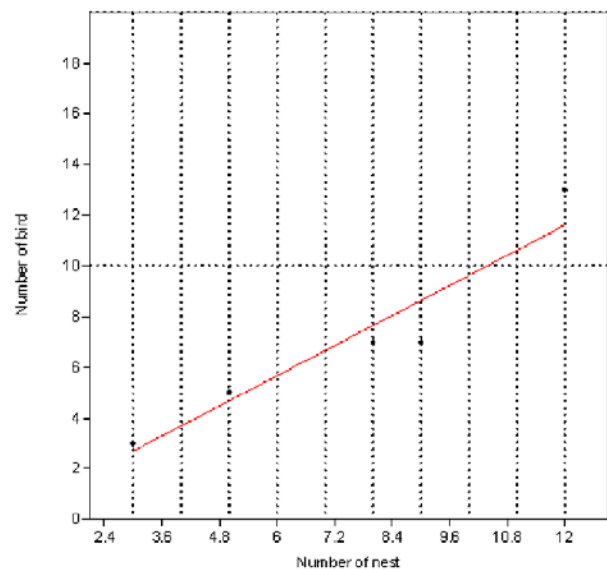

Figure 2. Nest abundance versus Picathartes abundance in the study area.
The red line represents the best fitted linear regression.

Distance of red-headed picathartes nesting sites to streams/rivers

The distance of red-headed picathartes colonies from water source ranged between 3 m and 20 m, with a mean value of 12.5 m. Colony 2 was the closest with a distance of 3 m, followed by Colony 6 with a distance of 8 metres while colony four was the farthest with a distance of 20 m (Figure 3).

Table 2: Differences in the mean nest height (m) of *Picathartes oreas* across the different colonies and locations.

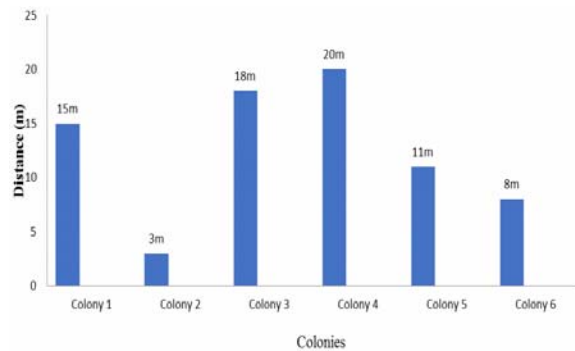| Parameters	Means±SE Height (m)	f	p
Colonies		6.55	0.031
C1	10.74±0.63a		
C2	2.34±0.24d		
C3	3.77±0.25c		
C4	10.44±0.36a		
C5	4.00±0.31c		
C6	6.33±1.53b		
Locations		10.47	0.009
Undisturbed	2.88±0.91b		
Disturbed	8.00±1.58a		

Figure 3. Distance of colonies of rock-fowl nesting sites from streams/rivers.

Tree species and family composition in Picathartes oreas *nesting sites*

A total of 68 tree species from 30 families were recorded in *P. oreas* nesting sites in the study area. There are more tree species in Colonies 1 and 2 (protected area) than in Colonies 3-6 (unprotected area) (Table 3). *Musanga cercropiode* species was common in the entire preferred habitat (Colony 1-6) of the red-headed picathartes. The vegetation was closed canopied in the park than in the community forest. There were higher species composition and diversity indices (Shannon index value of 3.352; 3.227) in the park than was recorded in the community forest (Shannon index value of 1.846) around red-headed picathartes habitats. Colony 1 had the highest Shannon index value of 3.352 followed by Colony 2 with a value of 3.227 while the least value was recorded in Colony 4 with a value of 1.846. However, Colony 4 and Colony 6 had the highest evenness value of 0.905 followed by Colony 1 with a value of 0.794 while Colony 3 had the least evenness value of 0.733 (Figure 4) and mean variance test on both Shannon and Simpson indexes revealed that there was significant different of woody plants species diversity between the undisturbed and disturbed habitats of rock-fowl's ($t = 4.70$, $df = 156.86$ while $p = <0. 001$ and $t = -2.19$, $df = 101.23$ while $p = 0.03$ (Table 4), respectively.

Table 3: Tree species and family richness recorded around the habitats of *Picathartes oreas*.

Colony	No. of tree species	No. of family
Colony 1	36	22
Colony 2	35	22
Colony 3	9	10
Colony 4	8	8
Colony 5	8	7
Colony 6	11	3

Table 4: Tree species diversity indices of rock fowl in both undisturbed and disturbed habitats.

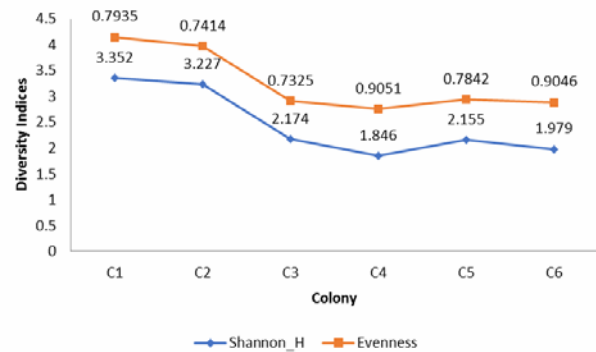|	Diversity	Variance	t	df	p
Shannon index			4.70	156.62	<0.001
Undisturbed	3.48	0.01			
Disturbed	2.77	0.01			
Simpson index			-2.19	101.23	0.03
Undisturbed	0.05	<0.001			
Disturbed	0.09	<0.001			

Figure 4. Evenness and Shannon diversity index of tree species recorded in the study-areas.
C = Colony.

Discussion

Estimating the population and habitat selection have important implications for conservation of rare and endangered bird species (Chalfoun and Schmidt, 2012; Rocha *et al* 2013). However, this presents a challenge when the species of study is an elusive and are habitat-specific species (such as the red-headed picathartes in a landscape where the species inhabits difficult and rugged terrain). Some habitats have better food resources, while others offer better protection against extreme climatic variations or offer safer locations for nest construction to decrease predation risk (Pinho, and Marini, 2013). This way, habitat availability and its quality directly act on survival and reproductive success.

The mean number of individuals 38±52 from six (6) colonies is low, an indication of the continued reduction in the population of the bird in Nigeria, which may be due to habitat destruction, disturbance and hunting (Atuo *et al* 2014, Odewumi and Abatcha, 2018). Though the birds were

sighted in both wet and dry seasons, they were commonly recorded during the rainy season. This may be attributed to the breeding season when reproductive activities like nest building, laying and incubation of eggs and caring for young made the bird to be more active and frequent in the location. This may also be as a result of the presence of water in the streams and rivers rich in crabs and fishes that the birds feed on as well as diverse range of invertebrates and small vertebrates (Fry, 2000). This is also in tandem with the statement by Ye *et al* 2019) that in the breeding season, animals may need greater environmental resources due to their own requirements and those of their offspring. The occurrence of red-headed picathartes colony in both protected and unprotected forest was as a result of limited habitable areas in the protected area cause by human activities and the availability of patchy emergent trees in the unprotected forest. This support the statement by Atuo *et al* 2016 that red-headed picathartes nesting sites were in the forest core, around forest edges and farmlands within close proximity (<200 m) to forested areas. Breeding sites within this habitat probably persisted due to a limitation of the highly specialised habitat required for nesting. Higher number (four) of colony of red-headed picathartes in the disturbed forest than the undisturbed forest implies that red-headed picathartes population can still survive in a relatively disturbed habitat that has rocks, hills, canopy cover and water sources. However, all the nests of red-headed picathartes were found in rugged terrain. This is in agreement with the statement by Thompson and Fotso (2000), that, red-headed picathartess inhabit closed-canopy, primary rainforest, but may have a greater tolerance for degraded habitat than previously believed. Thompson (2007); Birdlife International (2016), posited that Rock-fowls were capable of living near human habitation, as well as having their breeding sites within 30 m of a maize plot in Cameroon.

Nest-site selection is a vital component of avian habitat selection. It is thought that nest placement reflects selection for secure sites to minimize failure (Cancellieri and Murphy, 2014; Fu *et al* 2016). There were more nests of red-headed picathartes in the park than in the community forest. This implies that *P. oreas* prefers protected/undisturbed areas to build its nest than the unprotected/disturbed areas, probably for security, less disturbance, conduciveness of the breeding site and abundance of feeding materials. Red-headed picathartess prefer to construct their nests on rocks and caves, as all the nests observed were attached to the side of rocks. This is in tandem with Thompson (2007), which states that a rock-fowl nest needs to be built under an overhang of rock and cave, to protect it from water and the rock surface normally sloping forward slightly. This further confirm the assertion of Atuo *et al* 2016 that the occurrence of red-headed picathartes' nest sites was positively predicted by higher number of emergent trees, larger rocks and negatively related to disturbance matrices.

Red-headed picathartes is a rare and secretive forest species that breeds in highly specialized habitats in which its goes to an incredible length to build its nest at such a higher altitude to keep its young safe from harm and is skilled at overcoming natural adversity. The colonies/nesting sites of red-headed picathartes were found on high altitude with elevations ranging between 195 m and 529 m. This is to ward off disturbance and to provide security against predators on its offspring. This is in tandem with Fry (2000), and Del *et al* (2007), that rock-fowls specialise on rocky jungle habitat normally found between 450 m and 2,100 m (1,480 and 6,890 ft) above sea level and characterized by rocks, hills and with rugged terrain in forest covered in large boulders, caves and gorges as their preferred habitats type.

The majority of bird nests are differentiated structures that are constructed from a variety of materials which can generally be classified as being either structural materials (make up the general shape of the nest and provide structural support for the parents and offspring,) or lining materials (generally create a suitable microclimate in which parents can raise their offspring). (Hansell 2000). The mixture of mud and grass used to construct nests is probably to allow for easy sticking of the mud to the wall, to guarantee firmness and also to ensure that the needed warmth is impacted on the nest, while minimizing excessive cold regimes, while inside the nest. This is in conformity with Fry, (2000) and Bian *et al* (2006) which state that red-headed picathartes (*Picathartes oreas*) nest is a half-cup constructed of dry mud with grass fibres and dead leaves mixed in, often with the plant matter sticking out of the nest's walls. Elsewhere, common blackbirds living in cooler environments at higher latitudes within Great Britain built nests with thicker walls and consequently, greater insulatory properties, than conspecifics living in warmer environments at lower latitudes (Mainwaring *et al* 2014).

Furthermore, all the observed nests of the red-headed picathartes were on the south-eastern side of the rocks (the leeward side of the wind). This is probably because of south-eastern winds which blew cool and gentle wind from the Atlantic Ocean or perhaps the birds (*P. oreas*) were conscious of the direction of the wind to shield their nests away from the windward side, along with the north east trade wind and the fiery stormy rain which can be detrimental to the safety of their nests and chicks. The mean height of red-headed picathartes nest from the base of the rock was between 2.34±0.24 m to 10.74±0.63 m. This was probably for the prevention of intending predators and the protection of its young against predators. This was in line with Thompson (2007) who reported that the nests of the red-headed picathartes built on the rock surfaces were normally 1.2 to 5.2 m above the ground.

The red-headed picathartes preferred habitats close to water sources, especially during their breeding period so as to be able to reduce the amount of energy expended searching for food for their chicks and to provide adequate care and protection for the chicks. The average distance of 12.5 m to water sources recorded for red-headed picathartes colonies/nesting sites was to enable them to

feed around the stream especially where their colonies were located, where they picked up most of their diets, such as fish, snails, insects such that predators do not take advantage of their absence and prey on their young. This confirms the observations of Birdlife International, (2016) that *P. oreas* are mainly found in rocky areas of close canopied and fast-flowing streams, which help keep predators away from their nests.

The low diversity indices and patchy vegetation recorded at the unprotected forest was as a result of massive vegetation clearing that was taking place around the community forest for the purpose of agricultural activities. However, there were some emergent trees around the farmland to provide canopy for the birds. This is in conformity with the statements by Bian *et al* (2006) and Awa *et al* (2009), that in Cameroon many non-protected areas where red-headed picathartes occur, human activities such as logging and clearance of vegetation for agriculture occurs. This also support the statement by Atuo *et al* 2016 that red-headed picathartes are restricted to primary and secondary forest areas with enough emergent trees to provide a closed canopy around rock overhangs.

Conclussion

The distribution, abundance nesting site location was influenced by habitat availability and its quality. Red-headed picathartes colonies/nest locations was influenced by their ability for better food resources (closeness to streams), better protection against extreme climatic variations (close canopied forest) or to decrease predation risk (rugged terrain and claves), The findings on the characteristic features in the preferred habitat of red-headed picathartes revealed that rocks, river/streams, hills and valleys were the features recorded. This implies that, the *P. oreas* prefer rugged terrain and this may be one of the strategies to protect itself against predators. However, these species can be effectively protected by increasing forest protection through sound policies and sustainable land use practices, awareness creation and provision of sustainable livelihoods to rural populations.

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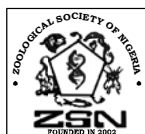
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