BirdPix – report on the photographic atlas of the birds of Nigeria, 2012–2019

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Ringim AS 2020. BirdPix – report on the photographic atlas of the birds of Nigeria, 2012–2019. Biodiversity Observations 11.4:1–10

Bird atlas, BirdPix, citizen science, Nigeiria

7 July 2020

Ornithology

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Abstract

This paper describes progress with the atlas of birds of Nigeria, from 7 March 2012 to 15 December 2019. The database of the project contained 658 records of 246 species submitted to the BirdPix section of the Virtual Museum. The BirdPix section of the Virtual Museum was launched in 2012 and is a supplementary data capture project for the African Bird Atlas. Over this period, for Nigeria, twelve citizen scientists contributed records to BirdPix. The most frequently recorded species were Laughing Dove *Streptopelia senegalensis* (769 records across its range, with 12 in Nigeria, from 12 grid cells), and Northern Red Bishop *Euplectes franciscanus* (30 records across the range, and recorded in 11 grid cells in Nigeria). At least two photographs of species range extensions had been submitted. This paper highlights the role of citizen science in biodiversity conservation and provides up-to-date information on the species distribution maps and lists of bird species recorded in the grid cells. Without a doubt, the BirdPix database will only be comprehensive if it contains the entire knowledge base of the species occurring within each grid cell. Data generated in the BirdPix project can be used for monitoring and modelling changes in species distributions over time. Increased awareness of the concept of citizen science and increased volunteer recruitment should be top priorities.

Keywords: Biodiversity mapping, Conservation, Public awareness, Species distribution

What is BirdPix, and why does it matter?

BirdPix is a photographic atlas of birds of Africa. It was launched in 2012. In Nigeria, the first record was uploaded into the BirdPix database on 7 March 2012, though historical records date back to 27 February 2007 (Figure 1). The goals of the project are (1) to assist with the mapping of the current distributions of birds occurring in Africa, and (2) to serve as a repository of photographic distribution records for this group (Loftie-Eaton *et al.* 2018). This ambitious project helps to provide up-to-date distribution maps for birds, important organisms within biodiversity research that serve as good indicators of environmental modification, and facilitates the prioritization of areas for biodiversity conservation (Donald *et al.* 2019).

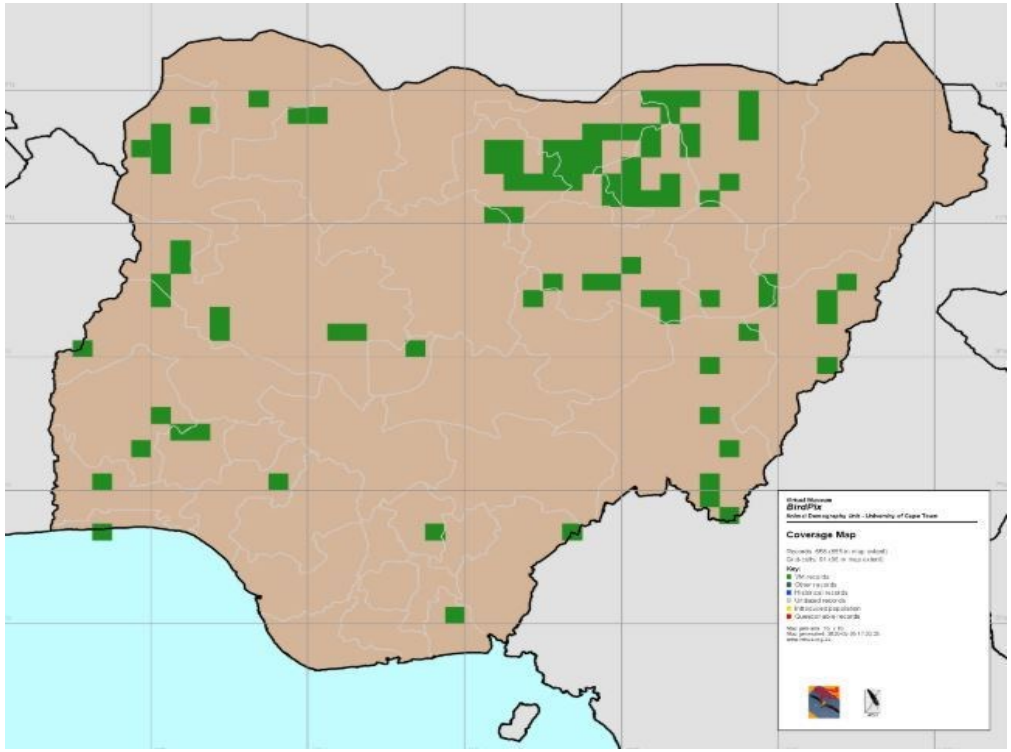

Figure 1. Distribution map of all BirdPix records in Nigeria, 2007–2019. Each green square is a quarter degree grid cell with at least one BirdPix record.

BirdPix is an excellent place to deposit photos of species that are outside of their normal ranges. For atlasers, it can be used to keep photos of species for which "Out of Range Forms" (ORFs) are generated. For bird ringers, BirdPix can be used to store interesting photos of birds in the hand; for example, pictures showing unusual patterns of wing moult, plumage variation with age and sex, etc. BirdPix is especially valuable as a source of incidental records for the formal Nigeria Bird Atlas Project (Tende *et al.* 2016) in that it enables people who are not confident of their bird identification skills to contribute to mapping distributions. Although the person uploading the photograph to BirdPix is encouraged to provide identification, the expert panel for the project tries to identify all records to species level.

Not only does BirdPix provide information about the current distribution of birds, but the backgrounds to the photos also help reveal information about the diversity of habitat types they depend on. Data from BirdPix has the potential to influence policy and decision making on issues related to biodiversity conservation, particularly for birds. In this paper, I summarize the records of the BirdPix database for Nigeria submitted over the period 7 March 2012 to 15 December 2019.

BirdPix database

This paper provides information related to BirdPix records of the birds of Nigeria as well as a distribution map. It makes use of the open-access citizen science database developed and managed by the Animal Demography Unit (ADU), the University of Cape Town, South Africa (Fitzpatrick Institute of African Ornithology, available online as BirdPix at *http://vmus.adu.org.za/?vm=BirdPix*). This paper is based on species recorded in the quarter degree grid cells (QDGCs) in Nigeria

What is citizen science?

Citizen science is a concept which engages the public in a scientific project (Kobori *et al.,* 2016), or otherwise involves public participation in some or all aspects of biodiversity and environmental assessments (Chandler *et al.* 2017). On one hand, citizen scientists are people who have chosen to use their free time and resources to engage in scientific processes (Louv & Fitzpatrick 2012). Through this concept, scientists and the public share ecological knowledge, taxonomic skills and awareness of biodiversity loss through collaborative research projects at national, regional or geographic scales. These include, for example, bird atlases, i.e. monitoring trends of bird populations, migration, etc.; aquatic insect counts; sea turtle surveys; and reef fish surveys (Louv & Fitzpatrick 2012). This approach to biodiversity mapping (biomapping) has a long history dating back to the beginning of science and natural history observation, including the work of John Ray, the great 17th-century naturalist who involved many volunteers in specimen collection (Kobori *et al.* 2016).

Nevertheless, the concept of citizen science has only gained tremendous attention in recent decades; in particular, due to increasing threats to biological diversity and the need to map the distributional patterns of species and ensure their conservation. Citizen scientists can generate huge datasets which have yielded important discoveries and results such as tracking biological changes and the impacts of environmental, anthropogenic and climatic phenomena on biodiversity (Donnelly *et al.* 2014). Worldwide, a number of organizations are involved in citizen science movements, such as the National Wildlife Federation of the United States, the Woodland Trust in the United Kingdom, and Fitzpatrick Institute of African Ornithology, South Africa (Louv & Fitzpatrick 2012). In Nigeria, the A.P. Leventis Ornithological Research Institute (APLORI) runs and promotes citizen science, with fewer than 200 volunteers as of June 2020 *http://nigeriabirdatlas.adu.org.za/coverage.php*

History of citizen science and biomapping in Nigeria

The formal launch of the Nigeria Bird Atlas Project (NiBAP) in November 2015 largely marked the beginning of organized citizen science in Nigeria. NiBAP is an initiative of the APLORI, launched with technical support from the ADU, who successfully managed the Southern African Bird Atlas Project (SABAP) for over 10 years. With the primary aim of engaging citizen participation to update and map the distributions of birds in Nigeria, NiBAP started with a project team of just three individuals at its launch. However, participation has gradually grown since

then to include over 190 individuals in June 2020 *http://nigeriabirdatlas.adu.org.za/coverage.php*

Public awareness and participant engagement were mainly carried out via seminars and training workshops at Universities across the country. One such event, titled "Atlasing and monitoring in Africa" was conducted in November 2017, with APLORI collaborating with the ADU to host two days of meetings between managers, stakeholders and other key citizen scientists to discuss current and ongoing atlas and monitoring schemes based on the protocol developed by the ADU. During this meeting, Dr. Megan Loftie-Eaton delivered a presentation titled "The Virtual Museum (VM)" and introduced the idea of biomapping through nature photography, also highlighting the role of citizen scientists in biomapping through the VM project. These projects include BirdPix (distribution maps

Table 1. Bird observers who submitted records from Nigeria to the BirdPix database before 15 December 2019.

Observer	Records
Ringim, Abubakar S.	476
Dickson, Rob	70
Underhill, Les	53
Owolabi, Bibitayo A.	36
Cronje Pieter	27
Okafor, Chioma	26
Rodstrom, Gunilla	6
Talatu, Tende	4
Elstadt, Cobus	4
Adekola, Oluwadunsin	3
Braimoh, Bukola	3
Elisha, Emmanuel Barde	1

Table 2. The 30 most recorded species in Nigeria in the BirdPix database on 15 December 2019. The first column provides the BirdPix species codes and the final column the number of records.

Code	Family	Species	Common name	n
317	Columbidae	*Streptopelia senegalensis*	Laughing (Palm) Dove	12
3748	Ploceidae	*Euplectes franciscanus*	Northern Red Bishop	11
846	Viduidae	*Vidua macroura*	Pin-tailed Whydah	9
851	Viduidae	*Vidua chalybeata*	Village Indigobird	9
3506	Alaudidae	*Galerida cristata*	Crested Lark	9
129	Accipitridae	*Milvus aegyptius*	Yellow-billed Kite	8
2032	Glareolidae	*Pluvianus aegyptius*	Egyptian Plover (Crocodile-bird)	8
3974	Estrildidae	*Uraeginthus bengalus*	Red-cheeked Cordon Bleu	7
161	Accipitridae	*Accipiter badius*	Shikra (Little Banded Goshawk)	7
410	Meropidae	*Merops pusillus*	Little Bee-eater	7
264	Scolopacidae	*Tringa glareola*	Wood Sandpiper	7
1702	Pycnonotidae	*Crinifer piscator*	Western Grey Plantain-eater	7
3972	Ploceidae	*Sporopipes frontalis*	Speckle-fronted Weaver	7
1530	Coraciidae	*Coracias abyssinica (C. abyssinicus)*	Abyssinian Roller	7
1031	Charadriidae	*Vanellus spinosus*	Spur-winged Plover (Lapwing)	7
872	Fringillidae	*Emberiza tahapisi*	Cinnamon-breasted (Rock) Bunting	6
3996	Viduidae	*Vidua orientalis*	Northern (Sahel) Paradise-Whydah	6
3852	Passeridae	*Passer griseus*	Northern Grey-headed Sparrow	6
163	Accipitridae	*Melierax metabates*	Dark Chanting-Goshawk	6
11491	Pycnonotidae	*Pycnonotus barbatus*	Common Bulbul	6
2274	Laniidae	*Corvinella corvina*	Yellow-billed Shrike	6
797	Ploceidae	*Ploceus cucullatus*	Village (Spotted-backed) Weaver	6
355	Centropodidae	*Centropus senegalensis*	Senegal Coucal	6
311	Columbidae	*Columba guinea*	Speckled (Rock) Pigeon	6
517	Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo	6
394	Cerylidae	*Ceryle rudis*	Pied Kingfisher	5
4104	Fringillidae	*Serinus leucopygius*	White-rumped Seedeater	5
424	Bucerotidae	*Tockus nasutus*	African Grey Hornbill	5
1880	Columbidae	*Streptopelia vinacea*	Vinaceous Dove	5
1660	Psittacidae	*Poicephalus senegalus*	Senegal Parrot	5

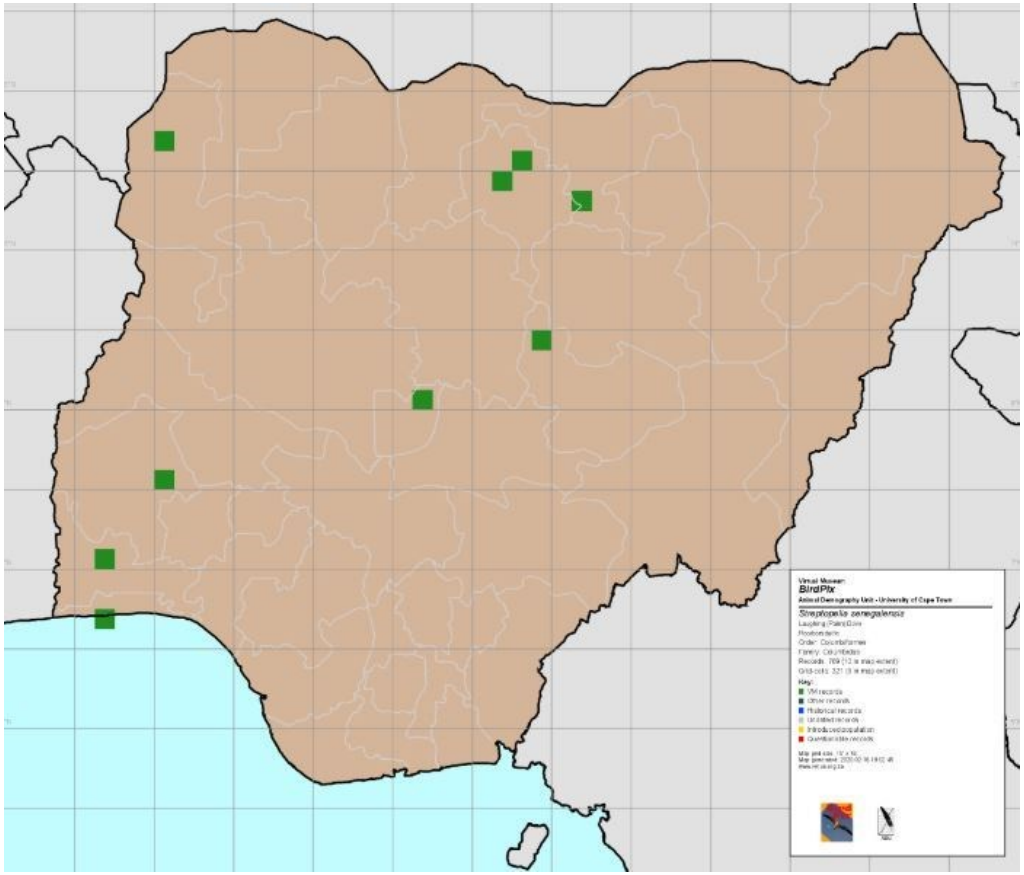

Figure 2. BirdPix distribution map for *Streptopelia senegalensis* in Nigeria .

for birds), FrogMAP (distribution maps for amphibians), LepiMAP (distribution maps for butterflies and moths), and ScorpionMAP (distribution maps for scorpions).

Through advocacy and creating continued awareness, participation in citizen science projects continues to grow in Nigeria. However, there appears to have been relatively greater engagement in NiBAP than in biomapping projects in Nigeria. By 15 December 2019 there were 12 contributors to the BirdPix project in Nigeria (Table 1). Concerted efforts to promote increased public engagement in biomapping via the VM project are therefore badly needed. The VM has enormous potential, considering the relatively low level of expertise required to participate and the diversity of taxa represented, including reptiles, mushrooms, spiders, scorpions, dragonflies, etc.

Figure 3. On 15 December 2019, there were 769 records of *Streptopelia senegalensis* in the BirdPix database across Africa. This Nigerian record is curated at http://vmus.adu.org.za/?vm=BirdPix-107132.

Is there a gap?

Mapping the distributions of over 900 bird species in Nigeria (Dowsett 2018) within each QDGC is indeed a huge challenge. As Nigeria's biodiversity is predicted to plummet, largely due to increasing human population, urbanization, habitat loss, and pollution, mapping the distribution of birds is particularly urgent. A strong understanding of bird distributions will ensure the successful conservation of birds and other taxa, since birds are good umbrella species (Roberge *et al.* 2008).

How many records were submitted to BirdPix?

A total of 658 photographic records were submitted from Nigeria to the BirdPix database up to 15 December 2019. These included 246 spe-

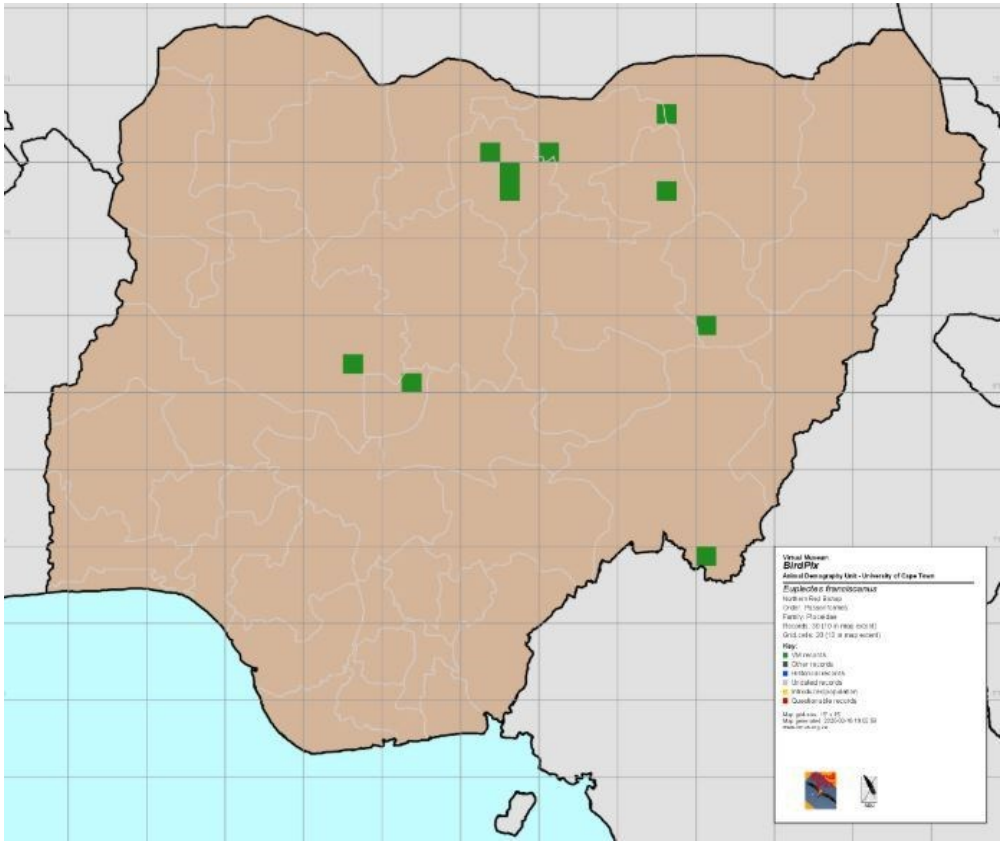

Figure 4. BirdPix distribution map for *Euplectes franciscanus* in Nigeria.

cies and were made in 90 quarter degree grid cells (Figure1). Thirty species have at least five BirdPix records (Table 2). The two most frequently recorded species were Laughing Dove *Streptopelia senegalensis* (recorded in 12 grid cells),(Figures 2 and 3) and Northern Red Bishop *Euplectes franciscanus* (11 grid cells) (Figures 4 and 5).

Are there remarkable submissions in the BirdPix database from Nigeria?

Since 2012, citizen scientists have made important but interesting submissions to the BirdPix project. Though every species is considered valuable, there are a few outstanding submissions which highlight the

Figure 5. On 15 December 2019, there were 30 records of *Euplectes franciscanus* in the BirdPix database across western and eastern Africa, between Senegal and Ethiopia. This is one of the 11 Nigerian records in BirdPix, curated at http://vmus.adu.org.za/?vm=BirdPix-84550.

Figure 6. BirdPix record 107184, *Passer domesticus* from Potiskum, Yobe State, submitted by the author. It epresents a westward range expansion. Further details are at http://vmus.adu.org.za/?vm=BirdPix-107184

importance of citizen science. BirdPix No. 107184 is a record of House Sparrow *Passer domesticus* from Potiskum, Yobe State, on 4 October 2018 (*http://vmus.adu.org.za/?vm=BirdPix-107184*) (Figure 6). The second record of this species was from Azare, Bauchi State, on 1 February 2019 (curated at *http://vmus.adu.org.za/?vm=BirdPix-71542*). The distribution of the species was previously confined to the far north-eastern corner of the country (Borrow & Demey 2014). Wilson & McGregor (2002) reported the first sighting of the species at Baga, Lake Chad, Borno State. These records (in Potiskum and Azare, respectively) indicate a westward range extension of the species (Ringim *et al.* 2019).

BirdPix No. 99229 is a record of Grey-backed Fiscal *Lanius excubitoroides* from Yola, Adamawa State, on 4 December 2019 (Figure 7). This photographic record provides the first proof of the extension of the species' known range by *c*. 300 km south-westwards of its previously documented distribution in Nigeria (Ringim *et al.* 2020).

Photographic evidence of the occurrence of threatened species is of value to conservation managers. The BirdPix database contained 11 records of seven Red List species on 15 December (2019) (Table 3).

How do I participate in the BirdPix project?

In order to take part in the BirdPix project, you only need to take photos of birds and upload them to the BirdPix section of the Virtual Museum website at *http://vmus.adu.org.za/*. Do not worry if you cannot identify the photographed species, as an expert panel does this. Taking photographs of birds can be easy, as many species spend most of their time foraging or roosting. This provides the opportunity to take photographs at several angles. Moreover, many species occupy a specific niche, and will generally remain within the niche long enough to take several photographs from different angles.

Before uploading to the Virtual Museum, you need to register as a citizen scientist. The registration process is described here: *https://www.slideshare.net/Animal_Demography_Unit/how-to-register-as-a-citizen-scientist-with-the-animal-demography-unit*. Once registered, log on to the website using your email address and password. The "Data upload" section now becomes visible. The critical information that needs to be uploaded into the database is date, location, and a series of one to a maximum of three photographs of a single species, preferably different angles of the same individual. Guidance on the upload process is provided in this slideshow: *https://www.slideshare.net/Animal_Demography_Unit/how-to-submit-records-to-the-virtual-museums*

The expert panels and the most experienced citizen scientists will in most cases confirm species identifications within a week. Some records take longer, in part due to large numbers of submissions and the fact that for some photos, species-level identification is not possible (Underhill *et al.* 2018). Records are sometimes identified to genus or

Figure 7. BirdPix record 99229, *Lanius excubitoroides* from Yola, Adamawa State. This record is also a range extension, submitted by the author to the BirdPix database. Further details are at *http://vmus.adu.org.za/?vm=BirdPix-99229*

family level, whereas some species can readily be identified from a poor, even partially blurred photograph (Underhill *et al.* 2018). However, a few species can only be identified in the hand, mostly Warblers and Cisticolas. As a beginner participant, the best strategy for receiving positive confirmed identification is to submit the best photograph. The most important parts of the bird to have in sharp focus are the face and wing. There is an exceptional field guide to the *Birds of Western Africa* written by Nik Borrow and Ron Demey. It is published by Princeton or Helm. It describes and illustrates 1300 bird species occurring in all 23 countries of Western Africa (Borrow & Demey 2014).

What instruments do I need?

To make a submission to the BirdPix project, you only need a smartphone or digital camera for taking photographs. Then follow the upload procedure described above. For location coordinates, you do not necessarily need a Global Positioning System (GPS) to take point coordinates, because the VM website is equipped with Google Earth and Map to help you locate the point where the species was photographed.

Primary challenges facing citizen science in Nigeria

Although citizen science has long been in existence, its development in Nigeria as in most African countries is still in its infant stage and is largely challenged by a lack of strong enthusiasm among citizens. This is mainly from lack of awareness on the importance of biomapping and conservation, but also poverty since not many citizens are willing to sacrifice their resources and time for data collection. Moreover, those with keen interest are constrained by limited access to resources and field instruments like binoculars, cameras, and transport, making it difficult to go out and report observations. On one hand, some withdraw from the project after realizing that it is an unpaid activity. Uncertainties including insecurity, kidnapping, insurgency, and banditry are also considerable challenges affecting citizen science participation across the country. This is on the grounds that citizen scientists do not have a sense of security going out to the bush for biomapping. In some cases, citizen scientists are misunderstood by security personnel and locals as informants to kidnappers or bandits because of their gear, for example, binoculars and digital cameras they carry.

Conclusions and recommendations

This paper highlights the content of the BirdPix database in Nigeria. It provides up-to-date information on the species distribution maps and lists of bird species recorded in the BirdPix project's grid cells. Without a doubt, the BirdPix database will only be comprehensive if the database contains the entire knowledge base of species occurring within each QDGC. Data generated in the BirdPix project can be used for

Table 3. The seven globally threatened species (based on the IUCN RedList) in the BirdPix database for Nigeria as of 15 December 2019

Code	Scientific name	Common name	Red List	n	Last recorded
108	*Torgos tracheliotus*	Lappet-faced Vulture	EN	1	23-01-2009
111	*Neophron percnopterus*	Egyptian Vulture	EN	1	07-03-2012
110	*Necrosyrtes monachus*	Hooded Vulture	CR	5	13-10-2019
107	*Gyps africanus*	White-backed Vulture	CR	1	27-02-2007
109	*Trigonoceps occipitalis*	White-headed Vulture	CR	1	27-02-2007
3894	*Ploceus bannermani*	Bannerman's Weaver	VU	1	14-05-2018
151	*Terathopius ecaudatus*	Bateleur	NT	1	22-06-2019

monitoring and modelling changes in species distribution, and composition over time (Underhill *et al.* 2018). Increasing local awareness of the concept of citizen science and recruiting more volunteers should be top priorities.

Acknowledgements

I dedicate this paper to the memory of Rob Dickinson, who played a vital role in assembling photographic data of African biodiversity in the Virtual Museum. I would like to appreciate all the citizen scientists for their photographs. The A.P. Leventis Ornithological Research Institute (APLORI) invited me to the first workshop on Atlasing and Monitoring in Africa in 2017, which significantly improved my knowledge about biomapping, and I am extremely grateful. Dr. Megan Loftie-Eaton and Karis Daniel proofread and provided invaluable assistance in writing this manuscript. Dr. Sam T. Ivande helped with vital information on the history of citizen science in Nigeria.

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Editorial acknowledgements

Les Underhill thanks Karis Daniel and Megan Loftie-Eaton for assistance with the production of this paper.

Biodiversity Observations

The scope of Biodiversity Observations includes papers describing observations about biodiversity in general, including animals, plants, algae and fungi. This includes observations of behaviour, breeding and flowering patterns, distributions and range extensions, foraging, food, movement, measurements, habitat and colouration/plumage variations. Biotic interactions such as pollination, fruit dispersal, herbivory and predation fall within the scope, as well as the use of indigenous and exotic species by humans. Observations of naturalised plants and animals will also be considered. Biodiversity Observations will also publish a variety of other interesting or relevant biodiversity material: reports of projects and conferences, annotated checklists for a site or region, specialist bibliographies, book reviews and any other appropriate material. Further details and guidelines to authors are on the journal website (https://journals.uct.ac.za/index.php/BO/).

ISSN 2219-0341

Editors: PN Laver and LG Underhill