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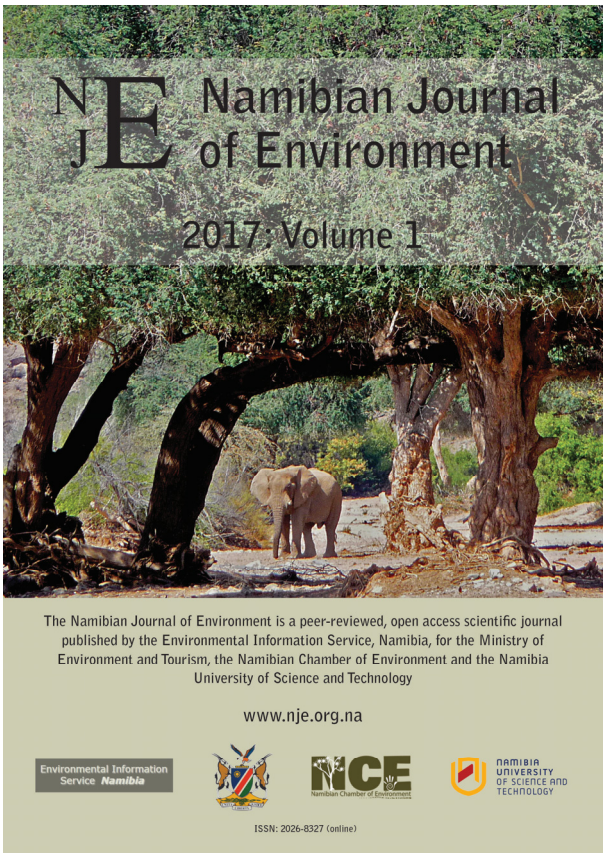

SECTION A: PEER-REVIEWED PAPERS

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Oxpeckers in Namibia: A review of their status and distribution in 2017

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ABSTRACT

Red-billed Oxpecker, *Buphagus erythrorhynchus,* and Yellow-billed Oxpecker, *B. africanus,* occur in Namibia with populations restricted to the extreme north-eastern parts (both species) and north-western parts of the country (Yellow-billed Oxpecker). The Red Data status of Red-billed Oxpecker in Namibia is Rare or Peripheral while Yellow-billed Oxpecker is considered Endangered. Assessments of the status of Namibian populations were made in 1983, 1984-85 and 1997-98. The aim of this study was to determine if their status and distribution had changed since the previous assessments and to ascertain the range of hosts used by the two species. The Red-billed Oxpecker population appears to have remained unchanged in terms of both numbers of birds (around 3,600 birds) and distribution. Cattle remain their most important host although a range of other hosts are used, including 10 game species, two equine species and two livestock species. The Yellow-billed Oxpecker population in the north-east may have increased but remains low (at around 2,300 birds) and there is evidence to suggest that its range has contracted. For the Yellow-billed Oxpecker in the north-east, the primary hosts are cattle and buffalo, *Syncerus caffer,* with these birds using seven game species, one equine species and one livestock species. In the north-west, Yellow-billed Oxpecker appears to have expanded its range and, as no assessment of the numbers of birds was made here, it is suggested that future efforts focus on determining population estimates for this population which was previously considered to be marginal in Namibia.

Keywords: *Buphagus africanus*; *Buphagus erythrorhynchus*; distribution; host species; Namibia, oxpecker; population status

INTRODUCTION

Oxpeckers feed primarily on ectoparasites, mucus and necrotic tissue present on ungulate hosts, and previous studies have recorded birds on a wide range of ungulate species (Stutterheim 1981, Stutterheim & Panagis 1985a, Hustler 1987, Hart et al. 1990, Mooring & Mundy 1996, Koenig 1997).

In Namibia, oxpeckers are currently limited to the extreme north-eastern and north-western parts of the country, although their historical distribution was much broader. The Red Data status of Yellow-billed Oxpecker, *Buphagus africanus,* in Namibia is listed as Endangered while Red-billed Oxpecker, *B. erythrorhyncus,* is considered Rare and Peripheral (Simmons et al. 2015). Both species of oxpecker are found in Kavango East, eastern Kavango West and Zambezi regions, while the Yellow-billed Oxpecker is also found in Kunene Region.

Declines in bird numbers and their distribution in southern Africa since the mid-1900s have been largely attributed to the use of arsenic-based cattle dipping schemes (Stutterheim & Brooke 1981, Stutterheim 1982). These methods of parasite control have since been replaced in Namibia. A recent reintroduction was undertaken in Otavi district in Namibia where 15 Red-billed Oxpeckers were released in an attempt to re-establish this species in part of its former range (Nebe & Nebe 2015). In 2017 the first case of successful breeding was recorded (B Nebe pers com).

Assessments of the status of Red-billed Oxpecker and Yellow-billed Oxpecker in Namibia were undertaken in 1983 (Brown & Brown 1987), 1984-85 (Stutterheim & Panagis 1985b), and 1997-98 (Robertson & Jarvis 2000). These studies dealt specifically with oxpeckers in the Zambezi region and predominantly with their presence in relation to cattle hosts. No recent oxpecker specific surveys in Namibia have been published, however some indication of relative abundance and distribution is available from the ongoing Southern African Bird Atlas Programme (SABAP) run by the Animal Demography Unit at the University of Cape Town (Harrison *et. al*. 1997, http://sabap2.adu.org.za).

In this study we report on surveys of both species of oxpecker, carried out in Kavango East and Zambezi regions (hereafter referred to as the north-east) and Kunene region (hereafter referred to as the north-west) in Namibia between 2010 and 2017. We present results from two types of counts and (a) assess host preferences between the two species, (b) provide estimates of bird numbers across the main host species, and (c) map the current distributions of each oxpecker species, comparing these with both SABAP1 (Mundy 1997a, 1997b) and SABAP2 distribution maps (http://sabap2.adu.org.za).

METHODS

Sampling

Between 2010 and 2017 field records were collected whilst driving to and from locations in Kavango East and Zambezi regions and Kunene region. In total, 49 counts were undertaken, comprising both *casual* counts (29 counts) where only host groups that contained oxpeckers were counted and *inclusive* counts (20 counts in the north-east) where all potential hosts and any oxpeckers present were counted. In the north-east, inclusive counts were undertaken across the entire Zambezi Region (former Caprivi strip), both inside and outside the state protected areas and including all game and domestic host species. Inclusive counts are important for the determination of oxpecker:host ratios which can be applied to host population figures to estimate bird numbers across an area. Inclusive counts were undertaken along the margins of the Kwando and Okavango rivers in 2010-2013, and along all the main road networks of eastern Zambezi region in 2017.

While casual counts alone cannot provide population estimates because they do not include all potential host animals, when combined with inclusive counts they allow a more robust assessment to be made of:
1) the range of host species used by each oxpecker species (with an indication of preference), and
2) the spatial distributions of the two species.

In the north-west of the country, only casual counts were made across an area ranging from the western boundary of Etosha National Park to Namibia's northern boundary with Angola. For all counts, host animals and oxpeckers were counted and the following details were recorded: date, time, GPS coordinates, host species, number of host animals, and number of oxpeckers of each species. For inclusive counts, the start and stop GPS coordinates were also recorded.

Analysis

Data were summarised for each oxpecker species separately, for both inclusive and casual counts. Data were tabulated to tally host groups, host numbers and bird numbers for each game and domestic host species.

For inclusive counts bird:host ratios were determined. As inclusive counts were only undertaken in the north-east, population estimates for each bird species could only be obtained for that area. Counts between 2010 and 2013 were primarily undertaken in wildlife areas proximal to the Okavango and Kwando river systems. These counts were therefore amalgamated and used to derive bird:host ratios on game species. In 2017 a comprehensive inclusive count along approximately the same road network counted in previous studies (Brown & Brown 1987, Sutterheim & Panagis 1985b, Robertson & Jarvis 2000) was conducted with the primary aim to determine bird presence and bird:host ratios on livestock.

The most recently available data on cattle numbers in Zambezi Region and East Kavango were obtained from the Department of Veterinary Services. Estimated numbers of wildlife hosts were obtained from numbers of wildlife seen during the Zambezi game count of 2016 (http://www.nacso.org.na).

All counts (both casual and inclusive) were used to map the presence of each bird species at the resolution of monad (1 minute x 1 minute) grid squares. Data from both the SABAP1 and SABAP2 programmes were compiled for purposes of comparison, however these data were only available at a coarser level of resolution i.e. quarter degree squares for SABAP1 and pentad squares (5 minute x 5 minute) for SABAP2.

RESULTS

Oxpeckers and host species

In the north-east a total of 969 Red-billed Oxpeckers was recorded on 307 host groups and 739 Yellow-billed Oxpeckers were recorded on 142 host groups. In the north-west, casual counts recorded 198 Yellow-billed Oxpeckers on 61 host groups (Table 1).

Host utilisation and preference - North-east

Red-billed Oxpecker was recorded on 10 game species, two equine species (donkey, horse) and two livestock species (cattle, goat). In both casual and inclusive counts kudu, impala and buffalo were the most common game hosts (Table 2a, 2b, scientific names of game species are given in Table 2a). Cattle were the most important domestic livestock hosts, followed by donkeys (Table 2c).

Yellow-billed Oxpecker was recorded on seven game species, one equine species (donkey) and one livestock species (cattle). Both buffalo and kudu

accounted for most birds on game hosts in casual counts (Table 2a) although birds were detected only on buffalo in inclusive counts despite a large number of kudu groups (85) being recorded (Table 2b). As with Red-billed Oxpecker, cattle were the most important livestock hosts, with a few birds being recorded on donkeys (Table 2c).

Host utilisation and preference - North-west

Only Yellow-billed Oxpecker is present in the north-west and it was only recorded on equine and bovine hosts (horse, donkey and cattle) (Table 3). No birds were observed on game animals (Table 4) despite the fact that substantial numbers of a wide range of potential game host species were observed each year.

Table 1: *Count summary: number of host groups and numbers of Red-billed and Yellow-billed Oxpeckers recorded between 2010 and 2017, in the north-east and north-west of Namibia.*

	North-East					North-West	
		Red-billed Oxpecker		Yellow-billed Oxpecker		Yellow-billed Oxpecker	
Year	Total number of Host Groups	Host Groups with birds	Number of birds	Host Groups with birds	Number of birds	Host Groups with birds	Number of birds
2010	189	56	182	28	133		
2011	185	38	114	11	143	21	35
2012	146	105	350	52	196	15	45
2013	373	65	202	27	172	10	32
2014	27	15	50	13	42	1	5
2015	13	6	23	8	28	14	81
2017	178	22	48	3	25		
	1111	**307**	**969**	**142**	**739**	**61**	**198**

Table 2a: *Number of hosts, host groups and number of associated Red-billed and Yellow-billed Oxpeckers recorded during casual counts in the north-east of Namibia between 2010 and 2017.*

Total Hosts				RBO where present			YBO where present		
Host	Total Groups	Total Hosts	Avg. Group size	Host Groups	Hosts	RBOs	Host Groups	Hosts	YBOs
Roan antelope *Hippotragus equinus*	7	34	5	5	20	23	3	20	10
Giraffe *Giraffa camelopardalis*	1	7	7	1	7	8			
Hippo *Hippopotamus amphibius*	3	20	7	3	20	14	1	4	1
Sable antelope *Hippotragus niger*	6	82	14	4	56	16	2	26	6
Tsessebe *Damaliscus lunatus*	1	6	6	1	6	1			
Warthog *Phacochoerus africanus*	5	23	5	3	12	5	2	11	6
Zebra *Equus quagga*	4	50	12	4	50	12			
Kudu *Tragelaphus strepsiceros*	52	280	5	39	198	110	15	94	57
Buffalo *Syncerus caffer*	20	1159	58	6	159	31	15	1059	188
Impala *Aepycerus melampus*	14	332	24	14	332	42	1	41	2
	113	**1993**	**143**	**80**	**860**	**262**	**39**	**1255**	**270**
Horse	2	4	2	2	4	9			
Donkey	15	44	3	11	34	40	5	13	15
Goat	3	50	17	3	50	7			
Cattle	217	4406	20	157	2988	487	85	2130	303
	237	**4504**	**42**	**173**	**3076**	**543**	**90**	**2143**	**318**

Table 2b: *Number of game hosts and groups and number of associated Red-billed and Yellow-billed Oxpeckers recorded during inclusive counts in the north-east of Namibia between 2010 and 2013.*

Total Hosts				RBO where present			YBO where present			Birds per host	
Host	Total Groups	Total Hosts	Avg. Group size	Host Groups	Hosts	RBOs	Host Groups	Hosts	YBOs	RBO	YBO
Roan	6	25	4				1	11	12		0.48
Giraffe	8	32	4	2	9	8				0.25	
Hippo	11	33	3								
Sable	10	38	4	1	6	2	1	1	2	0.0526	0.0526
Tsessebe	8	49	6								
Warthog	30	86	3								
Zebra	16	162	10								
Kudu	85	316	4	7	37	16				0.0506	
Buffalo	27	834	31	2	102	11	4	377	91	0.0132	0.1091
Impala	154	1706	11	3	62	10				0.0059	

Table 2c: *Number of livestock hosts and groups, and number of associated Red-billed and Yellow-billed Oxpeckers recorded during inclusive counts in the north-east of Namibia in 2017.*

Total Hosts				RBO where present			YBO where present			Birds per host	
Host	Total Groups	Total Hosts	Avg. Group size	Host Groups	Hosts	RBOs	Host Groups	Hosts	YBOs	RBO	YBO
Goat	34	540	16								
Cattle	139	2079	15	22	344	48	3	76	25	0.0231	0.012

The average group size of both species of oxpeckers on different host species ranged from 1 to 5.5, with the exception of Yellow-billed Oxpeckers on buffalo, which averaged about 15. This high average was influenced by a group of 70 Yellow-billed Oxpeckers recorded on a herd of buffalo in the north-east (Table 4).

Estimates of bird numbers in the north-east

By using known or estimated host numbers, and applying the bird:host ratios obtained from the inclusive counts, we derived population estimates for both oxpecker species. Buffalo are transient in the north-east and associated with the perennial water courses. Their numbers in Namibia vary over time as they move to and from neighbouring countries. Wetland counts undertaken between 2004 and 2014 along the Kwando river showed a range in animals seen from 1,297 – 6,556 over four counts (Du Preez et al. 2015). The number of 3,173 buffalo seen in the 2016 Zambezi game count falls in the middle of these values. Cattle numbers in the north-east have remained relatively stable over the long term but show some fluctuation between years. In order to derive a typical number for cattle in the north-east we used an average of values available for Zambezi and Kavango East during the time span of this study (Table 5).

Where available, bird:host ratios for each game species and cattle were applied to derive estimates of Red-billed Oxpecker and Yellow-billed Oxpecker populations in the north-east (Table 6).

It is estimated that there are at least approximately 3,600 Red-billed Oxpeckers in the north-east with the vast majority of these birds being associated with cattle (Table 6). The estimate for Yellow-billed Oxpecker in the north-east is around 2,290. In contrast to Red-billed Oxpecker there are around half

Table 3: *Number of livestock hosts and groups, and number of associated Yellow-billed Oxpeckers recorded during casual counts in the north-west of Namibia between 2010 and 2015.*

	Where birds were present		
Host	Host Groups	Host Numbers	YBO
Donkey	21	81	58
Horse	2	10	8
Cattle	36	412	125

Table 4: *Range in group size and average group size of oxpeckers on all host species in the north-east and north-west of Namibia between 2010 and 2017.*

	North-East				North-West	
	Red-billed Oxpecker		Yellow-billed Oxpecker		Yellow-billed Oxpecker	
Host	Range	Average	Range	Average	Range	Average
Roan antelope	2-12	4.6	2-12	5.5		
Giraffe	3-8	5.3				
Hippo	4-6	4.7	1	1.0		
Sable antelope	1-7	3.6	1-5	2.7		
Tsessebe	1-1	1.0				
Warthog	1-2	1.7	1-5	3.0		
Zebra	1-9	3.0				
Kudu	1-10	2.7	1-13	3.8		
Buffalo	1-12	5.3	2-70	14.7		
Impala	1-7	3.1	2	2.0		
Horse	3-6	4.5			4	4.0
Donkey	1-10	3.6	1-5	3	1-8	2.8
Goat	1-4	2.3				
Cattle	1-12	3.0	1-19	3.8	1-28	3.5

Table 5: *Cattle numbers in north-east Namibia between 2010 and 2014. Data were provided by the Department of Veterinary Services, Ministry of Agriculture, Water and Forestry, Namibia.*

Year	Cattle	Sheep	Goat	Horse	Donkey
2014	162,007	15	4,812	12	31
2013	141,634	35	3,703	0	103
2012	136,603	161	11,589	15	267
2010	152,823	163	10,443	12	117
Average	148,270	90	7,640	10	130

Table 6: *Current estimates of Red-billed and Yellow-billed Oxpecker numbers on game and cattle in north-east Namibia.*

Hosts		Red-billed Oxpecker		Yellow-billed Oxpecker**	
Game*	Animals	Birds per host	Estimate	Birds per host	Estimate
Roan	263			0.48	126
Giraffe	120	0.25	30		
Sable	691	0.0526	36	0.0526	36
Kudu	891	0.0506	45		
Buffalo	3,173	0.0132	42	0.1091	346
Impala	2,183	0.0059	13		
			166		508
Livestock					
Cattle	148,270	0.0231	3,425	0.012	1779
Overall			3591		2287

** Numbers for game species are actual numbers sighted in transect counts across the region and are therefore an underestimate of available hosts. The numbers of oxpeckers on game animals are therefore likely to be higher than the estimates presented here.*
*** The ratio for Yellow-billed Oxpeckers was derived from bird sightings on only three host groups.*

Table 7: *Comparison of current and historical bird:host ratios and estimates for Red-billed and Yellow-billed Oxpecker on cattle hosts in the north-east of Namibia.*

	1983-84[a]		**1997-98**[b]		**2017**	
	Bird:host	Estimate	Bird:host	Estimate	Bird:host	Estimate
RBO	0.0519-0.0845	2285-3780	0.0293-0.0396	3627-4902	0.0231	3,425
YBO	0.0461-0.0491	2062-2200	0.0027*	334	0.012**	1,779

[a] *From Brown & Brown 1987 and Stutterheim & Panagis 1985b. Estimates were derived in Robertson & Jarvis 2000.*
[b] *From Robertson & Jarvis 2000*
** Ratio derived from sightings of YBO on only six groups over three counts*
*** Ratio derived from only three bird groups one of which contained 16 birds. This ratio should be considered with caution.*

as many Yellow-billed Oxpeckers on cattle/livestock and the greater importance of game hosts, particularly buffalo, kudu (from casual counts), roan and sable antelope to this oxpecker species is evident.

A comparison of past bird:host ratios on cattle (Table 7) suggests a gradual reduction since the 1980s for Red-billed Oxpecker although the gradual increase and then stabilisation of cattle numbers in the region has had the effect of keeping the oxpecker population relatively constant. Relative to the Red-billed Oxpecker the sighting frequency of Yellow-billed Oxpecker on cattle remains low. In the three counts done by Robertson and Jarvis in 1997 and 1998 Yellow-billed Oxpecker was only observed on one, three and two host groups respectively. In the current count oxpeckers were only observed on three cattle groups.

Oxpecker distributions

Red-billed Oxpecker was observed throughout both the western and eastern parts of the north-east and in the multiple-use zone of Bwabwata National Park (Figure 1). Its distribution has shown effectively no change since the first bird atlas programme was concluded in the mid-1990s and our sightings are similar in distribution to those of the ongoing SABAP2 programme. Indications are that the range and size of this population has remained stable over time.

Yellow-billed Oxpecker was observed primarily along the Kwando River system and in close association with the Chobe and Linyanti river channels (Figure 2). There were only a few observations of birds in the western parts of Zambezi Region. The distribution of sightings in this study matches the general pattern of the SABAP1 programme however it is evident that there has been a reduction in numbers of birds in the section of the region east from where the Zambezi River forms the northern border of the country. This loss is also evident from the sightings recorded by the ongoing SABAP2 programme.

In the north-west of Namibia, where only Yellow-billed Oxpecker occurs, the distribution of birds has shown a dramatic expansion (Figure 3). Sightings were made as far south as Puros Conservancy in the west and in Ehi-Rovipuka Conservancy in the east. This is in sharp contrast to the distribution recorded by the SABAP1 programme where birds were limited to the margins of the Kunene River and northern border of the country east of Ruacana. Sightings from SABAP2 programme match areas recorded in SABAP1 but also show an expansion in range previously not recorded.

DISCUSSION

Host preferences on game species observed from this work concur with those found previously in Hwange National Park, Zimbabwe (Hustler 1987) and in Moremi Game Reserve, Botswana (Stutterheim & Panagis 1985a) and with a study of tick yields on game animals in Kenya (Hart *et al.* 1990).

The Red-billed Oxpecker population in the north-east appears to have remained stable. While bird:host ratios have shown a small decline our estimates suggest that there are similar numbers of birds present now as there were in the 1990s. Cattle remain the most important host for these birds however they do also use a broad variety of game hosts. They are distributed widely throughout the region and there is no evidence that their range has contracted.

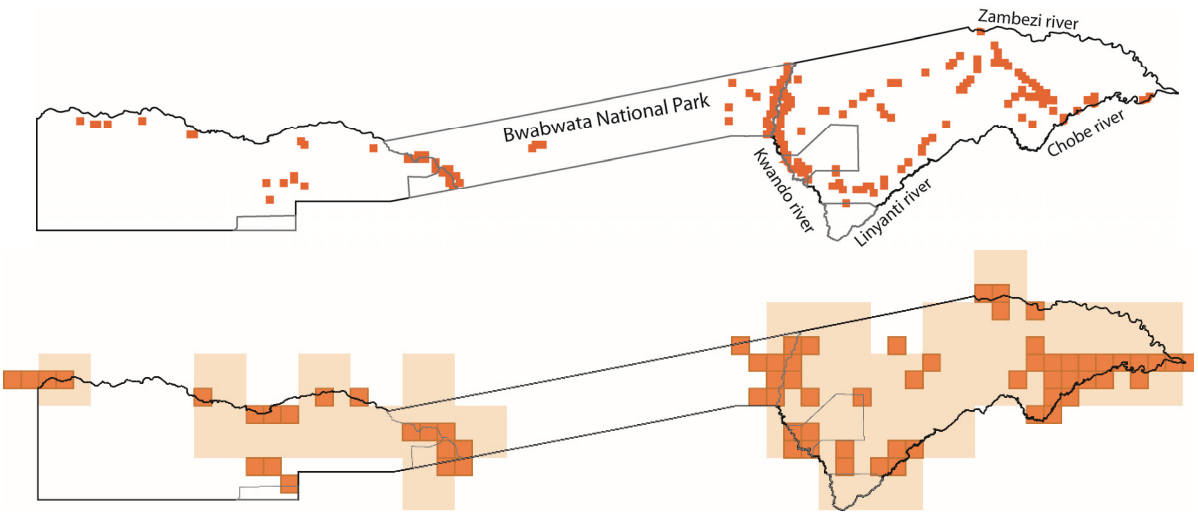

Figure 1: *Top: sightings of Red-billed Oxpecker in this study 2010-2017, bottom: sightings from SABAP1 (large blocks) and SABAP2 (small blocks).*

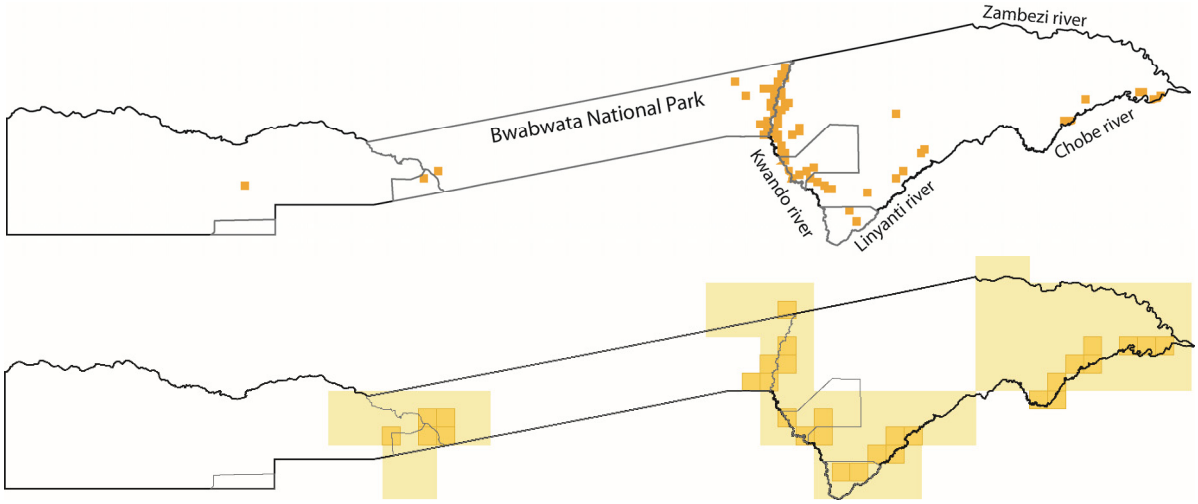

Figure 2: *Top: sightings of Yellow-billed Oxpecker in this study 2010-2017, bottom: sightings from SABAP1 (large blocks) and SABAP2 (small blocks).*

Figure 3: *Top: sightings of Yellow-billed Oxpecker in this study 2010-2015, bottom: sightings from SABAP1 (large blocks) and SABAP2 (small blocks).*

The Yellow-billed Oxpecker population in the north-east remains precarious. While cattle are an important host for these birds the bird:host ratio remains low. The estimates presented here should be considered with much caution. The restricted range of these birds with their greater apparent association with river systems suggests an alternative approach should be used to assess population size more accurately for these birds, perhaps based on zonation. A limited range of game species, in particular buffalo, are important for these birds and they host a significant proportion of the Yellow-billed Oxpecker population.

The Yellow-billed Oxpecker population in the north-west has shown a significant expansion of its range since the 1990s. This population was previously considered marginal in Namibia. However, it has now become more widespread and a series of *inclusive* counts are required throughout the north-west to derive robust bird:host ratios on livestock and game species for these birds, using a stratification based on livestock density.

The occurrence of Yellow-billed Oxpecker in the wetter north-east and the arid north-west provides an opportunity for further research to try to explain the factors limiting populations of this species in these quite different habitats. More detailed studies of feeding and breeding behavior, perhaps linked to climatic conditions and flooding of the large river systems of both the north-western and north-eastern populations, may provide useful insights into the drivers behind population growth or decline in Namibia for this endangered species.

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