NAMAS WIND FARM NEAR KLEINSEE, NORTHERN CAPE: APPLICATION FOR AMENDMENT OF THE ENVIRONMENTAL AUTHORISATION – AVIAN SPECIALIST COMMENT – 2019

1. Introduction

This specialist comment is relevant to the proposed (2019) amendments for Genesis **Namas** Wind (Pty) Ltd's Namas Wind Farm near Kleinsee and its likely impact on the avian community. Avian impacts of the proposed wind farm were assessed from the results of the 12 month monitoring in 2017-2018 (Simmons and Martins 2018) and several priority bird species that may be impacted by the wind farm were found to use the area.

The original layout proposed and amended by Genesis Namas Wind (Pty) Ltd, was part of the impact assessment undertaken in 2017-2018 and that was approved and given environmental Authorization on 18 February 2019. This proposed (2019) amendment seeks to:

- increase the power output of individual turbines from up to 4.5 MW to up to 7.0 MW;
- increase turbine hub height from up to 130-m to up to 150-m;
- tip height from up to 205-m to up to 240-m;
- reduce the number of turbines from up to 43 to up to 35; and
- leave the overall generation capacity at 140 MW.

The amendments can, therefore, be tabulated and compared as follows:

	Approved	Proposed amendment
Hub height	130-m	150-m
Tip height	up to 205-m	up to 240-m
Generation per turbine	up to 4.5 MW	up to 7.0 MW
Number of turbines	Up to 43	Up to 35

The overall effect could, thus, be a reduction by up to 19% in the overall number of turbines from up to 43 to up to 35.

The main effect of increasing hub height on the bird community can be summarised as follows:

2. Decreased Turbine Numbers and Increased Dimensions

2.1 Interactions between wind energy facilities and birds

Based on literature reviews (e.g. Kingsley & Whittam 2005, Drewitt & Langston 2006, 2008, Kuvlevsky et al. 2007, Loss et al. 2013) and personal communications (S. Loss and P. Whitfield pers comm.) we can summarise avian impacts, at wind farms in other parts of the world as follows. The annual avian mortality at eight operational farms in South Africa has been undertaken by Birdlife South Africa, allowing a South African perspective (Ralston-Paton et al. 2017).

What will be assessed here is the likely change in risk to birds passing through the wind farm where the following is altered:

- the number of turbines reduced from a maximum of 43 to a maximum of 35, an up to 19% reduction;
- the design has been changed from the possible 43-turbine layout to avoid several medium-high and medium-risk avian areas and to increase the number of turbines located in the low-sensitivity eastern areas of the site (Figure 1);
- the hub height is proposed to increase 15% from up to 130-m (authorised) to a maximum of 150-m (proposed);
- the tip height is proposed to increase by up to 17% from up to 205-m (authorised) to a maximum of 240-m (proposed).

There are three major ways these changes can influence birds:

a) **displacement and disturbance** (birds avoid the area, through disturbance caused by the operation of the turbines);
b) **habitat loss and fragmentation** (the infrastructure and building phase directly destroys or divides habitat); and
c) **direct mortality** (birds are struck by the turbines and die).

The possible 19% reduction in the number of turbines suggests that (a) displacement and disturbance will be reduced by a similar degree given that the overall 3-dimensional footprint will be reduced.

The same can be said for (b) the habitat loss and fragmentation, partly because the footprint will be reduced by 19%, and also because some of the roads have already been altered to reduce disturbance throughout the site (Figure 1).

This means that the remaining (c) direct mortality due to impact, is the most likely cause of death of birds. So we now ask, is increased avian mortality likely with taller turbines with longer blades?

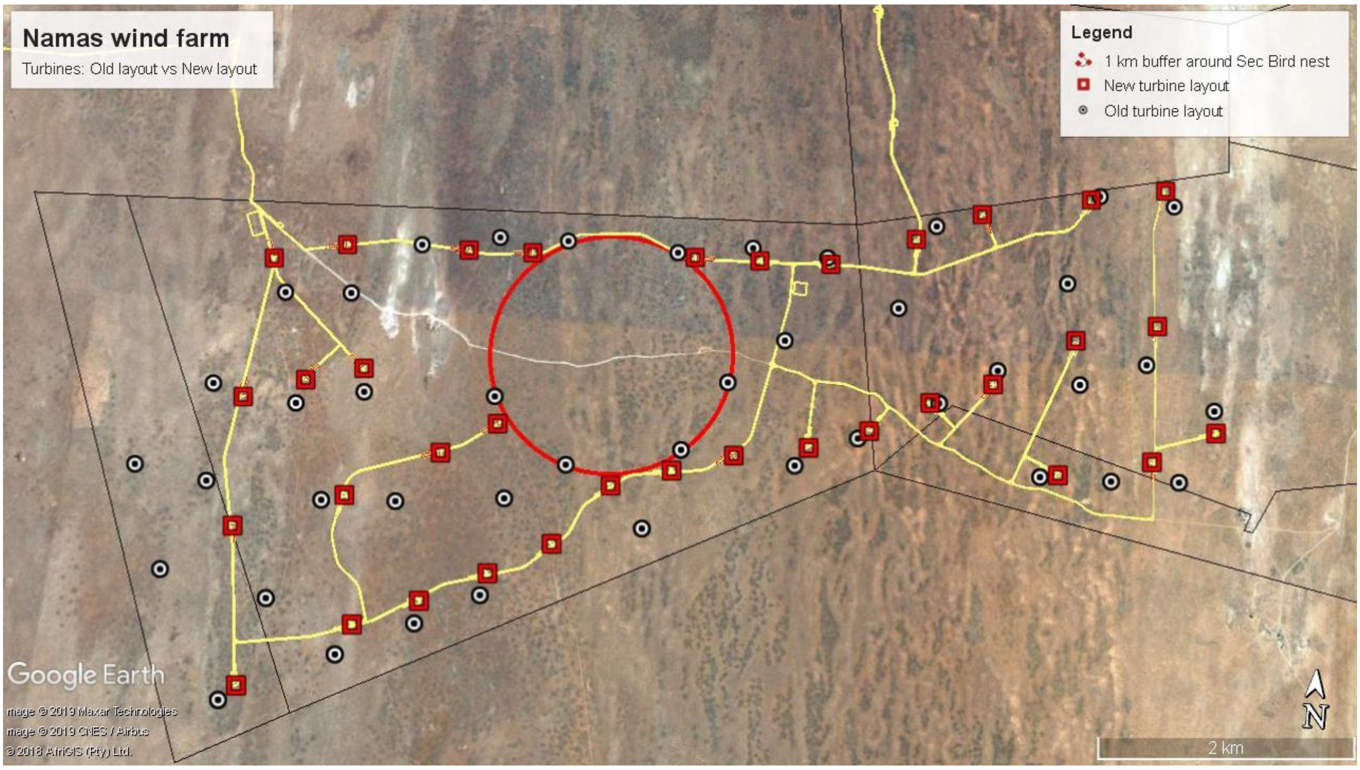

Figure 1: The change in the proposed amended turbine layout for Namas wind farm, September 2019. The small red squares represent the new 35-turbine layout, relative to the previous 43-turbine layout (= white circles). The Secretarybird nest 1km buffer (= large red circle) has been incorporated and implemented in the design of the amended layout. The new road network also avoids this sensitive area.

2.3 Avian effects of changing hub heights and blade-swept area

The two most important papers on avian and mammal mortality and the effect of increased hub height and blade length is that of Barclay et al. (2007) and Loss et al. (2013). They assessed collision rates of birds and bats at 33 and 53 sites (respectively) in North America, with a range of turbines from three to 454, and assessed the effect of variation in turbine height and blade-swept area on the mortality rates of birds and bats.

Barclay et al. (2007) found:

- no significant effect of increased height or blade length on the number of birds killed;
- However, they included lattice towers which are now known to increase mortality results for

shorter towers.

Loss et al (2013), re-analysing all data from Barclay et al and new studies, (without the lattice towers that have been discontinued) found:

- A significant effect of hub height on the number of avian mortalities at 53 wind farm sites in the USA. (Blade length could not be independently assessed because of statistical collinearity with hub height);
- In a model that included region and hub height, avian fatalities increased from about 2 birds/turbine/year at 40-m hub heights to 6.2 birds/turbine/year at 80-m hub height;
- This represents a ~3-fold increase in mortalities between 40-m and 80-m hub height.

In their review of facilities in Europe and the USA combined, Drewitt and Langston (2008) found that:

- taller communication towers were more likely to kill birds, than shorter ones;
- taller transmission lines (i.e. 400 kV vs 220 kV lines) are more likely to kill collision-prone birds than shorter ones in a Namibian study (J. Pallett unpubl. data).

2.4 General considerations: hub height and blade length

Thus, it seems taller structures generally kill more birds. However, the question arises: will the taller turbines with hub height of up to 150-m (previously up to 130-m) with longer blades (ranging from up to 75-m to up to 90-m), increase the risk of mortality of birds through direct impact? And will this be offset by fewer turbines?

The Loss et al. study, using the largest data set (from 53 wind farms in the USA), found a *significant* effect of increasing height on bird fatalities. With an increase in hub height from 40-m to 80-m, avian fatalities increased from about 2 to 6.2 birds per turbine per year.

Therefore, the increase in hub height from up to 130-m to up to 150-m is predicted to have some influence on the background mortality rates for birds, including priority birds in the Namas Wind Farm setting. By exactly how much is the question we attempt to answer below.

3.0 Modelling fatalities for increased hub heights beyond 80-m

There are two methods to predict bird fatalities with increases in hub height

- (1) Modelling real fatality data at wind farms with different hub heights to determine if a relationship occurs between fatalities and hub height (Figure 1) (note this does not use Namas Wind Farm data because it is not operational);
- (2) Determine through collision-risk modelling (CRM: Band et al. 2007) the effect of taller turbines on the risk to raptors flying over the Namas Wind Farm area. To simplify calculations,

we used the flight heights of birds through the Namas Wind Farm to gauge any increased risk. That is, we asked if more priority birds are likely to fly through the new blade swept area (60-240-m) than the old (55-205-m).

(1) Fatality data and hub height ("Loss model")

We took the fatality hub height data of Loss et al. (2013) and asked statisticians (Dr Birgit Erni and Francisco Cervantes) from UCT's Department of Statistics, Ecology and the Environment, to model the American data beyond 80-m hub heights. To strengthen the forecast for fatalities beyond 80-m hub heights, and to make them applicable to South Africa, we included the South African data (seven data points available from Ralston et al. 2017). These included two wind farms with 90-m and 95-m hub heights.

The results (Figure 2) indicate that fatalities are expected to increase exponentially 1.78-fold from an average 21 to 37 fatalities/turbine/year as turbines are increased from up to 130-m to up to 150-m.

These figures indicate a 76% increase in fatalities is expected ([37-21]/21). At the same time, the number of turbines will decrease from a maximum of 43 to a maximum of 35 – an up to 19% reduction. This will partially offset the expected increase in avian fatalities. Note that this is relevant for all birds and not just priority collision-prone birds.

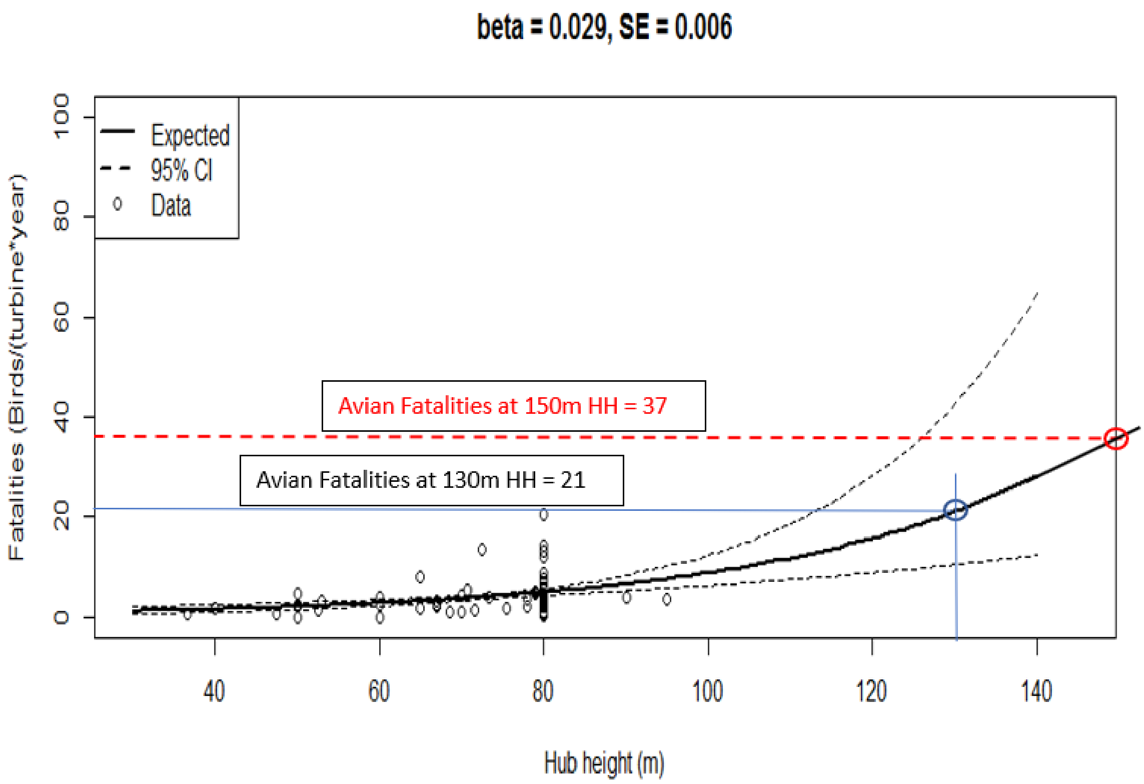

Figure 2: Modelled data combining avian fatalities from the USA (Loss et al. 2013) and from South Africa (Ralston-Paton et al. 2017) and their relationship with hub height. 95% confidence limits are shown as dotted lines. The South African data (n=7 farms, = red dots) include two farms with hub heights of 90-m and 95-m. The combined data and 95% confidence limits predict that on average 21 birds will be killed per year for 130-m-high turbines and on average 37 birds will be killed for 150-m-high turbines. The actual figures (21 fatalities at 130-m and 37 fatalities at 150-m) are not as important as the expected increase in fatalities between the two hub heights. That is 37/21 = 1.76-fold more bird fatalities are expected at the higher hub heights according to this forecast. That is a 76% increase at the proposed higher hub height.
Note: this is a statistical forecast and is not based on empirical data beyond 95 m hub heights. From Simmons, Cervantes-Peralta, Erni, Martins & Loss (2017).

(2) Flight heights of birds through the Namas Wind Farm as a measure of increased risk

To understand (2) – the number of priority birds likely to be killed on the Namas Wind Farm itself we re-assessed the number of flights at the blade swept areas for 55-205-m and 60-240-m. This was reported in the Namas final Avian Impact Assessment report (Simmons and Martins 2018). The Namas Wind Farm site had three Red Data priority species present (Secretarybird *Sagittarius serpentarius*, Ludwig's Bustard *Neotis ludwigii*, Kori Bustard *Ardeotis kori*) over a full year's monitoring (Table 1). Two of these species were recorded flying in the original blade swept area, (55 to 205-m).

The *Vulnerable* Secretarybird (Photo 1) was recorded flying within the zone of the original blade swept area for 42% of the 27 flights (Table 1) and was, therefore, most at risk from the authorised turbines. However, two reasons suggest that this is likely to be a low risk (i) all new turbine positions avoid all areas where these birds were previously recorded soaring or displaying, and (ii) Secretarybirds were never recorded flying above 205m, so the taller turbines should not pose a greater risk to this species.

Photo 1: Red Data Secretarybirds were recorded roosting on an inactive nest on the Namas Wind Farm, but all new amended turbine positions avoid this area through a buffer 1 km around the nest.

Of the nine priority species present, only Booted Eagles were recorded flying above the height of the authorised turbine tip heights (55-205-m). However, since only 6% of the flights were above 205-m, this species, too, is unlikely to be more at risk from the taller turbines proposed. Therefore, there would be a very low risk for any of the priority species impacting either the new or previously authorised turbines.

Table 1: Flying heights of the nine priority collision-prone species recorded every 15 seconds in and around the proposed Namas Wind Farm site. Three Red Data birds were recorded from data collected throughout the year – June, September, December 2017 and March 2018 from focal birds (from Simmons and Martins 2018). Only one species (Booted Eagle) was recorded above the previously authorised tip heights.

Species	Flight heights	Number of observations	Proportion of observations in blade-swept area
Ludwig's Bustard	1-55 m	32	84%
N= 38	**55-205 m [blade-swept zone]**	**6**	**16%**
	205+ m	0	0%
Kori Bustard	1 -55 m	14	100%
N = 14	**55-205 m [blade-swept zone]**	**0**	**0%**
	205+ m	0	0%
Secretarybird	1 -55 m	37	58%
N = 64	**55-205 m [blade-swept zone]**	**27**	**42%**
	205+ m	0	0%
Booted Eagle	1 -55 m	106	29%
N = 368	**55-205 m [blade-swept zone]**	**240**	**65%**
	205+ m	22	6%
Jackal Buzzard	1 -55 m	3	15%
N = 20	**55-205 m [blade-swept zone]**	**17**	**85%**
	205+ m	0	0%
Pale chanting Goshawk	1 -55 m	40	77%
N = 52	**55-205 m [blade-swept zone]**	**12**	**23%**
	205+ m	0	0%
Greater Kestrel	1 -55 m	42	89%
N = 47	**55-205 m [blade-swept zone]**	**5**	**11%**
	205+ m	0	0%

Black-chested Snake Eagle **N = 76**	1 -55 m	31	41%
	55-205 m [blade-swept zone]	**45**	**59%**
	205+ m	0	0%
Southern Black Korhaan **N = 7**	1 -55 m	7	100%
	55-205 m [blade-swept zone]	**0**	**0%**
	205+ m	0	0%

3. Conclusions

The purpose of this specialist input is to confirm the following:

- Whether or not the proposed amendment to the Namas Wind Farm will result in an increased level or change in the nature of impact(s) on birds, where such level or change in the nature of impact was not assessed and included in the previous specialist assessment for the project.
- Whether the mitigation measures outlined in the 2018 avian assessment report for the project (Simmons and Martins 2018) remain the same, or whether any changes to, or additional mitigation measures are required, as a result of the proposed amendments.

Avian impacts from turbines, particularly direct fatalities are mainly related to:

1. The species involved and the breeding season behaviour;
2. The hub height of the turbine and the blade lengths;
3. The number of birds and their Passage Rates (birds passing per hour);
4. The height at which birds pass through the wind farm.

It is our considered opinion that because of the species involved (and their flight behaviour and use of space) are not likely to change, the likelihood of a change in the impacts is estimated to be negligible.

Since the technical dimensions (hub height and blade length) of the turbines themselves are changing, we assessed the likelihood of more fatalities occurring. While our statistical model suggested that 76% more birds may be impacted, these are not likely to include priority birds because of the terrestrial nature of all three Red Data species (i.e. Secretarybird *Sagittarius serpentarius*, Ludwig's Bustard *Neotis ludwigii*, Kori Bustard *Ardeotis kori*) (Dean and Simmons 2005, Allan 2005a, b). This was corroborated by empirical data collected on site in 2017-2018 verifying that the three Red Data species were never recorded flying at the authorised blade swept area (55-205-m) or the amended BSA heights (60-240-m).

Therefore, there is no reason to believe that the nature or magnitude of the impacts as laid out in our previous specialist assessment (Simmons and Martins 2018) will change negatively. Indeed, the 19% reduction in the number of turbines from a maximum of 43 to a maximum of 35, and the precautionary buffer around the inactive Secretarybird nest (photo 1), should lead to a nett decrease in impacts to the priority (Red Data) avian community (see Table 1).

Table 1. A quantification of impacts to the three, main, collision-prone Red Data species and other priority raptors likely to be impacted by the proposed Namas WEF**.**

WEF development site - Authorised Impacts vs Proposed Amendment impacts

Nature: Negative due to direct impact fatalities, disturbance and loss of foraging habitat around the WEF site for the Red-listed bird groups identified as at risk above. This may increase for taller turbines with longer blades (Loss et al. 2013) but this is likely to be offset by the reduction in the number of turbines

The Red Data Secretarybirds, Lanner Falcon, and the two eagles (Black-chested Snake and Booted) are collectively summed under Raptors (**RA**) and are likely to be impacted as well as the nomadic Kori and Ludwig's Bustard (**BS**).

	Authorised		**Proposed Amendment**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	**1**	**1**	**1**	**1**
Duration	**4**	**4**	**4**	**4**
Magnitude	**5 (RA) 4 (BS)**	**4 (RA) 3 (BS)**	**4 (RA) 3 (BS)**	**3 (RA) 3 (BS)**
Probability	**4 (RA) 4 (BS)**	**3 (RA) 3 (BS)**	**4 (RA) 3 (BS)**	**3 (RA) 3 (BS)**
Significance (E+D+M)P	**40 (RA) 36 (BS) (medium) (medium)**	**27 (RA) 24 (BS) (low) (low)**	**36 (RA) 24 (BS) (medium) (low)**	**24 (RA) 24 (BS) (low) (low)**
Status (+ve or –ve)	Negative	Negative	Negative	Negative
Reversibility	Yes, if turbines avoid areas identified as sensitive and mitigation implemented in medium risk areas	Yes, if turbines avoid areas identified as high-risk	Yes, if turbines avoid areas identified as high-risk	Yes, if turbines avoid areas identified as high-risk
Irreplaceable loss of species?	No, Secretarybirds populations are relatively low here (not core habitat). Ludwig's Bustards are nomadic visitors to this area.			

<table>
<tr><td>Can impacts be mitigated?</td><td>Yes. If the areas identified as high-risk are avoided and mitigation measures implemented in the areas of medium-risk</td><td>Yes. If all areas identified as sensitive are avoided for development</td><td>Yes. If all areas identified as sensitive are avoided for development</td><td>Yes. If all areas identified as sensitive are avoided for development</td></tr>
<tr><td colspan="5">Mitigation for WEF site:

The mitigation for birds around the Namas WEF site are as follows:

• position the turbines away from risk areas of high aerial traffic or nests of collision-prone species;
• if birds impact the turbines then paint a single blade black for those select turbines known to kill most birds to reduce impacts for eagles and other raptors (Stokke et al. 2017);
• selective feathering or stopping of turbines can be implemented during high-use seasons or times in the day for turbines that continue to kill unsustainable numbers of raptors
• if raptors continue to be attracted into the site then habitat can be manipulated to reduce the attractiveness (from a prey point of view) for the raptors. Reducing the food resources will reduce raptor use of the area. This can be achieved by increasing the stocking density of sheep or goats on the farm;

One of the mitigations above (black-blade mitigations) is dependent upon knowing which turbines are responsible for most deaths. Thus, we recommended that: Genesis Namas Wind (Pty) Ltd implement 12-24 months post-construction monitoring to assess the mortality of birds in the wind farm, through direct observation and carcass searches. This will assist in determining where individual turbine-specific mitigation measures are required to be implemented.</td></tr>
<tr><td colspan="5">Residual impacts:

After mitigation, direct mortality through collision, or area avoidance, by the species identified above may still occur and further research and mitigation measures should be suggested. This can only be undertaken in conjunction with a systematic monitoring programme.</td></tr>
</table>

The previous mitigations outlined in Simmons and Martins' (2018) Avian Assessment report, particularly the black-blade mitigation (Stokke et al. 2017), are all still applicable in reducing the impacts to the Red Data species on site at the proposed Namas Wind Farm, if fatalities do occur.

In conclusion, no adverse negative effects associated with the proposed amendments were identified beyond those already identified in the original (and authorised) 2018 report. Only positive effects are considered to be applicable in that the priority birds may be less negatively impacted and face a reduced risk as a result (Table 1).

Dr R.E. Simmons M. Martins
Birds & Bats Unlimited
www.birds-and-bats-unlimited.com

19 September l 2019

Revised 4 October 2019

Bibliography

Allan DG. 2005a. Ludwig's Bustard *Neotis ludwigii.* In: Hockey P, Dean WRJ, Ryan P. (eds). Roberts birds of southern Africa. Pp 293-294. John Voelcker Bird Book Fund, Johannesburg.

Allan DG. 2005b. Kori Bustard *Ardeotis kori.* In: Hockey P, Dean WRJ, Ryan P. (eds). Roberts birds of southern Africa. Pp 295-296. John Voelcker Bird Book Fund, Johannesburg

Dean WRJ, Simmons RE 2005. Secretarybird *Sagittarius serpentarius* . In: Hockey P, Dean WRJ, Ryan P. (eds). Roberts birds of southern Africa. Pp 542-543. John Voelcker Bird Book Fund, Johannesburg.

Drewitt, A.L. & Langston, R.H.W. 2006. Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

Drewitt, A.L. & Langston, R.H.W. 2008. Collision effects of wind-power generators and other obstacles on birds. *Annals of the New York Academy of Science* 1134: 233-266**.**

De Lucas M, Ferrer M, Bechard MJ, Munoz AR. 2012. Griffon vulture mortality at wind farms in southern Spain : distribution of fatalities and active mitigation measures. Biological Conservation 147: 184–189.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, K.J. Sernka, and R.E. Good. 2001. Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States*.* National Wind Coordinating Committee.

Loss SR, Will T, Marra PP. 2013. Estimates of bird-collision mortality at wind facilities in the contiguous United States. Biological Conservation 168: 201–209.

Ralston-Paton S, Smallie J, Pearson A, Ramalho R. 2017*.* Wind energy's impacts on birds in South Africa: A preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme Wind Farms in South Africa. Birdlife South Africa, Cape Town.

Ralston-Paton S. 2017. Verreauxs' Eagle and wind farms: guidelines for impact assessment, monitoring and mitigation. Birdlife South Africa Occasional Papers, Johannesburg.

Simmons RE, Martins M. 2016. Photographic record of a Martial Eagle killed at Jeffreys Bay wind farm. Unpubl report Birds & Bats Unlimited.

Simmons RE and Martins M 2018. Pre-construction Avian Basic Assessment for the proposed NAMAS Wind Farm, Kleinsee, Northern Cape, Birds & Bats Unlimited, Cape Town.

Stokke BG, May R, Falkdalen U, Saether SA, Astrom J, Hamre O, Nygard T. 2017. Visual mitigation measures to reduce bird collisions – experimental tests at the Smøla wind-power plant, Norway.