# TSITSIKAMMA COMMUNITY WIND ENERGY FACILITY

Avian impact assessment

AVISENSE CONSULTING

**EXECUTIVE SUMMARY**

This study contains an extensive review of relevant literature on wind energy impacts on birds, and identifies potential impacts of the proposed Tsitsikamma Community Wind Energy Facility on the avifauna of the Humansdorp area of the Eastern Cape, South Africa. These expected impacts are: habitat destruction by construction of the facility itself and any ancillary infrastructure, disturbance and possible displacement of sensitive species by the operation of the facility, and mortality in collision with the blades of the wind turbines, or in collision or electrocution incidents associated with ancillary infrastructure.

The impact zone of the proposed wind energy facility features a matrix of cultivated pasture and farmland, with some small, remnant areas of Fynbos and/or Renosterveld, set in an area of undulating relief, with quite extensive areas of thicket or forest (including stands of alien trees) along the bigger drainage lines. The area is likely to support over 240 bird species, including 19 red-listed species, 41 endemics, and four red-listed endemics. Resident and/or seasonal influxes of large terrestrial birds, in particular Denham's Bustard *Neotis denhami* and Blue Crane *Anthropoides paradiseus*, and a range of locally resident or visiting raptors, which may forage in or move through the area, including Martial Eagle *Polemaetus bellicosus*, African Marsh Harrier *Circus ranivorus*, Black Harrier *Circus maurus*, Peregrine Falcon *Falco peregrinus* and Lanner Falcon *F. biarmicus*, are the species of greatest conservation significance which are most likely to be impacted by the wind energy facility. These priority species may be disturbed by the construction of the wind energy facility, and/or lose foraging habitat (in terms of the area covered by the construction footprint and by displacement from areas with operating turbines), and/or sustain mortalities in collisions with the turbine blades, or by collision with or electrocution on the new power infrastructure.

The potential negative effects of the proposed development may be reduced to acceptable and sustainable levels by strict adherence to a proposed mitigation scheme. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area is recommended and outlined, from pre-construction and into the operational phase of the project. Full clarity on the likely environmental impact of this facility can only be reached once a comprehensive pre-construction monitoring project has been completed. It is vital that the possible impacts of this facility be considered in terms of the cumulative effects of multiple other wind energy proposals submitted for the immediate area.

**CONSULTANT'S DECLARATION OF INDEPENDENCE**

Andrew Jenkins (*AVISENSE* Consulting cc) is an independent consultant to Savannah Environmental Pty (Ltd) and Exxaro / Watt Energy. He has no business, financial, personal or other interest in the activity, application or appeal in respect of which they were appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

## 1. INTRODUCTION

Exxaro Resources and Watt Energy are proposing to establish a commercial wind energy facility (WEF) (project name 'Tsitsikamma Community Wind Energy Facility'), as well as associated infrastructure, on a site located approximately 20 km south-west of Humansdorp, Eastern Cape Province (Fig. 1). Savannah Environmental Pty (Ltd) was appointed to compile the EIA report for this proposed development, and subsequently appointed *AVISENSE* Consulting to conduct the specialist avifaunal assessment. The study was conducted by Dr Andrew Jenkins, an ornithologist with over 20 years of experience in avian research and impact assessment work. He has been involved in the design and/or execution of many of the completed EIA and EMP studies for wind energy facilities in South Africa to date, including the only two operational facilities at Darling and Klipheuwel, Western Cape Province.

## 2. TERMS OF REFERENCE

The terms of reference for this environmental impact study, as supplied by Savannah Environmental (Pty) Ltd, were to provide:

- An indication of the methods used in determining the significance of potential impacts.
- A description of all the environmental issues (pertaining to birds) identified during the EIA process.
- An assessment of the significance of each of the identified direct, indirect and cumulative impacts, in terms of the expected nature, extent, duration, probability and severity of each, as well as in terms of the reversibility of impacts, and the degree to which each can be mitigated.
- A description and comparative assessment of alternatives in the development plan.
- Recommendations on practical mitigation of potentially significant negative impacts for inclusion in the Environmental Management Plan, with an indication of the expected efficacy of such mitigation measures.
- A description of any assumptions, uncertainties or knowledge gaps affecting this assessment.
- An environmental impact statement with a summary of key findings, an assessment of positive and negative implications of the proposed development, and a comparative assessment of identified alternatives.

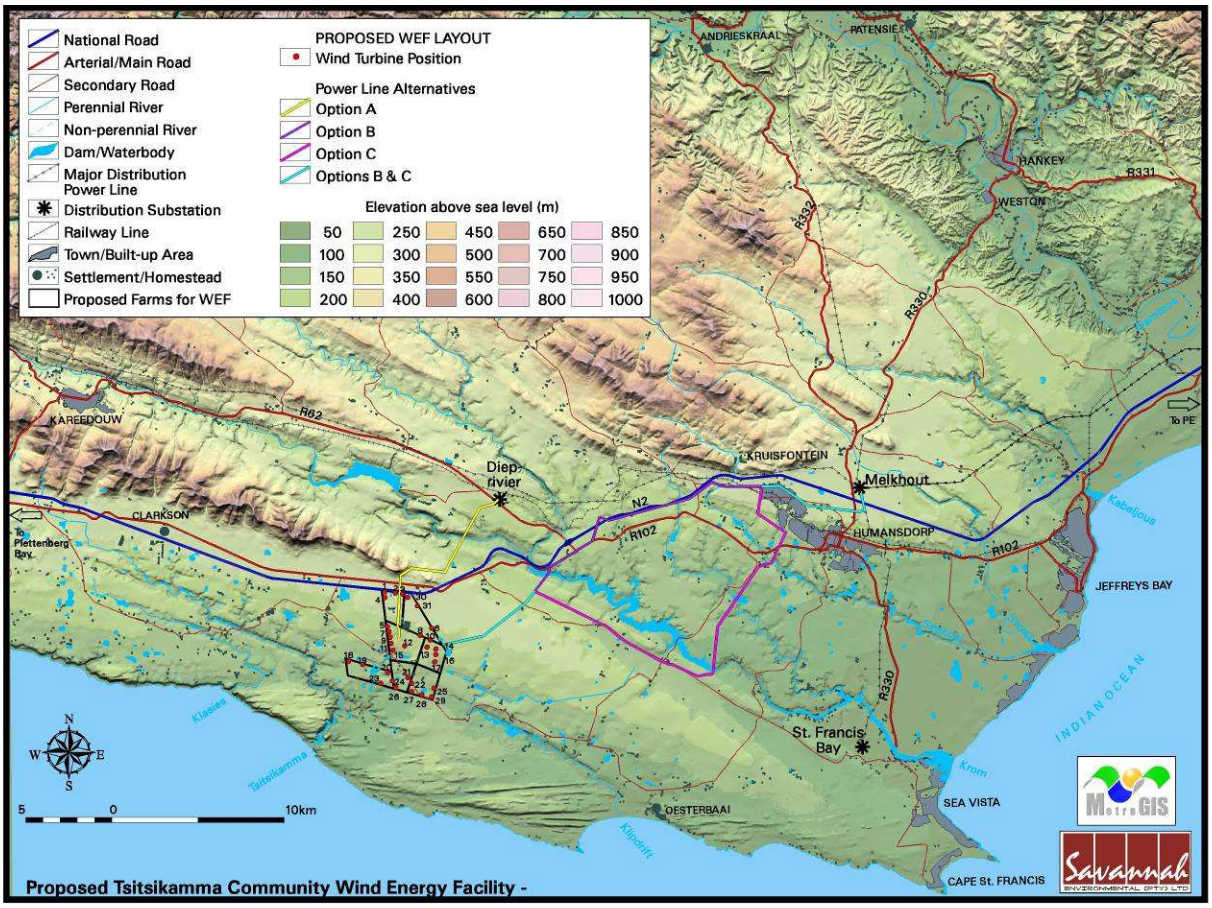


FIGURE 1. General location and layout of the proposed Tsitsikamma Community Wind Energy Facility.

## 3. STUDY METHODS

### 3.1. Approach

The initial scoping study, which forms the background to this report, included the following steps:

- A review of available published and unpublished literature pertaining to bird interactions with wind energy facilities is provided summarising the issues involved and the current level of knowledge in this field. Various information sources (listed below), including data on the birdlife of the area and previous studies of bird interactions with wind energy facility and electricity infrastructure, were examined.
- An inclusive, annotated list of the avifauna likely to occur within the impact zone of the proposed wind energy facility was compiled using a combination of the existing distributional data and previous experience/knowledge of the avifauna of the general area.

- A short-list of priority bird species (defined in terms of conservation status and endemism) which could possibly be impacted by the proposed wind energy facility was extracted from the total bird list. These species were subsequently considered as adequate surrogates for the local avifauna generally, and mitigation of impacts on these species was considered likely to accommodate any less important bird populations that may also potentially be affected.
- A summary of more likely and significant impacts of the wind energy facility on the local avifauna was drawn up, and a brief methodology was devised for the EIA phase for confirming these impacts and developing an effective mitigation strategy.

The present EIA report builds on the scoping study, with emphasis on the outcome of a site visit, made on 28-29 May 2011. While the scoping phase identified potential avifaunal issues associated with the proposed wind energy facility and its possible associated infrastructure, the EIA investigates these issues in more detail and includes:

- Field surveys of large terrestrial species, raptors and endemic passerines within the study area to determine the relative importance of local populations of these key taxa.
- Refinement of the expected species and priority species lists based on (i), and compilation of SABAP 2 atlas lists for the pentads visited during the site visit.
- Estimates of the extent and direction of possible movements of these species within/through the anticipated impact zone of the wind energy facility, in relation to the distribution of available resources – nesting or roosting sites (wetlands, stands of trees, existing power lines), foraging areas (croplands, wetlands), sources of list for slope soaring birds (ridge lines).
- Identification of any sensitive/high risk areas to locate wind turbines within the broader study area, in terms of (i) to (iii) above.
- Recommendations on mitigation where necessary (particularly with reference to the siting of turbines).
- A comprehensive, long-term programme for monitoring actual impacts from pre- to post-construction phases of the development, and improving our understanding of the long-term effects of wind energy developments on South African avifauna.

### 3.2. Data sources used

The following data sources and reports were used in the compilation of this report:

- Bird distribution data of the Southern African Bird Atlas Project (SABAP – Harrison *et al.* 1997) were obtained from the Animal Demography Unit website (http://sabap2.adu.org.za/index.php) for the relevant quarter-degree squares

(SABAP 1: 3424AB Clarkson - 74 cards submitted over the atlas period, 185 species recorded and 3424BA Kruisfontein - 51 cards submitted over the atlas period, 205 species recorded) or pentads (SABAP 2: 3400_2425, 3405_2425, 3400_2430, 3405_2430 – 15 cards submitted so far for these pentads combined). A composite list of species likely to occur in the impact zone of the wind energy facility was drawn up as a combination of these data, refined by a more specific assessment of the actual habitats affected, based on general knowledge of the avifauna of the region (APPENDIX 1).

- Conservation status and endemism of all species considered likely to occur in the area was determined as per the most recent iteration of the national Red-list for birds (Barnes 2000), informed by a more recent revision for raptors (Jenkins 2008a), the most recent iteration of the global list of threatened species (http://www.iucnredlist.org), and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005).
- Data from the Animal Demography Unit's Coordinated Avifaunal Roadcount project (CAR: http://car.adu.org.za/, Young *et al.* 2003), and Coordinated Waterbird Counts (CWAC: http://cwac.adu.org.za/, Taylor *et al.* 1999).
- Data from the Animal Demography Unit's Coordinated Avifaunal Roadcount project (CAR: http://car.adu.org.za/, Young *et al.* 2003).
- EIA reports and any subsequent monitoring reports on the potential impacts on birds of other proposed and/or constructed and operational wind energy facilities in South Africa (e.g. van Rooyen 2001a, Küyler 2004, Jenkins 2008b, 2009).

### 3.3. Limitations & assumptions

Any inaccuracies in the above sources of information could limit this study. The SABAP 1 data for this area are quite comprehensive, but they are now >15 years old (Harrison *et al.* 1997), a problem that is compounded by the relative lack of more recent, SABAP 2 data for the area. This deficiency was partially addressed by the short visit to the site.

Given that there are currently only three, very small wind energy facilities operational in South Africa (totaling only 8 turbines between them), practical experience of the environmental effects of wind energy facilities in this country is extremely limited, and we must base our estimates of the possible impacts of new facilities largely on lessons learned internationally. While many of the established, general principles can probably be usefully applied here, care should be taken in adapting international knowledge and experience to uniquely South African birds and conditions.

## 4. BACKGROUND TO THE STUDY

## 4.1 Interactions between wind energy facilities and birds

Recent literature reviews (www.nrel.gov, Kingsley & Whittam 2005, Drewitt & Langston 2006, Kuvlevsky *et al.* 2007, Stewart *et al.* 2007, Drewitt & Langston 2008, Krijgsveld *et al.* 2009, Sovacool 2009) are essential summaries and sources of information in this field. While the number of comprehensive, longer-term analyses of the effects of wind energy facilities on birds is increasing, and the body of empirical data describing these effects is rapidly growing, scientific research in this field is still in its infancy (Madders & Whitfield 2006, Stewart *et al.* 2007), and much of the available information originates from short-term, unpublished, descriptive studies, most of which have been carried out in the United States, and more recently across western Europe, where wind power generation is a more established and developed industry.

Concern about the impacts of wind facilities on birds first arose in the 1980s when numerous raptor mortalities were detected at facilities at Altamont Pass Wind Resource Area (California, USA) and Tarifa (southern Spain). More recently, there has been additional concern about the degree to which birds avoid or are excluded from the areas occupied by wind energy facilities – either because of the visible action of the turbine blades or because of the noise they generate - and hence suffer a loss of habitat (Larsen & Guillemette 2007, Stewart *et al.* 2007, Devereaux *et al.* 2008. Pearce-Higgins *et al.* 2009). With a few important exceptions, most studies completed to date suggest low absolute numbers of bird fatalities at wind energy facilities (Kingsley & Whittam 2005), and low casualty rates relative to other existing sources of anthropogenic avian mortality on a per structure basis (Crockford 1992, Colson & associates 1995, Gill *et al.* 1996, and Erickson *et al*. 2001).

### *4.1.1 Collisions with turbines*

*Collision rates*

As more monitoring has been conducted at a growing number of sites, some generic standards and common units have been established, with bird collisions with turbine blades generally measured in mortalities/turbine/year, mortalities/Mega-Watt/year, or mortalities /Giga-Watt Hour (Smallwood & Thelander 2008, Sovacool 2009). Wherever possible, measured collision rates should allow for (i) casualty remains which are not detected by observers (searcher efficiency - Newton & Little 2009), and (ii) casualties which are removed by scavengers before detection, and the rate at which this occurs (scavenger removal rate). Also, although collision rates may appear relatively low in many instances, cumulative effects over time, especially when applied to large, long lived, slow reproducing and/or threatened species (many of which are collision-prone), may be of considerable conservation significance.

The National Wind Co-ordinating Committee (2004) estimates that 2.3 birds are killed per turbine per year in the US outside of California – correcting for searcher efficiency and scavenger rates. However, this index ranges from as low as 0.63 mortalities/turbine/year in Oregon, to as high as 10 mortalities/turbine/year in Tennessee (NWCC 2004), illustrating the wide variance in mortality rates between sites. Curry & Kerlinger (2000) found that only 13% of the >5000 turbines at Altamont Pass, California were responsible for all Golden Eagle *Aquila chrysaetos* and Red-tailed Hawk *Buteo jamaicensis* collisions, but the most recent aggregate casualty estimates for Altamont run to >1000 raptor mortalities/turbine/year, and nearly 3000 mortalities/turbine/year overall (Smallwood & Thelander 2008), including >60 Golden Eagles, and at a mean rate of about 2-4 mortalities/MW/year.

At the Tarifa and Navarre wind energy facilities on the Straits of Gibraltar, southern Spain, about 0.04-0.08 birds are killed per turbine/year (Janss 2000a, de Lucas *et al.* 2008), with relatively high collision rates for threatened raptors such as Griffon Vulture *Gyps fulvus*, of particular concern (Table 1). At the same sites, collisions have also been found to be non-randomly distributed between turbines, with >50% of the vulture casualties recorded at Tarifa being killed by only 15% of the turbine array at the facility (Acha 1997). Collision rates from other European sites are equally variable, with certain locations sporadically problematic (Everaert 2003, Newton & Little 2009, Table 1).

To date, only eight wind turbines have been constructed in South Africa at two pilot wind energy facilities at Klipheuwel and Darling in the Western Cape (van Rooyen 2001, Jenkins 2001, 2003) and, more recently, in the first phase of a bigger development at Coega in the Eastern Cape. An avian mortality monitoring program was established at the Klipheuwel facility once the turbines were operational, involving regular site visits to monitor both bird traffic through the area and detect bird mortalities (Küyler 2004). This study found that (i) 9-57% of birds observed within 500m of the turbines were flying at blade height, and (ii) 0-32% of birds sighted were flying either between the turbines or within the arc of the rotors of the outermost turbines. Five bird carcasses were found on the three-turbine site during the 8-month monitoring period, of which two, a Horus Swift *Apus horus* and a Large-billed Lark *Galerida magnirostris*, were thought to have been killed by collision with turbine blades, indicating a net collision rate for birds of about 1.00 mortality/turbine/year.

It is important to note here that simple estimates of aggregate collision rates for birds are not an adequate expression of biodiversity impact. Rather, consideration must be given to the conservation status of the species affected or potentially affected, and the possibility that even relatively low collision rates for some threatened birds may not be sustainable in the long term.

*Causes of collision*

Multiple factors influence the number of birds killed at wind energy facilities. These can be classified into three broad groupings: (i) avian variables, (ii) location variables, and (iii) facility-related variables. Although only one study has so far shown a direct relationship between the abundance of birds in an area and the number of collisions (Everaert 2003), it would seem logical to assume that the more birds there are flying through an array of turbines, the higher the chances of a collision occurring. The nature of the birds present in the area is also very important as some species are more vulnerable to collision with turbines than others, and feature disproportionately frequently in collision surveys (Drewitt & Langston 2006, 2008, de Lucas *et al.* 2008). Species-specific variation in behaviour, from general levels of activity to particular foraging or commuting strategies, also affect susceptibility to collision (Barrios & Rodríguez 2004, Smallwood *et al.* 2009). There may also be seasonal and temporal differences in behaviour, for example breeding males displaying may be particularly at risk.

Landscape features can potentially channel birds towards a certain area, and in the case of raptors, influence their flight and foraging behaviour. Ridges and steep slopes are important factors in determining the extent to which an area is used by gliding and soaring birds (Barrios & Rodríguez 2004). High densities of prey will attract raptors, increasing the time spent hunting, and as a result reducing the time spent being observant. Poor weather affects visibility. Birds fly lower during strong headwinds (Hanowski & Hawrot 2000, Richardson 2000), so when the turbines are functioning at their maximum speed, birds are likely to be flying at their lowest, exponentially increasing collision risk (Drewitt & Langston 2006, 2008).

Larger wind energy facilities, with more turbines, are almost by definition more likely to incur significant numbers of bird casualties (Kingsley & Whittam 2005), and turbine size may be proportional to collision risk, with taller turbines associated with higher mortality rates in some instances (e.g. de Lucas *et al.* 2009, but see Howell 1995, Erickson *et al.* 1999, Barclay *et al.* 2007), although with newer technology, fewer, larger turbines are needed to generate equivalent or even greater quantities of power, possibly resulting in fewer collisions per Megawatt of power produced (Erickson *et al.* 1999). Certain turbine tower structures, and particularly the old-fashioned lattice designs, present many potential perches for birds, increasing the likelihood of collisions occurring as birds land at or leave these perch or roost sites. This generally is not a problem associated with more modern, tubular tower designs (Drewitt & Langston 2006, 2008), such as those proposed for this project.

Illumination of turbines and other infrastructure is often associated with increased collision risk (Winkelman 1995, Erickson *et al.* 2001), either because birds moving long distances at night do so by celestial navigation, and may confuse lights for stars (Kemper 1964), or because lights attract insects, which in turn attract birds. Changing constant lighting to intermittent lighting has been shown to reduce nocturnal collision rates

(Richardson 2000, APLIC 1994, Jaroslow 1979, Weir 1976) and changing flood-lighting from white to red can reduce mortality rates by up to 80% (Weir 1976).

Spacing between turbines at a wind facility can have an effect on the number of collisions. Some authors have suggested that paths should be left between turbines to allow free passage through the turbine strings (Drewitt & Langston 2006, Kuvlevsky *et al.* 2007, Drewitt & Langston 2008). This approach tallies well with wind energy generation principles, which require relatively large spaces between turbines in order to avoid wake and turbulence effects. An alternative perspective suggests that all attempts by birds to fly through wind energy facilities, rather than over or around them, should be discouraged to minimise collision risk (Drewitt & Langston 2006, Kuvlevsky *et al.* 2007, Drewitt & Langston 2008). This approach effectively renders the entire footprint of the facility as lost habitat (see below).

*Collision prone birds*

Collision prone birds are generally either (i) large species and/or species with high ratios of body weight to wing surface area (wing loading), which confers low maneuverability (cranes, bustards, vultures, gamebirds, waterfowl, falcons), (ii) species which fly at high speeds (gamebirds, pigeons and sandgrouse, swifts, falcons), (iii) species which are distracted in flight - predators or species with aerial displays (many raptors, aerial insectivores, some open country passerines), (iv) species which habitually fly in low light conditions, and (v) species with narrow fields of forward binocular vision (Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010, Noguera *et al.* 2010). These traits confer high levels of *susceptibility*, which may be compounded by high levels of *exposure* to man-made obstacles such as overhead power lines and wind turbine areas (Jenkins *et al.* 2010). Exposure is greatest in (i) very aerial species, (ii) species inclined to make regular and/or long distance movements (migrants, any species with widely separated resource areas - food, water, roost and nest sites), (iii) species that regularly fly in flocks (increasing the chances of incurring multiple fatalities in single collision incidents).

**Table 1.** Results of recent published studies of the effects of wind energy facilities on local avifauna.

| **Location** | ***n* wind farm/s assessed** | **Turbine hub height (m)** | ***n* turbines** | **Habitat** | **Bird groups assessed** | **Evidence of displacement?** | **Collision rate (birds/turbine/year)** | **Reference** |
|---|---|---|---|---|---|---|---|---|
| Tarifa, Southern Spain | 2 | 18-36 | 66-190 | Hilly woodland | Raptors | N/A | Raptors = 0.27, Griffon Vultures = 0.12 | Barrios & Rodríguez 2004 |
| Tarifa, Southern Spain | 2 | 28-36 | 66-190 | Hilly woodland | Raptors | N/A | 0.04-0.07, mostly Griffon Vultures | de Lucas *et al.* 2008 |
| East Anglia, UK | 2 | 60 | 8 | Croplands | Gamebirds, corvids, larks and see-eaters | Minimal, only gamebirds significantly affected | N/A | Devereaux *et al.* 2008 |
| Altamont Pass, California | 1 | 14-43 | 5400 | Hilly grassland | Various | N/A | 4.67 , raptors = 1.94 | Smallwood & Thelander 2008 |
| Southern Spain | 1 | 44 | 16 | Hilly woodland | Various | Yes, >75% reduction in raptor sightings | 0.03 | Farfán *et al.* 2009 |
| Netherlands | 3 | 67-78 | 7-10 | Farmland | Various | N/A | 27.0-39.0 | Krijgsveld *et al.* 2009 |
| Northumberland, UK | 1 | 30 | 9 | Coastal | Seabirds | N/A | 16.5-21.5, mostly large gulls | Newton & Little 2009 |
| N England & Scotland | 12 | 30-70 | 14-42 | Moorland | Gamebirds, shorebirds, raptors, passerines | Yes, 53% reduction in Hen Harrier *Circus cyaneus* sightings, other species also decreased | N/A | Pearce-Higgins *et al.* 2009 |

Soaring species may be particularly prone to colliding with wind turbines where the latter are placed along ridges to exploit the same updrafts favoured by such birds - vultures, storks, cranes, and most raptors - for cross-country flying (Erickson et al. 2001, Kerlinger & Dowdell 2003, Drewitt & Langston 2006, 2008, Jenkins *et al.* 2010, Noguera *et al.* 2010). Large soaring birds – for example, many raptors and storks - depend heavily on external sources of energy for sustainable flight (Pennycuick 1989). In terrestrial situations, this generally requires that they locate and exploit pockets or waves of rising air, either in the form of bubbles of vertically rising, differentially heated air – thermal soaring - or in the form of wind forced up over rises in the landscape, creating waves of rising turbulence – slope soaring.

Certain species are morphologically specialised for flying in open landscapes with high relief and strong prevailing winds, and are particularly dependent on slope soaring opportunities for efficient aerial foraging and travel. South African examples might include Bearded *Gypaetus barbatus* and Cape Vulture *Gyps coprotheres*, Verreaux's Eagle *Aquila verreauxii*, Jackal Buzzard *Buteo rufofuscus*, Rock Kestrel *Falco rupicolus*, Peregrine Falcon *Falco peregrinus*, Lanner Falcon *Falco biarmicus* and Black Stork *Ciconia nigra* and, to a lesser extent, most other open-country raptors. Such species are potentially threatened by wind energy developments where turbines are situated to exploit the wind shear created by hills and ridge-lines. In these situations, birds and industry are competing for the same wind resource, and the risk that slope soaring birds will collide with the turbine blades, or else be prevented from using foraging habitat critical for their survival, is greatly increased. Evidence of these effects has been obtained from several operational wind energy facilities in other parts of the world – for example relatively high mortality rates of large eagles, buzzards and kestrels at Altamont Pass, California (>1100 raptors killed annually or 1.9 raptor casualties/MW/year, Smallwood & Thelander 2008), and of vultures and kestrels at Tarifa, Spain (0.15-0.19 casualties/turbine/year, Barrios & Rodríguez 2004, de Lucas *et al.* 2008, Table 1), and displacement of raptors generally in southern Spain (Farfán *et al.* 2009) and of large eagles in Scotland (Walker *et al.* 2005) – and one study has shown that the additive impact of wind farm mortality on an already threatened raptor could theoretically cause its localised extinction (Carrete *et al.* 2009).

*Mitigating collision risk*

The only direct way to reduce the risk of birds colliding with turbine blades is to make the blades more conspicuous and hence easier to avoid. Blade conspicuity is compromised by a phenomenon known as 'motion smear' or retinal blur, in which rapidly moving objects become less visible the closer they are to the eye (McIsaac 2001, Hodos 2002). The retinal image can only be processed up to a certain speed, after which the image cannot be perceived. This effect is magnified in low light conditions, so that even slow blade rotation can be difficult for birds to see.

Laboratory-based studies of visual acuity in raptors have determined that (i) visual acuity appears superior when objects are viewed at a distance, suggesting that the birds may view nearby objects with one visual field and objects further away with another, (ii) moderate motion of the visual stimulus significantly influences acuity, and kestrels may be unable to resolve all portions of an object such as a rotating turbine blade because of motion smear, especially under low contrast or dim lighting conditions, (iii) this deficiency can be addressed by patterning the blade surface in a way which maximises the time between successive stimulations of the same retinal region, and (v) the easiest, cheapest and most visible blade pattern for this purpose, effective across the widest variety of backgrounds, is a single black blade in an array of white blades (McIsaac 2001, Hodos 2002). Hence blade marking may be an important means to reduce collision rates by making the rotating turbine blades as conspicuous as possible under the least favourable visual conditions, particularly at facilities where raptors are known or likely to be frequent collision casualties.

Even if the turbine rotors are marked in this way, many species may still be susceptible to colliding with them, especially during strong winds (when the rotor speed is high and birds tend to fly low and with less control) and when visibility is poor (at night or in thick mist). All other collision mitigation options operate indirectly, by reducing the frequency with which collision prone species are exposed to collision risk. This is achieved mainly by (i) siting farms and individual turbines away from areas of high avifaunal density or aggregation, regular commute routes or hazardous flight behavior, (ii) using low risk turbine designs and configurations, which discourage birds from perching on turbine towers or blades, and allow sufficient space for commuting birds to fly safely through the turbine strings, and (iii) carefully monitoring collision incidence, and being prepared to shut-down problem turbines at particular times or under particular conditions.

Effective mitigation can only be achieved with a commitment to rigorous pre- and post-construction monitoring (see below), ideally using a combination of occasional, direct observation of birds commuting or foraging through and around the wind energy facility, coupled with constant, remote tracking of avian traffic using specialised radar equipment (e.g. see http://www.detect-inc.com/wind.html). Such systems can be programmed to set the relevant turbines to idle as birds enter a pre-determined danger zone around the turbine array, and to re-engage those turbines once the birds have safely passed.

#### *4.1.2 Habitat loss – destruction, disturbance and displacement*

Although the final, destructive footprint of most wind energy facilities is likely to be relatively small, the construction phase of development inevitably incurs quite extensive temporary damage or permanent destruction of habitat, which may be of lasting significance in cases where wind energy facility sites coincide with critical areas for restricted range, endemic and/or threatened species. Similarly, construction, and to a lesser extent ongoing maintenance activities, are likely to cause some disturbance of birds in the general surrounds, and especially of shy and/or ground-nesting species resident in the area. Mitigation of such effects requires that generic best-practice principles be rigorously applied - sites are selected to avoid the destruction of key habitats, and construction and final footprints, as well as sources of disturbance of key species, must be kept to an absolute minimum. Some studies have shown significant decreases in the numbers of certain birds in areas where wind energy facilities are operational as a direct result of avoidance of the noise or movement of the turbines (e.g. Larsen & Guillemette 2007, Farfán *et al.* 2009, Table 1), while others have shown decreases which may be attributed to a combination of collision casualties and avoidance or exclusion from the impact zone of the facility in question (Stewart *et al.* 2007). Such displacement effects are probably more relevant in situations where wind energy facilities are built in natural habitat (Pearce-Higgins *et al.* 2009, Madders & Whitfield 2006) than in more modified environments such as farmland (Devereaux *et al.* 2008), and are highly species-specific in operation.

#### *4.1.3 Impacts of associated infrastructure*

Infrastructure commonly associated with wind energy facilities may also have detrimental effects on birds. The construction and maintenance of substations, and roadways causes both temporary and permanent habitat destruction and disturbance, and overhead power lines  substations and other live ancillary infrastructure may pose an electrocution risk to certain species (Van Rooyen 2004a, Lehman *et al.* 2007, Jenkins *et al.* 2010).

*Electrocution on power infrastructure*

Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004b, Lehman *et al.* 2007). Electrocution risk is strongly influenced by the voltage and design of the hardware installed (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components. Mitigation of electrocution risk involves the use of bird-safe structures (ideally with critical air gaps >2 m), the physical exclusion of birds from high risk areas of live infrastructure, and comprehensive insulation of such areas (van Rooyen 2004b, Lehman *et al.* 2007).

### 4.2. Description of the proposed wind energy facility

The project is proposed for portions of the following Farms: portions 19 and 22 of Zalverige Valley 660, portions 3 and 5 of Vergaaderingskraal 675, portion 1 of Ou Driefontein 721, portion 2 of New Driefontein 720, portions 3-9 of Wittekleibosch 787, Farm 818, the remainder of Farm 678 and portion 3 of Kliprug 676, all of which lie about 20 km west of Humansdorp, in the Eastern Cape Province, South Africa (Fig. 1).

The broader development site, within which the turbines and infrastructure will be built, covers an area of about 75 $km^2$. The proposed wind energy facility will generate up to 100 MW of power, and will comprise up to 50-60 wind turbines. Other infrastructure associated with the facility will include a small, on site substation, foundations to support the turbine towers, cabling between the project components, to be lain underground where practical, an overhead power line (132kV) feeding into the Eskom electricity network at the existing Melkhout Substation, a network of internal access roads, and a workshop area for maintenance and storage (Fig. 1).

## 5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

### 5.1 Vegetation of the study area

The natural vegetation of is probably dominated by Tsitsikamma Sandstone Fynbos (low montane or undulating proteoid shrubland with an ericoid understorey and interspersed with fynbos thicket) in the central part of the proposed development area, with Humansdorp Shale Renosterveld (medium dense shrubland dominated by renosterbos) in the lower areas in the north-east (Mucina & Rutherford 2006), Southern Cape Dune Fynbos (Fynbos heath covered dune slopes, with a strong restio component) adjacent to the coast, and patches of Southern Afrotemperate Forest along the watercourses.

### 5.2 Avian microhabitats

These comprise small, isolated areas of rocky **Fynbos or Renosterveld** covered hills (mostly in the south of the broader development area) (Fig. 2a), in a dominant matrix of **cultivated fields & pastures** (Fig. 2b). The deep valleys of the Klipdrift (east) and Tsitsikamma Rivers (west) and their immediate tributaries contain substantial patches of riparian thicket or **forest** (generally heavily infested by alien trees), and there are smaller patches of similar habitat along some of the smaller watercourses and drainage lines. The area also features a mosaic of small artificial **dams & wetlands**.

Average rainfall in the general area exceeds 650 mm annum, which falls throughout the year with a slight peak in late winter. Altitude averages about 160-180 m above sea level, ascending gradually from south to north, into the lower reaches of the Kareedouwberge. Land use is primarily dairy farming, with centre-pivot irrigation used to water areas of lush grazing to sustain the cattle herds. There are also limited areas of mixed agriculture. The site is positioned just south of the N2 highway. There are at least 5-6 farmsteads within or adjacent to the proposed development area, and one small, residential area. Road access comprises at least two main, gravel through-roads, a network of smaller, public access roads, and a further network of private farm tracks.

FIGURE 2a. Fynbos-covered slopes in the south of the proposed development area, looking north-west towards the forested/wooded valley of the Tsitsikamma River.

FIGURE 2b. Centre-pivot irrigation used to create lush grassland for dairy herds – a major land use option in the proposed Tsitsikamma Community WEF development area.

FIGURE 2c. Farm dams of various sizes (including some quite large impoundments in the north) are scattered across the proposed development area.

## 5.3 Avifauna of the impact area

The study area is located about 30 km south-east of the Kouga-Baviaanskloof Complex, 25 km east of the Tsitsikamma National Park, and about 50 km west of the Maitland-Gamtoos Coast – all of which are recognized as national Important Bird Areas (Barnes 1998), and are likely to support a diverse avifauna, including some significant populations of rare, threatened and/or endemic species. Over 240 bird species may occur with some regularity within the anticipated impact zone of the wind energy facility (Appendix 1), including 41 endemic or near-endemic species, 19 red-listed species, and four species – Knysna Woodpecker *Campethera notata*, Blue Crane *Anthropoides paradiseus*, Black Harrier *Circus maurus* and Knysna Warbler *Bradypterus sylvaticus* - which are both endemic and red-listed (Barnes 1998, 2000, Table 1).

Larger wetlands flanking the development area, including at least two large impoundments on the Krom River, the Krom River Estuary, and the Krom, Diep Tsitsikamma and Klipdrif Rivers themselves, may support some wetland birds, while sharply incised areas along the valleys of the larger rivers (especially the Tsitsikamma) may provide habitat for cliff-nesting raptors, including Lanner Falcon *Falco biarmicus* and possibly Peregrine Falcon *Falco peregrinus* (Jenkins 1994). Forest patches possibly support at least one pair of breeding Martial Eagle *Polemaetus bellicosus* in the near vicinity. Vlei areas along the river courses may attract African Marsh Harrier *Circus ranivorus*, and the Fynbos slopes and/or grassy Renosterveld flats may support Black Harrier as a seasonal visitor (Curtis *et al.* 2004).

Forty-five species were seen during a site visit on April 28-29 2011 (Appendix 1). Coverage of the area was adequate (Fig. 3), although the weather (cold, cloudy and windy) was not ideal. Notable observations included:

1. Seven sightings of Denham's Bustard (12 birds in total, with up to four birds in a group), foraging in the pastureland/croplands around the development site.
2. Six sightings of Blue Crane (40 birds in total, with up to 16 birds in a flock), foraging in the pastureland/croplands around the development site (Fig. 3).


FIGURE 3. Area covered (blue line) and significant sightings made (red ballons) within and around the (originally) proposed Tsitsikamma Community WEF development area during the April site visit, in relation to the (currently) proposed turbine layout (white targets).

Neither Knysna Woodpecker nor Knysna Warbler were seen during the site visit, but both are secretive birds and may have been overlooked. Certainly, the habitat encountered along the major river valleys looked promising for both, although these are unlikely to be badly affected by the proposed development.

On the basis of these on-site observations, and in combination with the available SABAP atlas data for the general area, 14 priority species are recognised as key in the assessment of avian impacts of the proposed Tsitsikamma Community Wind Energy Facility (Table 2), and as suitable surrogates for impacts on other species. These are mostly nationally and/or globally threatened species which are known to occur, or could occur in relatively high numbers in the development area and which are likely to be, or could be, negatively affected by the wind energy project. Peregrine Falcon is included despite the fact that it is not listed by either of the SABAP projects because it was seen nearby (at Humansdorp) and because the habitat looks at least marginally suitable. Some (in particular Denham's Bustard, Blue Crane and Martial Eagle) are either known or likely to breed in the general area. White Stork *Ciconia ciconia* is neither red-listed nor endemic, but it is protected under the global Convention on Migratory Species, and occurs in large numbers in the area in mid-late summer (Young *et al.* 2003).

In summary, the birds of greatest potential relevance and importance in terms of the possible impacts of the proposed wind energy facility are likely to be:

(i) Resident and/or seasonal influxes of large terrestrial birds, in particular Denham's Bustard and Blue Crane. The former is a widely but patchily spread pan-African species and a regional special, probably occurring permanently on site and may well breed there, while the latter is a threatened, endemic and occurs on site as breeding pairs in summer, and possibly also in large, non-breeding flocks in winter. Both are highly susceptible to collision mortality on power lines (Shaw *et al.* 2010a & b), probably susceptible to turbine collision mortality, and possibly susceptible to disturbance and displacement by the operating wind farm.

(ii) Resident and breeding and/or visiting raptors, in particular Martial Eagle, African Marsh Harrier, Black Harrier, Secretarybird *Sagittarius serpentarius*, Peregrine Falcon and Lanner Falcon. All are soaring species, prone to collision and possibly to displacement by the operating wind farm.

(iii) Flocks of wetland species commuting between resource areas (especially in relation to the Krom River Estuary and its impoundments and the coastline to the west).

(iv) A suite of smaller, restricted range and/or endemic species, possibly including Knysna Woodpecker and Knysna Warbler (see Table 1, Appendix 1).

**Table 2.** Priority bird species considered central to the avian impact assessment process for the Tsitsikamma Community Wind Energy Facility, selected on the basis of South African (Barnes 2000) or global conservation status (www.iucnredlist.org or http://www.birdlife.org/datazone/species/), level of endemism, relative abundance on site (SABAP reporting rates, direct observation), and estimated conservation or ecological significance of the local population. Red-listed endemic species are shaded in grey.

| Common name | Scientific name | SA conservation status/ (Global conservation status) | Regional endemism | Average SABAP reporting rate (*N* = 140 cards) | Estimated importance of local population | Preferred habitat | Risk posed by | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Collision | Electro-cution | Disturbance / habitat loss |
| Knysna Woodpecker | *Campethera notata* | Near-threatened | Endemic | 1.4 | Moderate | Forest and thicket patches | - | - | Moderate |
| Half-collared Kingfisher | *Alcedo semitorquata* | Near-threatened | - | 2.9 | Low | Rivers, wetlands | - | - | - |
| Denham's Bustard | *Neotis denhami* | Vulnerable (Near-threatened) | - | 34.2 | High | Pasturelands and heathlands | High | - | High |
| White-bellied Korhaan | *Eupodotis senegalensis* | Vulnerable | - | 1.4 | Low | Pasturelands | Moderate | - | High |
| Blue Crane | *Anthropoides paradiseus* | Vulnerable (Vulnerable) | Endemic | 7.9 | High | Croplands, pasturelands and wetlands | High | - | High |
| Black-winged Lapwing | *Vanellus melanopterus* | Near-threatened | - | 10.0 | Moderate | Pasturelands | - | - | High |
| African Marsh Harrier | *Circus ranivorus* | Vulnerable | - | 10.0 | Moderate | Wetlands, pasturelands and croplands | Moderate | - | Moderate |
| Black Harrier | *Circus maurus* | Near-threatened (Vulnerable) | Endemic | 5.0 | Moderate | Heathlands, wetlands and croplands | Moderate | - | High |
| Martial Eagle | *Polemaetus bellicosus* | Vulnerable (Near-threatened) | - | 1.4 | Moderate | Heathlands, pasturelands, and forest and thicket patches | High | High | Moderate |
| Secretarybird | *Sagittarius serpentarius* | Near-threatened | - | 2.1 | Moderate | Pasturelands and heathlands | High | - | Moderate |

| Common name | Scientific name | SA conservation status/ (Global conservation status) | Regional endemism | Average SABAP reporting rate (*N* = 140 cards) | Estimated importance of local population | Preferred habitat | Risk posed by | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **Collision** | **Electro-cution** | **Disturbance / habitat loss** |
| Lanner Falcon | *Falco biarmicus* | Near-threatened | - | 1.4 | Low | Pasturelands and croplands | High | Moderate | High |
| Peregrine Falcon | *Falco peregrinus* | Near-threatened | - | 0.0 | Low | Heathlands and croplands | High | Moderate | - |
| Knysna Warbler | *Bradypterus sylvaticus* | Vulnerable (Vulnerable) | Endemic | 1.0 | Low | Forest and thicket patches | - | - | Moderate |
| White Stork | *Ciconia ciconia* | - | - | 33.6 | High | Croplands, pasturelands | High | Moderate | - |

## 6. IMPACT ASSESSMENT

Impacts of the proposed Wind Energy Facility are most likely to be manifest in the following ways (Tables 3 & 4):

(i) Disturbance and displacement of resident/breeding or non-breeding large terrestrial birds from nesting and/or foraging areas by construction and/or operation of the facility, and /or mortality of these birds in collisions with the turbine blades or the new power lines while commuting between resource areas (croplands, nest sites, roost sites/wetlands).

(ii) Disturbance and displacement of resident/breeding or visiting raptors from foraging areas by construction and/or operation of the facility, and /or mortality of these species in collisions with the turbine blades or the new power lines while flying/foraging in the area, or by electrocution when perched on power infrastructure.

(iii) Disturbance and displacement of the flight lines of wetland birds commuting between resource areas positioned either side of the proposed development area and /or mortality of these birds in collisions with the turbine blades or the new power lines.

(iv) Disturbance and displacement of localised forest endemics – Knysna Woodpecker and Kynsna Warbler.

Mitigation of these impacts will be best achieved in the following ways:

(i) Minimising the disturbance impacts associated with the construction of the facility, by abbreviating construction time, scheduling activities around avian breeding and/or movement schedules (actual timing to be refined by the results of pre-construction monitoring), and lowering levels of associated noise. Possible Denham's Bustard and Blue Crane nest sites particularly relevant here.

(ii) Minimising habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible, building as few temporary roads as possible, and reducing the final extent of developed area to a minimum.

(iii) Minimising the disturbance impacts associated with the operation of the facility, by abbreviating maintenance times, scheduling activities in relation to avian breeding and/or movement schedules (actual timing to be refined by the results of pre- and post-construction monitoring), and lowering levels of associated noise. Possible Denham's Bustard and Blue Crane nest sites particularly relevant here.

(iv) Ensuring that lighting on the turbines is kept to a minimum, and is coloured (red or green) and intermittent, rather than permanent and white, to reduce confusion effects for nocturnal migrants.

(v) Minimising the length of any new power lines installed, ensuring that all new lines are marked with bird flight diverters (Jenkins *et al.* 2010) along their entire length, and that all new power line infrastructure is adequately insulated and bird friendly in configuration (Lehman *et al.* 2007). Note that current understanding of power line collision risk in birds precludes any guarantee of successfully distinguishing high risk from medium or low risk sections of a new line (Jenkins *et al.* 2010). The relatively low cost of marking the entire length of a new line during construction, especially quite a short length of line in an area frequented by collision prone birds, more than offsets the risk of not marking the correct sections, causing unnecessary mortality of birds, and then incurring the much greater cost of retro-fitting the line post-construction. In situations where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line.

(vi) Ensuring that all new power infrastructure (pylons, conductors, transformers, substations) is adequately insulated and bird friendly in configuration (Lehman *et al.* 2007).

(vii) Carefully monitoring the local avifauna both pre- and post-construction (see below), and implementing appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in this report, or when collision or electrocution mortalities are recorded for any of the priority species listed in this report. An essential weakness of the EIA process here is the dearth of knowledge about the actual movements of key species (bustards, cranes, eagles, other raptors, storks) through the impact area. Such knowledge must be generated as quickly and as accurately as possible in order for this and other wind energy proposals in the area to proceed in an environmentally sustainable way.

(viii) Ensuring that the results of pre-construction monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of other wind energy projects proposed for the same general area. Viewed in isolation, each of these projects may pose only a limited threat to the avifauna of the region. However, in combination they may result in landscape-scale displacement of threatened species from key areas of their distributions, the formation of significant barriers to energy-efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become repeated arrays of turbines spread across foraging areas and/or flight paths of priority species (Masden *et al.* 2010).

The broader, coastal plain area around Humansdorp/Jeffrey’s Bay/Cape St Francis is clearly of considerable importance to the regional status of Denham’s Bustard. Should this species be substantially impacted by either displacement or mortality associated with WEF development, cumulatively this could have a bearing on the national conservation status of this already threatened bird. Hence there is a strong requirement for careful monitoring and comprehensive mitigation.

(ix) Additional mitigation might include re-scheduling construction or maintenance activities on site, shutting down problem turbines either permanently or at certain times of year or in certain conditions, or installing a 'DeTect' or similar radar tracking system to monitor bird movements and institute temporary shut-downs as and when required.

### 6.1 Impact statement

This is a medium-sized wind energy project, proposed for a site with some conflicting issues in terms of its avifauna. The proposed development will possibly affect populations of regionally or nationally threatened (and impact susceptible) birds (mainly large terrestrial species and raptors) likely to occur within or close to the proposed turbine arrays. The facility will probably have a detrimental impact on these birds, particularly during its operational phase, unless commitment is made to mitigating these effects. Careful and responsible implementation of the required mitigation measures should reduce construction and operational phase impacts to sustainable levels, especially if every effort is made to monitor impacts throughout and to learn as much as possible about the effects of wind energy developments on South African avifauna. The impacts of this development must be viewed in the context of the potential cumulative effects generated by multiple other wind energy project proposed for the same general area. The cumulative impact of these projects on the utility of the area for Denham's Bustard is of particular concern.

**Table 3.** Assessment tables for construction impacts of the proposed Tsitsikamma Community Wind Energy Facility on the local avifauna.

**(A) Disturbance**

**Nature:** Noise, movement and temporary occupation of habitat during the building process. Likely to impact all birds in the area to some extent, but sensitive, sedentary and/or habitat specific species will most adversely affected.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Site & immediate area (2) | Site & immediate area (2) |
| **Duration** | Short (1) | Short (1) |
| **Magnitude** | Medium-Low (4) | Low-Medium (3) |
| **Probability** | Definite (5) | Definite (5) |
| **Significance** | 35 (Medium-Low) | 30 (Low-Medium) |
| **Status** | Negative | Negative |
| **Reversibility** | Medium | High |
| **Irreplaceable loss?** | Possible | Probably not |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:** Abbreviating construction time, scheduling activities around avian breeding and/or movement schedules (timing to be determined after pre-construction monitoring), lowering levels of associated noise, and reducing the size of the inclusive development footprint.

**Cumulative impacts:** Probably significant, given that there are many other WEF projects proposed for the general area.

**Residual impacts:** Some priority species may move away regardless of mitigation.

**(B) Habitat loss**

**Nature:** Destruction of habitat for priority species, either temporary – resulting from construction activities peripheral to the built area, or permanent - the area occupied by the completed development.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Site & immediate area (2) | Site & immediate area (1) |
| **Duration** | Permanent (5) | Permanent (5) |
| **Magnitude** | Low (2) | Low (2) |
| **Probability** | Definite (5) | Definite (5) |
| **Significance** | 45 (Medium) | 40 (Medium-Low) |
| **Status** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss?** | Possible | Probably not |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:** Minimising habitat destruction caused by the construction of the facility by keeping the lay-down areas as small as possible, building as few temporary roads as possible, and reducing the final extent of developed area to a minimum.

**Cumulative impacts:** Probable, given that there are many other WEF projects proposed for the general area.

**Residual impacts:** Some species may be permanently lost to the area regardless of mitigation.

**Table 4.** Assessment tables for operational impacts of the proposed Tsitsikamma Community Wind Energy Facility on the local avifauna.

**(A) Disturbance**

**Nature:** Noise and movement generated by operating turbines and maintenance activities is sufficient to disturb priority species, causing displacement from the area, adjustments to commute routes with energetic costs, or otherwise affecting nesting success or foraging efficiency.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Site & immediate area (2) | Site & immediate area (2) |
| **Duration** | Lifetime of the facility (4) | Lifetime of the facility (4) |
| **Magnitude** | Medium (6) | Medium-Low (5) |
| **Probability** | Highly probable (4) | Highly probable (4) |
| **Significance** | 48 (Medium) | 44 (Medium) |
| **Status** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss?** | Possible | Possible |
| **Can impacts be mitigated?** | Only slightly | |

**Mitigation:** Abbreviating maintenance times, scheduling activities in relation to avian breeding and/or movement schedules (timing to be determined after pre-construction monitoring), and lowering levels of associated noise.

**Cumulative impacts:** Highly likely, given that there are several other projects proposed for the same general area.

**Residual impacts:** Some priority species may be permanently lost from the area.

**(B) Mortality**

**Nature:** Collision of priority species with the wind turbine blades lines, or electrocution of the same on new power infrastructure.

| | **Without mitigation** | **With mitigation** |
|---|---|---|
| **Extent** | Region (3) | Region (3) |
| **Duration** | Lifetime of the facility (4) | Lifetime of the facility (4) |
| **Magnitude** | Medium-High (7) | Medium-Low (5) |
| **Probability** | Highly probable (4) | Probable (4) |
| **Significance** | 56 (Medium-High) | 48 (Medium) |
| **Status** | Negative | Negative |
| **Reversibility** | Low | Low |
| **Irreplaceable loss?** | Yes | Possibly not |
| **Can impacts be mitigated?** | Yes | |

**Mitigation:** Careful siting of turbines, bird friendly power hardware, monitoring priority bird movements and collisions, turbine management sensitive to these data – radar assisted if necessary.

**Cumulative impacts:** Yes, if many more turbines are built in the same general area (which seems highly likely), more collision hot-spots are likely, and mortality rates may increase.

**Residual impacts:** Some casualties may be incurred regardless of mitigation.

# 7. PROPOSED MONITORING PROGRAMME

## 7.1 General principles

The Birds & Wind Energy Specialist Group (BAWESG) has recently published best practice guidelines for bird monitoring at proposed wind energy development sites in South Africa (Jenkins *et al.* 2011). In terms of these guidelines, the primary aims of baseline or pre-construction monitoring are:

(i) To estimate the number/density of birds regularly present or resident within the broader impact area of the energy facility before its construction.

(ii) To document patterns of bird movements in the vicinity of the proposed facility before its construction.

(iii) To estimate predicted collision risk (the frequency with which individuals or flocks fly through the future rotor swept area of the proposed wind farm) for key species.

(iv) To establish a pre-impact baseline for bird numbers, distributions and movements.

(v) To mitigate impacts by informing the final design, and the construction and management strategy of the development.

Other generic stipulations of these guidelines include the following (Jenkins *et al.* 2011 and references therein):

(i) Monitoring data should be generated for both the broader impact zone of the proposed WEF, and for one or more comparable control sites, in order to allow comparison of data from pre- and post-construction monitoring to be calibrated in terms of an equivalent data set for a suitable control area.

(ii) Baseline or pre-construction monitoring requires periodic visits to both the development and control sites, sufficient in frequency to adequately sample all major variations in environmental conditions, and spanning a total study period of not less than 12 months.

(iii) Monitoring scope and intensity should be set in terms of the size, complexity and perceived sensitivity of each individual development site, as determined by the contracted avian specialist.

(iv) Variables measured/mapped on each site visit should include:

a. Density estimates for small terrestrial birds (in most cases not priority species, but potentially affected on a landscape scale by multiple developments in one area)
b. Absolute counts, density estimates or abundance indices for large terrestrial birds and raptors
c. Passage rates of birds flying through the proposed development area
d. Occupancy/numbers/breeding success at any focal raptor sites
e. Bird numbers at any focal wetlands
f. Full details of any incidental sightings of priority species.

## 7.2 Project specifics

The proposed Tsitsikamma Community Wind Energy Facility is a medium-sized wind farm, and a number of potentially significant bird impacts could result from this development were it to be authorized. The pre-construction monitoring work required to inform the final EIA report should be conducted over the recommended 12 months, and include a minimum of five data collection iterations spread more or less evenly over that period, in addition to an initial visit to the site with the consulting specialist in order to orientate the field team of two observers.

The location for the control survey area should be identified, ideally within 10 km of the development site. The selection of this site – done in terms of habitat, accessibility and landowner's permission - should be done during orientation. Note that it may be possible to share a control site with another, close neighbouring development site where bird monitoring is also underway.

*Sample counts of small terrestrial species*

Eight walked transects, each about 1 km in length, and two fixed point sampling stations, should be set up on the development site during the initial, site orientation visit. Similarly, four transects and two fixed point locations should be set in the control site. The transects should be located in open natural vegetation or in pasture/croplands, and the fixed points should be located at the well vegetated areas associated with the major drainage lines. Each transect should be walked once per visit to the site, and counts should be done once at each fixed point per visit, with the data collection procedures following the protocols laid out in the best practice guidelines (Jenkins *et al.* 2011).

*Counts of large terrestrial species and raptors*

An absolute count of large terrestrial birds and raptors should be done once per visit to the site, at both the development site and at the control, using a standardized combination of driving and walking to cover the required ground, and scanning from any available vantage points. The particulars of the route and methods used to derive these absolute tallies for key species should be determined for both sites at orientation. Data should be collected as per the protocols laid out in the best practice guidelines (Jenkins *et al.* 2011).

*Focal site surveys and monitoring*

Any habitats within the broader impact zone of a proposed wind energy facility, or an equivalent area around the control site, deemed likely to support nest sites of key raptor species (including owls) - cliff-lines or quarry faces, power lines, stands of large trees, marshes and drainage lines - should be surveyed using documented protocols in the initial stages of the monitoring project. All such sites should be mapped accurately, and checked on each visit to the study area to confirm continued occupancy, and to record any breeding activity, and the outcomes of such activity, that may take place over the survey period (Jenkins *et al.* 2011). No such sites are obvious at present, but some may emerge as monitoring proceeds.

Any major wetlands on and close to either the development area or the control should be identified, mapped and surveyed for waterbirds on each visit to the site, using the standard protocols set out by the CWAC initiative (Taylor *et al.* 1999). Such sites should include the largest 2-3 farm dams in each area, and will be confirmed at orientation.

*Incidental observations*

All other, incidental sightings of priority species (and particularly those suggestive of breeding or important feeding or roosting sites or flight paths) or other birds of interest, relevance or importance within the broader study area should be carefully plotted and documented. These could include details of nocturnal species (especially owls) heard calling at night (Jenkins *et al.* 2011). Again, all incidental sightings data should be collected as per the protocols laid out in the best practice guidelines (Jenkins *et al.* 2011).

*Movements and flight paths*

Counts of bird traffic over and around the development area and the control site should be conducted from four vantage points (three on the development site, and one on the control) which will be selected at orientation. At least 12 hours of observation should be accumulated at each vantage point for each monitoring iteration. All data should be collected as per the protocols laid out in the best practice guidelines (Jenkins *et al.* 2011).

**Table 4.** Provisional breakdown of time required in the field for each component of the baseline monitoring project required to inform the EIA for the Tsitsikamma Community Wind Energy Facility.

| | **Walked transects** | | **Vantage Points** | | **Fixed Point Counts** | | **Absolute Counts** | | **Wetland surveys** | | **Focal Sites** | | **Effort per iteration (hours)** | **Total effort (hours)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***n*** | **hours** | ***n*** | **hours** | ***n*** | **hours** | ***n*** | **hours** | ***n*** | **hours** | ***n*** | **hours** | | |
| **Wind energy facility** | 8 | 6 | 3 | 36 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 4 | 53 | 265 |
| **Control site** | 4 | 3 | 1 | 12 | 2 | 1 | 1 | 2 | 2 | 3 | 1 | 2 | 23 | 115 |

Overall, the monitoring project at Tsitsikamma and control should take up about 380 x 2 person hours (Table 4), in addition to about 30 x 3 person hours for the initial orientation visit, or about 770 person-hours in total. Note that an equivalent post-construction monitoring project will be required in order to measure the actual impacts of the facility should it be built, and to inform and refine the final bird impact mitigation strategy.

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**Appendix 1.** Annotated list of the bird species considered likely to occur within the impact zone of the proposed Tsitsikamma Community Wind Energy Facility. Species seen during the April site visit appear in **bold**.

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| Common Ostrich | *Struthio camelus* | | | X | X | | |
| **Red-necked Spurfowl** | ***Pternistes afer*** | | | **X** | **X** | **X** | |
| Common Quail | *Coturnix coturnix* | | | X | X | | |
| **Helmeted Guineafowl** | ***Numida meleagris*** | | | **X** | **X** | | |
| **Egyptian Goose** | ***Alopochen aegyptiaca*** | | | | **X** | | **X** |
| South African Shelduck | *Tadorna cana* | | Endemic | | | | X |
| **Spur-winged Goose** | ***Plectropterus gambensis*** | | | | **X** | | **X** |
| **White-faced Duck** | ***Dendrocygna viduata*** | | | | | | **X** |
| Cape Teal | *Anas capensis* | | | | | | X |
| African Black Duck | *Anas sparsa* | | | | | | X |
| **Yellow-billed Duck** | ***Anas undulata*** | | | | | | **X** |
| Cape Shoveler | *Anas smithii* | | Endemic | | | | X |
| Red-billed Teal | *Anas erythrorhyncha* | | | | | | X |
| Scaly-throated Honeyguide | *Indicator variegatus* | | | | | X | |
| Greater Honeyguide | *Indicator indicator* | | | | | X | |
| Lesser Honeyguide | *Indicator minor* | | | | | X | |

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| Knysna Woodpecker | *Campethera notata* | Near-threatened | Endemic | | | X | |
| Ground Woodpecker | *Geocolaptes olivaceus* | | Endemic | X | | | |
| Cardinal Woodpecker | *Dendropicos fuscescens* | | | | | X | |
| Olive Woodpecker | *Dendropicos griseocephalus* | | | | | X | |
| **Black-collared Barbet** | ***Lybius torquatus*** | | | | | **X** | |
| Red-fronted Tinkerbird | *Pogoniulus pusillus* | | | | | X | |
| Acacia Pied Barbet | *Tricholaema leucomelas* | | Near-endemic | | | X | |
| Crowned Hornbill | *Tockus alboterminatus* | | | | | X | |
| African Hoopoe | *Upupa africana* | | | | | X | |
| Green Wood-Hoopoe | *Phoeniculus purpureus* | | | | | X | |
| European Roller | *Coracias garrulus* | | | | X | | |
| Half-collared Kingfisher | *Alcedo semitorquata* | Near-threatened | | | | | X |
| Malachite Kingfisher | *Alcedo cristata* | | | | | | X |
| **Brown-hooded Kingfisher** | ***Halcyon albiventris*** | | | | | **X** | |
| Giant Kingfisher | *Megaceryle maximus* | | | | | | X |
| Pied Kingfisher | *Ceryle rudis* | | | | | | X |
| European Bee-eater | *Merops apiaster* | | | X | X | | |
| Speckled Mousebird | *Colius striatus* | | | X | X | | |
| Red-faced Mousebird | *Urocolius indicus* | | | X | X | | |
| Jacobin Cuckoo | *Clamator jacobinus* | | | X | | X | |

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| Great Spotted Cuckoo | *Clamator glandarius* | | | X | | X | |
| Red-chested Cuckoo | *Cuculus solitarius* | | | | | X | |
| Black Cuckoo | *Cuculus clamosus* | | | | | X | |
| Klaas's Cuckoo | *Chrysococcyx klaas* | | | X | | X | |
| Diderick Cuckoo | *Chrysococcyx caprius* | | | X | | X | |
| Burchell's Coucal | *Centropus burchellii* | | | | | | X |
| Alpine Swift | *Tachymarptis melba* | | | X | | | |
| Common Swift | *Apus apus* | | | X | | | |
| African Black Swift | *Apus barbatus* | | | X | | | |
| Little Swift | *Apus affinis* | | | X | | | |
| Horus Swift | *Apus horus* | | | X | | | |
| White-rumped Swift | *Apus caffer* | | | X | | | |
| Barn Owl | *Tyto alba* | | | X | X | | |
| Spotted Eagle-Owl | *Bubo africanus* | | | X | X | | |
| African Wood-Owl | *Strix woodfordii* | | | | | X | |
| Marsh Owl | *Asio capensis* | | | | | | X |
| Fiery-necked Nightjar | *Caprimulgus pectoralis* | | | X | | | |
| Rock Dove | *Columba livia* | | | X | X | | |
| Speckled Pigeon | *Columba guinea* | | | | X | | |
| African Olive-Pigeon | *Columba arquatrix* | | | | | X | |
| **Laughing Dove** | ***Streptopelia senegalensis*** | | | **X** | **X** | | |
| **Cape Turtle-Dove** | ***Streptopelia capicola*** | | | **X** | **X** | | |

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| **Red-eyed Dove** | ***Streptopelia semitorquata*** | | | | **X** | **X** | |
| Emerald-spotted Wood-Dove | *Turtur chalcospilos* | | | | | X | |
| Tambourine Dove | *Turtur tympanistria* | | | | | X | |
| Namaqua Dove | *Oena capensis* | | | X | | | |
| **Denham's Bustard** | ***Neotis denhami*** | **Vulnerable** | | **X** | **X** | | |
| Southern Black Korhaan | *Afrotis afra* | | Endemic | X | X | | |
| White-bellied Korhaan | *Eupodotis senegalensis* | Vulnerable | | X | | | |
| **Blue Crane** | ***Anthropoides paradiseus*** | **Vulnerable** | **Endemic** | **X** | **X** | | |
| Buff-spotted Flufftail | *Sarothrura elegans* | | | | | X | |
| Red-chested Flufftail | *Sarothrura rufa* | | | | | | X |
| African Rail | *Rallus caerulescens* | | | | | | X |
| Black Crake | *Amaurornis flavirostris* | | | | | | X |
| Baillon's Crake | *Porzana pusilla* | | | | | | X |
| African Purple Swamphen | *Porphyrio madagascariensis* | | | | | | X |
| African Finfoot | *Podica senegalensis* | Near-threatened | - | | | | X |
| Common Moorhen | *Gallinula chloropus* | | | | | | X |
| **Red-knobbed Coot** | ***Fulica cristata*** | | | | | | **X** |
| African Snipe | *Gallinago nigripennis* | | | X | | | X |
| African Jacana | *Actophilornis africanus* | | | | | | X |
| Water Thick-knee | *Burhinus vermiculatus* | | | | | | X |

| **Common name** | **Scientific name** | **Conservation status** | **Regional endemicity** | **Habitat** | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Fynbos / Renosterveld slopes** | **Old pastures and cultivated lands** | **Indigenous and alien forest** | **Wetlands** |
| Spotted Thick-knee | *Burhinus capensis* | | | X | X | | |
| Black-winged Stilt | *Himantopus himantopus* | | | | | | X |
| Pied Avocet | *Recurvirostra avosetta* | | | | | | X |
| Kittlitz's Plover | *Charadrius pecuarius* | | | | | | X |
| Three-banded Plover | *Charadrius tricollaris* | | | | | | X |
| **Blacksmith Lapwing** | ***Vanellus armatus*** | | | | | | **X** |
| Black-winged Lapwing | *Vanellus melanopterus* | Near-threatened | | X | X | | |
| Crowned Lapwing | *Vanellus coronatus* | | | X | X | | |
| **Kelp Gull** | ***Larus dominicanus*** | | | | **X** | | **X** |
| Whiskered Tern | *Chlidonias hybrida* | | | | | | X |
| White-winged Tern | *Chlidonias leucopterus* | | | | | | X |
| African Cuckoo Hawk | *Aviceda cuculoides* | | | X | | X | |
| Black-shouldered Kite | *Elanus caeruleus* | | | X | X | | |
| Black Kite | *Milvus migrans* | | | X | X | | |
| **African Fish-Eagle** | ***Haliaeetus vocifer*** | | | | | | **X** |
| African Marsh-Harrier | *Circus ranivorus* | Vulnerable | | | X | | X |
| Black Harrier | *Circus maurus* | Near-threatened | Endemic | X | X | | X |
| Pallid Harrier | *Circus macrourus* | Near-threatened | | X | | | |
| **African Harrier-Hawk** | ***Polyboroides typus*** | | | | | **X** | |
| African Goshawk | *Accipiter tachiro* | | | | | X | |
| Little Sparrowhawk | *Accipiter minullus* | | | | | X | |

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| Rufous-chested Sparrowhawk | *Accipiter rufiventris* | | | | | X | |
| Black Sparrowhawk | *Accipiter melanoleucus* | | | | | X | |
| Steppe Buzzard | *Buteo vulpinus* | | | | X | X | |
| Forest Buzzard | *Buteo trizonatus* | | Endemic | | X | X | |
| **Jackal Buzzard** | ***Buteo rufofuscus*** | | **Endemic** | **X** | **X** | **X** | |
| Verreauxs' Eagle | *Aquila verreauxii* | | | X | | | |
| Booted Eagle | *Aquila pennatus* | | | X | X | | |
| Martial Eagle | *Polemaetus bellicosus* | Vulnerable | | X | | | |
| Long-crested Eagle | *Lophaetus occipitalis* | | | | | X | X |
| African Crowned Eagle | *Stephanoaetus coronatus* | Near-threatened | | | | X | |
| Secretarybird | *Sagittarius serpentarius* | Near-threatened | | X | X | | |
| Lesser Kestrel | *Falco naumanni* | Vulnerable | | X | X | | |
| Rock Kestrel | *Falco rupicolus* | | | X | X | | |
| Amur Falcon | *Falco amurensis* | | | X | X | | |
| Eurasian Hobby | *Falco subbuteo* | | | X | | X | |
| Lanner Falcon | *Falco biarmicus* | Near-threatened | | X | X | | |
| Peregrine Falcon | *Falco peregrinus* | Near-threatened | | X | X | | |
| **Little Grebe** | ***Tachybaptus ruficollis*** | | | | | | **X** |
| Great Crested Grebe | *Podiceps cristatus* | | | | | | X |
| African Darter | *Anhinga rufa* | | | | | | X |

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| **Reed Cormorant** | ***Phalacrocorax africanus*** | | | | | | **X** |
| **White-breasted Cormorant** | ***Phalacrocorax lucidus*** | | | | | | **X** |
| Little Egret | *Egretta garzetta* | | | | | | X |
| Yellow-billed Egret | *Egretta intermedia* | | | | | | X |
| Great Egret | *Egretta alba* | | | | | | X |
| **Grey Heron** | ***Ardea cinerea*** | | | | | | **X** |
| **Black-headed Heron** | ***Ardea melanocephala*** | | | **X** | **X** | | **X** |
| Purple Heron | *Ardea purpurea* | | | | | | |
| **Cattle Egret** | ***Bubulcus ibis*** | | | | **X** | | **X** |
| Squacco Heron | *Ardeola ralloides* | | | | | | X |
| Little Bittern | *Ixobrychus minutus* | | | | | | X |
| Hamerkop | *Scopus umbretta* | | | | | | X |
| **Hadeda Ibis** | ***Bostrychia hagedash*** | | | | **X** | **X** | **X** |
| **African Sacred Ibis** | ***Threskiornis aethiopicus*** | | | | **X** | | **X** |
| **African Spoonbill** | ***Platalea alba*** | | | | | | **X** |
| Yellow-billed Stork | *Mycteria ibis* | Near-threatened | | | | | X |
| Black Stork | *Ciconia nigra* | Near-threatened | | X | | | X |
| **White Stork** | ***Ciconia ciconia*** | | | **X** | **X** | | **X** |
| Black-headed Oriole | *Oriolus larvatus* | | | | | X | |
| **Fork-tailed Drongo** | ***Dicrurus adsimilis*** | | | | | **X** | |
| Blue-mantled Crested-Flycatcher | *Trochocercus cyanomelas* | | | | | X | |

| Common name | Scientific name | Conservation status | Regional endemicity | Habitat | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fynbos / Renosterveld slopes | Old pastures and cultivated lands | Indigenous and alien forest | Wetlands |
| African Paradise-Flycatcher | *Terpsiphone viridis* | | | | | X | |
| Black-backed Puffback | *Dryoscopus cubla* | | | | | X | |
| Southern Tchagra | *Tchagra tchagra* | | Endemic | X | | X | |
| Southern Boubou | *Laniarius ferrugineus* | | Endemic | X | | X | |
| **Bokmakierie** | ***Telophorus zeylonus*** | | **Near-endemic** | **X** | | | |
| Grey-headed Bush-Shrike | *Malaconotus blanchoti* | | | | | X | |
| Cape Batis | *Batis capensis* | | Endemic | X | | X | |
| **Cape Crow** | ***Corvus capensis*** | | | **X** | **X** | **X** | |
| Pied Crow | *Corvus albus* | | | X | X | | |
| White-necked Raven | *Corvus albicollis* | | | X | X | | |
| Red-backed Shrike | *Lanius collurio* | | | X | X | | |
| **Common Fiscal** | ***Lanius collaris*** | | | **X** | **X** | | |
| Black Cuckooshrike | *Campephaga flava* | | | | | X | |
| Southern Black Tit | *Parus niger* | | | X | | X | |
| **Brown-throated Martin** | ***Riparia paludicola*** | | | | | | **X** |
| Banded Martin | *Riparia cincta* | | | X | X | | X |
| Barn Swallow | *Hirundo rustica* | | | X | X | | X |
| White-throated Swallow | *Hirundo albigularis* | | | | | | X |
| Pearl-breasted Swallow | *Hirundo dimidiata* | | | X | X | | X |
| Greater Striped Swallow | *Hirundo cucullata* | | | X | X | | |

| **Common name** | **Scientific name** | **Conservation status** | **Regional endemicity** | **Habitat** | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Fynbos / Renosterveld slopes** | **Old pastures and cultivated lands** | **Indigenous and alien forest** | **Wetlands** |
| Lesser Striped Swallow | *Hirundo abyssinica* | | | X | X | | |
| Rock Martin | *Hirundo fuligula* | | | X | | | |
| Common House-Martin | *Delichon urbicum* | | | X | X | | X |
| Black Saw-wing | *Psalidoprocne holomelaena* | | | | | X | |
| Cape Bulbul | *Pycnonotus capensis* | | Endemic | X | | X | |
| **Sombre Greenbul** | ***Andropadus importunus*** | | | | | **X** | |
| Fairy Flycatcher | *Stenostira scita* | | Endemic | X | | | |
| Cape Grassbird | *Sphenoeacus afer* | | Endemic | X | | | |
| Victorin's Warbler | *Cryptillas victorini* | | Endemic | X | | | |
| Little Rush-Warbler | *Bradypterus baboecala* | | | | | | X |
| Knysna Warbler | *Bradypterus sylvaticus* | Vulnerable | Endemic | | | X | |
| African Reed-Warbler | *Acrocephalus baeticatus* | | | | | | X |
| Lesser Swamp-Warbler | *Acrocephalus gracilirostris* | | | | | | X |
| Yellow-throated Woodland-Warbler | *Phylloscopus ruficapilla* | | | | | X | |
| Willow Warbler | *Phylloscopus trochilus* | | | | | X | |
| **Cape White-eye** | ***Zosterops virens*** | | **Endemic** | **X** | | **X** | |
| Lazy Cisticola | *Cisticola aberrans* | | | X | | | |
| **Grey-backed Cisticola** | ***Cisticola subruficapilla*** | | **Near-endemic** | **X** | | | |
| Wailing Cisticola | *Cisticola lais* | | | X | | | |

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| Levaillant's Cisticola | *Cisticola tinniens* | | | | | | X |
| Neddicky | *Cisticola fulvicapilla* | | | X | | | |
| Zitting Cisticola | *Cisticola juncidis* | | | | X | | |
| Cloud Cisticola | *Cisticola textrix* | | Near-endemic | | X | | |
| Karoo Prinia | *Prinia maculosa* | | Endemic | X | | X | |
| Bar-throated Apalis | *Apalis thoracica* | | | | | X | |
| Yellow-breasted Apalis | *Apalis flavida* | | | | | X | |
| Green-backed Camaroptera | *Camaroptera brachyura* | | | | | X | |
| Rufous-naped Lark | *Mirafra africana* | | | X | X | | |
| Cape Clapper Lark | *Mirafra apiata* | | Endemic | X | X | | |
| Eastern Long-billed Lark | *Certhilauda semitorquata* | | Endemic | X | X | | |
| Red-capped Lark | *Calandrella cinerea* | | | X | X | | |
| Cape Rock-Thrush | *Monticola rupestris* | | Endemic | X | | | |
| Olive Thrush | *Turdus olivaceus* | | | | | X | |
| Southern Black Flycatcher | *Melaenornis pammelaina* | | | | | X | |
| Fiscal Flycatcher | *Sigelus silens* | | Endemic | X | | X | |
| Spotted Flycatcher | *Muscicapa striata* | | | | | X | |
| African Dusky Flycatcher | *Muscicapa adusta* | | | | | X | |
| Cape Robin-Chat | *Cossypha caffra* | | | | | X | |
| White-browed Scrub-Robin | *Cercotrichas leucophrys* | | | | | X | |

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| **African Stonechat** | ***Saxicola torquatus*** | | | **X** | **X** | | |
| Capped Wheatear | *Oenanthe pileata* | | | X | X | | |
| Familiar Chat | *Cercomela familiaris* | | | X | X | | |
| Ant-eating Chat | *Myrmecocichla formicivora* | | Endemic | X | | | |
| Red-winged Starling | *Onychognathus morio* | | | X | | | |
| Cape Glossy Starling | *Lamprotornis nitens* | | | | | X | |
| **Pied Starling** | ***Spreo bicolor*** | | **Endemic** | **X** | **X** | | |
| Wattled Starling | *Creatophora cinerea* | | | X | X | | |
| **Common Starling** | ***Sturnus vulgaris*** | | | | **X** | | |
| Cape Sugarbird | *Promerops cafer* | | Endemic | X | | | |
| Orange-breasted Sunbird | *Anthobaphes violacea* | | Endemic | X | | | |
| Amethyst Sunbird | *Chalcomitra amethystina* | | | | | X | |
| Malachite Sunbird | *Nectarinia famosa* | | | X | | X | |
| Collared Sunbird | *Hedydipna collaris* | | | | | X | |
| Southern Double-collared Sunbird | *Cinnyris chalybeus* | | Endemic | X | | X | |
| Greater Double-collared Sunbird | *Cinnyris afer* | | Endemic | X | | X | |
| Cape Sugarbird | *Promerops cafer* | | Endemic | X | | | |
| Spectacled Weaver | *Ploceus ocularis* | | | X | | X | X |
| Cape Weaver | *Ploceus capensis* | | Endemic | X | | X | X |
| Southern Masked-Weaver | *Ploceus velatus* | | | X | | X | X |

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| Red-billed Quelea | *Quelea quelea* | | | X | X | | |
| Southern Red Bishop | *Euplectes orix* | | | | X | | X |
| **Yellow Bishop** | ***Euplectes capensis*** | | | | | | **X** |
| Thick-billed Weaver | *Amblyospiza albifrons* | | | | | | X |
| African Quailfinch | *Ortygospiza atricollis* | | | | X | | |
| **Swee Waxbill** | ***Coccopygia melanotis*** | | **Endemic** | | | **X** | |
| Common Waxbill | *Estrilda astrild* | | | | | | X |
| African Firefinch | *Lagonosticta rubricata* | | | | | X | |
| Bronze Mannikin | *Spermestes cucullatus* | | | | | | X |
| Pin-tailed Whydah | *Vidua macroura* | | | X | X | | |
| Dusky Indigobird | *Vidua funerea* | | | | | X | |
| **House Sparrow** | ***Passer domesticus*** | | | **X** | **X** | | |
| Cape Sparrow | *Passer melanurus* | | Near-endemic | X | X | | |
| Southern Grey-headed Sparrow | *Passer diffusus* | | | | X | X | |
| African Pied Wagtail | *Motacilla aguimp* | | | | | | X |
| **Cape Wagtail** | ***Motacilla capensis*** | | | **X** | **X** | | **X** |
| **Cape Longclaw** | ***Macronyx capensis*** | | **Endemic** | **X** | **X** | | |
| African Pipit | *Anthus cinnamomeus* | | | X | X | | |
| Plain-backed Pipit | *Anthus leucophrys* | | | X | X | | |
| Long-billed Pipit | *Anthus similis* | | | X | X | | |
| Cape Canary | *Serinus canicollis* | | Endemic | X | X | | |
| Brimstone Canary | *Crithagra sulphuratus* | | | | | X | |

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| White-throated Canary | *Crithagra albogularis* | | Near-endemic | X | | | |
| Streaky-headed Seedeater | *Crithagra gularis* | | | X | | | |
| Cape Bunting | *Emberiza capensis* | | Near-endemic | X | X | | |