NamPower/Namibia Nature Foundation Strategic Partnership

Newsletter No. 5: September 2010

IN THIS ISSUE

FOCUS ON FLAMINGOS AND POWER LINES

A collision event involving at least 20 flamingos on the Grootfontein - Gerus-Zambezi 350HVDC line (Tower 412-490) in November 2009 was reported in newsletter No. 4, p7. Two more collision events on the coast, in the same month, are cause for a growing concern about flamingo and power line interactions.

Power line survey: Trekkopje – Wlotzka 132 kV (TRE/WLO 1-186)

and the start of the Trekkopje – Henties Bay 66 kV bypass (W1 – W16)

Report by Ann & Mike Scott

Survey details

Area: Swakopmund/Wlotzkasbaken
Date & time: 16/7/2010 (10h30-12h30)
Participants: Kaarina Nkandi (Environment Management for the Areva Trekkopje Mine; email kaarina.nkandi@areva.com); Mike & Ann Scott (NP/NNF Partnership)

Motivation

Two flamingo collision events on transmission lines in the above area in November 2009 were reported by Siggi Pitsch of Power Lines Africa (Pty) Ltd (email siggi.pitsch@=plafrica.com, cell 081 284 8010), via Karl-Heinz Wagner (NamPower). Siggi Pitsch forwarded detailed maps with the following comments:

(1) On the 132kV – the flamingo was spotted between Towers [TRE / WLO 136] and [TRE / WLO 139], which is located between Lichen and Dolorite Sub-station.

(2) On the 66kV – the flamingos were reported between the first angled strain tower (W 12) and the intermediate just after the river crossing (W 16).

This area falls within the speculated flight path of flamingos between the coast and Etosha. At the time of inspection, no mitigation measures had been fitted.

Flamingo mortality on a power line between Swakopmund and Walvis Bay in 2007 (*photo Gloudi de Beer*)

Google image showing sites of flamingo collisions (red markers) on the new 132 kV Trekkopje-Wlotzka line north-east of Swakopmund (left), and 66 kV Trekkopje Bypass (right) (based on a Google map generated by Alice Jarvis [EIS]).

The NamPower/Namibia Nature Foundation Strategic Partnership is funded by the European Investment Bank
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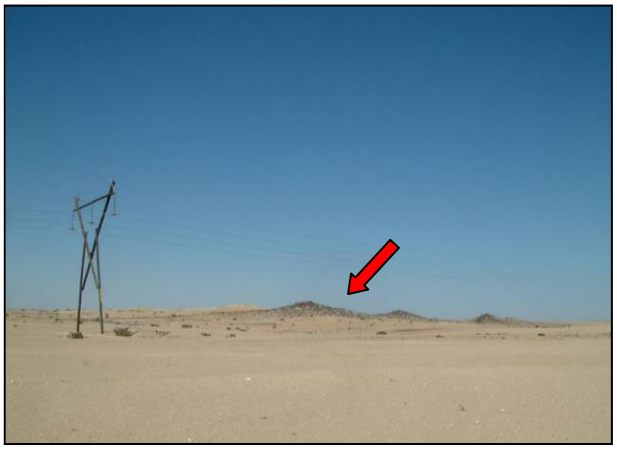


Dolorite dykes run more or less parallel to the 132 kV line and may offer shelter to flamingos flying north-eastwards against strong (east) winds; the birds would then probably fly low and, as they fly at night, the potential for colliding with these new power line structures could be high *(photo Ann Scott)*

The 66 kV Trekkopje Bypass line (right, with wooden five-pole structures) runs parallel to the larger 220 kV line (left); it is possible that the three flamingos collided with the less visible earth/optic fibre ground wires (red circle above and red arrows below) on the latter structure (*photos Ann Scott*)

Findings

Habitat: Desert - open gravel plains with dolorite dykes and dry water courses, and very little vegetation.
Bird mortalities: No more mortalities found.
Bird nests: None.
Wildlife (live): Rüppell's Korhaan; Pied Crows near construction camp at Trekkopje Substation; jackal spoor in the vicinity of the line.

Incident 1: One flamingo
Trekkopje – Wlotzka 132 kV line

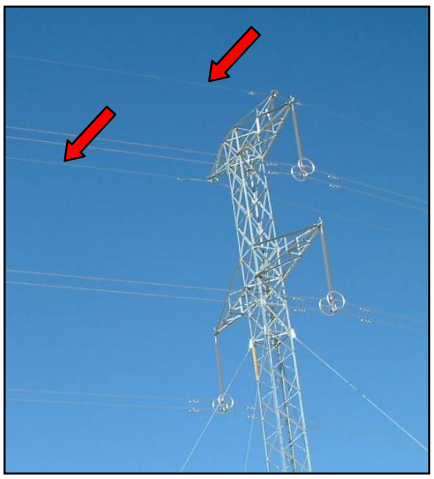
The 132 kV Trekkopje-Wlotzka line runs roughly from north-east to south-west. We investigated from Towers 1 to 186 (33.5 km; towers are on average 180m apart).

Incident 2: Three flamingos
66 kV Trekkopje Bypass and 220 kV line

We investigated from Tower W1 (S22.13606 E14.89558) to W16 (S22.11880 E14.87559); about 2.9 km (towers are on average 180m apart). The incident took place between Tower W12 and W16; but possibly on the high, less visible optic fibre ground wire (OPGW) of the adjacent 220 kV line.

General comments

There was much activity in the area by earthworks construction and other vehicles. In parts, areas that have been disturbed (e.g. on roads/tracks) are very soft and give off clouds of fine dust.
Dry water courses, and dolorite dykes (especially on the Trekkopje-Wlotzka line), run roughly from north-east to south-west, which coincides with the general direction of speculated flamingo flight paths. The dykes may offer some protection for birds flying against strong (east) winds, in which case the birds would probably fly low, along the lee side of the dykes. Power lines situated in these habitats may thus present a potential threat, especially to birds flying at night and especially new lines.



Recommendations

The mortality of flamingos is a cause for concern. As scavengers may have removed whole carcasses, the reported figures are considered to represent a minimum number of collisions. Both Greater Flamingos and Lesser Flamingos are classed as *Vulnerable* in Namibia (Simmons & Brown 2006), while the latter species is also regarded as *Globally Vulnerable* (see p4). If one were to multiply these minimum figures by the length of the line (and other similar lines) and per year, the result could be a significant off-take from the flamingo populations.
A similar collision incident involving 20 flamingos on the new 350 HVDC line east of Grootfontein was reported to have taken place in November 2009 (see Newsletter no. 4, pp 7-8); this line spans the speculated flamingo flight path between Etosha and Tsumkwe (see p4), the migrations apparently taking place after the first rains inland. The 132 kV Trekkopje-Wlotzka line also appears to run parallel to a migratory route for flamingos between the coast and Etosha National Park. Further incidents may thus be possible. The recommendations below should therefore be considered as extremely urgent (see also comments by Graham McCullogh on p3).

1. **Mitigation**: Investigate mitigation in problem areas already identified in this report. The Mace Bird Lite and/or blinking solar powered aviation lights attached to the optic fibre ground wires could be tested on an experimental basis. Investigate markers that could possibly provide an (ultra-sonic) auditory signal.
2. **Monitoring:** Include monitoring of the lines mentioned in this survey report (especially in identified problem areas and especially in November/ December) during regular activities by NamPower and Areva Environmental Management in order to determine:
   - Any further problems in other areas (if possible, please obtain photographic records of carcasses)
   - The effectiveness of mitigation measures (once applied)
3. **Assessment of the extent and areas of impact**: Investigate pilot monitoring surveys along power lines running through identified/potential flamingo flight paths in Namibia, in order to obtain a more holistic idea of the impact of power line collisions on these species. The surveys could be done in early December (as late October/November appears to be a time for migration) and possibly also during the dry season for comparison, using a standardized form. Based on the findings, make an assessment of the sections where mitigation is a priority. Given the constraints on NamPower resources during the rainy season, consider supplementary counts by trained volunteers. Follow up these pilot investigations with a further expanded survey of power lines.
4. **Research**: Conduct further research to establish/ confirm flamingo flight paths.
5. **Awareness**: Continue to promote awareness about the problem and reporting method to NamPower and Areva staff and other stakeholders (including environmental managers of other mines; construction companies; EIA practitioners; land owners/managers)

Acknowledgements
Thank you to Kaarina Nkandi (Areva) for her willing assistance in the field; Karl-Heinz Wagner (NamPower), Markus Pfaffenthaler (Areva) and Sandra Muller (Areva) for kindly facilitating the survey; and Siggi Pitsch (Power Line Africa [Pty] Ltd) for reporting the incidents and providing follow-up information.

Kaarina Nkandi (left) and Ann Scott at the Trekkopke-Wlotzka 132 kV line in July 2010 (*photo Mike Scott*)

Regular bird counts at the Walvis Bay wetlands yield totals of up to 40 000 Greater Flamingos and 30 000 Lesser Flamingos (K. Wearne pers. comm; *photo Ann Scott*)

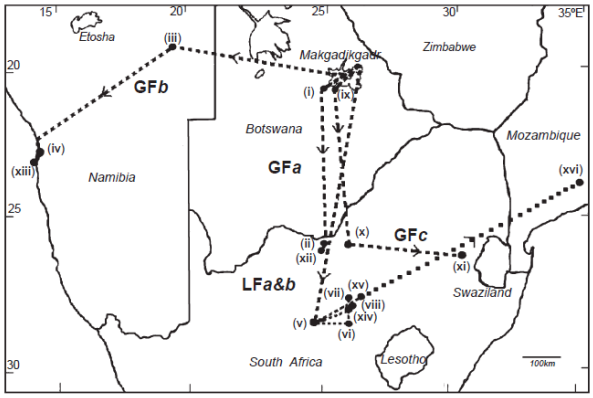
Comments by Graham McCulloch, flamingo researcher
(email gmmcculloch@info.bw)
I can appreciate your concerns - I believe flamingos are very vulnerable to power line collisions (I have seen a lot of it here on Sua Pan [Botswana], even with fluorescent light bulbs attached as deterrents [Botswana Ash mine]) - I think it could be the earth wire above which catches them out as they try to avoid the main power lines). I would guess that those lines closest to Etosha and Walvis would present the greatest risk.

Migration timing for flamingos is between late October and early December and varies at the end of the wet season, depending on the rains. It is usually around April - May, but can vary a lot. This year it will dry up next month, for example.

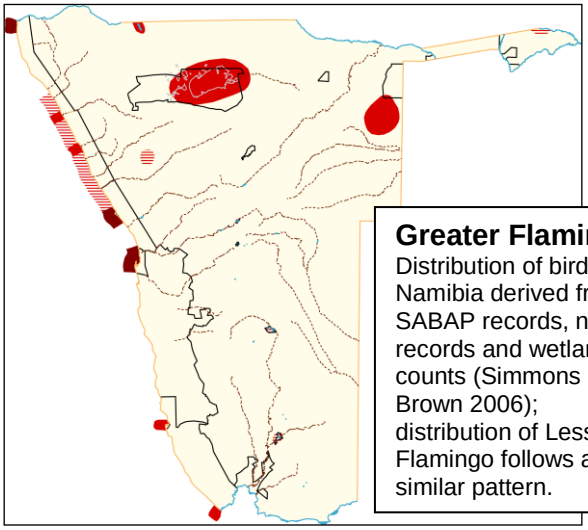
The routing of the migrating flamingos (both species) seems to occur along the lines you have suggested. A paper published after my last satellite tracking programme in 2001-2002 gives a rough idea of the flight path (see p4). The exact path is still not certain, as the satellite devices are not on continuously, but the movement of one of the Greater Flamingos confirms the path direct from the Makgadikgadi, via Bushman pans to Etosha, and from there to Walvis. There is also a good possibility of a direct path to Walvis from here.

Fluorescent light bulbs are good deterrents and have been placed on the powerline that feeds the soda ash mine here on Sua Pan. Light, I believe is the only answer with these predominantly nocturnal migrating birds. The problems occur on stormy nights and during dust storms - which present conditions in which collisions are very difficult to combat.

I am currently placing six more PTTs on Lesser Flamingos, which should give us flight path and seasonal movement data for the next three years. I will of course let you know when and how to get hold of this data, when it starts coming in.



The migration of two Greater Flamingos (GF *a & b*) and three Lesser Flamingos (LF *a, b & c*) from the Makgadigadi salt pans to their non-breeding destinations around southern Africa. Precise locations of all sites are given in the Appendix (*Map: McCullogh et al. 2003*)



Greater Flamingo
Distribution of birds in Namibia derived from SABAP records, nest records and wetland counts (Simmons & Brown 2006); distribution of Lesser Flamingo follows a similar pattern.

SATELLITE TRACKING OF FLAMINGOS IN SOUTHER AFRICA: THE IMPORTANCE OF SMALL WETLANDS FOR MANAGEMENT AND CONSERVATION

Graham McCulloch, Adrian Aebischer & Kenneth Irvine

Short communication: Oryx Vol 37 No 4 October 2003

Abstract- The Makgadikgadi Salt Pans in Botswana are one of the most important breeding sites in southern Africa for Lesser Flamingos *Phoeniconaias minor* and Greater Flamingos *Phoenicopterus ruber roseus*. Much of flamingo migration behaviour is unknown and there has been speculation on the pattern of flamingo movements to and from Makgadikgadi and their dispersal throughout southern Africa. We carried out the first satellite tracking of flamingos in southern Africa to find out where Lesser and Greater flamingos go after leaving Makgadikgadi. In July 2001 five Lesser and three Greater flamingos were tagged. Following migration from the pans, one of the Greater Flamingos flew west to the coast of Namibia, the other south to a small wetland in South Africa. The Lesser Flamingos moved south-east from Makgadikgadi to South Africa and Mozambique. Movement by both species was nocturnal. This work shows that flamingos migrate from all over southern Africa to Makgadikgadi to breed. It also shows that, during the non-breeding season, movement is widely dispersed and nomadic among a network of wetlands around the subcontinent. Small wetlands, often unrecognized as important for conservation, provide valuable feeding sites and migration staging posts along flamingo migration routes. This highlights the need for the conservation of the network of small wetlands around southern Africa, which are often under threat from anthropogenic activities, to protect two high profile bird species in decline.

Keywords Flamingos, migration, Phoeniconaias, Phoenicopterus, satellite tracking, southern Africa, telemetry,wetlands

GREATER AND LESSER FLAMINGOS – HIGH PROFILE RED DATA SPECIES IN DECLINE

Adapted from Simmons R.E. & Brown C.J. 2006. Birds to watch in Namibia: Red, Rare and Endemic Species. National Biodiversity Programme, Windhoek.

Greater Flamingo - *Vulnerable*

Phoenicopterus ruber
Range: Botswana, Namibia, South Africa
Area of occupancy: 61 290 km^2
Population estimate: 41 000 – 51 000 adults
Population trend: Stabilized after longe-term decline
Habitat: Coastal lagoons, flooded salt pans, farm dams
Threats: Low breeding frequency and success, water abstraction, only two breeding sites, reduced rainfall; power line collisions?

Distribution and ecology

Greater Flamingos are widely distributed in southern Africa with concentrations at flooded salt pans (during breeding) and coastal bays (during non-breeding). Inland they are most numerous at Etosha Pan, Lake Oponono (north of Etosha) and the Bushmanland (Tsumkwe) Pans; at the central coast, they are concentrated at Walvis Bay and Sandwich Harbour. River mouths and inland farm dams also hold small numbers of birds.

Greater Flamingos prefer less saline habitat than Lesser Flamingos. They feed by wading in shallow water with the bill upside down, filtering small crustaceans and other invertebrates from the water column and mud. They mainly take marine benthic organisms such as molluscs, and diatoms, and saline lake crustaceans such as fairy shrimps and brine flies.

Breeding occurs in large, typically mixed colonies on raised islands on flooded salt pan at Etosha, with a maximum of 27 000 pairs recorded in 1971. Laying induced by extensive flooding and continued high levels increases chances of success. Nest colonies are far out on the salt pan comprising several thousand nests, mixed with Lesser

Flamingos. Receding pan water reduces food supplies and increases predation leading to mass mortality.

Threats and conservation actions

Direct threats in Namibia include low level organochlorine pesticides used extensively in the catchment area of the Ekuma River against malaria mosquitoes. Naturally low breeding frequency and success in Etosha may be exacerbated by possible reduction in eastward inflow into Etosha Pan due to mining of aquifer water outside the park, and reduced rainfall associated with climate change. Soda ash mining around the main breeding site in Sua Pan, Botswana, may reduced water levels on the pan. Nighttime collisions with game fences and overhead power lines occur in Botswana and Zimbabwe. Natural mortality factors in Namibia include frequent hydrogen-sulphide eruptions in coastal areas, and disturbance from low flying aircraft. There are growing indications that the impacts of power line collisions in Namibia could be underestimated.

Actions

- There is a continuing need to undertake regular simultaneous counts Africa-wide to gauge population fluctuations.
- Research should investigate the feasibility of artificial breeding islands at suitable sites.
- Monitoring by Etosha Ecological Institute staff of breeding events and their success on Etosha Pan should be continued.
- Conservation management should continue to prevent harassment by illegal low flying aircraft at the coast and Etosha.
- The impacts of collisions with power lines in Namibia should be regarded as a priority for further investigation and action.

Greater Flamingos (*top; photo Susann Kinghorn*) differ from Lesser Flamingos (*bottom; photo Chris van Rooyen*) in being relatively larger and paler; the beak is pink with a black tip, whereas that of the Lesser Flamingo is dark red, appearing almost black when seen at a distance.
Juveniles of both species are smaller and lacking the crimson in the wings, but the black-tipped grey bill of the Greater Flamingo is still distinctive (*inset; photo Wilferd* Versfeld)

Lesser Flamingo – *Vulnerable, Globally Threatened*

Phoenicopterus minor

Range: Botswana, Namibia, South Africa, Zimbabwe
Area of occupancy: 49 082^2
Population estimate: 40 000 – 64 500 adults (resident)
Population trend: Fluctuating with recent increase
Habitat: Coastal lagoons, flooded salt pans, salt works
Threats: Low breeding frequency and success, water abstraction from only two breeding sites; power lineisions?

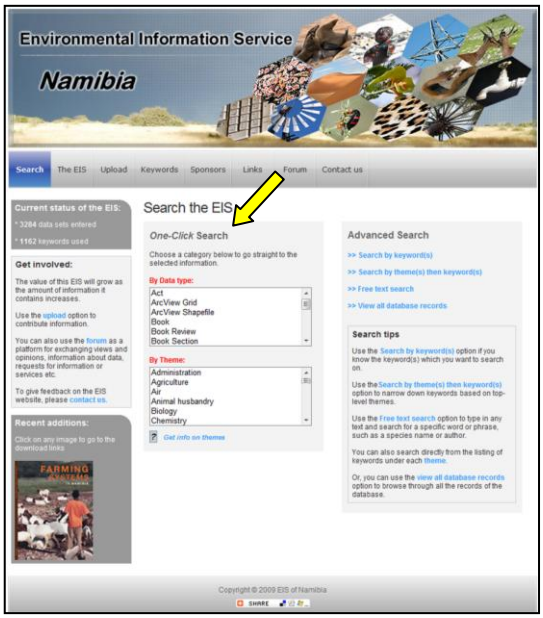
Distribution and ecology

Lesser Flamingos are more restricted in distribution in southern Africa than Greater Flamingos, and breed in mass concentrations at two flooded salt pans, Etosha (Namibia) and Sua Pan (Botswana), and more recently at Kamfers Dam near Kimberley in South Africa. Non-breeding birds are found concentrated at commercial salt pans inland and in coastal bays, especially Walvis Bay and Sandwich Harbour. Inland they are most numerous at Etosha Pan, Lake Oponono (north of Etosha) and the Bushmanland (Tsumkwe) Pans. River mouths such as the Cunene and Orange also hold small numbers of birds.

Lesser Flamingos prefer more saline habitat than Greater Flamingos, especially salt pans, salt works evaporation ponds, and brackish rivers such as the Ekuma River (which flows into Etosha Pan). They feed day and night by wading in shallow water, with bill upside-down, filtering tiny cyanobacteria from the surface, and small diatoms from the bottom layers.

Breeding in Etosha occurs typically after annual rainfall exceeds 400 mm and egg laying, which usually begins in January-February, starts within weeks of the birds migrating to the pan. Success is greater on average when rainfall exceeds 440 mm. Breeding colonies comprising several thousand nests are far out on the salt pan, frequently mixed with Greater Flamingos. Females lay a single egg on a raised nest mound, often in synchrony with thousands of other birds. Breeding is rarely successful however, and receding pan water reduces food supplies and increases predation, leading to mass mortality.

Threats and conservation actions are similar to those for Greater Flamingos (see above).



Home page of the EIS (design by Alice Jarvis).

THE ENVIRONMENTAL INFORMATION SERVICE (EIS) GETS BETTER AND BETTER

Alice Jarvis (email tr_aj@mweb.com.na)

Work on the EIS has been continuing both in adding new material to the site and in adding new features to the site. Some major datasets that have been added include spatial and literature records from the two Okavango books recently produced by RAISON, some EIA resources and a wide range of web links as well as a variety of miscellaneous reports and other documents.

New features include enhanced searching options, such as the ability to search your search results by date and to page through your results. Try out the new *One-Click* Search (yellow arrow above) from the home page which takes you straight to the results you are interested in, either by data type (e.g. ArcView shapefile, or journal article) or by Theme (e.g. Water, Infrastructure). All users can now submit files to the EIS using an interactive 'Upload' button, and there is an online 'Forum' where people could request information or services, discuss data issues etc.

The viewer for spatial data has been substantially improved: for selected datasets you can view the data on the Google Earth plug and you can now interactively add more layers to your view, switch layers on and off etc.

We are currently in the process of collating and coding many more datasets to be included, as well as converting key spatial datasets to kml (google earth) format so that they can be viewed in the viewer.

Please take the time to have a look at the EIS (www.nnf.org.na/EIS) and give feedback on how it could be enhanced. We encourage you to submit information and participate in the forum.

INCIDENT REPORTS

Brown Snake-eagle electrocuted in freak accident

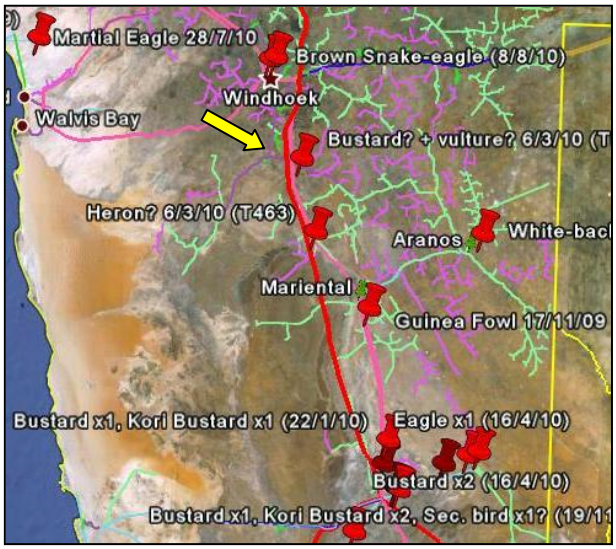
Neil Thomson & Gudrun Middendorff
(email batqs@mweb.com.na)

On 8/8/10, Neil and Gudrun found the remains of a Brown Snake-eagle at Gammams Sewage Works, in the north-western part of Windhoek (22 32.095S 17 01.623E; Tower 935). The remains of a large snake were visible in the birds' talons. They assume that the eagle had killed the snake and perched on the pole to eat it and that the snake may have touched a conductor, electrocuting the bird. Both carcasses were about a week old.

Top: The A-frame pole structure is normally considered 'safe' for perching raptors.
Centre: The body of the snake may have touched a conductor, electrocuting the bird.
Bottom: The remains of the snake were still visible in the bird's talons (*photos Neil Thomson*)

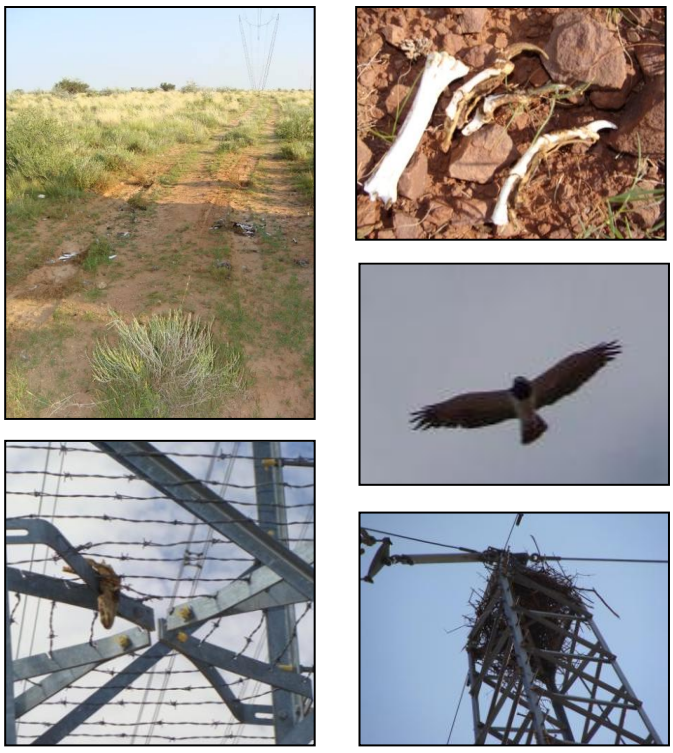
Survey of the Kokerboom-Auas 400 kV line

AC van Zyl (email AC.Van.Zyl@nampower.com.na)



AC van Zyl and team surveyed the northern section of the Kokerboom-Auas 400 kV line, from Tower 324 to Auas (yellow arrow above), on 6-7/3/10 (see newsletter no. 4, pp 5-6 for surveys on Tower 1-142 and Tower 143-323 of this same line).

Findings:
Bustard x1 (Kori?) – Tower 622
Bones (vulture?) – Tower 622
Water bird (heron?) – Tower 463
Nest of Black-chested Snake-eagle (Tower 622)
Rock monitor – Tower 461 (probably *prey* remains)



Top (left) Remains of a bustard.
Top (right) Remains of vulture.
Bottom (left) Remains of rock monitor.
Centre and bottom (right) Black-chested Snake-eagle and nest
(Photos AC van Zyl)

POLYTECHNIC STUDENT PROJECT REPORTS

Two Polytechnic student intern reports were recently initiated in cooperation with NamPower, and kindly overseen by Liz Komen of NARREC, with funding by the NamPower-NNF Strategic Partnership.

An assessment to determine the impact of a 220 kV power line on birds on the farms Ongos, Monte Christo south and Monte Christo north

Student: Siseho Simataa Phineous
(email sisehosimataaphineous@yahoo.com)
Institution: Polytechnic of Namibia
Department: Nature Conservation
Duty Station: NARREC
Date: 14/07/2010

Introduction
Birds are part of nature and play an important role within ecosystems. One of the threats to birds, especially birds of prey, is ongoing collision and electrocution by the power lines. However, electricity provision is important for development. We therefore need to learn more about the interactions of birds and power lines and the resultant problems.

Study areas
- Ongos, a 10 000 hectare, fenced private game farm sSituated in the Highland Savannah zone. The following animals can be found: kudu (*Tragelaphus strepsiceros*), gemsbok (*Oryx gazella*),warthogs (*Phacoecerus aethiopicus*), eland (*Taurotragus oryx*) and chacma baboons (*Papio ursinus*).
- Monte Christo south, a private game farm but not fenced, situated approximately 5 km west of NARREC. The animals found are the same as those found at Ongos.
- Monte Christo north, a fenced private game farm situated approximately 5 km west of NARREC. The animals are the same as those at Ongos.

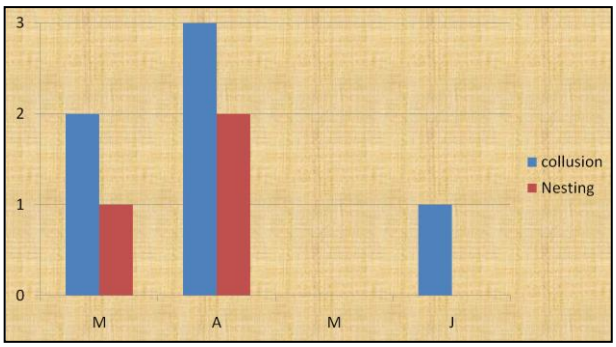
Project objectives
- To investigate the incidents of electrocution, collision and nesting on the power line.
- To identify and record the birds seen utilizing the valley.

Methods
An on-foot monitoring was conducted to walk under the power lines to look for bird carcasses found on the ground. The study site was visited twice a month from

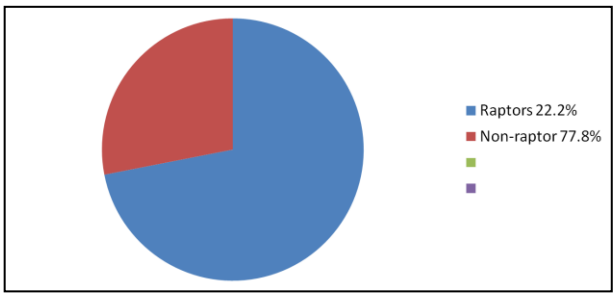
between 9:00-10:00 in the morning and 16:00-17:00 in the evening.

Results & discussion

Six collision incidents were seen. The birds that were involved are as follows: 1 Lesser Grey Shrike, 3 Larklike Buntings, 1 European Bee-eater and 1 Red- backed shrike. For the nests, we coul not identify the birds utilizing the nests, but we only observed an African Hawk that was bringing sticks to the nests. This may be an underestimate because no survey was done in May. Bush encroachment was a limitation in some sections of the power lines because it was difficult to walk on both sides of the lines. However, this means that there was a posibility of finding carcasses in such an accessible places. The presence of jackals was also a problem as there could be a possibility that they find the carcasses and eat them up between survey times. No electrocutions were noted, probably because of the design of the power line structures.



1. Collision and nesting incidents duirng the study period.



2. Proportions of raptors and non-raptors.

As shown in Figure 1 (above), the highest incident was collision. Most of the victims were small birds. This may mean that small birds are at high risk from collision because they tend to fly in groups. It has also been stated that birds that fly in flocks are at risk from collision because birds at the back cannot see the overhead power lines. Electrocution on small birds is rare because they have got a short wingspan. This means that they cannot easily bridge the air gap between two live components. The rate of electrocution on large birds of prey depends on the design of the structures and the availability of food in the research area. This means that a high population of e.g dassies/rock hyrax may lead to increased number of large birds of prey e.g Black Eagle, which may also result in high electrocution and collision risk.

Most of the birds seen utilizing the valley were small birds (see Figure 2). The results of this objective also show that electrocution risk is low because most of these birds are non-perching and they breed and feed on the ground.

Conclusion

Power lines in farm areas cause a threat to birds. The highest incident recorded was collision and most of the victims were small birds. Most of the collision incidents were at farm Ongos and Monte Christo south. No incidents of electrocution were found and only three nests were found.

Recommendations

NamPower servitudes should be cleared regularly. Further studies need to be done to provide NNF and NamPower with data as to how serious the interaction of birds and power lines is in Namibia.

Acknowledgements

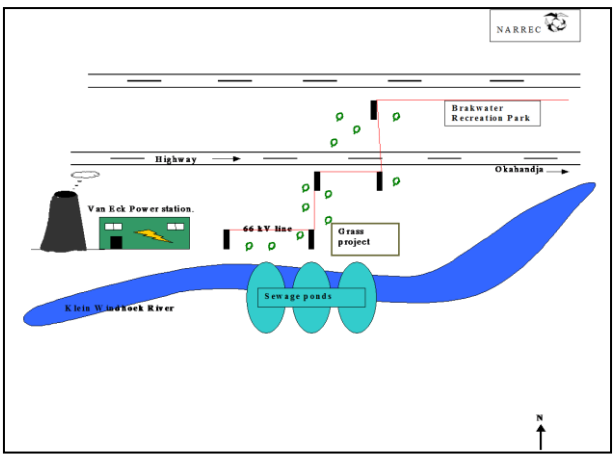
Mrs Liz Komen, Mr Mike Scott, Dr Ann Scott, Mrs Marietjie de Klerk, Mrs Shirley Bethune, Mr Christo Greyling, Wilson Muyenga.

An assessment of interactions between birds and the 66 kV line from Van Eck to Brakwater

Student: Wilson M.K. Muyenga
Student Number: 200812106
Tutor: Mrs Marietjie de Klerk
Department: Natural resources management (Nature conservation)
Duty station: Namibia Animal Rehabilitation Research and Educational Centre (NARREC)
Date: January – June 2010

Objectives

- To investigate collisions, electrocution and nesting incidents on the 66 kV power line from Van Eck to Brakwater.
- To determine which bird species use the study area.



The study area on the 66 kV line from Van Eck power station to Brakwater (map Wilson Muyenga).

Methods and materials
For both objectives the study site was visited twice a month for four months (March, April, May and June) and 4-5 hours spent walking the entire distance of 15 km. The power line transect was set at 10 meters on either side of the power line for the entire 15 km.

An already existing field investigation form was used for recording collision, electrocution and nesting incidents. The power line was closely inspected using Nikon binoculars.

Two observers walked along, one on each side of the power line to adequately cover the 20 meter width.
For the second objective a form was created to record all birds seen in the study area. Common names and scientific names were recorded to determine which bird could potentially be a threat to the power line or be threatened by the power line.

Results
- Despite 19 hours of observations, done during the study period, no incidents of any collisions, electrocutions nor nests on the power line were observed.
- Only 18 species of birds were observed. Most of the birds seen in the study area were smaller species and most of these birds are not raptors. Only three raptors, the Rock Kestrel, Black-shouldered Kite and Steppe Buzzard, were seen during the study period.

Discussion
Disappointingly for the project, no incidents of collisions, electrocutions and nets on the power line were observed, although the methods had been designed to record these. Disturbances could be one reason why there were no incidents of nesting observed on the power line, as this 66 kV power line runs just a few meters from the road. It might be difficult for birds to build a nest in these areas that are prone to disturbances and dust from passing vehicles and even people. Large trees like the camel thorn trees that dominate in the study area can provide suitable perches and nesting sites for birds. According to van Rooyen (2009) the 66 kV type of power line is safe from bird electrocution as the structure is designed so that birds cannot physically touch the live components. Perhaps twice-monthly observations were not often enough, and any birds that had been killed and fallen down, had been quickly eaten by scavengers such as black-backed jackals.

This survey done was to determine which bird species could potentially be threatened by the power line or could cause problems to power line structures. There are only three bird species that could potentially cause problems to the power line and these three were the raptors or birds of prey (see above). The small birds observed are not at risk of electrocution as they cannot touch across the live conductors. This same goes for smaller birds of prey mentioned, with the possible exception of the steppe buzzard, as they do not have a broad enough wing span unlike eagles and vultures which can easily bridge the air gap between two live conductors. However, they are all at risk of collision. Although none were observed in this study, Sociable Weavers are birds known to use power line structures as nesting sites.

Conclusion
No incidents of collisions, electrocution nor nesting were found or experienced on the 15 km 66 kV NamPower line from Van Eck to Brakwater. Rock Kestrel, Steppe Buzzard and Black-shouldered Kite are the only birds of prey that were seen and recorded in the study area. The rest of the birds found were small and not raptors. The design of the power line already takes into account bird problems. The structure is designed to prevent bird directly perching on the conductors. The birds might choose not to nest or perch on the power line because there are enough tall camel thorn trees nearby and the road may disturb them. Only three or the birds seen were raptors that need to perch high up to hunt and even then, two of these are too small to reach across two live wires or conductors. All the rest of the birds seen were also too small.

Recommendations
It is possible that more regular observation or monitoring could improve the results. This will also depend on the distance that one should be walking. I recommend shorter distances to observe more often e.g. 2- 4 km, twice a week with a day interval. I would recommend the method used for monitoring by two people, this way they are able to cover most of the areas under that power line and it saves time. Doing this alone one would have to walk zigzag under that power line in order to cover the area well. This will take much more time to monitor 10 km distances.

Acknowledgements
I would like to thank the following people: Mrs Liz Komen for allowing me to undertake my in-service training at NARREC and for her assistance in editing my project reports. Ms Shirley Bethune for editing and giving me ideas on my project reports. Mrs M. de Klerk, our tutor, for her assistance and comments on my project proposal. NamPower/NNF Strategic Partnership for funding me to carry out this project. My thanks also go to Phinneous Siseho for accompanying me on my power line monitoring and NARREC permanent staff for their assistance and their co-operation.