Lynch, C. D, (1989). The mammals of the north-eastern Cape Province. Mem. Nas. Mus. Bloemfontein 25: 1-116.

Linton, D. M., & Macdonald, D. W. (2018). Spring weather conditions influence breeding phenology and reproductive success in sympatric bat populations. Journal of Animal Ecology, 87(4), 1080-1090.

Marais W.C. Animalia Zoological & Ecological Consultation, (2011). Proposed Haverfontein Wind Energy Project, Albert Luthuli Local Municipality: Bat (Chiroptera) Impact Assessment, Animalia Zoological & Ecological Consultation, Johannesburg, South Africa.

MacEwan, K., Aronson, J., Richardson, E., Taylor, P., Coverdale, B., Jacobs, D., ... & Richards, L. (2018). South African Bat Fatality Threshold Guidelines–ed 2. South African Bat Assessment Association. South African Bat Fatality Threshold Guidelines October.

MacEwan, K., Sowler, S., Aronson, J., & Lötter, C. (2020). South African best practice guidelines for pre-construction monitoring of bats at wind energy facilities. South African Bat Assessment Association.

Marais W.C. Animalia Zoological & Ecological Consultation, (2022). Bat Environmental Impact Assessment (EIA) Report For 12-Month Pre-construction Bat Monitoring For the proposed Mukondeleli Wind Energy Facility (WEF) Mpumalanga, South Africa.

Miller-Butterworth, C. M., Jacobs, D. S., & Harley, E. H. (2003). Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature, 424(6945), 187-191.

Monadjem, A., Taylor, P. J., & Schoeman, M. C. (2020). Bats of southern and central Africa: a biogeographic and taxonomic synthesis. Wits University Press.

O'Farrell M.J., Bradley W.G. and Jones G.W. (1967). Fail and winter bat activity at a desert spring in southern Nevada. South-western Naturalist, 12, 163-171.

Peng R.K., Sutton S.L. and Fletcher C.R. (1992). Spatial and temporal distribution patterns of flying Diptera. Journal of Zoology, Lond., 228, 329-340.

Pretorius, M., Broders, H., Seamark, E., & Keith, M. (2020). Climatic correlates of migrant Natal long-fingered bat (*Miniopterus natalensis*) phenology in north-eastern South Africa. Wildlife Research, 47(5), 404-414.

Rachwald A. (1992). Habitat preference and activity of the noctule bat *Nyctalus noctula* in the Bialowieza primeval forest. Acta Theriologica, 37, 413-422.

Rautenbach, I.L. 1982. Mammals of the Transvaal. Pretoria: Ecoplan.

Schorr, R. A., Matthews, M. D., & Hoover, B. A. (2022). Finding bat roosts along cliffs: using rock climbing surveys to identify roosting habitat of bats. Acta Chiropterologica, 24(1), 167-176.

Shortridge, G.C. (1934). The mammals of South West Africa. William Heinemann Ltd, London.

Simmons, N. B., Seymour, K. L., Habersetzer, J. & Gunnell, G. F., (2008). Primitive Early Eocene bat from Wyoming and the evolution of flight and echolocation. Nature, 451, 818-821.

Skinner, J.D. & Chimimba, C.T. (2005). The mammals of the Southern African

Stepanian, P. M. & Wainwright, C. E. (2018). Ongoing changes in migration phenology and winter residency at Bracken Bat Cave. Global Change Biology 24(7), 3266–3275.

Subregion. 3rd ed. University of Cambridge, Cambridge.

Squires, K.A., Thurber, B.G., Zimmerling, J.R. and Francis, C.M. (2021). Timing and weather offer alternative mitigation strategies for lowering bat mortality at wind energy facilities in Ontario. Animals, 11(12), p.3503.

Taylor, P. J., (2000). Bats of southern Africa, University of Natal Press, Pietermaritzburg.
Van Cakenberghe V, Seamark E C. J. (eds) (2022) African Chiroptera Report 2022. AfricanBats NPC, Pretoria.

Van der Merwe, M. (1994). Reproductive biology of the Cape serotine bat, Eptesicus capensis, in the Transvaal, South Africa. South African Journal of Zoology 29: 36-39.

von Frenckell B, Barclay RMR (1987) Bat activity over calm and turbulent water.

Wieser, D., Mixanig, H., Krainer, K., Bruckner, A., & Reiter, G. (2020). The importance of inland cliffs and quarries for bats. Acta Chiropterologica, 22(2), 391-402.

Williams, T.C., Ireland, L.C. & Williams, J.M. (1973). High altitude flights of the free-tailed bat, *Tadarida brasiliensis*, observed with radar. Journal of Mammalogy, 54 (4): 807-821.

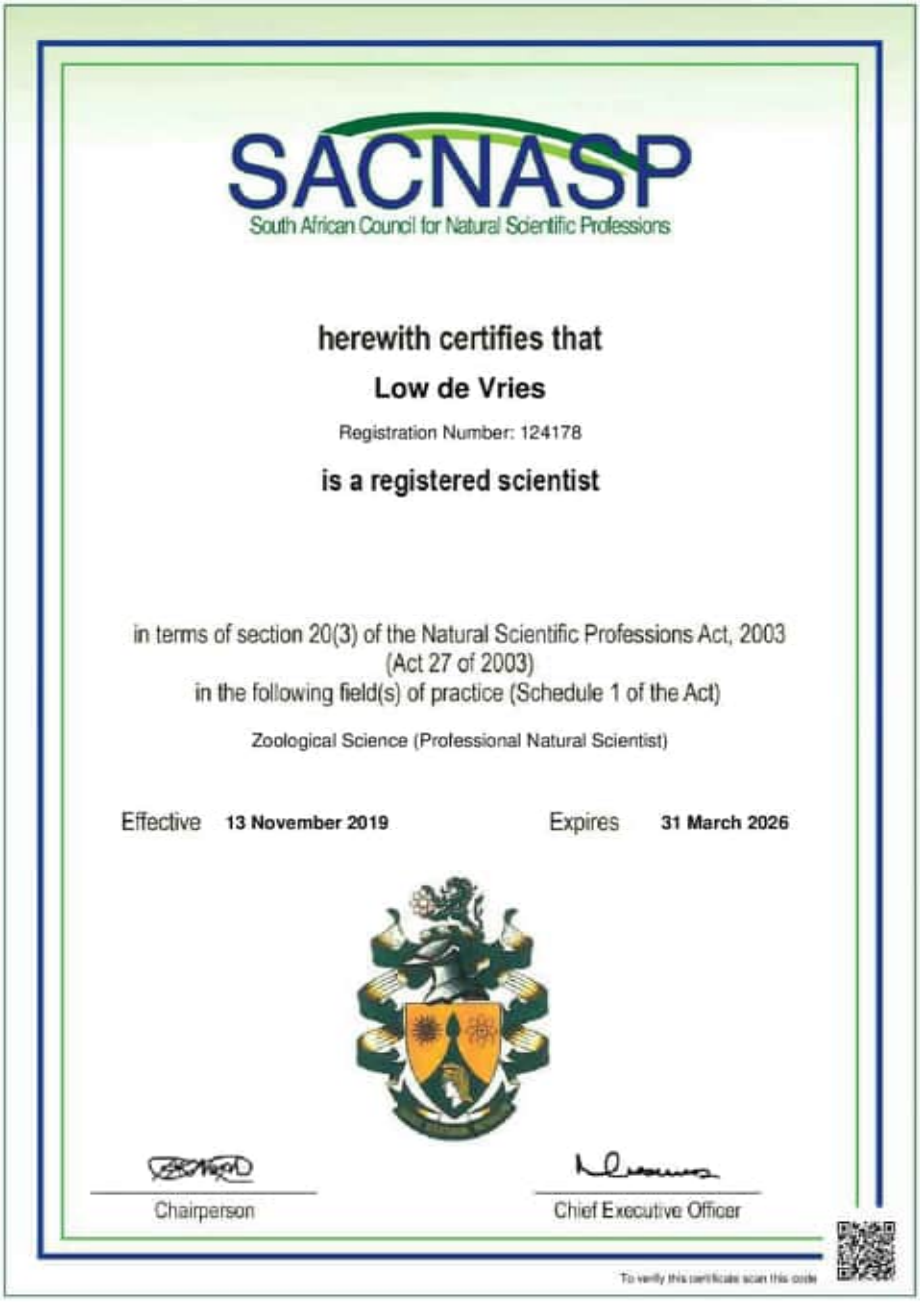
Wilson, D. E., (2015). Bats in question: the Smithsonian answer book, Smithsonian Institution.

WSP Group Africa (Pty) Ltd (2022). Camden I Solar Energy Facility Final Environmental Impact Assessment Report.

WSP Group Africa (Pty) Ltd (2022). Camden I Wind Energy Facility Environmental Impact Assessment report.

WSP Group Africa (Pty) Ltd (2022). Camden II Wind Energy Facility Final Environmental Impact Assessment Report.

Appendix 1: Specialist Qualifications



SACNASP
South African Council for Natural Scientific Professions

herewith certifies that

Low de Vries

Registration Number: 124178

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following field(s) of practice (Schedule 1 of the Act)

Zoological Science (Professional Natural Scientist)

Effective **13 November 2019** Expires **31 March 2026**

Chairperson

Chief Executive Officer

To verify this certificate scan this code

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Die Verteenwoordigende Studenteraad
The Student Representative Council

ken hiermee / hereby awards

AKADEMIESE EREKLEURE
ACADEMIC HONORARY COLOURS

toe aan / to

John Low de Vries

Doctor of Philosophy
Philosophiae Doctor

namens die Studentegemeenskap van die Universiteit van Pretoria
on behalf of the Student Community of the University of Pretoria

VSR / SRC

President

Datum / Date **4 September 2014**

Lid vir Kleure
Member for Colours

Appendix 2: Curriculum Vitae of bat specialist

Personal details	
Full Name	John Low de Vries
DOB	07-Nov-84
Nationality	South African
Marital Status	Married
Email	low@volantenvironmental.com
Phone	+27 82 323 5475
ID number	8 411 075 188 087

Education	
Completed	**Degree and Institution**
2002	Matric, Hoërskool Jeugland, Kempton Park, South Africa
2006	B. Sc Zoology, University of Pretoria, Pretoria, South Africa
2007	B. Sc (Hons) Zoology, University of Pretoria, Pretoria, South Africa
2014	PhD Zoology, University of Pretoria, Pretoria, South Africa

Key areas of expertise	
• Bat Specialist	Conducting surveys on bat diversity and abundance and researh on bat ecology.
• Environmental Assessment Practitioner	Writing and collating Basic Assessment (BA) for proposed Wind Energy Facilities

Memberships & Certificates
• SACNASP Registered Professional Natural Scientist in the field of Zoological Science - Registration Number: 124178
• Bat Assessment Specialist with South African Bat Assessment Association (SABAA)

Other Training
• Multivariate statistical modelling (Cape Town, South Africa)
• Bat handling and identification course (AfricanBats)

- Snake handling (Chameleon Village (South Africa)
- ArcGis online course
- First Aid level 2 (Johannesburg, South Africa)

Publications

Wood, M., **de Vries, JL**., Monadjem, A., Markotter, W. A critical review of factors influencing interspecific variation in home range size of bats. Mammal Review. *In submission*

Markotter W, **de Vries, J.L,** Paweska, J. 2022. Wing tattoos: A cost-effective and permanent method for marking bats. *In review*

Geldenhuys, M., **de Vries, JL.,** Dietrich, M., Mortlock, M., Epstein, J. H., Weyer, J., Paweska, J T., Markotter, W. Longitudinal surveillance of diverse coronaviruses within a *Rousettus aegyptiacus* maternal colony towards understanding viral maintenance and excretion dynamics. *In submission*

Markotter, W., Coertse, J., **de Vries, JL.**, Geldenhuys, M., Mortlock, M. 2020. Bat-borne viruses in Africa: A critical review. Journal of Zoology. 311:2. 77-98

de Vries JL, Marneweck D, Dalerum F, Page-Nicholson S, Mills MGL, Yarnell RW, Sliwa A, Do Linh San E. 2016. A conservation assessment of *Proteles cristata*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Dalerum F, Le Roux A, **de Vries JL**, Kamler JF, Page-Nicholson S, Stuart C, Stuart M, Wilson B, Do Linh San E. 2016. A conservation assessment of *Otocyon megalotis*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland, and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Dalerum, F., **de Vries, J.L.,** Pirk, C.W.W., Cameron, E.Z. 2016. Spatial and temporal dimensions to the taxonomic diversity of arthropods in an arid grassland savannah. *Journal of Arid Environments*. 144. 21-30

Kotze, R., Bennett, N., Cameron, E.Z., **de Vries, J.L.**, Marneweck, D.G., Pirk, C.W.W., Dalerum, F. 2012. Temporal patterns of den use suggest polygamous mating patterns in an obligate monogamous mammal. *Animal Behaviour*. 84. 1573-1578

de Vries, J.L., Pirk, C.W.W., Bateman, P.W., Cameron, E.Z., Dalerum, F. 2011. Extension of the diet of an extreme foraging specialist, the aardwolf (*Proteles cristata*). *African Zoology*. 6:1 194-196.

de Vries, J. L., Oosthuizen, M. K., Sichilima, A. M., Bennett, N. C. 2008. Circadian rhythms of locomotor activity in Ansell's mole-rat: are mole-rat's clocks ticking? *Journal of Zoology*. **276:4. 343-349**

Employment & work-related experiences

2020 - present	Director and founder of Volant Environmental
2016 - present	Postdoctoral fellow, University of Pretoria
2015 - 2016	Postdoctoral fellow, NZG
2014 - 2015	Marion Island field assistant, University of Pretoria

2013	Documentary presenter, Oxford Scientific Films
2010 - 2011	Wildlife Education Trainer, Enviro- Insight
2010 - 2011	Game Raning Lecturer, Damelin Centurion
2009 - 2018	Lecturer and tutor, University of Pretoria

Conference Contributions

Markotter W, **de Vries, J.L,** Wood, M. 2022. Small scale movement of *Rousettus aegyptiacus*. International Bat Research Conference. Austin, Texas
Infectious Diseases of Bats Symposium. Fort Collins, Colorado 2017. Body mass index of the Egyptian fruit bat, *Rousettus aegyptiacus*: An indicator of infection status. **de Vries, J.L**., Dietrich, M., Paweska, J., Markotter, W.
SASAS 2016. **de Vries, J.L.,** Jonker, M.L., Kriel, D., Kotze, A.K. The Tankwa goat: Phenotypically that different?
De Beers Diamond Route Conference, 2010. **de Vries, J.L.,** Pirk, C.W.W., Bennett, N.C. Is the aardwolf a seasonally influenced optimal forager?
Kimberley biodiversity research symposium, 2009. **de Vries, J.L.,** Bennett, N.C., Pirk, C.W.W., Dalerum, F., Cameron, E.Z. Den, and home range use of the aardwolf, *Proteles cristatus*

Recent Project Experience

For further details please contact me directly at low@volantenvironmental.com

Time span	Nature of project	Capacity	Industry / Sector	Client / Developer	Country (Province)
2025-current	Maquassi ERA	Bat Specialist	Renewable Energy / Onshore Wind	AGV	South Africa (North West)
2025-current	Khangela WEF	Bat Specialist	Renewable Energy / Onshore Wind	ACED (Pty) Ltd	South Africa (Northern Cape)
2025-current	Ishwati WEF	Bat Specialist	Renewable Energy / Onshore Wind	ACED (Pty) Ltd	South Africa (Northern Cape)
2025-current	Umsinde WEF	Bat Specialist	Renewable Energy / Onshore Wind	ACED (Pty) Ltd	South Africa (Northern Cape)
2024-current	Uvemvane WEF	Bat Specialist	Renewable Energy / Onshore Wind	ABO Energy South Africa	South Africa (Mpumalanga)
2024-current	Mordant WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Northern Cape)
2024	Castel WEF	Bat Specialist	Renewable Energy / Onshore Wind	Savannah (Pty) Ltd	South Africa (Northern Cape)
2024-current	Steeldrift WEF	Bat Specialist	Renewable Energy / Onshore Wind	EDF Renewables	South Africa (Mpumalanga)
2024	Deelkraal WEF	Bat Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Gauteng)
2024-current	Pretjiesberg WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Zutari	South Africa (Eastern Cape)
2024-2025	Mabele Emoyeni WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Sereti Green	South Africa (Free State)
2024-2025	Doringbaai South	Bat Specialist	Renewable Energy / Onshore Wind	WKN Windcurrent SA (Pty) Ltd	South Africa (Western Cape)
2023 - 2024	Unika WEF	Bat Specialist	Renewable Energy / Onshore Wind	Total Energies	Zambia (Eastern Province)
2023 - 2024	Pensulo WEF	Bat Specialist	Renewable Energy / Onshore Wind	Total Energies	Zambia (Central Zambia)

2023 - 2024	Rhenosterkop WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	AGV	South Africa (Northern Cape)
2023 - 2024	Hotazel WE	Bat and Bird Specialist	Renewable Energy / Onshore Wind	AGV	South Africa (Northern Cape)
2023 - 2024	Buffelsfontein SEF	Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Mpumalanga)
2023 - 2024	Stillfontein SEF	Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Mpumalanga)
2023 - 2024	Roodepoort SEF	Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Limpopo)
2023 - 2024	Kuske SEF	Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Limpopo)
2023 - 2024	Komati WEF and SEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	WKN Windcurrent SA (Pty) Ltd	South Africa (Mpumalanga)
2023 - 2024	Three Provinces 1 SEF and WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Mpumalanga)
2023 - 2024	Three Provinces 2 SEF and WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Cainmani	South Africa (Mpumalanga)
2023 - 2024	Brakdam WEF	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Northern Cape)
2023 - 2024	Hartebees Skeur WEF	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Northern Cape)
2023 - 2024	Brakputs WEF	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Northern Cape)
2023 - 2024	Varsputs WEF	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Northern Cape)
2023 - 2025	Daggakraal WEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	EDF Renewables	South Africa (Mpumalanga)
2023 - 2024	Imvubo SEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Nextec	South Africa (KZN)

2023 - 2024	Ingagne SEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Nextec	South Africa (KZN)
2023 - 2024	Camden WEF	Bird Specialist	Renewable Energy / Onshore Wind	EDF Renewables	South Africa (Mpumalanga)
2023 - 2023	Steelpoort SEF	Bird Specialist	Renewable Energy / Onshore Wind	Jones and Wagener	South Africa (Limpopo)
2023 - 2023	Tournee SEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	WKN Windcurrent SA (Pty) Ltd	South Africa (Mpumalanga)
2022 - 2023	Dubula SEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	CEN	South Africa (Eastern Cape)
2022	Dubula Greenfields SEF	Bat and Bird Specialist	Renewable Energy / Onshore Wind	CEN	South Africa (Eastern Cape)
2022	Tuinfontein Scoping survey	Bat and Bird Specialist	Renewable Energy / Onshore Wind	Akuo Energy	South Africa (Northern Cape)
2022	WEF Desktop surveys	Bat Specialist	Renewable Energy / Onshore Wind	Oryx Power	South Africa (Mpumalanga, Northern Cape, Eastern Cape)
2022	Langberg WEF Bat Scoping Survey	Bat Specialist	Renewable Energy / Onshore Wind	Akuo Energy	South Africa (Northern Cape)
2022	Thand Tau Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Free State)
2022	Camden Bird Impact Assessment	Bird Specialist	Renewable Energy / Onshore Wind	EDF Renewables	South Africa (Mpumalanga)
2022	Hotazel WEF Scopin Survey	Bat Specialist	Renewable Energy / Onshore Wind	Jones and Wagener	South Africa (Northern Cape)
2022	Rhenosterkop WEF Scopin Survey	Bat Specialist	Renewable Energy / Onshore Wind	Jones and Wagener	South Africa (Western Cape)
2022-2023	Doringbaai WEF Bat Impact assessment	Bat Specialist	Renewable Energy / Onshore Wind	WKN Windcurrent SA (Pty) Ltd	South Africa (Western Cape)
2022	Castle WEF walkthrough	Bat Specialist	Renewable Energy / Onshore Wind	Savannah (Pty) Ltd	South Africa (Northern Cape)

2021	Fraserburg raptor nest survey	Bird specialist	Renewable Energy / Onshore Wind	WKN Windcurrent SA (Pty) Ltd	Renewable Energy / Onshore Wind
2021-2022	Dordrecht Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	ACED (Pty) Ltd	South Africa (Eastern Cape)
2021 - 2022	Indwe Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Jones and Wagener	South Africa (Eastern Cape)
2021 - 2022	Waschbank Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Jones and Wagener	South Africa (Eastern Cape)
2022 - 2023	Gorachouqua Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Northern Cape)
2022 - 2023	Khoemana Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Northern Cape)
2021 - 2022	Dalmanutha Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Enertrag SA (Pty) Ltd	South Africa (Mpumalanga)
2020-2021	Bergrivier Bat Impact Assessment	Bat Specialist	Renewable Energy / Onshore Wind	Genesis Eco-Energy Developments (Pty) Ltd	South Africa (Western Cape)
2020-2021	Botterblom Bat Impact Assessment	Bat Specialist Bird assistant	Renewable Energy / Onshore Wind	Genesis Eco-Energy Developments (Pty) Ltd	South Africa (Northern Cape)
2012	Dangerous snake removal	Herpetologist	Mining (Coal)	Anadarko	Mocimboa da Paia, Mozambique

Low de Vries
PhD Zoology
Pr. Sci. Nat. Zoological Science

Bat Site Sensitivity Verification Report for the proposed ABO Uvemvane Wind Energy Facility 2 in Gauteng and Gauteng, South Africa

May 2025

Prepared for:

Strong, Ashlea
WSP Group (Pty) Ltd
Ashlea.Strong@wsp.com

Compiled by
Low de Vries (Pr. Sci. Nat., PhD: Zoology)
Colyn Grobler (MSc: Virology)
Volant Environmental (Pty) Ltd.
low@volantenvironmental.com

Expertise of Bat Specialists

Low de Vries is a registered bat assessment specialist with SABAA and has consulted for numerous field projects, which included bird surveys and the removal of dangerous snakes in Mozambique, as well as several biodiversity surveys in South Africa. He obtained a PhD in Zoology while investigating the general ecology of aardwolves with special focus on home range, diet, and prey abundance. After his PhD he spent 14 months on Marion Island assisting with field work on elephant seals, fur seals and killer whales. During his subsequent postdoctoral position at the University of Pretoria he spent six years conducting research on the ecology of bats and has obtained extensive knowledge on bat behaviour and movements, as well as experience in bat handling.

Low de Vries
PhD Zoology
Pr. Sci. Nat. Zoological Science

Disclaimer by Volant Environmental Director

I declare that the work presented in this report is my own and has not been influenced in any way by the developer. At no point has the developer asked me as specialist to manipulate the results to make it more favorable for the proposed development. I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP) and the EIA Regulations (2014, as amended). I have the necessary qualifications and expertise (*Pr. Sci. Nat. Zoological Science)* in conducting this specialist report.

Dr. Low de Vries

Low de Vries
PhD Zoology
Pr. Sci. Nat. Zoological Science

Specialist Summary

ABO Energy South Africa (Pty) Ltd is proposing the development of the ABO Uvemvane Wind Energy Facility 2 located near Heidelberg in the Lesedi Municipality in the Mpumalanga and Gauteng province of South Africa

Since a project of this nature is likely to have an impact on bats, Volant Environmental (Pty) Ltd was appointed to conduct the specialist bat assessment. Based on the DFFE Screening tool report for the proposed WEF the overall area is rated a being of High sensitivity to bats due to the rivers and numerous wetlands present on site. Croplands have been given a Medium sensitivity rating, but no buffers are required. A Site Sensitivity Verification survey (26-29 August 2024) and the first three months of the full twelve-month pre-construction bat monitoring was conducted on the proposed Wind Energy Facility development.

Concerning bats, our work on-site has produced the following findings thus far:

- A total of four species of bats were recorded on-site during our screening and pre-construction bat monitoring surveys which is on par for this region and habitat.
- Numerous active roosts were found
- No fatal flaws have been identified.

The current bat sensitivity based on the DFFE Screening Tool is classified as **High** and based on our desktop survey, ground truthing and data gathered to data we concur with this result

Author Contributions

Author	Qualification	SACNASP	Role in project
Low de Vries	PhD Zoology	Pr. Sci. Nat. – 124178	Project management, field work, data analysis, GIS, report writing
Colyn Grobler	MSc Virology	NA	Field work, data analysis, report writing

Contents

1. Introduction.....7
1.1 Project Details 12
1.2 Project Location..... 13
1.3 Description of Ecoregion 14
1.4 Bats and Windfarms 16
1.5 Bat Species most often Impacted by Windfarms 17
1.6 Bat Survey Validity Period 20
1.7 Regulatory Requirements..... 20
1.8 Assumptions and Limitations 21
2. Site Sensitivity Verification 21
2.1 ABO Uvemvane Wind Energy Facility 2 23
3. Methods 24
3.1 Resources 24
3.2 Desktop Study 25
3.3 Field Surveys..... 25
3.3.1 Passive Surveys..... 27
3.3.2 Active Surveys 30
3.3.3 Roost Surveys 31
3.4 Data Analyses 31
3.5 Foraging Areas..... 32
4. Results 32
4.1 Desktop Survey..... 32
4.1.1 Bat surveys Conducted in the Area. 32
4.1.2 Potential Species Present in the Area 34
4.1.3 Protected areas 37
4.2 Passive Monitoring..... 40

4.2.1 Bat Passes per Species 41
4.2.2 Bat Passes per Bat Detector 44
4.2.3 Bat Passes at Height 48
4.3 Roost inspections 50
4.4 Bat Sensitive Areas 53
4.4.1 Water bodies 54
4.4.2 Ridges 55
4.4.3 Wooded Areas 56
4.5 Bat buffers 57
5. Potential Impacts 59
6. Conclusion 60
7. References 61
Appendix 1: Specialist Qualifications 66
Appendix 2: Curriculum Vitae of bat specialist 69

List of figures

Figure 1. Location of the proposed ABO Uvemvane Wind Energy Facility 2 13
Figure 2. Vegetation types found on the Proposed Area of Influence 15
Figure 3. Examples of habitat types found across the Project Area of Influence 16
Figure 4. Bat Theme Screening tool output for the ABO Uvemvane Wind Energy Facility 2 24
Figure 5. Roads driven during Site Sensitivity Verification 27
Figure 6. Locations of met masts and short mast used to deploy bat detectors. 29
Figure 7. Short masts used to deploy bat detectors on the Project Area of Influence 30
Figure 8. Bats captured or collected near the Project Area of Influence 37
Figure 9. Location of protected areas near the Project Area of Influence 40
Figure 10. Hourly activity patterns of bats across the Project Area of Influence 42
Figure 11. Daily activity of bats across the Project Area of Influence 43
Figure 12. Bat species, and their relative abundance, detected during the current survey period. 44
Figure 13. Hourly bat activity per bat detector across the Project Area of Influence 46
Figure 14. Number of bat passes recorded daily per bat detector 47
Figure 15. Bat activity per bat detector across the Project Area of Influence during the survey period 48
Figure 16. Comparison of bat activity at various heights across the Project Area of Influence 49
Figure 17. Comparison of bat activity at various heights across the Project Area of Influence when only bat detectors deployed on the met masts are considered..... 50
Figure 18. Locations of active bat roosts that have been detected during the current survey period with required buffers 52
Figure 19. Examples of roosts found on the Project Area of Interest 53
Figure 20. Locations of sources of wetlands that are classified as sensitive to bats with required 200 m buffer applied. 55
Figure 21. Wooded areas located on the Project Area of Influence including required buffers .. 56
Figure 22. Buffers for bat sensitive areas that could be determined based on data collected during the current survey period. 58

List of Tables

Table 1. ABO Uvemvane Wind Energy Facility 2 technical details..... 12
Table 2. Summary of field work conducted..... 26
Table 3. Times and duration of driven transects..... 31
Table 4. Environmental reports for Wind Energy Facilities (and other developments) in the region of the proposed WEF..... 33
Table 5. List of species with possible occurrence around the proposed WEF site..... 35
Table 6. The identified public/privately owned protected areas identified close to proposed WEF site..... 39
Table 7. Bat species detected across the Project Area of Influence with their Impact Risk and abundance (BP/H)..... 41
Table 8. Bat detectors deployed across the Project Area of Influence with the relative abundance recorded at each..... 45

Acronyms & Glossary of Terms

PAOI: Project Area of Influence, the area that is affected by the proposed development.
Acoustic monitoring: Recording and analyses of echolocation calls to determine bat community species composition and abundance.
ACR: African Chiropteran Report.
AOI: Area of Influence, the area that is affected by potential impacts.
Bat call: An echolocation call emitted by a bat used to detect prey and navigate through its surroundings.
Bat detector: Electronic device for the detection and recording of bat echolocation calls. The terms Bat Detector and Song Meter are used interchangeably in this report.
Bat roost: A structure, natural or man-made, were bats roost during the day. This includes caves, trees, rocky outcrops, buildings, and culverts.
Blade tip sweep height: Height between ground level and the lowest point of the wind turbine rotor sweep zone.
bp/h: Bat passes per hour, calculated as a mean or median value from the nightly average bat passes per hour.
Buffer zone: A zone established around areas that are identified as sensitive for bats and includes flyways, foraging areas and bat roosts.
CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora.
Cumulative Impact: Impacts created due to past, present, and future activities and impacts associated with these activities.
Echolocation: A physiological process for locating distant or invisible objects (such as prey) by means of sound waves reflected to the emitter (such as a bat) by the objects.
EMPr: Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.
Endemic: A species that is restricted to a particular area.
EIA (Environmental Impact Assessment): The process of identifying environmental impacts due to activities and assessing and reporting these impacts.
GPS: Global Positioning System device.
IUCN: International Union for Conservation of Nature.
MW: Megawatts.
NEMA: National Environmental Management Act.
Pre-construction phase: The period prior to the construction of a wind energy facility.

Pulse: A single emission of sound by a bat.
Red data species: Species included in the Critically Endangered, Endangered, Vulnerable or Rare categories as defined by the IUCN.
REDZ (Renewable Energy Development Zones): Areas were wind and solar photovoltaic power development can occur in concentrated zones.
Rotor blades: The air foil of a wind turbine that catches the wind and rotates.
Rotor swept area: The area through which rotor blades of a wind turbine rotate.
S&EIA: Social and Environmental Impact Assessment (EIA): The process of identifying social and environmental impacts due to activities and assessing and reporting these impacts.
SABAA: South African Bat Assessment Association.
SABPG: South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities
SACNASP: South African Council for Natural Scientific Professions.
SANBI: South African National Biodiversity Institute.
Scoping Report: A report contemplated in regulation 21 of the NEMA amended EIA regulations R326 dated 7 April 2017.
Song meters: A particular brand of Bat Detector developed by Wildlife Acoustics. The terms Song Meter and Bat Detector are used interchangeably in this report.
SD card: A storage device for song meter recordings.
ToPS: Threatened or Protected Species.
Turbine: A device that harnesses wind energy and turns it into kinetic energy used for the generation of electricity.
WEF: Wind Energy Facility.

1. Introduction

1.1 Project Details

Volant Environmental (Pty) Ltd was commissioned by ABO Energy (Pty) Ltd to conduct a survey to assess the potentially Sensitive Areas for bats at a proposed wind energy facility (WEF) which will be known as the ABO Uvemvane WEF 2. The ABO Uvemvane WEF 2 will have a capacity of up to 180 MW with up to 25 turbines on an area of *ca* 3 400 ha. Each turbine will have a hub height of up to 180 m and a rotor diameter of 200 m (Table 1). The following report outlines details for this WEF, which will be referred to as the ABO Uvemvane WEF 2 throughout the report.

Table 1. ABO Uvemvane Wind Energy Facility 2 technical details

Technical Details (ABO Uvemvane Wind Energy Facility 2)		
Component	**Dimensions**	
Site Extent	Overall Site area:	3 400 ha
Installed Capacity	Maximum export capacity:	Up to 180 MW
Wind Turbines	Number of turbines:	Up to 25 turbines
	Hub height from ground:	Up to 180 m
	Rotor diameter:	Up to 200 m
	Maximum tip height:	280 m

1.2 Project Location

The full Project Area of Influence (PAOI) that we were appointed to perform bat assessments on covers an area of *ca* 8 200 ha. The proposed ABO Uvemvane WEF 2 (3 400 ha) forms part of the PAOI and is located 10.8 km Southeast of the town of Heidelberg in Lesedi Municipality in the Mpumalanga and Gauteng province of South Africa (Figure 1). The area can be accessed using the R23 that runs North of the proposed PAOI. Large areas are currently used as agricultural land with section of natural areas present across of the PAOI.

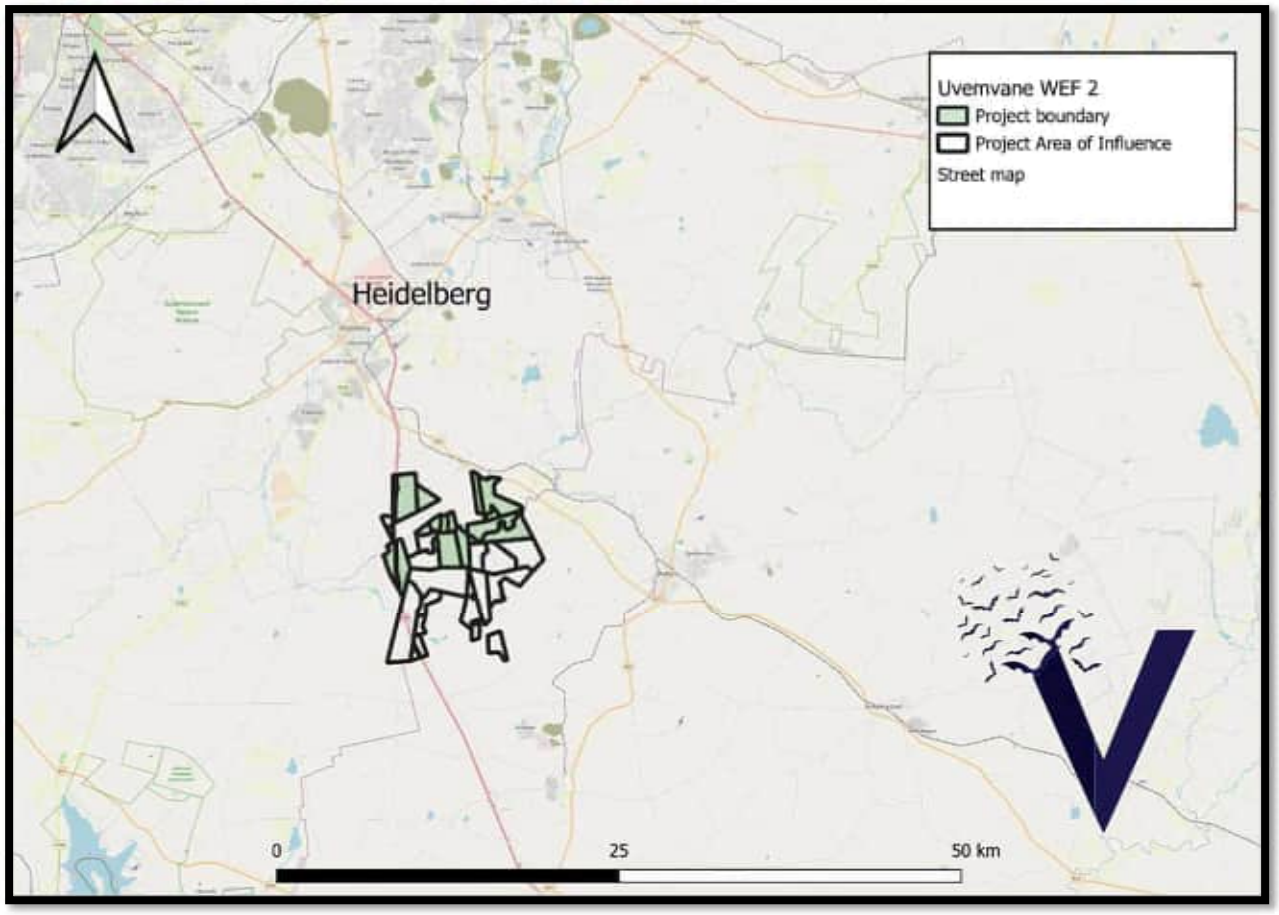


Figure 1. Location of the proposed ABO Uvemvane Wind Energy Facility 2

1.3 Description of Ecoregion

The proposed PAOI falls across the Savanna Bioregion with Andesite Mountain Bushveld vegetation present on the majority of the proposed development site with smaller pockets of Gold Reef Mountain Bushveld and Soweto Highveld Grassland (Figure 2 and 3, SANBI 2018). Based on the South African Best Practice Guidelines for Pre-Construction Monitoring of Bats at Wind Energy Facilities (SABPG, MacEwan et al. 2020) this is classified as the Savanna biome, and all future fatality risks during Pre-Construction monitoring will be assessed based on this ecoregion.
Andesite Mountain Bushveld is often characterised by dense, medium-tall thorny bushveld with a well-developed grass layer on hill slopes and some valleys with undulating landscape.

Mean maximum and minimum average temperatures in Heidelberg are 25.8°C and 13.5°C throughout the year with the area receiving 99 rainy days with an average annual rainfall of 59.09 mm.

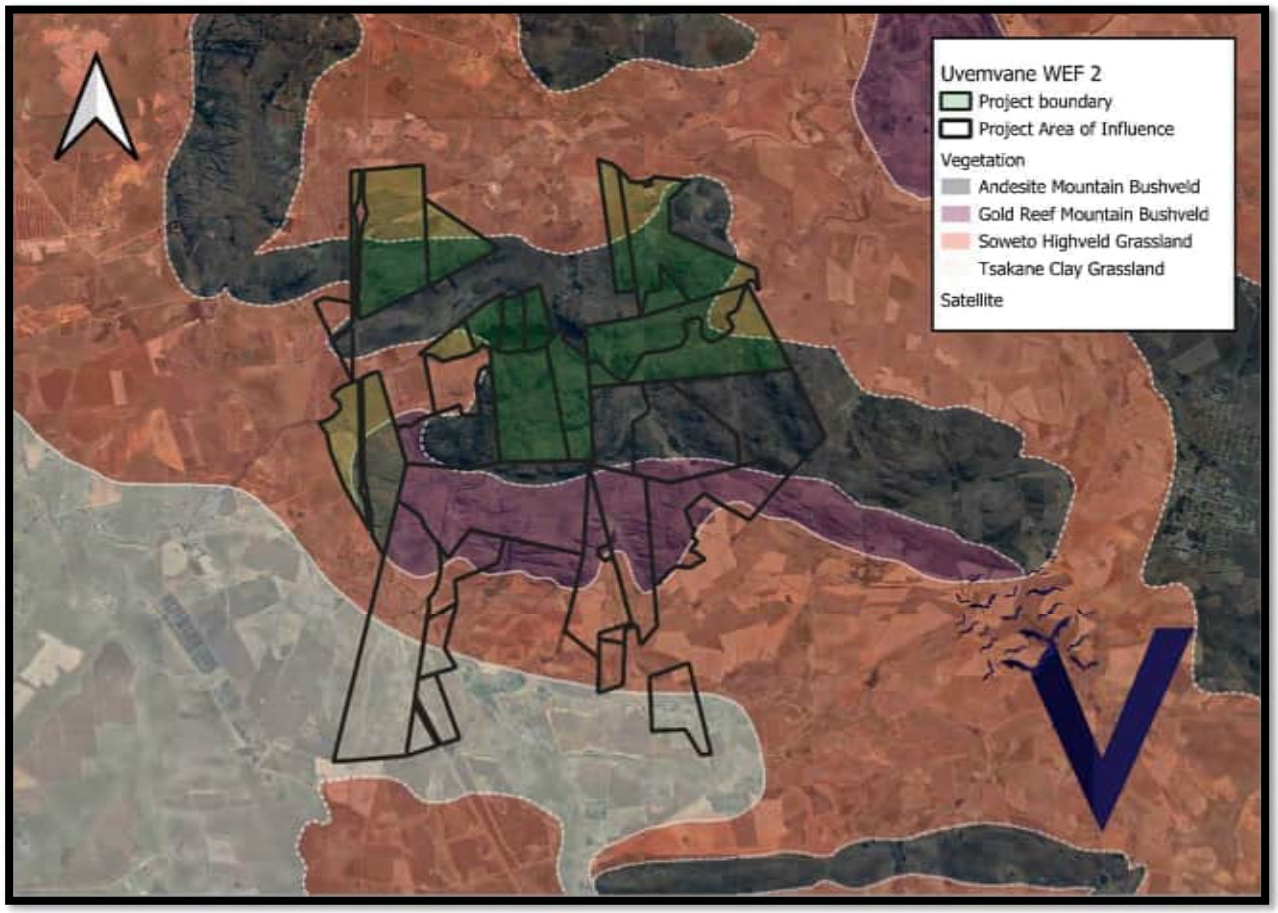


Figure 2. Vegetation types found on the Proposed Area of Influence

Figure 3. Examples of habitat types found across the Project Area of Influence

1.4 Bats and Windfarms

All bat species form part of the Order Chiroptera which is classified as the second largest group of mammals only after rodents. Bats are also the only known mammal that has adapted to be capable of true flight which allows for the movement of bat species over vast distances, often crossing country boundaries as they migrate. They are the second most speciated mammal with a near worldwide distribution. More than 70% of bat species are insectivorous, while others are frugivorous, carnivorous or sanguivorous. Of more than 1 300 bat species documented globally at least 20% occur on the African continent, predominantly in the sub-Saharan regions, and a few on

the northern African coast (Simmons et al. 2008). Bat reproduction is similar to that of other mammals where gestation normally varies between 1.5 to 7 months, but averages around two months (Wilson, 2015). Bats distributed in areas with less seasonal variation and more persistent food availability reproduce biannually, compared with more temperate regions that only give birth once a year (monoestrous) (Bernard and Cumming, 1997). Most of the bat species found in southern Africa are insectivorous although some species have also been found to feed on amphibians, fruit, nectar as well as other invertebrates. As a result of their feeding behaviors, bats contribute to the control and suppression of insect numbers which include agricultural pests such as moths and vectors for diseases such as mosquitoes (Rautenbach 1982, Taylor 2000).

Urban development and agricultural practices have had a significant impact on bat population as deforestation and terrain manipulation often results in ideal habitat destruction and roost disturbances. This includes the increase in established wind farms that have negatively impacted bat populations (Aronson 2022). Although most bat species are equipped with advanced echolocation abilities, they are still at risk of physical impact with the blades of wind turbines. Although deaths due to direct impact with turbine blades has been established, the majority of bat fatalities are due to the barotrauma associated with the low air pressure found around the moving blades of wind turbines that causes the lungs of a bat to collapse resulting in fatal internal haemorrhaging (Kunz et al. 2007). It has been suggested that bats are often attracted to structures that include wind turbines. It is believed that insects get trapped within the low-pressure pockets that form near the rotor sweep zones which forces bats into the rotor sweep zone. Additional attractants such as lights installed on turbines as well as the clearance of vegetation around turbine structures are believed to also attract insects and subsequently bats (Johnson et al. 2003).

1.5 Bat Species most often Impacted by Windfarms

Southern Africa has multiple bat species with a few species that have very large distribution and abundance. Some of these species are of importance based on their likelihood of being impacted by the construction and operation of wind farms, due to high abundances and certain behavioural

characteristics. Three species that have large distributions across South Africa and are present in most habitat classification regions are the Egyptian free-tailed bat (*Tadarida aegyptiaca),* Cape serotine (*Laephotis capensis*) and The Natal long-fingered bat (*Miniopterus natalensis*). These three species are often fatalities of wind farms and will be discussed further below.

Tadarida aegyptiaca

The Egyptian free-tailed bat is an open-space forager that is known to fly and forage at great heights (altitudes as high as 100-3 000 m) (Davis, 1962; Williams et al., 1973). These bats have been found covering extensive distances and large areas during foraging and also during migration to different roosting systems. They typically have a body mass of approximately 16 grams and are known as the fastest flyers amongst the Molossidae family with a widespread distribution throughout the Southern Africa. They are known to roosts in caves, cavities in trees, rock crevices and in the roofs of man-made structures such as buildings (Shortridge, 1934; Herselman and Norton, 1985; Skinner and Chimimba, 2000). They are classified as a species of Least Concern (SANBI Red List 2016) and are currently represented across large areas in South Africa where assessments have been conducted.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert regions, savannah, grassland and agricultural lands (large open spaces). As they are insectivorous bats, their presence is most commonly associated with insect abundance and thus having more insects present will correlate to an increase in their foraging presence (Monadjem et al. 2020). Their reproductive behavior leads to maternity colonies being established in November followed by birthing of a single pup, usually in November or December. The Egyptian free-tailed bat is considered to have a high risk of fatality from wind energy facilities due to turbine collisions (MacEwan et al. 2020). The wide spread abundance and distribution of these bats are linked to high mortality rates due to wind farms and thus are considered as one of the important species to focus on when assessing the impact a wind energy facility will have on bat populations.

Laephotis capensis

Laephotis capensis is commonly called the Cape serotine bat and was previously formally classified as *Neoromicia capensis*, and is classified as a species of Least Concern. They have a widespread distribution across southern Africa and as such are often fatally impacted by the presence of wind farms as they are found from arid and semi-arid areas to montane grasslands, forests, and savannas. They are most often found in roosts such as in under the bark of trees or in the roofs of houses with foraging occurring at the edge of vegetation due to them being clutter-edge foragers. Reproduction activities commence from end of March until the beginning of April with birthing occurring in October and November (van der Merwe 1994 and Lynch 1989). Due to their wide distribution and high abundance they have a high fatality count at existing wind farms and assessments focusing on their presence should be prioritized (MacEwan et al. 2020).

Miniopterus natalensis

Miniopterus natalensis, commonly referred to as the Natal long-fingered bat, occurs widely across South Africa with distribution regions stretching into the neighboring countries with sparse recordings from East and West Africa. They are currently classified as a species of Least Concern. These bats are a cave dwelling species with roost numbers known to reach 260 000 bats (De Hoop Guano Cave) (Monadjem et al. 2020). Mine shafts and quarry diggings are used as roosting sites for small colonies of this species. They often have multiple roosting sites which are occupied at different times of the year dependent on the reproductive stage of these bats. Maternity colonies are occupied during the summer months when pups are birthed from October to December (Monadjem et al. 2020). Due to the migration of these bats between roosts, they are often fatalities of existing wind farms and thus assessment of potential cave roost on proposed wind energy facilities are vital when assessing impacts on this bat species (MacEwan et al. 2020). The species is currently displaying low to moderate numbers of mortalities at operational wind farms in South Africa but show a medium to high risk of collision (MacEwan et al. 2020).

1.6 Bat Survey Validity Period

The current assessment is only representative for time spent assessing the proposed WEF and ultimate conclusions should not be drawn from this report (Table 2). Different bats are known to migrate before winter periods or annually (Jacobsen and du Plessis, 1976), and as such the species assemblages for the area could be vastly different during different periods of the year. The data reported in this report is solely based on data recorded, publicly available data and reports as well as specialist experience and scientific opinions. This should, however, allow for preliminary conclusions to be made regarding the potential impact of bats of the proposed WEF.

1.7 Regulatory Requirements

Amendments were made to the NEMA: EIA Regulations of 2014: GNR 326 EIA Regulations; GNR 327 Listing Notice 1; GNR 325 Listing Notice 2; GNR 324 Listing Notice 3 which pertains to WEF and the activities surrounding their construction. Under Listing Notice 2 it is stated that a Scoping and Environmental Impact Assessment (EIA) is required for WEF with an electricity output 20 MW or more and which is not located in an urban area or on existing infrastructure. Only a Basic Assessment (BA) is, however, required in cases where the entire boundary of the proposed WEF is in a Renewable Energy Development Zone (REDZ) or when the output is below 20 MW. The proposed ABO Uvemvane WEF 2 is not located in a REDZ but will have an electrical output above 20 MW. Based on The South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5 (SABPG, MacEwan *et al*., 2020), a full 12-month survey is thus required. All methods used to inform desktop studies and conduct field surveys were implemented according to the SABPG (MacEwan *et al.*, 2020) and were undertaken to comply with Appendix 6 of the EIA Regulations.

1.8 Assumptions and Limitations

The assumption was made that all sources of information used during the completion of this report, are reliable and accurate.

Distribution records of bats in southern Africa are still poorly reported and limited for many species. In addition, migratory patterns of bats are largely unknown in South Africa. Studies have reported that bats do migrate, but the exact routes followed are not known (Pretorius *et al*., 2020). The same is true for breeding behaviour and the formation of maternity colonies for many bat species.

Publicly available WEF reports for bats are reliant on in-depth site inspection and reporting echolocation calls (if no bat mortality data from adjacent facilities are available), but without echolocation call libraries, accurate identification of calls are not always possible. Published libraries created from release and handheld calls from captured bats are available for southern Africa but are geographically limited. The echolocation calls of a particular species from different regions in South Africa are known to vary to some degree (Monadjem *et al*., 2020), and as such call libraries created in different regions are not always comparable.

Lack of public access to existing monitoring reports for WEFs and Solar Energy Facility (SEFs) is a recurring problem in the industry and one that severely hampers pre-construction monitoring studies and the recommendations therein, a problem to be addressed by relevant NGOs and the governmental institutions.

2. Site Sensitivity Verification

The Minister of Environment, Forestry and Fisheries, gave notice that the submission of a report generated from the national web-based environmental screening tool, as contemplated in Regulation 16(1)(b)(v) of the Environmental Impact Assessment Regulations, 2014, published under Government Notice No. R982 in Government Gazette No. 38282 of 4 December 2014, as amended, will be compulsory from 4 October 2019 when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the Environmental Impact Assessment Regulations, 2014.

In addition, a set of protocols that an applicant needs to adhere to in the Environmental Authorisation (EA) process were developed and on 20 March 2020 the Minister of Forestry, Fisheries and the Environment gazetted the Protocols for national implementation purposes. The gazette '*Procedures to be followed for the Assessment and Minimum Criteria for Reporting of Identified Environmental Themes in terms of Section 24(5)(a) and (h) of the National Environmental Management Act (1998) when Applying for Environmental Authorisation*', has protocols that have been developed for environmental themes which include agriculture, avifauna, bats, biodiversity (terrestrial and aquatic biodiversity), noise, defence and civil aviation.

The protocols set requirements for the assessment and reporting of environmental impacts of activities requiring environmental assessment. The higher the sensitivity rating of the features on the proposed site as identified by the screening tool report, the more rigorous the assessment and reporting requirements.

The SSV was carried out in the following manner:

1. The results of the DFFE Screening Tool were analysed.
2. The data collected on site during the screening visit and one season of pre-construction monitoring surveys was consulted.
3. Desktop analysis of the African Chiropteran Report (ARC 2021)
4. The on-site methodologies we utilised were consistent with the Best Practice Guidelines for Bats and wind Energy in South Africa" (MacEwan et al., 2020).
5. The dates of the site visits were as follows:

A site sensitivity verification and scoping visit took place in August 2024 during which time equipment was deployed. This visit was followed by a twelve-month pre-construction seasonal bat monitoring survey of which the first seasonal survey was done during November 2024.

Based on the screening reports generated in August 2024, the following summary of the development site environmental sensitivities were identified by the screening tool, as required by the 2014 EIA regulations and summarised below separately for each identified WEF cluster.

2.1 ABO Uvemvane Wind Energy Facility 2

The PAOI falls across a region with croplands, which is classified Medium Sensitive to bats. However, due to numerous water sources, wetlands and two rivers the area is classified as being of **High Sensitivity** (Figure 4). Based on the fly-ways, rivers, sources of open water and foraging areas we agree with the Screening tool that the area should be classified as a **High Sensitivity** area for bats.

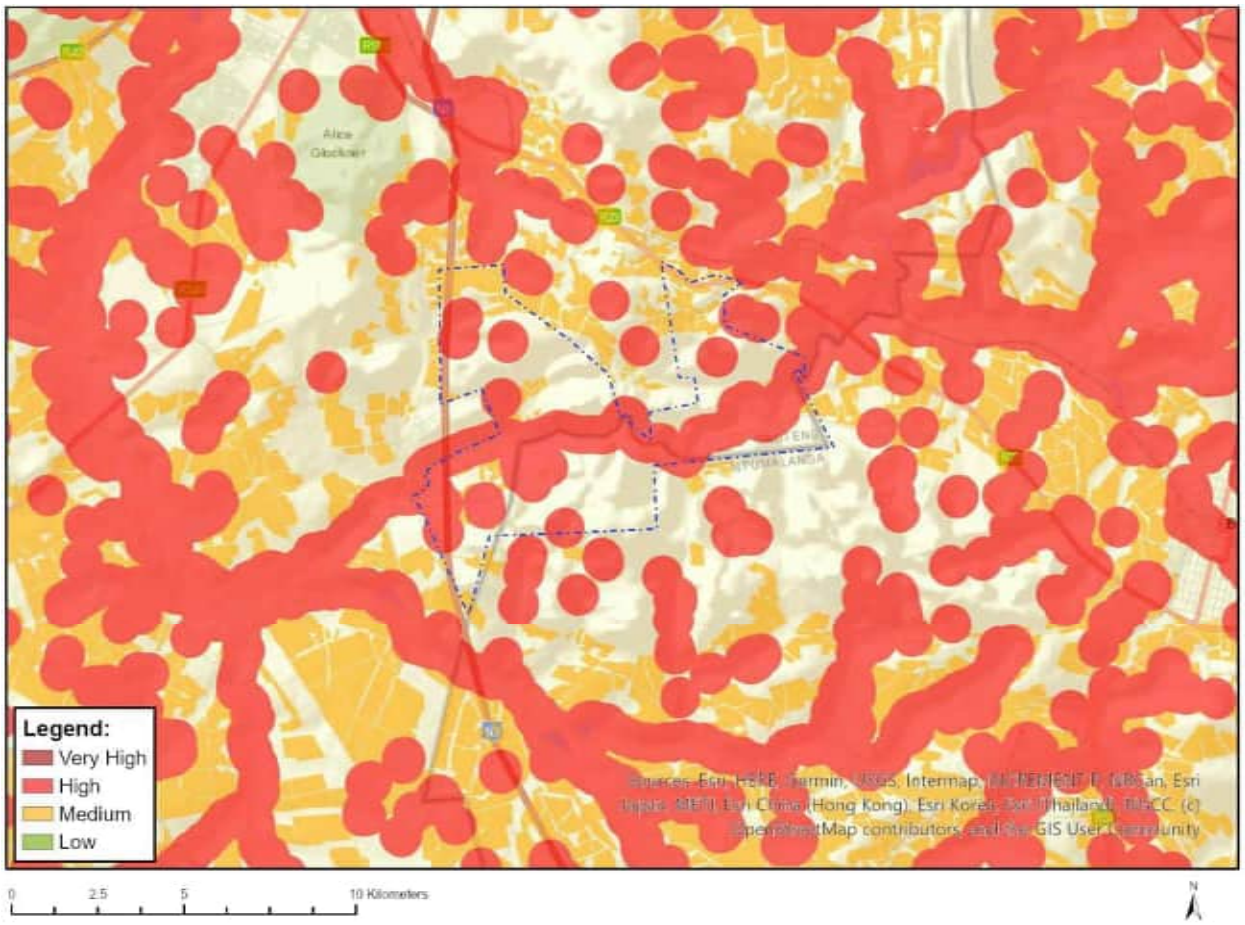


Figure 4. Bat Theme Screening tool output for the ABO Uvemvane Wind Energy Facility 2

3. Methods

3.1 Resources

Numerous resources are available to aid in the construction of a study of this nature and those consulted for the desktop study and during the pre-construction monitoring process are outlined below:

- The Bat Theme of the DFFE Screening Tool Report, which was generated in August 2024.
- Volant Environmental specialist site visit raw data and progress reports.
- African Chiropteran Report (2021)
- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2018) was used to obtain the description of vegetation types occurring in the study area.

3.2 Desktop Study

A thorough desktop study was undertaken to estimate the likelihood of specific species of bats being present at the proposed WEF. This included investigations into available literature, including Bats of Southern and Central Africa (Monadjem *et al.*, 2020), the African Chiroptera Report (ACR, 2022), and any other bat surveys or monitoring reports for nearby WEF as determined from the REEA (2024 Q2) information. Lack of public access to existing monitoring reports for WEFs and Solar Energy Facility (SEFs) is a recurring problem in the industry and one that severely hampers pre-construction monitoring studies and the recommendations therein, a problem to be addressed by relevant NGOs and the governmental institutions.

A search was conducted to identify any protected areas present within 100 km of the proposed WEF project area using the South African Protected Area Data (SAPAD 2024 Q2).

3.3 Field Surveys

All methodologies used for the bat Screening Survey was planned using the South Africa Best Practice guidelines for Pre-Construction monitoring of Bats at Wind Energy Facilities (MacEwan et al. 2020) as a guide and comply with all good practice guidelines. The first survey was conducted between the 26th and the 29th of August 2024 and was considered a Scoping Survey where bat detectors were deployed. An additional seasonal survey was conducted to conduct driven

transects and roost inspections as required by the SABPG (2020) (Section 3.3.2, Table 2 and Figure 5). Transects were driven in such a way as to cover all habitat types.

Table 2. Summary of field work conducted.

Date	Season	Activity	Comments
26 – 29 August 2024	Autumn	Deployment and site inspection	Bat detectors were deployed, and preliminary roost inspections conducted
19 – 22 November 2024	Spring	Driven transects and preliminary roost inspections	All transects were driven and data collected
February 2025	Summer	Driven transects and preliminary roost inspections	To be conducted
June 2025	Winter	Driven transects and preliminary roost inspections	To be conducted
August 2025	Autumn	Driven transects removal of equipment	To be conducted

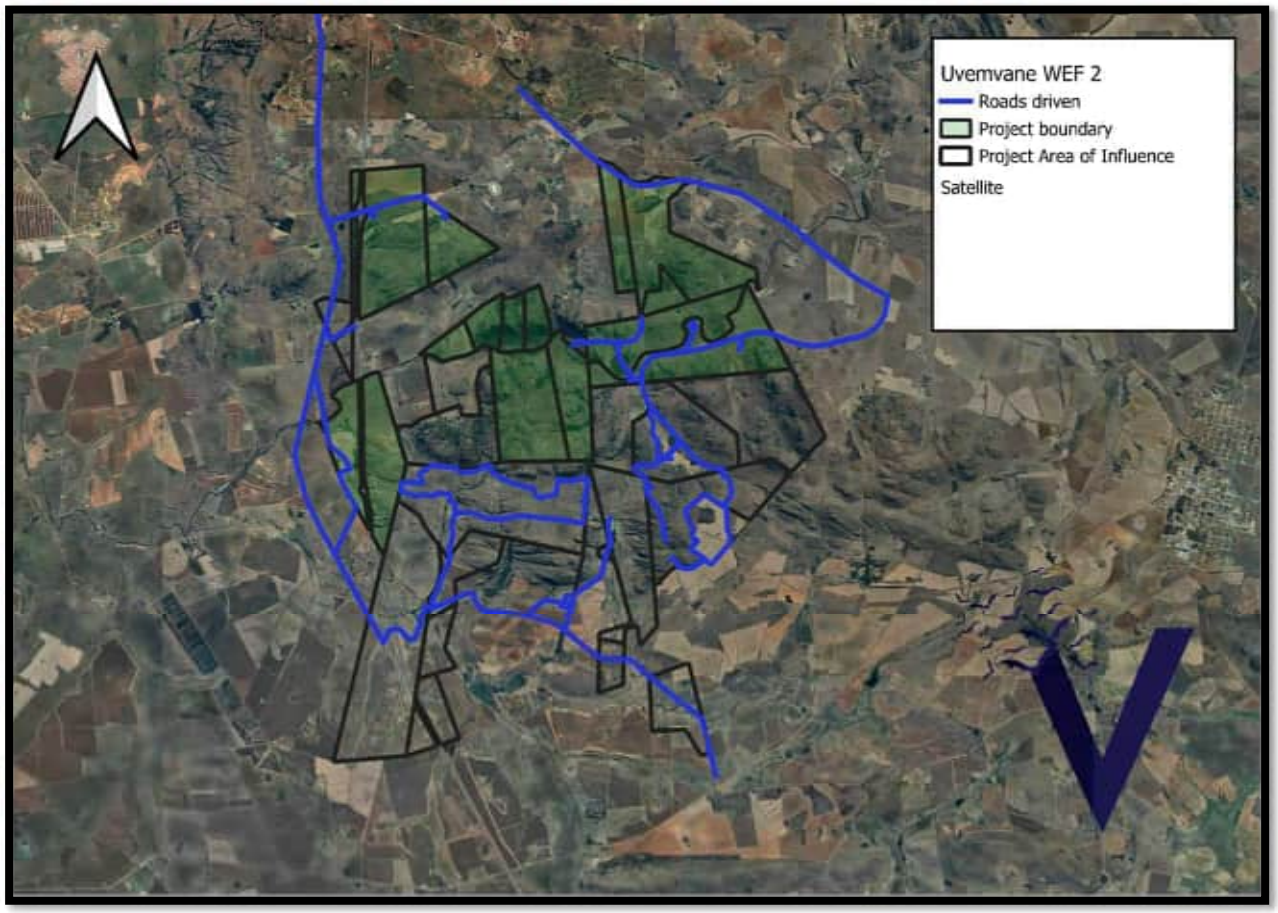


Figure 5. Roads driven during Site Sensitivity Verification

3.3.1 Passive Surveys

Nightly recordings of bats were captured using Wildlife Acoustics Bat detector SM4BAT FS Ultrasonic Recorders. Bat detectors were set to start recording 30 min before sunset until 30 min after sunrise to ensure that all active bats would be recorded. A total of five bat detectors were deployed across the PAOI (Figure 6). Locations where these detectors were placed were based on a thorough desktop investigation of the area and ground truthing conducted during the Scoping Phase. Subsequently, bat detectors were placed to ensure that all habitat types were monitored

and any areas that were deemed to be important to bats (Figure 6 and 7) as stipulated the SABPG (MacEwan et al. 2020)). This includes having at least one bat detector deployed at a height of 7 - 10 m per 5 000 ha of the PAOI, and one bat detector deployed at a height of 50 – 80 m per 10 000 ha for metrological masts that are 80 m tall. If a mast is taller than 80 m an additional bat detector must be deployed as close to the top of the mast as possible. This considered, three bat detectors were deployed at 10 m above ground. A further two bat detectors were deployed at height on the met mast, one at 70 m and one at 120 m. The bat equipment was deployed before the ABO Uvemvane WEF was divided into the ABO Uvemvane WEF 1 and 2, and as such not all the bat equipment is located on site. However, due to the proximity of ABO Uvemvane WEF 1 to ABO Uvemvane WEF 2 and the homogeneity of the habitats in which the detectors were deployed the from the one WEF can be used for the other. During the recording time, the device is 'armed' and will begin a recording if a 'Trigger' is detected. A trigger is defined as a sound within the set frequency range (Default: >16 kHz) amplitude (Default: 12 dB) for a minimum duration (Default: 1.5 ms). The recording then continues for the duration of the Trigger Window (Default: 3 second) after the last Trigger, and then saves the recorded data. If there are constant Triggers, the recording will save and close after the maximum length of a recording file (Default: 00m:15s). All the detectors are powered by solar systems, and all data were copied from the SD cards and backed up during the seasonal site visits.

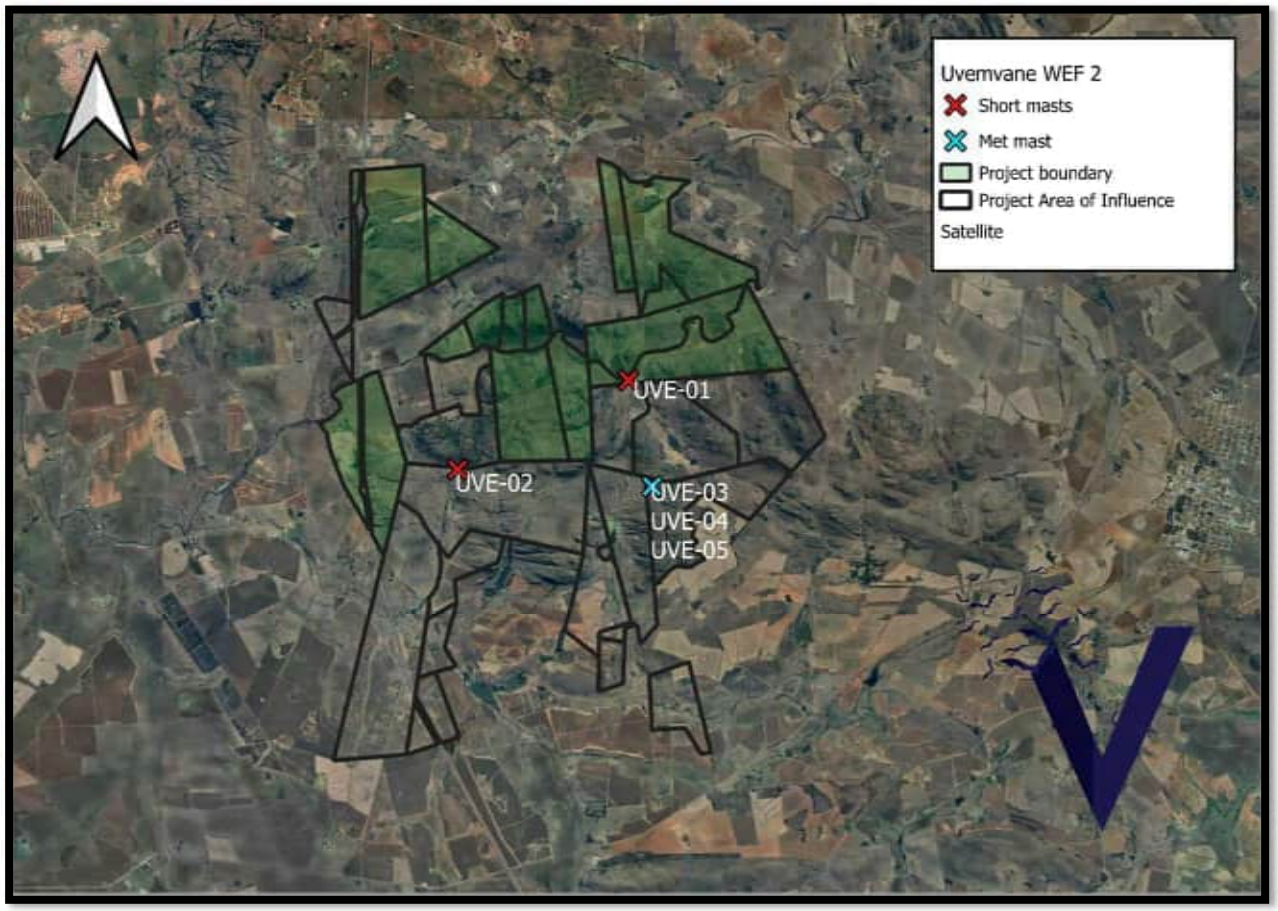


Figure 6. Locations of met masts and short mast used to deploy bat detectors.

Figure 7. Short masts used to deploy bat detectors on the Project Area of Influence

3.3.2 Active Surveys

Active surveys were conducted by driving transects around the area with a bat detector mounted on the roof of the vehicle at 30 km/h or slower (Table 3). Active surveys provides spatio-temporal representation of where different bat species may be found around the PAOI. When compared across seasons it will provide an idea of any specific trends present regarding the activity patterns that may be unique to different species across the site. The routes and number of transects employed represented adequate coverage of the PAOI. Surveys began at twilight when conducted in the evening and lasted between 2.5 and 4 hours as required by the SABPG (2020). Two nights of transects were conducted on the proposed WEF.

Table 3. Times and duration of driven transects

Date	Start time	End time	Total
20 November 2024	18:05	20:42	02:37
21 November 2024	18:05	20:38	02:33
Total			5:10

3.3.3 Roost Surveys

Bats use a variety of roosts including caves, trees, crevices and buildings, and the choice of roost is species dependent (Miller-Butterworth et al., 2003; Pretorius et al., 2020). The location of caves is fairly well known, and historical records in conjunction with active searching can be used to uncover them. Detection of non-cave roosts sites are more difficult and can only be achieved through active searching. Transects were walked on all properties during the day, and potential roosting sites investigated with a bat detector. In addition, the search team was on the lookout for signs of bat activity such as traces of fecal material.

3.4 Data Analyses

Kaleidoscope Pro v5.4.0 (www.wildlifeacoustics.com) was used to analyze all bat calls recorded *via* the auto-identification and cluster-analyses features. Due to the lack of release calls from bats in the southern Africa subregion and intra-species variation in bat calls the auto-identification feature is not always 100% accurate but does provide an indication of the potential bat species. As such all clusters created by the software was manually identified based on bat call parameters, including the peak frequency, call duration and bandwidth. Within each cluster one call was selected with a strong amplitude and minimal background noise to identify the species for that cluster.

3.5 Foraging Areas

The search team investigated areas with more complex vegetation structures which could potentially act as foraging areas, or areas that could be used as flythroughs. This included, but was not limited to, areas with trees or larger shrubs. It must be noted, however, that the absence of bats in these areas should not exclude these areas as potential foraging habitats.

4. Results

4.1 Desktop Survey

A thorough desktop study was undertaken to estimate the likelihood of specific species of bats being present at the proposed WEF. This included investigations into available literature, including Bats of Southern and Central Africa (Monadjem *et al.*, 2020), the African Chiroptera Report (ACR, 2022), and any other bat surveys or monitoring reports for nearby WEF as determined from the REEA (2024 Q2) information. Lack of public access to existing monitoring reports for WEFs and Solar Energy Facility (SEFs) is a recurring problem in the industry and one that severely hampers pre-construction monitoring studies and the recommendations therein, a problem to be addressed by relevant NGOs and the governmental institutions.

4.1.1 Bat surveys Conducted in the Area.

All nearby existing and proposed WEFs and SEF facilities were searched for online to find additional data regarding important bat findings that might be of importance to the proposed WEF. Investigations into available literature on other surveys or monitoring reports for nearby (100 km) the proposed WEF application were undertaken (see Table 4) as determined from the REEA (2024 Q2) information. These reports identified the potential impact of the proposed energy generating facilities on bat populations present and the mitigation strategies followed. Extensive lists of bat that could possibly be present on or near to the proposed WEF, was also compiled using the

previous study data and publicly available information. This information can be seen in Table 5 and summarised below. Additional SEF are present within the search area, but as bat assessments are not required based on the current guidelines, thorough assessments were not conducted, and no usable information regarding bats could be gathered from these facility reports.

Table 4. Environmental reports for Wind Energy Facilities (and other developments) in the region of the proposed WEF.

Project	Report details	Consultant	Distance from site
Impact Assessment Report For the proposed Igolide Wind Farm	Bat Pre-Application (Scoping) Impact Assessment Report For the proposed Igolide Wind Farm, Gauteng, South Africa	Animalia Consultants	85.1 km northwest

4.1.1.1 Bat Pre-Application (Scoping) Impact Assessment Report For the proposed Igolide Wind Farm, Gauteng, South Africa

- The bat assessment was performed between October 2021 and March 2023.
- A total of four bat detectors were deployed at the PAOI with 2 of them being at height.
- A total of five bat species were confirmed on the PAOI which were *Eptesicus hottentotus, T. aegyptiaca, Myotis tricolor, L. capensis*, and *M. natalensis*
- A potential cave within 20 km was identified was it was stated that based on bat activity in site, this will not have an impact on the proposed development as no migration patterns were discovered.
- Mitigation measures were provided and based on the available data at the point of report writing, no fatal flaws were discovered.

4.1.2 Potential Species Present in the Area

Our desktop study, which included the above-mentioned reports, data from the African Chiropteran Report (ACR, 2022) and Bats of Southern and Central Africa (Monadjem et al., 2020) revealed that 20 species could potentially be found in the area (Table 5). The ARC database was used to plot species that have been captured or recorded near the POAI. We used a radius of 100 km as bats are known to travel vast distances and this provides a broader context to ensure that species that may migrate across the PAOI are included. Only three species have been captured or collected within 50 km from the proposed WEF, *Laephotis capensis, Tadarida aegyptiaca* and *Chaerephon pumilus* (Figure 8, ACR, 2021). More species have been captured within 100 km of the PAOI, including *Myotis welwitchii* and *Rhinolophus capensis.* Probability of occurrence is based on the distribution ranges of the species and habitat and roosting requirements along with specialist knowledge and experience. The distribution ranges of all species have been drawn from the ACR database (2021).

Table 5. List of species with possible occurrence around the proposed WEF site

Species name	Common name	Conservation Status IUCN/ SA Red List	Foraging habits	Roosts	Probability of occurrence	Risk of Impact
Emballonuridae						
Taphozous mauritianus	Mauritian tomb bat	LC/LC	Open-air forager	Open-air forager	High	High
Hipposideridae						
Cloeotis percivali	Percival's short-eared trident bat	LC/T	Clutter forager	Cave and hollow dependent	Low	Low
Hipposideros caffer	Sundevall's leaf-nosed bat	LC/LC	Clutter forager	Cave and hollow dependent	Low	Low
Miniopteridae						
Miniopterus natalensis	Natal long-fingered bat	LC/NT	Clutter-edge forager	Caves	High	High
Molossidae						
Mops midas	Angolan free-tailed bat	LC/LC	Open-air forager	Roosts in any suitable crevice and in the roofs of buildings and houses	High	High
Tadarida aegyptiaca	Egyptian free tailed bat	LC/LC	Open-air forager	Caves, rock crevices, under exfoliating rocks, hollow trees, behind the bark of dead trees and buildings	High	High
Nycteridae						
Nycteris thebaica	Egyptian slit faced bat	LC/LC	Clutter forager	Caves, culverts, and trunks of large trees	Medium	Low
Pteropodidae						
Epomophorus crypturus	Peters's epauletted fruit bat	LC/LC	Clutter forager	In valleys and low lying areas where large fruiting trees are present.	Medium	High
Epomophorus wahlbergi	Wahlberg's Epauletted Fruit bat	LC/LC	Clutter forager	Roosts in dense foliage of large, leafy trees	Medium	High
Rousettus aegyptiacus	Egyptian rousette	LC/LC	Clutter forager	Caves	Low	High
Rhinolophidae						
Rhinolophus clivosus	Geoffroy's horseshoe bat	LC/NT	Clutter forager	Caves and mines	Medium	Low
Rhinolophus darlingi	Darling's horseshoe bat	LC/NT	Clutter forager	Caves and mines	Medium	Low

Species name	Common name	Conservation Status IUCN/ SA Red List	Foraging habits	Roosts	Probability of occurrence	Risk of Impact
Rhinolophus denti	Dent's horseshoe bat	LC/NT	Clutter forager	Caves and mines	**Medium**	**Low**
Rhinolophus simulator	Bushveld horseshoe bat	LC/NT	Clutter forager	Caves and mines	**Medium**	**Low**
			Vespertilionidae			
Cistugo lesueur	Lesueur's hairy bat	LC/NT	Clutter-edge forager	Rock crevices	**Low**	**High**
Eptesicus hottentotus	Long-tailed serotine	LC/LC	Clutter-edge forager	Caves and rock crevices	**High**	**Medium**
Laephotis capensis	Cape serotine	LC/LC	Clutter-edge forager	Under the bark of trees, foliage, and buildings	**High**	**High**
Myotis tricolor	Temminck's myotis	LC/NT	Clutter-edge forager	Caves	**Medium**	**Medium**
Pipistrellus hesperidus	Dusky pipistrelle	LC/LC	Clutter-edge forager	Wooded areas in trees as well as cracks in rocks	**High**	**Medium**
Scotophilus dinganii	Scotophilus dinganii	LC/LC	Clutter forager	Roosts mainly in holes in trees and roofs of houses	**High**	**Medium**

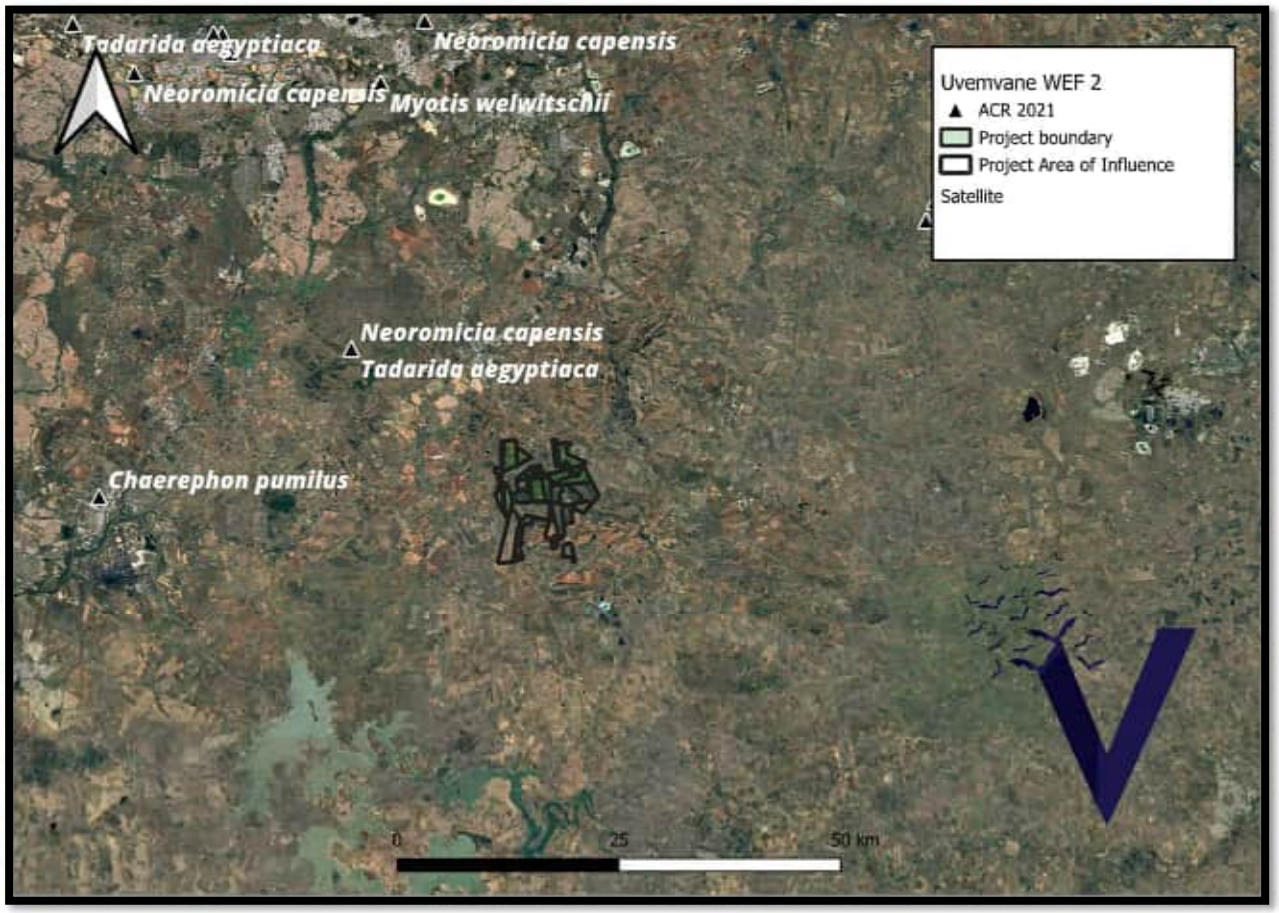


Figure 8. Bats captured or collected near the Project Area of Influence

4.1.3 Protected areas

A search was conducted to identify any protected areas present within 100 km of the proposed WEF project area using the South African Protected Area Data (SAPAD 2024 Q2). The identified public/privately owned protected areas are listed in the table below (Table 6). The reserves consist of privately as well as publicly owned land used for wildlife conservation as well as specific livestock farming. These sites are all registered designated protected areas (SAPAD 2024 Q2).

In addition to protected areas present around the proposed WEF site, a search for cave roosts was conducted. Locations of historical caves is fairly well known, but as not all the records are publically available, it does impose risks of these sites being missed. Summer roost inspections have been performed and the winter inspections will be done during the assessment. Due to the geological makeup of complex dolomite structures found in and around the Gauteng region, cave structures are easily formed. A few known caves found within the 50 Km and 100 Km radius are well known (eg Nash's Cave, Bat's Cave, Bakwena/Irene Cave, Skurweberg Caves, Gladysvale Mine, American Cave, Monument Cave, Fountains Cave, Scramblers, Sterkfontein, Gladysvale Mine, Kromdraai Mine, Minaar's Cave, Wondercave, Silwer Myn, Grobler's Cave, Porcupine Cave, Mamelodi Cave, Groenkloof, Swartkop cave). Most of the abovementioned caves are found North of the PAOI and should not affect the proposed development as the SABPG only require a 20 km search radius. Results obtained in this study will provide information on possible migration routes and roost presence.

Table 6. The identified public/privately owned protected areas identified close to proposed WEF site

Name	Location from WEF
Marievale Nature Reserve	24 Km North
Daisy Private Nature Reserve	12 Km Northeast
Voortrekker Private Nature Reserve	24 Km Northeast
Nicolaas Private Nature Reserve	29 Km Northeast
Devon Protected Environment	27 Km Northeast
Vaaldam Nature Reserve And Parent Farms	40 Km South
Lourensa Game Farm	87 Km South
Rietgat Game Reserve	56 Km Southwest
Leeuwkuil Nature Reserve	51 Km Southwest
Sasol Private Nature Reserve	63 Km Southwest
Leeuwspruit Private Nature Reserve	64 Km Southwest
Cloudy Creek Bird Sanctuary And Nature Reserve	67 Km Southwest
Suikerbosrand Nature Reserve	6 Km West
Johanna Jacobs Private Nature Reserve	48 Km West
Tweefontein Private Nature Reserve	75 Km West
Avalon Private Nature Reserve	21 Km North
Andros Private Nature Reseve	24 Km North
Ian P. Coetzer Private Nature Reserve	27 Km North
Rondebult Nature Reserve	33 Km North
Klipriviersberg Nature Reserve	46 Km Northwest
Olifantsvlei Nature Reserve	52 Km Northwest
Magaliesberg Biosphere Reserve	72 Km Northwest
Melville Koppies Nature Reserve	55 Km Northwest

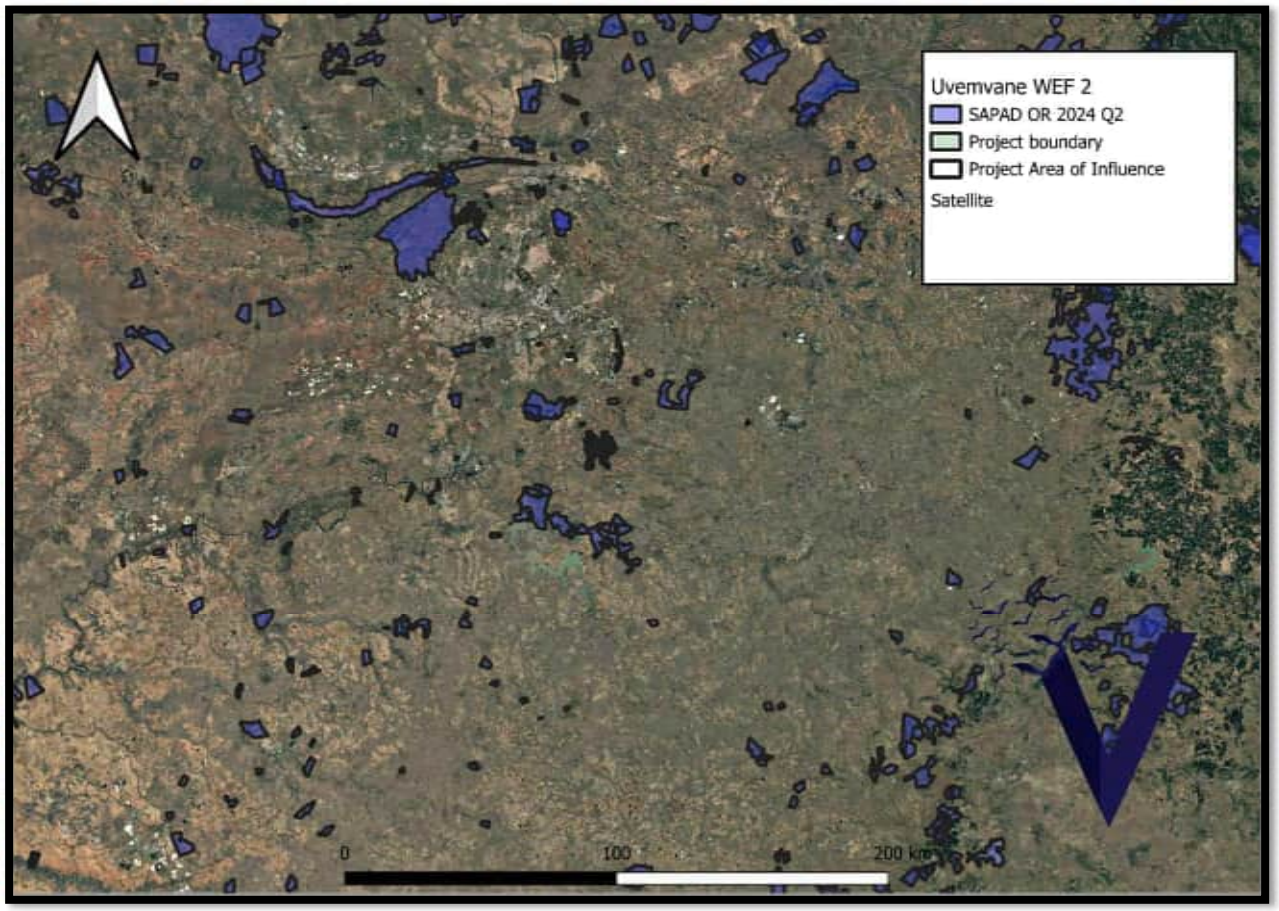


Figure 9. Location of protected areas near the Project Area of Influence

4.2 Passive Monitoring

We recorded four bat species across the monitoring period between 26 August and 22 November 2024 (Table 7). This included 129 540 bat calls recorded over a period of 2 499,42 hours at a median of 19,94 bat passes per hour. Of the species recorded *L. capensis* was the most abundant followed by *T. aegyptiaca*.

Table 7. Bat species detected across the Project Area of Influence with their Impact Risk and abundance (BP/H)

Species name	Common name	Conservation Status IUCN/ SA Red List	Foraging habits	Roosts	Risk of Impact	Median number of bat passes per hour
Molossidae						
Tadarida aegyptiaca	Egyptian free tailed bat	LC/LC	Open-air forager	Caves, rock crevices, under exfoliating rocks, hollow trees, behind the bark of dead trees and buildings	**High**	30,04
Vespertilionidae						
Laephotis capensis	Cape serotine	LC/LC	Clutter-edge forager	Under the bark of trees, foliage, and buildings	**High**	59,15
Pipistrellus hesperidus	Dusky pipistrelle	LC/LC	Clutter-edge forager	Wooded areas in trees as well as cracks in rocks	**Medium**	0,38
Scotophilus dinganii	Yellow bellied house bat	LC/LC	Clutter-edge forager	Under the bark of trees, foliage, and buildings	**Medium**	7,65

4.2.1 Bat Passes per Species

Laephotis capensis showed peaks in activity between 18:00 and 20:00 during the survey period (Figure 10). This peak in activity is linked to bats emerging from their roosts to drink water and start feeding. This peak was similar for all species with slight variations. *Tadarida aegyptiaca* peaked an hour later at 19:00 along with *S. dinganii* while *P. hesperidus* only peaked at 20:00. After the initial peaks observed there was a decline in activity for all four species throughout the night with virtually no bats recorded after 05:00.

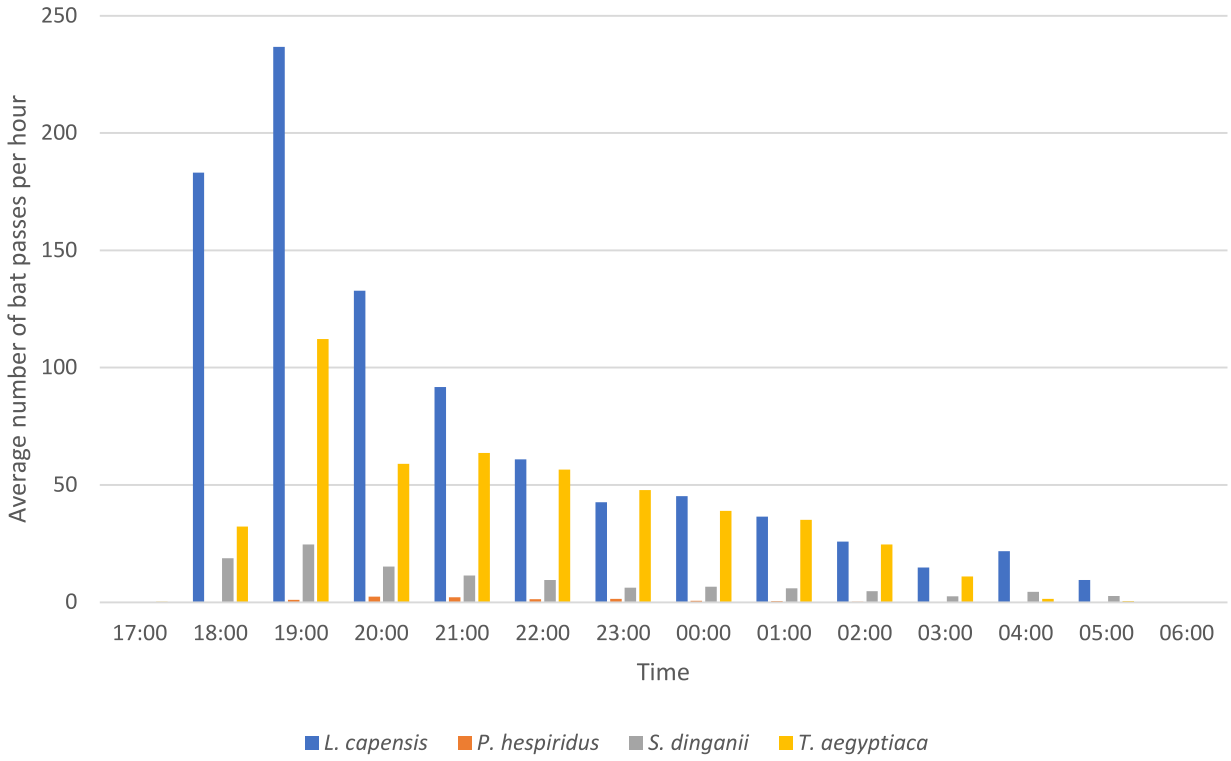


Figure 10. Hourly activity patterns of bats across the Project Area of Influence

Laephotis capensis was more active during the initial part of the survey between September and the middle of August after which there appears to be a decrease in their activity levels (Figure 11). This is opposed to *T. aegyptiaca* which increases in activity as *L. capensis* decreases. *Laephotis capensis* did, however, have the largest peaks in activity on the 15th and 26th of September when the median number of bat passes per hour was 247,49 and 226,66 respectively. These large peaks in activity are generally related to increased insect abundance which can often be correlated to changes in weather conditions. Conversely, on the 21st of September the median number of bat passes was 0 for all bat detectors, again a phenomenon that is likely linked to weather conditions and not due to any equipment malfunction. For the final EIA report all these anomalies will be compared and linked to climactic variables.

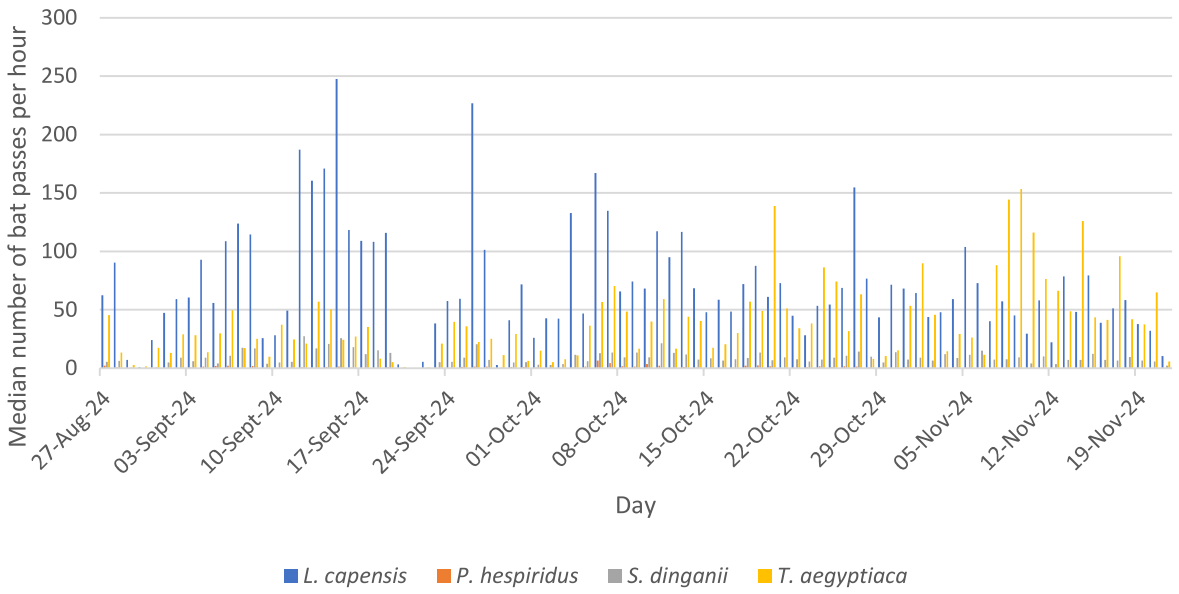


Figure 11. Daily activity of bats across the Project Area of Influence

Scotophilus dinganii and *P. hesperidus* had low, but relatively constant activity across the current survey period with a decrease for both during November (Figure 12). As stated previously *L. capensis* decreased in activity during November whereas *T. aegyptiaca* increased during the last month. This is not necessarily indicative of any pattern yet as this only represents the first three full months of the survey, but it seems as if *T. aegyptiaca* starts to move to the area during the summer months to potentially form maternity roosts.

Based on conversations with land owners the area is uncharacteristically dry for this part of the year, and it is expected that the number of bats recorded in the area will increase when it starts to rain.

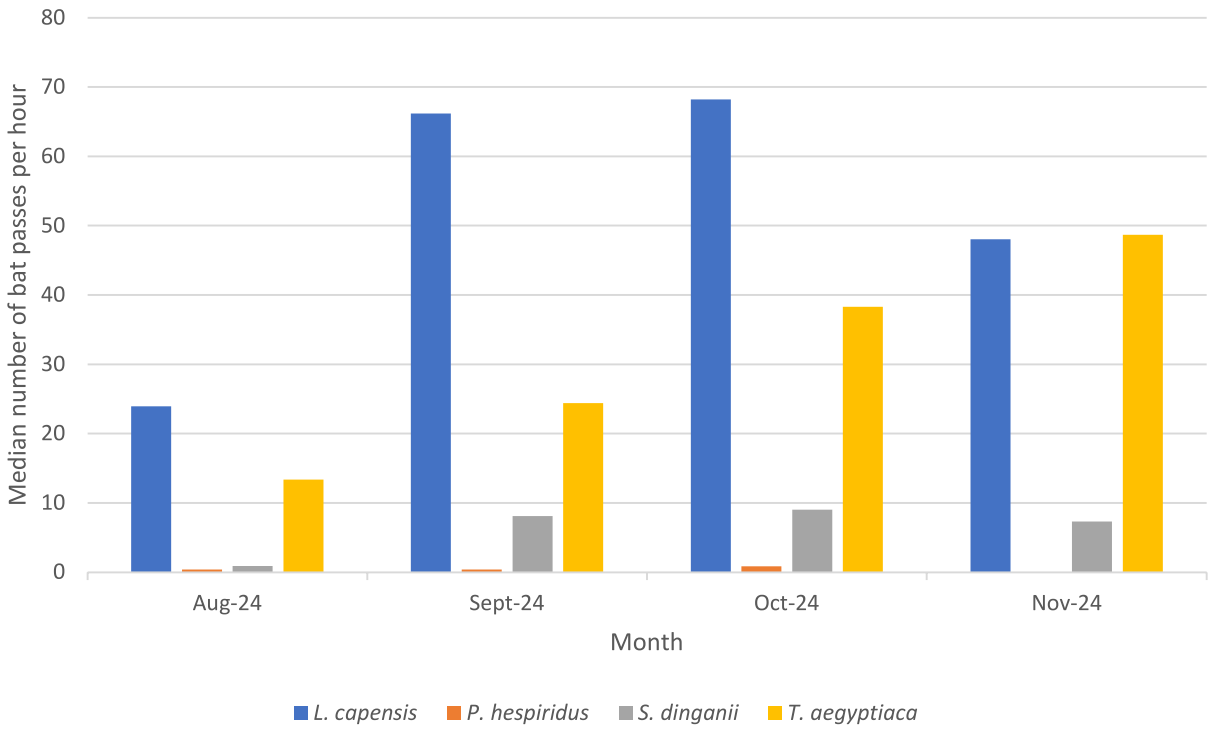


Figure 12. Bat species, and their relative abundance, detected during the current survey period.

4.2.2 Bat Passes per Bat Detector

The detectors that were deployed on the met mast was given to the team who installed the weather monitoring equipment to install. All detectors were already switched on ready to record, but unfortunately the met mast team switched them off when they deployed the detectors. Inspection on the equipment was done during October and the equipment was switched on, but unfortunately no data was recorded for the first two months. The microphone on UVE-02 failed during October and will be replaced during January 2025.