Updated Approach to Calculating Bat Fatality Thresholds for Wind Energy Facilities in South Africa

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Inkululeko WILDLIFE SERVICES

Policy Power People

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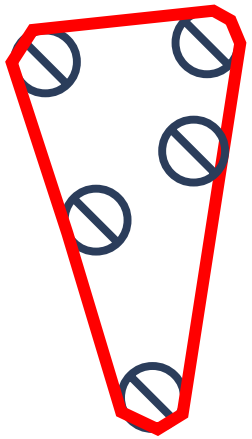
1. Current methods
2. An updated approach
3. Concluding remarks



SABAA Threshold Guidance

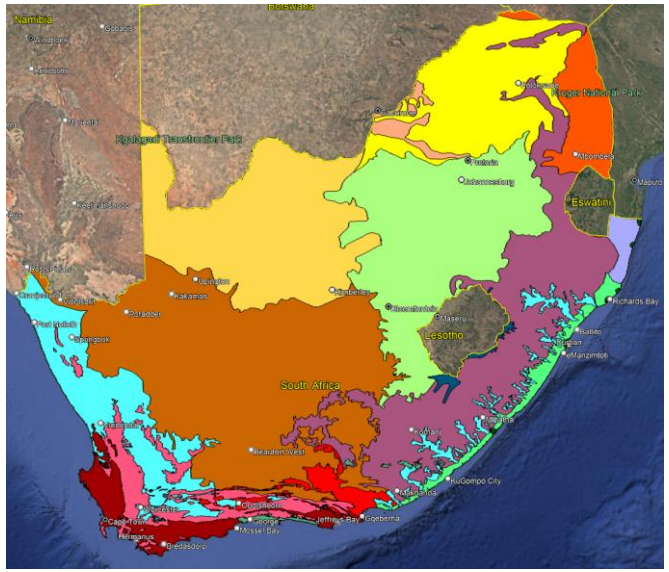
MacEwan *et al.* (2018)

Area of Impact (ha) / 10



x

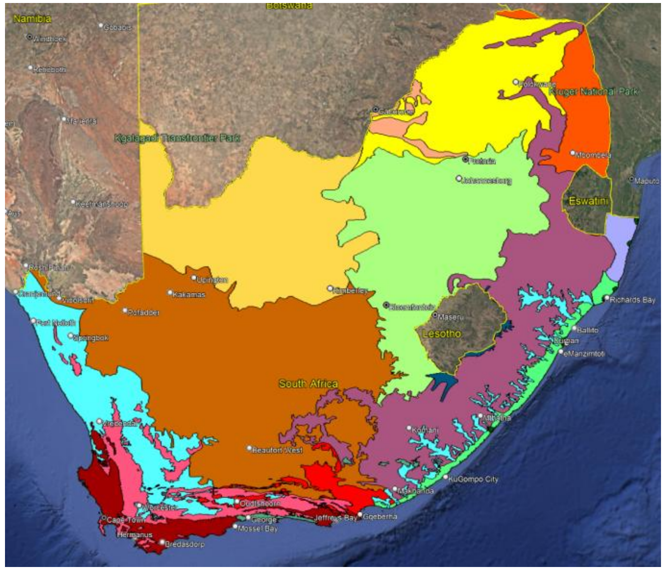
2% of insectivorous bats per 10 ha per ecoregion



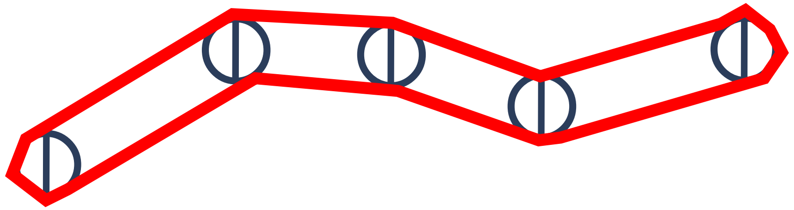
1 bat per annum threshold for each fruit bat species and each insectivorous bat Species of Conservation Concern

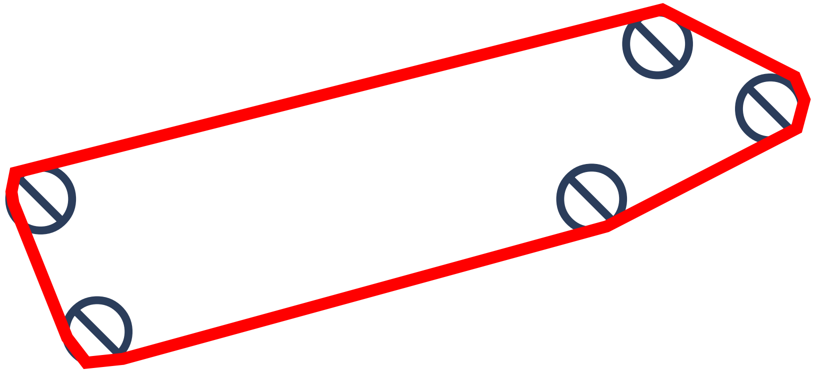
SA Threshold Guidance

MacEwan *et al.* (2018)



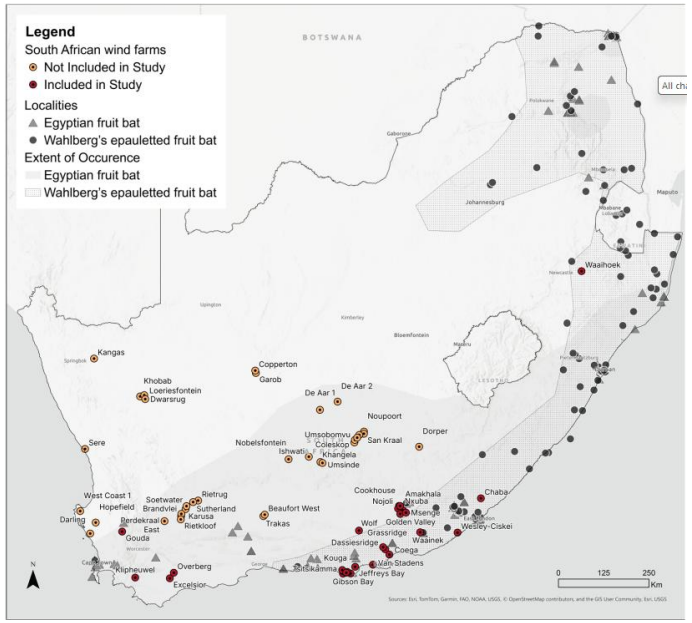
- Minimum convex polygon not always possible or sensible
- Average insectivorous bat activity not available for certain ecoregions
- 1 bat per annum threshold for fruit bats may be too conservative





Potential Biological Removal for 2 fruit bat species

Aronson (2025)



$$\frac{\text{National threshold}}{\text{Total capacity}} \times \text{WEF capacity}$$

$$\frac{800 \text{ bats}}{2523 \text{ MW}} \times \text{WEF capacity}$$



Egyptian Rousette

$$\frac{500 \text{ bats}}{1502 \text{ MW}} \times \text{WEF capacity}$$



Wahlberg's Epauletted Fruit Bat

Potential Biological Removal for 2 fruit bat species

Aronson (2025)

- **Accurate and up-to-date information on SA's installed wind farm capacity is not freely available**

Global decision framework for reducing bat fatalities at WEFs

Frick *et al.* (2026)

		Bat Demographic Inputs for Rmax			Recovery Factor (based on IUCN Status)	Project Area and Bat Density Inputs for Estimating Nmin					
Bat Species	IUCN Status	Adult Survival Rate	Age at First Breeding	Rmax	F	Project Area (km^2)	Minimum Bat Density (bat/km^2)	Maximum Bat Density (bat/km^2)	Scaling Factor	Nmin	PBR Fatality Threshold per Facility
Lasiurus cinereus	LC (Declining or Unknown)	0.9	1.5	0.24	0.5	600	5.5	18.2	2	6 068	367
Molossid	NT (Near Threatened)	0.9	1.5	0.24	0.3	26	5.5	18.2	2	263	10
Molossid	VU (Vulnerable)	0.9	1.5	0.24	0.1	26	5.5	18.2	2	263	3
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A
		0.9	1.5	0.24	#N/A				2	#DIV/0!	#N/A

Global decision framework for reducing bat fatalities at WEFs

Frick *et al.* (2026)

- Biological parameters might not apply to SA bat species
- Project area calculation method not specified
- Bat density highly variable in space and time

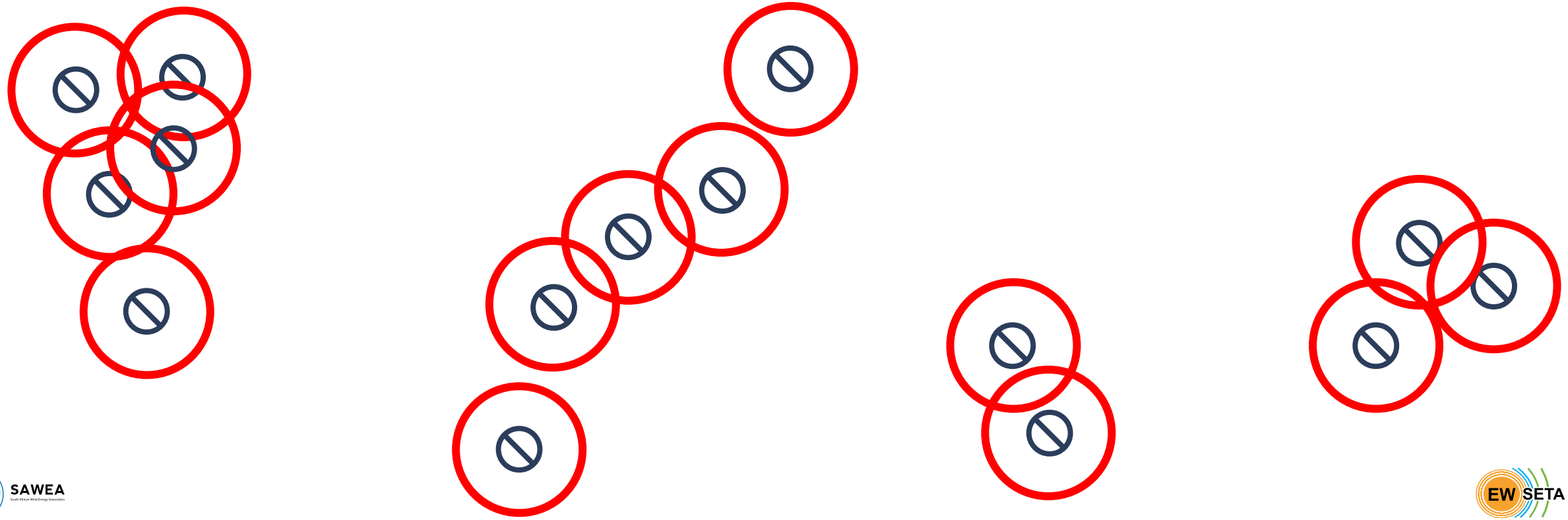
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		0,9	1,5	0,24	#N/A				2	#DIV/0!	#N/A
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		0,9	1,5	0,24	#N/A				2	#DIV/0!	#N/A
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		0,9	1,5	0,24	#N/A				2	#DIV/0!	#N/A

Updated Approach

- Calculation of a turbine-centric Area of Impact
- Utilization of all recorded 12-month local insectivorous bat activity data for impacted species
- Utilization of the Frick *et al*. (2026) method for fruit bats, OR
- Utilization of the Aronson (2025) method if free, accurate, and up-to-date SA WEF MW data are available
- A SA Bat Fatality Threshold Calculator (Excel Tool) has been drafted and needs testing

Calculation of a turbine-centric AoI

		Area of Impact (ha) = sum of turbine buffers with a radius of 1 blade length multiplied by:									
No. of turbines	Blade length (m)	1	2	3	4	5	6	7	8	9	10
40	60	45	181	407	724	1131	1629	2217	2895	3664	4524



Utilization of local activity data for impacted insectivorous species

Egyptian Free-tailed Bat (*Tadarida aegyptiaca*)																
12-month period	**Mean bat passes / hour**	**2% of mean bp/h x 10 ha**	**Annual bat fatality threshold for AoI = sum of turbine buffers with a radius of 1 blade length multiplied by:**										**Observed carcasses**	**GenEst estimated fatalities**			**Mitigation**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		**Lower 95% CI**	**Median**	**Upper 95% CI**	
Pre-construction	2.1	0.42	2	8	17	30	48	68	93	122	154	190					Not applicable
Op. Year 1	1.8	0.36	2	7	15	26	41	59	80	104	132	163	36	108	144	180	None
Op. Year 2													48	144	192	240	None
Op. Year 3	3.2	0.64	3	12	26	46	72	104	142	185	235	290					None
Op. Year 4	1.4	0.28	1	5	11	20	32	46	62	81	103	127					None
Op. Year 5	2.2	0.44	2	8	18	32	50	72	98	127	161	199	22	66	88	110	Curtailment
Op. Year 6	2.3	0.46	2	8	19	33	52	75	102	133	169	208	23	69	92	115	Curtailment
Overall average	**2.17**	**0.43**	**2**	**8**	**18**	**31**	**49**	**71**	**96**	**125**	**159**	**196**	**32**	**97**	**129**	**161**	

Utilization of local activity data for impacted insectivorous species

Natal Long-fingered Bat (*Miniopterus natalensis)*																
12-month period	**Mean bat passes / hour**	**2% of mean bp/h x 10 ha**	**Annual bat fatality threshold for AoI = sum of turbine buffers with a radius of 1 blade length multiplied by:**										**Observed carcasses**	**GenEst estimated fatalities**			**Mitigation**
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**		**Lower 95% CI**	**Median**	**Upper 95% CI**	
Pre-construction	0.8	0.16	1	3	7	12	18	26	35	46	59	72					Not applicable
Op. Year 1	0.3	0.06	0	1	2	4	7	10	13	17	22	27	1	2.7	3.6	4.5	None
Op. Year 2													2	4.5	6	7.5	None
Op. Year 3	0.4	0.08	0	1	3	6	9	13	18	23	29	36					None
Op. Year 4	1	0.2	1	4	8	14	23	33	44	58	73	90					None
Op. Year 5	0.9	0.18	1	3	7	13	20	29	40	52	66	81	1	4.05	5.4	6.75	Curtailment
Op. Year 6	0.7	0.14	1	3	6	10	16	23	31	41	51	63	1	3.15	4.2	5.25	Curtailment
Overall average	**0.68**	**0.14**	**1**	**2**	**6**	**10**	**15**	**22**	**30**	**40**	**50**	**62**	**1**	**4**	**5**	**6**	

Utilization of the Frick *et al.* (2026) method for fruit bats

		Bat Demographic Inputs for Rmax			Recovery Factor (based on IUCN Status)	Project Area and Bat Density Inputs for Estimating Nmin					
Bat Species	**IUCN Status**	**Adult Survival Rate**	**Age at First Breeding**	**Rmax**	**F**	**Project Area (km^2)**	**Minimum Bat Density (bat/km^2)**	**Maximum Bat Density (bat/km^2)**	**Scaling Factor**	**Nmin**	**PBR Fatality Threshold per Facility**
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Molossid	VU (Vulnerable)	0.9	1.5	0.24	0.1	26	5.5	18.2	2	263	3
E. wahlbergi	LC (Declining or Unknown)	0.9	2	0.20	0.5	30.12	1	5	2	48	2
E. wahlbergi	LC (Declining or Unknown)	0.9	2	0.20	0.5	19.13	1	5	2	31	2
E. wahlbergi	LC (Declining or Unknown)	0.9	2	0.20	0.5	1.94	5	10	2	19	1

CONCLUDING REMARKS

1. Updated approach needs testing by other SA bat specialists
2. Then consensus and approval from SABAA and SAWEA is needed
3. Revised SABAA threshold guidance must be published

THANK YOU

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