**Supplementary material**

Fencing affects movement patterns of two large carnivores in Southern Africa

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**Supplementary Table 1**

Results of the linear mixed-effects model for step length explaining the effect of the Etosha fence on the movement behaviour of GPS-collared lions in the Greater Etosha Landscape (Etosha National Park and the surrounding human-dominated landscape within 40 km buffer), Namibia from 2007-2020.

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| --- | --- | --- | --- | --- |
| **Variables (Fixed Effects)** | **Est (ß)** | **SE** | **t-value** | **P value** |
| Intercept | 635.50 | 79.64 | 7.98 | <0.005 |
| Season Warm Dry | -54.23 | 14.72 | -3.68 | <0.005 |
| Season Warm Wet | -47.81 | 13.81 | -3.46 | <0.005 |
| Time zone Night | 532.43 | 11.77 | 45.25 | <0.005 |
| Sex Male | -34.68 | 100.51 | -0.35 | 0.73 |
| Age subadult | 29.59 | 74.56 | 0.39 | 0.69 |
| Location outside Etosha | -266.31 | 23.44 | -11.36 | <0.005 |
| Distance Fence 0.5-1km | -96.88 | 29.99 | -3.23 | <0.005 |
| Distance Fence 0-0.5km | 37.49 | 29.34 | 1.28 | 0.20 |
| Time zone Night:Distance Fence 0.5-1km | 89.10 | 38.13 | 2.34 | 0.01 |
| Time zone Night:Distance Fence 0-0.5km | 143.37 | 36.68 | 3.91 | <0.005 |

**Supplementary Table 2**

Results of the linear mixed-effects model for step length explaining the effect of the Etosha fence on the movement behaviour of GPS-collared hyenas in the Greater Etosha Landscape (Etosha National Park and the surrounding human-dominated landscape within 40 km buffer), Namibia from 2008-2020.

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| **Variables (Fixed Effects)** | **Est (ß)** | **SE** | **t-value** | **P value** |
| Intercept | 364.04 | 105.39 | 1.61 | <0.005 |
| Season Warm Dry | -229.58 | 108.49 | -2.12 | 0.036 |
| Season Warm Wet | 100.98 | 77.45 | 1.30 | 0.192 |
| Time zone Night | 1432.81 | 62.59 | 22.89 | <0.005 |
| Location outside Etosha | -38.20 | 142.13 | -0.27 | 0.789 |
| Distance Fence 0.5-1km | 132.07 | 209.98 | 0.63 | 0.529 |
| Distance Fence 0-0.5km | 830.35 | 345.36 | 2.40 | 0.016 |
| Time zone Night:Distance Fence 0.5-1km | -47.50 | 271.15 | -0.17 | 0.861 |
| Time zone Night:Distance Fence 0-0.5km | -438.72 | 379.24 | -1.157 | 0.247 |

**Supplementary Table 3**

Results of the linear mixed-effects model for path straightness index explaining the effect of the Etosha fence on the movement behaviour of GPS-collared lions in the Greater Etosha Landscape (Etosha National Park and the surrounding human-dominated landscape within 40 km buffer), Namibia from 2007-2020.

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| --- | --- | --- | --- | --- |
| **Variables (Fixed Effects)** | **Est (ß)** | **SE** | **t-value** | **P value** |
| Intercept | 0.74 | 0.02 | 35.79 | <0.005 |
| Season Warm Dry | -0.02 | 0.01 | -2.14 | 0.020 |
| Season Warm Wet | -0.04 | 0.009 | -4.84 | <0.005 |
| Time zone Night | -0.05 | 0.008 | -6.53 | <0.005 |
| Distance Fence 0-0.5km | -0.04 | 0.02 | -2.11 | 0.035 |
| Distance Fence 0.5-1km | -0.10 | 0.02 | -4.35 | <0.005 |
| Sex Male | -0.009 | 0.02 | -0.37 | 0.72 |
| Age Subadult | 0.01 | 0.02 | 0.44 | 0.668 |
| Time zone Night:Distance Etosha category 0-0.5km | -0.01 | 0.03 | -0.38 | 0.706 |
| Time zone Night:Distance Etosha category 0.5-1km | -0.02 | 0.04 | -0.53 | 0.595 |

**Supplementary Table 4**

Results of the linear mixed-effects model for path straightness index explaining the effect of the Etosha fence on the movement behaviour of GPS-collared hyenas in the Greater Etosha Landscape (Etosha National Park and the surrounding human-dominated landscape within 40 km buffer), Namibia from 2008-2020.

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| --- | --- | --- | --- | --- |
| **Variables (Fixed Effects)** | **Est (ß)** | **SE** | **t-value** | **P value** |
| Intercept | 0.81 | 0.02 | 32.34 | <0.005 |
| Season Warm Dry | -0.14 | 0.04 | -3.45 | <0.005 |
| Season Warm Wet | -0.03 | 0.03 | -0.98 | 0.327 |
| Time zone Night | -0.22 | 0.03 | -7.22 | <0.005 |
| Distance Fence 0-0.5km | 0.05 | 0.27 | 0.21 | 0.832 |
| Distance Fence 0.5-1km | -0.01 | 0.10 | -0.12 | 0.905 |
| Time zone Night:Distance Fence category 0-0.5km | 0.03 | 0.38 | 0.08 | 0.932 |
| Time zone Night:Distance Fence category 0.5-1km | -0.07 | 0.22 | -0.33 | 0.739 |

**Supplementary Table 5**

Results of the generalized linear mixed-effects model explaining the Etosha fence crossing by GPS-collared lions and influence of environmental, seasonal, temporal and land management related variables in the Greater Etosha Landscape (Etosha National Park and the surrounding human-dominated landscape within 40 km buffer), Namibia from 2007-2020.

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| --- | --- | --- | --- | --- |
| **Variables (Fixed Effects)** | **Est (ß)** | **SE** | **z-value** | **P-value** |
| Intercept | -1.97 | 0.27 | -7.27 | 0.001 |
| Season Warm Dry | 0.26 | 0.13 | 1.94 | 0.052 |
| Season Warm Wet | -0.29 | 0.13 | -2.31 | 0.021 |
| Time zone Night | 0.54 | 0.16 | 3.27 | 0.001 |
| Habitat type Closed to open shrubland | 1.14 | 0.59 | 1.92 | 0.055 |
| Habitat type Mosaic Forest shrubland Grassland | 0.47 | 0.79 | 0.60 | 0.547 |
| Habitat type Mosaic vegetation croplands | 1.19 | 0.21 | 5.71 | <0.005 |
| Land use type PA | -0.86 | 0.18 | -4.84 | 0.001 |
| Sex Male | -0.69 | 0.31 | -2.26 | 0.023 |
| Age Subadult | -0.74 | 0.33 | -2.24 | 0.024 |
| Time zone night:Land use type PA | 0.63 | 0.21 | 2.93 | 0.003 |

**Supplementary Table 6**

Results of the generalized linear mixed-effects model explaining the Etosha fence crossing by GPS-collared hyenas and influence of environmental, seasonal, temporal and land management related variables in the Greater Etosha Landscape (Etosha National Park and the surrounding human-dominated landscape within 40 km buffer), Namibia from 2008-2020.

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| **Variables (Fixed Effects)** | **Est (ß)** | **SE** | **z-value** | **P-value** |
| Intercept | 1.43 | 1.32 | 1.08 | 0.282 |
| Season Warm Dry | 0.50 | 0.51 | 0.99 | 0.322 |
| Season Warm Wet | 1.32 | 0.48 | 2.75 | 0.005 |
| Time zone Night | -2.72 | 1.33 | -2.04 | 0.041 |
| Habitat type Closed to open shrubland | 0.22 | 0.64 | 0.35 | 0.726 |
| Habitat type Mosaic Forest shrubland Grassland | -1.04 | 0.98 | -1.06 | 0.286 |
| Habitat type Mosaic vegetation croplands | 0.88 | 1.02 | 0.87 | 0.387 |
| Habitat type Open broadleaved deciduous forest | 0.09 | 0.91 | 0.09 | 0.922 |
| Land use type PA | -5.21 | 1.35 | -3.85 | 0.001 |
| Time zone night:Land use type PA | 4.12 | 1.42 | 2.92 | 0.003 |