# Supplementary Material

# Vultures feeding on the dark side: current sanitary regulations may not be enough

LOLA FERNÁNDEZ-GÓMEZ, AINARA CORTÉS-AVIZANDA, ENEKO ARRONDO, MARINA GARCÍA-ALFONSO, OLGA CEBALLOS, EUGENIO MONTELÍO and JOSÉ A. DONÁZAR

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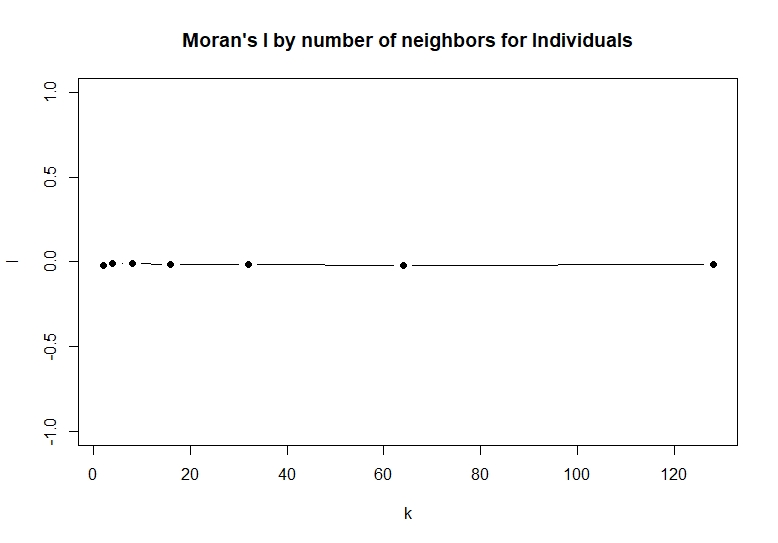
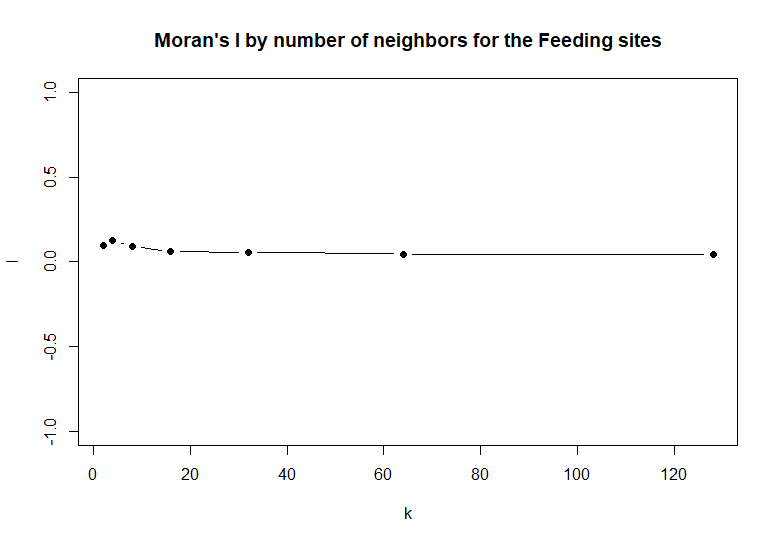
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## Appendix S1. GPS device settings and time elapsed between consecutive locations. Devices were activated one hour before sunrise and turned off one hour after sunset. High-performance setting was active continuously except if we detected a low battery status for several days. Low-performance setting was activated until the battery recovered normal status. During the study period, the time between consecutive locations ranged from 5 seconds to 14.9 h with a median of 5 min.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Battery status | | | |
|  |  | Full | Non-full | Close to security level | Under security level |
| Griffon vulture | Low-performance setting | 10 min | 30 min | 1 h | 1 day |
| High-performance setting | 5 min | 20 min | 30 min | 1 day |

## Appendix S2. Analysis of spatial autocorrelation.

For each analysis, we checked the residuals of the best final average models (see below Appendix 3). We used the Moran´s I approximation following Moreira *et al.* 2018 procedures. I is for Moran´s I, k is the number of nearest neighbours. The results show that no spatial correlation existed for (a): FEEDING SITE or (b) VULTURE analyses.



(a)

(b)

## Appendix S3. Top-ranked models for both response variables FEEDING SITE and VULTURE*.* For both analyses we show up to the competing models (plus the null model) for the biomass models and the resources. Alternative models (∆AICc <2) are bolded. All models include random factors. See variable acronyms and random factors in Web Table 2.

|  |
| --- |
| **Feeding sites (Resources)** |
| **Model** | **df** | **logLik** | **AICc** | **∆AICc** | **Weight** |
| **Resource + Season + Resource:Season** | **12** | **-1541.58** | **3107.50** | **0.00** | **0.64** |
| **Abruptness + Resource + Season + Resource:Season** | **13** | **-1541.16** | **3108.72** | **1.22** | **0.35** |
| Resource + Season | 8 | -1550.41 | 3116.98 | 9.48 | 0.01 |
| Abruptness + Resource + Season | 9 | -1549.91 | 3118.01 | 10.51 | 0.00 |
| Resource | 7 | -1555.52 | 3125.16 | 17.66 | 0.00 |
| Abruptness + Resource | 8 | -1554.93 | 3126.00 | 18.51 | 0.00 |
| Season | 4 | -1596.42 | 3200.88 | 93.38 | 0.00 |
| Abruptness + Season | 5 | -1595.78 | 3201.61 | 94.12 | 0.00 |
| Null model | 3 | -1600.88 | 3207.79 | 100.29 | 0.00 |
| Abruptness | 4 | -1600.18 | 3208.40 | 100.91 | 0.00 |
| **Feeding sites (Biomass)** |  |  |  |  |  |
| **Model** | **df** | **logLik** | **AICc** | **∆AICc** | **Weight** |
| **Biomass + Biomass2 + Season + Biomass:Season** | **7** | **-1266.84** | **2547.80** | **0.00** | **0.48** |
| **Abruptness + Biomass + Biomass2 + Season + Biomass:Season** | **8** | **-1266.52** | **2549.19** | **1.39** | **0.24** |
| **Biomass + Biomass2 + HFP + Season + Biomass:Season** | **8** | **-1266.81** | **2549.78** | **1.98** | **0.18** |
| Biomass + Biomass2 +Abruptness + HFP + Season + Biomass:Season | 9 | -1266.50 | 2551.19 | 3.39 | 0.09 |
| Biomass + Biomass2 | 5 | -1273.60 | 2557.26 | 9.46 | 0.00 |
| Abruptness + Biomass + Biomass2 | 6 | -1273.32 | 2558.73 | 10.93 | 0.00 |
| Biomass + Biomass2 + HFP | 6 | -1273.52 | 2559.13 | 11.33 | 0.00 |
| Biomass + Biomass2 + Season | 6 | -1273.58 | 2559.26 | 11.46 | 0.00 |
| Biomass + Biomass2 +Abruptness + HFP | 7 | -1273.25 | 2560.62 | 12.82 | 0.00 |
| Abruptness + Biomass + Biomass2 + Season | 7 | -1273.31 | 2560.75 | 12.95 | 0.00 |
| Biomass + Biomass2 + HFP + Season | 7 | -1273.51 | 2561.14 | 13.34 | 0.00 |
| Biomass + Biomass2 + Abruptness + HFP + Season | 8 | -1273.24 | 2562.65 | 14.85 | 0.00 |
| Season | 4 | -1520.69 | 3049.42 | 501.62 | 0.00 |
| Abruptness + Season | 5 | -1520.30 | 3050.67 | 502.87 | 0.00 |
| HFP + Season | 5 | -1520.60 | 3051.26 | 503.46 | 0.00 |
| Abruptness + HFP + Season | 6 | -1520.24 | 3052.58 | 504.78 | 0.00 |
| Null model | 3 | -1524.38 | 3054.78 | 506.98 | 0.00 |
| Abruptness | 4 | -1523.96 | 3055.96 | 508.16 | 0.00 |
| HFP | 4 | -1524.33 | 3056.70 | 508.90 | 0.00 |
| Abruptness + HFP | 5 | -1523.93 | 3057.93 | 510.13 | 0.00 |
| **Vulture (Resources)** |  |  |  |  |  |
| **Model** | **df** | **logLik** | **AICc** | **∆AICc** | **Weight** |
| **Resource + Breeding + Season** | **10** | **-2699.40** | **5418.91** | **0.00** | **0.05** |
| **Resource + Season** | **9** | **-2700.98** | **5420.06** | **1.16** | **0.03** |
| **Resource + Breeding + Season + Sex** | **11** | **-2698.98** | **5420.09** | **1.19** | **0.03** |
| **Abruptness + Resource + Breeding + Season** | **11** | **-2699.10** | **5420.34** | **1.44** | **0.03** |
| **Distance + Resource + Breeding + Season** | **11** | **-2699.16** | **5420.47** | **1.56** | **0.02** |
| **Resource + Breeding** | **9** | **-2701.20** | **5420.49** | **1.58** | **0.02** |
| **KDE50 + Resource + Breeding + Season** | **11** | **-2699.35** | **5420.84** | **1.94** | **0.02** |
| **KDE95 + Resource + Breeding + Season** | **11** | **-2699.37** | **5420.88** | **1.98** | **0.02** |
| Distance + Resource + Breeding + Season + Distance:Resource | 15 | -2695.50 | 5421.25 | 2.34 | 0.02 |
| Resource + Season + Sex | 10 | -2700.69 | 5421.49 | 2.59 | 0.01 |
| Abruptness + Resource + Breeding + Season + Sex | 12 | -2698.68 | 5421.52 | 2.61 | 0.01 |
| Abruptness + Resource + Season | 10 | -2700.72 | 5421.55 | 2.65 | 0.01 |
| Resource | 8 | -2702.76 | 5421.61 | 2.70 | 0.01 |
| Distance + Resource + Season | 10 | -2700.75 | 5421.63 | 2.72 | 0.01 |
| Distance + Resource + Breeding + Season + Sex | 12 | -2698.74 | 5421.65 | 2.75 | 0.01 |
| KDE50 + Resource + Breeding + Season + Sex | 12 | -2698.75 | 5421.66 | 2.75 | 0.01 |
| Resource + Breeding + Sex | 10 | -2700.78 | 5421.68 | 2.77 | 0.01 |
| Abruptness + Resource + Breeding | 10 | -2700.91 | 5421.93 | 3.03 | 0.01 |
| KDE50 + Resource + Season | 10 | -2700.92 | 5421.96 | 3.05 | 0.01 |
| Abruptness + Distance + Resource + Breeding + Season | 12 | -2698.92 | 5422.01 | 3.11 | 0.01 |
| **Vulture (Biomass)** |  |  |  |  |  |
| **Model** | **df** | **logLik** | **AICc** | **∆AICc** | **Weight** |
| **Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex** | **11** | **-2662.35** | **5346.83** | **0.00** | **0.04** |
| **Biomass + Biomass2 + Distance + Season + Sex + Biomass:Sex** | **10** | **-2663.77** | **5347.65** | **0.82** | **0.02** |
| **Biomass + Biomass2 + Breeding + Season + Sex + Biomass:Sex** | **10** | **-2663.77** | **5347.66** | **0.82** | **0.02** |
| **KDE50 + Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex** | **12** | **-2662.01** | **5348.19** | **1.35** | **0.02** |
| **Biomass + Biomass2 + Season + Sex + Biomass:Sex** | **9** | **-2665.20** | **5348.50** | **1.66** | **0.02** |
| **Biomass + Biomass2 + Distance + Breeding + Sex + Biomass:Sex** | **10** | **-2664.20** | **5348.52** | **1.68** | **0.02** |
| **Abruptness + Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex** | **12** | **-2662.18** | **5348.53** | **1.70** | **0.02** |
| KDE95 + Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex | 12 | -2662.34 | 5348.85 | 2.01 | 0.01 |
| Biomass + Biomass2 + Distance + HFP + Breeding + Season + Sex + Biomass:Sex | 12 | -2662.35 | 5348.86 | 2.03 | 0.01 |
| Abruptness + Biomass + Biomass2 + Breeding + Season + Sex + Biomass:Sex | 11 | -2663.42 | 5348.98 | 2.15 | 0.01 |
| KDE50 + Biomass + Biomass2 + Distance + Season + Sex + Biomass:Sex | 11 | -2663.43 | 5349.00 | 2.16 | 0.01 |
| KDE50 + Biomass + Biomass2 + Breeding + Season + Sex + Biomass:Sex | 11 | -2663.46 | 5349.06 | 2.23 | 0.01 |
| Biomass + Biomass2 + Distance + Sex + Biomass:Sex | 9 | -2665.60 | 5349.30 | 2.46 | 0.01 |
| Biomass + Biomass2 + Breeding + Sex + Biomass:Sex | 9 | -2665.62 | 5349.34 | 2.51 | 0.01 |
| Abruptness + Biomass + Biomass2 + Distance + Season + Sex + Biomass:Sex | 11 | -2663.63 | 5349.40 | 2.56 | 0.01 |
| Biomass + Biomass2 + Distance + Breeding | 9 | -2665.71 | 5349.52 | 2.68 | 0.01 |
| Biomass + Biomass2 + HFP + Breeding + Season + Sex + Biomass:Sex | 11 | -2663.75 | 5349.65 | 2.81 | 0.01 |
| KDE95 + Biomass + Biomass2 + Breeding + Season + Sex + Biomass:Sex | 11 | -2663.76 | 5349.66 | 2.83 | 0.01 |
| KDE95 + Biomass + Biomass2 + Distance + Season + Sex + Biomass:Sex | 11 | -2663.76 | 5349.66 | 2.83 | 0.01 |
| Biomass + Biomass2 + Distance + HFP + Breeding + Sex + Biomass:Sex | 11 | -2663.77 | 5349.67 | 2.84 | 0.01 |

Appendix S4. Standard deviation for each random factor in the VULTURE modelling for both Biomass and Resource approaches. Only models within ΔAICc <2 are shown.

|  |  |  |  |
| --- | --- | --- | --- |
| **Biomass** | **ID** | **Site** | **Semester** |
| Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex | 0.5885 | 0.2270 | 0.7553 |
| Biomass + Biomass2 + Distance + Season + Sex + Biomass:Sex | 0.6190 | 0.2278 | 00.7598 |
| Biomass + Biomass2 + Breeding + Season + Sex + Biomass:Sex | 0.5618 | 0.2281 | 0.7565 |
| KDE50 + Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex | 0.5789 | 0.2269 | 0.7556 |
| Biomass + Biomass2 + Season + Sex + Biomass:Sex | 0.5924 | 0.2288 | 0.7610 |
| Biomass + Biomass2 + Distance + Breeding + Sex + Biomass:Sex | 0.5891 | 0.2270 | 1.1221 |
| Abruptness + Biomass + Biomass2 + Distance + Breeding + Season + Sex + Biomass:Sex | 0.5876 | 0.2261 | 0.7522 |
| **Resource** | **ID** | **Site** | **Semester** |
| Resource + Breeding + Season | 0.5750 | 0.1943 | 0.6997 |
| Resource + Season | 0.6032 | 0.1951 | 0.7038 |
| Resource + Breeding + Season + Sex | 0.5691 | 0.1942 | 0.6991 |
| Abruptness + Resource + Breeding + Season | 0.5755 | 0.1933 | 0.6953 |
| Distance + Resource + Breeding + Season | 0.5838 | 0.1938 | 0.6985 |
| Resource + Breeding | 0.5753 | 0.1945 | 1.0332 |
| KDE50 + Resource + Breeding + Season | 0.5727 | 0.1944 | 0.6999 |
| KDE95 + Resource + Breeding + Season | 0.5774 | 0.1943 | 0.6995 |

**References**

Moreira, F., Martins, R.C., Catry, I. & D’Amico, M. (2018). Drivers of power line use by white storks: A case study of birds nesting on anthropogenic structures. *J. Appl. Ecol.*, 55, 2263–2273.