**Supplementary Material**

Seasonal and daily activity patterns by Eleonora’s Falcon *Falco eleonorae* based on GPS telemetry: a contribution to the species’ movement ecology at its breeding grounds

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References

Appendix S1. Estimation of nesting site coordinates.

For each individual, but for ELEF05, we considered the GSM data received during the breeding period and used the “recurse” package (Bracis *et al.* 2018) to estimate the frequency of visits and the total residence time within a buffer of 50m around each GPS fix. Then, we averaged the coordinates of the GPS fixes whose frequency of visits and residence time were greater than the 3rd quantile of the obtained values. The averaged coordinates were then compared to the ones estimated by visual inspection of the distribution pattern of the GSM data. In all cases the difference between the two methods in the estimated coordinates was less than 10m. Thus, the coordinates estimated through visual inspection were considered in all subsequent analyses. To decide on the appropriate size of the buffer we tested various radii (namely, 30, 40 and 50m) and compared the resulting coordinates to the true coordinates of ELEF05. We did not consider smaller radii (i.e. less than 30m) given that the average size of the nesting site of Eleonora’s falcon has been previously estimated at 20-50m (Walter 1979), but also in order to avoid location errors related to the GPS measurement error in a rugged surface such as the nesting cliffs.

Table S1. Summary statistics of ranging distance for six tagged falcons based on GSM data. Note that different time periods are considered (see Table 1).

| **Breeding event** | **Number of GPS fixes** | **Mean** | **Standard deviation** | **Median** | **Q1** | **Q3** |
| --- | --- | --- | --- | --- | --- | --- |
| ELEF01.2015 | 72 | 13.911 | 23.080 | 1.575 | 0.189 | 23.962 |
| ELEF02.2016 | 66 | 34.903 | 45.610 | 13.381 | 2.076 | 51.941 |
| ELEF02.2017 | 65 | 30.807 | 28.033 | 26.145 | 1.880 | 48.140 |
| ELEF02.2018 | 37 | 8.421 | 13.184 | 1.656 | 0.306 | 16.102 |
| ELEF02.2019 | 23 | 11.470 | 17.579 | 1.364 | 0.325 | 19.867 |
| ELEF03.2015 | 100 | 14.246 | 16.149 | 8.171 | 0.893 | 25.251 |
| ELEF04.2015 | 102 | 5.367 | 8.104 | 0.301 | 0.135 | 8.949 |
| ELEF05.2016 | 20 | 18.617 | 25.310 | 2.923 | 1.345 | 32.854 |
| ELEF05.2017 | 5 | 1.140 | 1.377 | 0.162 | 0.140 | 2.391 |
| ELEF06.2016 | 1 | 0.105 | - | - | - | - |
| TOTAL | 491 | 16.768 | 26.140 | 3.836 | 0.308 | 24.713 |

Table S2. Post-hoc Tukey tests between pairs of different categories of wind direction, based on their estimated marginal means according to the GLMM results.

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| --- | --- | --- | --- |
| **Contrasts** | **Estimate** | **Standard Error** | **p-value** |
| South vs East | -0.74 | 0.21 | 0.002 |
| South vs North | -0.63 | 0.24 | 0.040 |
| South vs West | -0.93 | 0.21 | <0.000 |
| East vs North | 0.11 | 0.17 | 0.917 |
| East vs West | -0.19 | 0.11 | 0.339 |
| North vs West | -0.30 | 0.16 | 0.274 |

Table S3. Moonlight conditions (i.e. illuminated fraction of the moon, ranging from 0-new moon to 1-full moon) at nights during which ranging activity was detected based on GSM data received during the breeding period (see Table 1).

| **Breeding event** | **Number of GPS fixes** | **Mean** | **Standard deviation** | **Median** | **Q1** | **Q3** |
| --- | --- | --- | --- | --- | --- | --- |
| ELEF01.2015 | 1 | 0.096 | - | - | - | - |
| ELEF02.2016 | 7 | 0.690 | 0.166 | 0.787 | 0.672 | 0.787 |
| ELEF02.2017 | 0 | - | - | - | - | - |
| ELEF02.2018 | 1 | 0.025 | - | - | - | - |
| ELEF02.2019 | 1 | 0.500 | - | - | - | - |
| ELEF03.2015 | 4 | 0.148 | 0.210 | 0.072 | 0.004 | 0.216 |
| ELEF04.2015 | 9 | 0.297 | 0.238 | 0.223 | 0.144 | 0.420 |
| ELEF05.2016 | 5 | 0.322 | 0.176 | 0.447 | 0.129 | 0.447 |
| ELEF05.2017 | 2 | 0.469 | 0.133 | 0.469 | 0.422 | 0.516 |
| ELEF06.2016 | 1 | 0.336 | - | - | - | - |
| TOTAL | 31 | 0.374 | 0.264 | 0.375 | 0.134 | 0.561 |

Table S4. Wind regime statistics during the breeding period (15 July–31 October 2015–2018) in our study area. The mean wind direction was north-northeast. Post-hoc comparisons suggested that northern and eastern winds were stronger compared to southerly and western winds (*P* < 0.05 between North-South, North-West, East-South, East-West, but not between North-East).

| **Wind direction** | ***Wind speed (m/s*)** | |
| --- | --- | --- |
| **Mean** | **Standard deviation** |
| North | 5.287 | 3.331 |
| East | 5.232 | 2.657 |
| South | 4.002 | 2.564 |
| West | 4.594 | 2.228 |
| Total | 4.968 | 2.770 |

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| Figure S1**.** The values of the smooth effect for Julian date based on the GAMM results. |

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| Figure S2. Time budget of ranging activity for five female Eleonora’s Falcons during the breeding period (morning: 06h00-11h59, afternoon: 12h00-18h59, night: 19h00-05h59 UTC). |

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| A close up of a map  Description automatically generated |
| Figure S3. The location of field observations of Eleonora’s falcons according to the eBird database during the pre-breeding period (i.e. April till mid-July) in Greece and western Turkey during the last 30 years. The 95% utilization distribution areas of two tracked falcons is also depicted (see Fig. 4a). |

**References**

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