Diurnal and nocturnal home range of Italian hares (Lepus corsicanus) on Elba Island estimate by GPS technology

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Introduction
In 2015, as foreseen by the National Action Plan for the Conservation of Lepus corsicanus [8], a reintroduction project started on Elba Island, in the National Park of the Tuscan Archipelago. The aim was to recreate a wild population of Italian hares (Lepus corsicanus De Winton, 1899) [7], an endemic species of the Italian peninsula and Sicily, genetically and morphologically distinct from the European hare (Lepus europaeus) [2][4][5], in his historical distribution range [8]. A total of 35 adult hares, reared in the breeding center of the State Forestry corps in Bieri (LU), were equipped with VHF collars and reintroduced in 2 different study areas. On Monte Calamita only 10 subjects were released because the mortality in the first week turned out to be high (40 %); on Monte Perone, instead, only 15% of the hares died in the first 7 days after release, therefore further reintroductions were carried out in this area [6][9].

One of the subjects released in December 2016 on Monte Perone, was recaptured and equipped with a GPS collar. In the same way in December 2017 other 3 reared animals were equipped with the same tags and released in the same area.

Aim of the work - Evaluation of the spatial behavior of the Italian hare between day and night time with the help of GPS Technology

Study area
Monte Perone – Elba Island (Figure A)

The area is characterized by a Mediterranean environment.

GPS Collar characteristics
- Model: Tellus Micro T2H Followit (Figure B)
- Weight: 0.08 Kg
- VHF Beacon (activity/mortality/recovery sensor)
- GPS Receiver
- GPRS/UHF download options
- Remote Drop-OFF mechanism
- Collected information: GPS position, date and time (GMT), time needed to take the fix, altitude, number of intercepted satellites, horizontal dilution of precision, temperature (°C) and activity

Monitored subjects
Reintroduction session: In June 2017 with the help of 20 operators, trapping nets (Figure C) and VHF technology was caught a hare (ID 6031) (Figure D), a male released in December 2016. After the replacement of the VHF tag with the GPS Collar, he was immediately released.

Introduction session: In December 2017, three hares, one male (ID 6028) and two females (ID 6029, ID 6030), were fitted with the same GPS tags and reintroduced. All the subjects came from the breeding center of the State forestry corp in Bieri (LU), were equipped with microchip and ear tags and weighed before their release.

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Table 1 Monitoring period and collected data: Report of the monitoring activity and of the collected data

<table>
<thead>
<tr>
<th>Date</th>
<th>Sex</th>
<th>ID</th>
<th>Season</th>
<th>Start monitoring</th>
<th>End monitoring</th>
<th>Monitoring days</th>
<th>Data downloaded</th>
<th>Collected fixes</th>
<th>Average fixes/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>6031</td>
<td>Male</td>
<td>6031</td>
<td>Summer</td>
<td>2017-06-17</td>
<td>2017-07-14</td>
<td>28</td>
<td>95</td>
<td>396</td>
<td>7.74</td>
</tr>
<tr>
<td>6029</td>
<td>Male</td>
<td>6029</td>
<td>Winter</td>
<td>2017-12-07</td>
<td>2018-02-08</td>
<td>62</td>
<td>132</td>
<td>309</td>
<td>9.26</td>
</tr>
<tr>
<td>6030</td>
<td>Female</td>
<td>6030</td>
<td>Winter</td>
<td>2017-12-31</td>
<td>2018-02-06</td>
<td>36</td>
<td>114</td>
<td>339</td>
<td>8.25</td>
</tr>
</tbody>
</table>

Table 2: Overlaps (%) of diurnal and nocturnal Home ranges, calculated with a modified Minta Index [1]

<table>
<thead>
<tr>
<th>Source</th>
<th>Overlapping %</th>
</tr>
</thead>
<tbody>
<tr>
<td>6028</td>
<td>94.29%</td>
</tr>
<tr>
<td>6031</td>
<td>81.64%</td>
</tr>
<tr>
<td>6029</td>
<td>68.40%</td>
</tr>
<tr>
<td>6030</td>
<td>84.53%</td>
</tr>
</tbody>
</table>

Results
GPS technology, unlike the use of VHF one, allowed us to carry out a constant monitoring activity and to estimate the nocturnal home range of the hares.

The average nocturnal and diurnal home range sizes are respectively 97.41 and 87.33 hectares and their comparison doesn’t differ statistically (U test = 7, p < 0.05).

The average overlapping percentage between the home ranges results 82.22% (Table 4).

Analysis
- Only fixes with a valid position, connection with a minimum of 4 satellites and a three dimensional accuracy of the position (Latitude, Longitude and Altitude), were analysed.
- The subdivision of the fixes between night and day was based on seasonal sunrise and sunset time.
- Diurnal and nocturnal home ranges were compared with the HRT 2.0 plugin in ArcGIS using the Kernel method (95%).
- The dimensions of daily nocturnal home ranges of each subject were at first compared by applying the Mann Whitney U test [7][10]. The second analysis evaluates the overlapping percentage of those areas with a modified Minta index [3][10].

Discussion and conclusions

The results of the analysis suggest that hares fulfill their needs using the same environment without changing their home range between day and night time. In a study conducted in the Regional natural reserve of Monterano (RM) the average home range sizes of Italian hares resulted slightly smaller: 36 ha the nocturnal one and 30 ha the diurnal [1]. In both cases the diurnal home range is smaller than the nocturnal one, probably linked to the edology of the species, which diurnal activity reduces.

References