Analysis of Home Range of Eurasian Eagle Owl (*Bubo bubo*) by WT-100

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Abstract: This study aimed to estimate the home range of Eurasian Eagle Owl (*Bubo bubo*) from May to November 2012. *Bubo bubo* were rescued by Chungnam Wild Animal Rescue Center. WT-100 weigh 83g. Analysis of home ranges used a SHP File and ArcGIS 9.0 for GIS, and used a Kernel Density Estimation (KDE) and Minimum Convex Polygon (MCP) for analysis. Home range were 39.1 km² (MCP) and 27.8 km² (KDE 95%), 20.9 km² (KDE 90%), 4.2 km² (KDE 50%). Home range of *Bubo bubo* showed very similar results to the previous study. That is result of opportunistic foraging tactics to selecting prey.

Keywords: Kernel Density Estimation (KDE), Minimum Convex Polygon (MCP), Home range analysis

Introduction

Eurasian Eagle Owl (*Bubo bubo*) is a large strigiform, which is distributed globally in the Palearctic regions and in North Africa. Eurasian Eagle Owl inhabits the areas with the irregular terrain adjacent to open areas and with a constant slope, or the areas without artificial disturbance factors, rather than densely forested areas (del Hoyo et al., 1999; Ortego, 2007). In Korea, Eurasian Eagle Owl are sedentary birds of prey which are highly dependent on certain regions. It prefers the rocky areas or mountains to the forested areas. Even in the forested areas, it inhabits around the edge of the forest, rather than in the completely forested areas (Won, 1981; Choi et al., 2007). Eurasian Eagle Owl usually feeds on mammals and birds. Depending on the habitats, the prey items vary difference (Penteriani et al., 2002; Choi et al., 2007). This availability of prey item is the most significant factor in the limitation of home range (Mitchell and Powell, 2007). The decrease of prey items influences the declining fertility rate of Eurasian Eagle Owl (Penteriani et al., 2002).

Birds of prey, such as Eurasian Eagle Owl, are the top predators which play a significant role in the ecological circulation system. As regarded as indicator species to indicate an environmental condition, they play a role as keystone species for maintaining the environments (Penteriani et al., 2002). Moreover, the keystone species plays a critical role in conservation. This can be investigated primarily by developing the ecological information regarding the use and distribution of habitat and the home ranges. Recently, the research on the spatial distribution such as home range has been conducted in various ways by using spatial data collection device such as radio-tracking. The radio-tracking method plays a significant role in wildlife animal researches, in that the radio-tracking can obtain the data regarding the wildlife animals’ use of habitats and their temporal and spatial movements (Aebischer and Robertson, 1993). The radio-tracking can provide important information with regard to the protection and management of the population of birds of prey, such as habitat size, migration route, predatory behavior, and cause of death (Kenward, 1985). The previous research on Eurasian Eagle Owl has investigated the breeding depending on habitats, the use of food resources, the environmental analysis of habitat (Jaksic and Marti, 1984; Martinez et al., 2003; Ortego and Diaz, 2004; Choi et al., 2007), and the breeding behavior (Penteriani et al., 2005; Sin and Baek, 2008). However, few researches have examined the home range, which is an important factor in its inhabitation (Delgado and Penteriani, 2007). Therefore, this study investigated the home range of Eurasian Eagle Owl by using the radio-tracking. Consequently, the study aims to provide ecological data which is required for the preservation of Eurasian Eagle Owl habitats in the future.

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Materials and Methods

Attachment of wild animal tracking device
The Eurasian Eagle Owl, which was used for this study, was rescued by Chungnam Wild Animal Rescue Center and was released after being recovered. Based on Kenward (1985), the wild animal tracking device (WT-100: GPS-CDMA based Telemetry) was attached as a back-pack type. All of the Bubo bubos in this study were matured birds (3 female individuals and 1 male individual), rescued in Chungcheongnam-do areas including Hapdeok-ri, Hapdeok-eup, Dangjin; Hapdeok-eup Daejeon-ri, Dangjin; Hwajeon-ri, Bongsan-myeon, Yesan-gun; Sindong-ri, Namul-myeon, Geumsan-gun. The rescued Bubo bubo had sufficient treatment. Then, based on the determination of veterinarian, the release and its schedule was determined. They were released to the place where they had been rescued (Table 1, Fig. 1).

For tracking their home ranges, each individual was assigned with identification number (i.e., T7652, T1697, T5163, and T8785). In the case of T5163, it was recaptured on April, 26 and reassigned with the identification number (i.e., T7416) before being released again. The weight of wild animal tracking device, which can minimize the limitation of flying behavior is less than 5% of the body weight (Kenward 1985). The wild animal tracking device (WT-100) used in this study weighed 83g, which was 3.82% in average (3.49%-4.28%) of the body weight of Eurasian Eagle Owl. As the WT-100 (GPS-CDMA based Telemetry) is the system to send the coordinate obtained by GPS to the integrated server through CDMA system, the users of this device can identify the locational information on the web. Therefore, the location coordinates were daily checked on the web to identify the survival and movement of the individuals in the wildlife. The location coordinates were obtained four times daily including twice in the daytime and twice at nighttime.

Tracking status of Eurasian Eagle Owl
T7651 had been tracked for 232 days from the release date (March 7) to the date on which the data transmission was completed (September 23). T1697 had been tracked for 147 days (March 7~July 31). T5163 had been tracked for 49 days from the release date (March 9) to the re-rescued date (April 26). After that, it was assigned with T7416 and it had been tracked for 177 days from the release date (June 2) to November, 25. T8785 had been tracked for 237 days from March, 7 to September, 28.

The reception rate of GPS acquire was 98.6% in average. The Eurasian Eagle Owl which had the highest reception rate (99.9%) was T7416, which received the coordinates for 688 out of 689 times in total. On the other hand, the Eurasian Eagle Owl which had the lowest reception rate (97.2%) was T76951, which received the coordinates for 755 out of 777 times in total (Table 2).

Home range analysis
The received GPS coordinates for home range analysis were analyzed by using the national digital map for GIS (1/25,000) SHP File and Animal Movement Tool of Hawth’s Analysis Tool for ArcGIS 9.x(ESRI Inc.) and ArcGIS. This study used Minimum Convex Polygon Method (MCP) 100% method and Kernel Density Estimation (KDE) 95%.

**Table 1. The Information for 5 Eurasian Eagle Owl (Bubo bubo)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Sex</th>
<th>Age</th>
<th>Weight (g)</th>
<th>Rescue day and Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>T7651</td>
<td>Female</td>
<td>Adult</td>
<td>1,940</td>
<td>13 February (Hapdeok-eup Hopdeok-ri, Dangjin)</td>
</tr>
<tr>
<td>T1697</td>
<td>Male</td>
<td>Adult</td>
<td>2,120</td>
<td>13 February (Hapdeok-eup Daejeon-ri, Dangjin)</td>
</tr>
<tr>
<td>T8785</td>
<td>Female</td>
<td>Adult</td>
<td>2,316</td>
<td>29 February (Geumsan-gun Namil-myeon, Chungeon-dong)</td>
</tr>
<tr>
<td>T5163</td>
<td>Female</td>
<td>Adult</td>
<td>2,380</td>
<td>17 February (Yesan-gun Bongsan-myeon, Chungeon-dong)</td>
</tr>
<tr>
<td>T7416*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>29 April-T5163 Rescue (Geumsan-gun Namil-myeon, Chungeon-dong)</td>
</tr>
</tbody>
</table>

*: Re-rescue T5163

Fig. 1. Location of study site (HH: Hapdeok-eup Hopdeok-ri, Dangjin; HD: Hapdeok-eup Daejeon-ri, Dangjin; YB: Yesan-gun Bongsan-myeon; GN: Geumsan-gun Namil-myeon).
The home ranges of the total of five individual Eurasian Eagle Owl, including four individuals and one individual which was released after being recaptured, were analyzed. The average home range based on Minimum Convex-hull Polygon (MCP) was 39.1 km$^2$ (SD=27.7, n=5). The individual which had the broadest home range was T5163 (80.5 km$^2$). On the other hand, the individual having the narrowest home range was T1697 (8.5 km$^2$). As a result of the application of Kernel Density Estimation (KDE), the average area of the habitat which showed the 95% of use was 27.8 km$^2$ (SD=36.2, n=5). The individual which had the largest home range was T5163 (91.9 km$^2$), whereas the individual which had the smallest home range was T1697 (5.6 km$^2$) (Table 3, Fig. 2).

T5163, which showed the broadest home range, had constantly moved until it was rescued again after being released. Given that T5163 was dehydrated at the time of being re-rescued, it could not make stable home range when it had been initially released. In this sense, the home range of T5163 is hardly regarded as usual movement and behavior pattern. Therefore, the result of home range analysis of the rest four individuals, except for T5163, indicated that the average areas of home range was 28.7 km$^2$ (MCP). The average area of habitat representing the 95% KDE of use was 11.8 km$^2$. Besides T5163, another individual that showed the broadest home range was T7651. Its home range became stable after it moved about 6km on March, 7. Therefore, this movement behavior might result in somewhat broad home range of the MCP analysis.

The result of this study indicated that the home range of Eurasian Eagle Owl, except for T5163 which moved the most, was within a radius of 2 km (12.6 km$^2$)-3 km (28.3 km$^2$) based on the place where they roosted in the daytime. Moreover, they showed active movement centered on the daytime roosting places while they stayed at a relatively certain place during the daytime (Fig. 2). This finding confirmed that Eurasian Eagle Owls, as nocturnal birds, have narrow habitats. Also, their preying behavior are active in the range of 10~20 km$^2$ from the nesting places. This is a similar result to the finding that the home range of Eurasian Eagle Owl in Spain was 25 km$^2$ (Serrano, 2000; Ortego and Diaz, 2004; Dalbeck and Heg, 2006). In general, the core areas of the distribution of wildlife animal are KDE 50% of the areas (Yoo et al., 2013). As the KDE 50% was applied to the home range analysis of Eurasian Eagle Owl in this study, the average home range was 4.2 km$^2$ (Range: 0.6~16.5 km$^2$) and it decreased to 1.1 km$^2$ if the abnormal movement pattern of T5163 was excluded. However, considering the ecological characteristics of Eurasian Eagle Owl which has nocturnal activity and certain resting area in the daytime, it is hardly to determine that the area of KDE 50% is considered to be core areas. As the core areas are the range of organism’s habitation which includes universally favorable conditions for habitation, they are determined by the analysis of objective factors to increase biodiversity (Yoo et al., 2013). Therefore, considering the ecological characteristics and using patterns within the home range, the interpretation of this core area (KDE 50%) limited to the habitation range of Eurasian Eagle Owl might be overestimated. Rather, it is significant to understand the resting areas in the daytime or the minimum boundary line of their activity.

When it comes to the selection of habitat, Eurasian Eagle Owl is affected by the availability of food resources and the density of available food within the habitat. Also, it uses the species inhabiting the habitat areas as the main food sources (Martinez et al., 2003; Ortego and Diaz, 2004; Dalbeck and Heg, 2006). Furthermore, if the main food sources decrease, the Eurasian Eagle Owl can maintain a stable population due to its opportunistic feeding habits to select various food sources (Penteriani et al., 2002). In Korea, the main food sources are birds and mammals, however; it has opportunistic feeding habits, depending on the different food sources in diverse habitats. In other words, instead of its preference for a certain taxonomic group, it prefers the prey with proper size and the types of prey depend on the inhabited environment. Hence, it has the high rate of predation of mammals such as rodents in open areas and that of birds in forested areas (Choi et al., 2007). The results of this study indicated that Eurasian Eagle Owl stably uses the habitat within a radius of 2 km from the place where they roosted in the daytime. It implies that the forested and patch areas where they roost in the daytime are mostly open areas composed of farmlands and residential areas. Thus, the rodents are densely populated in these areas. In addition, it implies that Eurasian Eagle Owl has a feeding habit to use mammals and birds as food sources, depending on the density of main food sources.

Eurasian Eagle Owl breeds in the areas which have irregular and topographic slopes such as rocky areas and
hills (Ortego and Diaz, 2004; Dalbeck and Heg, 2006). The home range is influenced not only by the abundance of prey resources within habitats, but also by the ecological characteristics such as the breeding of target individual (Davidson-Watts and Jones, 2006; Chung et al., 2010). The target subjects in this study were the individuals that were rescued and released. No rocky or cliffy areas which could be used as breeding places within the research sites were observed. Therefore, it is expected that the habitat of Eurasian Eagle Owls might be moved if they breed in the future. For obtaining more detailed information, it is required to study further on the home range for diverse ecological characteristics such as the utilization rate, the dispersion, and the breeding period according to the type of habitat.

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References


