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Use of space within their enclosure in captive Dholes (*Cuon alpinus*)

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# Use of space within their enclosure in captive Dholes (*Cuon alpinus*)

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**Author:**
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In this study, 12 dholes (*Cuon alpinus*) at Kolmården Wildlife Park were observed to investigate how they use their enclosure and if they tend to share space with each other. Using scan sampling for every five minutes, the location of the dholes was marked on a hand drawn map with 14 zones. The study lasted for a total of 72 observation hours during three weeks. The results showed that the dholes had marked preferences for certain zones. Within the zones, attractive areas, so-called hotspots, were found. A hotspot includes the majority of the markings in the zones. The number of observations ranged from 1341 in the most popular zone to 71 in the least popular. Comparisons between data for mornings vs. afternoon and feeding days vs. non-feeding days showed no obvious differences in utilization of the zones. Two frequently used pathways through the enclosure were found. Finally, the results showed that the dholes have a tendency to share space with each other.

**Keyword:**
Captivity; Enclosure; Use of space; Dhole; *Cuon alpinus*
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Foreword

This report is a degree thesis at the bachelor’s level (16 ECTS credits) performed by the author in collaboration with two study colleagues, Mikaela Hanson and Ida Milton. This cooperation included the planning of the study, the collection of data and analyses. Thereafter each student has written and structured the report in all its parts individually.
1 Abstract

In this study, 12 dholes (*Cuon alpinus*) at Kolmården Wildlife Park were observed to investigate how they use their enclosure and if they tend to share space with each other. Using scan sampling for every five minutes, the location of the dholes was marked on a hand drawn map with 14 zones. The study lasted for a total of 72 observation hours during three weeks. The results showed that the dholes had marked preferences for certain zones. Within the zones, attractive areas, so-called hotspots, were found. A hotspot includes the majority of the markings in the zones. The number of observations ranged from 1341 in the most popular zone to 71 in the least popular. Comparisons between data for mornings vs. afternoon and feeding days vs. non-feeding days showed no obvious differences in utilization of the zones. Two frequently used pathways through the enclosure were found. Finally, the results showed that the dholes have a tendency to share space with each other.

2 Introduction

The dhole (Figure 1), or Asian wild dog, *Cuon alpinus*, is a pack-living animal and a cousin to our domesticated dog (Fox, 1984). They usually live in packs of 5 to 12 individuals, but packs of up to 40 individuals have been reported (Cohen, 1978). For a pack of 13 members an area of approximately 20km² is regularly used with a maximum coverage of 40km² with a daily walk of 1-8km (Fox, 1984). As carnivores, their home range usually includes different types of habitats (Fox, 1984) such as hunting areas with high prey density and denning sites for hiding (Gittleman and Harvey, 1982). In contrast to the wolf pack where the dominant members eat first, the dholes eat simultaneously and there is usually little aggression (Fox, 1984). Usually one or two individuals keep lookout for predators while the other members of the pack eats (Durbin et. al, 2003; Fox, 1984). In the wild, they are mostly spread through India but since the 20th century, humans begun keeping them in captivity in Europe (Maisch, 2010).

In captivity, they often move around together and if their enclosure is big enough, they move around as big groups. If the enclosure is too small, they move around as solitary animals (Maisch, 2010). It is recommended to have a size of 2000 m² or larger for a pack of 15 animals (Maisch, 2010). Also, the topography in the enclosure is important to satisfy the natural behaviours. They often play around in the water and should therefore have access to water in the enclosure. They also need places to retreat from visitors and it is important that these places allow natural pack behaviour. If the enclosure is big enough the
Dholes will not hide from visitors the whole time, but instead take an interest in them (Maisch, 2010).

Today, it is a fact that the dhole is endangered in the wild. According to an assessment done by the International Union for Conservation of Nature (IUCN) in 2008, less than 2500 individuals was left in the wild (Maisch, 2010). Therefore it is important that the populations in captivity are appropriately managed. It has been found difficult to get captive populations to reproduce successfully, but since the new European Endangered Species Programme for Dholes from 2006, the reproduction success has turned and the captive population begun to increase in number (Maisch, 2010).

Besides the reproduction problems that occur in captivity, some species can develop stereotypic behaviours (Clubb and Mason, 2007). One example of these can be pacing back and forth on the same trail which may indicate a lack of stimulation for hunting behaviours or space to guard as a territory (Terlouw et al., 1991). Therefore, the enrichment in the enclosures is important. It is also important to know how the animals utilize their enclosure to maximize their welfare (Ross et al., 2009).

The objective of this study was therefore to investigate how the dholes in captivity at Kolmården Wildlife Park use the space in their outdoor enclosure and if they tend to share space with each other or not. Movement patterns were also studied to find out if the dholes have any frequently used trails.

![Figure 1. The appearance of the dhole pack. A single adolescent member sitting (to the left) and a group resting in the sun (to the right). Both photos were taken by the author at Kolmården Wildlife Park in 2013.](image-url)
3 Materials and methods

3.1 Animals and housing

The study took place at Kolmården Wildlife Park, near Norrköping, Sweden. The study included 12 animals, five males and seven females housed in an outdoor enclosure of 2 852 m². The enclosure was divided into two parts (one bigger and one smaller), separated by a high fence, which the animals could access through a hatchway.

All the animals are related to each other with one couple as parents, both born in 2005. The female originates from France and the male from Great Britain. Two of the offsprings are older than the others, born in 2008 and 2010, respectively. All the other offsprings were born in 2012. The mother was pregnant at the beginning of the observations and therefore she would not be as present as the other individuals. She spent most of her time in the den except when she came out to occasionally eat or drink.

The animals were fed three times a week. They were given big pieces of beef or horse meat to share. When food was provided, the hatchway was closed with all the animals in the bigger part of the enclosure, so the caretakers could provide the food in the smaller part of the enclosure. The caretakers counted the animals twice a day, once in the mornings and once in the afternoons. Occasionally, the caretakers provided enrichments in forms of boxes with tails, herbs etc.

3.2 Observations

The outdoor enclosure was drawn on a map (Figure 2) and was divided into different zones. Landmarks such as trees, rocks and water were used as markers for the division. The different features of the zones are shown in Table 1. Two observers were positioned at different sites to get a complete overview of the enclosure. Scan sampling was used every five minutes to mark on the map where the animals were located in the enclosure. If an animal was moving, the direction was marked with an arrow. For every hour, the individual maps from the observers were summarized into one common map (In total, six maps per day). These maps were then used to assess if the dholes have a tendency to prefer certain zones in the enclosure and if they tend to share space or not. The observations lasted for a total of six hours per day (three hours in the morning and three in the afternoon) for a total of twelve days. In the present study, separate individuals were not marked because it was difficult to distinguish them.
Figure 2. Map of the dholes’ enclosure divided into 14 zones

Table 1. Description of the environment in the different zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Environmental features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Area containing a cliffside with ledges of different heights and a few smaller trees and rocks scattered.</td>
</tr>
<tr>
<td>2</td>
<td>A slightly rugged area with a few scattered trees with a smaller den.</td>
</tr>
<tr>
<td>3</td>
<td>An area with a big uprooted tree resting on a stump. The area also contains a smaller assemblage of trees.</td>
</tr>
<tr>
<td>4</td>
<td>Dense assemblage with pine trees in another flat area.</td>
</tr>
<tr>
<td>5</td>
<td>An area containing a slope towards the water with a few groups of trees.</td>
</tr>
<tr>
<td>6</td>
<td>A ditch with water under the visitor bridge.</td>
</tr>
<tr>
<td>7</td>
<td>A rock of elongated shape that emerges from the ground and an assemblage of trees to the right.</td>
</tr>
<tr>
<td>8</td>
<td>A downwards slope towards the water area. Bigger rock at the top of the slope.</td>
</tr>
<tr>
<td>9</td>
<td>Greater housing den located under a knoll with a few trees on top. Scattered throughout the area is a few trees and smaller rocks.</td>
</tr>
<tr>
<td>10</td>
<td>Water area and a slight grass slope going towards it.</td>
</tr>
<tr>
<td>11</td>
<td>Secluded area containing den site. Rock assemblage to the right of the den. Scattered trees throughout the area.</td>
</tr>
<tr>
<td>12</td>
<td>Secluded area containing a water part and a slightly rugged grassy area with a few assemblages of trees.</td>
</tr>
<tr>
<td>13</td>
<td>Secluded area containing smaller cliffside.</td>
</tr>
<tr>
<td>14</td>
<td>Isolation area filled with straw. The observers is not able to to see into this area.</td>
</tr>
</tbody>
</table>

3.3 Statistical analysis

To investigate if the dholes preferred certain zones in their enclosure an analysis of variance (ANOVA) was done. This was followed by pairwise Wilcoxon signed-ranked tests to assess which zones differed in their degree of utilization. In addition, comparisons between feeding-days versus non feeding-days and mornings versus afternoons were done using their number of observations. In all statistical analyses a significance level of 0.05 was used.
4 Results

4.1 Utilization of zones

The number of observations ranged from 1341 for the most popular zone to only 71 for the least popular zone. Figure 3 shows the distribution of the utilization of the different zones in total. I observed that the animals preferred certain areas, so-called hotspots, within most of the zones. In zones 10, 13 and 14, my observations did not reveal any hotspots, indicating the dholes did not show preferred areas within these zones.

Figure 3. Total number of observations in each zone and the locations of the hotspots.

Figure 4. Distribution of the utilization of the 14 zone for all 12 days, given as percentage of total numbers of observations.
Figure 4 shows that all zones in the enclosure were used. Zone 2, 9 and 12 was mostly used with 16.9, 13.6 and 13.0% of all observations, respectively. The least used zone was zone 10 with 0.9% of all observations.

A comparison between the different zones showed in some cases significant differences in utilization (Table 2). This led to the ranking of zones from the highest to the lowest number of observations made. The “>” symbol indicates significant differences and the “/” indicates the lack of significant difference.

Zone ranking: 2/9/12/ 7/ 3/ 4/ 11/ 14/ 5/ 8/ 6/ 1>13/ 10

Table 2. Results from the comparison of all zones using Wilcoxon signed rank-test. Significant differences (p<0.05) are marked with grey background and bold numbers.

4.2 Mornings versus afternoons

No statistical analyses were made to compare the utilization of the zones in the mornings and the afternoons. Instead, the mean values of utilization for each zone for all the mornings and all the afternoons were calculated separately and then compared (Figure 5).

Figure 5. Mean utilization of all the zones for all the mornings and all afternoons during the 12 days of observation.
In the mornings, zones 12, 9 and 2 were mostly used with 23.4, 15.6 and 13.7% of all observations, respectively. In contrast to the mornings, zone 2 was mostly used in the afternoons with 20.3% of all observations. The second highest value in the afternoons was found in zone 7 with 14.3%.

These results led to the rankings of the utilization frequency for both mornings and afternoons. The “=” symbol represents same utilization frequency and the “-” symbol represent a difference in the utilization frequency. The ranking is presented from the highest number of observations to the lowest.

Mornings
Zone ranking: 12-9-2-11-14=7-4-3-5-1-6-8-10-13

Afternoons
Zone ranking: 2-7-9-3-4-11-8-5-14-6=12=1-13-10

4.3 Feeding-day versus non feeding-day

The mean values of utilization for each zone for all the feeding days and non-feeding days were calculated separately and then compared (Figure 6).

On feeding days, the most popular zones were zones 9 and 2 with 17.3% and 16.5% of all observations. The least popular zone on feeding days was zone 10 with 0.8%. On non-feeding days, the highest number of observations was made in zones 2 and 12 with 17.5 and 15.8% of all observations made, respectively.
These results led to the rankings of the utilization frequency for both mornings and afternoons. The “=” symbol represents same utilization frequency and the “-” symbol represent a difference in the utilization frequency. The ranking is presented from the highest number of observations to the lowest.

Feeding days
Zone ranking: 9-2-7=12-11-4-3-14-8=1-6=5-13-10

Non-feeding days
Zone ranking: 2-12-7-9-3-5-14-4-11-8-6-1-13-10

4.4 Pathways
No statistical analysis was done to assess if the dholes had certain pathways through their enclosure. During the observations, the animals moved across the whole enclosure in any direction. When visitors came close to the enclosure, the dholes were curious and followed them along the outer line of the enclosure. While running and chasing each other it seemed like they used the upper part of the enclosure more than the lower part (Figure 7).

![Figure 7. Map of the used pathways. The blue lines show the path and arrows mark the direction.](image)

4.5 Tendency to share space
No statistical analysis was done to assess if the dholes tend to share space or stay apart. Instead, the average number of hours during which the animals shared space was counted for every zone separately. This was done for the total
72 hours of observations. The results in Table 3 show the total number of hours that the animals shared space with 2 or 3 or 4 conspecifics etc. in each zone.

**Table 3. Total number of hours that the dholes shared space with other animals in each zone**

<table>
<thead>
<tr>
<th>Zone</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>12</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>3</td>
<td>0</td>
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</tr>
<tr>
<td>4</td>
<td>7</td>
<td>2</td>
<td>1</td>
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<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>1</td>
<td>0</td>
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<td>6</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>8</td>
<td>1</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>17</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>10</td>
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<td>0</td>
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<tr>
<td>11</td>
<td>12</td>
<td>0</td>
<td>1</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>13</td>
<td>0</td>
<td>1</td>
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<td>0</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td>14</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

Zone 2 had the highest number of hours during which the dholes shared space (21 hours). Zones 10 and 13, on the other hand, had no hours where the dhole shared space. For one hour, zone 12 had the highest number of individuals at the same time with 7 individuals.

5 Discussion

5.1 Utilization of zones

The results from this study show that the dholes used their whole enclosure with marked preferences for some zones and certain areas within these, called hotspots. This could be explained by the fact that the animals need places to hide and retreat from visitors (Maisch 2010). The topography in the enclosure at Kolmården meets this need with areas with different features. Therefore, depending on the frequency of visitors, the animals can retreat to hide. The dholes are social animals. This leads to a preference of certain zones which allow them to socialize with each other.

The zones mostly used were zones 2 and 9. The common feature of these two zones is that both have denning sites. During the observations, several individuals were resting together in these dens. In addition, the female gave birth to a litter of seven pups during the observation period, and therefore she was most often found in the bigger den in zone 9. The dholes have a social organization in which the pack members help the dominant female to raise the pack’s pups (Fox, 1984). This may explain the observed gatherings of family members in this zone. In zone 2, the den could also act as a lookout post, which the dholes use in order to keep track of their environment. During my
observations, the animals often used the roof of the den as a lookout post, keeping track of their surroundings. The high number of observations in zone 9 could also be explained by the fact that the hatchway to the smaller part of the enclosure was located there. When fed, the caretakers closed off the bigger part of the enclosure and entered the smaller part when placing the food. This raised curiosity in the animals, leading to a gathering right in front of the hatchway. Additionally, the caretakers provided enrichments and performed their daily count of the animals in this zone. I found no significant difference in utilization between zones 2 and 9. This could be explained by the presence of denning sites in both zones.

The zones that were least used were zones 10 and 13. In these zones, the topography was not as attractive to the dholes, since it was quite plain areas. For the bigger part of the observations, these zones were only used when the animals were passing through to the neighbouring zones. For both zones, there were significant differences between them and all other zones but not between each other. This indicates that these two areas were not preferable for the dholes.

5.2 Mornings versus afternoons

In the mornings, zone 12 was the most utilized zone. During the observations, the animals were resting for the bigger part of the mornings. This comports with previous studies reporting that the dholes are diurnal animals (Kamler et al., 2012) and that they rest in the mornings. During the mornings, the sun was shining in zone 12 and was therefore good place for sunbathing. There were often several individuals in this zone at the same time.

According to the ranking, zone 9 and 2 had the second and third places in popularity in the mornings. These were overall popular resting sites due to the dens. Solitary animals were found scattered in the enclosure during the resting periods in the mornings, but not to the same extent as the gatherings in zone 12.

In the afternoons, the most frequently used zones were zones 2, 7 and 9. As mentioned before, both zones 2 and 9 were popular resting sites. In the afternoons, the sun had moved from zones 11-14 to zones 1-8. The sun together with hiding places made zone 7 a good resting place.

5.3 Feeding-day versus non feeding-day

According to the ranking of the zones on feeding days, the most utilized zones were 9, 2 and 7. This could be explained by the fact that the animals got their food in zone 9 behind the den. Also, when fed, the pack members often helped each other to drag the food upwards into zones 7 and 2. The dholes are curious animals and when feeding time was near, the animals begun to move towards zone 9, waiting to get food. In comparison to the non-feeding days, zone 4 had a
higher ranking. This could be due to the fact that occasionally the food ended up in zone 4 when the pack dragged it up into zone 7. Fox (1984) explains this behaviour with the fact that in the wild, the adults do not want to draw unnecessary attention to the den and the pups. The risk for predators detecting the den would decrease.

On the non-feeding days, zones 2, 12 and 7 were the most utilized zones. As mentioned before, zone 2 had a den where several individuals rested. I also observed some playing with the enrichment around this den.

5.4 Pathways
The dholes often ran across the entire enclosure, but during the observations they had two specific pathways they used regularly. While playing and chasing each other, they often used the upper part of the enclosure more than the lower part. When visitors came close to the enclosure, the animals approached them and followed them along the water area. Dholes are good swimmers and in the wild they hunt near and in water (Maisch 2010). As a part of the family Canidae, the dholes are social animals and are aware of their surroundings and curious about the visitors (Maisch 2010). This curiosity can also explain why they ran across the upper part of the enclosure since there was a road on the other side of the fence. On feeding days, the caretakers drove the car with food on the other side of that fence.

5.5 Tendency to share space
Table 3 shows that the animals did share their space with each other. Zone 12 had the highest number of animals at the same time, which could be explained by the fact that the animals were sunbathing together in this zone. Zone 2 had 21 hours during which 2 individuals shared space. This could be because of the social organization within the packs with joint caring for the pups. This indicates that the dholes do not actively stay apart from each other. As previous authors have shown, the dholes are highly social and it is not unusual to see up to fifteen individuals running together (Maisch 2010).

6 Conclusion
The results from this study show that the dholes at Kolmården Zoo have marked preferences for certain zones in their enclosure with hotspots in each zone. These hotspots are due to certain features such as lookout posts or dens. No specific differences of utilization between feeding vs. non-feeding days and mornings vs. afternoons were found. Two frequently used pathways were found and the dholes show a tendency to share space with each other.
7 Acknowledgments

I would like to thank my supervisor Matthias Laska for all guidance and help during this project. I would also like to say thank you to my fellow students Mikaela Hanson and Ida Milton for the good cooperation during the data collection and analyses. Finally I would like to thank the caretakers at Kolmårdens Wildlife Park for the opportunity to use their animals and all information about them.

8 References


