

Conservation Internship Report

Telemetry research on smooth snake (Coronella austriaca)

1. Introduction

'Grenspark De Zoom – Kalmthoutse Heide' was the first transboundary nature reserve founded by the Benelux Economic Union. The whole area is a voluntary partnership between different nature management, the surrounding towns and a number of private owners. As far as nature protection goes, this collaboration provides an important example of an international alliance. The entire area is part of the Natura 2000 program, highlighting its remarkable nature value in a network of European reserves. Because of this status, the protection of natural habitats of plant and animal species that are threatened, rare or vulnerable, is crucial.

One of these vulnerable species under European protection, is *Coronella austriaca* or the smooth snake. In Flanders, the snake is only found in the provinces of Antwerp and Limburg, mostly on heathlands and open forests. The deterioration of its occurrence is most likely due to the disappearance and fragmentation of adequate habitats. Through regional management with a focus on green infrastructure, the province of Antwerp wants to use corridors to restore and improve the network of habitats this species needs to thrive (Provincie Antwerpen, 2017).

The population in the Grenspark in Antwerp is the largest in Antwerp. Because of its hidden lifestyle, studying this species is no obvious task. Since 2011, a herpetological research team monitors the occurrence and behavior of the snakes in the park as to formulate adequate management strategies (Van Hecke & Bonte, 2013). Densities of these animals were estimated using capture-mark-recapture techniques. Even though the resulting information was useful for further research, it was mainly lacking data on migration and on males in general. This bias is mainly due to their more secret habitats.

Therefore, from March until October 2016, a second investigation was conducted by Grenspark De Zoom – Kalmthoutse Heide, in collaboration with the Vrije Universiteit Brussel and the University of Antwerp, to follow the smooth snakes more closely. The aim of this research was to find male-female differences in behavior and especially migration. While studying the migration of this cryptic species, specific components like migration distances, important corridors, the location of hibernacula and forage areas were looked at.

2. Activities

The main focus of this internship was, using telemetry to track the movement of smooth snakes in the Grenspark. Together with other volunteers, I aided Loïc Van Doorn, a master student at the VUB, in collecting data for his thesis. His work would be a follow-up on the research Van Hecke & Bonte (2013) did on the ecology of the snake in the park. In order to practice the correct tagging of the animals, the team had several meetings with a Dutch expert on smooth snakes. He suggested a number of techniques that could be used to handle and tag the snakes. Accompanied by him, we learned the holding and tagging of the animals. The use of the telemetric equipment such as antenna and receiver, were practiced afterwards near the university campus in Wilrijk.

Beside the actual tracking, there were also times I had to search for new, untagged individuals. Right after molting, a significant number of snakes lost their tag and therefore new or preferably the same individuals had to be found and tagged. The most obvious way to do this, was to frequent known sunbathing spots or to look for snakes underneath corrugated roofing that was positioned in the area, to provide shelter or a place to warm. Because of previously mentioned losses of tags and unfortunately, hot and dry weather, no snakes were found at the end of the summer and the project was ended prematurely.

I was therefore given another assignment by my contact in the park. Over the years, the Grenspark has known a proliferation of signs and other marks next to its main roads. Because these signs are placed by various organizations, the park has no clear overview of their location. Being a conglomerate of different private owners and stakeholders, the Grenspark has to be well-organized to ensure a stable performance. On top of that, one of the projects the Grenspark wants to start with, is working out a uniform 'signing plan'. It aspires to a collection of signs that all have the same layout, independent of their content and function. I was therefore given the responsibility to make an inventory of all signs and their location. To do this, I had meetings with representatives of these organizations, I used maps with known locations of signs and I also went into the field to look for them myself.

3. Material and methods

3.1. Tracking

Once the snakes were caught, we tagged them with a Biotrack Picopix Ag 392. These tags weigh 1,5 grams and their batteries have a lifespan of approximately 3 months. The devices were externally attached in front of the cloaca using tegaderm surgical tape to avoid damage and ensure an easy molting. We had an antenna and a SIKA Radio Tracking Receiver to pick up each individual signal of these tags in the field. The signals could be carried over a distance of 50-100 meter.

Afterwards, every snake was released at the same location they were caught. From that moment on, someone went into the field daily and tried to locate the animals. When they were found, the coordinates were determined using a GPS and written down together with additional information like visibility, habitat and behavior. Eventually, this data was collected in a centralized folder at the visitor center De Vroente.

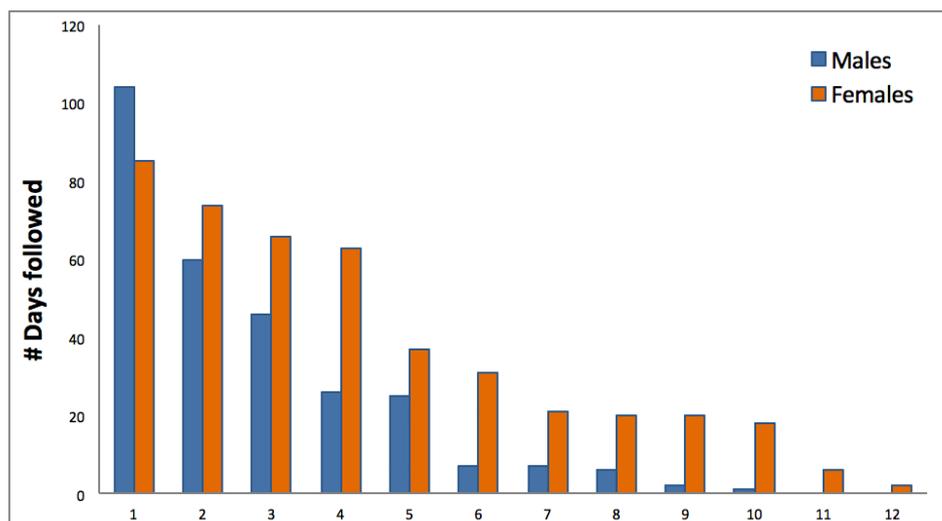
3.2. Sign inventory

The signs were collected using Oruxmaps on a Samsung Galaxy Tab 3 tablet. The tablet was equipped with a GPS so whenever I found a sign, it was sufficient to take a picture of it and the device would automatically attach the corresponding coordinates. I was given maps of popular trails with known signs placed along them. The location of signs on the property of the EVIDES water company were shown to me after I had a meeting with the grounds manager. The remaining signs along the main roads were added to the inventory by scouting the area with a mountain bike. Afterwards, the data collected on the tablet was imported into ArcGIS and plotted on a map of the Grenspark and its surroundings.

4. Results

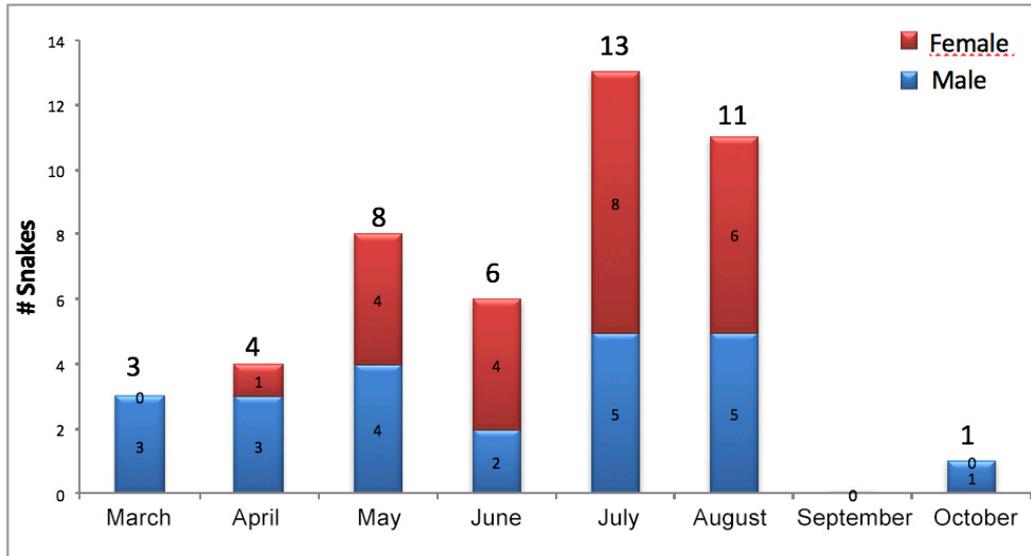
4.1. Tracking

During the entire study, a total of 10 males and 11 females were tagged and tracked. The first snake was released back into the wild at the 22th of March 2017 and on the 11th of November in the same year, the information of the final individual was collected. As seen in graph 1 below, all males combined were followed for 284 days, with an average of 28 days for each individual. The females had a total of 443 days, averaging 37 days for each individual.



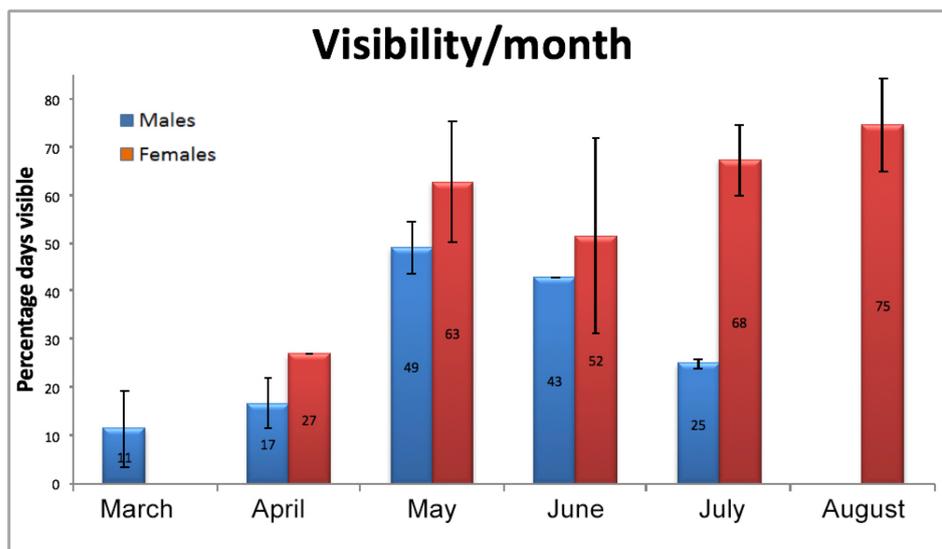
Graph 1: The total number of days a male or female was followed

Graph 2 shows the number of tracked snakes for each month. From March until August, we see a steady increase and afterwards a sudden drop. At the start of the study, we had 3 males tagged with a transmitter and this number increased until July where in total 13 animals were tagged. The number of males remained fairly even during the study while total female count rose towards a maximum of 8 during the summer months.



Graph 2: Number of tracked snakes for each month

In graph 3, the visibility of both genders was plotted for each month. We notice a rise in visibility of the males towards May, followed by a decrease during the next months. The visibility of the females increased significantly from the start until the finish of the study with a small dip during June.



Graph 3: Visibility of male/female for each month

Most of the snakes resided along the Verbindingsstraat, a paved road crossing the reserve (Figure 1). During spring, both males and females were active and moved along the road. No individual was seen crossing the Verbindingsstraat. Statistical analysis has shown that the road has a significant effect on the population. The home range of the animals is not significantly smaller than that of the snakes that live elsewhere, but the shape of the home range does significantly differ from the shape of the home range of snakes that live in the field (van Doorn, 2017).

The individuals that live next to the road were mostly seen sunbathing between the low vegetation, often multiple individuals close to each other (Figure 2). When summer came, the females reduced their activity and remained highly sedentary. Frequently, it was noted that females stayed in an area of about one square meter, for multiple days. Meanwhile males continued to be active throughout the whole summer.



Figure 1: Movement pattern of individuals along the Verbindingsstraat during spring



Figure 2: Three tagged individuals, sunbathing next to the Verbindingsstraat

4.2. Sign inventory

In total, 177 signs over a surface of around 82 square kilometers were found. It should be said that the maps that were provided to me beforehand, gave an accurate general impression of the state of all the signs in that area. Approximately 90% of the signs indicated on the maps, were still at their designated spot. Of the 177 signs that were located, only one can be considered unreadable because of overgrown mosses and one was destroyed by vandalism.

Despite the fact that signs often displayed the same type of information, they did not look the same due to their different layout. This layout was dependent on the owner that originally placed the signs. Even though the layout was different, signs with similar content were placed on comparable locations. As an example, I found signs with access regulations that had different owners, at similar locations next to public roads around the park.

5. Discussion

The decrease of tagged individuals after August can be explained by a couple of factors. Firstly, a previous study of Valckenborg & Willockx (2003) shows us that around that time, both male and female smooth snakes have their second shedding. In case of females, the shedding occurs right before they give birth. Since the transmitter was taped onto the skin of the snake, it will be dropped together with the skin and the animal can no longer be tracked. When the shedding is initiated, the snake shows several distinct characteristics like loss of color and image, and an opaque discoloration of the eyes. Unfortunately, the loss of several animals could not have been avoided.

During other periods of the study, recapture rates were high enough to ensure a viable research population. However, in September a decrease in available volunteers and participants of the study caused the recapture rates to decline and therefore less snakes could be tracked.

Still, the main reason behind the decline in tagged individuals is probably the unusual hot and dry weather during the month of September. As is visible in graph 2, that month we had the least number of tagged individuals. Even though smooth snakes prefer warm weather to keep their body temperature up, they do not like straight harsh sunlight and extreme temperatures. When describing the ecology of the snake, Van Hecke and Bonte (2013) noted that smooth snakes do not like direct sun warmth as do most European snakes.

The rise in visibility of female snakes during the summer months was in accordance with other literature (Creemers & van Delft, 2009). In order to facilitate the development of the embryo's, female smooth snakes try to bask in indirect sun heat as much as possible. They increase their sun bathing periods and therefore are more easily spotted in the field. Male snakes however increase their general activity. Consequentially to more movement is the decrease in perceived visibility of the snake. Since the location of the snake can still be determined without it being visible, the trend of visibility (graph 3) was not comparable to the trend of number of tagged individuals (graph 2).

The negative effects of the Verbindingsstraat have already been reported in previous studies. Van Hecke and Bonte (2013) noted that the increased mortality along this road has two causes. Firstly, there is a high mortality rate because of migration across the road. The Verbindingsstraat divides suitable habitat in two areas and individuals often get run over by cars when trying to reach the other side. Another reason is the prevalence of low vegetation along the road, making it an ideal environment for sunbathing. This was confirmed by the data we collected, also showing a high number of snakes aside the road. A significant effect of the road on the shape of the home range gave us the same conclusion. After conducting previous studies on smooth snakes in the Grenspark, it was concluded that in order to ensure a viable population, certain management options had to be taken. These varied from introducing poles as roadblocks, to permanently inhibiting all motorized traffic on the road. Sadly, at that time none of these measures seemed feasible and to this day, the Verbindingsstraat continues to cause significant mortality to the population of smooth snakes and various other species.

Even though the sign inventory is nearly completed, the project cannot yet be considered finished. A large number of signs was already added to the inventory but signs of 'Natuurpunt' and 'Natuurmonumenten' still need to be located. When this is done, the Grenspark can start creating a general design for all signs to ensure a more uniform method of displaying information in and around the park.

6. Conclusion

From 2011 until 2013, the Herpetological Society of 'Grenspark De Zoom – Kalmthoutse Heide' studied the behavioral ecology and distribution of the smooth snake in the transboundary nature reserve De Zoom – Kalmthoutse Heide, with the purpose of formulating adequate nature management measures. This provided the park with a number of useful management strategies to ensure a viable smooth snake population. However, some important data on sex ratios and movement patterns were still missing after this research so a second study was conducted.

During this study, I learned about the structure and organization of a cross border reserve by participating in one of its many activities. I attended several meetings between staff members and volunteers of both sides of the border, which gave me a good impression of the numerous complications that are associated with such a transboundary cooperation. It also provided me with a more clear view on the large number of stakeholders that are part of such a large organization.

More related to the telemetric research, this internship was a first encounter with the monitoring of a threatened species and all necessary actions it entails. I got to study a rather elusive animal up close and learned more about its behavior and ecological preferences.

By compiling an inventory of all signs around the park, I also experienced less exiting and non-ecological aspects of the management of such a park. However, I am fully aware that these smaller side activities during which we simply collect data, are necessary to ensure long-term conservation of a park with a size and complexity as the Grenspark.

7. References

Creemers, R. & J. Van Delft (2009). *De Amfibieën en Reptielen van Nederland*. Utrecht, KNNV, 476p.

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Spellerberg, I. (1977). Marking live snakes for identification of individuals in population studies. *Journal of Applied Ecology* 14(1): 137-138.

Van Doorn, L. (2017). Telemetrieonderzoek naar de ecologie van de gladde slang in het Grenspark De Zoom-Kalmthoutse Heide. Unpublished.

Van Hecke A. & C. Bonte (2013). Onderzoek naar het Leefgedrag van de Gladde slang (*Coronella austriaca*) in het Grenspark De Zoom - Kalmthoutse Heide & Beheerondersteunend Advies.

Valckenborgh, F. & R. Willockx (2003). *De Gladde Slang in Kalmthout V: waarnemingen 2002*. Aminoal onderzoeksrapport.

8. Attachments

Date	Duration	Activity
10/03/2016	3h	First meet up and introduction to research
19/03/2016	4h	Learning about the application of the material
26/03/2016	2h	Meeting with expert to learn about handling snakes
09/07/2016	1d	Fieldwork: monitoring snakes
10/07/2016	1d	Fieldwork: monitoring snakes
11/07/2016	1d	Fieldwork: monitoring snakes
12/07/2016	1d	Fieldwork: monitoring snakes
14/07/2016	1d	Fieldwork: monitoring snakes
16/07/2016	1d	Fieldwork: monitoring snakes
21/07/2016	1d	Fieldwork: monitoring snakes
22/07/2016	1d	Fieldwork: monitoring snakes
1/08/2016	1d	Fieldwork: monitoring snakes
2/08/2016	1d	Fieldwork: monitoring snakes
3/08/2016	1d	Fieldwork: monitoring snakes
13/09/2016	1d	Fieldwork: looking for new individuals
14/09/2016	1d	Fieldwork: looking for new individuals
16/09/2016	1d	Fieldwork: looking for new individuals
06/10/2016	1d	Fieldwork: monitoring snakes
15/10/2016	1d	Fieldwork: sign inventory Belgian roads
27/10/2016	1d	Fieldwork: sign inventory SSB-Stb
01/11/2016	1d	Fieldwork: sign inventory SSB-StD
11/12/2016	2h	Discussion of telemetry results
06/01/2017	1d	Fieldwork: sign inventory Dutch roads
12/01/2017	1d	Fieldwork: sign inventory Evides
13/02/2017	1d	Fieldwork: sign inventory Ravenshof

Table 1: Summary of activities during internship